BEHAVIORAL HEALTH ECHO
MODULE 4: SLEEP DISORDERS

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Addressing Sleep In Primary Care
I have no pertinent financial or commercial conflicts to disclose.
OBJECTIVES

• Define sleep and hypothesized purposes of sleep
• Describe key features of major sleep disorders
• Demonstrate evaluation tools for assessing sleep health & pathology
WHY CARE ABOUT SLEEP?

• 46% of Americans report inadequate sleep
• 54% of drivers have driven drowsy within the last year
• 28% of drivers drive drowsy at least monthly\(^1\)
• Abnormalities in sleep are linked to cardiovascular, neurologic, immune, endocrine, psychiatric, occupational and relationship dysfunction.

\(^1\) http://www.sleepfoundation.org
\(^2\) https://imgur.com/gallery/8FF96
DEFINITIONS OF SLEEP

Behavioral
- Decreased mobility
- Species-specific sleeping posture
- Decreased responsiveness
- Quiescence
- Increased reaction time
- Elevated arousal threshold
- Attenuated cognitive function

Physiologic (polysomnographic)
- EEG: synchronized or theta/sawtooth
- EMG: reduced to absent
- EOG: slow rolling or rapid eye movements
BIOLOGICAL FUNCTIONS OF SLEEP

- Body and brain tissue restoration
- Facilitation of waste clearance of the CNS via glymphatic system
- Energy conservation
- Adaptation
- Memory reinforcement and consolidation
- Synaptic neuronal network integrity
- Thermoregulation
SLEEP DURATION CONSENSUS

- 2015: AASM, Sleep Research Society, National Healthy Sleep Awareness Project, Sleep Health Objective of Healthy People.
- n=2391, 20-39 y
  - Sleep <7 hours associated with low physical and mental HRQOL
  - Sleep <6 hours associated with higher risk for cardiovascular disease
- In the last half of the 20th century, average sleep duration has decreased by 1.5-2 hours per night.

Newborns (0-3 mos): 14-17 h
Infants (4-11 mos): 12-15 h
Toddlers (1-2 years): 11-14 h
Preschoolers (3-5): 10-13 h
School-age (6-13): 9-11 h
Teenagers (14-17): 8-10 h
Young adults (18-25): 7-9 h
Adults (26-64): 7-8 h
Older adults (65+): 7-8 h
**BORBÉLY’S TWO PROCESS MODEL**

**Process S**
- Sleep/wake homeostasis or “sleep drive”
- As wakefulness progresses, adenosine builds in CNS and inhibits DA firing and promotes slow wave sleep (SWS) and drowsiness
- Caffeine is an adenosine receptor antagonist

**Process C**
- Circadian Rhythm
- Genetic variations: (night owls/morning larks)
- Suprachiasmatic nucleus (SCN): pacemaker
  - Produces melatonin
  - Regulates changes in biorhythms:
    - Core body temperature
    - Appetite
    - Sleep
    - Hormones
- 24.15 hours
- Stabilized by zeitgebers (time givers): 450 nm light (blue) suppresses melatonin production in pineal gland

PROCESS C

PRIMARY SLEEP COMPLAINTS

- Excessive daytime sleepiness
- Insomnia
- Abnormal sleep behaviors
EXCESSIVE DAYTIME SLEEPINESS

- Yawning, sagging of eyelids, nodding, increased reaction time.
- Differs from fatigue: a state of sustained lack of energy as might be seen in MS coupled with lack of motivation or drive.
TAKING A HISTORY

Sleep hygiene:
• Evening routine
• Bedtime vs sleep-onset
• Wake time vs out-of-bed

Movements
• Urge to move
• Leg discomfort
• PLMS
• Dream enactment

Nocturnal event
• Sleepwalking
• Night terror
• Rhythmic movement
• Timing, duration, recall?
• Hallucinations/paralysis

Breathing events:
• Snoring
• Nasal congestion
• Tonsils
• Weight change
• Gasping
• Witnessed apneas
• Sleep position

Daytime symptoms:
• Naps
• Drowsy driving/near miss
• School/job performance
• Cataplexy
• Sleep attacks
# EXCESSIVE DAYTIME SLEEPINESS

## Epworth Sleepiness Scale

<table>
<thead>
<tr>
<th>Situation</th>
<th>Chance of Dozing (0-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting and reading</td>
<td></td>
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<tr>
<td>Watching TV</td>
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<td>Sitting, inactive in a public place (e.g. a theatre or a meeting)</td>
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<td>As a passenger in a car for an hour without a break</td>
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<td>Lying down to rest in the afternoon when circumstances permit</td>
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<td>Sitting and talking to someone</td>
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<td>Sitting quietly after a lunch without alcohol</td>
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<td>In a car, while stopped for a few minutes in the traffic</td>
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*It is important that you answer each question as best you can.*

0-5 Lower Normal Daytime Sleepiness  
6-10 Higher Normal  
11-12 Mild Excessive Daytime Sleepiness  
13-15 Moderate EDS  
16-24 Severe EDS

SPECIALTY ASSESSMENT OF EDS

Mean Sleep Latency Test (MSLT)
• Measures tendency to fall asleep by measuring time to fall asleep using PSG
• Assuming adequate sleep (>7 hours/night for 2 weeks), subjects are given 4-5 nap opportunities spaced by 2 hours and limited to 20 minutes.
• Need to be free of sleep disrupting medication (aka: psychotropics)

Maintenance of Wakefulness Test (MWT)
• Similar to MSLT but instead patients are seated and ability to stay awake without stimulation is assessed

Psychomotor Vigilance Test (PVT)
• Direct measure of motor and visual attention.
FLOWCHART OF EXCESSIVE DAYTIME SLEEPINESS

EXCESSIVE DAYTIME SLEEPINESS

- Circadian rhythm disturbance
  - Advanced sleep phase
  - Delayed sleep phase
  - Irregular sleep type
  - Free running
  - Shift work
- Sleep disturbance
  - Intrinsic issue
    - Sleep apnea
    - PLMD
    - Hypoventilation
    - GERD
    - Pain
    - CHF
  - Extrinsic issue
    - Noise
    - Temperature
    - Light
    - Bedding
    - Allergen
    - Bed partners
- Intrinsic sleep mechanism disorder
  - Narcolepsy with cataplexy
  - Narcolepsy without cataplexy
  - Idiopathic
  - Hypersomnia
  - Kleine-Levine syndrome
  - Neurologic disorders
- Sleep deprivation
  - Volitional timing
  - Work schedule
  - Poor time management
- Fatigue
  - Psychiatric and other medical issues
CIRCADIAN RHYTHM DISORDERS

A. A persistent or recurrent pattern of sleep disruption that is primarily due to an alteration of the circadian system or to a misalignment between the endogenous circadian rhythm and the sleep–wake schedule required by an individual’s physical environment or social or professional schedule.

B. The sleep disruption leads to excessive sleepiness or insomnia, or both.

C. The sleep disturbance causes clinically significant distress or impairment in social, occupational, and other important areas of functioning.
CRD PRESENTATION

• Difficulty falling asleep at their desired time*
• Difficulty waking at desired time
• When allowed to set their own schedule, patients exhibit normal quality and amounts of sleep for their age.

*allowing for adequate amounts of sleep
INSTRUCTIONS:
1. Write the date, day of the week, and type of day: Work, School, Day Off, or Vacation.
2. Put the letter “C” in the box when you have coffee, cola or tea. Put “M” when you take any medicine. Put “A” when you drink alcohol. Put “E” when you exercise.
3. Put a line (I) to show when you go to bed. Shade in the box that shows when you think you fell asleep.
4. Shade in all the boxes that show when you are asleep at night or when you take a nap during the day.
5. Leave boxes unshaded to show when you wake up at night and when you are awake during the day.

SAMPLE ENTRY BELOW: On a Monday when I worked, I jogged on my lunch break at 1 PM, had a glass of wine with dinner at 6 PM, fell asleep watching TV from 7 to 8 PM, went to bed at 10:30 PM, fell asleep around Midnight, woke up and couldn’t go back to sleep at about 4 AM, went back to sleep from 5 to 7 AM, and had coffee and medicine at 7:00 in the morning.

<table>
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<th>Type of Day</th>
<th>Noon</th>
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Name: Patient R
DOB: 1/1
Health professional: 
Unit #: 

List medications: FloEase, Amoxicillin, Allegra

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<td>Coke + Dr. Pepper</td>
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<tr>
<td>Mon</td>
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<td>Mt Dew</td>
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<td>Dr. Pepper + Tea</td>
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Key: ↑=out of bed  ↓=in bed  Filled in=asleep
ACTIGRAPHY
CIRCADIAN RHYTHM DISORDERS

*Insomnia* during the major sleep period and/or *excessive sleepiness* (including inadvertent sleep) during the major awake period

- **Shift Work Type Circadian Rhythm Disorder**
  - associated with a shift work schedule (work hours outside 7 am to 7 pm)

- **Social Jet Lag**
  - Mismatch between workday and non-workday sleep times

- **Delayed Sleep Phase Circadian Rhythm Disorder**
  - Sleep onset insomnia, difficulty awakening and excessive morning sleepiness

- **Advanced Sleep Phase Circadian Rhythm Disorder**
  - Early morning sleep maintenance insomnia, excessive afternoon/evening sleepiness

- **Non-24 Hour Sleep-Wake Disorder (Free-Running Disorder)**
  - 18-73% of totally blind individuals; extremely rare in sighted individuals
  - Typically delay sleep-wake phase successively each day

- **Irregular Sleep-Wake Rhythm Disorder**
  - No regular sleep-wake pattern
  - No major sleep phase
FLOWCHART OF EXCESSIVE DAYTIME SLEEPINESS

Principles and Practice of Sleep Medicine, Chapter 58, 576-586.e3, 2017.
SLEEP DISTURBANCES

- Sleep disordered breathing (OSA/OHS)
- Restless Legs Syndrome
- Periodic Limb Movement Disorder
- GERD
- Pain
- BPH
- CHF
SLEEP DISORDERED BREATHING

Obstructive Sleep Apnea (Can’t Breathe)
• Upper airway collapse with sleep disruption or intermittent hypoxemia
• Continued respiratory effort without airflow

Central Sleep Apnea (Won’t Breathe)
• Pause of central ventilatory drive
• No respiratory effort or airflow

Periodic Breathing
• Cheyne-Stokes Respirations
• Alternating hyperventilation and central apneas due to unstable ventilatory control

Sleep-related Hypoventilation
• Non-obstructive decreases in minute ventilation
SDB QUESTIONNAIRES

• STOP BANG

SNORING?
Do you snore loudly (louder than talking or loud enough to be heard through closed doors)?

Yes / No

TIRED?
Do you often feel tired, fatigued, or sleepy during the daytime?

Yes / No

OBSERVED?
Has anyone observed you stop breathing during your sleep?

Yes / No

PRESSURE?
Do you have or are you being treated for high blood pressure?

Yes / No

BODY MASS INDEX more than 35 kg/m²?

Yes / No

AGE older than 50 years?

Yes / No

NECK circumference?
Neck circumference greater than 40 cm?

Yes / No

Gender=male?

Yes / No

• Sn=0.84; Sp=0.56
• Low risk for OSA: yes to 0 to 2 questions. High risk for OSA: yes to 3 or more questions.¹

• Sn=0.69; Sp=0.83
• High Risk: > 2 categories with score 2+
• Low Risk: ≤ 1 category with score 2+

WILLIS-EKBOM DISEASE/RESTLESS LEGS SYNDROME

1. **Urge** to move the legs accompanied by/due to discomfort
2. Urge or discomfort more prevalent *when at rest*
3. Urge or discomfort is **relieved by movement**
4. Urge or discomfort occurs only or worse *in the evening*
5. The above do not occur only in context of another medical or psychiatric condition (eg arthritis, habitual tapping, myalgias, sciatica, etc.)

FLOWCHART OF EXCESSIVE DAYTIME SLEEPINESS

Principles and Practice of Sleep Medicine, Chapter 58, 576-586.e3, 2017.
PRIMARY DISORDERS OF HYPERSOMNOLENCE

- Narcolepsy +/- cataplexy
- Idiopathic hypersomnia
- Kleine-Levine syndrome
NARCOLEPSY

- Excessive daytime sleepiness
  - Sleep attacks and drowsiness
- Inappropriate transitions to REM sleep
  - Hypnagogic/hypnopompic hallucinations
  - Sleep paralysis
  - Cataplexy (Type 1)
- 0.02-0.04% prevalence

NARCOLEPSY

• Type 1 (with cataplexy)
  – immune mediated destruction of orexin (hypocretin) producing neurons in hypothalamus
  – CSF hypocretin 1
  – (HLA)-DQB1*06:02

• Type 2 (without cataplexy)
  – Normal CSF hypocretin 1 and HLA negative

• Secondary
  – Due to neurologic conditions
NARCOLEPSY DIAGNOSIS

A. Recurrent periods of an **irrepressible need to sleep, lapsing into sleep**, or napping occurring within the same day. These must have been occurring at least three times per week over the past 3 months.

B. The presence of at least one of the following:
   A. Episodes of **cataplexy**, defined as either (a) or (b), occurring at least a few times per month:
      A. In individuals with long-standing disease, brief (seconds to minutes) episodes of **sudden bilateral loss of muscle tone with maintained consciousness** that are precipitated by laughter or joking.
      B. In children or in individuals within 6 months of onset, **spontaneous grimaces or jaw-opening episodes** with tongue thrusting or a global hypotonia, without any obvious emotional triggers.
   B. **Hypocretin deficiency**, as measured using cerebrospinal fluid (CSF) hypocretin-1
   C. Nocturnal sleep polysomnography showing rapid eye movement (REM) sleep latency less than or equal to **15 minutes**, or a multiple sleep latency test showing a mean sleep latency less than or equal to 8 minutes and two or more sleep-onset REM periods.

NARCOLEPSY TREATMENT

- Must fully treat any comorbid sleep disorder (OSA, RLS, etc.)
- Sleep hygiene and scheduled naps
- Wake promoting medication
  - Modafinil/armodafinil
  - Methylphenidate
  - Amphetamine
- SSRI/SNRI for cataplexy
  - Potent suppressor of REM sleep
- Sodium Oxybate (Xyrem)
  - GABA-B agonist induces slow wave sleep
  - REMS controlled
HYPERSOMNOLENCE (IDIOPATHIC)

A. Self-reported excessive sleepiness despite a main sleep period lasting at least 7 hours, with at least one of the following symptoms:
   A. Recurrent periods of sleep or lapses into sleep within the same day.
   B. A prolonged main sleep episode of more than 9 hours per day that is nonrestorative (i.e., unrefreshing).
   C. Difficulty being fully awake after abrupt awakening.

B. The hypersomnolence occurs at least three times per week, for at least 3 months.

C. The hypersomnolence is accompanied by significant distress or impairment in cognitive, social, occupational, or other important areas of functioning.

D. The hypersomnolence is not better explained by and does not occur exclusively during the course of another sleep disorder (e.g., narcolepsy, breathing-related sleep disorder, circadian rhythm sleep-wake disorder, or a parasomnia).

E. The hypersomnolence is not attributable to the physiological effects of a substance (e.g., a drug of abuse, a medication).

F. Coexisting mental and medical disorders do not adequately explain the predominant complaint of hypersomnolence.
NARCOLEPSY VS HYPERSOMNIA

Narcolepsy:
- Nocturnal sleep fragmented
- REM phenomena:
  - Cataplexy, hallucinations, sleep paralysis
- Sleep-onset REM periods on PSG/MSLT
- Hypocretin deficiency

Hypersomnia:
- Highly efficient sleep (>90%)
- No/minimal REM phenomena
- Long sleep time
- No SOREMPs
- 25% spontaneously recover
FLOWCHART OF EXCESSIVE DAYTIME SLEEPINESS

Principles and Practice of Sleep Medicine, Chapter 58, 576-586.e3, 2017.
SUMMARY

- Sleep is an important evolutionary adaptation with implications for major organ system homeostasis.
- Sleep is controlled by intrinsic and extrinsic factors.
- Americans need more sleep.
- Excessive daytime sleepiness can have multiple diverse causes and etiologies.
- Evaluation begins with a careful history.
- Bedside and laboratory tools can help in differentiating causes of excessive daytime sleepiness.
FLOWCHART OF EXCESSIVE DAYTIME SLEEPINESS

Principles and Practice of Sleep Medicine, Chapter 58, 576-586.e3, 2017.
CIRCADIAN RHYTHM DISORDERS

• Shift Work Type:
  – **Insomnia** during the major sleep period and/or **excessive sleepiness** (including inadvertent sleep) during the major awake period associated with a shift work schedule (work hours outside 7 am to 7 pm).

• Social Jet Lag
  – Mismatch between work and non-work sleep times

• Increased risk of cancer, metabolic syndrome, motor vehicle accidents
CIRCADIAN RHYTHM DISORDERS

Delayed sleep phase

• Sleep and wake times delayed at least 2 hours (typically 3-6 hours) from conventional times.
• Typically difficult to fall asleep before 2 am and prefer to sleep until past 10 am
• Duration of at least 3 months to many years
• Most prevalent in adolescents/young adults (3-7%)
• Often complain of sleep onset insomnia
• May have history of many failed attempts of sedative use, bedtime alcohol use, psychotherapy or behavioral interventions.
• Enforcement of conventional wake times results in chronic sleep deprivation or EDS and is associated with mood, personality and anxiety disorders.

Sabra M. Abbott, Kathryn J. Reid and Phyllis C. Zee Principles and Practice of Sleep Medicine, Chapter 40, 414-423.e5
CIRCADIAN RHYTHM DISORDERS

Advanced sleep phase
- Sleep and wake times advanced at least 2 hours from conventional times.
- Typically experience early morning awakenings (2-5 am)
- Afternoon or evening sleepiness
- Likely significantly underreported
- Other disorders must be ruled out including mood disorders and sleep-disordered breathing or periodic limb movements of sleep
- Tend to gravitate to professions that favor this chronotype.
CIRCADIAN RHYTHM DISORDERS

Non-24 Hour Sleep-Wake Disorder (Free-Running Disorder)

- No stable phase relation between pacemaker and 24 hour clock.
- Extremely rare in sighted individuals
- 18-73% of totally blind individuals
- Typical circadian rhythm is longer than 24 hours and sleep/wake times are successively delayed each day when allowed.

Sabra M. Abbott, Kathryn J. Reid and Phyllis C. Zee Principles and Practice of Sleep Medicine, Chapter 40, 414-423.e5
CIRCADIAN RHYTHM DISORDERS

Irregular Sleep-Wake Rhythm Disorder
• No well defined sleep pattern
• Typically no major sleep period
• Often associated with Alzheimer’s Disease or other CNS injury
• May be due to instability of intrinsic pacemakers or irregular exposure to external cues (light/dark cycles, etc.)