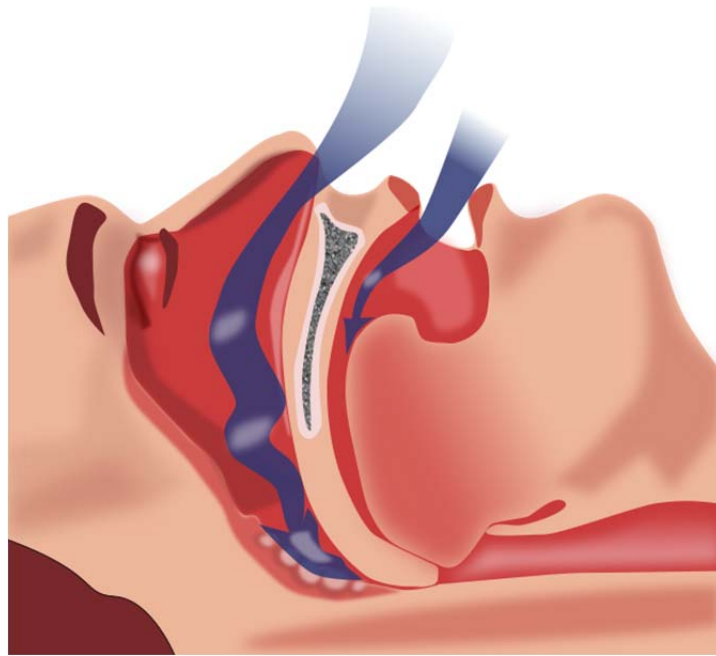


Dr. Avi Ishaaya's Guide to Obstructive Sleep Apnea



The information contained in this book is provided for informational purposes only. It is not intended to be a substitute for professional medical advice. Always seek the advice of a qualified health care provider if you have questions regarding your medical condition or before starting any new treatment.

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In This Chapter

Defining Sleep Apnea

What causes sleep apnea?

Symptoms

Children with Sleep Apnea

WHAT IS SLEEP APNEA?



What is sleep apnea? How is it defined? What are its symptoms?

Defining Sleep Apnea

Sleep apnea is a disorder characterized by complete or partial cessations of breathing during sleep. The interruptions in breathing, called apneas, can cause or exacerbate a number of other dangerous medical conditions.

The 3 Types of Sleep Apneas

There are three types of sleep apnea: central, obstructive, and mixed.

- In **central sleep apnea** (CSA), the brain fails to instruct the body to breathe. The person *can* breathe, but doesn't.
- **Obstructive sleep apnea** (OSA) is far more common than central sleep apnea. With obstructive sleep apnea, the upper airway repeatedly collapses during sleep, either completely or partially preventing air from reaching the lungs. During an obstructive sleep apnea event, the person is unable to breathe.
- **Mixed sleep apnea** is a condition where a person experiences both central and obstructive apnea.

Key Terms

Sleep apnea is a disorder characterized by complete or partial cessations of breathing during sleep despite effort to breathe.

The gaps in breathing occur between 5 to over 100 times per hour depending on the severity of the condition, and typically last between 20 and 40 seconds. In some cases, breathing may stop for up to two minutes at a time. During each lapse in breathing, blood oxygen levels in the blood drop below normal.

When the brain registers the lack of oxygen in the body, it jolts the body to wake up. This reopens the airway but also interrupts sleep. A gasp or choking sound can often be heard as breathing resumes. The person will typically fall back asleep with no memory of being woken up, which makes sleep apnea hard to recognize. The condition is typically identified by spouses or family members who notice heavy snoring and pauses in breathing.

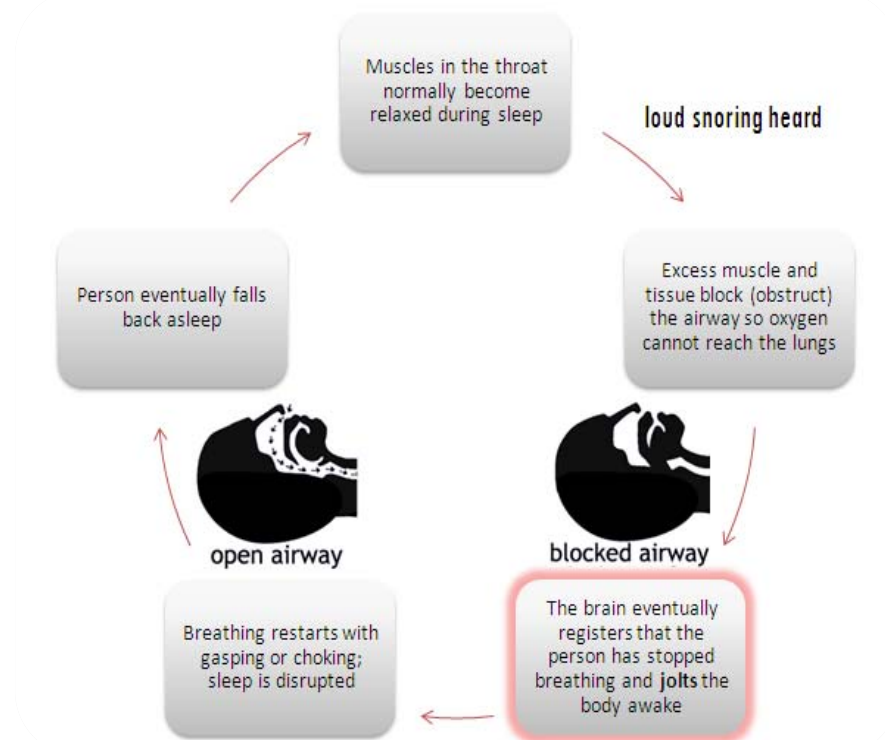
Poor Sleep and Heart Problems

As a result of repeatedly being woken up throughout the night, the person fails to sustain deep sleep and may feel tired throughout the day. Over time, the heart also weakens because it endures stress every time the body is jolted awake. The combination of poor sleep and cardiovascular stress predisposes OSA patients to a number of diseases, including obesity, hypertension, stroke, cancer, memory problems, difficulty concentrating, mood disturbance, anxiety, and depression.

What Causes Sleep Apnea?

1. **Muscles in the body become relaxed during sleep.** This is a normal part of sleeping.
2. **When throat muscles relax, they can block the airway and prevent oxygen from entering the lungs.** People with OSA experience complete (or near-complete) blockages repeatedly throughout the night. When the obstruction is partial, snoring becomes louder as air struggles to pass in and out of the lungs. When the obstruction is complete, the person completely stops breathing and is silent. Several factors make obstruction more likely including genetics, obesity, and gender. Those factors are covered in the ["Risk Factors"](#) section.
3. **When the brain registers that the person has stopped breathing, it reacts by jolting the body.** This places stress on the cardiovascular system.
4. **The sleeper wakes up causing the throat muscles to stiffen, thus removing the obstruction.** A gasp or choking sound can often be heard as the person begins to breathe again. Waking up disturbs sleep by preventing the sleeper from achieving deep sleep, even though the person rarely remembers waking up.

The Sleep Apnea Cycle



Symptoms of Sleep Apnea

The major symptoms of sleep apnea are:

- **Loud, persistent snoring.** Loud snoring is often followed by periods of silence when the airway is completely obstructed.
- **Unexplained or excessive daytime sleepiness.** People with sleep apnea are prone to dozing off while at work, watching TV, driving or even during conversations.
- **Poor sleep.** Since the brain repeatedly jolts the body to wake up and resume breathing, sleep quality is disturbed throughout the night.
- **Witnessed apneas.** Bed partners of sleep apnea sufferers may see or hear pauses in breathing followed by choking and gasping sounds.

Key Term

Excessive daytime

sleepiness is a condition that can be measured with the Epworth Sleepiness Scale. See page 16.

Other *nighttime* symptoms may include:

- Excessive legs and arms movement
- Frequent urination (nocturia)
- Excessive sweating

Other *daytime* symptoms may include:

- Waking up with Heartburn
- Waking up with dry mouth or sore throat
- Waking up with a headache or migraine
- Waking up tired and groggy
- Forgetfulness and memory loss
- Difficulty concentrating and completing tasks

Other, often overlooked, conditions that contribute to increased risk for sleep apnea include:

- Anxiety
- Depression
- Diminished sex drive
- High blood pressure/hypertension

- Increased heart rate
- Insomnia
- Mood disturbance and severe irritability
- Obesity
- Type 2 diabetes
- Stroke
- Recurrent atrial fibrillation
- Congestive heart failure
- Coronary or cardiovascular disease
- Unexplained weight gain

Children with Sleep Apnea

The American Academy of Pediatrics updated their guidelines to recommend that **every child who snores should be evaluated for sleep apnea**. Since the symptoms of sleep apnea in children may be similar to children who have Attention Deficit Disorder, many undiagnosed pediatric sleep-apnea sufferers are misdiagnosed with ADHD or Autistic Spectrum Disorder.

Children who have sleep apnea nearly always snore, however, they may not complain of being sleepy or appear to be tired during the day. Additionally, in children younger than five years old, symptoms may include mouth breathing, sweating, restlessness or waking up excessively. Children older than five may exhibit hyperactivity, poor academic performance and hostile behavior. As well, bedwetting, slow growth, short attention span, and unusual sleep positions- for example, sitting up in bed, legs crossed and slumped over a pillow- are also seen in children with sleep apnea.

When left untreated, sleep apnea in children may affect parts of the brain involved in learning, taking a toll on cognitive function and academic performance, and shaving points off a child's IQ. It may also affect a child's normal growth and contribute to childhood obesity since children who do not get enough rest are less physically active and seek more carbohydrate-rich, high-calorie food. Furthermore, recent research suggests sleep apnea may cause serious long-term health problems such as high blood pressure and heart disease that generally are not present until adulthood.

It has been shown that changes in the chemical make up in the brain of children suffering from OSA normalize after they start treatment of sleep apnea. Therefore, it is suggested that children with psychological deficits should be examined for sleep disorders more carefully.

THE DANGERS AND COMPLICATIONS OF SLEEP APNEA

In This Chapter

Immediate Consequences

Long-term Complications

Fatigue and Depression

Memory and Concentration
Impairment

Obesity

Heart Failure

High Blood Pressure

Arrhythmias

Coronary Artery Disease

Atrial Fibrillation

Asthma, Seizures, and
Headaches

Erectile Dysfunction (ED)

Loud Snoring and Marital
Complications

Death

Comorbidities



Although sufferers and their partners often minimize their condition, sleep apnea carries a wide range of serious physical and psychological consequences when left untreated.

Immediate Consequences of Untreated Sleep Apnea

The immediate consequences of untreated sleep apnea include:

- Chronic sleepiness
- Poor concentration
- Mood disturbance
- Loud snoring
- Marital distress
- Memory loss

Long-Term Consequences of Untreated Sleep Apnea

Some of the main complications of OSA include:

- Fatigue and Depression
- Memory and Concentration Impairment
- Obesity
- Heart Failure
- High Blood Pressure (Hypertension)
- Arrhythmias
- Cancer
- Coronary Artery Disease
- Atrial Fibrillation
- Stroke
- Asthma, Seizures, and Headaches
- Erectile Dysfunction (ED)
- Diabetes mellitus
- GERD
- Death

Fatigue and Depression

Reduced sleep quality leads to chronic sleepiness throughout the day. Sleepiness can affect quality of life, motivation, and raise one's risk of injury while at work or driving. People with sleep apnea are 2-3 times more likely to get into a car accident and 5-7 times more likely to get into multiple accidents. Untreated sleep apnea sufferers are more likely to be irritated, moody, and depressed. People with even mild sleep apnea are twice as likely to have depression as those without while those with moderate to severe sleep apnea are 2 to 6 times as likely to suffer from depression.

Memory and Concentration Impairment

The absence of restful sleep can cause difficulty concentrating and memory disturbance, also known as cognitive impairment. These factors can affect job performance and productivity. Research has suggested that people with OSA show a loss of tissue in brain regions associated with memory which may cause irreversible

memory loss.

Obesity

Sleep apnea and obesity feed on each other and create a deadly downward spiral of disease. Repeated arousals during sleep may result in insulin resistance and poor regulation of blood sugars. In addition, hormonal changes may increase the storage of fat and increased appetite for high calorie foods, leading to further weight gain. Ninety percent of morbidly obese males and fifty percent of morbidly obese females have sleep apnea. A PAP device, the gold standard for treating OSA, such as CPAP (continuous positive airway pressure) or APAP (Auto-titrating positive airway pressure) has been shown to reduce insulin resistance and improve blood sugar control.

Heart Failure

Patients with moderate-to-severe sleep apnea have a greater risk of death from heart disease and heart failure. One third of patients with sleep apnea also show symptoms of congestive heart failure. Heart failure can be exacerbated by sleep apnea and leads to a greater chance of death. Between 11-37% of patients with heart failure have sleep apnea. It is strongly recommended that any new patient with congestive heart failure should be screened for sleep apnea.

High Blood Pressure

Sleep apnea is considered an identifiable cause of high blood pressure (hypertension) and is observed in 50-70% of patients. Sleep apnea has been identified as the most common cause of secondary hypertension in the US. As with congestive heart failure, it is recommended that all patients with newly diagnosed or difficult-to-control hypertension should be screened for sleep apnea.

Arrhythmias

Individuals with untreated sleep apnea are 2-4 times as likely to experience nocturnal complex arrhythmia (irregular heart rhythms that may be harmful). Bradyarrhythmia (slower, irregular heart rhythm) is observed in 10% of patients and is commonly seen during apneic events. At times, patients may have pauses in their heartbeat lasting several seconds as a result of the apneas, requiring a pacemaker.

Coronary Artery Disease

There is a very strong, independent association between sleep apnea and coronary artery disease (CAD). Men with untreated severe sleep apnea have an increased number of fatal and non-fatal cardiovascular events (such as heart attack, stroke, and angina) which can be nearly normalized with proper treatment of sleep apnea.

Atrial Fibrillation and Stroke

Atrial fibrillation and complex ventricular ectopy (abnormal heart beats) occur more frequently with OSA. Untreated obstructive sleep apnea doubles the risk of recurrence of atrial fibrillation. Patients with obstructive sleep apnea are more likely to have a stroke and die than those without sleep apnea. The risk of developing a stroke increases as the severity of the sleep apnea increases. Roughly 90% of stroke patients are found to have OSA. Therefore, all stroke patients should be evaluated for the disease.

Asthma, Seizures, and Headaches

Medical studies have shown that sleep apnea may exacerbate asthma symptoms and reduce the effectiveness of medication, underlining the need to evaluate in brittle asthmatics. Additionally, there may be an association between seizures and obstructive sleep apnea, especially in older adults. Some studies have shown treatment of obstructive sleep apnea, when present, may help in the control of seizures. Sleep disorders, including apnea, may be the underlying causes of some chronic headaches. In some patients with both chronic headaches and sleep apnea, treating the sleep disorder has cured the headache, even the very severe and disabling ones known as cluster headaches. Recent literature has also linked OSA to morning headaches which can improve with treatment.

Erectile Dysfunction (ED)

Men with any degree of ED are more than twice as likely to have OSA as their counterparts. As ED worsens, the prevalence of OSA increases: OSA occurred in 59% in men with normal erectile function; 83% with moderate ED; and 88% with severe ED. The link may be due to sleep deprivation or hypoxemia (decreased oxygen in the blood) caused by sleep apnea. It is recommended that men with even mild ED be referred for a sleep evaluation.

Loud Snoring and Marital Distress

Sleep apnea is often accompanied by very loud snoring which can affect the quality of sleep of the sufferers' *bed partners*. As a result, spouses or partners may also suffer from sleeplessness and fatigue. In some cases, the snoring can disrupt relationships, forcing couples to sleep apart and affecting intimacy. Diagnosis and treatment of sleep apnea can help alleviate these problems.

Cancer Two major studies which examined the association between sleep apnea and cancer, found a correlation between sleep apnea and cancer occurrence and sleep apnea and cancer fatality. Specifically they showed that the more severe a patient's untreated sleep apnea, the greater the risk of being diagnosed with cancer and of dying from cancer. In fact, those with untreated moderate sleep apnea were found to die at twice the rate of those without it, and those with untreated severe sleep apnea died at a

rate of nearly 5 times those without the disease. Researchers suggest that when a person is deprived of oxygen, the body compensates by producing more blood vessels which can feed cancer cells and cause tumors to grow and spread more quickly.

GERD

Gastroesophageal Reflux has been associated with sleep apnea, though researchers are still studying the possible causal relationship between sleep apnea and acid reflux. Most GERD patients' symptoms worsen at night while they try to sleep. It is estimated that about 50-75% of sleep apnea sufferers or people suffering from sleep disordered breathing also have GERD. It appears that treatment of either condition improves the severity of the other disease.

Death

People with untreated moderate to severe sleep apnea have an increased rate of all-cause mortality (death) which means that they are more likely to die from any cause as compared to people without sleep apnea. In a study using patients with untreated moderate-to-severe sleep apnea, researchers found that the five-year risk of death was 14% in those who refused CPAP treatment compared to 4% in those receiving treatment. The 14-year risk of death was 33% compared with only 7% in those without sleep apnea. Furthermore, patients with severe sleep apnea are almost three times as likely to die from heart-related complications.

Comorbidities

The table below illustrates the prevalence of OSA found in people suffering from various other diseases. As you can see, OSA is associated with many other disease states.

Disease	Prevalence	Disease	Prevalence
Asthma	17%	Ischemic heart disease	38%
Atrial fibrillation	49%	Morbid obesity, female	50%
Congestive heart failure	76%	Morbid obesity, male	90%
Daytime sleepiness	87%	Obesity	77%
Drug-resistant hypertension	83%	Pulmonary hypertension	77%
Dysrhythmias	58%	Stroke	90%
Gastroesophageal reflux disease	60%	Type 2 diabetes mellitus	86%
Hypertension	30%	Nocturia	48%

The image on the following page presents this data (and more) graphically.

The Consequences of Obstructive Sleep Apnea

Obstructive sleep apnea afflicts 1 in every 5 Americans.
What other problems arise for OSA patients?

STROKE

- » Men with moderate to severe OSA were nearly 3x more likely to have a stroke.
- » OSA is often found in patients following a stroke.
- » Risk of stroke rises with severity of the disease.

90%

POOR SLEEP*

58% 87%

STRESS ON THE HEART

HYPERTENSION

- » Sleep apnea is an identifiable cause of high blood pressure.
- » OSA is the leading cause of secondary hypertension.

37%

CORONARY ARTERY DISEASE

30%

CARDIAC ARRHYTHMIAS

- » 4x as likely to have atrial fibrillation

58%

CONGESTIVE HEART FAILURE

- » Moderate OSA have increased mortality rates.
- » New patients are screened for OSA.

76%

HEART DISEASE

38%

SUDDEN DEATH

- » OSA sufferers have a 30% higher risk of heart attack or premature death.

30%

More than 50% of sudden deaths from OSA occur between 10 pm and 6 am.

MEDICAL COSTS

- » Untreated sleep apnea costs Americans an extra 4.3 billion per year.
- » Treated sleep apnea can halve a patient's healthcare costs.

Change in annual health care costs per patient after treating OSA:

\$200,000

MOOD DISTURBANCE

- » Depression
- » Anxiety
- » Loss of motivation
- » Shortened attention span
- » Moodiness and bad temper
- » Poorer judgment

DAYTIME SLEEPINESS

- » 6-fold increased risk of car accidents
- » Impaired concentration and memory loss
- » Reduced work-efficiency
- » Reduced alertness
- » Slower reaction time

LOUD SNORING

- » Relationship discord
- » Morning headaches caused by oxygen deprivation

DIABETES TYPE II

- » Lack of insulin control and poorly controlled blood sugars
- » 58% have OSA

OBESITY

- » As sleep shortens or diminishes in quality, appetite for high-calorie food increases.
- » Obesity is the best documented risk factor for OSA. It is estimated that 90% of obese males and 50% of obese females have OSA.
- » The prevalence of OSA increases with body mass index (BMI).
- » Approximately 80% of OSA patients weigh 130% or more of their ideal body weight.

GASTROESOPHAGEAL REFLUX DISEASE (GERD)

SEXUAL DYSFUNCTION

- » Loss of libido
- » Impotence

NOCTURIA

- » Frequent urination at night

80% of middle-aged men

48%

AM I AT RISK?

In This Chapter

Risk Factors

Symptoms: The 3 S's

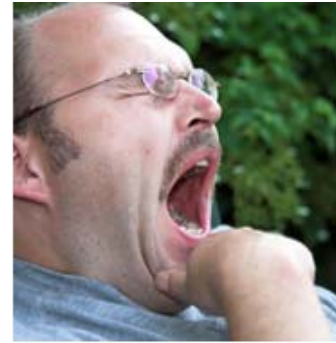
When should I see a doctor?

Spotlight: Screening for OSA

What will happen at the appointment?

Questions Your Doctor May Ask You

Spotlight: The Link between Obesity and Sleep Apnea



What are the symptoms of OSA? What are some of the factors that predispose patients to OSA? What should you do if you realize you or your partner is at risk?

Risk Factors for Obstructive Sleep Apnea

- **Male gender.** Males, who typically have higher BMI than females, are three times as likely to have OSA. However, post-menopausal women are nearly as likely to have OSA as their male counterparts.
- **Older age.** As muscles weaken with age, the chances of obstruction increase. Adults between 40 and 60 years old are at significantly greater risk for sleep apnea.
- **Obesity.** More than half of sleep apnea sufferers are overweight. It's believed that fat deposits narrow the airway, making it more susceptible to obstruction. Ninety percent of morbidly obese individuals suffer from sleep apnea. Large amounts of central body fat are also a risk factor.
- **A wide neck.** Wide necks are indicators of obesity. Men with neck circumferences of 17" or greater and women with neck circumferences of 16" or greater are at greater risk for sleep apnea.
- **High blood pressure.** Untreated hypertension increases one's chance of having sleep apnea.
- **Family history of sleep apnea.** Those with family members who have sleep apnea are 2-4 times as likely to have it themselves.
- **Enlarged tonsils or an enlarged tongue.** Both enlarged tonsils and tongues can block the airway more easily.
- **Small airways in the nose, throat, or mouth.** Small airways are easier to obstruct, and thus carry a greater risk of sleep apnea.
- **Nasal congestion.** Nasal congestion makes it more difficult for air to pass through to the lungs and can independently disturb sleep by creating physical discomfort.
- **Abnormal jaw.** Morphological features like recessed or small jaw suggest a narrow airway, leading to a higher probability of sleep apnea.
- **During pregnancy or after menopause.** Women during pregnancy and after menopause often have a higher BMI and are more susceptible to obstructive sleep apnea. Women are three times more likely to have sleep apnea after menopause than before.
- **Race.** There is a greater incidence of sleep apnea in African American, Hispanic, Chinese, and Pacific Islander populations.

- **Sleep position.** Obstructive events are more likely when sleeping on one's back.
- **Use of alcohol or sedatives.** Alcohol and sedatives relax the muscles in the throat which makes them more likely to obstruct the airway.
- **Smoking.** Smoking can irritate the back of the throat and promote fluid retention, narrowing the airway.
- **Lower extremity edema.** Those with unexplained lower extremity edema are at a higher risk for obstructive sleep apnea.
- **Polycystic Ovary Syndrome (PCOS).** OSA, daytime sleepiness, and diabetes are all associated with PCOS.

Symptoms: The 3S

The easiest way to identify people at risk for sleep apnea is by the “3 S’s”:

- **Snooring** that is persistent and loud
- **Sleepiness** during the day that is unexplained
- **Significant other's report of apneas.**

Other symptoms include:

- Anxiety
- Depression
- Difficulty concentrating and completing a task
- Diminished sex drive
- Forgetfulness
- Frequent urination at night (nocturia)
- High blood pressure
- Increased heart rate
- Insomnia
- Mood disturbance and severe irritability
- Morning headaches and at times uncontrolled migraine headaches
- Night sweats
- Sore throat or dry mouth in the morning due to the irritated throat from the increased turbulence and snoring
- Unexplained weight gain

When should you see a doctor?

You should see your doctor when you notice any of the following symptoms:

- Persistent sleepiness throughout the day (mostly seen when you are watching a movie, driving a car, seating in the movie theater, reading a book, or even waiting for a doctor's visit)
- Impaired sleep quality (waking up tired after a full night of sleep; sleep that is not restorative)
- Observed apneas during sleep by your bed partner
- Waking up with choking or gasping as if you were being smothered
- High blood pressure and heart problems that are unexplained or uncontrolled by medication
- In children, behavioral problems or difficulty with concentration and school work



Spotlight: Screening for OSA

Several screening tools have been developed by researchers to help physicians screen for sleep apnea. The most prominent tools are discussed below. *These tools should not be used as substitutes for diagnoses by a sleep test but are screening tools that may warrant further testing.*

The questionnaires described below can be found at the end of this eBook.

- ▶ **The STOP-BANG Questionnaire.** The STOP-BANG Questionnaire is a validated questionnaire that is used to screen patients for sleep apnea.
- ▶ **The Berlin Questionnaire.** Like the STOP-BANG, the Berlin questionnaire was especially designed to screen for obstructive sleep apnea although scoring the Berlin questionnaire is a little more complicated than the STOP-BANG.
- ▶ **The Epworth Sleepiness Scale.** The Epworth Sleepiness Scale measures a patient's sleepiness throughout the day. The test examines the likelihood of dozing off or falling asleep in various situations.

What can you expect during your appointment?

If you believe you may be suffering from sleep apnea, you should schedule an appointment with your doctor or a sleep specialist as soon as possible. Ask your doctor if there is anything you should bring to your appointment. Some doctors may ask you to chart your sleeping patterns (how long, how many interruptions) and monitor your energy levels prior to the appointment. It is suggested that you bring your bed partner with you or even a recording of yourself snoring.

Your doctor will inspect you for physical features that increase the likelihood of having sleep apnea such as your body mass index (BMI), a large neck circumference, excessive abdominal fat, and an enlarged tongue or tonsils.

Your doctor will also ask you about your medical history and co-existent diseases. Your doctor may ask you to fill out a questionnaire like the STOP-BANG questionnaire, the Epworth Sleepiness Scale, or the Berlin questionnaire. If your doctor determines that you are at risk for having sleep apnea, he or she will prescribe a sleep test to confirm the diagnosis.

Questions Your Doctor May Ask You

Below are some of the questions your doctor may ask you at your appointment. *Do you feel refreshed after sleep?*

1. *Do you sleep on your back or on your side?*

2. *Has your partner witnessed gaps in breathing, loud snoring, gasping, or choking?*

3. *Do you fall asleep as soon as you go to bed?*

4. *How frequently do you wake up to use the restroom?*

5. *Is there a history of sleep apnea in your family?*

6. *Are you taking any medication?*

7. *Do you ingest stimulants such as coffee or tobacco?*

8. *How frequently do you consume alcohol?*

9. *How many times a day do you experience bouts of tiredness?*

10. *Do you suffer with anxiety, depression, or irritability?*

11. *Do you have difficulty concentrating or remembering things?*

12. *Do you experience heartburn?*

13. *How often do you have morning headaches?*

14. *Is your sex drive diminished?*

Spotlight: The Link between Obesity and Sleep Apnea

Sleep apnea and obesity feed on each other creating a deadly downward spiral of disease.

Repeated arousals during sleep, which characterize sleep apnea, may result in insulin resistance and poor regulation of blood sugars. In addition, hormonal changes may increase the storage of fat and the increased appetite for high calorie foods, leading to further weight gain. Thus poor sleep as experienced by sleep apnea sufferers can



contribute to weight gain or to the inability to lose weight. On the other hand, obese or over-weight people are at higher risk for obstructive sleep apnea as fat deposits narrow the airway making it more susceptible to obstruction.

What are Leptin and Ghrelin and why should I care?

So what is the biology linking poor sleep and weight gain? Introducing Leptin and Ghrelin. Leptin is the hormone involved in the regulation of appetite, metabolism and calorie burning. Leptin's job is to inform the brain when the body had enough food and should start burning up calories. When one sleeps, the levels of Leptin in his body increase. When the level of Leptin is high, the brain thinks that it has sufficient energy and thus it does not generate hunger. However, when one does not get enough sleep, the level of Leptin decreases. When the level of Leptin is low, the brain thinks that it does not have enough energy and thus creates feeling of hunger, even though what it really needs is sleep and not food. Furthermore, the brain instructs the body to store the calories consumed as fat preparing itself for the next time it may need energy.



Ghrelin is the other hormone involved in regulation of weight. As opposed to Leptin, Ghrelin's job is to inform the brain when it needs to eat and when the body should store energy as fat instead of burning calories. When sleeping, the body requires less energy, and, therefore, the level of Ghrelin decreases. When one does not get enough sleep, the level of Ghrelin increases causing the brain to think that it is hungry, when, in fact, all it needs is sleep. The brain also notifies the body to stop burning calories and instead store them since it thinks there is an energy shortage.



In This Chapter

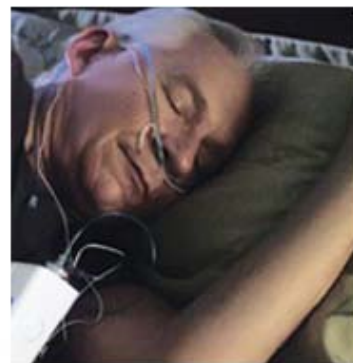
How is sleep apnea diagnosed?

What is a sleep study?

What are the differences between apneas, hypopneas, and RERAs?

Sample Data from a Home Sleep Test

DIAGNOSING OBSTRUCTIVE SLEEP APNEA



How is OSA diagnosed? What options does a patient have? How does a sleep study work and what does it measure?

How is sleep apnea diagnosed?

Obstructive sleep apnea is diagnosed based on the number of apneas (cessation of breathing) or hypopneas (partial or incomplete cessations of breathing) observed per hour. These totals are combined into an index score called the apnea-hypopnea index (AHI). The AHI is an average of the total number of apneas and hypopneas lasting 10 seconds or more, per hour.

Another measure used is the respiratory disturbance index (RDI). The RDI is more inclusive than the AHI because it counts disruptions in breathing that do not qualify as apneas or hypopneas but still result in physiological arousal. These disturbances are called respiratory effort related arousal or RERAs.

Both indices are used to create a final diagnosis. (See the table to the right.)

AHI or RDI	Diagnosis	Requires Treatment?
5 or greater	Mild sleep apnea	Sometimes*
15 or greater	Moderate sleep apnea	Always
30 or greater	Severe sleep apnea	Always

* May require treatment depending on nature of apneas and symptoms. Medicare will cover costs for treatment of patients with mild OSA who exhibit symptoms.

In order to accurately determine the frequency and severity of sleep disturbances, a physician will prescribe a sleep study. The sleep study can be conducted in a laboratory (called a polysomnogram or PSG) or at home.

What is a sleep study?

In order to confirm a diagnosis of sleep apnea, a doctor must prescribe a sleep study (or “sleep test”). The sleep study takes a full night to complete. During the study, the patient is connected to several sensors that measure various physiological data such as brain activity, heart rate, blood oxygen, respiratory effort, sleep position, and eye movements.

The data is recorded and later scored by a sleep technologist. The technologist searches the data and counts all the apneas, hypopneas, and RERAs (see the next section for more) that occurred during the study. The results are shared with a physician or specialist who then renders an interpretation and makes treatment recommendations to



A PATIENT TAKING A HOME SLEEP TEST

the patient.

Two Ways to Test for Sleep Apnea

The sleep study can be conducted in a sleep clinic or at home, with equally reproducible results.

SLEEP LABORATORY OR SLEEP CLINIC (POLYSOMNOGRAM OR PSG)

In a sleep lab or clinic, patients stay overnight and are hooked up to medical equipment that monitors all respiratory activity, oxygen levels, heart rhythms, muscle activity in the legs, and brain activity.


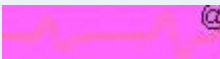

HOME SLEEP TEST (PORTABLE SLEEP MONITORING)

The patient is connected to a small device that monitors snoring and all respiratory activity including blood oxygen saturation, heart rate, sleep position, and breathing effort. The home test device is able to distinguish, much like the in-lab study, among the different types of sleep apnea. [Click here](#) to see what a home sleep test looks like.

Home testing has several advantages: it allows patients to sleep comfortably at home; it is more convenient and affordable, and is more representative of the patient's normal sleep habits. The Centers for Medicare and Medicaid Services and the American Academy of Sleep Medicine have endorsed the use of home sleep tests for those patients with a high-likelihood of having sleep apnea.

What are the differences among apneas, hypopneas, and RERAs?

Apneas, hypopneas, and RERAs (respiratory effort related arousals) are different types of sleep disturbances. The difference between them relates to the amount of reduction in airflow and blood oxygen saturation.

	Reduction in airflow	Reduction in blood oxygen saturation	Length of disruption	Has physiological arousal?	Example
Apnea	90%	3%*	10 seconds or more	Yes	
Hypopnea	30% or 50%	4% or 3%	10 seconds or more	Yes	
RERA	30%	Any or none	10 seconds or more	Yes	

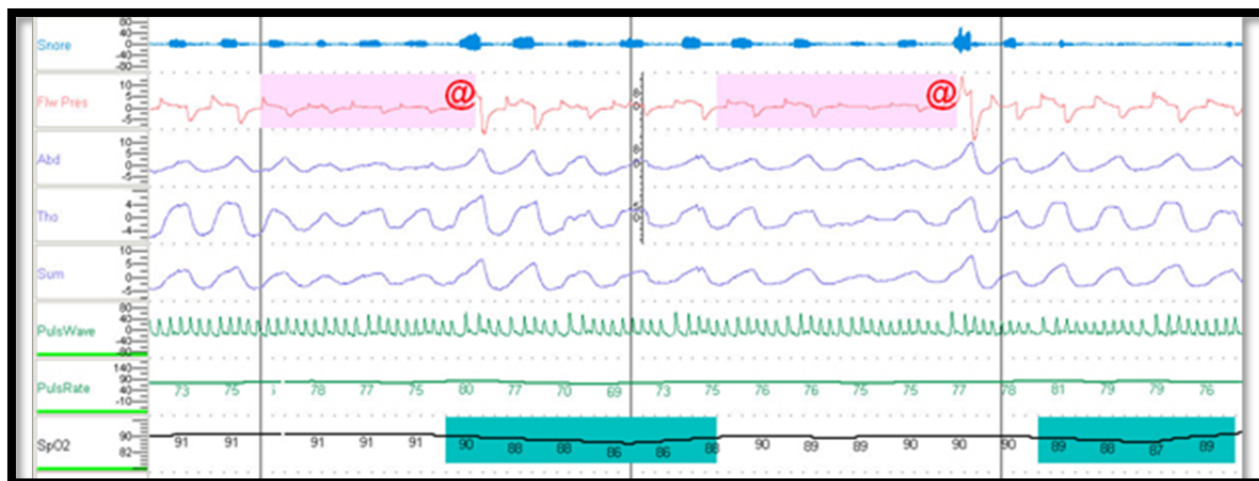
* Many sleep technicians will score apneas based on the 90% reduction in airflow alone.

Key Term

Apnea-Hypopnea Index is a measure of the total number of apneas and hypopneas per hour.

Sample Data from a Home Sleep Test

The data below is a sample from an actual patient using a home sleep test. The results show two apneic episodes, over a 30 second period, although results vary depending on the person and severity of the apnea.



Legend

Snore represents snoring intensity

FlwPres represents air flow pressure

SpO2 represents blood oxygen saturation

Abd, Tho, Sum indicate changes in the abdominal and thoracic sensors

PulsWave and **PulsRate** measure heart rate



signifies an apnea



signifies an oxygen desaturation

Following the cessation of breathing (first apnea), blood oxygen saturation dropped from 91 to 86 during the first episode and 90 to 87 in the second (highlighted in turquoise).

Note that the abdominal and thoracic sensors (rows three and four in purple) still show activity, indicating that the patient is trying to breath but cannot. This pattern is typical of obstructive sleep events. In contrast, during *central* sleep apneic events the abdominals and thoracic lines become flat as the patient stops making effort to breathe because the brain is not sending messages to breathe. These episodes are scored and are then collected into a final report that summarizes the sleep study findings.

TREATMENT

In This Chapter

Treatment Options

Spotlight: CPAP Vs. APAP

Lifestyle Changes

Spotlight: Tips for Using the APAP and CPAP



What treatments are available for sleep apnea and how do they compare to each other?

Treatment Options

PAP therapy, the Gold Standard

The “gold standard” and most common treatment for obstructive sleep apnea is a PAP device like the CPAP, Continuous Positive Airway Pressure, or the newer APAP, Automatic Positive Airway Pressure.). Both APAP and CPAP deliver air pressure that holds the airway open and prevents obstruction by the tongue or soft palate. *Ninety-five percent of patients who use PAP therapy see a 90-95% reduction in the number of apneas and hypopneas they experience* which makes CPAP or APAP the optimal treatment for sleep apnea patients.



CPAP

CPAPs are used at home, although they must be calibrated by a sleep technician in a sleep lab prior to being used so the correct pressure can be obtained. This process is called a CPAP titration. During titration, the patient is fit with the CPAP machine and a mask that goes under or over the nose or one that goes over the nose and mouth. The sleep technician will adjust the air pressure level in order to resolve all obstructive and snoring events. When titration is completed, the patient can begin using the CPAP at home. The CPAP device delivers a steady and constant stream of filtered air through the mask. The air pressure does not continuously adjust to the breathing needs of the patient, but is set at a constant pressure rate as was determined by the technician during titration. It is recommended that CPAP titrations be performed once a year due to changes in airway resistance, weight, and medical conditions.

Key Term

Titration refers to the process of determining the lowest effective PAP pressure that will prevent the occurrence of apneic events.

AUTO PAP (APAP)

In contrast to the CPAP, the Auto PAP (automatic positive airway pressure, also called “automatic PAP”, “auto CPAP” or “auto-titrating PAP”) is self-titrating and automatically adjusts the air pressure each night to maximize sleep quality and resolve obstructive apneas. When a person is breathing normally, the pressure delivered is low. The APAP is equipped with sensors that track respiration. When the Auto PAP senses an apnea or hypopnea, it automatically increases its air pressure to keep the airway open and unobstructed.

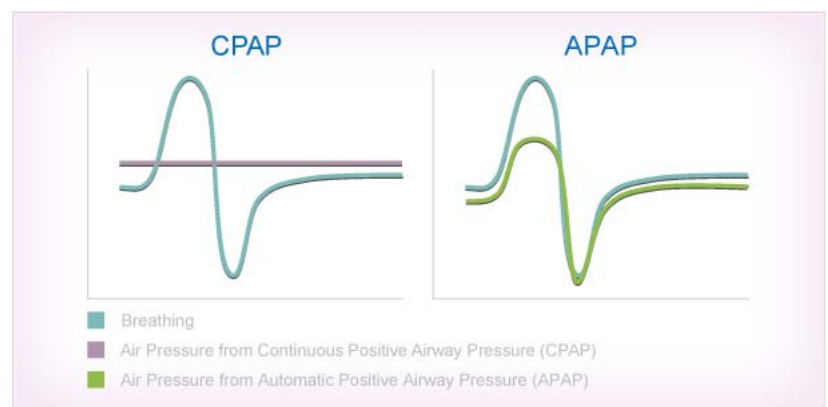
The end result is that sleep quality is preserved while delivering up to 40% less

pressure than the traditional CPAP (which has one constant pressure) leading to a better night sleep. Because the APAP automatically titrates, the correct pressure will always be delivered ensuring that sleep will be uninterrupted. There is no need for titration in a sleep lab and the machines can be used immediately.

Spotlight: CPAP versus APAP: What's the Difference?

Only one machine can adjust itself to find a pressure level that maximizes comfort: the APAP. The APAP device “breathes” with the patient delivering the right amount of air pressure at the right time to keep the airways open, while the older CPAP device blows air at a constant pressure regardless of the patient's breathing pattern.

The diagram to the right shows how the APAP automatically adjusts the pressure delivered as a patient breathes. The APAP continuously searches for the right pressure level to deliver the correct amount that is neither too high nor too low, maximizing both comfort and use. The pressure matches the patient's natural breathing cycle, providing inspiratory comfort (breathing in) and expiratory relief (breathing out). The result is a pressure pattern that matches the patient's entire breathing cycle.



In contrast, the CPAP delivers a continuous airstream that is incapable of adjusting to the patient's breathing needs. The constant positive pressure is maintained throughout the entire breathing cycle.

Additionally, the APAP is superior to the CPAP in that it does not need to be titrated (adjusted) in a sleep lab. When using a CPAP, a patient must stay overnight at a sleep lab to have the device titrated.

Dental Devices

Dental appliances may be useful in shifting the tongue and jaw forward to prevent the airway from closing. They are helpful in treating OSA but are not as immediate as PAP therapy. Dental devices may need to be adjusted. Once adjusted a repeat study is recommended. Dental devices can be used together with a PAP device to reduce the required level of air pressure.

Surgery

A third option for patients is surgery. There are several types of surgeries that may be recommended, each focusing on different parts of the airway. Some of the surgeries available include resection or hardening of the palate, removing the tonsils, advancing the tongue, and advancing the jaw line. On average, 50 percent of patients may see a 50percent reduction in their apnea-hypopnea index with simple surgeries. Those surgeries, however, are more effective at eliminating *snoring* than eliminating *apneas*. Patients with moderate to severe sleep apnea would benefit from jaw advancement if they are unable to tolerate PAP therapy. Jaw advancement surgery is more complicated but usually successful and requires a hospital stay.

Lifestyle Changes

Some patients may be able to alleviate their symptoms considerably by making lifestyle changes that may increase the airway diameter. Those suffering from sleep apnea should consider making these changes in addition to, but not instead of, medical treatment.

- Losing weight
- Quitting smoking
- Opening or clearing the nasal passages using a nasal dilator, saline wash, or breathing strip,
- Avoiding alcohol, sleeping pills, and sedatives
- Avoiding sleep deprivation
- Avoiding sleeping on the back
- Elevating the head four to six inches above the rest of the body

Spotlight: Tips for Adjusting to CPAP and APAP

Research shows that the first month is crucial to the success of APAP and CPAP treatment. Many patients stop using PAP therapy during the first three months, a critical time for adjusting to the device. Below are some tips to assist patients in acclimating to treatment.

- Be prepared to endure some discomfort in the beginning. It takes time to adjust to your new device. Some patients experience slight headaches for the first few mornings after beginning treatment..

- Ensure that the mask is properly fitted. Adjust the straps so that they are comfortable and snug. Make sure the mask creates a seal around the nose (and mouth if using a full-face mask). If red lines appear on the face, the mask is too tight; the headgear should be loosened. Over-tightening the mask can cause air leaks. If mask leak occur, slightly reposition the mask to allow it to re-seal or adjust the headgear until the leak stops. If the mask does not fit appropriately after adjustments, discuss trying different mask type or size with your provider.
- To reduce dry mouth, use a humidifier with your CPAP. All APAPs already have humidifiers attached.
- Patients with allergies should use a special fine filter. The filter should be replaced when necessary, usually every three months. Filters should be changed more often if the patient sleeps with the window open. If nasal congestion persists, talk to your doctor as prescription nasal sprays often help.
- Clean the mask and tubing frequently.
- Muffle the sound of the machine by putting it under the bed (hard floors only). The APAP device is usually a much quieter machine than the CPAP.

STATISTICS

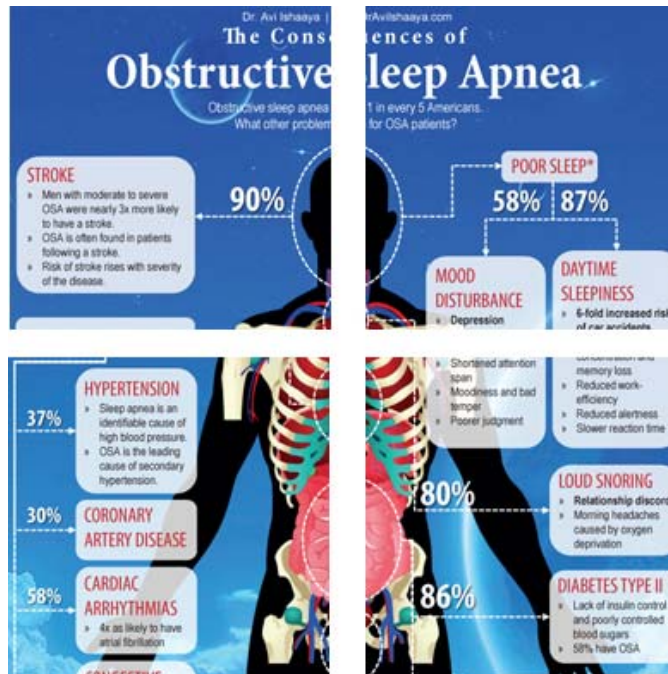
In This Chapter

Prevalence

Risk Factors

Dangers and Complications

Treatment



Prevalence

- Sleep apnea is extremely common. According to current estimates, as least 1 in 5 Americans have mild sleep apnea and 1 in 15 has moderate or severe sleep apnea.
- It is believed that 80% of those affected with obstructive sleep apnea are undiagnosed and in need of treatment.
- It is estimated that 9% of middle-age women and 24% of middle-age men are affected by sleep apnea and the majority are undiagnosed and untreated.
- In individuals over 65, obstructive sleep apnea with an AHI>10 has been found in 70% of the men and 56% of the women, which are three times the estimates for middle age.
- We are seeing an increasing prevalence in the adolescent population due to the rise of childhood obesity.

Risk Factors

- In one clinical study, 17% of African Americans tested positive for obstructive sleep apnea compared to 8% of Caucasians.
- Men are at a 2- to 3-fold greater risk for having obstructive sleep apnea compared to women.
- In a study comparing snoring habits in pregnant and non-pregnant women, research found that 14% of pregnant women reported snoring often or always versus only 4% of non-pregnant women
- Sleep deprivation and poor sleep increase appetite and can lead to obesity.
- Approximately 80% of OSA patients weigh 130% or more of their ideal body weight.
- More than 50% of sleep apnea sufferers are overweight.
- 90% of morbidly obese males and 50% of morbidly obese females have sleep apnea.
- 70% of Sleep Apnea sufferers are obese.
- Men with a neck circumference of 17" or greater are at greater risk for sleep apnea.
- Women with a neck circumference of 16" or greater are at greater risk for sleep apnea.
- The risk of sleep apnea doubles for every 22lb increase in weight.
- Building up a sleep debt over a matter of days can impair metabolism and disrupt hormone levels.

Dangers and Complications

- Over the past 10 years, referrals for sleep studies have increased 12-fold.
- Between 50-70% of obstructive sleep apnea patients have systemic hypertension independent of obesity, age, smoking, and alcohol intake.
- It is estimated that the risk of depression in patients with mild obstructive sleep apnea is doubled. In patients with moderate or severe obstructive sleep apnea, the risk is 2.6 times as great.
- Sleep apnea sufferers have a 30% higher risk of heart attack or death compared to their normal counterparts.
- The all-cause mortality rate over a 14-year period for patients with moderate to severe OSA was 33%, compared to 7% for people without OSA.
- Cancer patients with untreated moderate sleep apnea were found to die at twice the rate of those without sleep apnea, and those with untreated severe sleep apnea died at a rate of nearly 5 times those without the disease.

Treatment

- According to one study, the 5-year risk of death for moderate-to-severe sleep apnea patients was 14% for those who refused PAP treatment compared to 4% for those receiving treatment.
- In the US, diagnosing and treating sleep apnea can significantly reduce patients' overall healthcare costs. Untreated sleep apnea costs \$1,336 more in health care costs per person, compared to individuals without sleep apnea. This accounts for an estimated \$3.4 billion a year in additional medical costs.
- Approximately 95% of patients with OSA will have a 90%-95% reduction in their apnea-hypopnea index with PAP treatment.
- 10% weight reduction may decrease the severity of sleep apnea by 50%.
- According to studies, patients with untreated sleep apnea are 2.5 times more likely to suffer a fatal cardiovascular event compared to patients who are treated for sleep apnea.

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The information contained in this book is provided for informational purposes only. It is not intended to be a substitute for professional medical advice. Always seek the advice of a qualified health care provider if you have questions regarding your medical condition or before starting any new treatment.

ABOUT THE AUTHOR

Abraham (Avi) Ishaaya, M.D.,F.C.C.P.,F.A.A.S.M., F.A.C.G. S., M.A.C.G.S. (Dr. Avi) got his Bachelor's degree with honors from UCLA at age 19 and graduated from medical school at age 23. He completed his residency in Internal Medicine at Cedars-Sinai Medical Center in Los Angeles and proceeded to complete a fellowship in Pulmonary, Critical Care and Sleep Medicine. He is board-certified in Pulmonary, Sleep, Internal and Geriatrics medicine and has been in private practice since 1996. Dr. Avi is also a Member of the American Society of Bariatric Medicine. He is Assistant Clinical Professor of Medicine at UCLA School of Medicine. Over the past 20 years, Dr. Avi has been treating sleep disorders patients and has directed multiple sleep labs including the Cedar Sinai Sleep Lab. He currently directs the Midway Sleep Lab, one of the few sleep labs in Los Angeles accredited by the American Academy of Sleep Medicine (AASM).



Dr. Avi has been awarded the Paul Rubenstein Award and the Excellence in Original Research Award (awarded twice). He is a Solomon Scholar and has received honors from the Cedars-Sinai Medical Center and Southern California Pulmonary Research Conference. His caring, comprehensive approach combined with his extensive medical background has made him a top physician for many celebrities and other doctors. Dr. Avi believes in treating the patient, not just the symptoms.

QUESTIONNAIRES

STOP BANG QUESTIONNAIRE

1. Snoring

Do you snore loudly (louder than talking or loud enough to be heard through closed doors)?

Yes No

2. Tired

Do you often feel tired, fatigued, or sleepy during daytime?

Yes No

3. Observed

Has anyone observed you stop breathing during your sleep?

Yes No

4. Blood pressure

Do you have or are you being treated for high blood pressure?

Yes No

5. BMI

BMI more than 35 kg/m²?

Yes No

6. Age

Age over 50 years old?

Yes No

7. Neck circumference

Neck circumference greater than 40 cm?

Yes No

8. Gender

Gender male?

Yes No

High risk of OSA: answering yes to three or more items

Low risk of OSA: answering yes to less than three items

Adapted from:

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Berlin Questionnaire

1. Do you snore?

☐ Yes ☐ No ☐ Don't know

2. How loud is your snoring?

☐ As loud as breathing ☐ As loud as talking ☐ Louder than talking ☐ Can be heard in next room

3. How frequently do you snore?

☐ Almost daily ☐ 3-4 times/wk ☐ 1-2 times/wk ☐ 1-2 times/mo ☐ Rarely or never

4. Does your snoring bother other people?

☐ Yes ☐ No ☐ Don't know

5. Has anyone ever noticed you stop breathing in your sleep?

☐ Almost daily ☐ 3-4 times/wk ☐ 1-2 times/wk ☐ 1-2 times/mo ☐ Rarely or never

6. How often do you feel tired after sleeping?

☐ Almost daily ☐ 3-4 times/wk ☐ 1-2 times/wk ☐ 1-2 times/mo ☐ Rarely or never

7. Do you feel tired during your waking time?

☐ Almost daily ☐ 3-4 times/wk ☐ 1-2 times/wk ☐ 1-2 times/mo ☐ Rarely or never

8. How often do you nod off or fall asleep while driving?

☐ Almost daily ☐ 3-4 times/wk ☐ 1-2 times/wk ☐ 1-2 times/mo ☐ Rarely or never

9. Do you have high blood pressure?

☐ Yes ☐ No ☐ Don't know

10. Is your BMI over 30?

☐ Yes ☐ No ☐ Don't know

Epworth Sleepiness Scale

0 = *No* chance of dozing 2 = *Moderate* chance of dozing

1 = *Slight* chance of dozing 3 = *High* chance of dozing

1. Sitting and reading	0	1	2	3
2. Watching TV	0	1	2	3
3. Sitting, inactive in a public place	0	1	2	3
4. As a passenger in a car for an hour without a break	0	1	2	3
5. Lying down to rest in the afternoon when circumstances permit	0	1	2	3
6. Sitting and talking to someone	0	1	2	3
7. Sitting quietly after lunch (without alcohol)	0	1	2	3
8. In a car, while stopped for a few minutes in traffic	0	1	2	3

**Total Epworth
Score**

A total score of 10 or more indicates a high risk level for sleep apnea.