

Why An SDB Course About Comorbidities?

- SDB is a serious health problem affecting approximately 42 million adults Young et al. *New Eng J Med* 1993
- Approximately 75% of severe SDB patients are not diagnosed Young et al. *Sleep* 2008
- Clinical studies have shown that treating SDB can:
 - reduce blood pressure Becker et al. *Circulation* 2003
 - improve left ventricular ejection fraction Kaneko et al. *New Eng J Med* 2003
 - improve insulin sensitivity Harsch et al. *Am J Respir Crit Care Med* 2004



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Some Things You Can't Put a Price On

- Overweight and obesity lead to multiple health problems
- 4 out of 5 obese people have comorbid conditions associated with obesity: **type 2 diabetes, hypertension, osteoarthritis, high cholesterol, obstructive sleep apnea (OSA)** EC Mun et al. *Gastroenterology* 2001
- Being overweight increases the risk of many diseases and health conditions including: **hypertension, dyslipidemia, type 2 diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea and respiratory problems, and some cancers (endometrial, breast, and colon)** International Association for the Study of Obesity
- Obesity appears to lessen life expectancy, especially among younger adults Fontaine et al *J Am Med Assoc* 2003

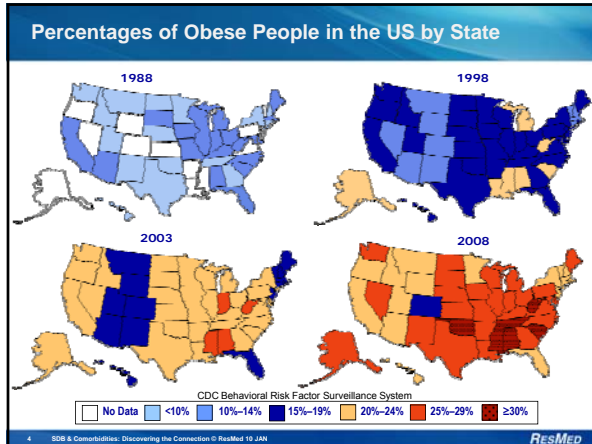
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What Does Being Overweight and Obese Cost?



- Cost of overweight and obesity? \$117 billion – direct and indirect costs (which is comparable to the economic costs of cigarette smoking) Source: Weight-Control Information Network, a division of the National Institutes of Health
- 39.3 million lost work days annually due to overweight and obesity-related comorbidities Wolf et al *Obes Res* 1998
- An obese patient incurs 36% higher average annual medical expenditures than a healthy weight individual Finkelstein et al *Obes Res* 2004
- Estimated that the annual medical burden of obesity has risen to almost 10% of all medical spending, could amount to \$147 billion per year in 2008 Finkelstein et al. *Health Affairs* 2009

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Obesity and SDB

OSA patients are often obese

- Obesity creates an obstructive load on the upper airway
- Fat storage in the neck is particularly associated with OSA
- Obesity is a significant risk factor for OSA; 60% to 70% of OSA patients are obese.

Reista et al Int J Obes Relat Metab Disord 2001

Body shape matters

- Being apple-shaped (more fat in the stomach) puts patients at a higher risk for OSA than being pear-shaped (more fat in the hips and thighs)
- Visceral fat seems to convey a higher risk of apnea compared with other types of locations of fat

Billington Obes Res 2002


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Relationship Between Obesity and SDB

- There is a direct relationship between the level of obesity and the likelihood of having OSA
 - The incidence of OSA is 20- to 30-fold higher in morbidly obese patients

Kyzer World J Surg 1998
- 77% obese patients have sleep apnea
- There is a direct relationship between weight and severity of sleep apnea
 - As BMI, waist circumference and external neck circumference increase, sleep apnea severity increases

Carmelli et al. Obes Res 2000



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Type 2 Diabetes

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    graph LR
      A[Normal] --> B[Impaired Glucose Tolerance]
      B --> C[Insulin Resistance]
      C --> D[Type 2 Diabetes]
  
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- Poor nutrition contributes to elevated blood glucose levels
- Continuously high glycemia increases insulin demand from insulin-producing β -cells in the pancreas
- Pancreas continues to produce more insulin, yet the body cells/muscles become less sensitive to insulin
- More insulin is required to overcome this "resistance" until the pancreas cannot keep up
- Blood glucose levels start to rise, first after meals, and then eventually remain high in the fasting state
- Type 2 diabetes sufferers are said to be "Insulin Resistant"

[Click here to learn more about insulin](#)

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Understanding Insulin

- **Insulin** is a hormone produced in the *pancreas*
 - It is the key that opens the channel to the cell.
- Type 2 Diabetes
 - Produced insulin cannot work properly
- Hyperglycemia (high glucose levels)
 - Without insulin working properly, glucose channels remain closed

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SDB and Diabetes

- 48% of type 2 diabetes suffer from sleep apnea
Einhorn et al. *Endocrine Prac* 2007
- 86% of obese patients with type 2 diabetes, have OSA
Foster et al. *Diabetes Care* 2009
- Like SDB, high percentage of diabetes patients not being recognized
 - 30% of patients presenting to a sleep clinic have impaired glucose tolerance (IGT) or diabetes
 - None of the IGT patients were previously diagnosed
 - 40% of the type 2 diabetics were undiagnosed
Meslier et al. *Eur Respir J* 2003
- International Diabetes Federation (IDF) recommendation in 2008:

"Health professionals working in both type 2 diabetes and sleep apnea should adopt clinical practices to ensure that a patient presenting with one condition is considered for the other."

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Possible Mechanisms

- Increased sympathetic nervous activity
- Elevated levels of Cortisol
- Accumulation of sleep debt due to sleep fragmentation
- Recurrent intermittent hypoxia

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Postprandial Glucose Values Significantly Reduced With CPAP Use

Meal	Group	Pretherapy (mg/dL)	Posttherapy (mg/dL)
Breakfast	CPAP use > 4 hrs (n=12)	~200	~130
	CPAP use < 4 hrs (n=12)	~190	~140
Lunch	CPAP use > 4 hrs (n=12)	~200	~135
	CPAP use < 4 hrs (n=12)	~190	~145
Dinner	CPAP use > 4 hrs (n=12)	~200	~135
	CPAP use < 4 hrs (n=12)	~190	~150

In all patients, glucose levels dropped, but only in those using CPAP > 4 hours was the drop statistically significant after all meals.

Babu et al. Arch Intern Med 2005

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Compliance Can Make A Difference in HbA1c

CPAP use > 4 hrs day

Group of > 4 hrs CPAP users
Number of days usage directly correlates with reduction in HbA1c.

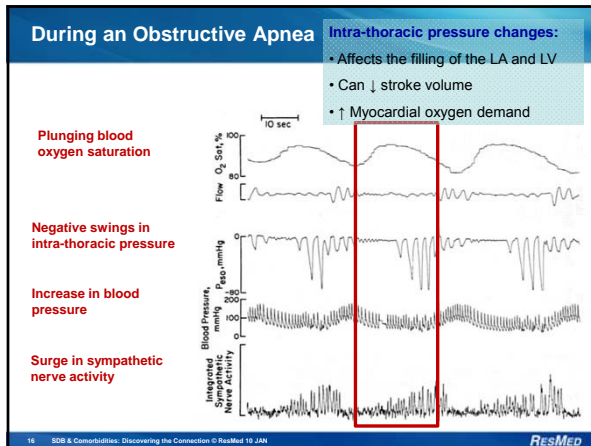
CPAP use < 4 hrs day

Group of < 4 hrs CPAP users
No correlation to usage and HbA1c levels.

Babu et al. Arch Intern Med 2005

[Click here to learn more about HbA1c](#)

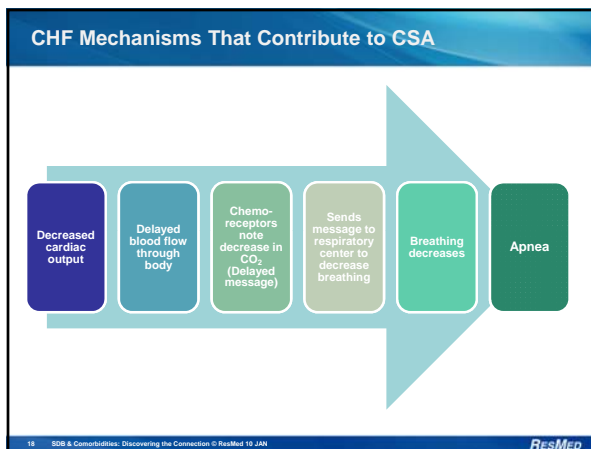
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What is Congestive Heart Failure (CHF)?

- A syndrome where the heart is incapable of pumping enough blood to meet the body's needs (oxygen and nutrients)
- Determined by measuring left ventricular ejection fraction (LVEF)
 - Volume (%) of blood pumped out of the left ventricle
 - Normal LVEF > 50%
 - LVEF < 40% = diagnosis of heart failure

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Clinician - What Do I Do?

<p>Step 1</p>  <p>ASSESS</p> <p>S Do you snooze loudly? T Do you often feel tired, or fatigued during daytime? O Has anyone observed you stop breathing during sleep? P Do you have or are you being treated for high blood pressure?</p> <p>▶ If positive for one or more, go to step 2.</p>	<p>Step 2</p>  <p>SCREEN</p> <ul style="list-style-type: none"> ▶ Berlin questionnaire ▶ Epworth Sleepiness Scale ▶ Oximetry ▶ Apnealink <p>If two or more high risk categories, go to step 3.</p>	<p>Step 3</p>  <p>REFER</p> <ul style="list-style-type: none"> ▶ Refer the patient to a sleep clinic directly or to their physician for a referral to a sleep clinic.
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Sleep Center - What Do I Do?

<p>Step 1</p>  <p>REVIEW</p> <p>Review history and physical examination data</p> <ul style="list-style-type: none"> ▶ History of cardiac issues ▶ Review patient's list of medication ▶ What is the referring physician's specialty? 	<p>Step 2</p>  <p>IDENTIFY</p> <ul style="list-style-type: none"> ▶ Obstructive events ▶ Central events 	<p>Step 3</p>  <p>TITRATE</p> <ul style="list-style-type: none"> ▶ CPAP or VPAP (bilevel) ▶ Adaptive servo-ventilation
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Efficacy of Treatment

- Treatment should be at therapeutic pressure
 - Sub-optimal pressure may not show improvement in cardiovascular consequences of SDB. *Pepperell et al. Lancet 2002*
- PAP therapy should at least be 4 hours per night, every night
- PAP machine should be matched to proper diagnosis
 - OSA - CPAP
 - Hypoventilation - Bilevel
 - CSA – Adaptive servo-ventilation
- Leaks will affect therapy
 - Proper mask
 - Nasal vs. full face
 - Proper mask fit
 - Monitor leak




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Obesity is a significant risk factor for OSA; 60% to 70% of OSA patients are obese

Resta et al. Int J Obes Rel Metab Disord 2001



In obese patients with type 2 diabetes, prevalence of OSA is 86%

Foster. Diabetes Care 2009



76% of congestive heart failure (CHF) patients have SDB

Oidenburg. Eur Heart J 2007

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