



Obstructive sleep apnea and type 2 diabetes

Obstructive Sleep Apnea (OSA) may contribute to or exacerbate type 2 diabetes for some of your patients.

PHILIPS

RESPIRONICS

sense and simplicity

Prevalence of OSA and diabetes

Prevalence of OSA

- Five to ten percent of the adult population, approximately 20 million people, may have OSA in the U.S.^{2,3}
- Studies show that greater than nine percent of men and four percent of women have an apnea hypopnea index (AHI) of greater than 15 per hour.
- Prevalence of OSA is higher in the following groups:⁴
 - Men
 - Post-menopausal women
 - Hispanic women
 - African-Americans
- 85 to 90 percent of patients with OSA have not been identified as having the disorder.²

Common signs and symptoms of undiagnosed OSA

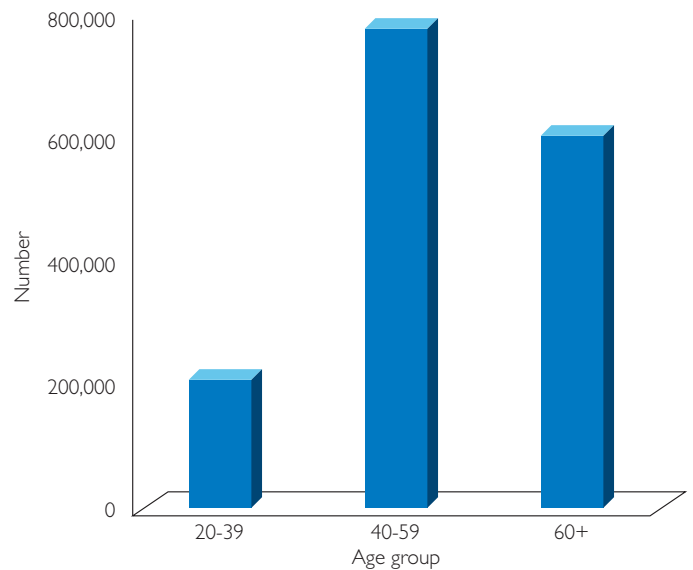
- Excessive daytime sleepiness, unrefreshing sleep, or daytime fatigue
- Gasping or choking while sleeping
- Witnessed apneas while sleeping
- Loud or disruptive snoring
- Morning headaches
- History of hypertension, new onset, or refractory hypertension
- History of refractory depression
- Frequent nighttime urination



Prevalence of diabetes

- Prevalence of diabetes in the U.S. has been growing⁵
 - Men: 10.5 percent of men > 20 years of age have been diagnosed with diabetes
 - Women: 8.8 percent of women > 20 years of age have been diagnosed with diabetes
 - Age 60 or older: 20.9 percent have been diagnosed with diabetes
- Prevalence of diabetes is strong in various ethnic backgrounds⁴
 - Non-Hispanic whites: 8.7 percent of population over age 20
 - Non-Hispanic blacks: 13.3 percent of population over age 20
 - Hispanic/Latino Americans: 9.5 percent of population over age 20

Estimated number of new cases of diagnosed diabetes in people aged 20 years or older, by age group — United States, 2005



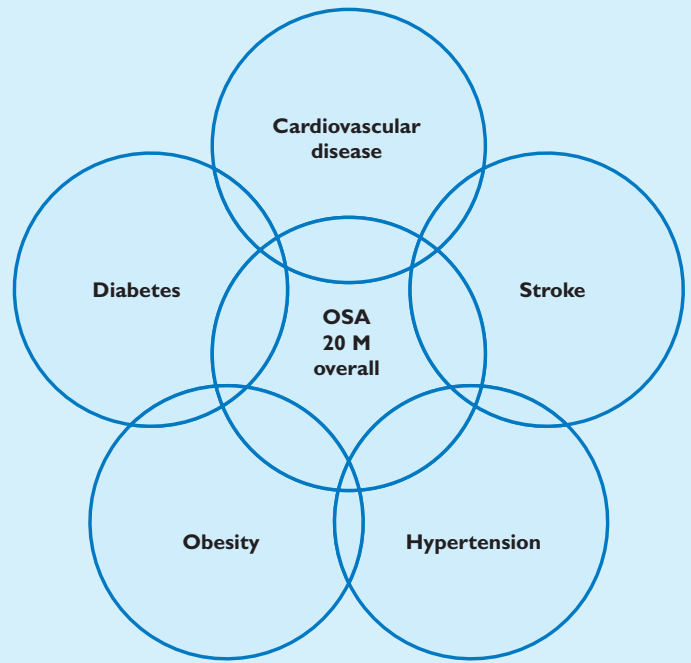
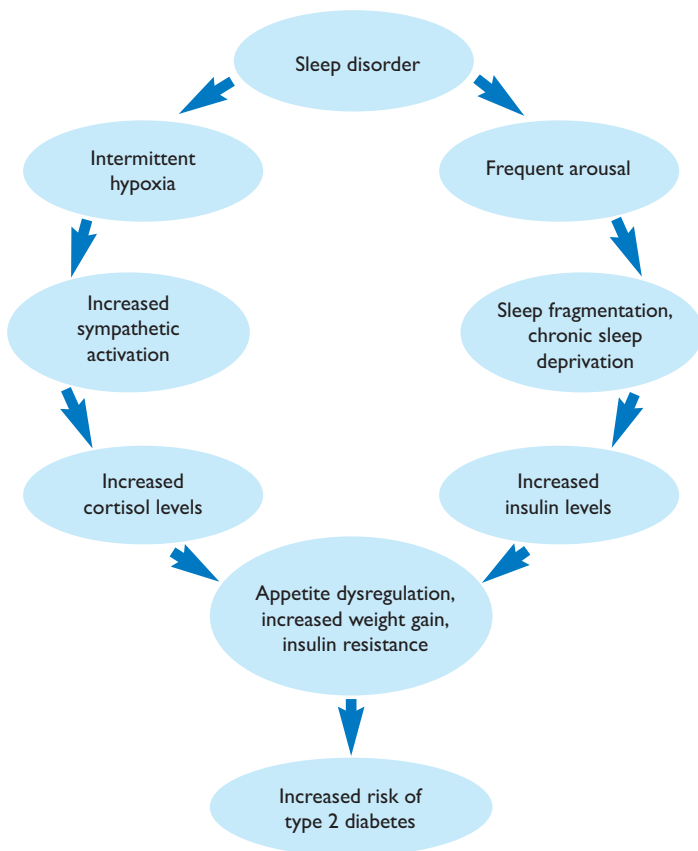
Source: 2001-2003 National Health Interview Survey estimates projected to year 2005.⁵ Reprinted with permission.

The relationship between OSA and diabetes

OSA is independently associated with type 2 diabetes, insulin resistance, and glucose intolerance. OSA remains undiagnosed in a large percentage of people with OSA symptoms.

- The normal sleep cycle is closely related to endocrine and metabolic functions. Numerous studies show a relationship between OSA and diabetes.^{1,6,7,8,9}
- Numerous studies highlight the relationship between insulin resistance and the development of cardiovascular disease. OSA may be associated with this relationship due to OSA-related hypoxemia or an exaggerated sympathetic response seen with undiagnosed or untreated OSA.^{9,10}
- Increasing hypoxemia during sleep is independently associated with glucose intolerance on the basis of either fasting glucose values or two-hour glucose values.⁷
- OSA has been associated with development of insulin resistance.^{1,6,7,11,12,13}
- OSA has been associated with higher odds of metabolic dysfunction after adjustment for age, gender, smoking status, BMI, waist circumference, and self-reported sleep duration.⁷

A metabolic burden exists with sleep apnea



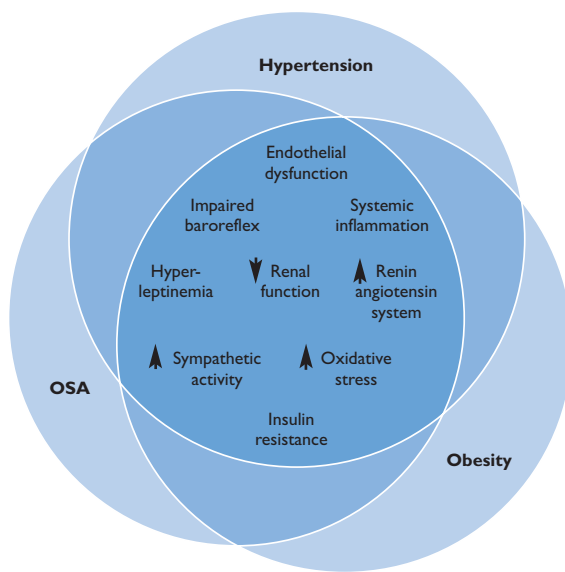
Many of the 20 million people in the U.S. suspected of having OSA may have an increased risk for other serious health conditions.

Prevalence of diabetes, obesity, and OSA

- During the past 20 years, the prevalence of obesity and type 2 diabetes in the U.S. has increased.¹⁴
- The prevalence rate of OSA in adults with type 2 diabetes with an AHI of > 15 events/hour is 36 percent.
 - 49 percent of male participants with an AHI > 15 have type 2 diabetes.¹
 - 21 percent of female participants with an AHI > 15 have type 2 diabetes.¹
- Self-reported diabetes is three to four times more prevalent in subjects with an AHI > 15.¹
- The incidence of developing type 2 diabetes after four years with an AHI > 15 is 1.62 when adjusted for age, sex, and BMI.¹
- Insulin resistance and glucose intolerance are shown to rise correspondingly with increasing levels of OSA after adjusting for age, gender, race, BMI, waist circumference, and smoking history.⁷

Pathophysiological mechanisms and treatment options for OSA

- OSA, cardiovascular disease, and diabetes share many of the same comorbidities, including stroke, coronary artery disease, and metabolic syndrome.
- OSA, obesity, and hypertension share many of the same cardiovascular and metabolic consequences.
- Epidemiologic data support a link between obesity and hypertension, as well as between OSA and hypertension.¹⁵



Putative pathophysiological mechanisms involved in the interactions between obesity, OSA, and hypertension.¹⁵ Reprinted with permission.

Treatment of OSA with CPAP therapy

The majority of patients with OSA are prescribed treatment with Continuous Positive Airway Pressure therapy (CPAP). CPAP therapy provides a pneumatic splint to keep the OSA patient's airway open to prevent apneas.

Treatment of OSA with CPAP improves the patient's sleep-related breathing and quality of sleep. In addition, it helps alleviate other daytime symptoms including sleepiness, moodiness, impaired concentration, memory loss, and morning headaches. Adequately treated OSA has also been associated with improved glycemic control and insulin sensitivity.

- The International Diabetes Federation (IDF) recommends that health professionals working with both type 2 diabetes and sleep-disordered breathing (SDB) adopt clinical practices to ensure that a patient presenting with one condition is considered for the other.¹⁶
- Treatment of OSA with positive airway pressure (PAP) therapy improves sleep-related breathing and may result in improved glycemic control.
- Treatment of OSA is also associated with improvement in insulin responsiveness.¹⁷
- Effective treatment of OSA with CPAP rapidly improves insulin sensitivity in patients with OSA.¹⁸



Responirics' goal is to provide the most up-to-date information on clinical research with respect to the relationship between OSA and other disease states. While research has established a comorbidity relationship between OSA and diabetes, research is ongoing to identify potential causative relationships between OSA and diabetes.

¹Reichmuth, K.J., et al., *Am J Respir Crit Care Med* 2005;172: 1590-1595; ²Young, T., et al., *NEJM* 1993;328: 1230-1235; ³Young, T., et al., *Am J Respir Crit Care Med* 2002;165: 1217-1239; ⁴O'Connor, et al., *Sleep* 2003;26(1): 74-79; ⁵National Diabetes Information Clearinghouse (NCIC), <http://diabetes.niddk.nih.gov/dm/pubs/statistics/>; ⁶Einhorn, D., et al., *Endocr Pract* 2007;13;4: 355-362; ⁷Punjabi, et al., *Am J Epidemiol* 2004;160: 521-530; ⁸Babu, et al., *Arch Intern Med* 2005;165: 447-452; ⁹Nilsson, et al., *Diabetes Care* 2004;27: 2464-2469; ¹⁰Resnick, et al., *Diabetes Care* 2003;26: 702-709; ¹¹Harsch, I.A., et al., *Respiration* 2004;71: 252-259; ¹²Vontzas, A.N., et al., *J Clin Endocrinol Metab* 2000;85: 1151-1158; ¹³Ip, M.S., et al., *Am J Respir Crit Care Med* 2000;165: 670-676; ¹⁴Chasens, E.R., *The Diabetes Educator* 2007;33: 475-482; ¹⁵Wolk, R., et al., *Hypertension* 2003;42: 1067-1074; ¹⁶Shaw, J.E., et al., *Diabetes Research and Clinical Practice* 2008;81: 2-12; ¹⁷Brooks, B., et al., *J Clinical Endocrinology and Metabolism* 1994;79:6: 1681-1685; ¹⁸Harsch, I.A., et al., *Am J Respir Crit Care Med* 2004;169: 156-162

Obstructive Sleep Apnea (OSA) and type 2 diabetes often coexist and are individually associated with significant morbidity.

Role of the physician and diabetic disease manager

There is increasing evidence about the connection between OSA and patients with type 2 diabetes. This strong association supports the need for a lower threshold for a sleep evaluation in patients with diabetes.¹

A patient with OSA may have an increased risk of developing potentially life-threatening conditions. Since it is associated with type 2 diabetes, early screening and identification of OSA in diabetic patients may help reduce the effects of these conditions. Once your patients have been diagnosed with OSA and therapy has begun, close follow-up is important to ensure that the patient's sleep apnea is improving with treatment. Effective treatment of sleep apnea not only results in better sleep and reduced daytime sleepiness, but also may result in improved glycemic control.¹

Key factors often associated with OSA include:

- BMI > 30
- Large neck girth
 - 17 inches for men
 - 16 inches for women
- Micronathia or crowded airway
- Daytime sleepiness or fatigue

A few simple questions can help you better identify patients who may be at risk for OSA. Questions to ask may include:

- Do you snore loudly while sleeping?
- Do you feel excessively tired during the day?
- Have you ever been told you stop breathing or choke loudly while you sleep?
- Do you have a history of hypertension?



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