

# Screening for Obstructive Sleep Apnea in Adults

## US Preventive Services Task Force

### Recommendation Statement

US Preventive Services Task Force

**IMPORTANCE** Based on data from the 1990s, estimated prevalence of obstructive sleep apnea (OSA) in the United States is 10% for mild OSA and 3.8% to 6.5% for moderate to severe OSA; current prevalence may be higher, given the increasing prevalence of obesity. Severe OSA is associated with increased all-cause mortality, cardiovascular disease and cerebrovascular events, diabetes, cognitive impairment, decreased quality of life, and motor vehicle crashes.

**OBJECTIVE** To issue a new US Preventive Services Task Force (USPSTF) recommendation on screening for OSA in asymptomatic adults.

**EVIDENCE REVIEW** The USPSTF reviewed the evidence on the accuracy, benefits, and potential harms of screening for OSA in asymptomatic adults seen in primary care, including those with unrecognized symptoms. The USPSTF also evaluated the evidence on the benefits and harms of treatment of OSA on intermediate and final health outcomes.

**FINDINGS** The USPSTF found insufficient evidence on screening for or treatment of OSA in asymptomatic adults or adults with unrecognized symptoms. Therefore, the USPSTF was unable to determine the magnitude of the benefits or harms of screening for OSA or whether there is a net benefit or harm to screening.

**CONCLUSIONS AND RECOMMENDATION** The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for OSA in asymptomatic adults. (I statement)

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**Author/Group Information:** The US Preventive Services Task Force (USPSTF) members are listed at the end of this article.

**Corresponding Author:** Kirsten Bibbins-Domingo, PhD, MD, MAS (chair@uspstf.net).

**T**he 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 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 concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for obstructive sleep apnea (OSA) in asymptomatic adults (I statement) (Figure 1).

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

## Rationale

### Importance

Based on data from the 1990s, the estimated prevalence of OSA in the United States is 10% for mild OSA and 3.8% to 6.5% for

Figure 1. US Preventive Services Task Force Grades and Levels of Certainty

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 or 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 or 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 or 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.

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. 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 not generalizable to routine primary care practice. lack of information on important health outcomes. More information may allow 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 based on the nature of the overall evidence available to assess the net benefit of a preventive service.	

moderate to severe OSA.<sup>1-3</sup> Current prevalence may be higher, given the increasing prevalence of obesity.<sup>4,5</sup> The proportion of persons with OSA who are asymptomatic or have unrecognized symptoms is unknown. Severe OSA is associated with increased all-cause mortality<sup>6</sup>; however, the role OSA plays in increasing overall mortality, independent from other risk factors (older age, higher body mass index [BMI], and other cardiovascular risk factors), is less clear. In addition to mortality, other adverse health outcomes associated with untreated OSA include cardiovascular disease and cerebrovascular events, diabetes, cognitive impairment, decreased quality of life, and motor vehicle crashes.

**Detection**

Evidence on the use of validated screening questionnaires in asymptomatic adults (or adults with unrecognized symptoms) to accurately identify who will benefit from further testing for OSA is inadequate. The USPSTF identified this as a critical gap in the evidence.

**Benefits of Early Detection and Intervention or Treatment**

The USPSTF found inadequate direct evidence on the benefit of screening for OSA in asymptomatic populations. The USPSTF found no studies that evaluated the effect of screening for OSA on health

Figure 2. Screening for Obstructive Sleep Apnea in Adults: Clinical Summary

Population	Asymptomatic adults, including those with unrecognized symptoms
Recommendation	No recommendation. Grade: I (insufficient evidence)
Risk Assessment	Risk factors associated with obstructive sleep apnea (OSA) include male sex, older age (40 to 70 y), postmenopausal status, higher body mass index, and craniofacial and upper airway abnormalities. Evidence on other risk factors, such as smoking, alcohol and sedative use, and nasal congestion, is sparse or mixed.
Screening Tests	Evidence on the use of validated screening questionnaires in asymptomatic adults (or adults with unrecognized symptoms) to accurately identify who will benefit from further testing for OSA is inadequate.
Treatment and Interventions	Treatment with continuous positive airway pressure or mandibular advancement devices can improve intermediate outcomes (apnea-hypopnea index, Epworth Sleepiness Scale score, and blood pressure) in populations referred for treatment. However, the applicability of this evidence to screen-detected populations is limited.
Balance of Benefits and Harms	The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for OSA in asymptomatic adults.

For a summary of the evidence systematically reviewed in making this recommendation, the full recommendation statement, and supporting documents, please go to <https://www.uspreventiveservicestaskforce.org>.



outcomes. The USPSTF found at least adequate evidence that treatment with continuous positive airway pressure (CPAP) and mandibular advancement devices (MADs) can improve intermediate outcomes (eg, the apnea-hypopnea index [AHI], Epworth Sleepiness Scale [ESS] score, and blood pressure) in populations referred for treatment. However, the applicability of this evidence to screen-detected populations is limited. The adequacy of the evidence varies based on the type of intervention and the reported intermediate outcomes. The USPSTF found inadequate evidence on the link between change in the intermediate outcome (eg, AHI) and reduction in the health outcome (eg, mortality). The USPSTF found evidence that treatment with CPAP can improve general and sleep-related quality of life in populations referred for treatment, but the applicability of this evidence to screen-detected populations is unknown. The USPSTF found inadequate evidence on whether treatment with CPAP or MADs improves other health outcomes (mortality, cognitive impairment, motor vehicle crashes, and cardiovascular or cerebrovascular events). The USPSTF also found inadequate evidence on the effect of treatment with various surgical procedures in improving intermediate or health outcomes.

#### Harms of Early Detection and Intervention or Treatment

The USPSTF found inadequate evidence on the direct harms of screening for OSA. The USPSTF found adequate evidence that the harms of treatment of OSA with CPAP and MADs are small. Reported harms include oral or nasal dryness; eye or skin irritation; rash; epistaxis; pain; excess salivation; and oral mucosal, dental, and jaw symptoms. The USPSTF found inadequate evidence on the harms of surgical treatment of OSA.

#### USPSTF Assessment

The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for OSA in

asymptomatic adults. Evidence on screening tools to accurately detect persons in asymptomatic populations who should receive further testing and treatment of subsequently diagnosed OSA to improve health outcomes is lacking, and the balance of benefits and harms cannot be determined.

### Clinical Considerations

#### Patient Population Under Consideration

This recommendation applies to asymptomatic adults (18 years and older). It also applies to adults with unrecognized symptoms of OSA (Figure 2). This includes persons who are not aware of their symptoms or do not report symptoms as being a concern to their clinician. This recommendation does not apply to persons presenting with symptoms (eg, snoring, witnessed apnea, excessive daytime sleepiness, impaired cognition, mood changes, or gasping or choking at night) or concerns about OSA, persons who have been referred for evaluation or treatment of suspected OSA, or persons who have acute conditions that could trigger the onset of OSA (eg, stroke). Care of these persons should be managed as clinically appropriate. This recommendation also does not apply to children, adolescents, or pregnant women.

#### Suggestions for Practice Regarding the I Statement Potential Preventable Burden

Based on data from the 1990s, the estimated prevalence of OSA in the United States is 10% for mild OSA and 3.8% to 6.5% for moderate to severe OSA.<sup>1-3</sup> Current prevalence may be higher, given the increasing prevalence of obesity.<sup>4,5</sup> Extrapolation from long-term follow-up data from the Wisconsin Sleep Cohort Study (1988-1994 to 2007-2010) results in an estimated prevalence of 16% for mild OSA and 10% for moderate to severe OSA.<sup>4</sup> The

prevalence of severe OSA in asymptomatic persons is unknown. In the Wisconsin Sleep Cohort Study, approximately 6% of adults with no or mild OSA progressed to moderate to severe OSA over 4 years.<sup>7</sup>

Risk factors associated with OSA include male sex, older age (40 to 70 years), postmenopausal status, higher BMI, and craniofacial and upper airway abnormalities. The evidence on other risk factors, such as smoking, alcohol and sedative use, and nasal congestion, is sparse or mixed.<sup>1</sup>

Observational studies have reported an association between severe OSA and mortality risk.<sup>8</sup> In theory, screening for OSA could improve mortality by identifying OSA early and providing treatment before it can adversely influence mortality. Although studies generally show that treatment of OSA with CPAP and MADs improves intermediate outcomes, such as AHI and ESS score, there is a lack of studies demonstrating that change in AHI or ESS score improves health outcomes, and no well-controlled trials have demonstrated an improvement in mortality with treatment of OSA.

In trials reviewed by the USPSTF, treatment with CPAP effectively reduced AHI to normal (<5) or near-normal (<10) levels. Treatment with MADs showed more modest improvements in AHI. Treatment with either CPAP or MADs improved ESS scores by approximately 2 points, and trials evaluating treatment with CPAP also found reductions in blood pressure. However, the clinical significance of these small reductions is unclear. Of note, trials that evaluated treatment with CPAP or MADs were primarily conducted in referred or sleep clinic patients, not screen-detected patients from primary care settings.

#### Potential Harms

Direct evidence on the harms of screening for OSA is lacking. Commonly reported harms of treatment with CPAP include oral or nasal dryness, eye or skin irritation, rash, epistaxis, and pain.<sup>1</sup> An estimated 14% to 32% of patients discontinue treatment with CPAP over 4 years.<sup>6</sup> Commonly reported harms of treatment with MADs include oral mucosal, dental, or jaw symptoms, such as mucosal or dental pain, discomfort or tenderness, mucosal erosions, and jaw or temporomandibular joint pain or discomfort. Less common harms include oral dryness and excess salivation. Limited study data suggest that 7% of patients discontinue treatment with MADs because of harms.<sup>1</sup>

#### Current Practice

Most primary care clinicians do not routinely screen for OSA.<sup>1</sup> According to a practice-based research network study of 44 practices, only 20% of patients with sleep-related symptoms who regularly visit a primary care clinician spontaneously reported their symptoms to their clinician.<sup>9</sup> Some potential barriers to screening cited by clinicians include being unsure about how to identify and diagnose OSA, uncertainty regarding which type of sleep monitors are best for the diagnosis of OSA, and how to follow up patients who have been diagnosed with OSA.<sup>1</sup>

#### Screening Tests

Potential screening questionnaires and clinical prediction tools include the ESS, STOP Questionnaire (Snoring, Tiredness, Observed Apnea, High Blood Pressure), STOP-Bang Questionnaire (STOP Questionnaire plus BMI, Age, Neck Circumference, and

Gender), Berlin Questionnaire, Wisconsin Sleep Questionnaire, and the Multivariable Apnea Prediction (MVAP) tool. However, none of these instruments have been adequately validated in a primary care setting.<sup>1</sup>

## Other Considerations

### Research Needs and Gaps

The identification of valid and reliable clinical prediction tools that could accurately determine which asymptomatic persons (or persons with unrecognized symptoms) would benefit from further evaluation and testing for OSA is needed. In addition, studies that evaluate the effect of OSA treatments or interventions on health outcomes (eg, all-cause and cardiovascular mortality, cardiovascular disease and cerebrovascular events, motor vehicle crashes, and cognitive impairment) that are adequately powered and have an appropriate length of follow-up are needed. Studies are also needed to evaluate whether improvement in AHI (for mild to severe OSA) leads to improvement in health outcomes. These represent critical gaps in the current evidence base. The USPSTF has identified the need for further research on the effect on health outcomes of screening for OSA among asymptomatic persons in the general population, as well as the role of sleepiness in determining health outcomes. More data on the natural history of mild OSA are also needed, in particular the rates of progression from mild to severe OSA, the length of duration before progression, and the magnitude of benefit if OSA is identified and treated earlier.

## Discussion

### Burden of Disease

Obstructive sleep apnea is the repeated collapse and obstruction of the upper airway during sleep, which results in reduced airflow (hypopnea) or complete airflow cessation (apnea), oxygen desaturation, and arousals from sleep.<sup>6</sup> The severity of OSA can be categorized as mild, moderate, or severe based on the number of apnea and hypopnea events per hour (known as the AHI).<sup>1</sup> An AHI of 5 to less than 15 is considered mild, 15 to less than 30 is considered moderate, and 30 or greater is considered severe. Obstructive sleep apnea syndrome (OSAS) is defined as having an AHI of 5 or greater with evidence of daytime sleepiness.

Reported estimates of OSA prevalence vary based on the study definition of OSA, sampling bias, and year of study publication.<sup>10</sup> A 2013 systematic review reported an estimated prevalence of 2% to 14% based on 4 community-based studies,<sup>11</sup> while 2 US-based studies conducted in the 1990s reported an estimated prevalence of 10% for mild OSA and 3.8% to 6.5% for moderate or severe OSA.<sup>1-3</sup> Obstructive sleep apnea is more common in men than in women (odds ratio, 3.1 [95% CI, 2.5 to 3.8])<sup>11</sup> and increases with age through the 60s and 70s and then plateaus.<sup>12-14</sup> The prevalence difference between men and women narrows after menopause.<sup>2,3,14,15</sup> In both men and women, observational studies have found that the prevalence of OSA progressively increases as BMI increases. Using data from the Wisconsin Sleep Cohort Study, 1 study found that a 10% increase in weight was associated with a 6-fold increase in risk of incident OSA over 4 years of follow-up.<sup>7</sup>

Patients with severe untreated OSA have an increased risk of all-cause mortality. Based on prospective cohort studies, severe OSA has been found to be associated with a 2-fold increased risk of all-cause mortality (hazard ratio, 2.07 [95% CI, 1.48 to 2.91]) and cardiovascular mortality (hazard ratio, 2.9 [95% CI, 1.1 to 7.3] to 5.9 [95% CI, 2.6 to 13.3]).<sup>1</sup> However, it is unclear whether OSA contributes to this increase in mortality independently, beyond the contributions of age, BMI, and other confounding factors.<sup>1</sup> Other adverse outcomes have also been reported with OSA, such as increased risk of motor vehicle and other crashes; cognitive impairment; lost work days, work disability, and impaired work performance; and decreased quality of life.<sup>1</sup>

### Scope of Review

The USPSTF commissioned a systematic review<sup>1,8</sup> to evaluate the evidence on the accuracy, benefits, and potential harms of screening for OSA in asymptomatic adults seen in primary care, including those with unrecognized symptoms. The systematic review also evaluated the evidence on the benefits and harms of treatment of OSA on intermediate outcomes (eg, change in AHI, sleepiness, and blood pressure) and health outcomes (eg, mortality, quality of life, cardiovascular and cerebrovascular events, and cognitive impairment). The review focused on studies in adults 18 years and older and excluded children, adolescents, and pregnant women.

### Accuracy of Screening and Diagnostic Tests

Several screening questionnaires and clinical prediction tools have been developed to identify persons who are at higher risk of OSA. The USPSTF found evidence on 2 tools that have been evaluated in primary care or general populations (vs referral populations): the Berlin Questionnaire and the MVAP tool.<sup>1</sup> The Berlin Questionnaire was evaluated in a single cross-sectional study that sampled Norwegian residents from the National Population Register; 16 302 participants completed the questionnaire, and 518 went on to have polysomnography.<sup>16</sup> Based on analyses that adjusted for oversampling of high-risk participants, the Berlin Questionnaire had a sensitivity of 37.2% (95% CI, 36.0% to 38.4%) and a specificity of 84.0% (95% CI, 83.2% to 84.7%) when using an AHI cutpoint of 5 or greater. Using an AHI cutpoint of 15 or greater, the Berlin Questionnaire had a sensitivity of 43.0% (95% CI, 41.2% to 44.8%) and a specificity of 79.7% (95% CI, 79.0% to 80.5%).<sup>1,16</sup> Overall, the study found poor accuracy. In addition, this single study has not been externally validated and was found to have moderate risk of bias due to missing data, attrition bias, and spectrum bias.

Two studies evaluated the MVAP tool in community or primary care settings. Although both studies were published by the same research group, one study was conducted in Medicare patients with daytime sleepiness ( $n = 452$ ),<sup>17</sup> while the other was conducted in patients with hypertension ( $n = 250$ ) visiting internal medicine practices (US Department of Veterans Affairs medical center system and a university-based hypertension clinic).<sup>18</sup> Among the Medicare patients with daytime sleepiness, the MVAP tool had a sensitivity of 90.9% and a specificity of 64.4% to predict severe OSAS (defined in the study as an AHI  $\geq 30$  and ESS score  $>10$ ).<sup>17</sup> Among patients with hypertension, the MVAP tool had a sensitivity of 91.5% and a specificity of 43.9% to predict severe OSAS.<sup>18</sup> When unattended, in-home portable sleep monitor testing was added, the sensitivity of the MVAP tool to predict severe OSAS

increased to 90.9% and specificity increased to 75.7%<sup>17</sup>; in the study of Medicare patients, while sensitivity decreased to 88.2%, specificity increased to 71.6% among patients with hypertension.<sup>18</sup> The 2 studies that evaluated the MVAP tool were conducted in populations that had a high prevalence of OSAS (and thus were more likely to be symptomatic) and a high risk of spectrum bias (ie, the study population does not represent the general primary care population).

The USPSTF also evaluated the evidence on the accuracy of diagnostic tests for OSA. In particular, it evaluated the evidence on the various types of portable sleep monitors compared with polysomnography. Evidence was obtained from 2 systematic reviews and 19 additional studies.<sup>1</sup> Most studies evaluated type III and type IV portable monitors. The USPSTF reviewed evidence from 3 studies ( $n = 160$ ) on type II portable monitors, 21 studies ( $n = 1691$ ) on type III portable monitors, and 84 studies ( $n = 8773$ ) on type IV portable monitors.<sup>1</sup> None of the studies were conducted in screen-detected populations, and most were conducted in referral populations being evaluated for suspected OSA. Studies were conducted in a variety of settings (home or laboratory) and used a variety of AHI cutpoints, which were not always well reported.<sup>1</sup> The overall quality of evidence on type II and type IV portable monitors was found to be fair, while the overall quality of evidence on type III portable monitors was found to be good. A broad range of sensitivity and specificity was reported across multiple AHI cutpoints. Generally, studies on type II and type III portable monitors reported moderate to high sensitivity and specificity, whereas sensitivity and specificity of type IV portable monitors was highly variable and inconsistent (more information is available in Table 5 of the full evidence report<sup>1</sup>). Overall, consistent with findings from other systematic reviews, type III and type IV portable monitors seem to be generally accurate in diagnosing OSA but have a wide and variable bias in estimating actual AHI<sup>6,19</sup> in patients being evaluated for suspected OSA. It is unclear how these portable sleep monitors would perform in asymptomatic, screen-detected persons.

### Effectiveness of Early Detection and Treatment

The USPSTF found no studies that directly evaluated the effect of screening for OSA on health outcomes, such as mortality, quality of life, and cardiovascular and cerebrovascular events. The USPSTF did identify and review studies on the effect of treatment on intermediate outcomes (eg, AHI, ESS score, and blood pressure) and health outcomes (eg, mortality, quality of life, and cardiovascular and cerebrovascular events).

The USPSTF reviewed evidence from 76 good- to fair-quality treatment trials that described the effect of various interventions on intermediate outcomes, including AHI, ESS score, and blood pressure.<sup>1</sup> The most evidence was available on CPAP and found that compared with sham intervention, CPAP reduced AHI (weighted mean difference [WMD],  $-33.8$  [95% CI,  $-42.0$  to  $-25.6$ ]; 13 studies;  $n = 543$ ), ESS score (WMD,  $-2.0$  [95% CI,  $-2.6$  to  $-1.4$ ]; 22 studies;  $n = 2721$ ), and blood pressure (diurnal systolic blood pressure WMD,  $-2.4$  [95% CI,  $-3.9$  to  $-0.9$ ] and diurnal diastolic blood pressure WMD,  $-1.3$  [95% CI,  $-2.2$  to  $-0.4$ ]; 15 studies;  $n = 1190$ ).<sup>1</sup> Less evidence was available on the effect of treatment with MADs on intermediate outcomes. Meta-analysis found that compared with sham intervention, MADs reduced AHI (WMD,  $-12.6$  [95% CI,  $-15.5$  to  $-9.7$ ]; 6 studies;  $n = 307$ ) and ESS score

(WMD, -1.5 [95% CI, -2.8 to -0.2]; 5 studies; n = 267) but not blood pressure. Five studies evaluated treatment with upper airway surgery; each evaluated a different surgical technique. Findings on AHI were inconsistent, and no statistically significant improvements in ESS score or blood pressure were found. Although studies generally showed that treatment with CPAP reduced AHI to near-normal levels, treatment with MADs resulted in more modest reductions, and the clinical significance of the small reductions in ESS score is uncertain. Small reductions in blood pressure are associated with cardiovascular disease benefits at the population level, but no evidence of this benefit was seen in these studies. Further, given that most of the trials were conducted in referred or sleep clinic patients, the applicability of this evidence to a screen-detected population is limited.

The USPSTF reviewed evidence from 50 fair- to good-quality trials that evaluated the effect of various treatments or interventions on health outcomes.<sup>1</sup> The most evidence was available on CPAP; however, the USPSTF found the evidence on most outcomes to be inadequate because of short length of follow-up and underpowered studies (ie, too few events observed). Thirty-one trials (n = 2673) reported on the effect of treatment with CPAP on mortality; most trials (29/31) followed up participants for only 12 weeks or less, and most trials (27/31) reported no deaths in either study group.<sup>1</sup> Twelve trials reported on cognitive function; however, they used heterogeneous outcome measures, which made comparison difficult, and results were generally inconsistent. Five trials (n = 1529) reported on incidence of myocardial infarction. Most trials (4/5) followed up participants for less than 1 year, and when combined, only reported 1 death (in the control group). Few trials reported on motor vehicle crashes, cerebrovascular events, or heart failure.<sup>1</sup> Evidence was available on general and sleep-related quality of life, and there were small but statistically significant improvements in sleep-related quality-of-life scores, but the clinical significance of these improvements is unclear. Importantly, given the characteristics of included study participants (who were from sleep clinics or referral populations, were largely symptomatic, and had daytime sleepiness and more severe OSA), the applicability of this evidence to an asymptomatic, screen-detected population is questionable. Few studies reported on the effect of treatment with MADs (6 studies; n = 510) or upper airway surgery (4 studies; n = 187) on any health outcomes.

Despite the consistent observational findings of an association between severe OSA and increased mortality, the USPSTF identified no studies that reported on change in AHI and associated change in mortality. Thus, it is unclear whether treatments that improve AHI would also improve mortality.

### Potential Harms of Screening and Treatment

The USPSTF identified no studies that directly evaluated the harms of screening for OSA. A subset of studies that evaluated the effectiveness of various OSA treatments also reported on harms of treatment. Nine studies (n = 1759) reported on harms of treatment with CPAP. Follow-up in these studies was generally from 8 to 12 weeks, and most participants were men, with a mean age range of 42 to 61 years, who were overweight or obese (mean BMI, 27-39 [calculated as weight in kilograms divided by height in meters squared]). Overall, 2% to 47% of trial participants reported any adverse effects from treatment with CPAP, including oral or nasal

dryness, eye or skin irritation, rash, epistaxis, and pain.<sup>1</sup> Eight trials (n = 443) reported on harms of treatment with MADs. Follow-up in these studies was generally from 4 to 6 weeks. In 7 trials, 17% to 74% of participants reported oral mucosal, dental, or jaw symptoms, compared with 0% to 17% of participants in comparator groups. In 4 studies, 5% to 33% of participants reported oral dryness, compared with 0% to 3% in control groups, and in 3 studies, 23% to 68% of participants reported excessive salivation, compared with 0% to 3% in comparator groups.<sup>1</sup> Four trials (n = 205) reported harms of treatment with upper airway surgery; 1% to 81% of participants reported any harms, which included pain, postoperative bleeding, difficulty speaking and swallowing, change in vocal quality, hematomas, ulcerations, infections, and temporary nasal regurgitation.<sup>1</sup>

### Estimate of Magnitude of Net Benefit

Overall, the USPSTF found insufficient evidence on screening for OSA in asymptomatic adults or adults with unrecognized symptoms. No studies directly evaluated the benefits or harms of screening for OSA. Few studies evaluated the accuracy of specific screening tools to identify persons at high risk for OSA who could benefit from further testing. Although numerous studies evaluated the effectiveness of treatment with CPAP or MADs to improve intermediate outcomes (eg, AHI, ESS score, or blood pressure) in patients already receiving care or referred for care at a sleep clinic, the clinical significance of these changes and the applicability of this evidence to asymptomatic, screen-detected populations are unclear. Further, evidence is insufficient to determine whether treatment of screen-detected asymptomatic or unrecognized OSA improves final health outcomes (eg, mortality or cardiovascular events) or whether improving intermediate outcomes (eg, AHI or ESS score) would improve these final health outcomes. Studies that evaluated the effect of treatment with CPAP or MADs on mortality were either underpowered or of too short duration to detect a difference between treated and untreated groups, and no studies reported on whether change in AHI or ESS score affects mortality. Fewer studies reported on the harms of treatment. Overall, the USPSTF was unable to determine the magnitude of the benefits or harms of screening for OSA or whether there is a net benefit or harm to screening in asymptomatic adults or adults with unrecognized symptoms.

### How Does Evidence Fit With Biological Understanding?

According to observational studies, severe untreated OSA has been found to be associated with an increased risk of all-cause and cardiovascular mortality.<sup>1</sup> Other adverse outcomes that have been reported include increased risk of motor vehicle and other crashes; cognitive impairment; lost work days, work disability, and impaired work performance; and decreased quality of life.<sup>1</sup> However, it is unclear what role OSA plays in causing these adverse outcomes, independent from other associated factors such as obesity, older age, hypertension, and general lifestyle. One hypothesis is that OSA leads to chronic disturbances in gas exchange, sympathetic nervous system arousal, and fragmented sleep.<sup>1,6</sup>

### Response to Public Comment

A draft version of this recommendation statement was posted for public comment on the USPSTF website from June 14 to

July 11, 2016. Some comments expressed concern that the definition of “asymptomatic” is unclear, did not agree that an asymptomatic population is the same as persons with unrecognized symptoms, or expressed concern that many symptomatic patients do not report symptoms to their health care professional. The USPSTF discussed its definitional approach extensively when creating the research plan. In the research plan, the USPSTF established that persons without symptoms or with unrecognized symptoms are the population of interest in which to identify potentially unrecognized OSA. In response to comments, the USPSTF described common symptoms of OSA and defined what is meant by persons with unrecognized symptoms. Other comments suggested that a number of key studies were omitted that link OSA treatment to improved health outcomes. The USPSTF examined these studies and found they were either already included in the review, did not meet eligibility criteria for inclusion in the review, or were otherwise outside the scope of the review. A few comments suggested that persons who work in safety-sensitive transportation occupations (eg, truck drivers or rail operators) have unique testing needs. Clinicians seeking information on testing persons who work in these occupations can consult the appropriate agency’s guidelines. The US Department of Transportation recently sought public input related to the evaluation of moderate to severe OSA among persons with these occupations.<sup>19</sup>

## Recommendations of Others

The American Academy of Family Physicians’ recommendation is consistent with that of the USPSTF and concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for OSA in asymptomatic adults.<sup>20</sup> The American College of Physicians recommends conducting a sleep study for patients with unexplained daytime sleepiness (grade: weak recommendation, low-quality evidence). It also recommends polysomnography for diagnostic testing in patients with suspected OSA. For patients without serious comorbid conditions, portable sleep monitors are recommended when polysomnography is not available (grade: weak recommendation, moderate-quality evidence).<sup>21</sup> The American Academy of Sleep Medicine recommends that routine health maintenance evaluations include questions about OSA and evaluation for risk factors (obesity, retrognathia, and treatment-refractory hypertension). Positive findings should trigger a comprehensive sleep evaluation.<sup>22</sup> The National Institute for Health and Care Excellence states that moderate to severe OSA or hypopnea syndrome can be diagnosed from patient history and an in-home sleep study using oximetry or other monitoring devices. In some cases, further studies that monitor additional physiological variables in a sleep laboratory or at home may be required, especially when alternative diagnoses are being considered.<sup>23</sup>

### ARTICLE INFORMATION

#### The US Preventive Services Task Force (USPSTF)

**members:** Kirsten Bibbins-Domingo, PhD, MD, MAS; David C. Grossman, MD, MPH; Susan J. Curry, PhD; Karina W. Davidson, PhD, MASc; John W. Epling Jr, MD, MSED; Francisco A. R. García, MD, MPH; Jessica Herzstein, MD, MPH; Alex R. Kemper, MD, MPH, MS; Alex H. Krist, MD, MPH; Ann E. Kurth, PhD, RN, MSN, MPH; C. Seth Landefeld, MD; Carol M. Mangione, MD, MSPH; William R. Phillips, MD, MPH; Maureen G. Phipps, MD, MPH; Michael P. Pignone, MD, MPH; Michael Silverstein, MD, MPH; Chien-Wen Tseng, MD, MPH, MSEE.

**Affiliations of The US Preventive Services Task Force (USPSTF) members:** University of California, San Francisco (Bibbins-Domingo); Group Health Research Institute, Seattle, Washington (Grossman); University of Iowa, Iowa City (Curry); Columbia University, New York, New York (Davidson); State University of New York Upstate Medical University, Syracuse (Epling); Pima County Department of Health, Tucson, Arizona (García); Independent consultant, Washington, DC (Herzstein); Duke University, Durham, North Carolina (Kemper); Fairfax Family Practice Residency, Fairfax, Virginia (Krist); Virginia Commonwealth University, Richmond (Krist); Yale University, New Haven, Connecticut (Kurth); University of Alabama at Birmingham (Landefeld); University of California, Los Angeles (Mangione); University of Washington, Seattle (Phillips); Brown University, Providence, Rhode Island (Phipps); University of Texas at Austin (Pignone); Boston University, Boston, Massachusetts (Silverstein); University of Hawaii, Manoa (Tseng).

**Author Contributions:** Dr Bibbins-Domingo had full access to all of the data in the study and takes responsibility for the integrity of the data and the

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### REFERENCES

- Jonas DE, Amick HR, Feltner C, et al. *Screening for Obstructive Sleep Apnea in Adults: An Evidence Review for the US Preventive Services Task Force: Evidence Synthesis No. 146*. Rockville, MD: Agency for Healthcare Research and Quality; 2017. AHRQ publication 14-05216-EF-1.
- Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. *N Engl J Med*. 1993;328(17):1230-1235.
- Bixler EO, Vgontzas AN, Lin HM, et al. Association of hypertension and sleep-disordered breathing. *Arch Intern Med*. 2000;160(15):2289-2295.
- Peppard PE, Young T, Barnett JH, Palta M, Hagen EW, Hla KM. Increased prevalence of sleep-disordered breathing in adults. *Am J Epidemiol*. 2013;177(9):1006-1014.
- Young T, Palta M, Dempsey J, Peppard PE, Nieto FJ, Hla KM. Burden of sleep apnea: rationale, design, and major findings of the Wisconsin Sleep Cohort study. *WMJ*. 2009;108(5):246-249.
- Balk EM, Moorthy D, Obadan NO, et al. *Diagnosis and Treatment of Obstructive Sleep Apnea in Adults: Comparative Effectiveness Review No. 32*. Rockville, MD: Agency for Healthcare Research and Quality; 2011. Report 11-EHC052.
- Peppard PE, Young T, Palta M, Dempsey J, Skatrud J. Longitudinal study of moderate weight change and sleep-disordered breathing. *JAMA*. 2000;284(23):3015-3021.
- Jonas DE, Amick HR, Feltner C, et al. Screening for obstructive sleep apnea in adults: evidence report and systematic review for the US Preventive Services Task Force. *JAMA*. doi:10.1001/jama.2016.19635

9. Mold JW, Quattlebaum C, Schinnerer E, Boeckman L, Orr W, Hollabaugh K. Identification by primary care clinicians of patients with obstructive sleep apnea: a Practice-Based Research Network (PBRN) study. *J Am Board Fam Med*. 2011; 24(2):138-145.
10. Caples SM, Gami AS, Somers VK. Obstructive sleep apnea. *Ann Intern Med*. 2005;142(3):187-197.
11. Myers KA, Mrkobrada M, Simel DL. Does this patient have obstructive sleep apnea? The Rational Clinical Examination systematic review. *JAMA*. 2013;310(7):731-741.
12. Young T, Shahar E, Nieto FJ, et al; Sleep Heart Health Study Research Group. Predictors of sleep-disordered breathing in community-dwelling adults: the Sleep Heart Health Study. *Arch Intern Med*. 2002;162(8):893-900.
13. Bixler EO, Vgontzas AN, Ten Have T, Tyson K, Kales A. Effects of age on sleep apnea in men, I: prevalence and severity. *Am J Respir Crit Care Med*. 1998;157(1):144-148.
14. Bixler EO, Vgontzas AN, Lin HM, et al. Prevalence of sleep-disordered breathing in women: effects of gender. *Am J Respir Crit Care Med*. 2001;163(3, pt 1):608-613.
15. Young T, Skatrud J, Peppard PE. Risk factors for obstructive sleep apnea in adults. *JAMA*. 2004; 291(16):2013-2016.
16. Hrubos-Strøm H, Randby A, Namtvedt SK, et al. A Norwegian population-based study on the risk and prevalence of obstructive sleep apnea: the Akershus Sleep Apnea Project (ASAP). *J Sleep Res*. 2011;20(1, pt 2):162-170.
17. Morales CR, Hurley S, Wick LC, et al. In-home, self-assembled sleep studies are useful in diagnosing sleep apnea in the elderly. *Sleep*. 2012; 35(11):1491-1501.
18. Gurubhagavatula I, Fields BG, Morales CR, et al. Screening for severe obstructive sleep apnea syndrome in hypertensive outpatients. *J Clin Hypertens (Greenwich)*. 2013;15(4):279-288.
19. Federal Motor Carrier Safety Administration. U.S. DOT seeks input on screening and treating commercial motor vehicle drivers and rail workers with obstructive sleep apnea. <https://www.fmcsa.dot.gov/newsroom/us-dot-seeks-input-screening-and-treating-commercial-motor-vehicle-drivers-and-rail-workers>. March 8, 2016. Accessed January 3, 2017.
20. American Academy of Family Physicians. Clinical preventive services recommendations. <http://www.aafp.org/patient-care/browse/type.tag-clinical-preventive-services-recommendations.html>. Accessed December 29, 2016.
21. Qaseem A, Dallas P, Owens DK, Starkey M, Holty JE, Shekelle P; Clinical Guidelines Committee of the American College of Physicians. Diagnosis of obstructive sleep apnea in adults: a clinical practice guideline from the American College of Physicians. *Ann Intern Med*. 2014;161(3):210-220.
22. Epstein LJ, Kristo D, Strollo PJ Jr, et al; Adult Obstructive Sleep Apnea Task Force of the American Academy of Sleep Medicine. Clinical guideline for the evaluation, management and long-term care of obstructive sleep apnea in adults. *J Clin Sleep Med*. 2009;5(3):263-276.
23. National Institute for Health and Care Excellence. *NICE Technology Appraisal Guidance 139: Continuous Positive Airway Pressure for the Treatment of Obstructive Sleep Apnoea/Hypopnoea Syndrome*. London, United Kingdom: National Institute for Health and Care Excellence; 2008.