Sleep and Heart Health: Consequences of OSA

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Objectives

- Explain the physiology of normal sleep
- Beneficial effects of sleep
- Examine disruptions in normal sleep as it affects the cardiovascular system
- Obstructive sleep apnea (OSA) as it affects sleep in Cardiovascular Disease
- Summary of OSA consequences on the heart and what you can do to prevent them!

April 20, 2011
MI After Non-Cardiac Surgery Are Often Overlooked

MISSING THE BOAT

- **POISE Trial** (Perioperative Ischemic Evaluation)
  - 8351 patients in 190 centers in 23 countries were followed three days post non-cardiac surgery
  - Within 30 days of randomization, 415 patients (5%) showed evidence of perioperative MI."
  - ¾ occurred within 48 hours of surgery; 2/3 without symptoms
  - Looked for asymptomatic myocardial infarctions within 3 days after surgery using cardiac biomarkers.
- Conclusion the authors drew
  - Beta blockers reduce risk of MI but increase risk of severe stroke and overall death in patients undergoing non-cardiac surgery
  - "Surgery is the ultimate stress test."
  - "Narcotics blunt the discomfort of the surgery but may mask the ischemic symptoms."

Devereaux PG, Xavier D, Pogue, J. Ann Intern Med 2011; 154:523-528.

MI After Non-Cardiac Surgery Are Often Overlooked

- Surgery = Anesthesia, patient asleep
- Adult population risk for obstructive sleep apnea ~ >4%

"We're not optimizing medical therapy before surgery." "There are existing guidelines and risk scores that are probably underused."

CHEST

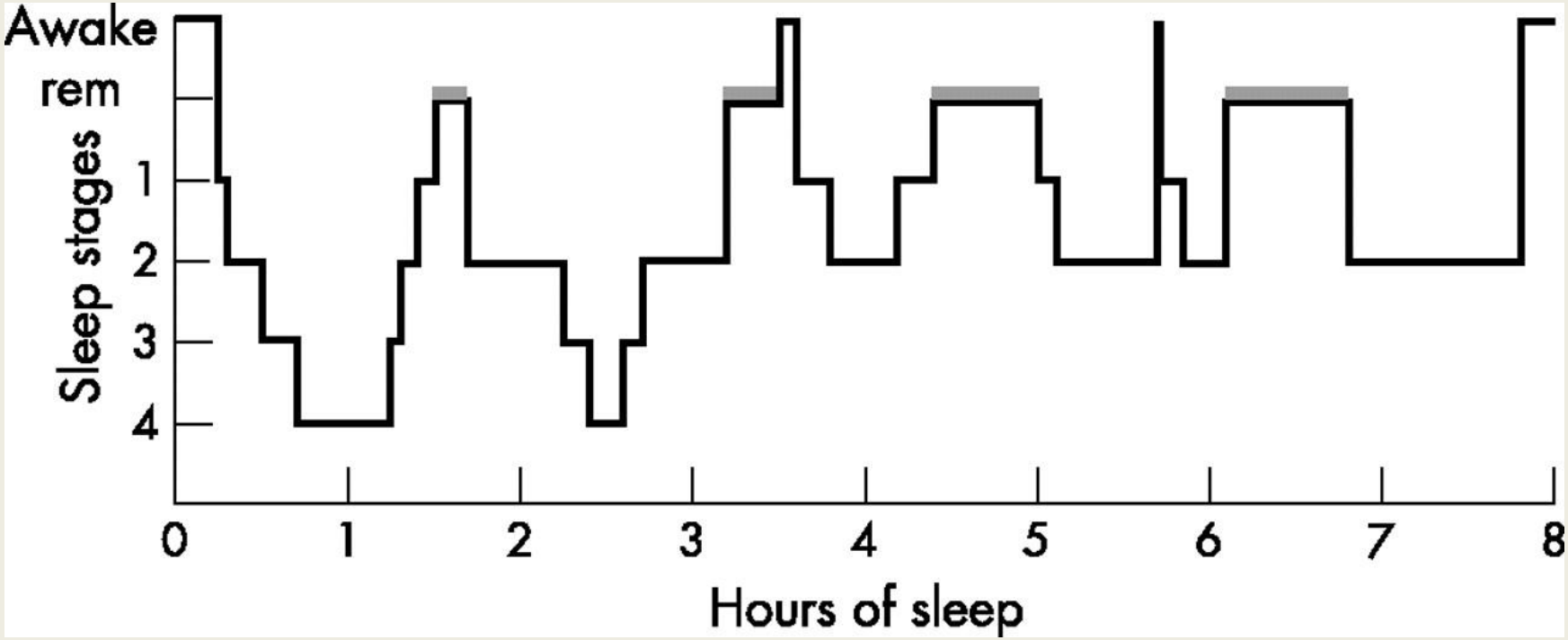
Official publication of the American College of Chest Physicians

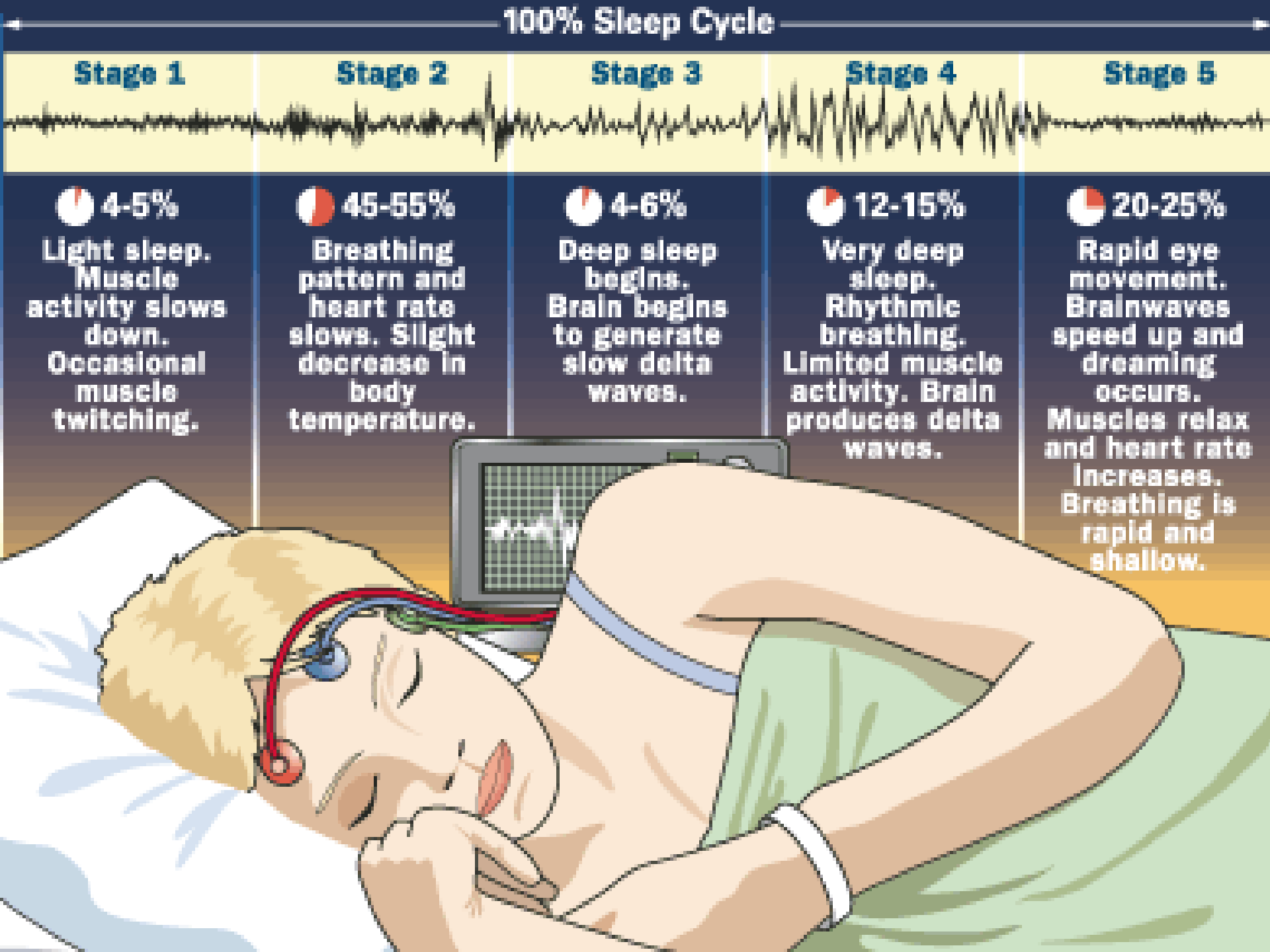
Obstructive Sleep Apnea : The Elephant in the Cardiovascular Room

Jessie P. Bakker, Bhavneesh Sharma and Atul Malhotra

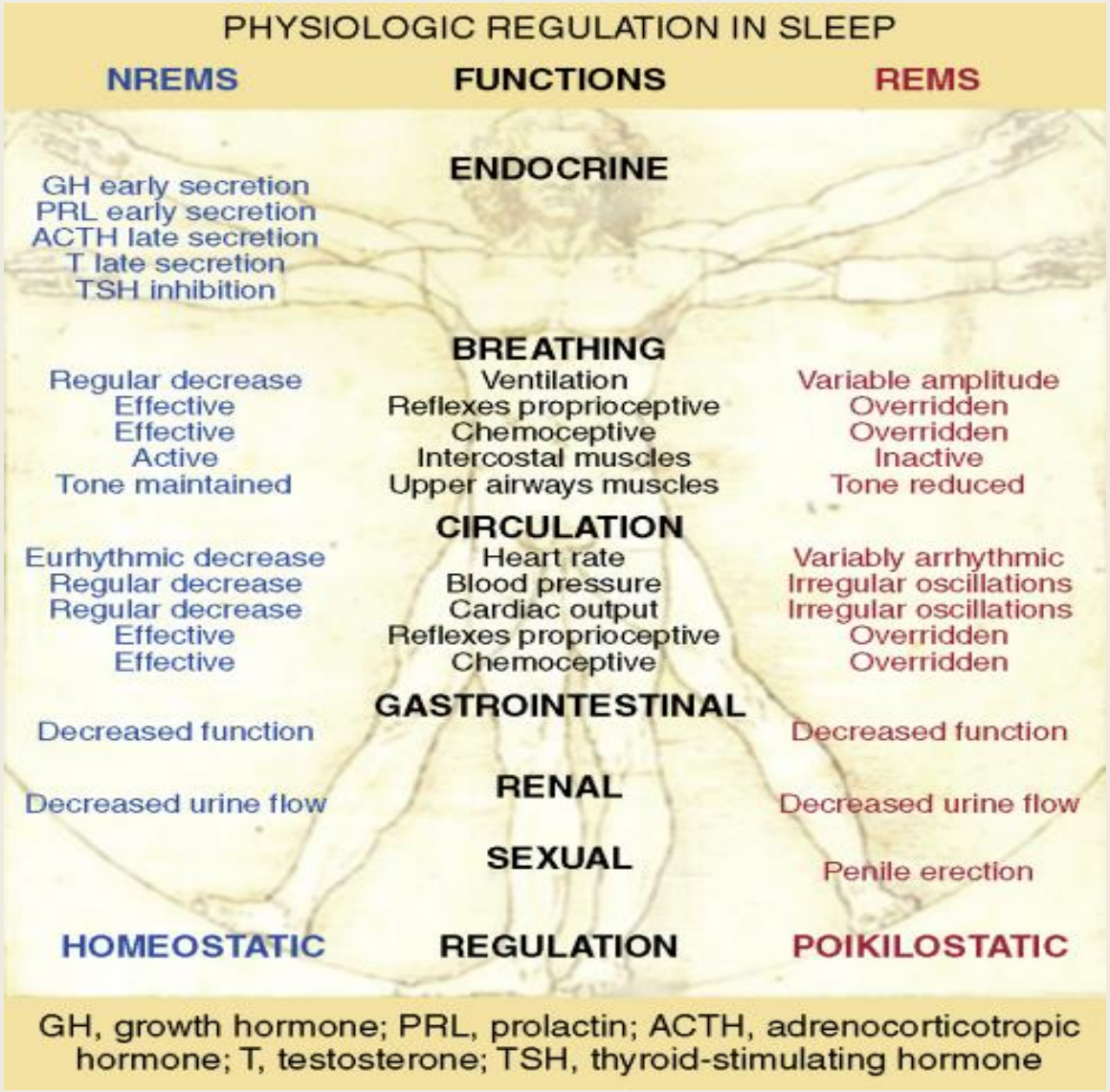
Chest 2012;141;580-581
DOI 10.1378/chest.11-2178

Normal Sleep Architecture




100% Sleep Cycle
Stage 1
Stage 2
Stage 3
Stage 4
Stage 5
4-5%
Light sleep. Muscle activity slows down. Occasional muscle twitching.
45-55%
Breathing pattern and heart rate slows. Slight decrease in body temperature.
4-6%
Deep sleep begins. Brain begins to generate slow delta waves.
12-15%
Very deep sleep. Rhythmic breathing. Limited muscle activity. Brain produces delta waves.
20-25%
Rapid eye movement. Brainwaves speed up and dreaming occurs. Muscles relax and heart rate increases. Breathing is rapid and shallow.

What happens when we sleep

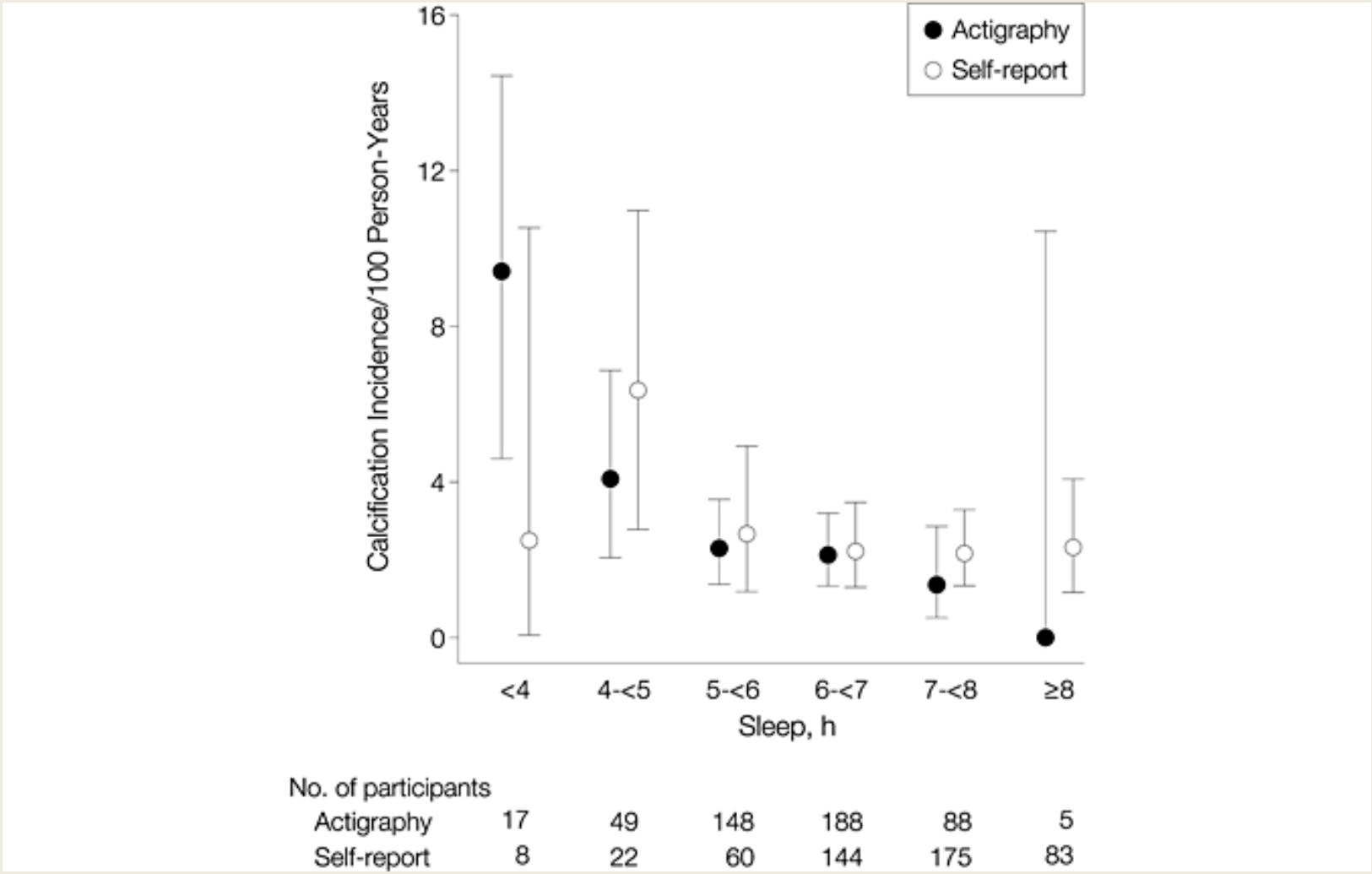


Coronary Calcification and Sleep Times in Patients without OSA

- 495 patients (age 35-47) are screened with CT to look for coronary artery calcifications at baseline and again 5 years later
- Sleep measurements with wrist actigraphy looked at duration of sleep between the scans
- Patients with sleep disorders were “theoretically” excluded using questionnaires (ESS, Berlin, etc) and common risk factors smoking, obesity, family history, HTN
- 12.3% (61 patients) developed coronary calcifications and it was correlated with sleep time

King, C. *The Journal of the American Medical Association*, Dec. 24/31, 2008; vol 300: pp 2859-2866.

Coronary Calcification Incidence by Mean Sleep Duration



King, C. R. et al. JAMA 2008;300:2859-2866

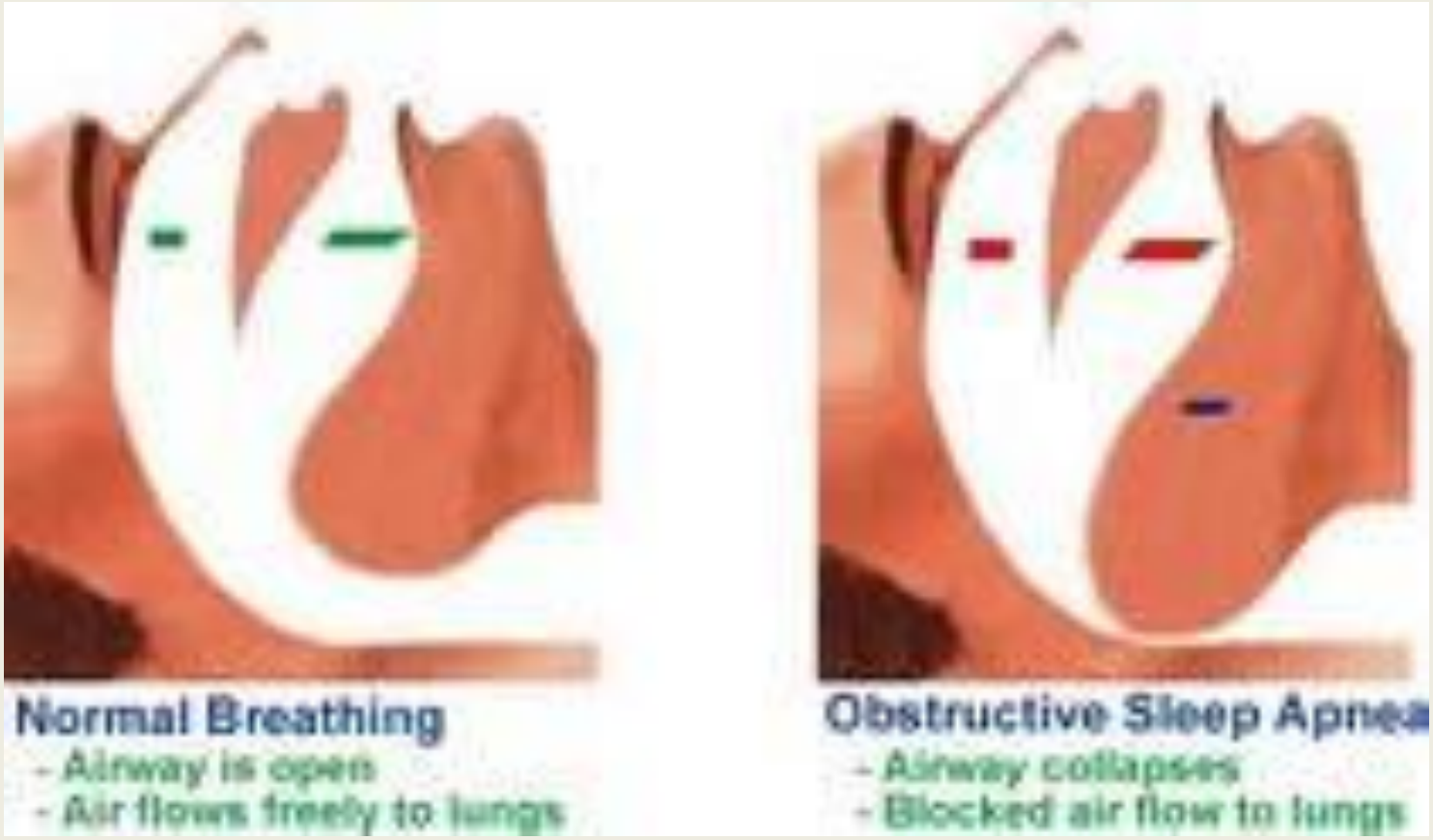
JAMA

Sleep and Physiology

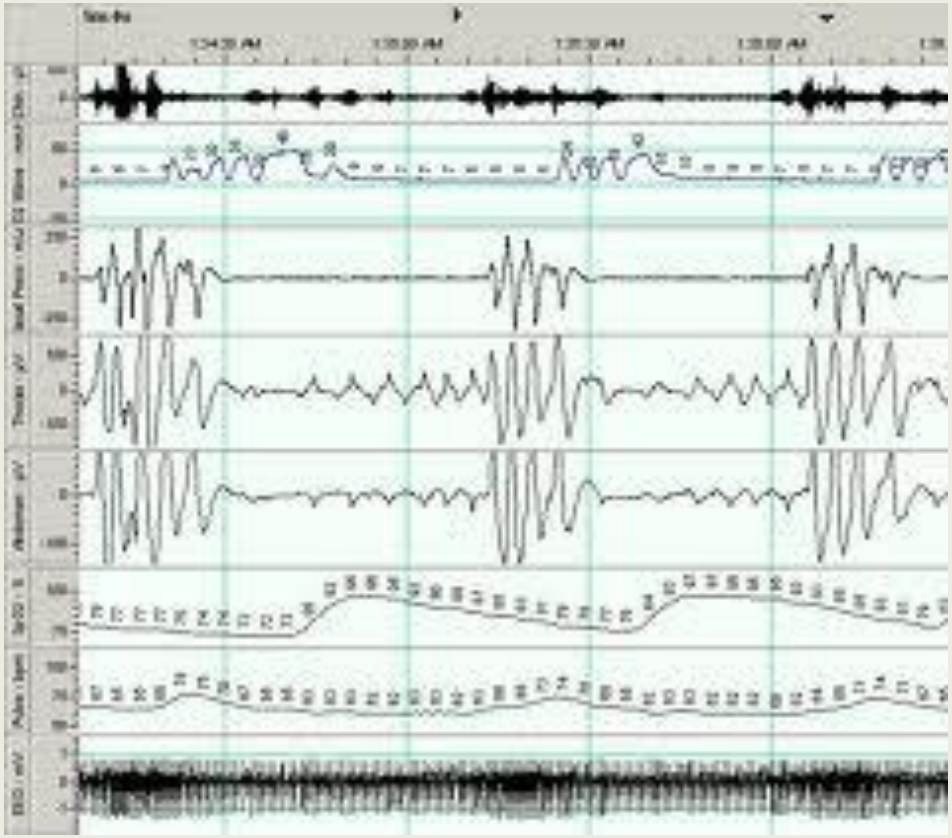
What are some beneficial effects of sleep?

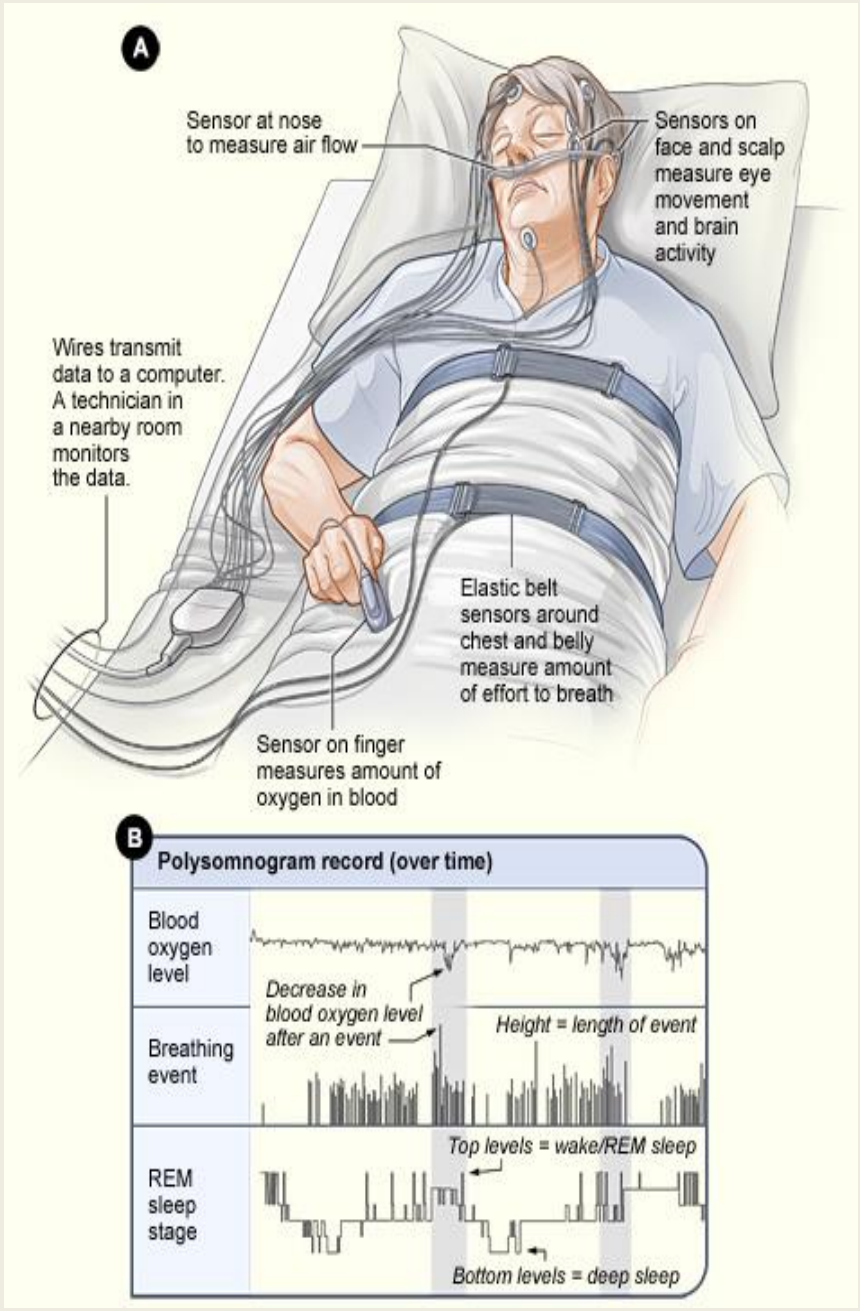
- Weight loss
- Preventing certain cancers
- Preventing cardiovascular disease
- Preventing mood disorders
- Improving GI function
- Immune system regulation (inflammatory and anti-inflammatory properties)
- Regulates endocrine system

The Airway


Normal Breathing
- Airway is open
- Air flows freely to lungs
Obstructive Sleep Apnea
- Airway collapses
- Blocked air flow to lungs

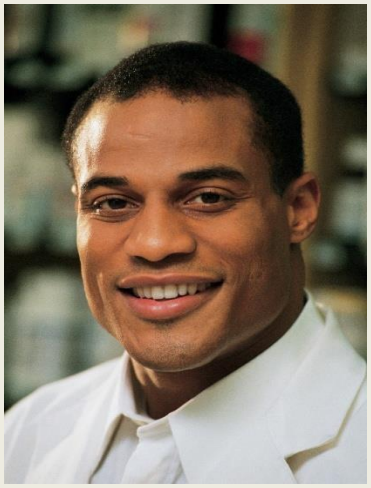
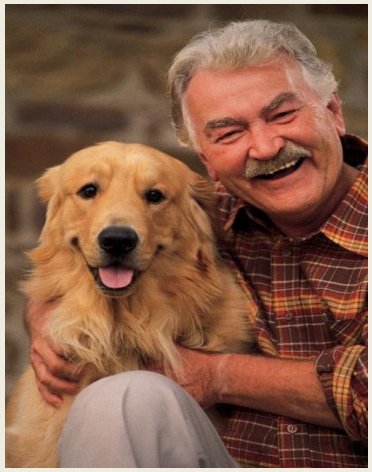
PSG

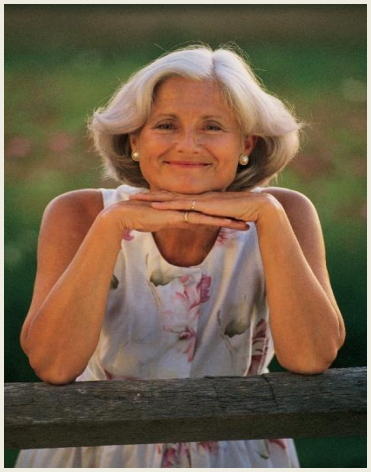



A
Sensor at nose to measure air flow
Sensors on face and scalp measure eye movement and brain activity
Wires transmit data to a computer. A technician in a nearby room monitors the data.
Elastic belt sensors around chest and belly measure amount of effort to breath
Sensor on finger measures amount of oxygen in blood
B
Polysomnogram record (over time)
Blood oxygen level
Decrease in blood oxygen level after an event
Breathing event
Height = length of event
REM sleep stage
Top levels = wake/REM sleep
Bottom levels = deep sleep

Prevalence of OSA

- 18 -20 million adults suffer from
  - symptomatic OSA
  - severe asymptomatic OSA
- 90% remain undiagnosed and untreated



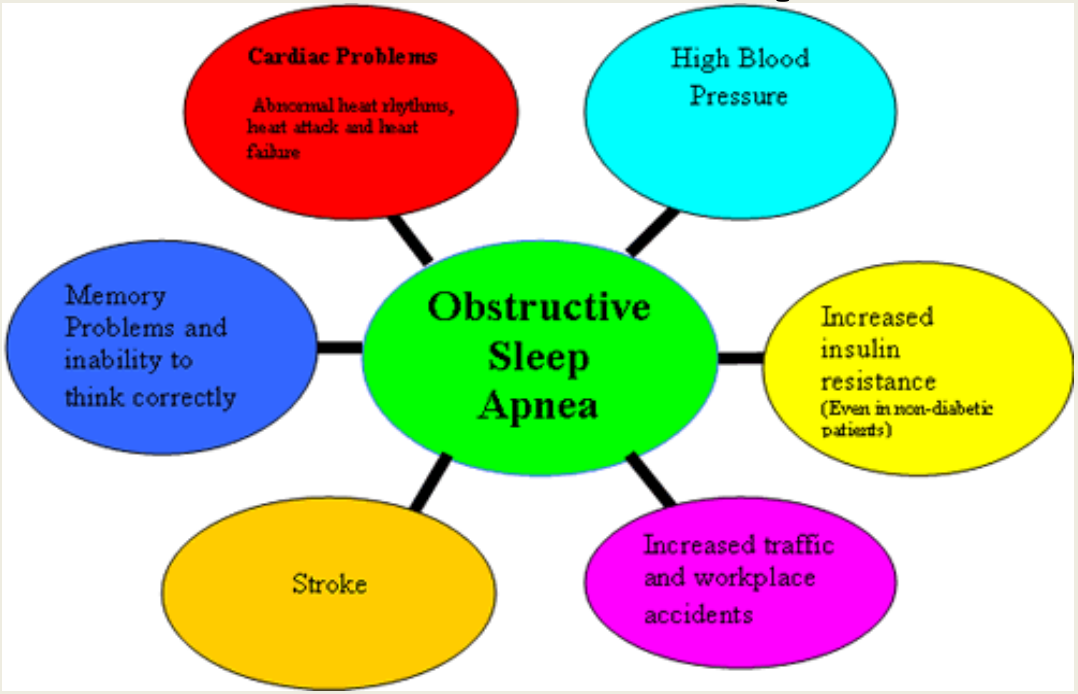
Impact of OSA

- Decreased quality of life
- Carries an economic toll
  - Consume higher amounts of healthcare $$ prior to diagnosis
    - Hospitalizations
    - Accidents
- Public safety issue
  - Drowsy driving
  - Accidents in the work place

Risk factors for OSA

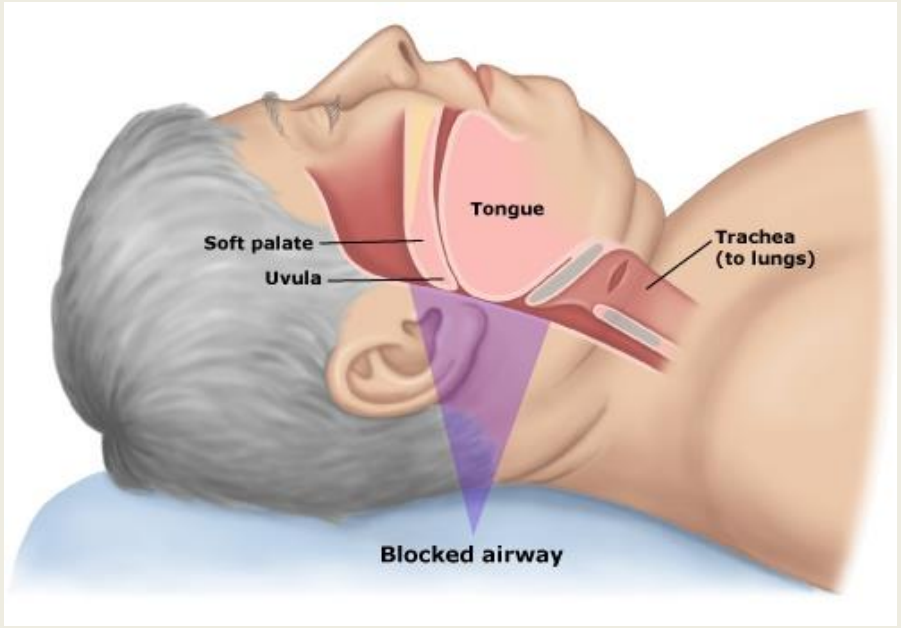
- Family history
- Prior upper airway issues (cleft palate/surgery, laser procedures, radiation, large tonsils)
- Increasing age *highest during middle age
- Smoking
- Obesity
- Male gender
- Postmenopausal status
- Sedative hypnotic medications
- Alcohol
- Neck circumference (> 17 inches (43 cm in males)
- HTN (40%)

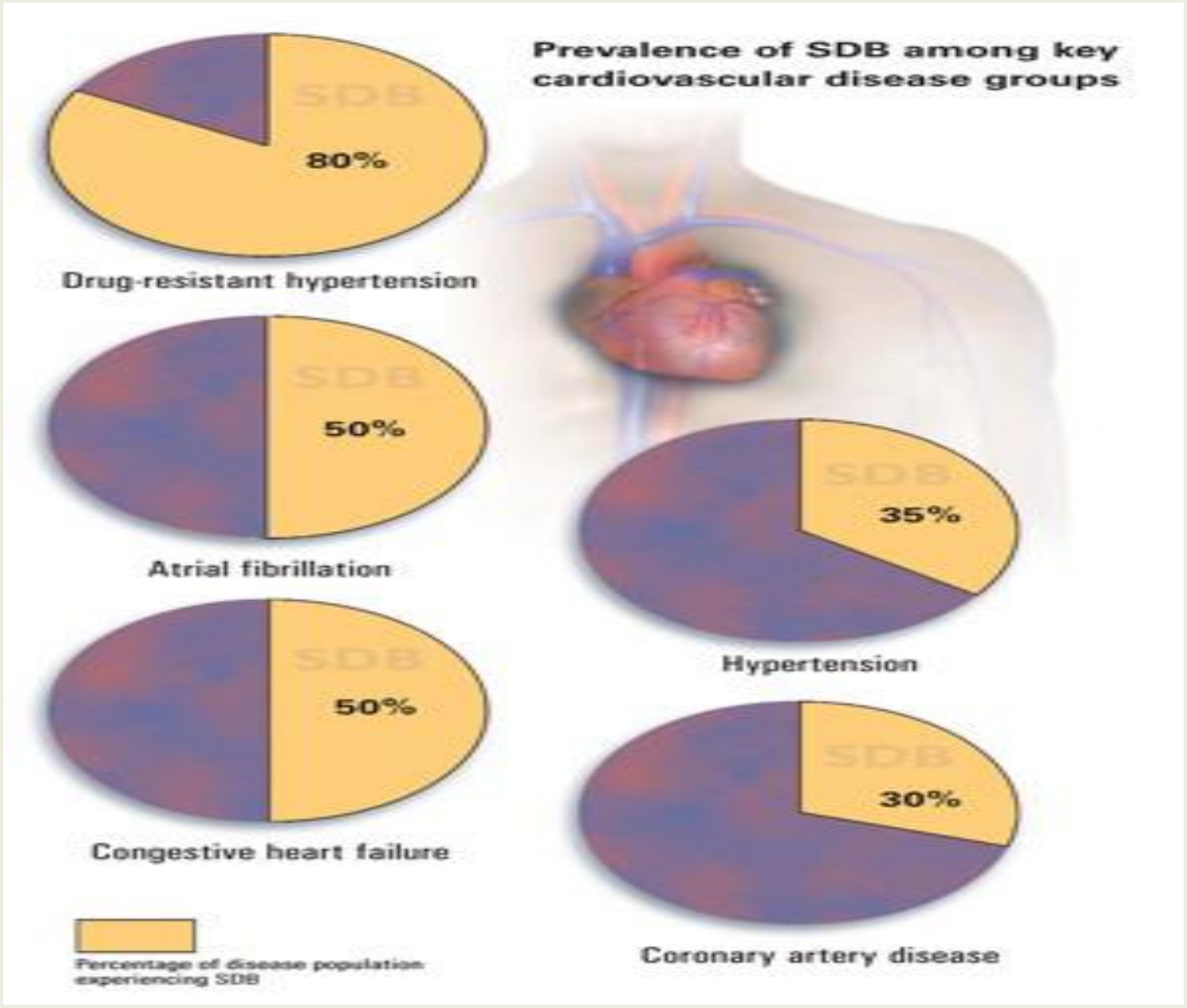
OSA is Linked to Multiple Conditions



- Cardiovascular (CV) disease
  - **HTN, CHF, Pulmonary Hypertension, Cor pulmonale, CVA, Suddent death due to fatal arrhythmias, Atrial fibrillation, Nocturnal angina, MI, and others!**
- Glucose regulation with type II diabetes
- Autonomic instability
- GERD
- Increased morbidity & mortality from co-morbid conditions

Sleep and the Heart
Complications of OSA




Prevalence of SDB among key cardiovascular disease groups
80%
Drug-resistant hypertension
50%
Atrial fibrillation
50%
Congestive heart failure
35%
Hypertension
30%
Coronary artery disease
Percentage of disease population experiencing SDB

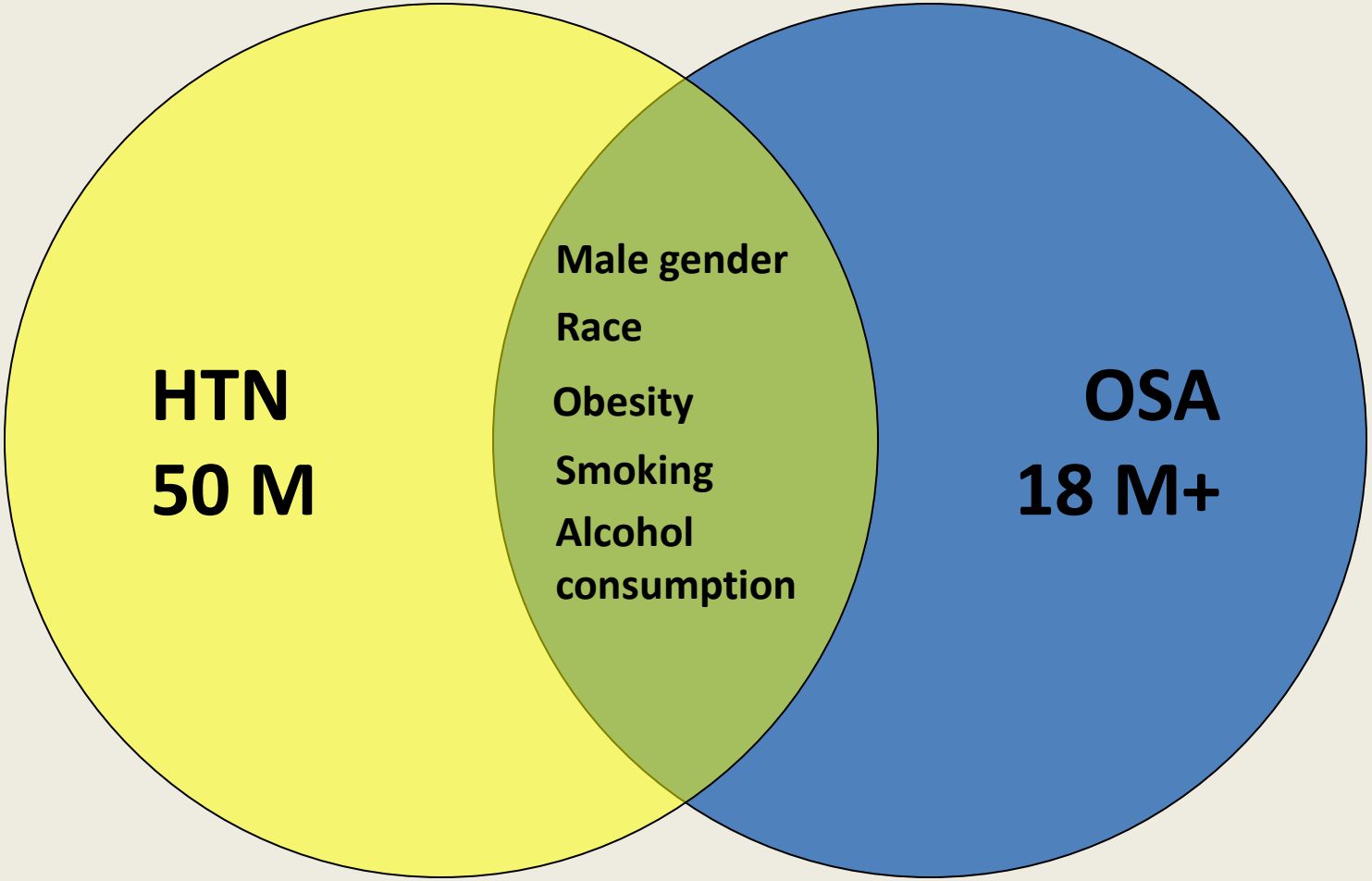
Groups Considered “At Increased Risk” for Cardiovascular Events

- Nocturnal angina, ischemia, myocardial infarction (~250,000/yr), lethal arrhythmias or cardiac arrest at night (~47,500/yr)
- Atrial fibrillation (2.5M/yr)
- Family report of highly irregular breathing, excessive snoring, or apnea in patients with coronary disease (5-10M/yr)
- Long QT3 syndrome, Brugada syndrome, and sudden nocturnal death syndrome (SUNDS)
- Near-miss or siblings of sudden infant death syndrome (SIDS) victims
- Patients on cardiac medications (13.5M/yr)

Systemic Hypertension (HTN)

- Estimated 30% individuals with HTN remain undiagnosed
- 50 million Americans
  - 1 in 4 adults
- Effective medical control of BP will prevent or forestall complications
- Direct healthcare costs are $22B/year

HTN and OSA


HTN
50 M
Male gender
Race
Obesity
Smoking
Alcohol consumption
OSA
18 M+

Proposed Mechanisms of HTN in OSA

- Frequent arousals cause acute transient increases in blood pressure
- Hypoxemia
  - causes peripheral vasoconstriction
- Greater intrathoracic pressure from upper airway obstruction
  - Increased LV transmural pressure leading to increased afterload, increased venous return to RV, impedes LV filling during diastole and decreased LV stroke volume
- Morgan and coworkers measured an increased sympathetic outflow after the hypoxic stimulus was removed
- In OSA, increased sympathetic tone has been demonstrated in resting muscle compared to controls

Sleep disordered breathing and cardiovascular events: fatal vs. nonfatal

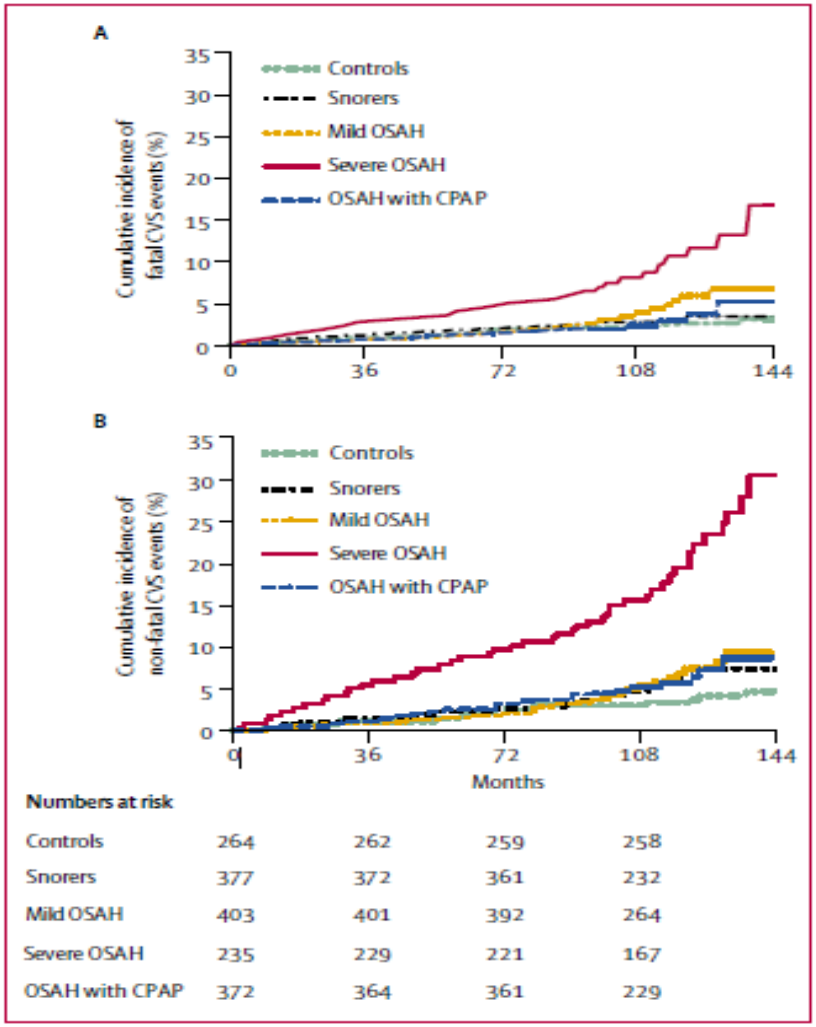


Figure 2: Cumulative percentage of individuals with new fatal (A) and non-fatal (B) cardiovascular events in each of the five groups studied

Long-term cardiovascular outcomes in men with obstructive sleep apnoea-hypopnoea with or without treatment with continuous positive airway pressure: an observational study

Marin et al. Lancet. 2005;365(1046-53)

Central Sleep Apnea

- This is not obstructive sleep apnea and it is treated differently, risk factors overlap but others exist
  - Complications of cervical spine surgery, radiation or severe degeneration
  - Encephalitis, poliomyelitis
  - Neurodegenerative conditions such as Parkinson's Disease
  - Primary hypoventilation syndromes (Pickwick Pattern)
  - Brainstem stroke
- Commonly seen with sedatives/hypnotics medications and very common with alcohol use
- Can be normal
  - hypercapnea threshold changes during sleep
  - Transitional sleep

SUMMARY
Cardiovascular Complications OSA

- Untreated severe OSA
  - Increased fatal and nonfatal events
- Increased apnea severity is associated with increased all-cause mortality in men < 50 years old
- OSA is associated with a 2x risk of stroke or death from any cause
- OSA is associated with heart failure
  - Patients that go untreated have increased risk of death
- Sleep Related Breathing Disorder (SRBD) is highly associated with HTN

Questions?

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Helpful Websites for Patients

- www.sleepeducation.com (American Academy of Sleep Medicine)
- www.healthysleep.com (ResMed)
- www.cpap.com (CPAP.com/supplies and info)
- www.womensheart.org (Women and Heart Dz)
- www.sleepandyou.com (Sleep and Health)
- www.understandingsleep.org (Harvard Sleep)
  - This is the one Mr. Shaquille O'Neal appeared in on video