

# Comparative Effectiveness of Diagnosis and Treatment of Obstructive Sleep Apnea in Adults

## Focus of Research for Clinicians

In response to a request from the public regarding obstructive sleep apnea (OSA), a common disorder associated with serious morbidity and mortality, a review was undertaken to examine the comparative effectiveness of approaches for screening, diagnosing, and treating OSA. The systematic review included 234 clinical studies published through September 2010. The full report, listing all studies, is available at <http://www.effectivehealthcare.ahrq.gov/apnea.cfm>. This summary, based on the full report of research evidence, is provided to inform discussions of options with patients and to assist in decisionmaking along with consideration of a patient's values and preferences. However, reviews of evidence should not be construed to represent clinical recommendations or guidelines.

## Background Information

Obstructive sleep apnea (OSA) is a common disorder that affects people of all ages but is most prevalent among older adults. Prevalence appears to be increasing, possibly in association with increasing rates of obesity. OSA involves repeated airway collapse during sleep, resulting in partial or complete cessation of breathing (hypopnea or apnea, respectively), sometimes as often as once each minute. Typical symptoms of OSA include poor sleep quality and daytime sleepiness, although many patients may be asymptomatic. OSA is an important public health issue due to associated morbidity and mortality rates, attendant comorbidities (such as diabetes), and adverse effects on quality of life. Studies show that before diagnosis, patients with OSA have increased rates of health care use, more frequent and longer hospital stays, and greater health care costs than after diagnosis.

Diagnosis and treatment of OSA are complicated by an inconsistent definition of OSA; debate concerning the level of respiratory abnormality that defines the disorder; and the most appropriate approach to diagnose OSA. For example, the apnea-hypopnea index (AHI) is used as a metric to diagnose OSA and to classify disease severity, but there is no current AHI threshold that indicates the need for treatment. By consensus, individuals are diagnosed with OSA if they have an AHI >15 events/hr or an AHI of 5 to 14 with documented hypertension, ischemic heart disease, history of stroke, or symptoms of excessive daytime sleepiness, impaired cognition, mood disorders, or insomnia. Individuals with frequent events (AHI  $\geq$ 30 events/hr) are more likely to be at risk for adverse outcomes.

Polysomnography (PSG) is the current diagnostic standard for OSA. PSG involves an overnight sleep-laboratory study during which neurophysiologic and cardiorespiratory signals are recorded. Portable sleep monitors (types II, III, and IV), used in hospitals, sleep centers, or homes, reduce resource requirements and obtain results more representative of a typical night's sleep. Various questionnaires and clinical prediction rules have also been used to assist in decreasing the resources required for diagnosis.

OSA is commonly treated with a continuous positive airway pressure (CPAP) device. Additional OSA treatments include but are not limited to oral devices, most commonly mandibular advancement devices (MADs); surgery; weight-loss programs; and positional therapy and alarms. Compliance with CPAP and other devices is an important reason for examining options to effectively treat OSA.

## Conclusion

Severe OSA (as defined by a high AHI) is associated with all-cause mortality and diabetes, providing evidence for the importance of identifying such individuals. Regarding diagnosis, portable monitors can predict a diagnosis of OSA, but additional studies are needed to prove their value compared with PSG. Some questionnaires may be useful screening tools. With respect to treatment, CPAP remains the most effective treatment for OSA, but MADs are also effective, and weight-loss programs may be effective for patients who are obese. There is insufficient evidence to evaluate the relative effectiveness of other treatment options, including surgery, though some individual studies do show efficacy of specific surgical interventions. Compliance remains a barrier to CPAP treatment, but there is insufficient evidence to evaluate compliance with other treatment options.



## Clinical Bottom Line

### Health outcomes of OSA:

- Severe OSA (AHI  $\geq 30$  events/hr) is a predictor of all-cause mortality (HR = 1.5–3.0). ●●●
  - One study showed that this correlation was not seen in men >70 years of age or in women.
- A high baseline AHI is correlated with diabetes (OR = 2.81–4.06). ●○○

### Detection of OSA:

#### Diagnosis

- At-home monitors\* accurately predict elevated AHI suggestive of OSA (but cannot estimate exact AHI values as measured by sleep-laboratory PSG/Type I monitors):
  - Type II monitors. ●○○
  - Type III and IV monitors. ●●○
  - There is insufficient evidence to compare the types of at-home monitors. ○○○

\*Type II monitors record the same information as PSG, Type III have at least two respiratory channels, and Type IV is any portable monitor that fails to meet the requirements of Type II or III classification.

#### Screening

- The Berlin Questionnaire may be accurate in screening for OSA. ●○○
- Some clinical prediction rules (a morphometric model and a pulmonary function data model) may have predictive capacity, but these tools have not been validated externally. ●○○
- There is insufficient evidence at this time to evaluate the effectiveness of most questionnaires, including the commonly used STOP and STOP-Bang questionnaires, in aiding diagnosis. ○○○

#### Additional Findings

- There is insufficient evidence to evaluate:
  - The effectiveness of phased testing in aiding diagnosis. ○○○
  - The usefulness of preoperative screening for OSA in improving postoperative outcomes. ○○○

### Treatment of OSA<sup>†</sup>:

#### CPAP and MAD

- CPAP and MAD are effective treatments for OSA (e.g., they improve sleepiness and lower AHI values). CPAP is superior to MAD in achieving an AHI of  $\leq 5$  events/hr. ●●○
  - Studies of MAD predominately exclude patients with comorbidities or unsafe levels of sleepiness.
  - Evidence is insufficient to address which patients might benefit most from treatment with CPAP, MAD, or CPAP compared to MAD. ○○○
- Types of positive airway pressure machines:
  - AutoCPAP and fixed CPAP are equally effective. ●●○
  - Evidence is insufficient to compare other CPAP devices (oral CPAP, nasal CPAP, bilevel PAP, flexible bilevel PAP, and humidified CPAP or autoCPAP). ○○○

<sup>†</sup>Current research evaluates only intermediate outcomes, and thus these messages may not apply to long-term clinical outcomes.

#### Surgery

- The studies for surgical interventions are limited, and while some studies show efficacy of individual interventions, current evidence is insufficient to determine their relative effectiveness when compared to each other, to sham or no treatment, or to other OSA interventions. ○○○

#### Other Treatments

- Weight-loss programs may be an effective treatment for OSA (vs. control interventions) in patients who are obese. ●○○
- There is insufficient evidence to compare the relative effectiveness of other treatments for OSA, such as implants, exercises, positional approaches, and nasal dilator strips. ○○○

#### Compliance

- Compliance with OSA treatments:
  - High AHI and ESS are predictors of improved CPAP compliance. ●●○
  - Evidence is insufficient to evaluate potential predictors of MAD compliance. ○○○

ESS = Epworth Sleepiness Scale, a short questionnaire that is the standard measure of scoring daytime sleepiness symptoms; AutoCPAP = autotitrated CPAP, a CPAP device that automatically adjusts the level of delivered pressure based the patient's requirements; HR = hazard ratio (i.e., the mortality rate in patients with OSA is 1.5 times to 3 times the rate occurring in an unaffected population); OR = odds ratio (i.e., individuals with OSA have a 2.81-fold to 4.06-fold increased odds of developing diabetes when compared with unaffected individuals); STOP = Snoring, Tiredness during daytime, Observed apnea, and high blood Pressure; STOP-Bang = STOP plus Body mass index, age, neck circumference, and gender variables.

#### Strength of Evidence Scale

- High: ●●● There are consistent results from good-quality studies. Further research is very unlikely to change the conclusions.
- Moderate: ●●○ Findings are supported, but further research could change the conclusions.
- Low: ●○○ There are very few studies, or existing studies are flawed.
- Insufficient: ○○○ Research is either unavailable or does not permit estimation of a treatment effect.

## Additional Information

Treatment	Varieties/Modifications	Adverse Events <sup>†</sup>
CPAP	Various types allow for choices regarding fit, air pressure, humidity, and oral versus nasal airflow, although comparative effectiveness evidence is not available equally for all.	Claustrophobia, nasal and oral dryness (including nosebleeds), pressure discomfort, gum or lip soreness or pain, excessive salivation, skin irritation, nasal irritation and obstruction, aerophagia, abdominal distention, and chest wall discomfort.
MAD	Various designs allow for choices about the degree of mandibular advancement, adjustment options, material, fit, tongue stabilization, and intraoral versus extraoral placement.	Sleep disruption; sensations of pressure in the mouth; mucosal erosions; excessive salivation; dental crown damage; loosening of teeth; tooth, mouth, and jaw damage; and temporomandibular joint (TMJ) or jaw pain.
Surgery	Different types of upper airway surgeries as well as bariatric surgery. Common types of surgery for OSA include uvulopalatopharyngoplasty (UPPP), maxillary-mandibular advancement osteotomy, radiofrequency ablation, and insertion of palatal implants.	<b>Postsurgical complications:</b> infection, hemorrhage, nerve palsies, emergency surgical treatments, cardiovascular events, respiratory failure, rehospitalization, and death. <b>Long-term adverse events:</b> speech or voice changes, difficulties swallowing, and airway stenosis.
Weight-loss programs	Educational sessions, behavioral programs, and counseling about diet and exercise.	No reported long-term adverse events.

<sup>†</sup> Adverse-event reporting in evaluated studies was sparse. The adverse events above are evaluated based on cohorts of patients who received specific treatments within each study, rather than by interstudy comparisons. Furthermore, many studies were short term and provided little evidence regarding long-term adverse events.

## Gaps in Knowledge

### Long-term outcomes:

- Published studies have not adequately evaluated long-term clinical outcomes. Studies addressing long-term outcomes are currently ongoing. The effectiveness of treatments is thus currently based on intermediate measures such as sleepiness and AHI. However, trial evidence is lacking to determine whether improving sleep-study measures has any effect on mortality or comorbidities.

### Patient Populations:

- No studies use subgroup analysis in evaluating the effectiveness of treatments.

### Compliance:

- Patient adherence is a major problem inhibiting the effectiveness of CPAP treatment, but the relative compliance rates with MAD or other treatment interventions have not been evaluated.

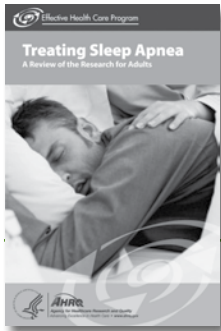
## What To Discuss With Your Patients

- The negative health outcomes associated with OSA.
- Sleepiness and the number of episodes of apnea and hypopnea can be improved with treatment; however, evidence is lacking for many long-term outcomes.
- The diagnostic and screening tools available to test for and evaluate OSA status and severity.
- The potential benefits and adverse events associated with CPAP, MAD, and other treatment options—including the importance of compliance.
- Patient preferences regarding diagnosis and treatment.

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## Resource for Patients

*Treating Sleep Apnea: A Review of the Research for Adults* is a free companion to this clinician research summary. It can help patients talk with their health care professionals about the many options for diagnosis and treatment. It provides information about:



- Diagnostic and screening tools.
- Treatment options.
- Current evidence of effectiveness and harms.
- Questions for patients to ask their doctor.

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## Ordering Information

For electronic copies of *Treating Sleep Apnea: A Review of the Research for Adults* (AHRQ Pub. No. 11-EHC052-A), this clinician research summary, and the full systematic review, visit [www.effectivehealthcare.ahrq.gov/apnea.cfm](http://www.effectivehealthcare.ahrq.gov/apnea.cfm). To order free print copies, call the AHRQ Publications Clearinghouse at 800-358-9295.

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## Source

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