Obstructive Sleep Apnea

Indicator Report

TOOL DEVELOPMENT & SURVEILLANCE WORKGROUP

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Background

The *Obstructive Sleep Apnea Indicator Report* contains current information gathered by field experts in conjunction with the American Academy of Sleep Medicine (AASM) and the Centers for Disease Control and Prevention (CDC). This report was supported by the Centers for Disease Control and Prevention of the U.S. Department of Health and Human Services (HHS) as part of a financial assistance award totaling $704,163 with 100 percent funded by CDC/HHS. The contents are those of the author(s) and do not necessarily represent the official views of, nor an endorsement, by CDC/HHS, or the U.S. Government.

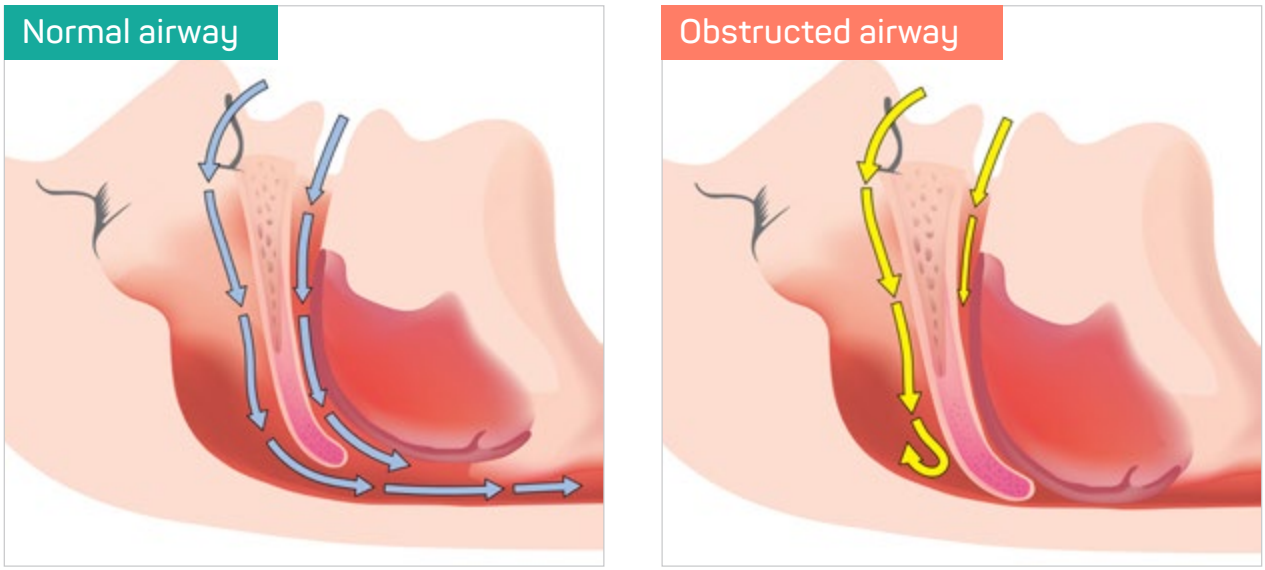
This publication includes information related to obstructive sleep apnea (OSA) in adults including symptoms, risk factors, health outcomes, and long-term care management. It also includes data regarding healthcare costs and prevalence across special populations and communities, including Hispanic or Latino persons, Black or African American persons, and American Indian or Alaska Native persons.

Due to the limited public health programs addressing OSA, there are currently no public health indicators available to present in this report. Public health professionals, policy makers, state health departments, and communities can use this report card to increase awareness and reduce the number of individuals with undiagnosed and untreated OSA. The Healthy People 2030 initiative, an ongoing project headed by the Department of Health and Human Services, has the key objective of increasing the proportion of adults with sleep apnea symptoms who get evaluated by a health care provider.[1]

What is obstructive sleep apnea (OSA)?

OSA is a medical condition in which the airway repeatedly closes, either partially or completely, during sleep. These breathing pauses or stops are associated with a drop in blood oxygen levels, leading to a surge in adrenaline that may cause an arousal from sleep and a subsequent reopening of the airway. These events may recur numerous times throughout sleep.[2]

Figure 1: Representation of airflow through a normal airway and an obstructed airway during sleep.



Which symptoms are suggestive of OSA and how many people experience them?

Symptoms of OSA may include loud, habitual snoring, fragmented sleep, unrefreshing sleep, daytime sleepiness, insomnia, frequent urination at night, morning headaches, mood changes, and difficulty with memory or concentration. Not all patients experience the same set of symptoms; some may have multiple symptoms while others may have none. Among those in the general population, the majority of people with a diagnosis of OSA do not have symptoms. Bedpartner reporting can be a valuable asset in determining who needs an evaluation.[2] Two national surveys address the prevalence of self-reported sleep symptoms. Based on an extensive evidence review,[3] the Behavioral Risk Factors Surveillance Survey (BRFSS) attempted to gather population-based data regarding symptom prevalence.[4] However, as risk factors for OSA (see "What are the risk factors for OSA?" section below) change, such as the prevalence of obesity, periodic reassessments are needed for accurate, current estimates of symptom prevalence. The National Health and Nutrition Examination Survey (NHANES) also included questions about self-reported symptoms and knowledge of physician-diagnosed OSA. Unfortunately, these questions did not continue, and neither national survey provides a comprehensive assessment of OSA symptom prevalence.[5]

Table 1: Symptoms that are suggestive of OSA and may occur during the day or at night.

Symptoms of OSA		
Wake Symptoms		
Daytime sleepiness – falling asleep inappropriately (while driving, at work, at school, in meetings, during conversations, other sedentary activities)	Car crashes (especially single vehicle, rear-ending another vehicle, off-road deviation)	Presenteeism (school, work) – in attendance, but not performing at your best
Morning headaches	Difficulty with focus or concentration	Absenteeism (school, work)
Mood changes	Forgetfulness	Declining work performance
Sleep Symptoms		
Loud, habitual snoring (can be disruptive to others)	Fragmented sleep, insomnia	Nightmares
Choking/gasping	Unrefreshing sleep	
Others say you stop breathing during sleep	Frequent urination at night	

What are the risk factors for OSA?

There are multiple factors that increase the risk of developing OSA. Some of these factors are modifiable, while others are not. Having one of these risk factors may modestly increase risk, and multiple factors may dramatically increase the risk of developing OSA.[2]

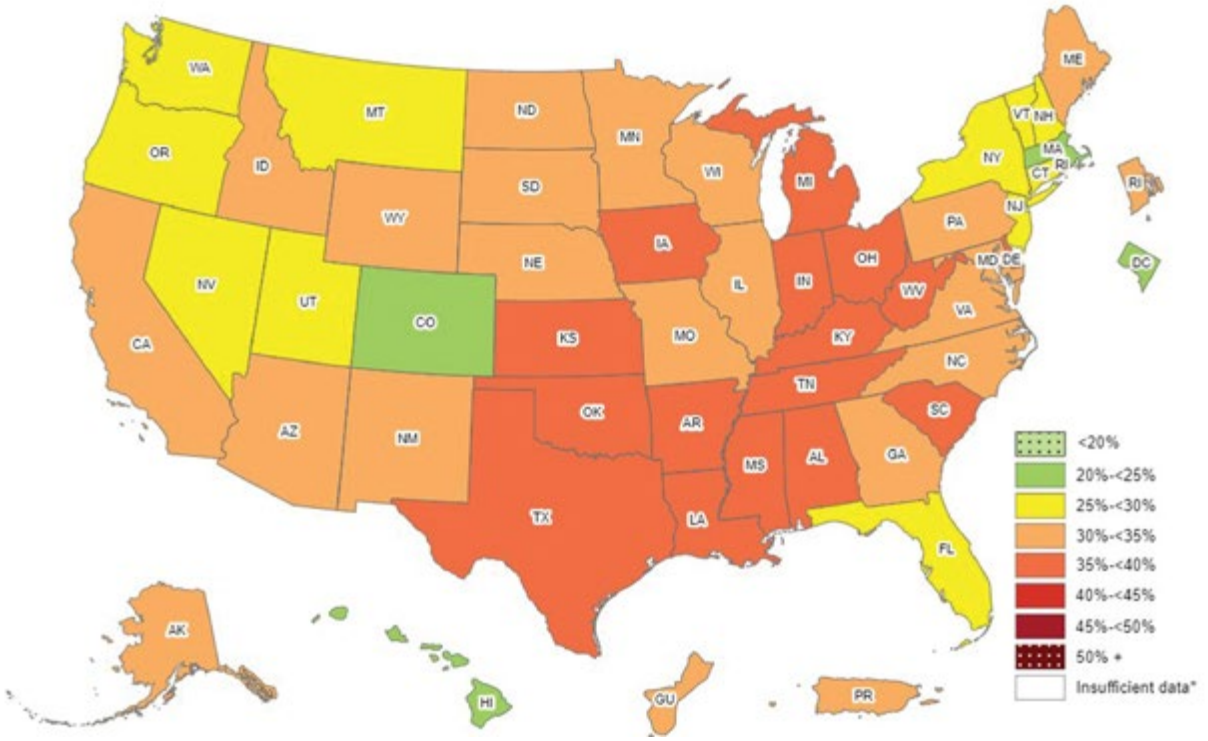
Modifiable risk factors

Among the modifiable factors, the most important is central obesity, which refers to body weight concentrated in the waist and neck areas as opposed to hips, thighs, and limbs, and which can be estimated using body mass index (BMI) or neck circumference.

Obesity is a major modifiable risk factor for sleep apnea.

- Several large population studies have clearly associated weight increases with increasing risk of developing OSA.[6, 7] For example, one such study showed that a 10% increase in weight resulted in a six-fold increase in the risk of developing at least moderately severe OSA.[6] Importantly, weight loss is associated with reduced severity of OSA.[8, 9]
- The risk of having OSA increases with neck circumference: ≥ 17 inches for males and ≥ 16 inches for females.[10]

Figure 2: Prevalence† of self-reported obesity among U.S. adults by state and territory, BRFSS, 2020



†Prevalence estimates reflect BRFSS methodological changes started in 2011. Data source: CDC's Behavioral Risk Factor Surveillance System. For detailed data for each map, go to https://www.cdc.gov/obesity/data/prevalence-maps.html

Behavioral risk factors are also modifiable.

- Some studies have shown that current cigarette smoking,[11] exposure to second-hand cigarette smoke,[12] and increased blood alcohol levels at bedtime increase risk.[13]

Some risk factors pertain to upper airway anatomy, which may be modified surgically.

- Retrognathia (a condition in which the lower jaw is further back than the upper jaw), large tonsils, large tongue, low hanging soft palate (the tissue part in back of the roof of the mouth), small jaw (micrognathia), and bony prominences of the roof of the mouth or floor of the mouth (tori) are also risk factors that may be correctible with surgery.[14-16]

Similarly, nasal polyps, nasal septal deviation, narrow nostrils that collapse easily, and large nasal turbinates (tissue inside the nose) all increase the risk of snoring and developing OSA.[17]

Non-modifiable risk factors

Some of the non-modifiable factors include sex (males have a higher prevalence than females),[18] age (the risk increases with increasing age),[19] and family history (there is an increasing likelihood of developing OSA if a first-degree relative has it).[20] Another significant non-modifiable risk factor is head and neck anatomy that cannot be altered surgically.[21]

Table 2: Key factors associated with OSA

Central obesity or weight gain	*Behavioral*
· BMI ≥30 kg/m2	· Cigarette smoking
· Large neck size (≥17 inches in males, ≥16 inches in females)	· Exposure to secondhand smoke
	· Alcohol consumption before bed
	· Sleeping in supine position (on one's back)
Anatomical	*Heritable/Demographic*
· Large tongue	· Family history
· Recessed lower jaw	· Sex
· High vault palate	· Age

Are there specific groups of people who are at high risk for OSA?

There are specific subgroups who should be evaluated for the presence of symptoms and other risk factors for sleep apnea.

One-third of commercial truck drivers in the U.S. have OSA and the risk for motor vehicle accidents for all drivers (passengers as well as commercial) with untreated OSA is 243% higher than a driver without OSA.[18]

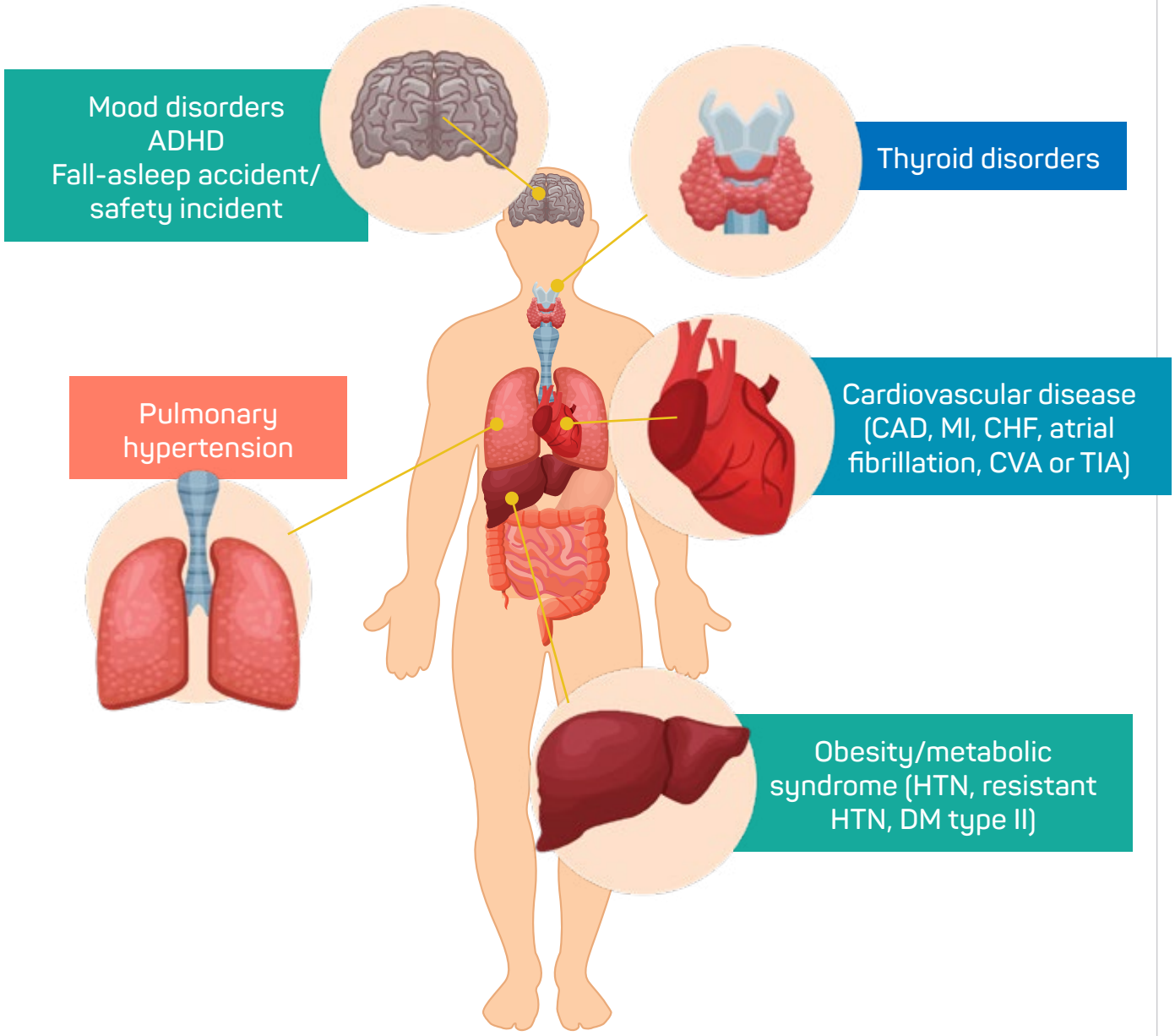
Table 3: Groups at risk for OSA

At-risk groups		
Demographic		
• Racial or ethnic groups including Hispanic or Latino persons, Black or African American persons, Asian persons, and American Indian or Alaska Native persons		
• Females after menopause		
• Middle-aged/older		
• Lower socioeconomic groups		
Safety-sensitive occupations, or experienced a safety-related incident or accident		
• Commercial vehicle operators (truck, bus or rail operators; delivery car drivers; airline pilots; ship captains)		
• Heavy machine operators		
• Nuclear reactor workers		
Medical conditions		
• Chronic lung or heart disease	• Treatment of refractory hypertension	• Hypothyroidism

• Cryptogenic epilepsy due to unidentified causes	• Type 2 diabetes	• Preoperative - any procedure requiring general anesthesia or narcotics, including but not limited to:
		  • Bariatric surgery
		  • Orthopedic surgery such as hip/knee replacement

• Obesity or overweight	• Abnormal heart rhythm	
• Congestive heart failure	• Stroke	
• Atrial fibrillation	• Pulmonary Treatment - resistant hypertension	

Figure 3: Medical conditions and complications associated with an increased risk of OSA



Please refer to the abbreviation table on page 24

How is OSA diagnosed?

Sleep studies are needed to confirm a diagnosis of OSA. These studies may be done at home or in a sleep laboratory. They measure the frequency of breathing stops or reductions in airflow per hour of sleep. The vast majority of cases of OSA (more than 80%) remain undiagnosed.[23]

Tests to assess for OSA have been categorized into four types of studies. Type 1 and Type 2 studies are called polysomnography (PSG). PSG is typically done in a laboratory setting (Type 1), but can be done at home (Type 2), and has more extensive monitoring, including brain wave activity, eye movements, and chin muscle tone, in addition to respiratory effort, airflow, oximetry, leg movements and body position. Brain wave activity confirms whether a patient is asleep or awake and assesses for sleep fragmentation and for brief arousals from sleep. Type 3 and Type 4 studies are called home sleep apnea tests (HSATs). Type 3 studies are the most commonly done out-of-lab recordings, and generally include assessment of airflow, respiratory effort, and oxygen saturation. Type 4 studies only include oxygen saturation, heart rate, and sometimes airflow.

Table 4: Types of studies for OSA

Channels	*Type I (in-lab)*	*Type II (out of lab)*	*Type III (out of lab)*	*Type IV (out of lab)*
Brain waves (4)	+	+		
Eye movement (2)	+	+		
Chin muscle (1)	+	+		
EKG	+	+	+	
Airflow (nose, mouth)	+	+	+	+/-
Breathing effort: chest, abdomen	+	+	+	
Body position	+	+	+	
Oxygen saturation	+	+	+	+
Heart rate	+	+	+	+
Arterial tone			+	

Figure 4: Diagram of in-lab sleep study (PSG)

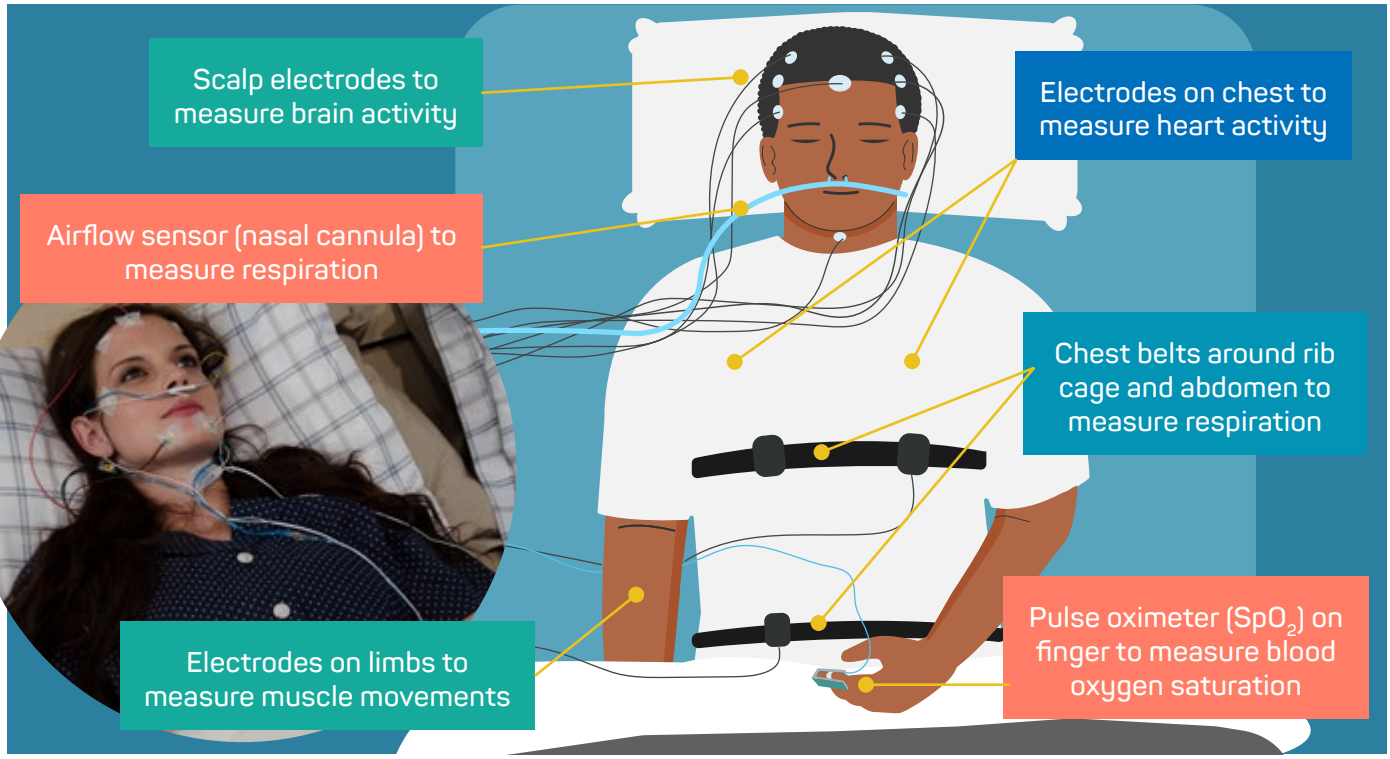
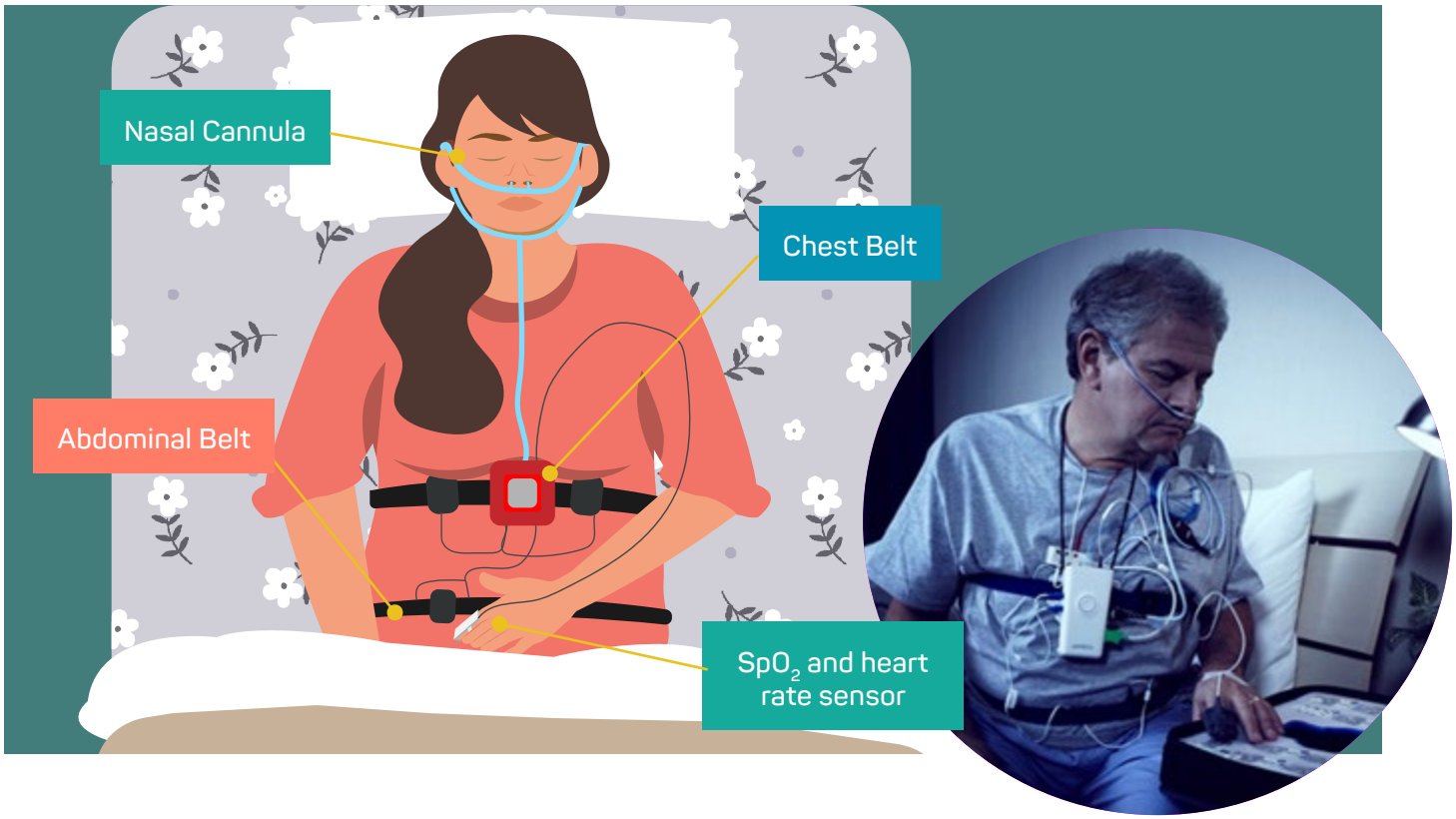


Figure 5: Diagram of a commonly used home sleep apnea test (HSAT)



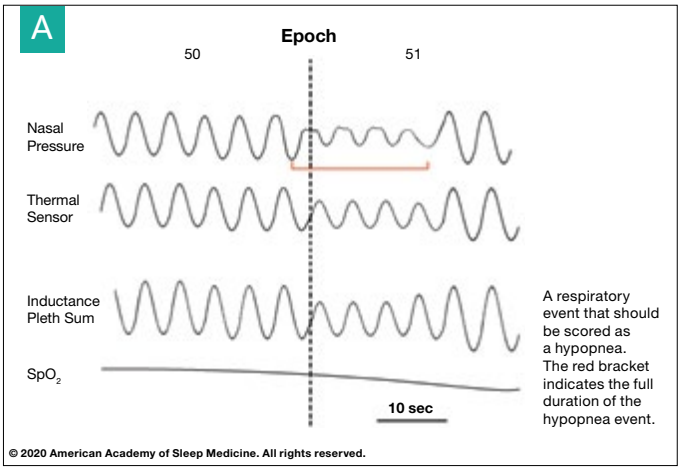
How is severity of OSA categorized?

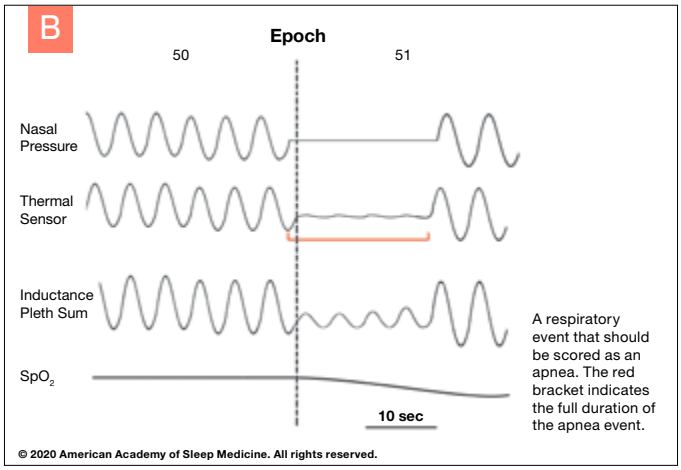
Based on the findings during the sleep study, a physician or other healthcare provider may categorize the severity of the findings as at least mild, at least moderate, or severe.

The number of stops (apneas) or reductions (hypopneas) in breathing each hour are used to classify severity. This number is called the apnea-hypopnea index (AHI). An AHI ≥5 events per hour is considered at least mild, ≥15 events per hour is considered at least moderate, and ≥30 events per hour is considered severe.[25]

Symptoms do not necessarily correlate perfectly with AHI. Some people with AHI values between 5 and 15 events per hour may have severe daytime sleepiness or other symptoms, and those with ≥30 events per hour may not report sleepiness.[25]

Figure 6: Snapshot of sleep study epoch - airflow showing hypopnea (A) and apnea (B), associated with a drop in SpO_2





The frequency of breathing pauses during sleep is by itself not a perfect indicator of disease severity.

People with infrequent reductions or pauses in breathing may have severe symptoms, and those with frequent reductions or pauses in breathing may not report symptoms.

Is OSA common?

OSA is very common and affects close to 29.4 million Americans.[26-28] A research study in 1993 among working adults found that OSA is very common.[26] A subsequent analysis estimated that the rates are likely even higher due to the higher prevalence of obesity.[28]

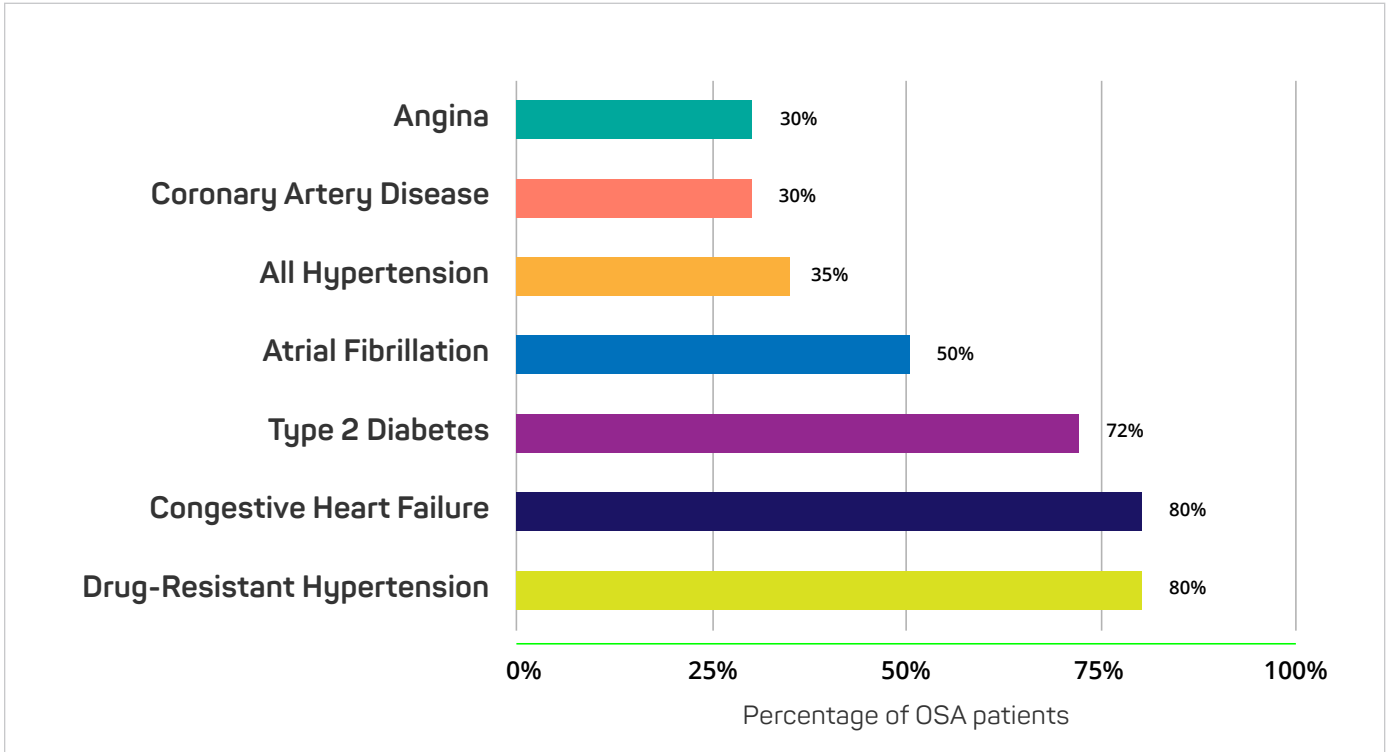
At least **9% of females** and **24% of males** had at least mild OSA, defined as having at least **5 respiratory events per hour**.

About **4% of females** and **9% of males** had at least **15 breathing pauses per hour**, which is considered at least moderate OSA.

About **2% of females** and **4% of males** had OSA with at least **5 breathing pauses per hour along with daytime sleepiness.**

OSA is common in patients with existing medical conditions such as hypertension[29], type 2 diabetes[30], and congestive heart failure[31]. The proportion of people with cardiovascular disease who also have OSA ranges from 30-80%, depending on the underlying condition.[31-34]

Figure 7: Prevalence of OSA in patients with co-morbid conditions

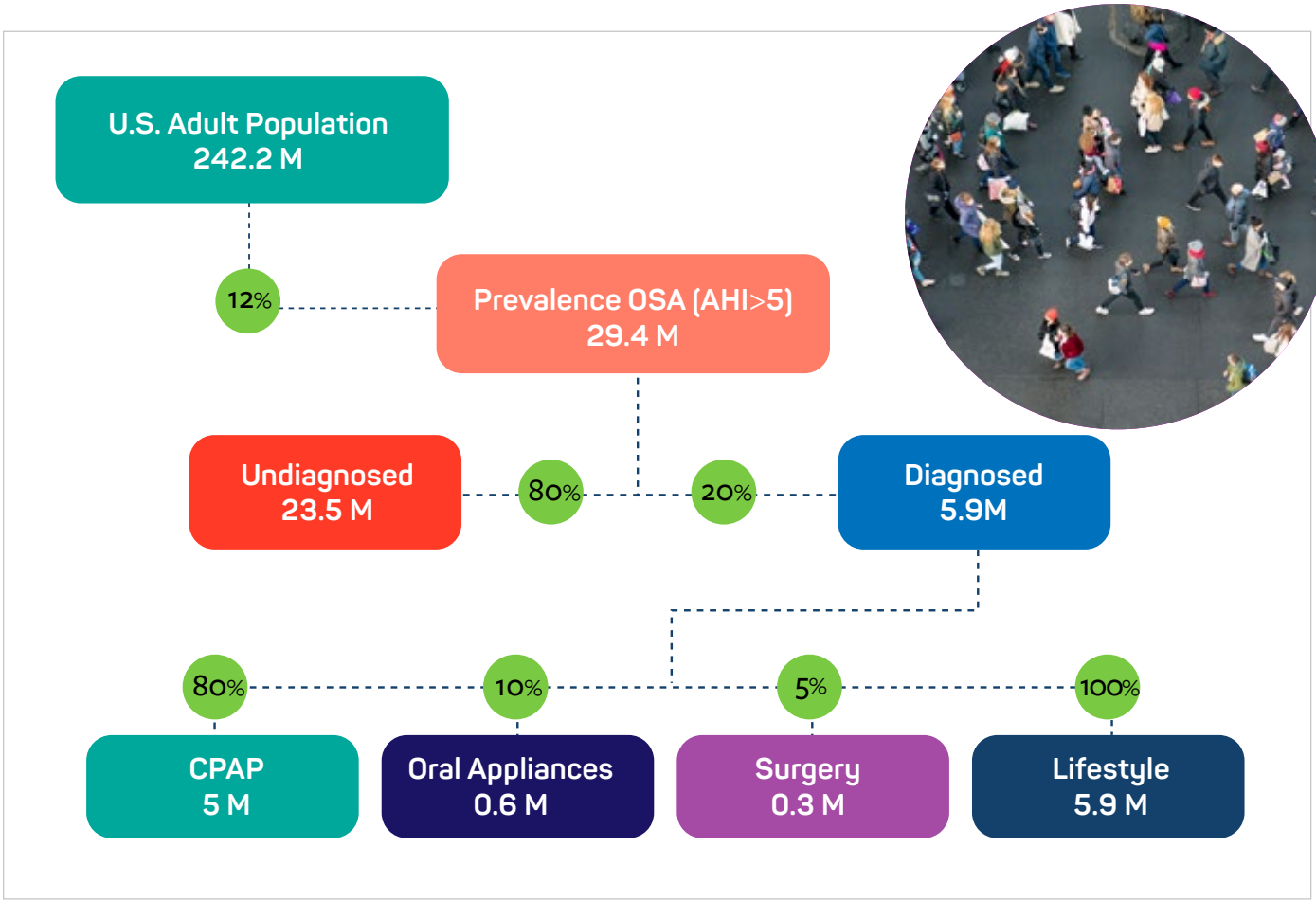


For both sexes, the most common risk factor for OSA is obesity. Obesity prevalence has been rising in the US for the past several decades[35] and small amounts of weight gain greatly increase the odds of developing SDB.[9] OSA prevalence in adults has been estimated using an apnea-hypopnea index (AHI) cutoff value of at least five events per hour. Using this threshold value of AHI, about 9% to 38% of adults have OSA. Among older ages, this prevalence can be as high as 90% in men and 78% in women.[36] The prevalence of sleep-disordered breathing in adults is significantly higher now than it was in 1994.[37] In addition to obesity and sex, age is another risk factor for OSA, with OSA being more common in older adults. Rates of OSA in females approaches those of males as they reach older age, particularly after menopause.

Data regarding OSA prevalence in other groups (e.g., LGBTQ+, gender non-conforming subgroups) are limited or unavailable at the time of this publication.

Figure 8: Prevalence, diagnosis, and treatment of OSA in the United States.

Data from: Hidden Health Crisis Costing America Billions Underdiagnosing and Undertreating Obstructive Sleep Apnea Draining Healthcare System (Frost and Sullivan 2016)[27]



Global prevalence

Global estimates of prevalence among 16 countries suggest that OSA is common worldwide, affecting approximately one billion individuals. Prevalence rates are believed to be highest in China, followed by the United States, Brazil, and India.[38]

What are the social or economic factors associated with OSA?

According to Healthy People 2030,[39] social determinants of health are environmental factors that affect a wide range of health, functioning, and quality-of-life outcomes and risks and can contribute to health disparities and inequities. Examples of these factors can range from socioeconomic status indicators such as income, education, safe housing, and transportation to other factors such as racism, access to health care, good air quality, language and literacy skills. All these factors have been associated with insufficient and short sleep.[40-42] More studies are needed to explore the association of these factors with OSA.

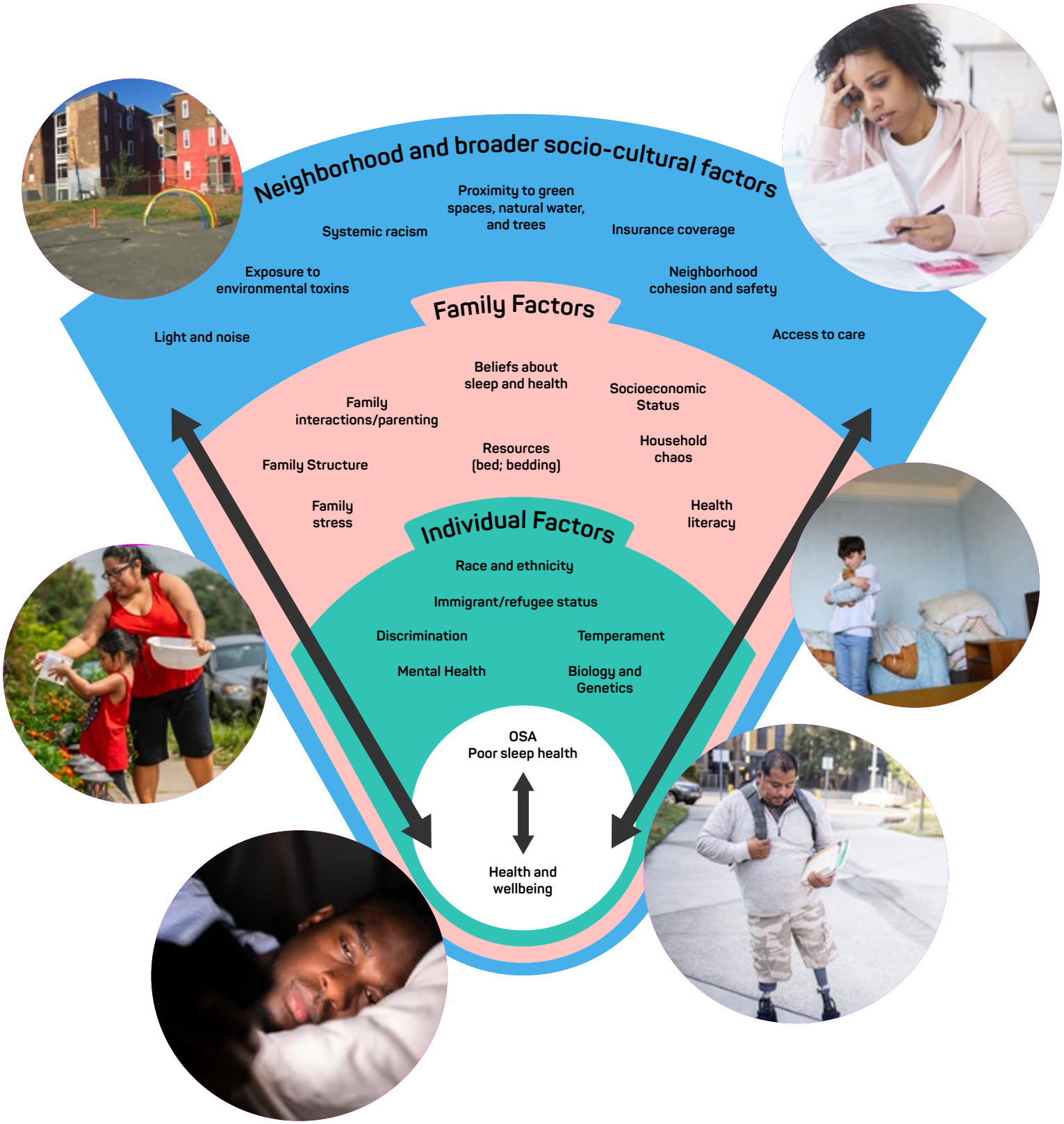
OSA is more common in certain racial and ethnic communities, based on data from Black and Hispanic or Latino communities in the U.S., as well as global data from India, China, Malaysia, and other Asian countries. In populations in Asia and south-east Asia, OSA is more likely to occur even in the absence of obesity and may be related to craniofacial or hereditary risk factors.[43] A high prevalence of moderate or severe OSA was found in Black or African American persons living in the southern United States who were previously undiagnosed (95%).[44] Hispanic or Latino persons also show higher risk for OSA compared to White persons.[43]

Obesity seems to be a major risk factor, particularly among Black or African American persons, Hispanic or Latino persons and Pacific Islander persons.[45] Many non-White populations historically live in disadvantaged neighborhoods that create physical and social environments that contribute to obesity.[46] Furthermore, Black children have been shown to have a higher prevalence (4-6 times) of OSA compared to White children and were two times more likely to have sleep-disordered breathing when obese.[46, 47] Socioeconomic status has also been shown to influence positive airway pressure (PAP), the first-line therapy for OSA. Black or African American persons who had a higher socioeconomic status (higher education, greater household income) had a higher chance of adhering to PAP therapy compared to Black or African American persons or White persons of lower socioeconomic status.[48]

A high prevalence of moderate or severe OSA was found in Black or African American persons living in the southern United States who were previously undiagnosed (95%).[38] Hispanic or Latino persons also show higher risk for OSA compared to Caucasians.[37]

Figure 9: Social-ecological factors contributing to sleep disparities at multiple levels: the individual level, the family level, and the broader neighborhood and socio-cultural context. As represented by the lateral black arrows, factors at each level likely interact over time to contribute to sleep disparities.

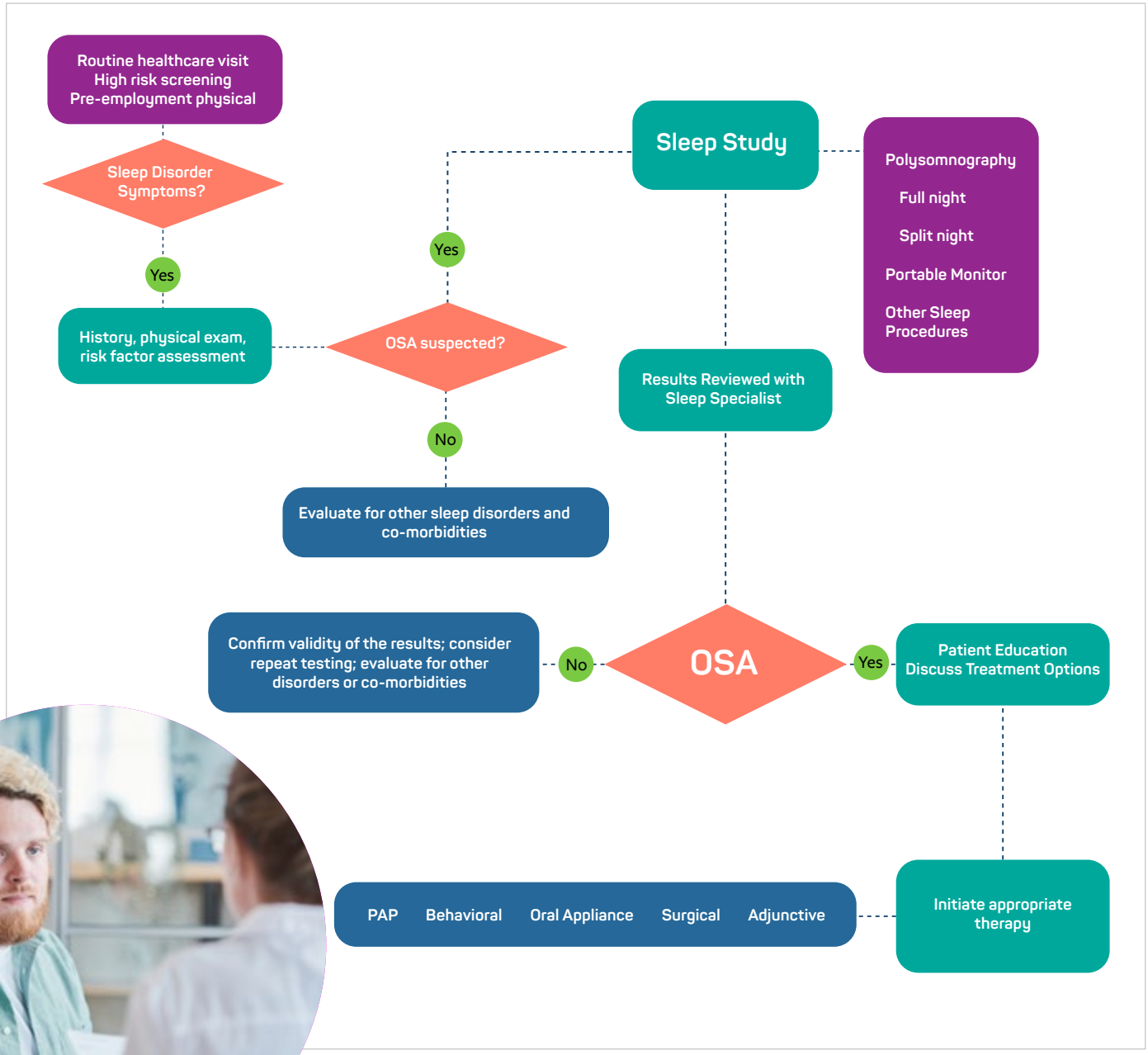
Data from: Disparities in Sleep Health and Potential Intervention Models: A Focused Review. [49]



What are the typical steps involved in identifying and treating OSA?

Figure 10. Care pathway for OSA

This care pathway has been adopted from the Clinical Guideline for the Evaluation, Management and Long-term Care of Obstructive Sleep Apnea in Adults.[50]



What are the risks associated with not identifying and treating OSA?

Morbidity

Cardio- and cerebrovascular disease: Sleep apnea has been associated with both cardiovascular and cerebrovascular disease. Conditions include hypertension, ischemic heart disease, stroke, pulmonary hypertension, and cardiac arrhythmias such as atrial fibrillation. Between 30-50% of people who have OSA also have hypertension. Additionally, 40% of people with hypertension have OSA.[51] The risk of sleep apnea in patients with resistant hypertension (hypertension requiring 3 or more blood pressure-lowering medications) is 80%.[29] The American Heart Association lists OSA as one of the leading causes of secondary hypertension.[53, 54] While there are many shared risk factors between cardiovascular disease and OSA, including obesity, OSA appears to be an independent risk factor.[31] Untreated sleep apnea increases the risk of stroke by two to four-fold.[22, 54, 55]

Between 30-50% of people who have OSA, also have hypertension.

Additionally, people with hypertension have about a 40% higher prevalence of OSA.[51]

Metabolic dysfunction: Sleep apnea also contributes to increased risk of metabolic disorders, such as type 2 diabetes and metabolic syndrome, and these associations are independent of obesity.[56] OSA is associated with increased glucose and triglyceride levels.[56] Among patients with diabetes, the treatment of sleep apnea with PAP therapy improved glycemic control and insulin resistance.[57, 58] Similarly, among patients without diabetes, therapy also improved insulin resistance.[58, 59]

Excessive daytime sleepiness: Because OSA reduces or impairs sleep quality, excessive daytime sleepiness is one of the most common consequences. This can lead to impaired function during daytime activities at work, school, home, or social activities, and lead to falling asleep inappropriately, especially when sedentary.[60, 61] The tendency to fall asleep is worse during the mid-afternoon, when chronically disordered sleep due to OSA coincides with a low point in the biological clock.[62]

Impaired brain function: Sleep apnea has been associated with a myriad of impairments in brain function, such as inattentiveness, loss of memory, difficulty processing complex data, exercising judgement, and making decisions. OSA can also increase the risk of accidents at home and at work, or while driving (see section on "Motor Vehicle Crashes").[55] Sleep apnea can result in altered brain chemistry and lead to early clinical and cellular changes that are associated with early Alzheimer's Disease. Some have hypothesized that treatment with PAP may reverse these changes.[63]

Quality of life: OSA is associated with reduced quality of life based on a variety of measures, including social, emotional, and physical function, vitality, and health perception.[23, 64] Quality of life includes how we feel during the day, not just at night. Daytime sleepiness, poor work performance, being irritable, depressive symptoms, and having low energy are some of the ways that OSA can impact quality of life. When OSA is treated, quality of life improves significantly, with treated patients reporting more energy, experiencing fewer work or motor vehicle accidents, and being more socially involved, less depressed and less irritable.[65]

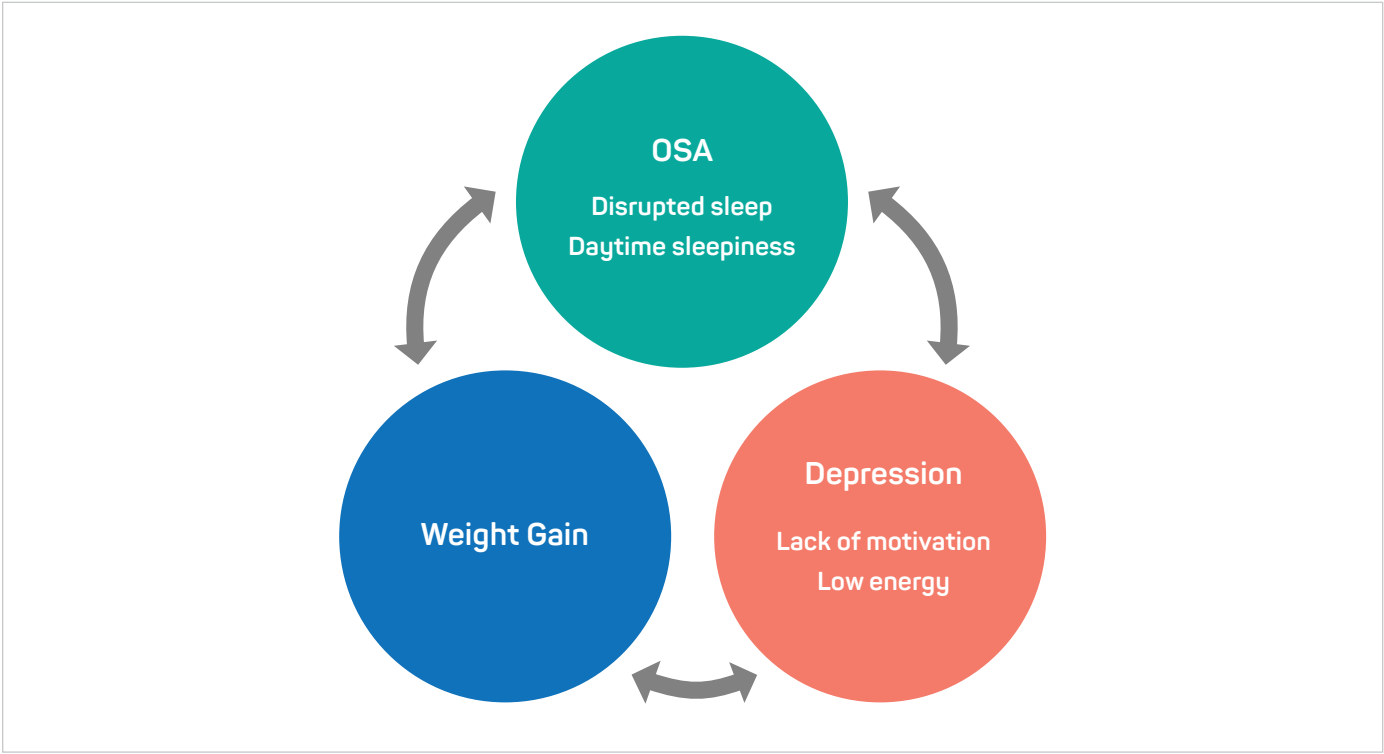
Motor vehicle crashes: The risk of motor vehicle accidents can increase up to 480% if OSA is not treated.[66] Twenty-six percent of patients admitted to a level one trauma center as a driver in a motor vehicle crash were found to be at high risk for OSA based on screening tests.[67] Numerous studies have shown that treatment of OSA with PAP results in reduced risk of vehicular crashes.[66]

Research shows that people with OSA are **2.4 times more likely to experience a motor vehicle crash** compared to people without OSA.[13]

Depression: Patients with OSA have a higher prevalence of depression, which can compound their decreased alertness and poor concentration, thus increasing risks for workplace and motor vehicle accidents.[68] There appears to be a bi-directional relationship between depression and OSA. Both disorders have symptoms of poor-quality sleep, daytime sleepiness, and difficulty with focus and concentration. OSA should be screened for and treated in patients with depression so that both disorders can be effectively managed.[69]

Patients with OSA have a higher prevalence of depression which can compound their decreased alertness and poor concentration.

Figure 11. Relationship between depression and obstructive sleep apnea.



Social/sexual functioning: Recent studies have highlighted the association between OSA and sexual dysfunction. Men with OSA are at increased risk for erectile dysfunction,[70] while women with OSA have higher rates of female sexual dysfunction.[71] Hormonal changes and sleep fragmentation that characterize OSA may be responsible for sexual dysfunction, but the mechanisms are still under investigation. Treatment of OSA with PAP therapy has been shown to improve erectile dysfunction.[70, 71]

Eye conditions: OSA has been linked to several ocular disorders including glaucoma, non-arthritic ischemic optic neuropathy, central serous chorioretinopathy, floppy eye syndrome, and retinal vein occlusion.[72] Treating OSA may reduce the progression of certain ocular disorders, including glaucoma.[73]

Pulmonary conditions: OSA has been linked to asthma. A bi-directional relationship has been described, with each condition being associated with the other. About half of adult patients with asthma have OSA, and the odds of having OSA is 2.64 higher in patients with asthma than those without asthma.[74]

Mortality

Mortality associated with untreated OSA

OSA is associated with higher mortality, particularly if moderate or severe, and in those who are not receiving effective treatment.

Mortality was higher for males with breathing stops more than 20 times per hour[75] versus those with less than 20 breathing stops per hour. This was particularly true for males under 50 years in age, as mortality from other causes in this group is less common.

Among adults with severe OSA (breathing reductions or stops > 30 times per hour) who were not using PAP, during an average of 14 years of observation, death from all causes was 3.8 times higher than among those with < 5 breathing reductions or stops per hour, and death due to cardiovascular disease was 5.2 times higher.[6]

> Some people with OSA are at higher risk of premature mortality, particularly those with more severe disease who are untreated.

Reduced mortality with PAP therapy

Use of PAP to treat OSA is protective against death. PAP also reduces mortality in patients with OSA after stroke[76] and reduces fatal and non-fatal cardiac events.[77]

Surveys for OSA

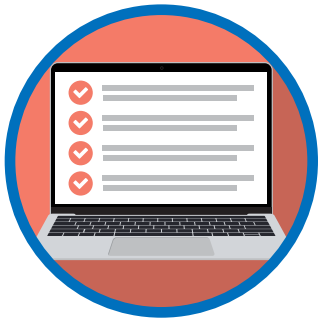
A number of surveys are available to assess the risk of OSA or its associated symptoms, such as daytime sleepiness or other functional outcomes. The value and role of these surveys has been reviewed previously.[78] These instruments and surveys include:

An assessment of the overall risk of OSA:

Berlin Questionnaire;[79] STOP-BANG;[80] Multivariable Apnea Prediction (MVAP); Symptomless MVAP[81]

Subjective assessment of daytime sleepiness:

Epworth Sleepiness Scale (ESS)[16]



Functional outcomes:

Patient-Reported Outcomes Measurement (PROMIS)-29, PROMIS Sleep Disturbance, PROMIS Sleep Related Impairment,[83, 84] Calgary Sleep Apnea Quality of Life Index (SAQLI),[85] NHANES questionnaires,[86] BRFSS questionnaires,[87] Sleep Disorders Questionnaire, Functional Outcomes of Sleep 10 (FOSQ-10),[88] Insomnia Severity Index (ISI),[81] Pittsburgh Sleep Quality Index (PSQI).[90]

Economic burden of OSA

Undiagnosed OSA was estimated to cost the United States approximately $149.6 billion in 2015.[27] OSA can be expensive because of costs related to medical and mental health conditions, workplace accidents, loss of productivity at work, and motor vehicle accidents. Treating OSA can save an estimated 67% of these costs per capita.[27] On average, treatment costs $1,190 per patient annually, which is comparable to the cost of a single visit to an emergency department for a moderate-level health complaint ($1,200).[27]

Untreated OSA is associated with two-fold higher medical expenses, mostly because of cardiovascular disease.[91]

> Undiagnosed OSA was estimated to cost the United States approximately **$149.6 billion in 2016.**[29]

Testing, treatment, and appointments cost an average of $2,105 per year per capita.[27]

In the United States, the total cost of motor vehicle crashes where undiagnosed OSA was a contributing factor was estimated at $26.2 billion in 2015. Treatment of OSA can save costs by preventing damage to vehicles or other property, lost wages from missing work, higher insurance premiums, and medical expenses.[27]

Table 5. Cost burden of OSA in undiagnosed versus diagnosed and treatment costs in the United States (2015)

Data from: Hidden Health Crisis Costing America Billions Underdiagnosing and Undertreating Obstructive Sleep Apnea Draining Healthcare System (Frost and Sullivan 2016)[27]

Undiagnosed	
# People with OSA	**23,500,000**
	Cost of Undiagnosed OSA ($US Billions)
Comorbidities & Mental Health	**$30**
Motor Vehicle Accidents	**$26.2**
Workplace Accidents	**$6.5**
Lost Productivity	**$86.9**
Total Costs ($US Bil)	**$149.6**

Diagnosed	
# People with OSA	**5,900,000**
	Cost of Diagnosed OSA ($US Billions)
Diagnosis, Testing and Follow-up	**$0.8**
Non-surgical Treatment (PAP and Oral Appliance	**$6.2**
Surgical Treatment	**$5.4**
Total Costs ($US Bil)	**$12.4**

✕ Cost per Person **$6,366**

✓ Cost per Person **$2,105**

Table 6. Economic impact of comorbidities in the undiagnosed OSA population in United States (2015)

Data from: Hidden Health Crisis Costing America Billions Underdiagnosing and Undertreating Obstructive Sleep Apnea Draining Healthcare System (Frost and Sullivan 2016)[27]

Comorbidity	*# People in U.S. with Undiagnosed OSA and Comorbidity (Million)*	*Costs ($US Billion)*
Hypertension	14.1	$5.4
Heart Disease	3.1	$6.7
Diabetes	5.6	$6.4
Asthma and Other Breathing Disorders	5.9	$2.6
Insomnia	0.8	$2.1
Depression, Anxiety, and Other Mental Health Problems	8.7	$7.1
		Total $30.3 (Billion)

Assessment of fitness

General considerations

Strategies to measure fitness for daytime functioning and occupational performance include assessment for symptoms of untreated sleep apnea, and in particular, daytime sleepiness.

Available tools to measure sleepiness include subjective scales using questionnaires and objective testing using either multiple sleep latency test (MSLT),[92] or maintenance of wakefulness testing (MWT).[93] Other tools to assess cognitive function are mostly used in research environments, and include laboratory measures of vigilance using the psychomotor vigilance task (PVT)[94] or the Divided Attention Driving Test (DADT),[95] as well as the percentage of eyelid closure over the pupil over time (PERCLOS),[96] which assesses vigilance using eyelid closure in real time, while performing safety-sensitive tasks such as driving.

Occupational assessment

Some safety-sensitive occupations require that a person with OSA obtain a determination of fitness for duty. Such determinations are typically performed by occupational health physicians. Such physicians rely on medical documentation provided by the sleep physician. This data may include sleep study reports, adherence and effectiveness of therapy, assessment of symptoms, and other factors. Ongoing assessments are required. For example, commercial vehicle operators with OSA require evaluation at least annually, and sometimes more often, rather than every two years, as is done with operators without OSA. Individuals who work in safety-sensitive positions are encouraged to seek medical advice or evaluation, particularly if they suspect or have symptoms or risk factors related to OSA.[97]

Available Resources

I think I may have OSA. What can I do next?

If you suspect that you may have OSA, please consider getting an evaluation at a sleep center.

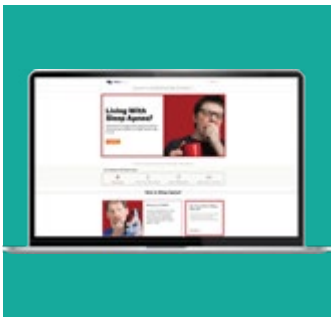
A list of sleep centers that have been accredited by and are members of the American Academy of Sleep Medicine are available here:

sleepeducation.org/sleep-center

Patient support groups

Alliance of Sleep Apnea Partners:

apneapartners.org

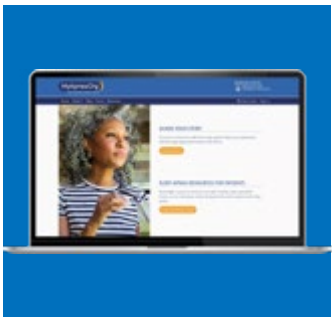


The American Sleep Apnea Association:

sleephealth.org

Society for Women's Health Research (SWHR):

swhr.org/science/networks/sleep



MyApnea:

myapnea.org

Evidence Gaps

This report highlights existing gaps in the scientific evidence. More work is needed to gather information on state-specific OSA prevalence data, and OSA prevalence in particular sub-groups including LGBTQ+ communities; longitudinal trends in national/regional populations; and association with social determinants of health. Pre-clinical indicators of OSA have not been sufficiently studied, leading the US Preventive Services Task Force (USPSTF) to conclude that an accurate risk-benefit assessment of screening for OSA in the general adult population cannot be conducted.[98] Therefore, no specific screening guidelines are available. More data are needed to develop accurate and feasible population-wide screening strategies to identify latent cases. Building and implementing a surveillance program to identify latent cases or sub-clinical markers can help guide resources toward disease prevention or early intervention to limit disease progression or adverse health consequences. Prior efforts were made to offer OSA-specific screening questions as part of the National Healthy Sleep Awareness Project.[3] This work needs to be expanded.

ABBREVIATIONS

AASM	American Academy of Sleep Medicine	**ISI**	Insomnia Severity Index
ADHD	attention-deficit/ hyperactivity disorder	**KSS**	Karolinska Sleepiness Scale
AHI	apnea-hypopnea index	**MI**	myocardial infarction
BRFSS	Behavioral Risk Factor Surveillance System	**MSLT**	Multiple Sleep Latency Test
BMI	body mass index	**MVC**	motor vehicle crashes
BPAP	bilevel positive airway pressure	**MVP**	Multivariable Apnea Prediction
CAD	coronary artery disease	**MWT**	Maintenance of Wakefulness Test
CDC	Centers for Disease Control and Prevention	**NHANES**	National Health and Nutrition Examination Survey
CHF	congestive heart failure	**OSA**	obstructive sleep apnea
CPAP	continuous positive airway pressure	**PAP**	positive airway pressure
CVA	cerebrovascular accident	**PROMIS**	Patient-Reported Outcomes Measurement Information System
DADT	Divided Attention Driving Test	**PSG**	polysomnography
DM type II	type 2 diabetes mellitus	**PSQI**	Pittsburgh Sleep Quality Index
EKG	electrocardiogram	**PVT**	psychomotor vigilance task
ESS	Epworth Sleepiness Scale	**QOL**	quality of life
FOSQ-10	Functional Outcomes of Sleep 10	**SAQLI**	Calgary Sleep Apnea Quality of Life Index
HSAT	home sleep apnea test	**STOP-BANG**	Snoring, Tired, Observed, Blood Pressure, BMI, Age, Neck, Gender
HTN	hypertension	**TIA**	transient ischemic attack

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