

Not Every Patient Needs to Go to the Sleep Lab

**An Update and
Controversy**

November 19, 2004

Controversy: The issue is not whether some patients should have treatment without testing, but how many and which ones?

A Confession: I've Done It Already. Examples:

- Morbidly obese patients admitted to the ICU with respiratory failure
- Indigent, non-insured patients who can afford to buy a re-tooled CPAP machine (\$200-400) but who cannot afford a sleep study (\$800-1600)
- Wealthy patients who “know” they have sleep apnea, want CPAP, and are willing to pay out of pocket for it

Some Assumptions

- Polysomnography and diagnostic criteria for sleep apnea are imperfect.
- Clinical skills (eg, history and physical examination) can establish a likelihood of sleep apnea with some certainty in some patients.
- Auto-titrating CPAP is as effective as in-lab titrated CPAP.
- Cost of a sleep study (PSG) is \$800-\$2000.
- Cost to purchase auto-titrating CPAP machine is \$500-800 (high end).
- Sleep apnea is common, and getting more so
- "Inappropriate" CPAP is harmless.
- Untreated sleep apnea kills.

The “Gold Standard” is Imperfect

- False negative sleep studies
 - No REM sleep
 - No Supine sleep
 - No alcohol, muscle relaxants, etc
- Insensitive monitoring devices
 - Thermocouples instead of pressure monitors
- Lack of standard diagnostic criteria
 - Is a hypopnea a 3% or 4% desat? ± arousal?
 - Is sleep apnea an RDI of 5, 10, 15?

Factors to Consider

■ AHI

- Does not account for duration of respiratory events, degree of O₂ desaturations, or amount of sleep disturbance

■ Oxygen desaturation

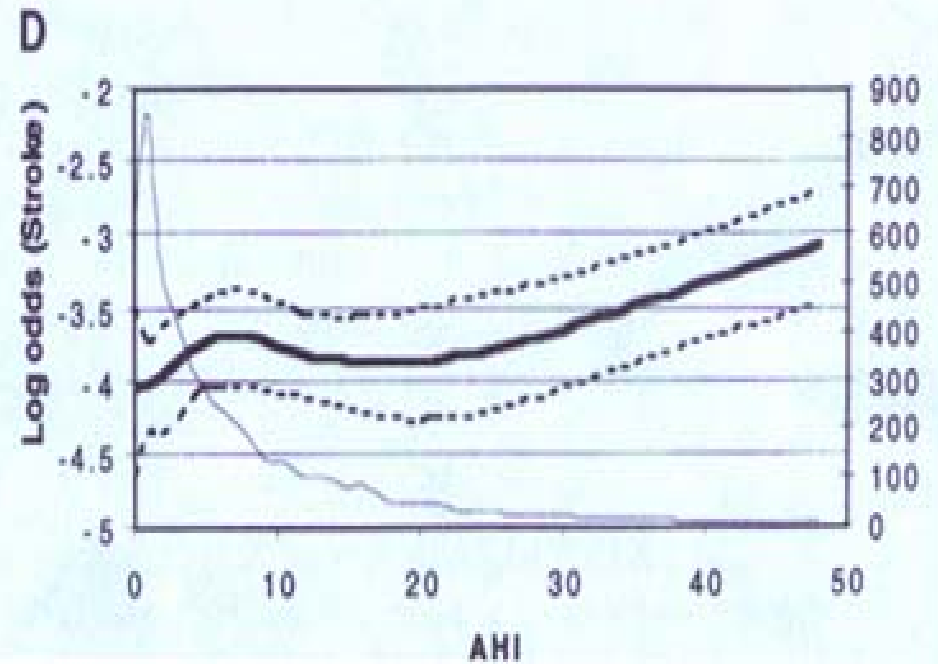
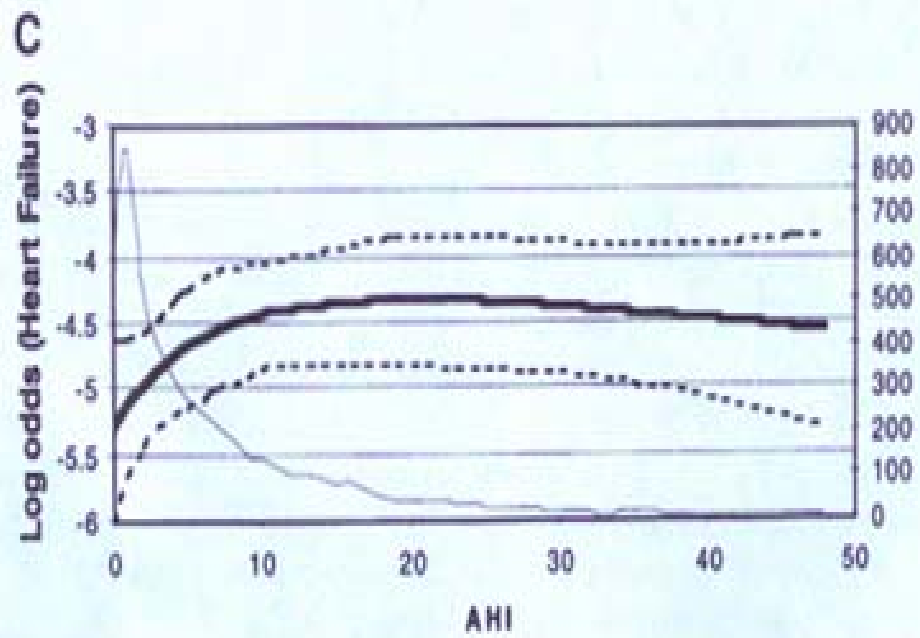
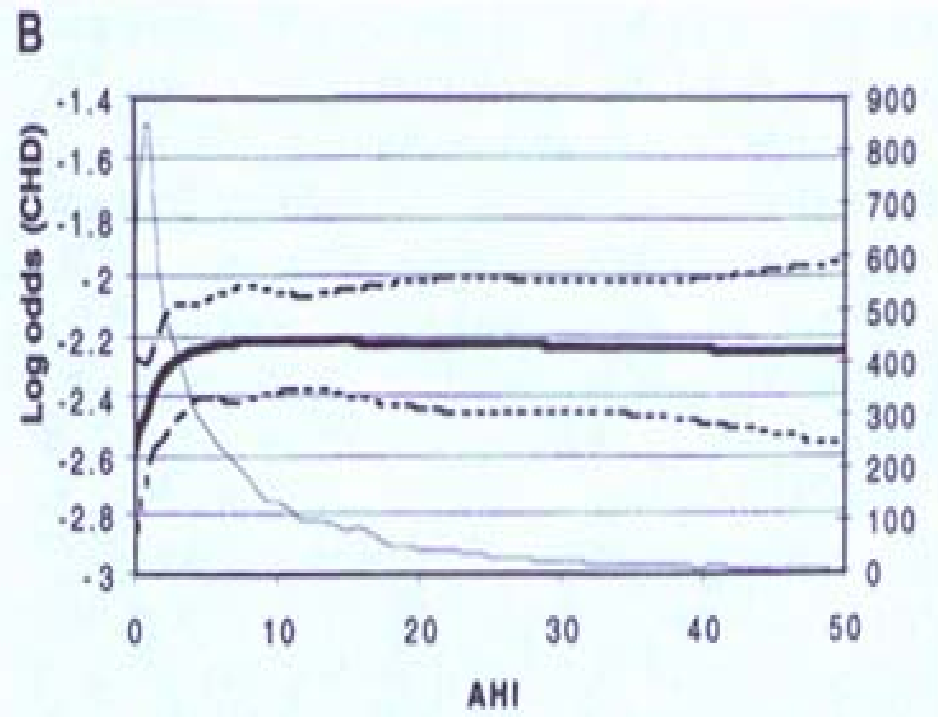
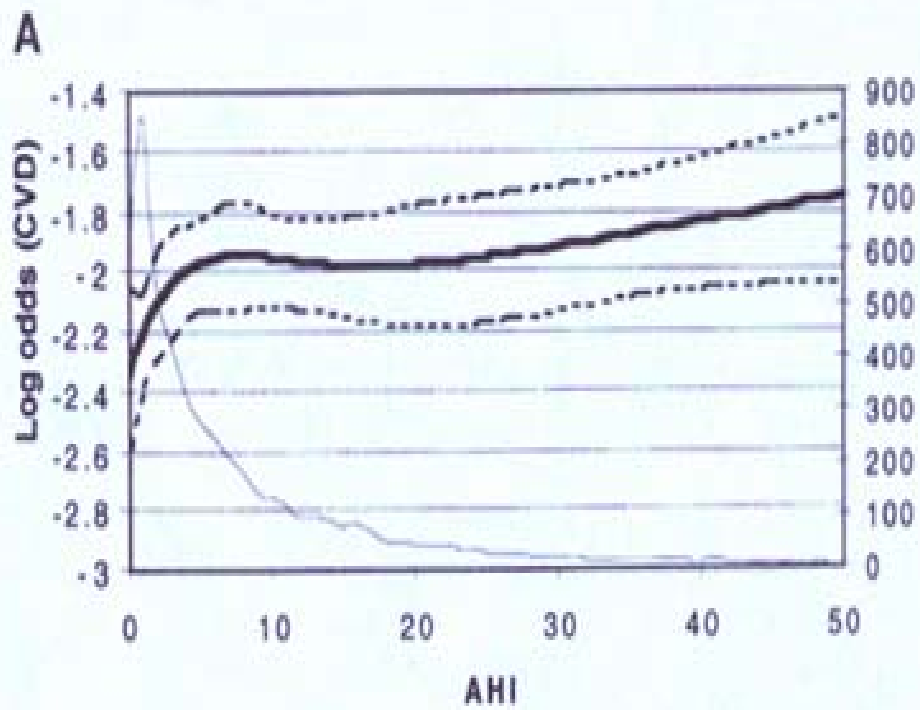
- Correlates best with outcomes, but not well-studied
- Most reliable and reproducible

■ Sleep disturbance

- Does not predict much except sleepiness

What IS Sleep Apnea, Anyway?

- Shahar et al, *Am J Respir Crit Care Med*, 2001
 - AHI's of 1-10 are associated with increased cardiovascular risk
- Guilleminault et al, *Chest*, 1993
 - Subtle respiratory events ("RERA's") cause somnolence which is reversible with CPAP
- Lindberg et al, *Eur Respir J*, 1998; Hu et al, *Am J Epidemiol* 1999
 - Snoring is associated with many of the risks associated with sleep apnea



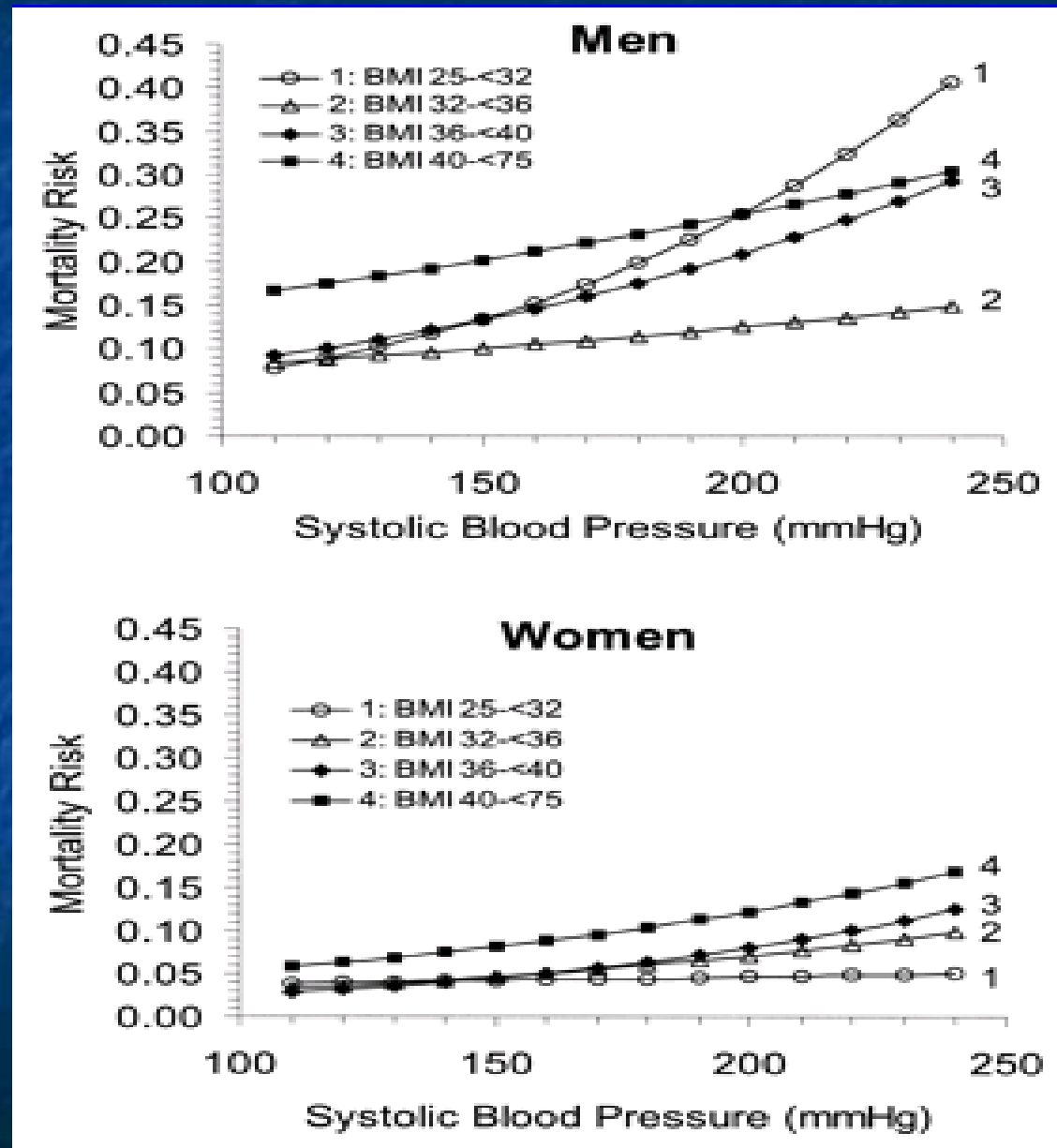
UARS (Upper Airway Resistance Syndrome) Guilleminault et al, 1993

- Study Population: Patients with Idiopathic Hypersomnia. 15 had UARS
- Diagnostic Criteria: ≥ 5 RERA's/hr (Respiratory Effort Related Arousals, eg, abnormal increases in respiratory effort preceding arousals, with very low Pes prior to arousals.)
- Treatment: nCPAP eliminated the sleepiness (MSLT scores rose) and arousals

What About "Simple Snoring?"

- Snoring in pregnancy is associated with increased hypertension and growth retardation, controlling for weight, age, smoking. (Franklin, Chest, 2000)
- Snoring is associated with cognitive decline (Quesnot, J Am Geriatric Soc, 1999)
- Snoring medical students are more likely to fail exams, controlling for BMI, age, sex. (Ficker, Sleep, 1999).
- Snoring is a risk factor for cardiovascular disease in women. (Hu, J Am Coll Cardiol 2000).
- Snoring is a risk for type II diabetes. (Al-Delaimy, Am J Epidemiol 2002).

Disease is a Spectrum...



Sleep-Disordered Breathing is a Spectrum

**OBESITY-HYPOVENTILATION
(PICKWICKIAN SYNDROME)**

SEVERE OSA

MODERATE OSA

MILD OSA

UARS

CHRONIC, HEAVY SNORING

INTERMITTENT SNORING

QUIET BREATHING

“Arguments over the definition of obstructive sleep apnoea/hypopnoea syndrome (OSAHS) have still not been satisfactorily resolved. As a result, robust estimates of the prevalence of OSAHS are not possible. New approaches are needed to identify those who have “CPAP responsive” disease, enabling more accurate estimates to be made of the prevalence of the sleep apnoea syndrome in the community.”

**Stradling and Davies
Thorax, 2004**

**So, how good are standard
clinical tools in diagnosing
sleep apnea (whatever
that is?)**

Kushida et al, *Ann Intern Med* 1997

- N=300
- BMI, neck circumference, oral cavity measurements
- Model predicted AHI > 5
 - Sensitivity 97.6%
 - Specificity 100%
 - PPV 100%

Netzer et al. *Ann Intern Med* 1999

- N=100
- Multicenter trial
- Berlin questionnaire: queries about snoring, sleepiness, obesity, hypertension
- Being identified as “high risk” predicted an RDI > 5
 - sensitivity 86 %
 - specificity 77 %
 - PPV 89 %

Exam: Tonsillar Hypertrophy



Shepard JW Jr. Mayo Clin Proc 1990;65(9)

**OK, so which patients and
how many could go
straight to treatment
without testing?**

The Use of Clinical Prediction Formulas in the Evaluation of Obstructive Sleep Apnea

Rowley *et al*, *Sleep* 2000

- Crocker *et al*, *Am Rev Respir Dis* 1990
 - age, BMI, witnessed apneas, hypertension
- Maislin *et al*, *Sleep* 1995
 - sex, BMI, age, snorting, snoring, witnessed apneas
- Flemons *et al*, *Am J Respir Crit Care Med*, 1994
 - Neck circumference, hypertension, habitual snoring, choking
- Viner *et al* *Ann Intern Med* 1991
 - Sex, age, snoring, BMI

Rowley's Analysis

- A prospective application of 4 clinical prediction models to 370 subjects
 - 46.5 (38-56) years
 - BMI 37.1 (30.7-46.6) Kg/m²
 - 52% male
 - 52% hypertensive
 - 67% had AHI > 10; 49% had AHI > 20
- Hypopnea required 3% desaturation
- "OSA" was defined as AHI \geq 10 events/hr
- Sensitivity, specificity, positive and negative predictive values were calculated

“... these tests would significantly increase the yield of detecting patients with an AHI > 20 ...if we utilized Model 4 (Maislin)...39% of the patients with an AHI ≥ 20 would be identified with only 7% of the patients with positive results being falsely identified.”

Rowley's Conclusion

About 40 % of patients could go straight to auto-titrating CPAP without polysomnography. 7% may be falsely identified (or may have UARS, or milder OSA). Careful follow up would be necessary. Much time and money would be saved.

My conclusion

Comparison of Patients with and Without Sleep Apnea

OSA present

OSA Absent

Age (years)	47	46	NS
BMI (kg/m ²)	39.2	33.7	<0.001
NC (cm/in)	43/16.93	40/15.75	<0.001
M:F	145:103	46:76	<0.0001
% HBP	53	48	NS
% snoring	81	70	0.014
% witnessed apnea	69	48	<0.0001
% gasping	49	38	<0.037

OK, so how would you treat a patient with suspected sleep apnea without establishing a CPAP pressure by in-lab titration?

Autotitrating CPAP

- Most commonly, increases pressure to eliminate vibration of palate and soft tissue
- Costs \$200-300 more than “straight” CPAP
- May improve compliance
- Results in lower pressure over all

Comparison of Autotitrating vs In-Lab Titrated CPAP

Hudgel et al, 2000, n=33

- Pressures were lower on APAP
 - CPAP: 8-16, mean 10.6
 - APAP: 3-13, mean 6.4
- ESS improved the same amount
 - (initial: 15, follow-up: 8 on CPAP, 9 on APAP)
- Compliance was the same
 - Total use: CPAP 427 hrs, APAP, 492 hrs
 - ≥ 4 hrs/night: CPAP 66%, APAP, 73.5%

**OK, but how many people
does this affect?**

Comparison of the Prevalence Rates of Obstructive Sleep Apnea to Cancer, Heart Disease and Stroke in the United States

Prevalence of Obstructive Sleep Apnea ⁺	2-4%
Prevalence of Patients who ever had Cancer [*]	~3%
Prevalence of Coronary Heart Disease ^{**}	~5%
Prevalence of Stroke ^{**}	~1%

+ Data from Young et al, 1993, *N Engl J Med*

* Data estimated from Cancer Facts and Figures, 1995 and 1990 US Census

** Data estimated from *Heart & Stroke Facts*, 1995 and US Census

SDB with Aging

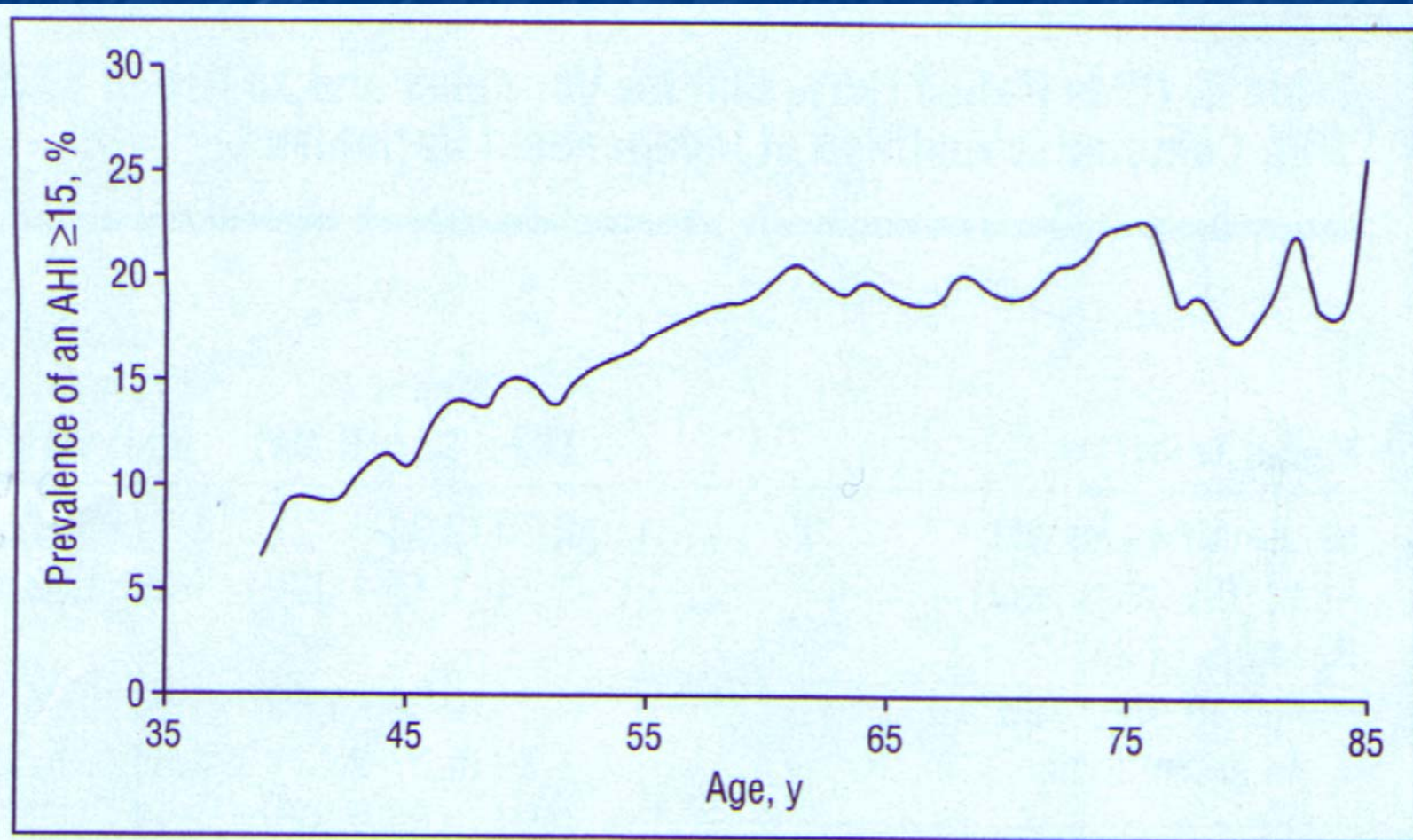
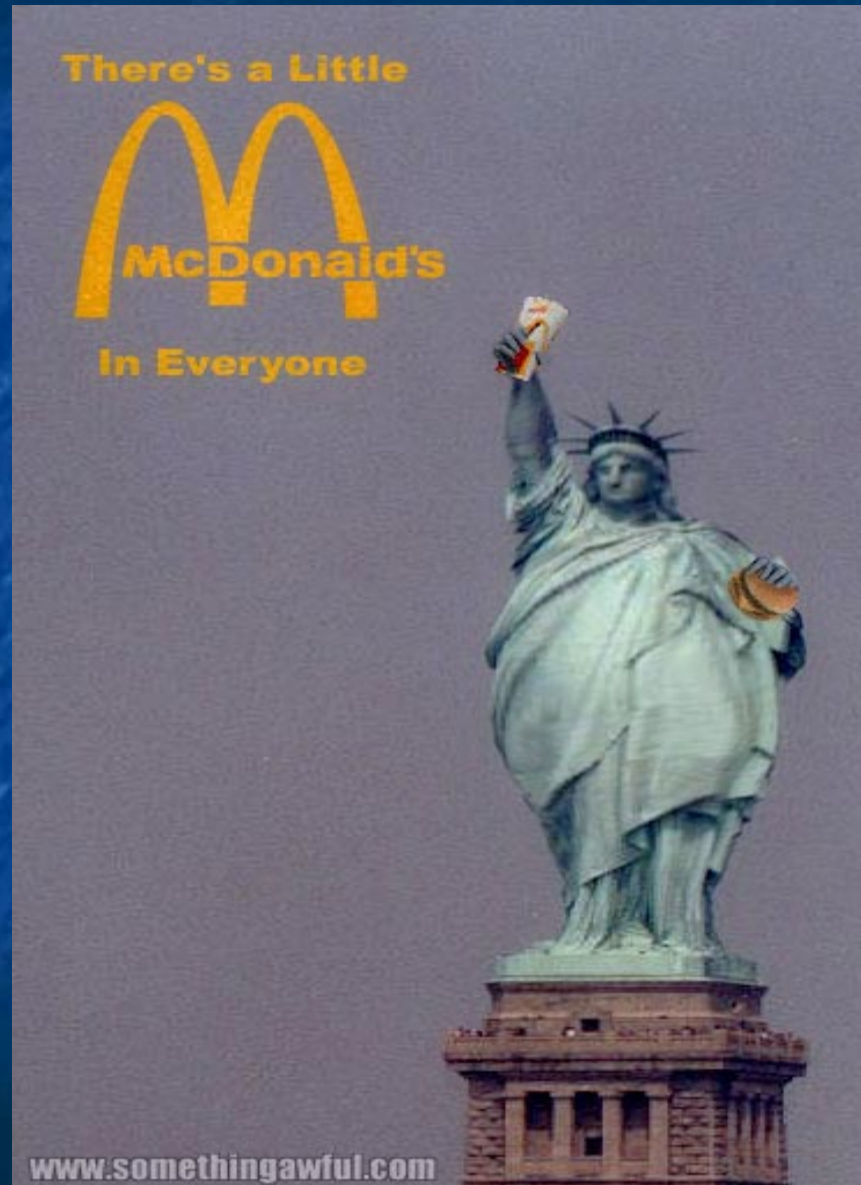


Figure 1. Smoothed plot (5-year moving average) of the prevalence of an apnea-hypopnea index (AHI) of 15 or greater by age.

Why Sleep Apnea Isn't Going Away.....



Over Treatment Vs Under Treatment of Sleep Apnea

- **“Unindicated” CPAP**
 - \$1000 cost
 - Rhinorrhea, stuffiness, nose abrasions, etc
- **Untreated Sleep Apnea**
 - Cardiovascular disease
 - Car wrecks
 - Hypertension
 - Neuropsychiatric deficits
 - Death
 - Impotence

Positive Airway Pressure: Problems



But what is the risk to the patient if he does have sleep apnea, and hassle and cost prevent or delay him from getting CPAP?

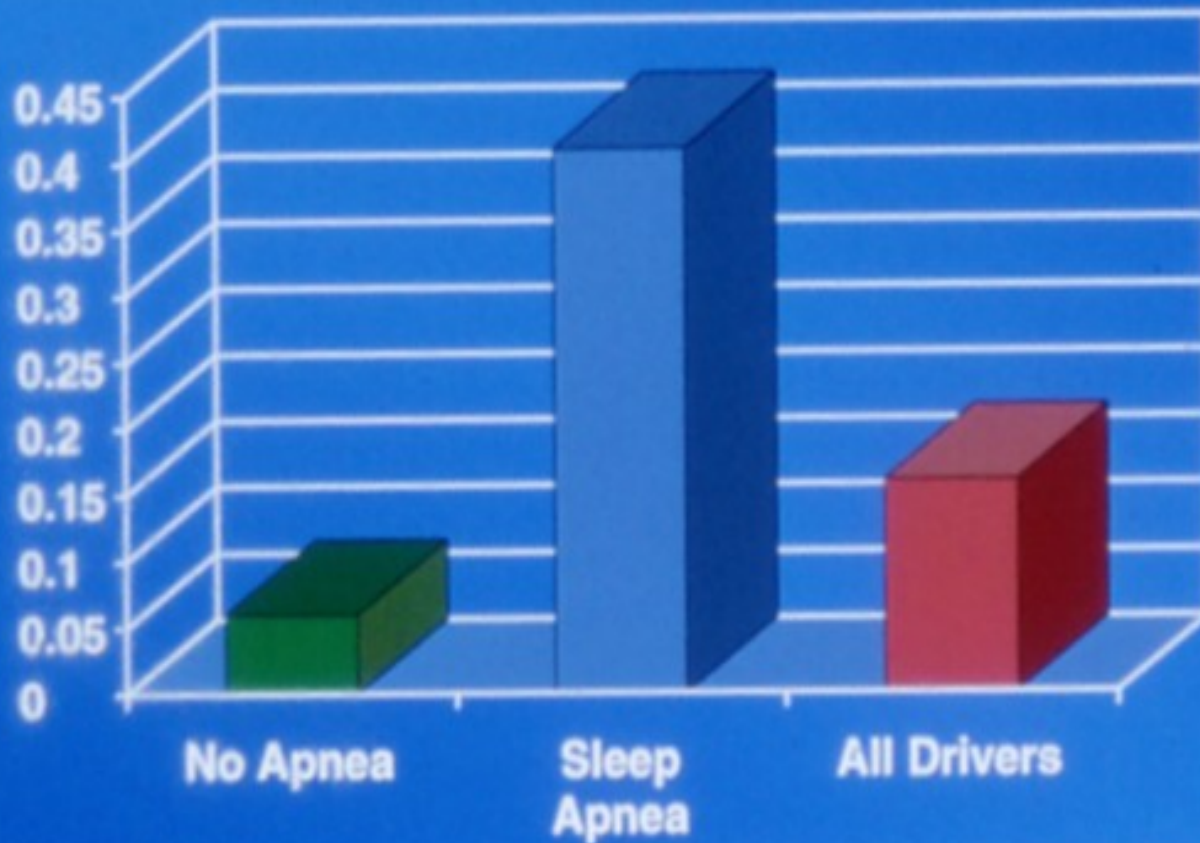
Consequences of Obstructive Sleep Apnea

- Impaired cognitive function
- Impaired quality of life
- Daytime sleepiness
- Increased risk of automobile accidents
- Increased health care costs
- Hypertension
- Cardiovascular disease
- Worsened glucose tolerance
- Increased mortality rates
- Impotence

**Why Sleep Apnea is a
public health problem.**

Consequences: Automobile Accidents

Accident/driver/5 yrs



Findley et al. Amer Rev Respir Dis 1988



The Epworth Sleepiness Scale

How likely are you to doze off or fall asleep in the following situations, in contrast to just feeling tired? This refers to your usual way of life in recent times. Even if you have not done some of these things recently, try to work out how they would have affected you. Use the following scale to chose the *most appropriate* number for each situation:

- 0=would *never* doze
- 1=*slight* chance of dozing
- 2= *moderate* chance of dozing
- 3=*high* chance of dozing

Situation	Chance of Dozing
Sitting and reading	_____
Watching TV	_____
Sitting, inactive, in a public place	_____
As a passenger in a car for an hour	_____
Lying down in the afternoon	_____
Sitting and talking to someone	_____
Sitting quietly after a lunch without alcohol	_____
In a car, while stopped for a few minutes in traffic	_____

The following sleepiness scale can be helpful in determining how much sleeping disorder you have. How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your usual way of life in recent times. Use the following scale to choose the *most appropriate number* for each situation.

0 = would *never* doze

1 = *slight* chance of dozing

2 = *moderate* chance of dozing

3 = *high* chance of dozing

4 = Always

SITUATION

CHANCE OF DOZING

Sitting and reading

4

Watching Television

4

Sitting, inactive in a public place (theater or movie)

4

As a passenger in a car for an hour without a break

4

Lying down to rest in the afternoon

4

Sitting and talking to someone

4

Sitting quietly after a lunch without alcohol

4

In a car, while stopped for a few minutes in traffic

4

driving down Interstate

4

For each of the beverages listed, write in the average number that you drink each day.

**What is the evidence that
CPAP reduces the risk?**

CPAP: Benefits

- Improved cognitive function
- Improved quality of life
- Reduced daytime sleepiness
- Reduced risk of automobile accidents
- Reduced health care costs
- Reduced blood pressure
- Reduced cardiac arrhythmias
- Reduced mortality rate
- Reversal of impotence

Becker, 2003

Open

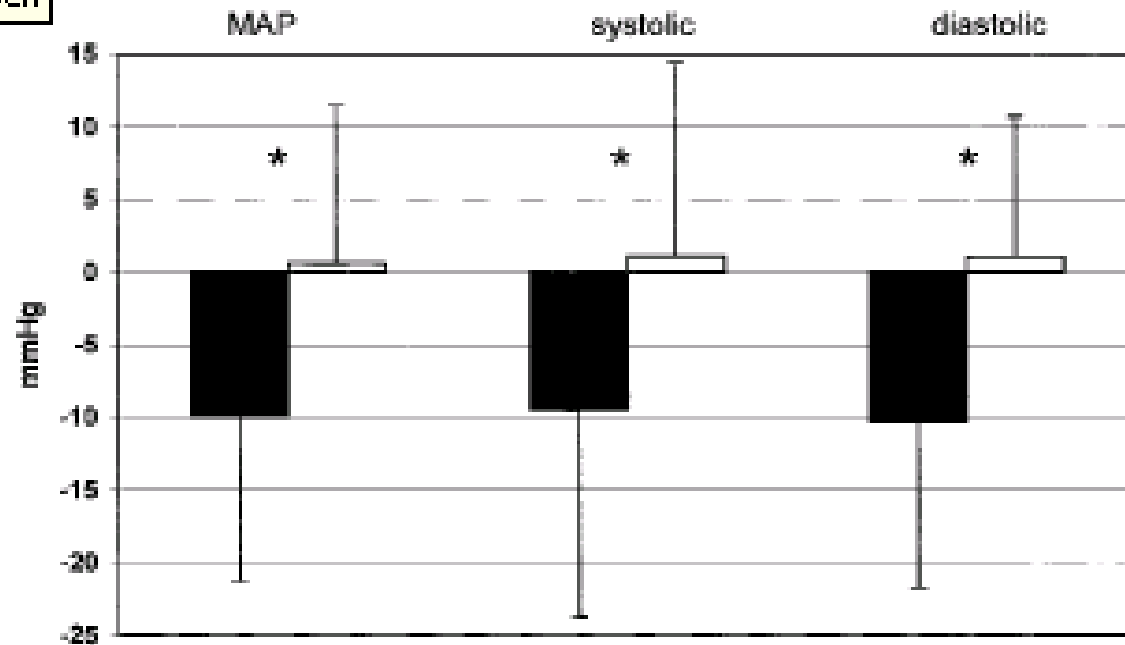
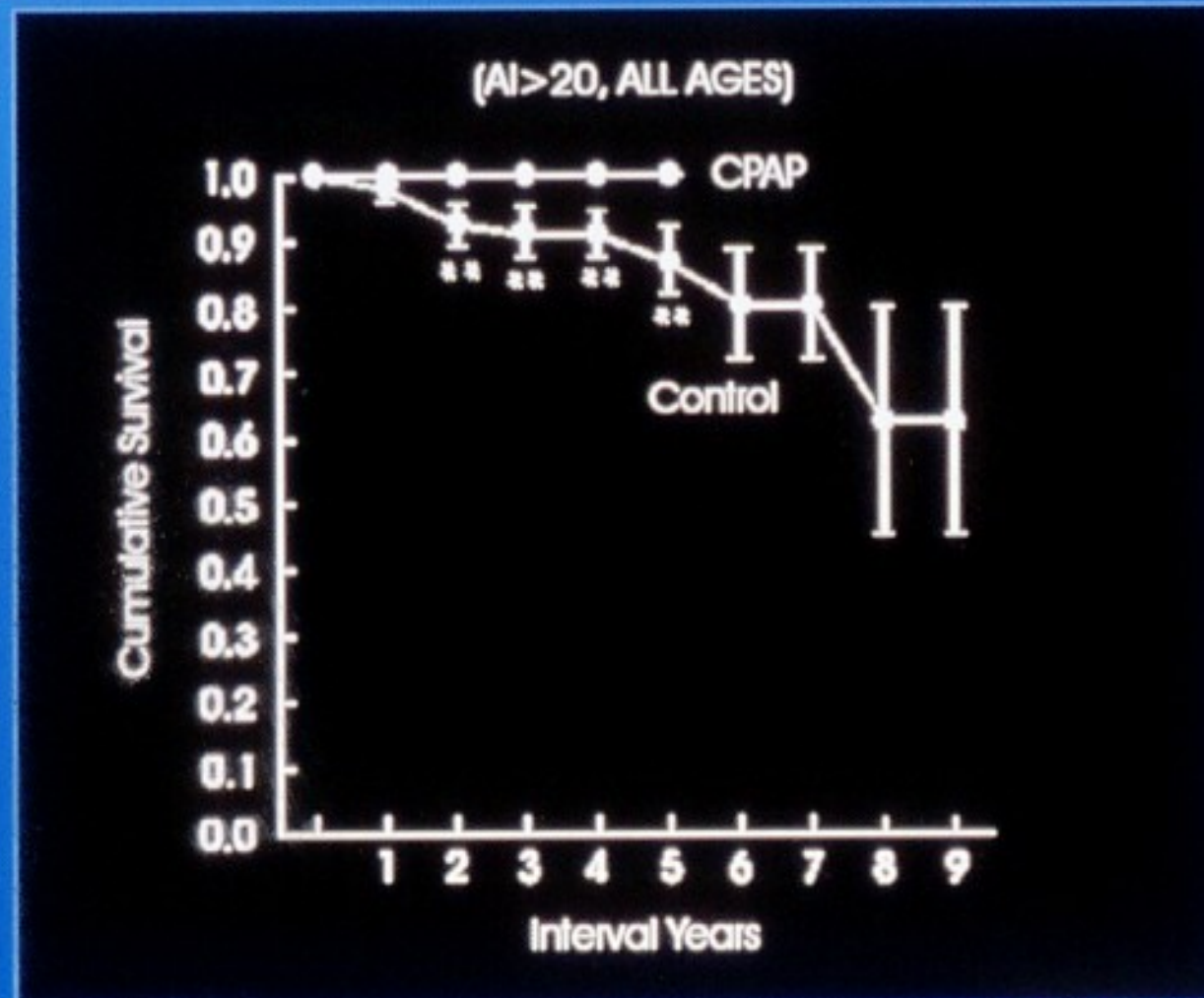


Figure 2. Changes in blood pressure with effective (closed bars) and subtherapeutic (open bars) nCPAP. *Significant difference. MAP indicates mean arterial blood pressure; systolic, systolic blood pressure; and diastolic, diastolic blood pressure. MAP, $P=0.01$; systolic blood pressure, $P=0.04$; diastolic blood pressure, $P<0.005$.

Benefits of CPAP: Mortality



He et al. Chest. 1988;94



Conclusions

- Polysomnography and CPAP titrations are imperfect and over-rated tools
- Sleep-disordered breathing is a spectrum, not an all-or-nothing phenomenon
- We have over-emphasized the AHI in particular, and technology in general
- It is illogical to spend more time and money diagnosing something than treating it, especially if the treatment is safe, cheap and effective and the disease can kill.
- We must still be clinicians and use clinical judgment.

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Clinical Prediction Formulae

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Complications

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CPAP Treatment-General

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CPAP Treatment-Benefits

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CPAP Treatment-Benefits, continued

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