INTRODUCTION

When we breathe (inhale and exhale) air flows in a smooth, laminar manner. Obstructions that occur along the path of airflow lead to irregular, turbulent air movement. Air turbulence is often accompanied by irregular vibration of the structures of the upper airway. The resultant sound – snoring – may range from mild to severe.

When the flow of air slows during sleep (reduced by at least 30%) this is known as a hypopnea. When the flow of air stops completely during sleep (for at least 10 seconds), this is known as an apnea. When these abnormal events (apnea and hypopnea) are due to obstructive, anatomic causes – often related to the collapse or blockage of the upper airway, a patient is considered to have Obstructive Sleep Apnea, or OSA.

Snoring is widespread, and is believed to affect as many as 50% of adults including both men and women; over 45 million Americans. In one 2006 survey of over 2,000 British couples, 56% of respondents admitted that they snored (70% of men admitted to snoring; 40% of women admitted to snoring). 30% of the respondents stated that their bed partner snores. 48% of the respondents stated that snoring affected their personal relationships, with 46% of respondents admitting that they sleep in separate bedrooms as a result of snoring. Respondents noted that they felt snoring had caused them to be irritable (47%), had led to arguments (36%), and had impacted their sexual relationships (17%). Some respondents stated that snoring had led to their divorce. Others noted that snoring had led to poor sleep (72%), and had impacted their ability to work effectively (38%).

While it is well known that snoring increases with age, it is less well known that the impact on younger patients may also be significant. Many patients who snore may have sleep apnea;
many patients who have sleep apnea snore. These conditions are distinct but related – each with their own set of causes, effects, and treatments.

**IMPACT OF SNORING AND SLEEP APNEA**

**SNORING**

Anatomically speaking, snoring is a sign of increased upper airway resistance. Snoring has a negative impact both on the individual who snores, as well as on that person’s bed partner. Patients who snore often awake after an unsatisfying, disrupted sleep to encounter a day of sleepiness and fatigue.

Drowsiness, irritability, and decreased libido may all be associated with snoring. It appears that snoring is independently associated with daytime somnolence, and not merely a proxy for sleep apnea. One study provided evidence of an association between snoring severity and reduced sexual satisfaction.

In addition to these lifestyle challenges, patients who snore have been shown to have increased rates of hypertension (elevated blood pressure) when compared to patients who do not snore. Studies have also documented a positive correlation between loud snoring and the risk of heart attack and stroke.

One 2008 study found that “objectively measured heavy snoring is an independent risk factor for early carotid atherosclerosis...and stroke.” Another study evaluated over 1500 patients who suffered acute myocardial infarcts (heart attacks), and found that “heavy snoring is associated with case fatality...in patients with a first acute myocardial infarction.”

In women aged 25-79 years old, one recent study found snoring with or without sleep apnea to be related to the presence of diabetes mellitus. This is of particular concern, as diabetes is strongly related to cardiovascular disease and early death. An earlier study supports these results, having found a two-fold higher risk of developing diabetes in women who snore compared to
women who do not snore\textsuperscript{11}. Fortunately, there is some evidence that in diabetic patients with sleep apnea, diabetic parameters improve when patients’ sleep apnea is brought under control\textsuperscript{12 13 14}.

For women of child-bearing age, snoring and witnessed sleep apneas appear to be related to such complications during pregnancy as pre-eclampsia\textsuperscript{15}. One study found that women who snore during pregnancy have an increased incidence of pregnancy-induced hypertension, and that snoring may indicate a risk for growth retardation of the fetus\textsuperscript{16}. On another note, the presence of OSA seems to significantly increase in women who have gone through menopause, although this risk may decrease with hormone replacement therapy\textsuperscript{17}.

Raising a public safety issue, a 2009 study of 7905 subjects discovered that men suffering from excessive daytime sleepiness who habitually snore drive significantly more than others\textsuperscript{18}. Other studies have noted that snoring men have a greater than 3-fold higher risk of traffic accidents than those who do not snore\textsuperscript{19}.

Even in children, snoring may be pathological. One study found a direct relationship between primary snoring and elevated blood pressure in children\textsuperscript{20}. This raises concerns, as elevated blood pressure is a known risk factor for adverse cardiovascular events. Other studies have found links between childhood snoring and diminished academic performance in primary school children\textsuperscript{21}. Suggestions have been made that children with routine, habitual snoring should be screened routinely for hypertension, and academic performance\textsuperscript{22}.

Anatomically, snoring may also lead to an enlarged uvula (the “punching bag” that hangs down from your soft palate), and increased episodes of acid reflux. An enlarged uvula may – in turn – lead to increased snoring, coughing, and even to a choking sensation. Others have documented the association between snoring and chronic bronchitis\textsuperscript{23}.

Snoring may have a severe impact on inter-personal relationships. According to one study of 4900 couples, as many as 80\% of snoring couples end up in separate bedrooms. Another study of women who sleep with men who snore found that these women were almost twice as likely as
women who sleep with non-snorers to report problems with insomnia, daytime fatigue, daytime sleepiness, awakening unrefreshed from sleep, and morning headache. A study from the Mayo clinic showed that snoring also seems to be associated with reduced sexual satisfaction in men. It is clear that snoring impacts both the patient who snores as well as his or her bed-partner.

Fortunately, several studies have documented statistically significant improvements in marital relations after a patient’s snoring was corrected. One study of 10 married couples performed at the Mayo Clinic found that the bed-partner of the snoring patient gained an additional 74% to 87% of sleep per night after their partner’s snoring was corrected.

**OBSTRUCTIVE SLEEP APNEA**

A high percentage of patients who snore also may have obstructive sleep apnea (OSA). It is for this reason that patients who snore should consider having a sleep study for diagnosis. Patients with OSA may have some of the following symptoms:

- Headaches
- Fatigue - Tired during the day, even after a night’s sleep
- Irregular snoring with gasps, snorting, and pauses in breathing
- Trouble concentrating; difficulty with memory
- Difficulty with sexual performance
- Bed-wetting (enuresis)
- Moodiness, irritability, depression
- Unexplained weight gain

OSA is the most common sleep-related breathing disorder, and it is well-documented to have a serious impact on a patient’s quality of life, work efficiency, and driving safety. One meta-analysis which evaluated the results of 18 other studies found untreated sleep apnea to be “a significant contributor to motor vehicle crashes.” The authors concluded that “…individuals with OSA are clearly at increased risk for crash.”
In terms of lifestyle issues, some studies have found an association between the presence of OSA and erectile dysfunction in men\textsuperscript{31, 32}. Untreated OSA may also lead to hypertension, coronary artery disease, memory impairment, stroke, and adult onset diabetes. In one study, snoring was found to be associated with elevation in blood glucose markers, potential signs of impending diabetes\textsuperscript{33}.

OSA appears to be related to the development of heart and vascular disease, as noted by a 2008 publication of the American Heart Association and the American College of Cardiology\textsuperscript{34}. Almost 40\% of patients with OSA have elevated blood pressure. Moreover, it appears that patients with OSA may have a 2 to 3 times increased risk of heart attack and stroke\textsuperscript{35, 36, 37}. Americans who have OSA are more likely to die suddenly of cardiac causes between 10 p.m. and 6 a.m. than during the other 16 hours of the day combined, according to findings of a Mayo Clinic study.

OSA may also have a significant impact on the health of children. Children with OSA have been shown to suffer from bed-wetting (enuresis), behavior problems, deficient attention span, obesity\textsuperscript{38}, and failure to thrive. Heart and lung problems (cor pulmonale, pulmonary hypertension) may also co-exist in children with sleep apnea\textsuperscript{39}.

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\textsuperscript{1} The Great British Snoring Survey. http://www.pflhealthcare.com/release.cfm?ID=70


