What Is The Epidemiology Of Sleep Apnea In Older Adults?
Mechanism of Age-Dependent SDB

- **Muscle fibers**
  - Age-associated changes in fiber-type distribution in the genioglossus (tongue) of Wistar rats
  - Results in decreased muscle endurance and increased risk of SDB
  - Oliven et al., Exp Gerontol, 2001
- **Repetitive barotrauma model**
- **Increased rates of Central Sleep Apnea due to CHF, etc.**
- **Increases in pharyngeal collapsibility and resistance** (Eikermann et al., Chest, 2007)

BMI and SDB

- OR for RDI>=15 as a function of elevated BMI and various age categories.
- Young et al., Arch Int Med 2002
Risk Factors: Edentulous

- Edentulous patients have higher rates of SDB (AHI>=15)
  - Denture use: OR 6.29 (95% CI: 1.71-23.22)
  - BMI: OR 1.15 (95% CI: 0.97-1.37)
- Endeshaw et al., J Public Health Dent, 2004

- Mechanism
  - Reduced retropharyngeal space (Bucca et al., Resp Res, 2006)
  - Chronic inflammatory changes affecting tongue associated with denture use

Differential Diagnosis

- Sleep Deprivation
- Irregular Sleep Phase (Circadian)
- Hypothyroidism
- Sedative Medications/Polypharmacy
- Depression

Prevalence of Sleep Apnea in Institutionalized AD

- 38 institutionalized AD patients. MMSE 6.5 (range 0-16).
- Gehrman et al., Am J Geriatric Psychiatry, 2003
What is the impact of sleep apnea in older adults?

Adjustment of perception of “acceptable” health with aging

- Usual activities (severe impairment)
- Pain/discomfort (extreme)

  - Population-based survey of 228 Dutch
SDB and Sleepiness by Severity

- Effect may be most prominent for severe SDB
  - Honolulu-Asia Aging Study of Sleep Apnea
    - Only severe SDB (AHI>30) associated with daytime sleepiness (ESS)
    - Foley et al., Sleep, 2003
  - Philadelphia Cohort
    - AHI>30 was a risk factor for daytime sleepiness
    - Pack et al., Ann Neurology, 2006

SDB and Sleepiness: Sleep Time

- Total sleep time may influence relationship
  - Study of Osteoporotic Fractures (females)
    - Daytime sleepiness (ESS) increased by 0.44 with every 15 unit (1 standard deviation) increase in AHI
    - Daytime sleepiness decreased by 1 with every 75 min increase (1 standard deviation) in total sleep time
    - When including total sleep time in the daytime sleepiness model, SDB was no longer independently associated with sleepiness
    - Kezirian et al., Sleep, 2007
  - Osteoporotic Fractures in Men Study
    - Kezirian et al., Sleep, 2009: Similar findings noted
    - Both studies included objective assessment of total sleep time using actigraphy

How do we assess daytime sleepiness in older adults?
Prevalence of Sleepiness by Age Group

- Self-reported tiredness/lack of energy
  - BRFSS dataset
  - Grandner et al., Sleep, 2012
- Approximately 20% of older adults complain of sleepiness (SHHS)
  - Whitney et al., Sleep, 1998

Daytime Sleepiness vs. Naps

- 64% of older subjects take a nap vs 45% of younger subjects
  - Buysse et al., JAGS 1992
- Only 21-37% of older adults who nap complain of excessive daytime sleepiness

Assessing Sleepiness: ESS

- The Epworth Sleepiness Scale does not correlate with actigraphy-determined daytime napping in post acute rehab patients (Skibitsky et al., J Am Med Dir Assoc, 2012)
- Large percent of missing items (Oken et al., Sleep Breathing, 2012)

[Diagram showing self-reported tiredness/lack of energy by age group with data from BRFSS dataset and Grandner et al., Sleep, 2012.]


[Diagram of the Epworth Sleepiness Scale with data from Skibitsky et al., J Am Med Dir Assoc, 2012 and Oken et al., Sleep Breathing, 2012.]
Multiple Sleep Latency Test

- Daytime sleep latency in general may increase with age (Dijk et al., Sleep, 2010):
  - 8.7 min in 20-30 year old subjects
  - 14.2 min in 66-83 year old subjects
- Older adults with narcolepsy less likely to have sleep-onset REM episodes and have longer sleep onset latency as compared to younger narcolepsy patients (Dauvilliers et al., Neurology, 2004)

Risk Factors for Sleepiness

- Study of 1293 older adults, 149 with EDS, 144 without (Pack et al., Ann Neurol, 2006)
  * AHI: OR for 20-events/hr increase
  ** PSQI: OR for one-point increase
  ^ Pain/physical discomfort >= 3 times/wk
  ^^ Sleepiness more/less common vs rare/none (US Pharmacopeia side effects data)

OSA and Cardiovascular Outcomes

- Mean age: 58.7 / 60.9
- Mean AHI: 2.0 / 35.3
- Adjusted hazard ratio for stroke or death in patients with sleep apnea syndrome was 1.97
- Yaggi et al., NEJM, 2005
SRBD and Stroke Risk: Prospective

- Sleep Heart Health Study, n=5422, median 8.7 yrs follow-up
  - Average age of stroke patients: 72-75
  - Redline et al., Am J Respir Crit Care Med, 2010

Longitudinal risk of cognitive impairment in OSA

- Sleep Disordered Breathing: Mortality

Punjabi et al., PLOS One, 2009
Defining the Phenotype

**Sleep Disordered Breathing (SDB)**
- Abnormal respiratory patterns in sleep
- 20-30% prevalence of SDB in older adults (Young et al., Arch Int Med 2002)

**Sleep Apnea Syndrome**
- SDB+daytime sleepiness or other clinical complaints
- Lower prevalence rate than SDB: possibly 5-10%

Effect of daytime sleepiness

- Older adults with daytime sleepiness + SDB (AHI>≥20 events/hr, solid line) had higher mortality rates than those with either condition alone or neither condition.

- Prospective study of 289 older adults followed for an average of 13.8 years (Gooneratne et al., Sleep, in press)

Age Effects on Risk Factors: Concept of Competing Risks
Sleep Apnea and Delirium

- Study of 106 older adult patients undergoing elective knee surgery
  - OSA diagnosis was based on medical record review
  - Flink et al., Anesthesiology, 2012
- Incidence rate for delirium: 53.5 in those with OSA vs 20.9 in those without OSA
Prevalence of comorbid SDB and Insomnia

- Study of older adults recruited for a research study on insomnia
  - 80 subjects, prescreened by history for SDB
    - Age: 69.4 +/- 7.2 years
- Findings:
  - AHI>15 events/hr: 29%
  - AHI>5 events/hr: 43%
- Prevalence of SDB in middle-aged adults recruited for insomnia studies: 9%
  - Lichstein et al., Sleep, 1994

Iceland Cohort

- 824 untreated OSA patients compared to 762 controls (Bjornsdottir et al., J Sleep Res, 2012)
- Examined relationship between SDB and difficulty initiating sleep vs difficulty maintaining sleep

<table>
<thead>
<tr>
<th></th>
<th>DIS OR (95% CI)*</th>
<th>DMS OR (95% CI)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>0.55 (0.32-0.97)</td>
<td>2.11 (1.52-2.93)</td>
</tr>
<tr>
<td>Women</td>
<td>0.00 (0.00-1.23)</td>
<td>1.50 (0.83-2.69)</td>
</tr>
</tbody>
</table>

ICSD-2 Definition of Sleep Apnea

- Insomnia is one of the defining symptoms of sleep apnea
Functional Consequences of Comorbid Insomnia and OSA

Persistent Sedative Users: Modifiable factors

- Retrospective review of 137 long-term sedative users
- Average duration of use: 13.5 years
- Krakow et al., J Nerv Ment Dis, 2010

How should we treat sleep apnea in older adults?
### Treatment of Sleep Breathing Disorders

<table>
<thead>
<tr>
<th>Snoring</th>
<th>Mild OSA (AHI 5-15)</th>
<th>Mod OSA (AHI 15-30)</th>
<th>Severe OSA (AHI&gt;30)</th>
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</thead>
<tbody>
<tr>
<td>Weight loss for obese patients†</td>
<td>Weight loss for obese patients†</td>
<td>Weight loss for obese patients-adjunctive†</td>
<td>Weight loss for obese patients-adjunctive†</td>
</tr>
<tr>
<td>Positional Therapy *</td>
<td>Positional Therapy*</td>
<td>Positional Therapy*</td>
<td>Nasal CPAP</td>
</tr>
<tr>
<td>Laser surgery / Radiofrequency ablation†</td>
<td>Nasal CPAP</td>
<td>Nasal CPAP</td>
<td>Oxygen**</td>
</tr>
<tr>
<td>Oral Appliance ¹</td>
<td>Oral Appliance ¹</td>
<td>Oral Appliance ¹</td>
<td>Tracheotomy ¹**</td>
</tr>
<tr>
<td>Nasal CPAP</td>
<td>Surgery ¹**</td>
<td>Surgery ¹**</td>
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</tr>
</tbody>
</table>

*The utility of positional therapy is dependent on the PSG finding of a markedly reduced AHI in the lateral position.

†Consider follow-up PSG to document efficacy

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### Weight Loss

- Weight loss can reduce sleep apnea severity
  - Ancoli-Israel et al., Sleep Med, 2001
- Older adults at greater risk for osteopenia/osteoporosis, or sarcopenia with weight loss
  - Reduced mortality rate in older adults who had a BMI>30 kg/m² relative to those with a BMI of 25-29.9 kg/m²
  - Stessman et al., JAGS, 2009

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### CPAP for OSA

- Remains preferred therapy for older adults
  - Bloom et al., JAGS, 2009
  - Weaver and Chasens, Sleep Med Reviews, 2007
- Older adults may require lower average CPAP levels compared to younger subjects: 6.9 vs. 9.3 cm H²O
  - Kostikas et al., Respir Med, 2006
- Paucity of randomized controlled trials demonstrating efficacy of CPAP in older adults
CPAP Compliance
- Study of compliance in 33 older VA patients
- 64% compliance rate (>5 hours per night at 6 months)
- Risk factors for non-compliance:
  - Inadequate resolution of symptoms
  - Nocturia and/or BPH
  - Lower AHI
  - Older age at diagnosis
- Factors not associated with compliance: Visual impairment, presence of spouse/significant other, psychiatric illnesses
- CPAP education and support groups can be effective
- Russo-Magno et al., JAGS, 2001

Mask options for older adults with upper extremity weakness

Oral Appliance
- Can be useful for patients with mild to moderate disease
- Patients must have at least eight teeth each in the upper and lower jaws to provide a suitable anchor. (Bloom et al., JAGS, 2009)
CPAP for OSA in Dementia

• Randomized, sham-therapy controlled, intervention study, double-blind
• 39 subjects
• Chong et al., JAGS, 2006

Enrollment

- Inclusion Criteria: Mild-mod AD (MMSE>17), RDI>10
- Characteristics: Mean age 78 years, 95% Caucasian

CPAP
Sham CPAP
CPAP
End

3 weeks
1 week
1 week

CPAP for OSA in Dementia

• CPAP can be used effectively in older adults with cognitive impairment (Chong et al., JAGS, 2006)
• Average use: 4.8 hours/night (Ayalon et al., Am J Geri Psychiatry, 2006)

Additional Considerations

• Does CPAP treatment increase intraocular pressure? (Kleekens et al., Invest Ophthal Vis Sci, 2008)
• AutoCPAP in the elderly—may have lower efficacy rates (Husain A., J Clin Neurophysiol, 2003).
  ▫ Complex sleep apnea?
• Can medications be used for OSA, such as donepezil for OSA in AD? (Kureas et al., Chest 2008)
• Management of comorbid sleep apnea and insomnia: CPAP with CBT-I or sedatives?
Conclusion

• Sleep disordered breathing affects 20-25% of older adults
  ▫ Prevalence increased in patients with dementia
• Most studies show than severe sleep apnea (AHI>=20 or sleepiness or 30 events/hr) is most consistently associated with increased morbidity and mortality
  ▫ Lower treatment thresholds may be warranted in certain subgroups, such as patients with cardio/cerebrovascular disease or significant symptomatology
• Treatment is similar for older adults: CPAP most likely effective
  ▫ CPAP can be used in patients with cognitive impairment.
  ▫ Caution regarding weight loss