Sleep – Putting in Place the Missing Foundation for Your Patient

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Learning Objectives:

1. Review basic sleep physiology and circadian rhythms
2. Understand the extent of sleep deprivation and sleep problems among the population
3. Know how sleep problems impact common medical problems
4. Be able to use behavioral strategies and nutritional supplements to improve sleep
Sleep Physiology
REM Sleep:

- brainwaves most similar to wake
- muscles are paralyzed
- memory and learning is consolidated, also important for mood regulation
- occurs more towards morning, linked to circadian rhythm of body temp
NonREM sleep:

- Stages 1, 2, 3
- Stage 3 is “deep” or “slow wave” sleep (SWS)
- Growth hormone secreted exclusively during deep sleep, important for physical repair
- Also consolidates memories

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Sleep Cycling

A typical hypnogram showing sleep stages and cycles in adult sleep (image by Luke Mastin)
Circadian Physiology
What is Our Body Clock?

• The suprachiasmatic nucleus (SCN) deep in the brain is the “central pacemaker”
  – Gets light signals from our eyes
  – Signals for production of melatonin in the absence of light
• Cellular mechanisms
  - Clock genes in every cell
  - Cells are more / less active at certain times of day
Age-related levels of Melatonin

Core Body Temperature:

- Decreasing temperature associated with sleep
- Increasing temperature associated with wakening
- Performance is the worse when temperature is lowest [Dirk JD. *J Sleep Research.* 1992;1(2):112-7.]

- Estimated that core body temperature minimum is 4 hours before end of natural wake period, less in young adults [Duffy JF. *Am J Physiol.* 1998;275(5 Pt 2):R1478-87]

- Not monitored clinically
Sleep Deprivation and Disorders
Sleep problems = 24 hour problems!

• Cognitive ability: Memory to creativity
• Physical safety: Operating machinery to driving
• Social interactions: EQ to motivation
• Mental health: Anxiety to suicidal thoughts
• Physical health: Obesity, heart health, inflammation
How Much Sleep Do We Need?

• Adults need 7-9 hours Hirschkowitz M. *Sleep Health* 1. 2015:40-43.
• Individual variability in sleep need
• Adult average in 2013 is 6.8 hours, 7.9 hrs in 1942

Can a Person Sleep More than They Need to? No.
People are *Sleep Deprived*!

Sleep in America 2014, Gallup 2013

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Choose a Quality vs. Quantity Day

Prevalence of Sleep Complaints

- Snore while sleeping? 48%
- Snort, gasp or stop breathing? 11%
- Trouble falling asleep? 16%
- Wake up unable to return to sleep? 20%
- Unrested during the day regardless of hours of sleep? 27%
- Not enough sleep? 26%
- Leg jerks while trying to sleep? 6%

Ram S & Seirawan H. Prevalence and impact of sleep disorders and sleep habits in the United States. Sleep Breath 2010;14:63-70
Classes of Sleep Disorders

- Insomnia
- Sleep Related Breathing Disorders
- Central Disorders of Hypersomnolence
- Circadian Rhythm Sleep-Wake Disorders
- Parasomnias
- Sleep Related Movement Disorders

Sleep Impacts Medical Conditions
Heart Disease:

• Short sleep duration and fragmentation predict increased systolic and diastolic blood pressure

• Blood pressure dips during healthy sleep

• Sympathetic tone is increased, baroreflex sensitivity decreased

• Inflammatory markers including white blood cells, IL-6 and CRP increased by sleep deprivation
Obesity:

• Leptin (satiety hormone) decreased in sleep deprivation
• Ghrelin (hunger hormone) increased in sleep debt Mullington JM. *Prog Cardiovasc Dis.* 2009;51(4):294-302
• Motivation to exercise decreases
• Sleep deprived people eat more calories. Women eat 329, men 263 St. Onge MP. American Heart Association meeting. 2011.
Diabetes:

• Metabolic syndrome = insulin resistance, glucose intolerance, hypertension, obesity and dyslipidemia

• Lowest diabetes risk when sleeping 7-8 hours Shan Z. Diabetes Care. 2015;38(3):529-37


• Endogenous glucose production increased with sleep deprivation
• Free Fatty Acids also increased by sleep debt
• Sleep extension improves insulin sensitivity
Inflammation & GI Disorders:

Multi-directional relationships:
- sleep deprivation increases inflammatory cytokines TNF, IL-1 and IL-6
- These cytokines disturb sleep
- GI diseases such as Inflammatory Bowel Disease, colorectal cancer, gastro-esophageal reflux and liver disease have changed cytokine profiles
- Sleep disruption increases the severity of these GI disorders
Irritable Bowel Syndrome:

- Subjectively, many experience poor sleep quality, sleep efficiency, and disturbance
- Objectively, a few studies found no statistical difference between IBS patients and healthy normals on overnight sleep study - less slow wave sleep - more Stage 2 - more arousals Shaver J.L. *Sleep Medicine Clinics*, 3(1): 2008

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Create a Sleep Healthy Lifestyle
Limiting Light at Night

- Think of the type of light humans were exposed to in the hour before bed before electricity (yellow-red to dark)
- Current electronic blue light suppresses melatonin
- At wind down alarm, put all devices in docking station outside of bedroom
- Lights low
- Also part of making the bedroom an ideal place to sleep
- Limit night lights throughout house to those needed for safety
- Blue-light omitting goggles hours before bedtime to allow melatonin to increase
- Blue-light blocking apps for computer or devices

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Wind Down

- Goal is to be in a parasympathetic state at bedtime, and allow sleepiness to emerge
- Relaxing activities in low light
- Avoid task oriented activities
- Take the time needed (quick vs. slow transitioners)
- In another room
- Appropriate time for alarm – “wind down alarm”
A new definition of time . . .
Put Your Thoughts to Rest

Spend 10 minutes, 1-2 hours before bedtime, writing down the thoughts that tend to arise at night. Use whatever style works for you to express them.

Then in the night, if your mind starts, tell yourself “I already thought about that, and will have time tomorrow, now’s time to sleep.”

- limit-setting with yourself, establishes that you are ‘off-duty’ during sleep time & insulates your sleep from intrusive thoughts
- it’s a skill, and you’ll get better with practice
Unplugging at Night

• 95% of Americans are on electronics before bed, type by age
• 10% of young people age 13-18 are awoken by their device in night 2011 Sleep in America Poll. National Sleep Foundation
• Device in bedroom associated with worse sleep
• As part of wind-down turn off and store devices
• Cognitive re-framing “do you really NEED to be in touch during sleep times, or is it better to rest for the next day?”
Falling Asleep:

• Normal to take up to 30 minutes to fall asleep
• Now that they’ve “kicked their thoughts out of bed”, need to do something self-sustaining, to independently fall asleep on their own
• Devices not helpful at this time
• Find out what usually happens when they are awake in bed and not able to sleep
• Do their strategy as soon as they realize they are awake in bed – no decision making!
An Ideal Bedroom

Think “cave-like”
• Dark
• Quiet
• Cool
• No pets
• Clean
• No clock
• Comfortable mattress
Good Morning!

• Full spectrum light for 30 mins in first 1-2 hours of wake to increase melatonin pulse at night, and shift it slightly earlier
• Make it actionable with a specific plan
• 10 min bursts of light every couple hours
• Avoid modern experience of dim indoor light during the day, and during the night
• If they want to use a lightbox, they should talk to physician as there are contraindications
Substances and Sleep
Caffeine and Alcohol

Caffeine
- acts on adenosine receptors to cause alertness
- improves performance for about 4 hours, active in body up to 12 hours
- often increased sensitivity with aging
- individual variability
- caution new energy drinks can have much more caffeine

Alcohol
- aids sleep onset by decreasing body temp, when metabolized body temp increases causing awakening
- Individual variability in sensitivity
- using alcohol as sleep aids increases risk of alcoholism

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Caffeine and Alcohol

• People can be resistant to looking at these issues!
• Frame it as “an experiment” to gather information
• Frame it as a choice that can vary by circumstances, ie. they choose to celebrate the birthday party with alcohol, but nights at home they choose to prioritize sleep by not drinking
Glycine

- non-essential amino acid with excitatory and inhibitory actions, acts on glutamate and glycine receptors
- Causes a drop in core body temperature
- Ingestion before bed improves subjective sleep quality, and decreases daytime fatigue
- PSG shows reduced sleep latency and SWS latency
- Dose 3g hs

Melatonin

• Doses .3mg to 5 mg seem effective: Ferracioli-Oda E. *PLoS One.* 8(5):e63773.doi:10.1371
  – Decreased sleep latency
  – Increase total sleep time
  – Improved sleep quality

• In elderly use the lowest effective dose Vural EM. *Drugs Aging.* 2014;31(6):441-51.

• Exogenous melatonin is absorbed rapidly, within 30 to 60 minutes and elevates levels for 3-4 hours. Time-released available which increases melatonin for 5-7 hours Aldhous m. *Br J Clin Pharmacol.* 1985;19:517-521.

• Clinically reported side effects can include: Headache, Vivid dreams, GI upset, Morning grogginess

L-Theanine

• Amino acid found in green & black tea
• Increases dopamine and glycine  Yamada T. *Nutr Neurosci.* 2005;8(4):219-26
• Produces relaxation
• Counteracts caffeine
• 400mg in boys with ADHD improved sleep efficiency and decreased movement during sleep  Lyon MR. *Alt Med Rev.* 2011;16(4):348-54.

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Thank you!

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