Sleep and Sleep Disorders
In the older adult
October 8, 2013
University of California San Diego

Jose S. Loredo, MD, MS, MPH, FCCP, FAASM
Pulmonary/Critical Care/Sleep Medicine
Professor of Clinical Medicine
University of California San Diego School of Medicine
The significance of sleep

- One third of our life is spent sleeping
- Most sleep knowledge has been gained in the last 50 years
- Sleep is a dynamic behavior
- Controlled by elaborate and precise mechanism
What is the purpose of sleep?

- Mental and physical restorative properties
- A state of cardiovascular relaxation
  - Heart rate, Blood pressure, Metabolic rate
- Learning
  - REM and Deep sleep
- The cure for sleepiness
Disturbed sleep is detrimental

- Obstructive sleep apnea is associated with:
  - Hypertension
  - Heart attacks
  - Congestive heart failure
  - Stroke
  - Obesity
  - Diabetes
  - Inflammation
  - All cause mortality
Short Sleep duration: an important health risk factor

- **Sleeping ≤ 6 hours per night**
  - Higher risk of hypertension (SHHS)
    - Gottlieb et al. *Sleep* 2006; 29(8):1009-14

- **Sleeping ≤ 5 hours per night** (Nurses Health Study)
  - Higher risk of coronary events

- **Sleeping < 7 hour or > 9 hours** (Goldilocks model)
  - More sleep complaint
  - Increased mortality
Forces that drive sleep

- Circadian forces
- Homeostatic forces
- Neurohormonal forces
- Socio-Cultural forces
The circadian rhythm
Humans cannot maintain muscle tone/reflexes during sleep

- Cannot sleep standing up
- Cannot cough during sleep
- Cannot swallow well during sleep – aspirate
- Cannot keep our airways open

![Diagram showing normal breathing and obstructive sleep apnea](image-url)
Normal sleep physiological changes that may affect the older adult

- Loss of body temperature control in REM sleep.
- Loss of muscle tone during REM sleep
- Dipping of blood pressure (10% to 20%)
- Hypoventilation
  - $\text{SaO}_2$ decreased by 2-3% (usually not less than 95%)
  - $\text{PCO}_2$ increased by 2-3 mmHg
Age related trends in sleep architecture

The graph illustrates the changes in sleep architecture across different age groups. It shows the trends in total sleep time, sleep latency, WASO, REM, SWS, Stage 2, and Stage 1 as age increases from 5 to 85 years.
Age related changes in circadian rhythm

- Circadian = about one day long (24 hours)
- Internal clock – the suprachiasmatic nucleus (SCN)
  - Rhythm slightly longer than 24 hours
  - Needs to be entrained by outside stimuli
    - Bright light (sun – main zeitgeber)
    - Work schedule
    - Clocks
Aging effects on the circadian rhythm

- Cerebral atrophy
- Weaker SCN, desynchronized
- Reduced rhythm amplitude
- Reduce melatonin output
- Weaker or non existent zeitgebers
  - Little light exposure
  - No outdoor activities
- End results
  - Advanced sleep phase
  - Sundowning
Common sleep disorders in the older adult

- Obstructive sleep apnea
- Insomnia
- Restless legs syndrome
- Periodic limb movement during sleep syndrome
- REM sleep behavior disorder
What is obstructive sleep apnea?

- Pauses in breathing during sleep (apneas)
- Followed by loud snoring and gasping when breathing starts
- Results in brief awakenings (arousals)
- Excessive daytime sleepiness
OSA: Clinical consequences

Sleep Apnea
(AHI ≥ 5/hr)

Sleep Fragmentation
(Hypoxia, Hypercapnia)

Excessive daytime somnolence

Cardiovascular complications

Morbidity and Mortality
OSA: A public health problem (epidemic)

25-30% OSA are thin
Prevalence of OSA in the U.S.

In 2003, 17% of adults in the US had mild or worse OSA.

(Young et al. Excess weight and SDB. J Appl Physiol 2005;99:1592-1599)
Prevalence of OSA in specific populations

- **Chronic Renal failure** (Kuhlmann et al. Clin Nephrol 2000;53(6):460) 16-80%
- **Gulf war veterans** (Peacock et al. Mil Med 1997;162(4):249-251) 8.3%
- **Older veterans** (Stoohs et al. J Am Geriatr Soc 1996;44(11):1295-300) 80%
- **HTN** (Silverberg et al. Sleep 1997;20:794-806) 22-48%
- **Drug resistant HTN** (Logan et al. J. Hypertension 2001) 80%
- **Obesity** (Resta et al. Int J obes Relat Metab Disord 2001) 51.5%
- **CHF** (Javaheri et al. Circulation 1999) 50%
- **Atrial Fibrillation** (Somers et al. ATS Pres. 2004) 45%
- **The elderly** (Ancoli-Israel et al. Sleep 1991) 56-70%
- **Elderly African-Americans** (Ancoli-Israel et al. AJRCCM 1999) 2.5 x
- **Hispanics** ?
Consequences: excessive somnolence
Consequences: motor vehicle accidents

Thag Anderson becomes the first fatality as a result of falling asleep at the wheel.
Consequences: changes in daytime functioning

- Lack of concentration
- Change in personality
- Depression, fatigue, ED
- Family discord
Consequences: Cardiovascular disease

- Obesity
- HTN
- Stroke
- Hypersomnolence
- Metabolic Syndrome
- Activated Chemoreceptors
- Erectile dysfunction
- Insulin resistance
- Inflammation
- Angina
- High SNS activity
- Hypercoagulability
OSA risk factors: *Obesity*

- **Central obesity**
- **Neck circumference**
  - Men $\geq 17$ inches
  - Women $\geq 16$ inches
- **Body Mass Index**
  - Overweight BMI $\geq 25$
  - Obesity BMI $\geq 30$
- **70% of OSA are overweight or obese**
OSA risk factor: male gender
3:1 male vs. female
Abnormal upper airway: Large tongue


OSA risk factors: age

![Bar chart showing OSA risk factors by age and gender](image)
OSA risk factors: *other factors*

- Family history
- Smoking
- Use of alcoholic beverages
- Medical illnesses:
  - hypothyroidism,
  - post polio syndrome
OSA: How do I know if I have it?

- Clinical suspicion
- Overnight sleep study (2 types)
  - In the laboratory
  - At your home
Portable sleep studies – Home sleep testing

- For the diagnosis of OSA
- High pre-test probability of OSA
- Associated with sleep history and physical

OSA: who needs treatment?

- Abnormal sleep study (AHI ≥ 5/hr), and
  - Excessive daytime sleepiness
  - Hypertension
  - Heart failure
  - Coronary heart disease
  - Stroke
  - Pulmonary hypertension
Treatment of OSA: risk control

- Weight reduction
- Avoid alcoholic beverages
- Quit smoking
- Good sleep habits
  - Regular sleep schedule
  - Sleep 8 hours per night
- Daily aerobic exercise
  - (30 minutes /day)
Continuous Positive Airway Pressure (CPAP)

*Most effective therapy for OSA*

- Splints throat open with constant pressure
Treatment of OSA: *jaw advancement device* can be 60% as effective as CPAP
Treatment of OSA: Surgery

Uvulopalatopharyngoplasty
Effective only in very selected cases
Didgeridoo reduces OSA severity in randomized trial

Puhan et al. BMJ 2006;332:266-270

Playing a wind instrument was not associated with a lower risk of OSA in orchestra members.

Other treatment for OSA: Physical fitness

- (n 27) 12-weeks 150 min/week of moderate-intensity aerobic activity, followed by resistance training twice/week, Vs (n 16) Stretching.

- AHI reduction ($P < 0.01$)
  - exercise: $32.2 \pm 5.6$ to $24.6 \pm 4.4$,
  - stretching: $24.4 \pm 5.6$ to $28.9 \pm 6.4$;

- Reductions in AHI and ODI were achieved without a significant decrease in body weight

Insomnia definition

- Difficulty initiating sleep
- Difficulty maintaining sleep
- Awakening earlier than desired
- Non-restorative sleep

Primary vs. Comorbid Insomnia

Prevalence of insomnia

- 95% lifetime prevalence – everyone gets it
- 30-50% symptoms at any one time
- 10-15% chronic insomnia affects functioning
Pathophysiology: the Spielman Model (the three-Ps)

- **Predisposition to insomnia**
  - Genetic predisposition
  - Physiologic – hyperarousal
  - Psychological – worry, ruminate

- **Precipitating factors**
  - Stress
  - Disease
  - Poor sleep hygiene

- **Perpetuating factors**
  - Maladaptive behavior – increased TIB, TV, clock
  - Conditioned arousal – wakes up when in bed

Drugs that cause insomnia: Non-prescription

- Alcohol
- **Caffeine** (24 hour half-life in sensitive patient)
- Diet pills (stimulants)
  - Ephedrine
  - Pseudophedrine
  - Amphetamines
- Nicotine (night time withdrawal)
Treatment of Insomnia

- Correct the causative factor
- Target treatment to the specific type of insomnia
- Two major therapeutic interventions
  - Cognitive-behavioral therapy
  - Pharmacological therapy
Cognitive-Behavioral therapy

- **Sleep hygiene education** - Good habits of sleep
- **Relaxation Training** - Leave stress out of the bedroom
- **Stimulus control** - The bed is only for sleep
- **Sleep restriction** - Improves sleep efficiency
- **Cognitive therapy** - Corrects maladaptive behavior and misperceptions.
Insomnia therapy: Sleep hygiene education

- Avoid stimulant (caffeine, nicotine, chocolate)
- Avoid alcohol around bedtime
- Bedtime snack
- Exercise regularly, not within 4 hours of sleep
- 1 hour to unwind before sleep
- Keep bedroom quiet, dark, comfortable
- Maintain a regular sleep schedule, no napping
- Get one hour of bright sun light in the morning without sun glasses
Insomnia: Hour of sleep preparation

- Day ends 1 hour before bedtime
- First 20-30 minutes do mechanical preparation – bath, pajamas, brush teeth, etc.
- Last 30-40 minutes – sit and do something relaxing
  - Reading – neutral yet enjoyable material
  - Soft music
  - Worry time if needed
  - No TV
  - When sleepy, go to bed
Pharmacological treatment – Tailored Tx

- **Sleep onset (short and long acting)**
  - Zaleplon (Sonata), Triazolam (Halcion)
  - Ramelteon (Rozerem) 8 mg
  - Zolpidem (Ambien) 5, 10 mg

- **Sleep maintenance (long acting)**
  - Zolpidem (Ambien CR) 6.5, 12.5 mg
  - Eszopiclone (Lunesta) 1, 2, 3 mg
  - Temazepam (Restoril) 7.5 to 30 mg
  - Doxepin (Silenor) 3, 6 mg
Pharmacologic therapy

- Chronic insomnia – long term use
  - Ramelteon (Rozerem)  8 mg
  - Eszopiclione (Lunesta)  1, 2, 3 mg

- Only a few hours left in the night – Middle of the night awakening
  - Sonata (Zaleplon)  5 mg
  - Intermezzo (Zolpidem) sublingual  1.75 and 3.5 mg
Effectiveness of Insomnia Therapy
CBT vs. Pharmacological therapy

- CBT effect size comparable to Drug therapy
  - 50% improvement in Sleep latency and WASO
- CBT superior in
  - Reducing Sleep latency
  - Improving sleep quality
  - 70-80% of insomniacs benefit
  - More normal sleepers after 6 months (20-30%)
- Pharmacologic tx superior in total sleep time

(Morin et al. SLEEP 1999;22:1134-1156)
Can sleeping pills kill you?

- 10,529 insomniac using sleeping pills vs 23,676 matched controls.
- Followed for 2.5 years
- Results:
  - Those receiving sleeping pills had a > 3 fold increase in the risk of death even with < 18 pills per year.
  - Controlled for pre-existing medical problems
  - Dose response effect
  - Even noted with specific medications

(Kripke DF, Langer RD, Kline LE. BMJ 2012;2:e000850)
Restless Legs Syndrome (Ekbohm Syndrome): a neurological sensory-movement disorder (not a sleep disorder)
Restless leg syndrome

- Urge to move legs
- Resting
- Getting moving (walking) produces temporary relief
- Evenings – worse in the evening
RLS

- Prevalence ~ 15% of the population
- Causes is unknown
  - Can be familial in 50%
  - Anemia – Check Ferritin level
  - Associated with
    - DM, Parkinson’s disease,
    - Peripheral neuropathy,
    - Renal failure
    - Pregnancy
- Can range from mild to debilitating
RLS

- Worsened by
  - Smoking
  - Over exertion
  - Medications:
    - Antinausea drugs (prochlorperazine or metoclopramide)
    - Antiseizure drugs (phenytoin or droperidol)
    - Antipsychotic drugs (haloperidol or phenothiazine derivatives)
    - Cold and allergy medications
    - Antidepressants: Tricyclics and SSRIs
Periodic Leg Movement Disorder
Polysomnographic study of an asymptomatic patient with very frequent (3 per minute during this 5-minute epoch of stage 2 NREM sleep) periodic extremity movements. Note that these extremity movements are sufficiently large to cause movement artifact in the respiratory monitoring channels.
Periodic Limb Movements in Sleep (PLMS)

- Leg kicks or leg jerks occurring every 5 to 90 seconds during sleep
- PLMD – Periodic limb movement disorder when sleep and daytime functioning are disturbed
- PLM index (PLMI) ≥ 5/hr is considered abnormal; ≥15/h clinically significant
Diagnosis of PLMS(D): Symptoms

- Excessive daytime sleepiness
- Non refreshing sleep
- Bed partner complains of leg kicks (patient usually not aware)
- Bed covers in disarray in the morning
- Sleep onset and sleep maintenance insomnia
- Frequent awakenings after sleep onset

*International Classification of Sleep Disorders, 1997*
Prevalence of PLMD

- Children referred to a sleep lab.
  - Isolated PLMSI > 5/hr, 1.2%

- In the general population (age 15-100)
  - PLMS 3.9%
    Ohayon and Roth. J Psychosom Res. 2002;53(1):547-54

- In the elderly: PLMSI > 10/hr 33-35%
  Ancoli-Israel et al. Sleep 1991; 14:496-500
PLMD and associated conditions

- Age
- Neuropathy
- Iron Deficiency – low ferritin
- Spinal cord injuries
- End-stage renal disease – may be a marker for mortality

RLS – PLMs Connection

- RLS is a clinical diagnosis made in the office
- PLMS is a polysomnographic diagnosis
- 20% of patients with PLMS will have RLS
- 80% of patients with RLS have PLMS
- Both may be associated with low ferritin levels
Treatment of PLMD and RLS

- **Low dose dopamine agonist** (1-2 hours before bedtime)
  - Pramipexole (Mirapex) 0.25 to 1 mg
  - Ropnirole (Requip) 0.25 to 4 mg
- **Clonazepam** 0.25 to 1 mg qhs
- **Gabapentin (Horizant)** 600 mg nightly
- **Iron supplements**
REM Sleep Behavior Disorder (RBD)

- Mostly a disorder of elderly men
- Do not lose muscle tone during REM
- Act out their dreams – Usually violent dreams
- May injure self or others
- Celebrated cases of murder – attributed to RBD
- 85% develop neurodegenerative disorders (Parkinson’s disease, multiple system atrophy (0livopontocerebelar degeneration and Shy-Drager syndrome), dementia with Lewy body disease)
Diagnosis of RBD

- Clinical history
- Polysomnogram
  - Shows 50% of an epoch in unequivocal REM sleep that has increased muscle tone
- RBD questionnaire
- Must rule out OSA – can masquerade as RBD and will respond to CPAP
Treatment of RBD

- Make bedroom safe
  - Remove sharp-edged furniture from around bed
  - Sleep with mattress on the floor
  - Close and lock windows and doors
  - Heavy curtains

- Counseling regarding Parkinson’s disease

- Pharmacological therapy
  - Clonazepam (Klonopin) – 0.25 to 1 mg at bedtime. Extremely effective
  - High dose Melatonin 6-9 mg