The background of the slide is a reproduction of the painting 'The Starry Night' by Vincent van Gogh. The painting depicts a night sky with a turbulent, swirling pattern of blue and white, punctuated by several bright, glowing yellow stars and a large, luminous yellow moon. In the foreground, there are dark, silhouetted hills and a prominent, dark, twisted cypress tree on the left side. The overall mood is one of intense emotional energy and a sense of cosmic wonder.

Understanding and Managing Sleep

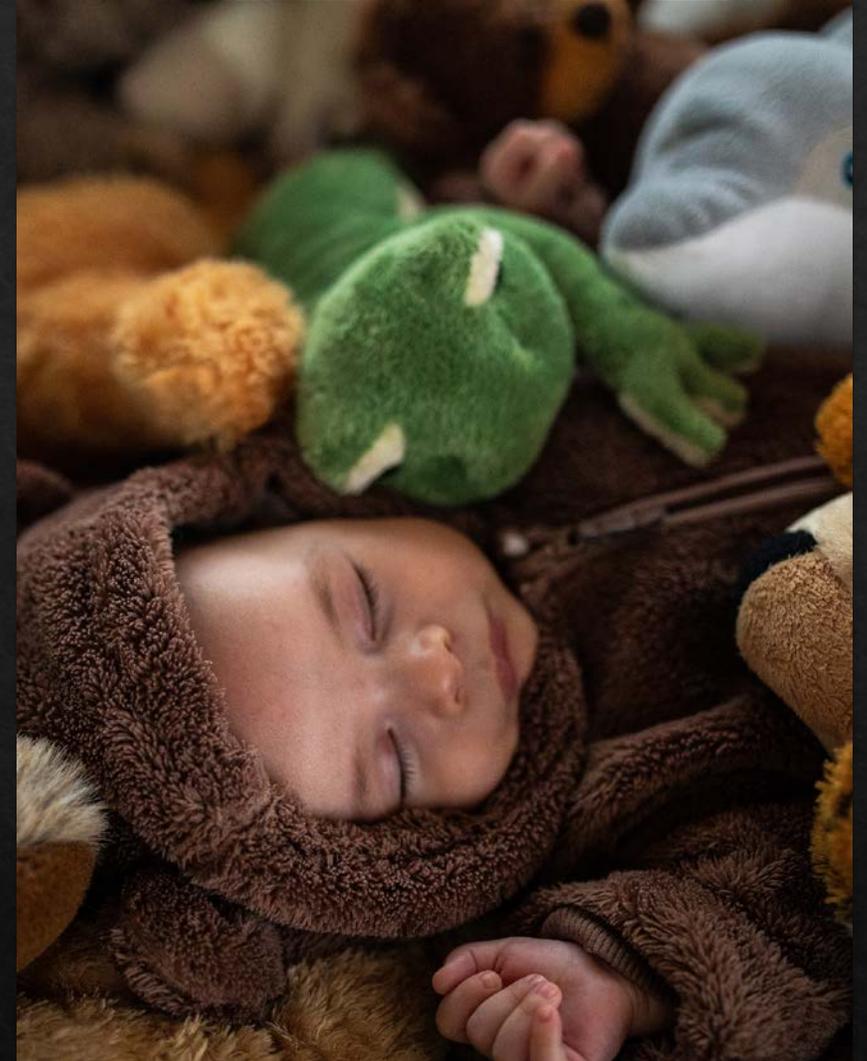
Julia Jenkins, MD, FAAFP, DipABLM

Outline

- Define physiologic, behavioral, and environmental factors impacting sleep
- Manage insomnia with sleep hygiene advice, stimulus control, and lifestyle interventions
- Identify over the counter, prescription, and lifestyle-based treatment options

"Innocent sleep. Sleep that soothes away all our worries. Sleep that puts each day to rest. Sleep that relieves the weary laborer and heals hurt minds."

-William Shakespeare, Macbeth.



Your Brain Cleanses Itself



During deep sleep, the brain's glymphatic system clears out toxic waste products, including proteins linked to Alzheimer's disease.

Sleep Protects Your Heart



Chronic sleep deprivation is linked to a higher risk of high blood pressure, cardiovascular disease, and heart failure.

It Stabilizes Your Mood



Insufficient sleep impairs emotional regulation, leading to irritability, mood disturbances, and an increased risk of anxiety and depression.

It Boosts Daily Performance



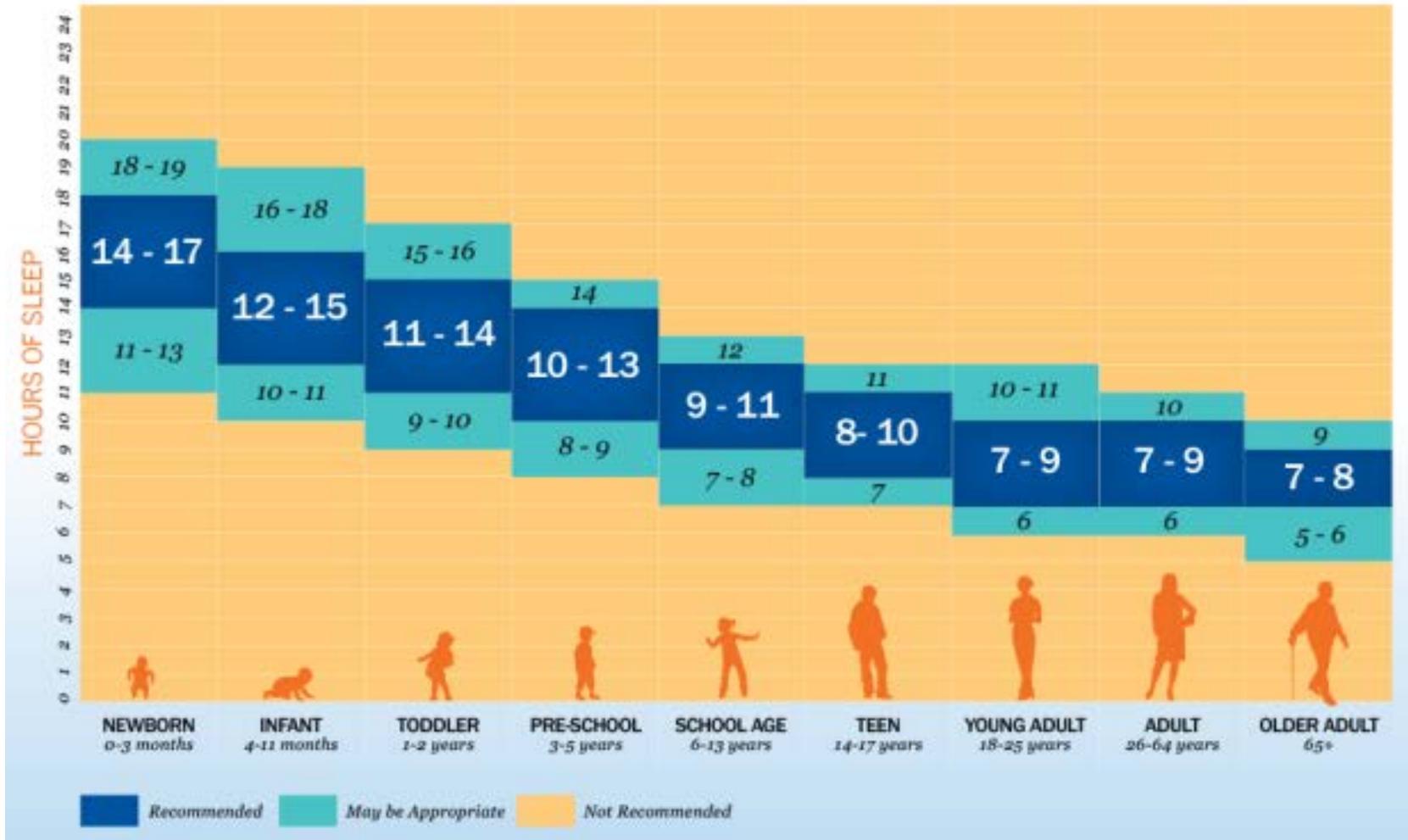
Quality sleep is essential for daytime alertness, concentration, memory consolidation, and maintaining a strong immune system.

Good Sleep Can Extend Your Life



Optimal sleep duration (7-8 hours), especially when combined with physical activity and good nutrition, is associated with a significantly lower risk of all-cause mortality.

SLEEP DURATION RECOMMENDATIONS

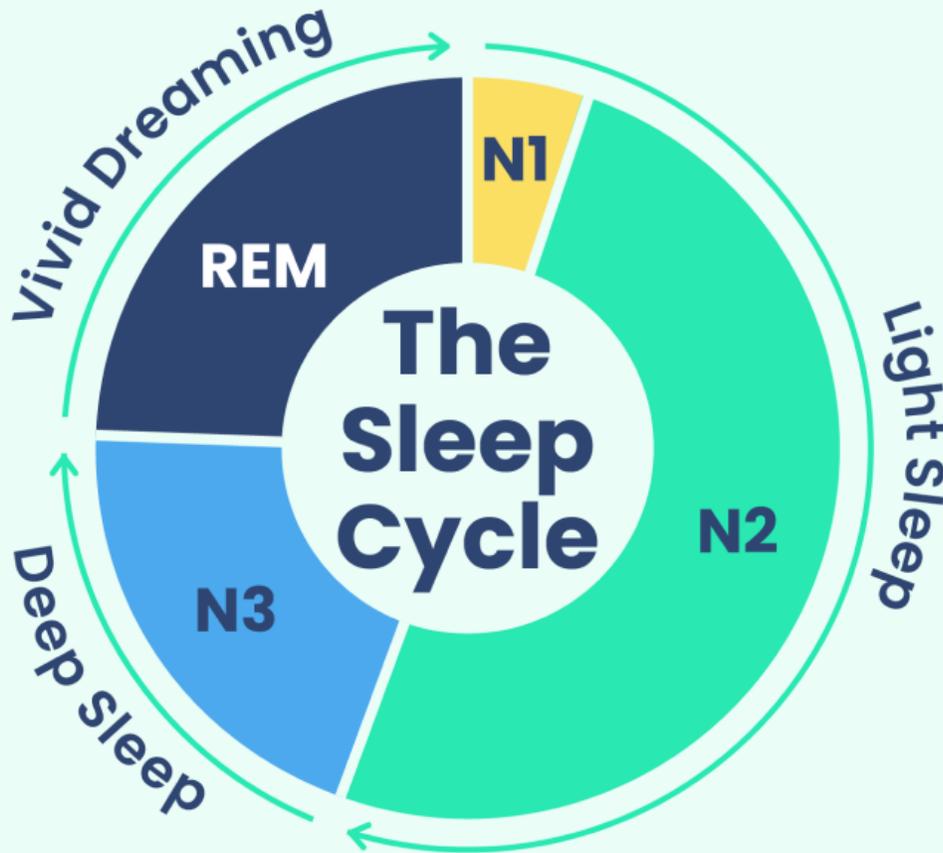


Insomnia Stats

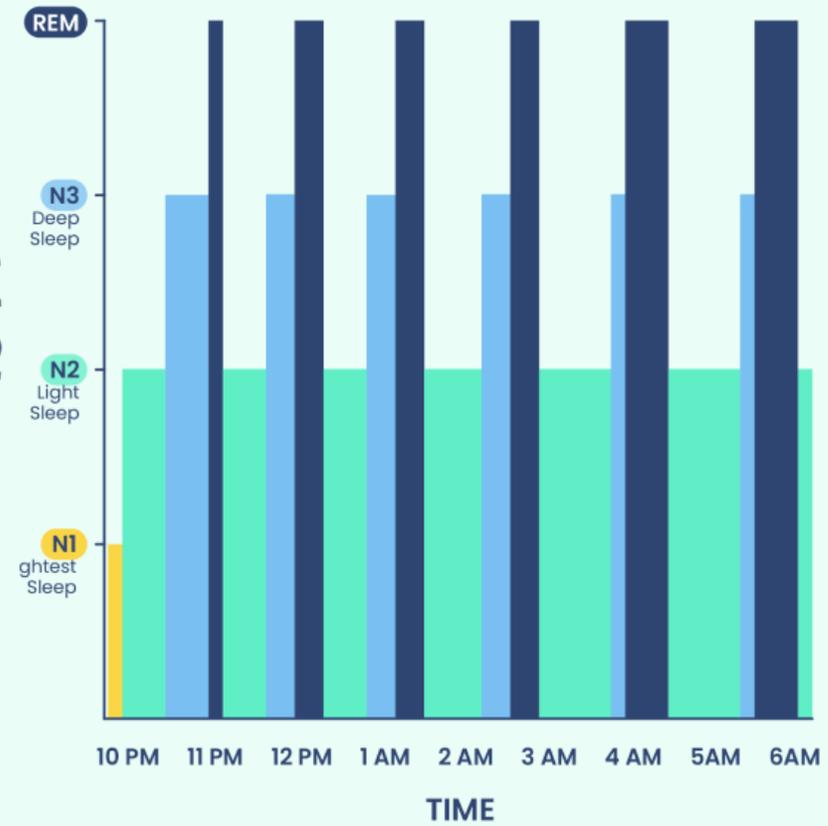
- Up to 75% of adults intermittently experience sleep disturbances.
- About 15% of people experience **chronic insomnia**, for > 3 months.
- **Restless legs syndrome (RLS)** affects **5% to 10%** of adults and **2% to 4%** of children.
- Between 14% to 17% of children grind their teeth during sleep (**bruxism**), 15% of adolescents, and 8% of adults.

Insomnia Stats

- About 10% to 30% of adults in the U.S. have **obstructive sleep apnea**.
- **69%** of men ages 40 and older and **76%** of women in that age group get up to **go to the bathroom** at least once per night .
- **95%** of adults may lose an hour of sleep each week **due to pain** (painsomnia). Neck and back pain are the most common.
- **63%** of adults with **heartburn** say it has affected their ability to sleep well.

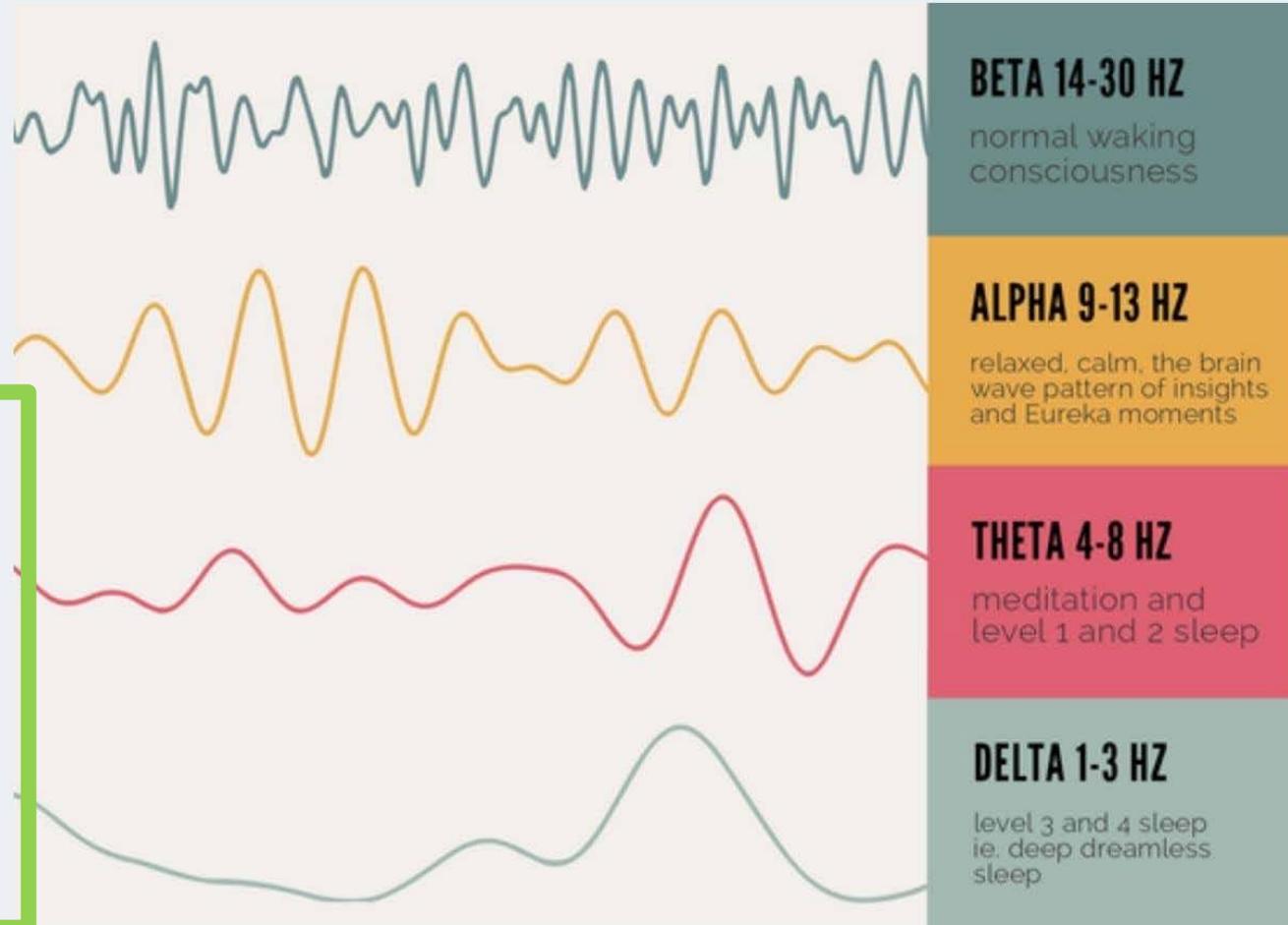


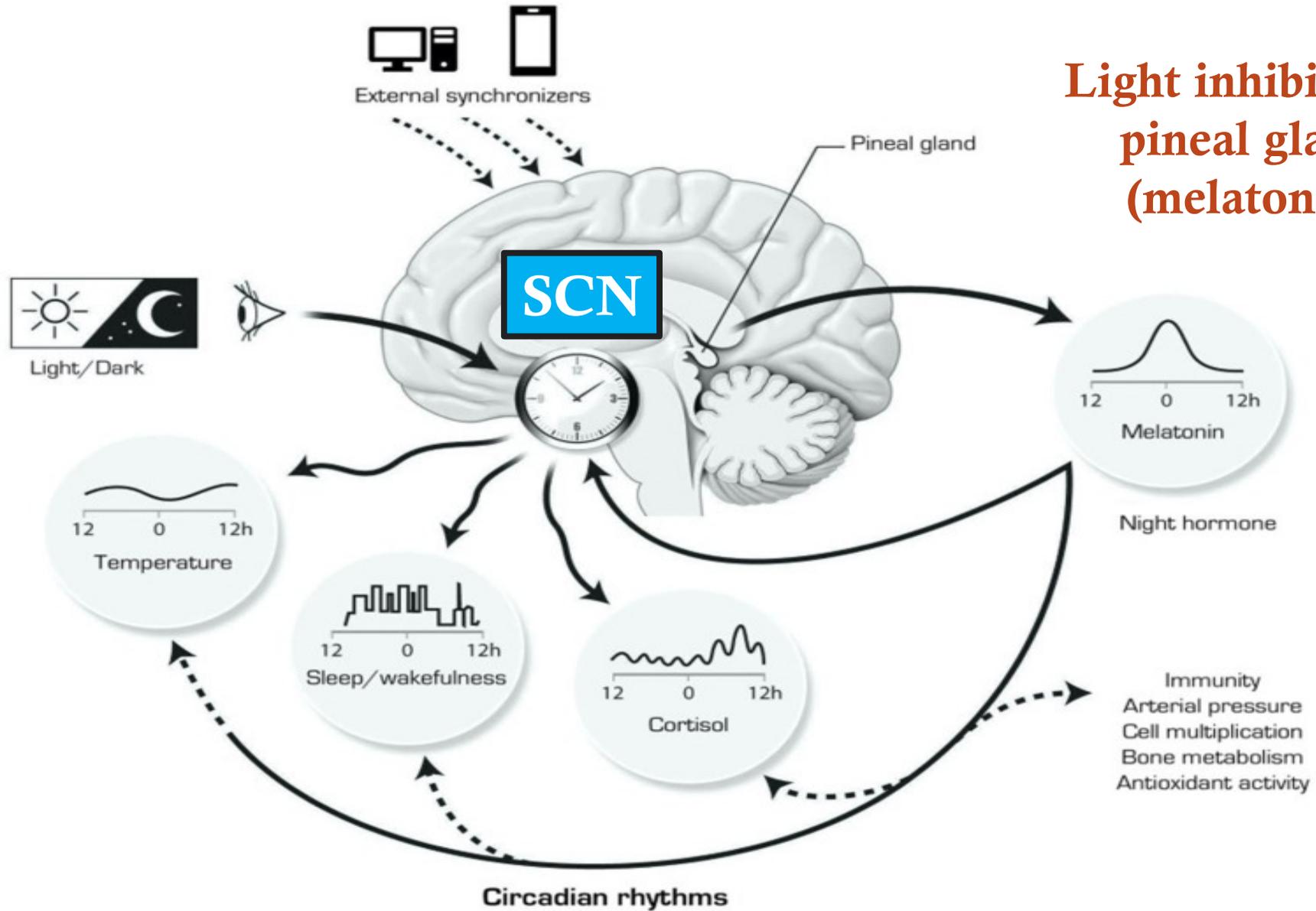
Sleep Cycles Through the Night



STAGES OF SLEEP

- Two Phases NREM & REM
- NREM Stage 1 -Dozing Off
- NREM Stage 2 - Memory Consolidation
- NREM Stage 3 - Muscular repair and body regeneration.
- REM - Emotional regulation and skill learning.





SCN = Suprachiasmatic Nucleus

Circadian Neurotransmitters

Promote Sleep

- Melatonin
- Adenosine
- GABA
- Glycine
- Acetylcholine
- Galanin



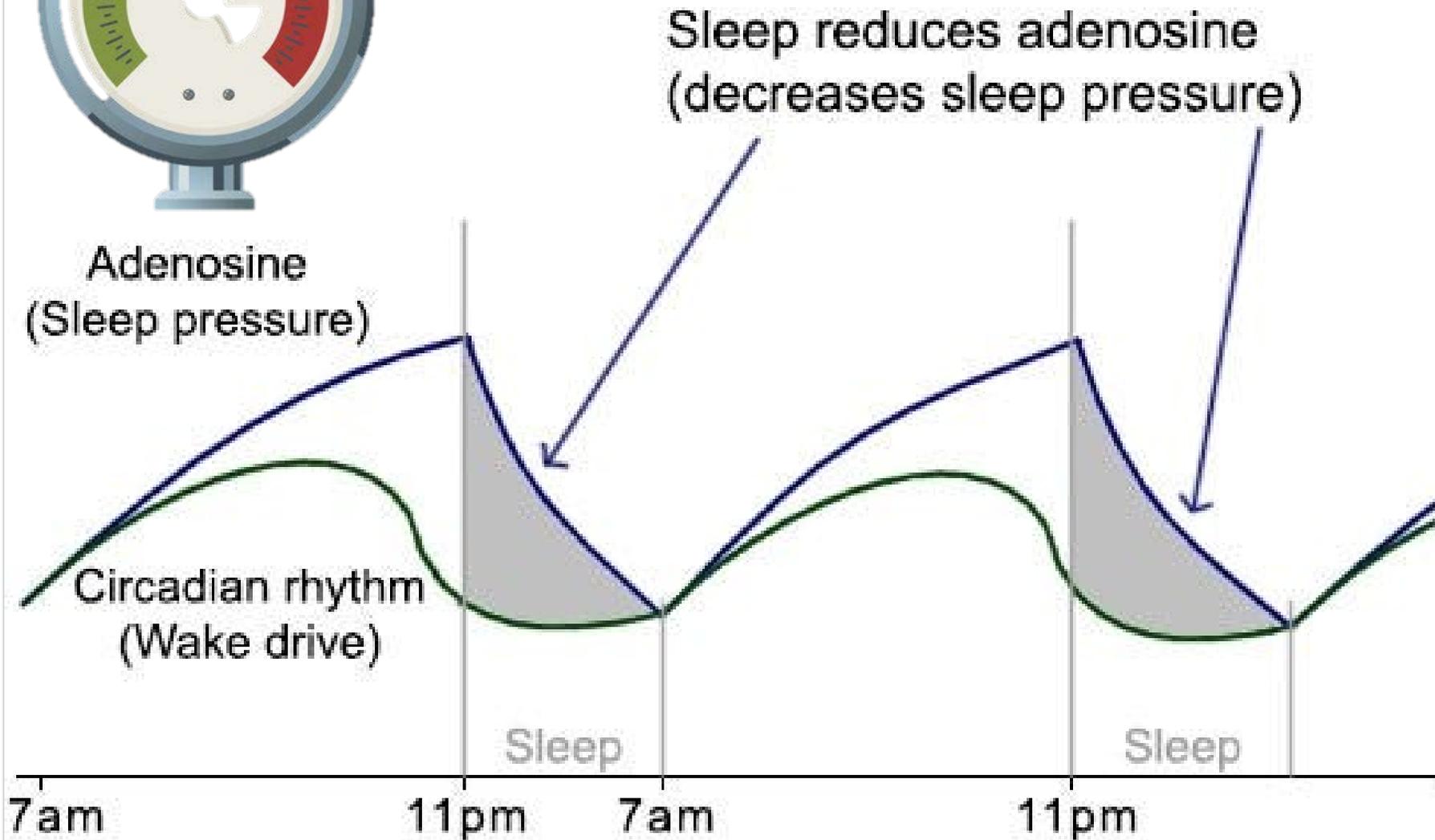
Promote Wakefulness

- Histamine
- Serotonin
- Orexin
- Glutamate
- Dopamine
- Norepinephrine



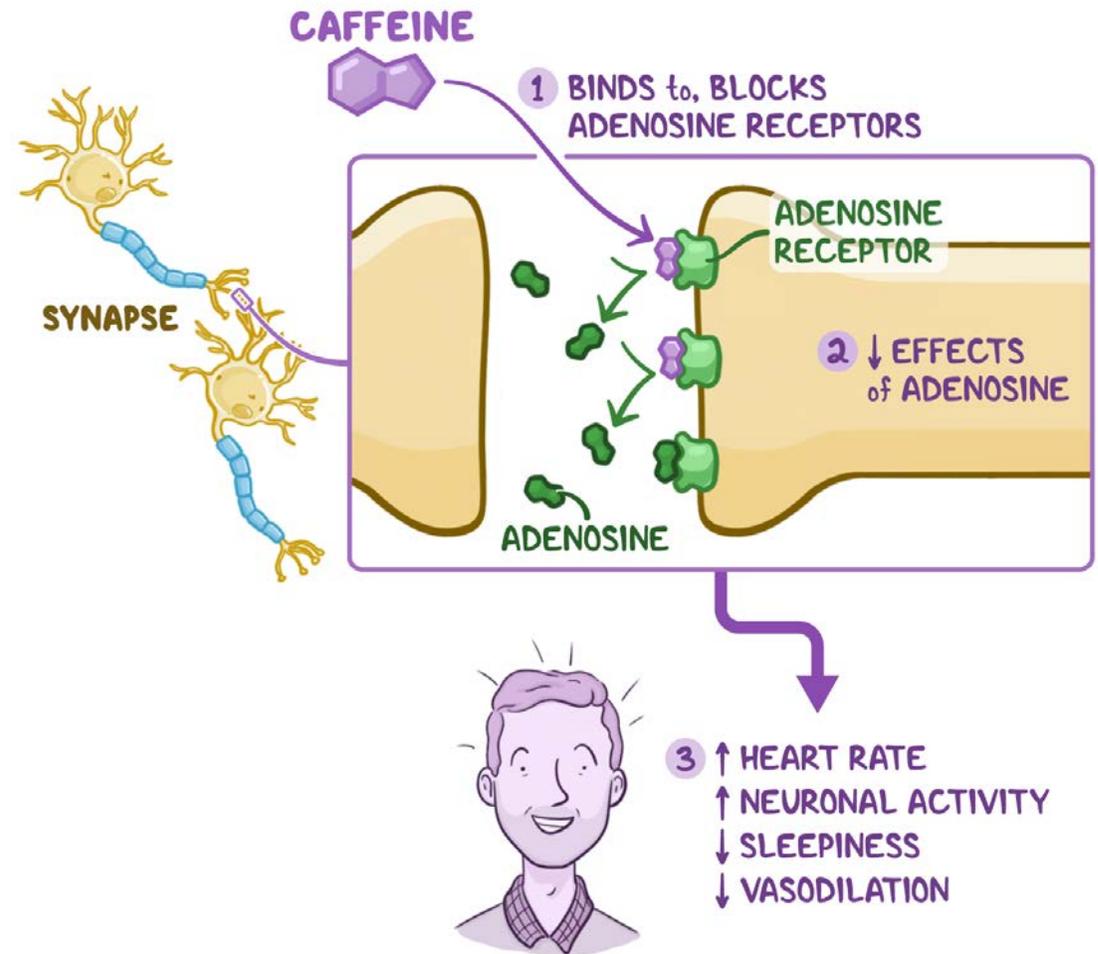


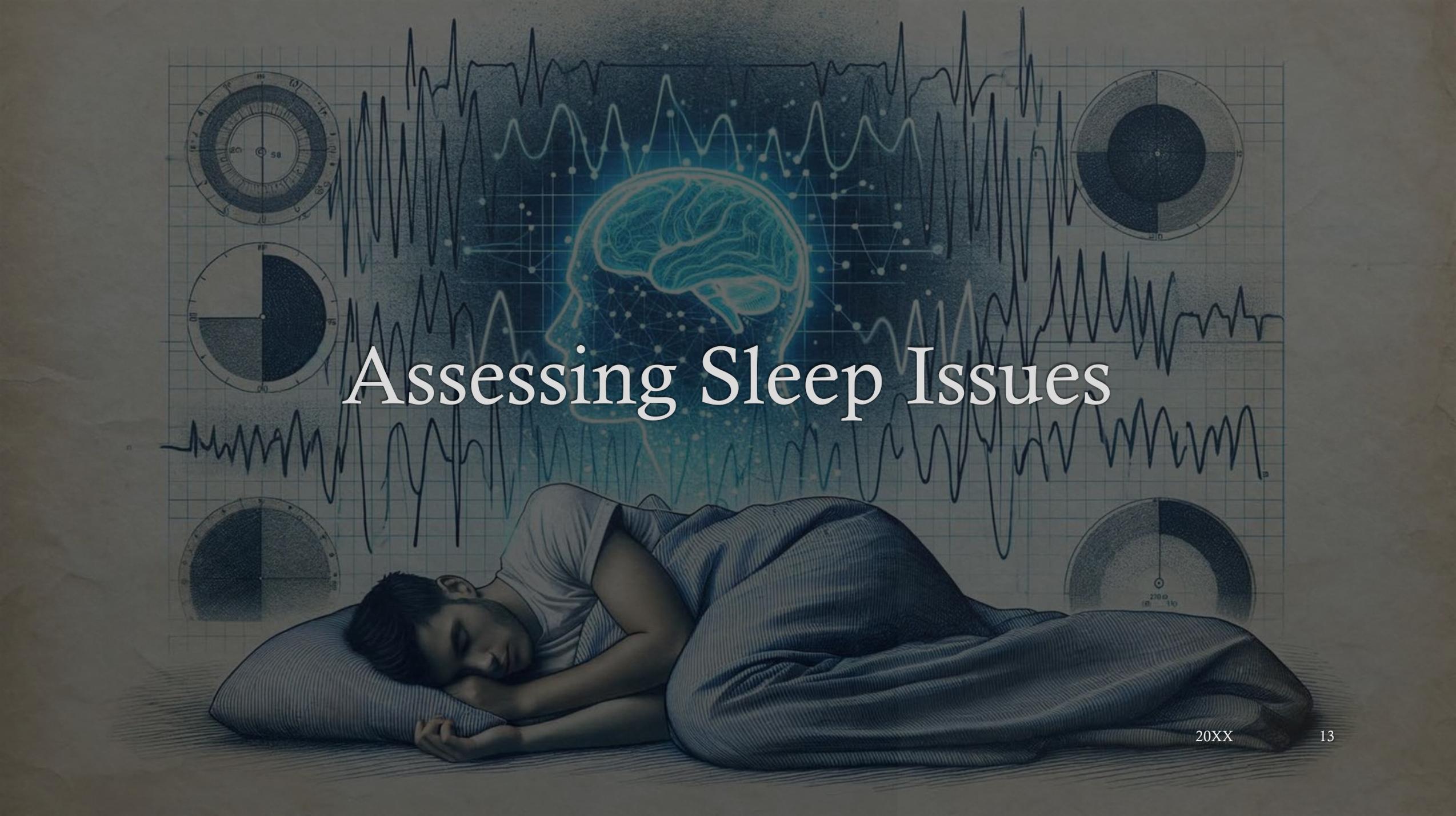
Adenosine
(Sleep pressure)





CAFFEINE

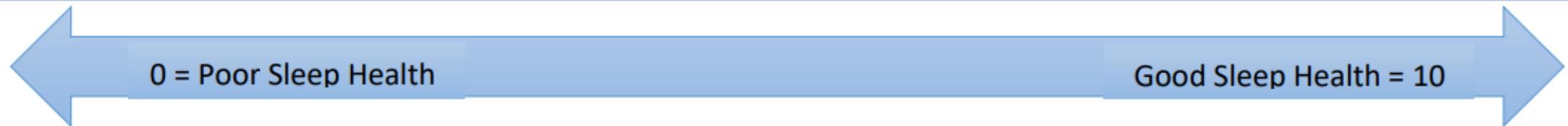




Assessing Sleep Issues

SATED QUESTIONNAIRE

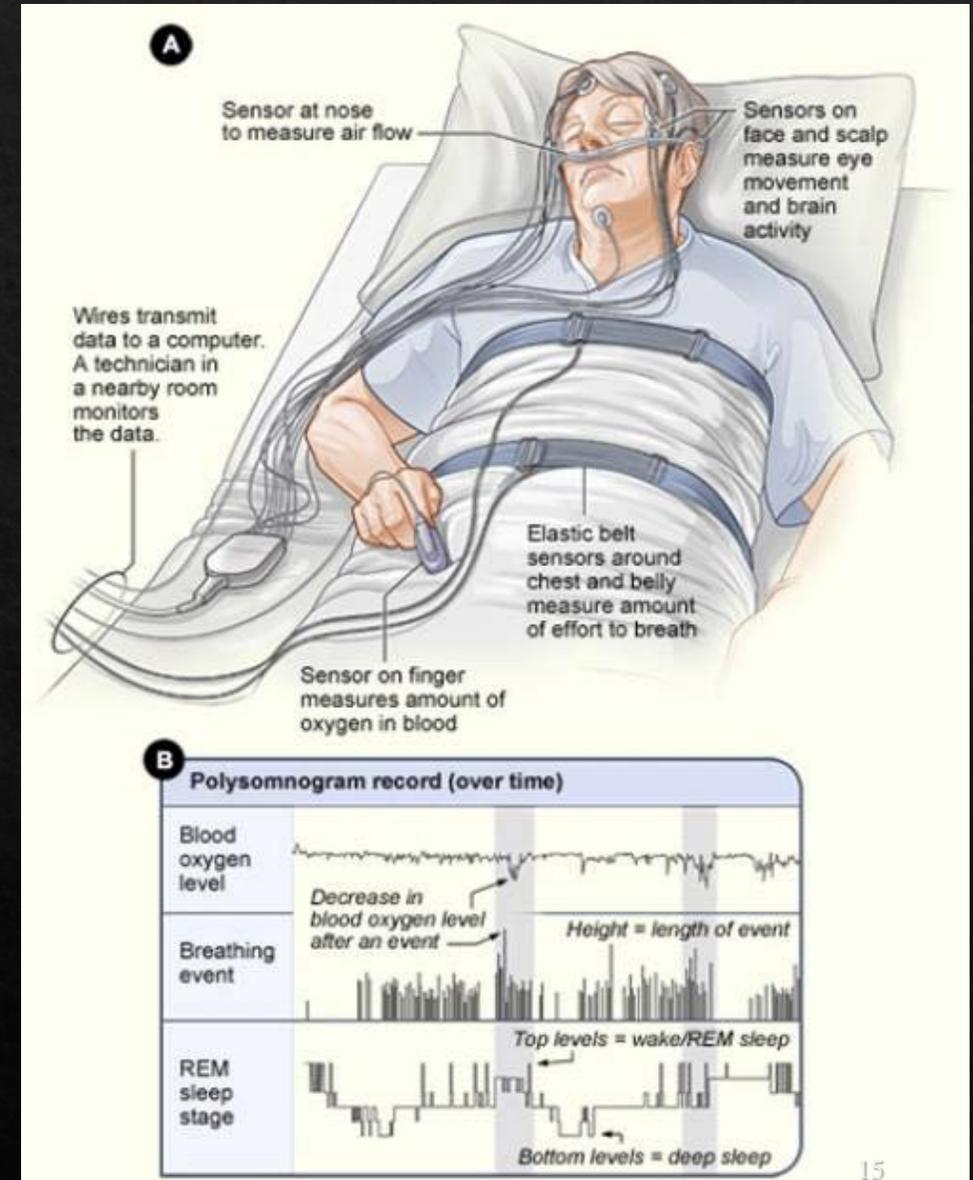
	Rarely/Never (0)	Sometimes (1)	Usually/Always (2)
1. Are you satisfied with your sleep?			
2. Do you stay awake all day without dozing?			
3. Are you asleep (or trying to sleep) between 2:00 am and 4 am?			
4. Do you spend less than 30 minutes awake at night? (This includes the time it takes to fall asleep and awakenings from sleep.)			
5. Do you sleep between 6 and 8 hours per day?			



SATED = Satisfaction with sleep; Alertness during waking hours; Timing of sleep; Sleep Efficiency; and Sleep Duration

Polysomnography

- Electroencephalogram (EEG) – brain waves
- Electromyography (EMG) – muscle movements, RLS
- Electrooculogram (EOG) – eye movements
- Electrocardiogram (ECG) – heart rate and rhythm
- Oral and nasal airflow pressure and temperature
- Chest and abdomen movement (i.e. - respiratory effort)
- Oxygen saturation
- Sleep timing (including latency or time to sleep, number of awakenings, and length of sleep)



Home Sleep Study

- Electroencephalogram (EEG) — brain waves
- Electromyography (EMG) — muscle movement
- Electrooculogram (EOG) — eye movements
- Electrocardiogram (ECG) — heart rate and rhythm
- Oral and nasal airflow pressure
- Chest and abdomen movement (i.e. - respiratory effort)
- Oxygen saturation
- Some measure body movement — i.e. actinography



Actinography and Sleep Trackers

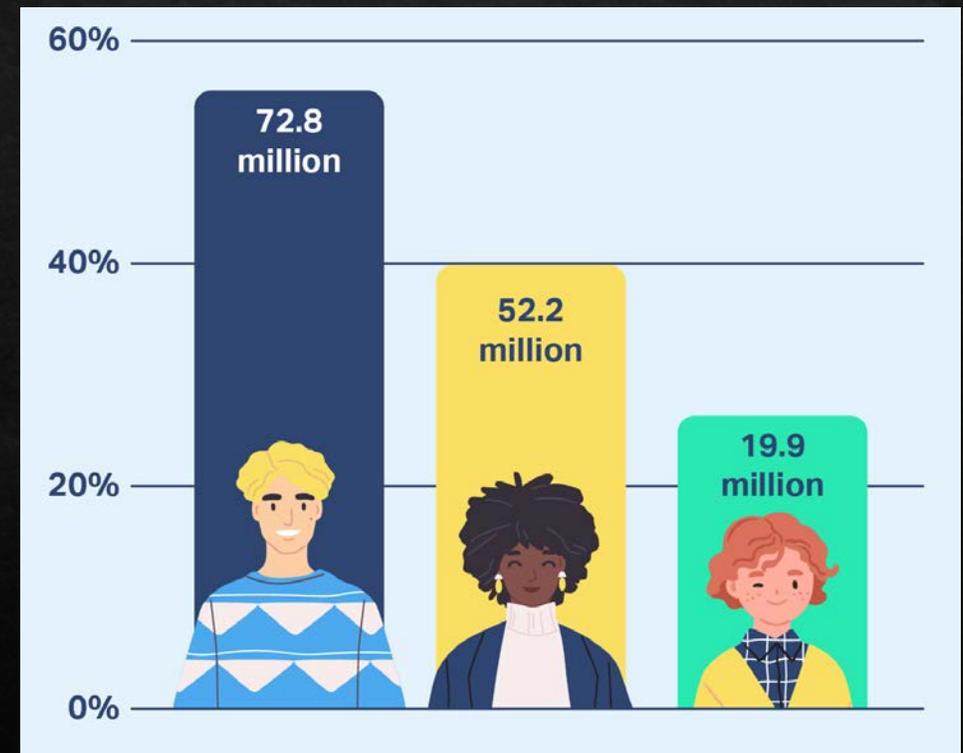
Accelerometer measures movement. Often combined with HR to determine sleep stages (lower in non-REM, higher in REM). Not helpful for diagnosing OSA or RLS, but it can be helpful for treating insomnia.

- What time you fall asleep
- What time you wake up
- How long you take to fall asleep
- How long you sleep in total
- How much time you spend awake during the night



Snoring and Sleep Apnea

- About 57% of men, 40% of women, and 27% of children snore in the U.S.
- Up to 70% of snorers have been diagnosed with sleep apnea
- Obstructive sleep apnea (OSA) affects around one billion adults worldwide, with **80-90% of cases going undiagnosed.**
- A 10% increase in body weight may make you six times more likely to have OSA.
- Sleep arousals from OSA interfere with deep or slow wave sleep (SWS)





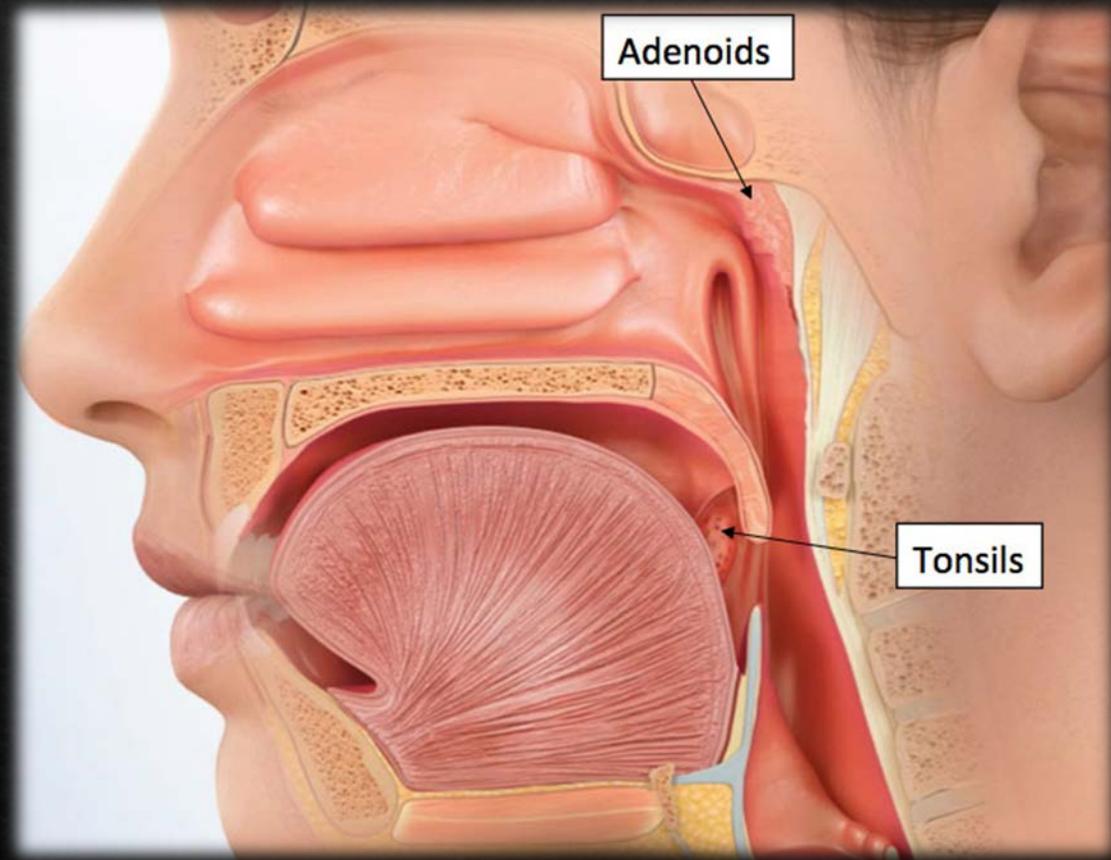
Obstructive Sleep Apnea

- ◇ Epworth Sleepiness Scale (0 to 3, chance of dozing)
 1. Sitting and reading
 2. Watching TV
 3. Sitting inactive in a public place [theater/meeting]
 4. As a passenger in a car for an hour without a break
 5. Lying down to rest in the afternoon when circumstances permit
 6. Sitting quietly after a lunch without alcohol
 7. Sitting and talking to someone
 8. In a car, while stopped for a few minutes in traffic

- ◇ >10 indicates excessive sleepiness

OSA in Kids

- ◆ Mostly seen between 2 and 6 years old, from enlarged adenoids and tonsils
- ◆ In kids, insomnia and OSA has been associated with ADHD and behavioral disturbances
- ◆ Nocturnal enuresis may be a sign of OSA in kids



Medications that Disrupt Sleep

- Alcohol
- Anticonvulsants
- Antihistamines
- Appetite suppressants
- Benzodiazepines
- Bronchodilators
- Caffeine
- Carbidopa/levodopa
- Corticosteroids
- Diuretics
- Decongestants
- Estrogen
- Lipophilic Beta Blockers
- MAO inhibitors
- Nicotine
- Pseudoephedrine
- SSRI's
- Sedatives
- Sympathomimetics
- Tetrahydrozoline
- Thyroid hormones
- Tricyclic antidepressants

Effects of Antidepressants on Sleep

Drug class	Sleep continuity	SWS	REM latency	REM sleep
Sedative TCA (e.g., amitriptyline, doxepin, trimipramine)	↑	↑	↑	↓
Activating TCA (e.g., imipramine, desipramine)	↓	↓	↑	↓
MAOI (e.g., tranylcypromine, moclobemide)	↓/0	?	↑	↓
SSRI (e.g., fluoxetine, escitalopram, paroxetine, sertraline)	↓/0	0/↑	↑	↓
SNRI and NRI (e.g., venlafaxine, duloxetine, reboxetine)	↓	0//↑	↑	↓
Bupropion	0/↓	0/↑	0/↓	0/↑
Sedative antidepressants (e.g., mirtazapine, trazodone)	↑	↑	0	0

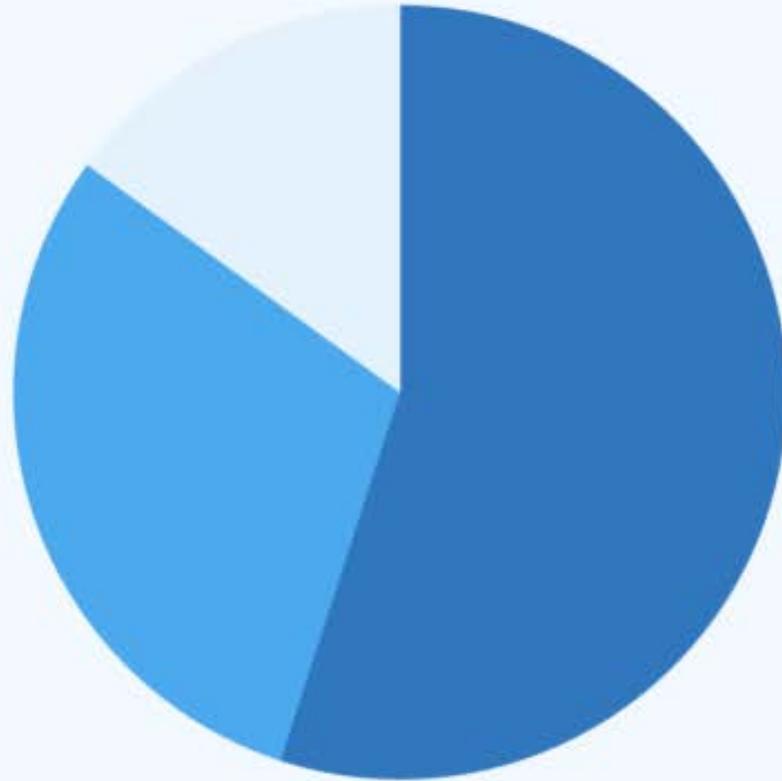
Antidepressants with **activating effects**, like fluoxetine and venlafaxine, can impair sleep. Ones with **antihistaminergic** action, like a sedating TCA's or mirtazapine, or strong **antagonistic action at serotonergic 5-HT₂ receptors**, like trazodone, improve sleep.

SWS = slow wave sleep

Hot flashes
affect up to

85%

of women in the U.S.,
about 143 million.



Out of that
population, up to

64%

report significant sleep
disturbances and higher
insomnia rates.

Treating Insomnia



CBT-I

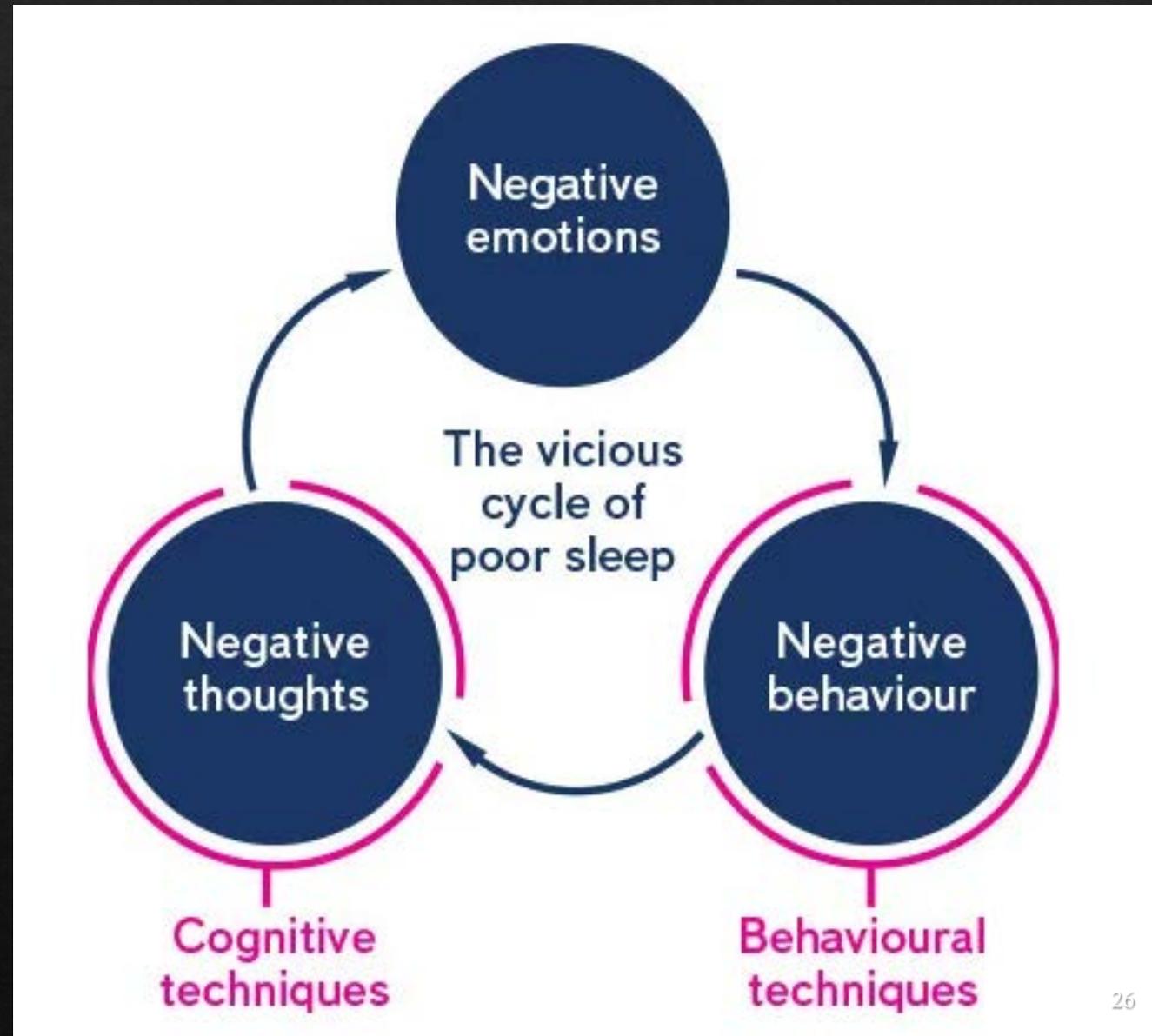
*The American College of Physicians (ACP 2016) recommends that all adult patients receive cognitive behavioral therapy for insomnia (CBT-I) as **the initial treatment** for chronic insomnia disorder. (Grade: strong recommendation, moderate-quality evidence)*

Management of Chronic Insomnia Disorder in Adults: A Clinical Practice Guideline From the American College of Physicians. Ann Intern Med.2016;165:125-133.
doi:10.7326/M15-2175

CBT-I focuses on restructuring the thoughts, feelings, and behaviors that are contributing to insomnia.

Techniques:

- ◇ stimulus control
- ◇ sleep restriction
- ◇ relaxation training



SLEEP DISRUPTORS:

Common lifestyle and environmental factors that interfere with sleep architecture and quality.



Caffeine Disrupts Sleep Architecture and Duration

Reduces total sleep time by ~45 mins and decreases deep sleep.



Alcohol Fragments Sleep Later in the Night

While initially sedating, it disrupts sleep later by altering serotonin and norepinephrine levels.



High-Sugar and Saturated Fat Meals Lead to Lighter Sleep

Associated with more arousals and less restorative, deep slow-wave sleep (SWS).



Reserve the Bed for Sleep and Intimacy Only

This is a core tenet of Stimulus Control Therapy to strengthen sleep cues.



Regular Exercise Improves Overall Sleep Quality

Improves self-reported sleep quality and may enhance sleep efficiency in adults.



Fiber-Rich Foods and Complex Carbs Promote Deeper Sleep

Greater fiber intake is associated with more time spent in restorative slow-wave sleep.



RELAXING PRE-SLEEP RITUAL

Establish a Relaxing Pre-Sleep Ritual

Techniques like meditation or deep breathing can reduce pre-sleep arousal and mental activity.



Optimize the Bedroom Environment

A cool, dark, and quiet room is crucial for minimizing sleep disturbances.

RECOMMEND CAFFEINE CUT-OFF TIMES



AT LEAST
8.8 HOURS
BEFORE BED



Coffee
Caffeine
8.8
HOURS
BEFORE BED



Pre-workout
Supplement
13.2
HOURS
PRIOR



Non-Sleep Activities in Bed Weaken the Sleep Association

Using screens or working in bed conditions the brain for wakefulness, not sleep.



Stress and "Sleep Anxiety" Increase Physiological Arousal

Worrying about sleep creates a vicious cycle that makes falling asleep more difficult.

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Common lifestyle and environmental factors that interfere with sleep architecture and quality.



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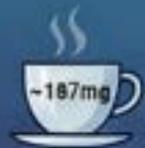
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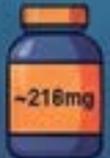


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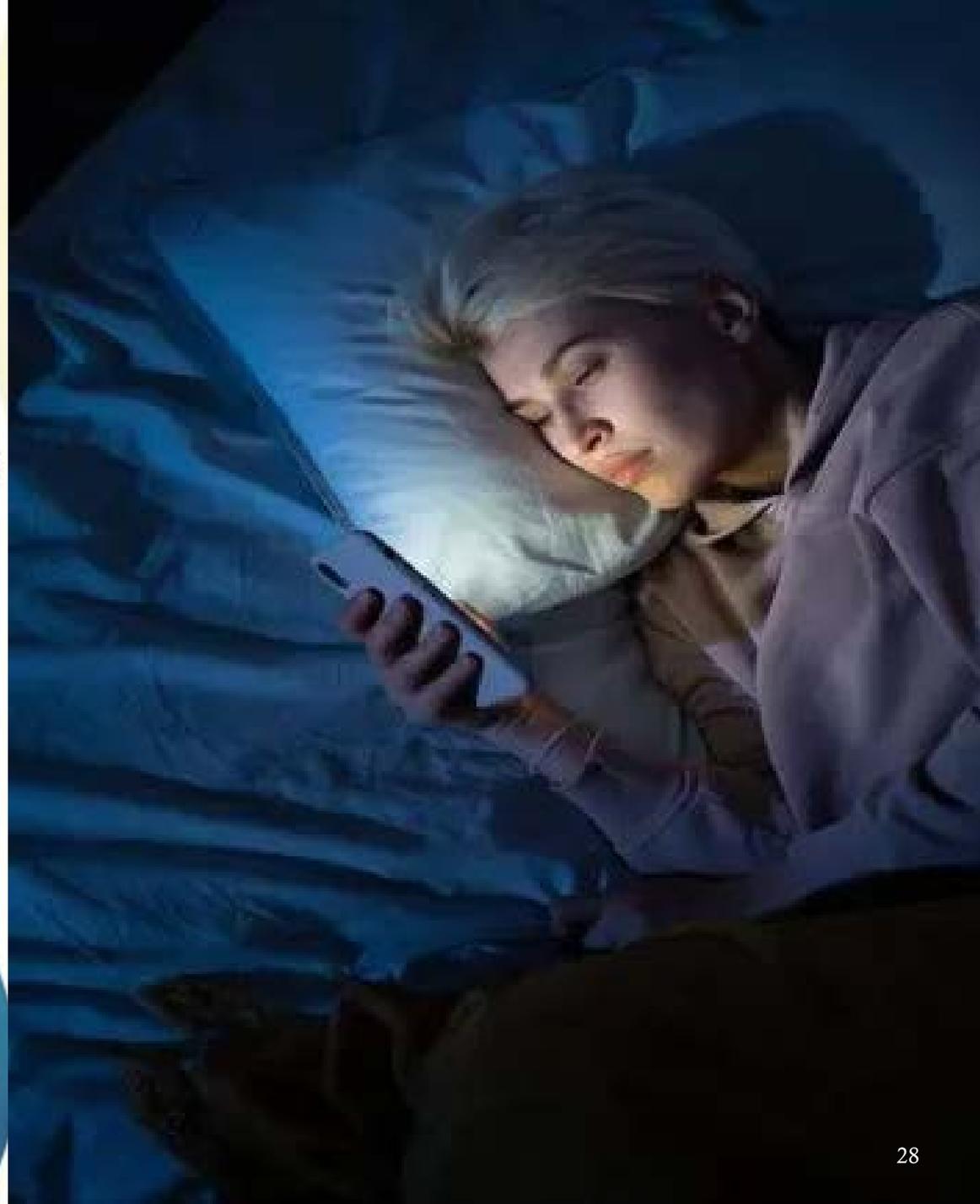
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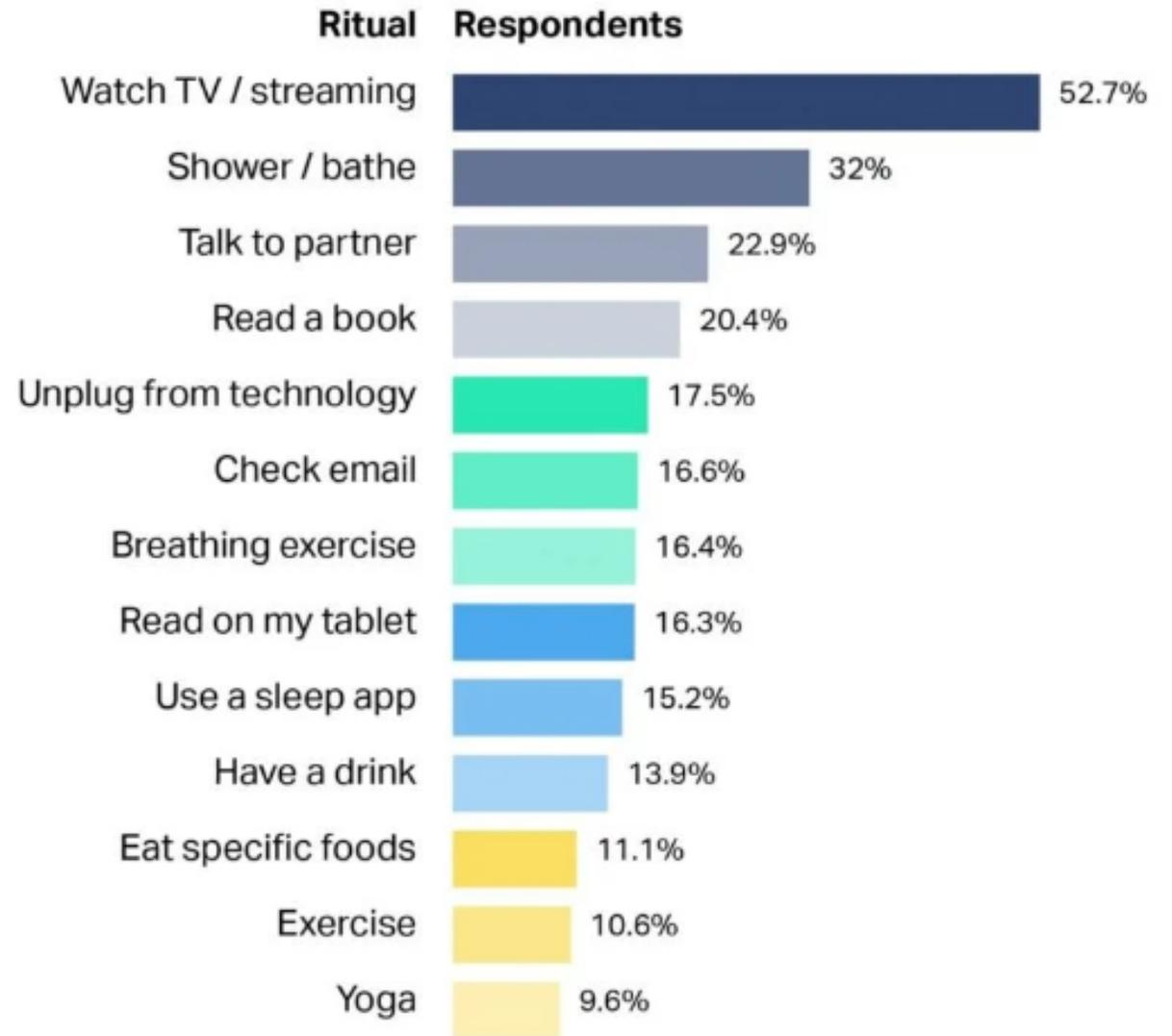
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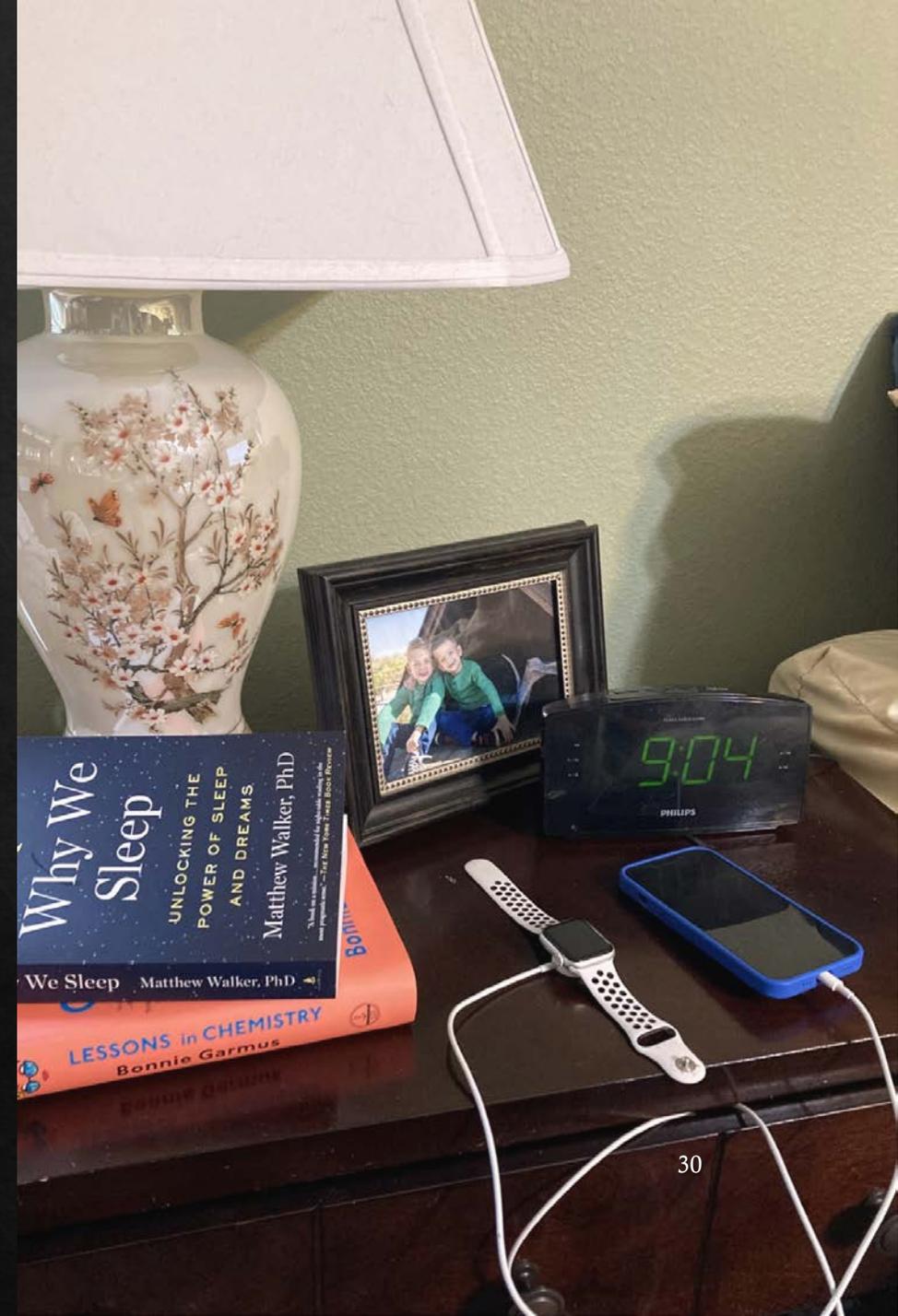
Pre-Bedtime Routines

- ◇ **50%** of people who watch TV before bed get less than seven hours of sleep.
- ◇ **58%** of adults who shower or bathe before bed say that doing so helps them sleep
- ◇ In one survey, U.S. adults spent over **3 hours** on social media before bed every night.
- ◇ YouTube is the most popular social media platform used before bed.



What's on Your Nightstand?

- ◆ Quick snapshot of bedtime habits.
- ◆ Bright lighting, smart phones, computers, stimulating reading material, a TV remote, sleep aids, and various kinds of food and drink can reflect beliefs and behaviors around sleep that may require attention.
- ◆ Keep alarm clock out of sight





SLEEP PROMOTERS:

Behaviors and environmental optimizations to strengthen sleep quality and duration.



SLEEP & INTIMACY ONLY

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Relaxing Sleep Rituals

- ◇ Wind-down routine, phone reminder (Apple Health)
 - ◇ Set sleep goals, “Sleep Focus” to turn off notifications
- ◇ Bath with epsom salts – Mg+
- ◇ Sauna (muscle tension)
- ◇ Mindfulness meditation
- ◇ Sleep Apps (Calm, CBT-i Coach, Pzizz, etc.)
- ◇ Essential oils
 - ◇ Lavender, Chamomile, Bergamot, Sandalwood, etc.
- ◇ Prayer, Journaling
- ◇ Breathing exercises, like 4-7-8 (inhale-hold-exhale)
- ◇ Herbal tea with milk (decaf)





Diet and Sleep

- ◇ Do not eat within 2 hours of bedtime, but do not go to bed hungry
- ◇ Complex carbs and dairy (tryptophan) seem to be helpful
- ◇ Avoid diets high in simple carbohydrates and sugars
- ◇ Adults who snacked on seeds and nuts before bed sleep **32 minutes more**, on average, than those who snacked on chips, crackers, or pretzels.



Other Lifestyle Habits and Sleep Impact

- ◆ Caffeine
 - ◆ Amount & timing (before lunch)
- ◆ Alcohol
 - ◆ Drinking > two per day for men and > one per day for women can decrease sleep quality by 39%
- ◆ Exercise
 - ◆ Helps with sleep, but exercising later in the day increases core body temp

Prescriptions & Supplements

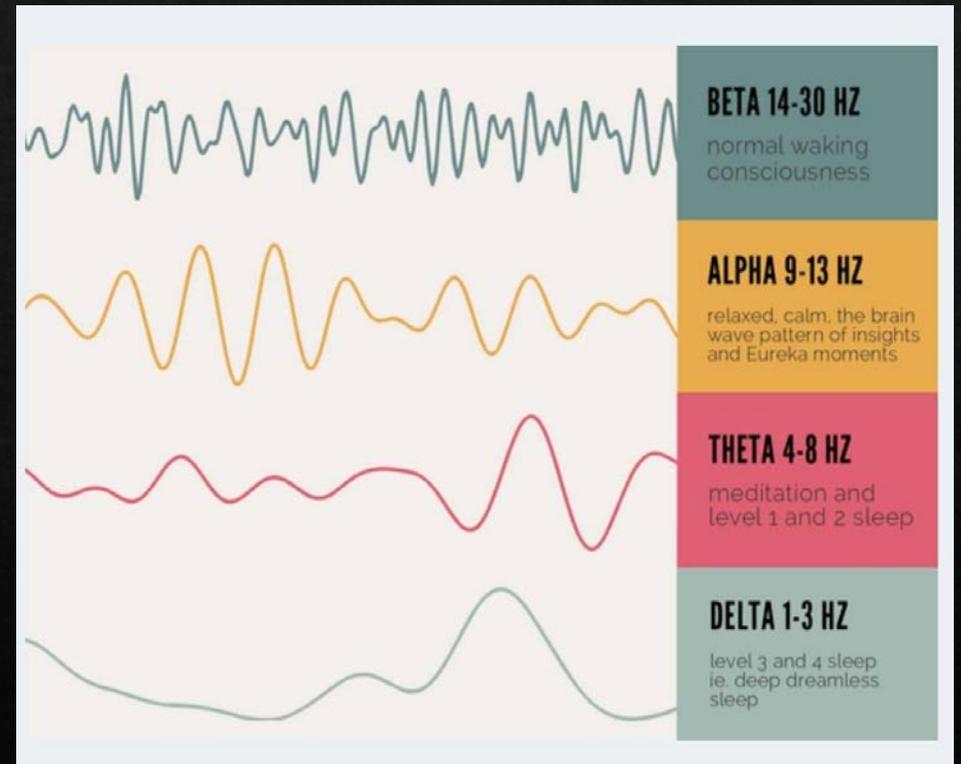


Prescriptions

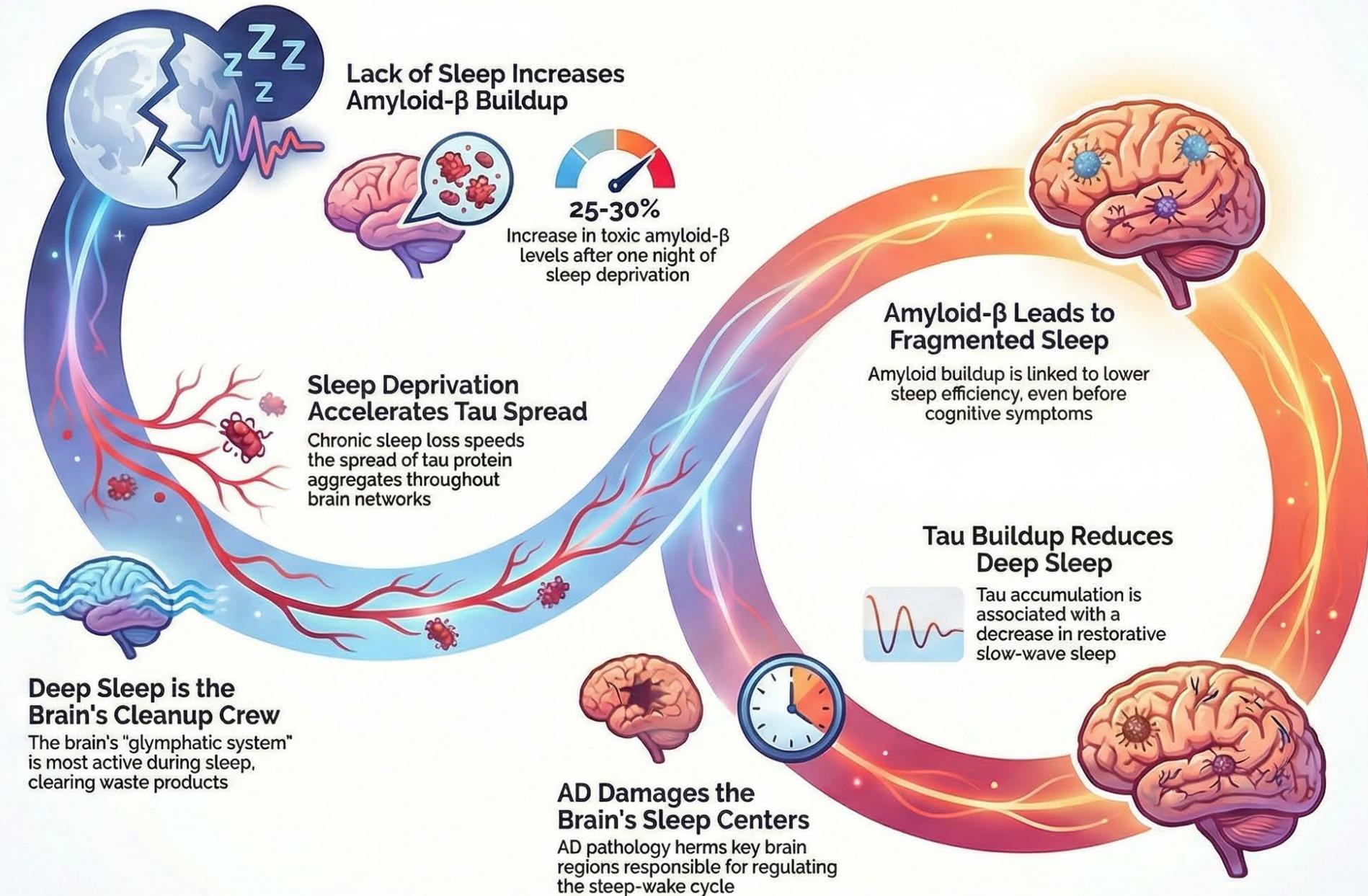
- ◇ BENZODIAZEPINE RECEPTOR AGONISTS
 - ◇ BNZ: temazepam
 - ◇ Non-BNZ: “Z-drugs” (zolpidem, eszopiclone)
- ◇ MELATONIN AGONIST: RAMELTEON
- ◇ TRICYCLIC ANTIDEPRESSANT: DOXEPIN
- ◇ OREXIN RECEPTOR ANTAGONIST: SUVOREXANT
- ◇ OFF-LABEL TREATMENTS
 - ◇ Antihistamines
 - ◇ Trazodone
 - ◇ Mirtazapine
 - ◇ Other TCA’s (amitriptyline, nortriptyline)
 - ◇ Atypical antipsychotics

Slow Wave (Deep) Sleep

- ❖ Slow-wave sleep, or non-rapid eye movement (NREM) sleep, is associated with memory: reductions can lead to **impaired memory**.
- ❖ During slow-wave sleep the brain releases the greatest amount of **growth hormone**, which may play a role in repairing damage.
- ❖ BNZ's, opioids, and alcohol **decrease** slow wave sleep, zolpidem does not.

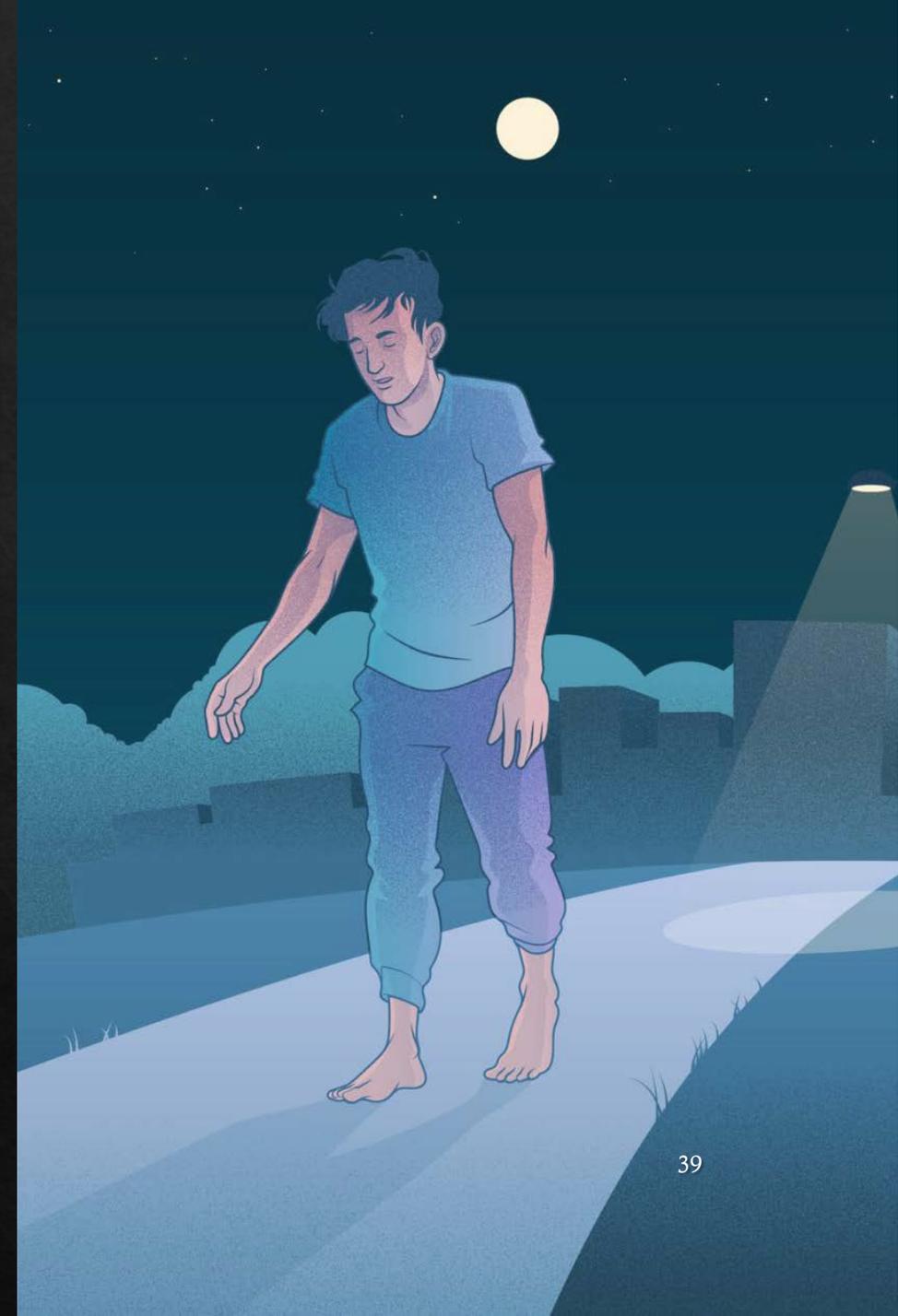


The Vicious Cycle of Sleep & Alzheimer's



Z-drugs: zolpidem (Ambien), eszopiclone (Lunesta)

- ◆ Decrease of 5 to 15 minutes in sleep onset time compared with placebo, a 30- to 60-minute increase in total sleep time, and moderate to large improvement in subjective sleep quality.
- ◆ The US Food and Drug Administration (FDA) added a boxed warning in 2019 on the risk of rare but serious complex sleep-related behaviors (ex. parasomnias like sleepwalking).
- ◆ Can develop a dependence/ tolerance, and excessive sedation can occur the next day.



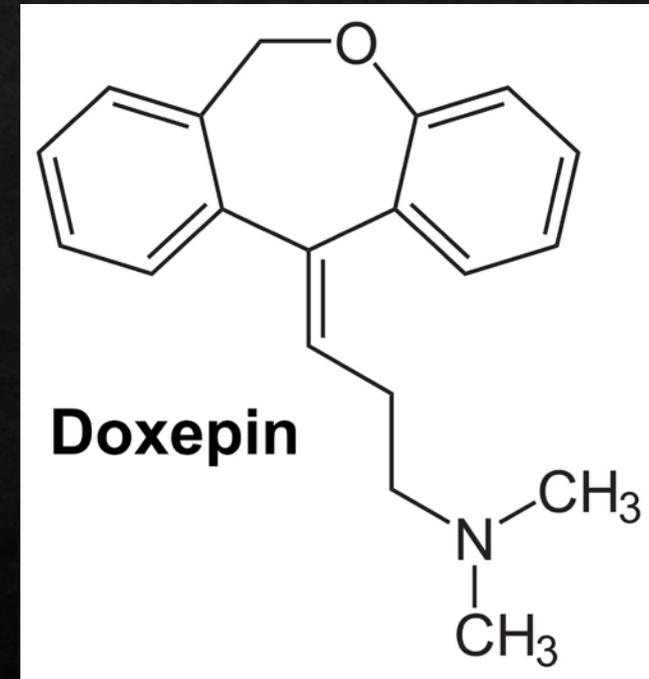
Dual orexin receptor antagonists (DORAs)

- ◇ Orexin (also called hypocretin) promotes wakefulness
- ◇ DORAs decreased subjective sleep latency by **7 minutes**, increased subjective sleep time by **18 minutes**, and improved subjective sleep quality.
 - ◇ Lemborexant (Dayvigo), ~ \$337 (GoodRx 2024)
 - ◇ Suvorexant (Belsomra), ~ \$446 (GoodRx 2024)
 - ◇ Daridorexant (Quviviq), ~ \$519 (GoodRx 2024)
- ◇ Less risk of withdrawal or rebound



Doxepin

- ◇ TCA, at low doses it mostly has antihistamine activity
- ◇ Enhances sleep maintenance
- ◇ Used at higher doses for depression
- ◇ Improved total sleep time by **25 to 35 minutes** for 3 mg and 6 mg doses
- ◇ CostPlusDrugs
 - ◇ ~\$23 to \$26 for 30 days (3mg & 6mg)



Ramelteon (Rozerem)

- ◇ Melatonin receptor agonist
- ◇ Indicated for difficulty with sleep onset
- ◇ Improvement in subjective sleep latency (**4.6 minutes**) and total sleep time (**7.3 minutes**)
- ◇ GoodRx (2024):
 - ◇ ~ \$33 to \$112, generic
 - ◇ ~ \$410, brand
- ◇ CostPlusDrugs
 - ◇ ~ \$15



OTC Sleep Aids



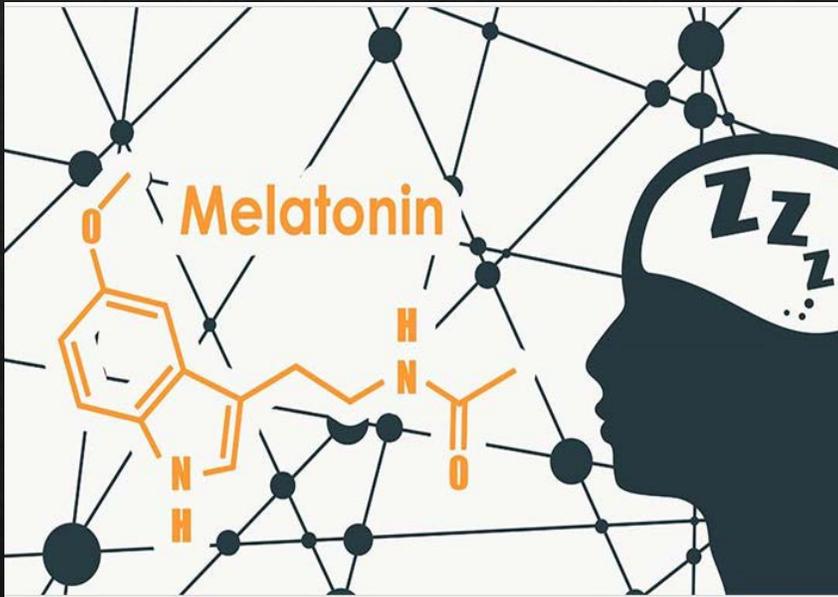
- ◇ Diphenhydramine – 25 to 50 mg at bedtime
- ◇ Doxylamine – 25 mg about 30 minutes before bedtime
- ◇ Anticholinergic effects (dizziness, impaired coordination, urinary retention, dry mouth, thickened bronchial secretions, etc.)
- ◇ Mean reduction in sleep onset of approximately **8 minutes** compared with placebo, and a **12-minute improvement** in total sleep time.



Supplements and Botanicals

- ◇ *Melatonin
- ◇ *Magnesium
- ◇ *Vitamin D
- ◇ *Tart Cherry Juice
- ◇ Ashwaganda
- ◇ Valerian Root , *withdrawal
- ◇ Kava kava (some safety concerns, liver)
- ◇ L-Theanine (black and green tea)
- ◇ L-aurine
- ◇ L-tryptophan
- ◇ THC & CBD, *withdrawal

Melatonin Supplement



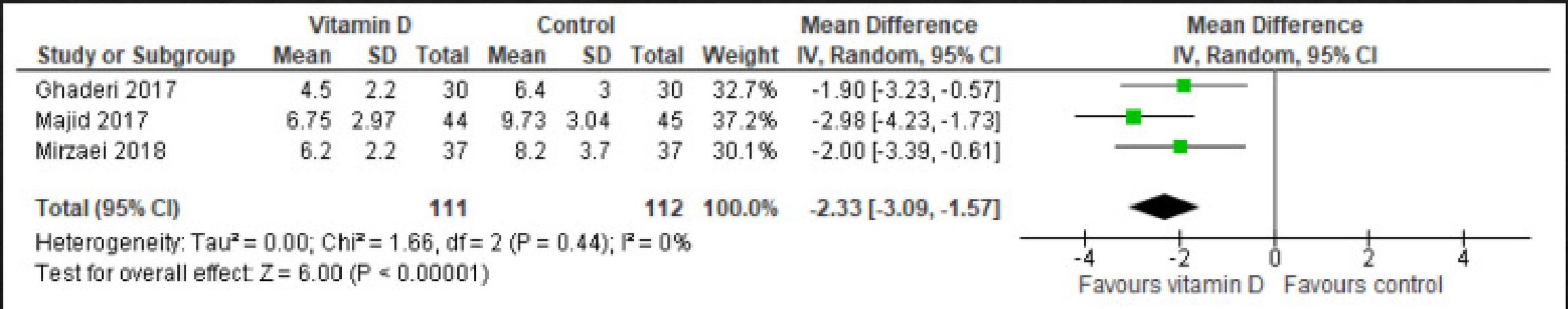
Top brands per consumerlab.com:
Swanson (low dose), Solgar or NOW
liquid melatonin (moderate dose)

- ◇ Supplement dosing and quality varies greatly
- ◇ Helps with timing of sleep onset (ex. jet lag)
- ◇ Start with 1mg, increase to 3mg MAX
- ◇ **Beta blockers lower nighttime melatonin**
 - ◇ Highly lipophilic (worst): propranolol
 - ◇ Mod. lipophilic: bisoprolol, carvedilol, metoprolol
 - ◇ Low lipophilicity (better): atenolol, labetalol, sotalol
- ◇ In children: used for mild-TBI, autism, ADHD
- ◇ May decrease nighttime urinary frequency in women

Magnesium

- ◆ Nearly HALF of the U.S. population does not get adequate amounts of Mg
- ◆ Risk factors: alcohol use, diabetes, digestive disorders, and PPI use.
- ◆ May shorten the time it takes to fall asleep, but questionable benefit if not deficient in magnesium
- ◆ Look for Mag threonine or Mag glycinate, 400mg to 500mg/day





Vitamin D

Meta-analysis of the effect of vitamin D supplementation on sleep quality assessed by the Pittsburg Sleep Quality Index (19 items, score from 0 to 21. ≤5 indicates good sleep, >5 poor sleep quality)

- ◆ Vitamin D deficiency is associated with an increased risk of sleep disorders, shorter sleep duration, and poor sleep quality.
- ◆ Vit D supplementation has been shown to significantly improve sleep quality—likely by influencing melatonin production and receptors involved in sleep regulation.
- ◆ Evidence regarding its ability to improve sleep duration or treat specific sleep disorders remains less conclusive.

Tart Cherry Juice



- ◇ Contains tryptophan and melatonin
- ◇ Sugar-free, 1 hour before going to bed
- ◇ Small studies have shown increased sleep time by **34 to 84 minutes**, along with improved sleep quality
- ◇ May also reduce arthritis and muscle pain, lower blood pressure, improve memory, lower fasting blood sugar
- ◇ 6 to 8oz serving, 1 to 2 daily



Case 1

66yo male with OSA, A fib, HTN, GERD, obesity.

- ◇ Difficulty using CPAP, “it doesn’t help”
 - ◇ Sleep stimuli and sleep hygiene, CBT-I
- ◇ Spironolactone (MRA)
 - ◇ 9 to 21% incidence of hyperaldosteronism, which increases fluid retention in the neck
- ◇ Obesity
 - ◇ Weight loss → Tirzepatide?
- ◇ GERD
 - ◇ Heartburn at night? Low magnesium?
- ◇ On a beta blocker?
 - ◇ May impact melatonin



Case 2

49yo female nurse with neck pain, alcohol use, anxiety.

- ◇ Shift work, fragmented sleep
 - ◇ Melatonin? Sleep restriction
- ◇ Anxiety
 - ◇ Work? Sleep anxiety? Doom scrolling?
 - ◇ Schedule worrying, Blue light
 - ◇ Doxepin, Trazodone, Ambien
- ◇ Peri-menopause
 - ◇ HRT? Room temp? Vit D
- ◇ Neck pain
 - ◇ Tylenol, stretching, pillow



Sleep Solutions



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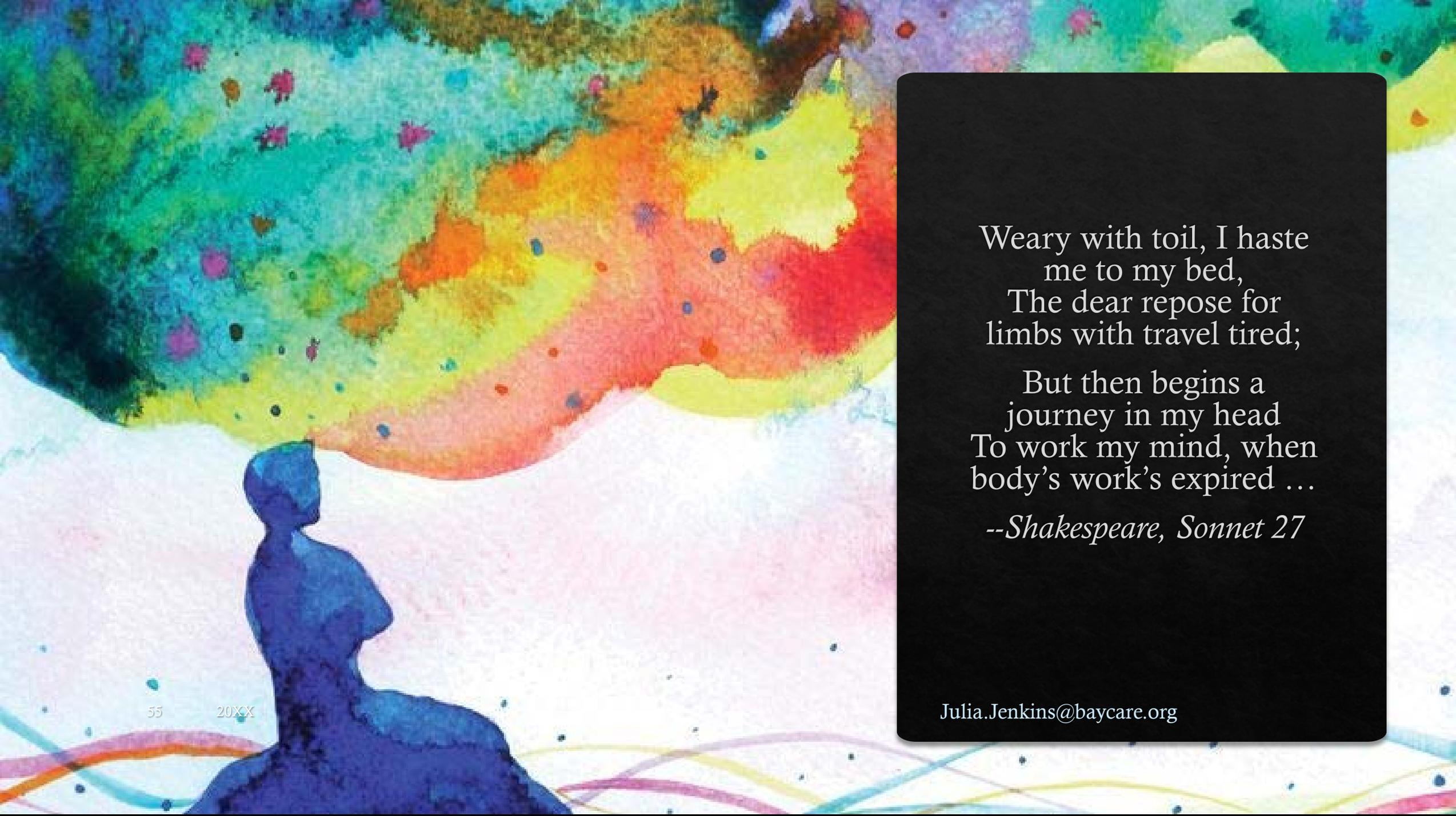


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Key Takeaways

- ◇ Daytime and sleep routines, along with exercise/ meals/ light & electronics timing, are the foundational elements to healthy sleep
- ◇ Caution patients about caffeine and alcohol
- ◇ Consider obstructive sleep apnea in the differential
- ◇ Review prescription meds that may impact sleep
- ◇ First line insomnia treatment should be **CBT-I**
- ◇ Supplements and Rx meds may also help
- ◇ Start with a few simple recommendations to avoid worsening sleep anxiety





Weary with toil, I haste
me to my bed,
The dear repose for
limbs with travel tired;

But then begins a
journey in my head
To work my mind, when
body's work's expired ...

--Shakespeare, Sonnet 27

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