

Why Sleep Matters



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Disclaimer

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Sleep is important because

- Every mammal sleeps. It is a preserved aspect of behavior in EVERY mammal.
- All living organisms have sleep-like behaviors



Biology matters...



<http://www.heraldsun.com.au/travel/world/lonely-planet-and-escape-writers-40-amazing-travel-experiences-part-3/story-fnjjva7c-1226747395832>

http://newphotoeveryday.com/wp-content/uploads/2012/03/Sleeping-Tiger_small.jpg

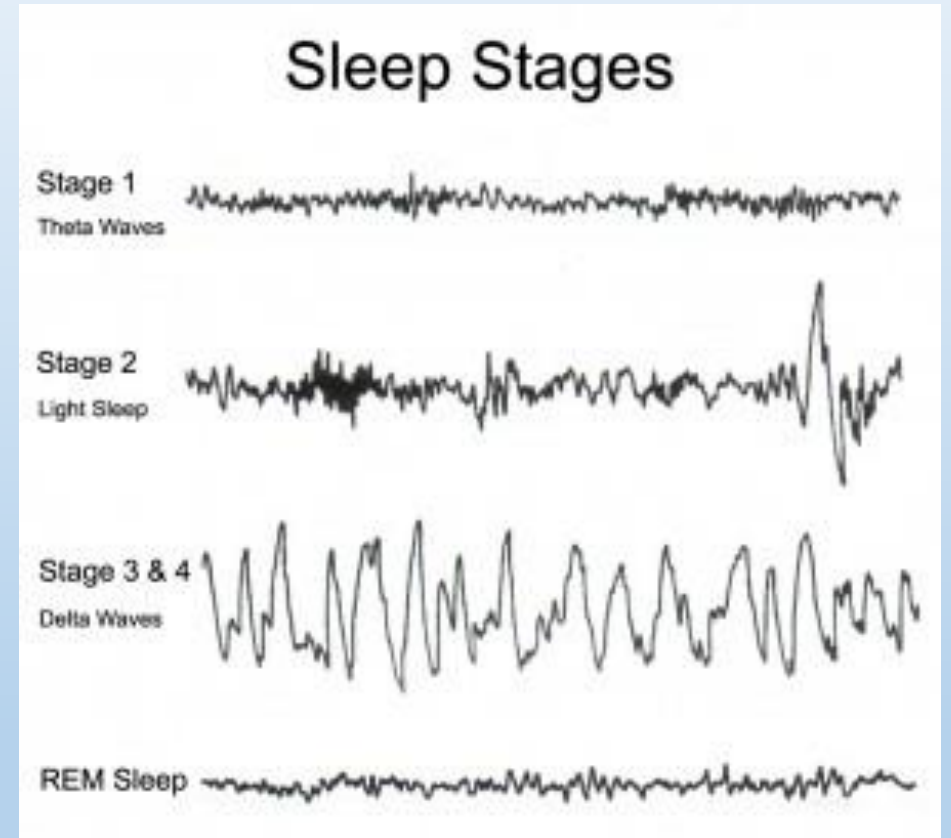
http://1.bp.blogspot.com/-2LrnCfirE1E/TrXJd_ieVVI/AAAAAAAAAGiw/Yfz5eyUABos/s1600/sleeping+bear.jpg

Why Do We Sleep?

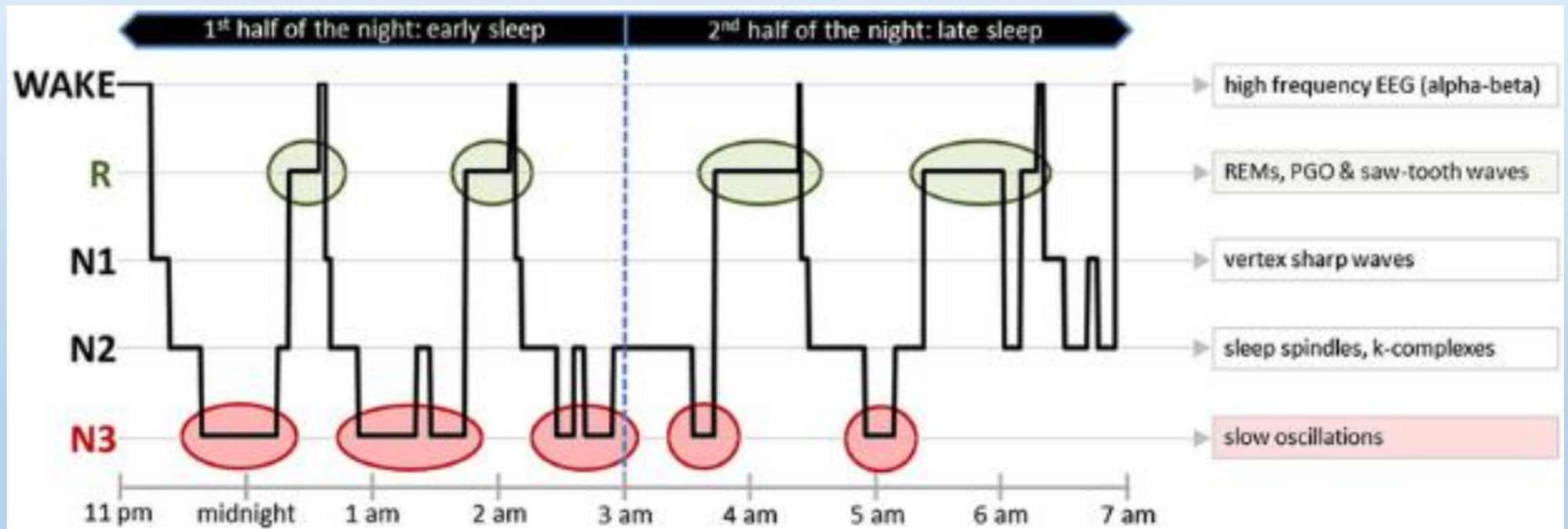
- Sleep drives metabolite/toxin clearance from the Brain
- Energy conservation
 - Albeit only about a slice of bread
- Consolidate memories
 - Primarily REM sleep
- Growth and restoration
 - N3 or slow wave sleep
 - Growth hormone secretion

Sleep Stages

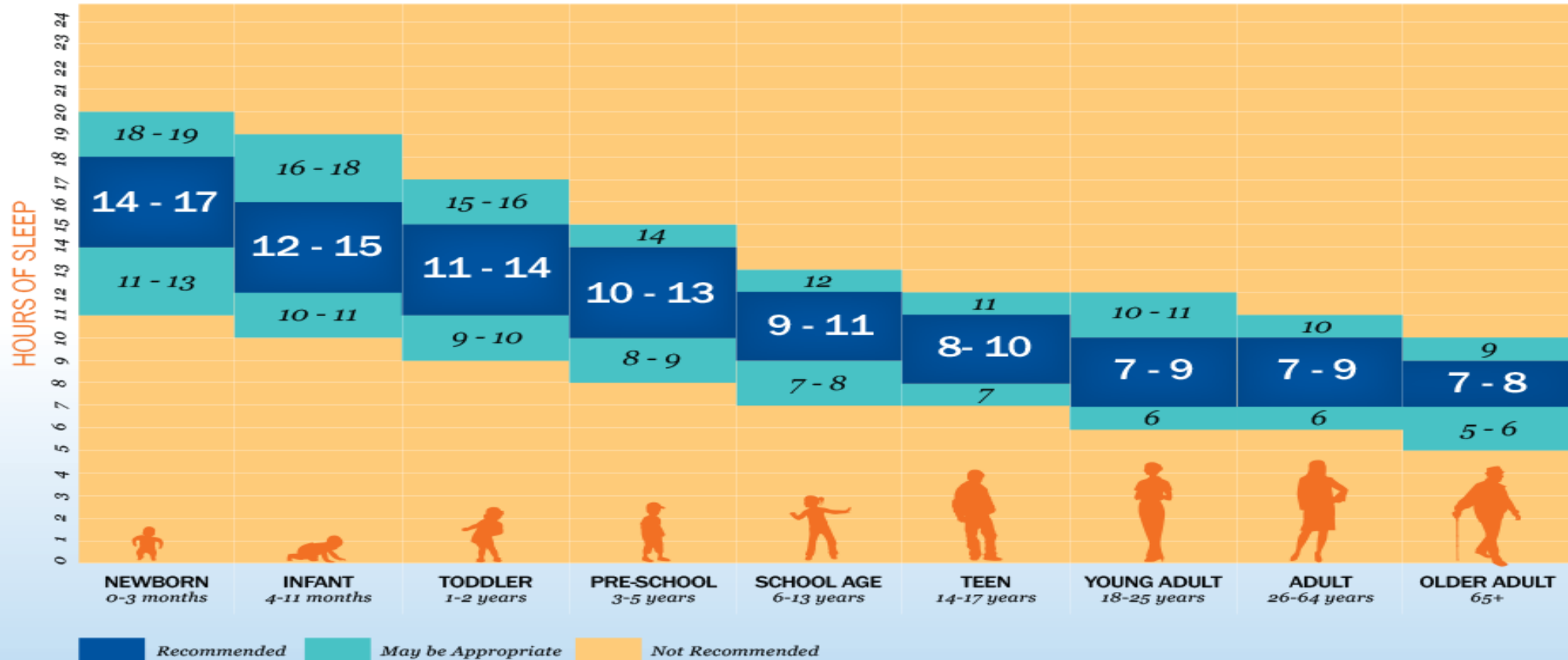
- Non-rapid eyemovement (NREM) sleep
 - N1: transitional sleep
 - N2: majority of sleep
 - N3: deep sleep or slow wave sleep
- Rapid eye movement (REM) sleep
 - Muscle paralysis
 - Brain activation
 - Most vivid dreams



Sleep Hypnogram: Sleep Architecture



SLEEP DURATION RECOMMENDATIONS



SLEEPFOUNDATION.ORG | SLEEP.ORG

CDC Sleep Quantity Recommendations

Age Group		Recommended Hours of Sleep Per Day
Newborn	0–3 months	14–17 hours (National Sleep Foundation) ¹ No recommendation (American Academy of Sleep Medicine) ²
Infant	4–12 months	12–16 hours per 24 hours (including naps) ²
Toddler	1–2 years	11–14 hours per 24 hours (including naps) ²
Preschool	3–5 years	10–13 hours per 24 hours (including naps) ²
School Age	6–12 years	9–12 hours per 24 hours ²
Teen	13–18 years	8–10 hours per 24 hours ²
Adult	18–60 years	7 or more hours per night ³
	61–64 years	7–9 hours ¹
	65 years and older	7–8 hours ¹

Top Ten Reasons NOT to Sleep

1. Your car is old and you have a large deductible
2. Your IQ is 200 and you want to appear normal
3. Longevity is in your family and 100 is just too long to live
4. Valentines Day comes just once a year
5. People tell you, you're just too happy
6. You appear half your age
7. You need an excuse for your failing memory
8. After your recent workout binge, your clothes don't fit
9. You never know how much sleep you really got
10. It's the late night munchies!

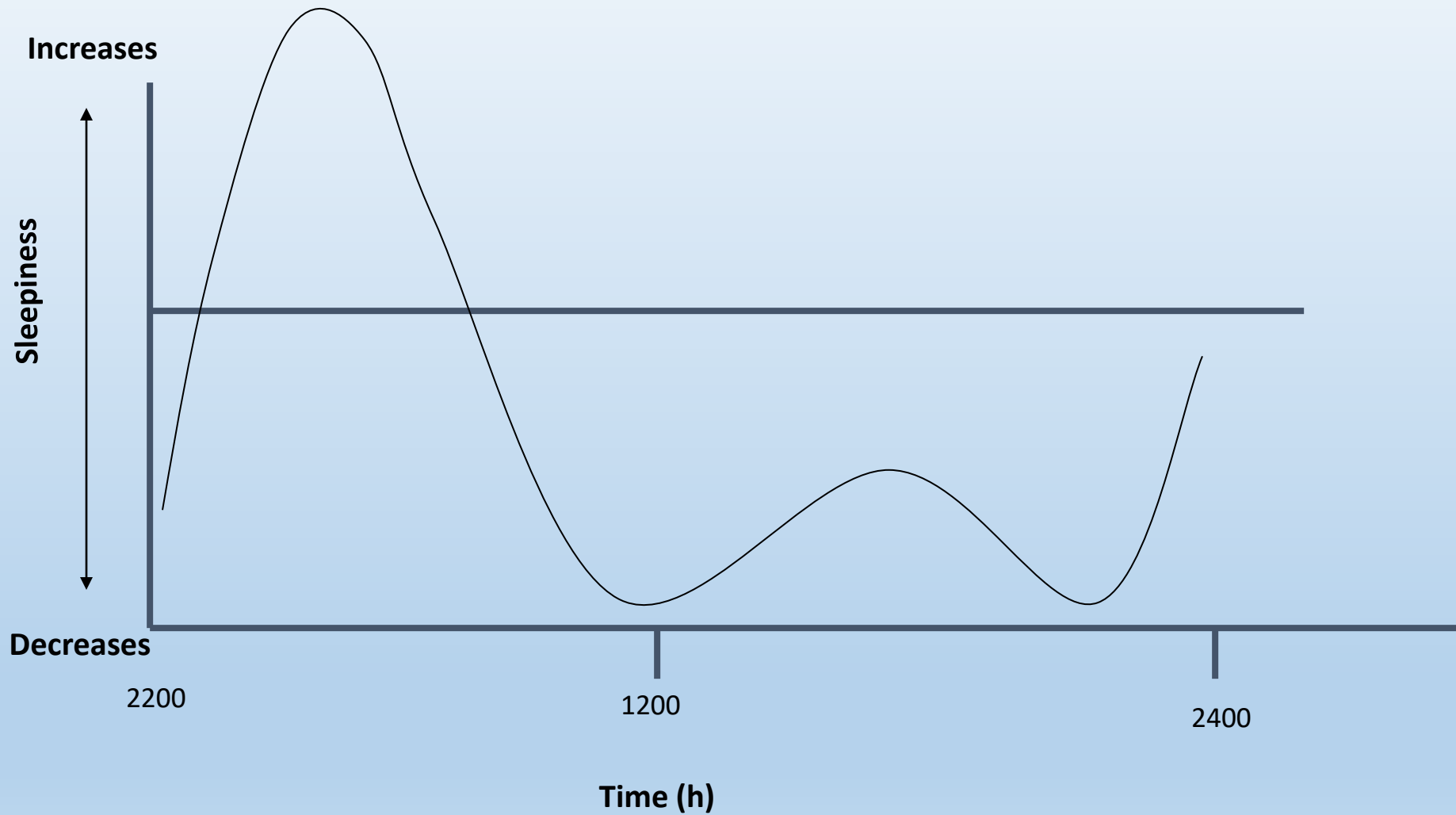
Sleep Characteristics

- How much sleep?
 - Length of sleep with spontaneous awakening
 - Most adults require 7-8 hours (8.2 hours)
 - Range from 4-10 hours
 - Alert in all situations
- Quality of sleep
 - Percentage, duration and type of sleep stages
 - Affected by arousals and awakenings
 - Internal and external factors
- Adequate sleep
 - Awaken spontaneously
 - Feeling refreshed

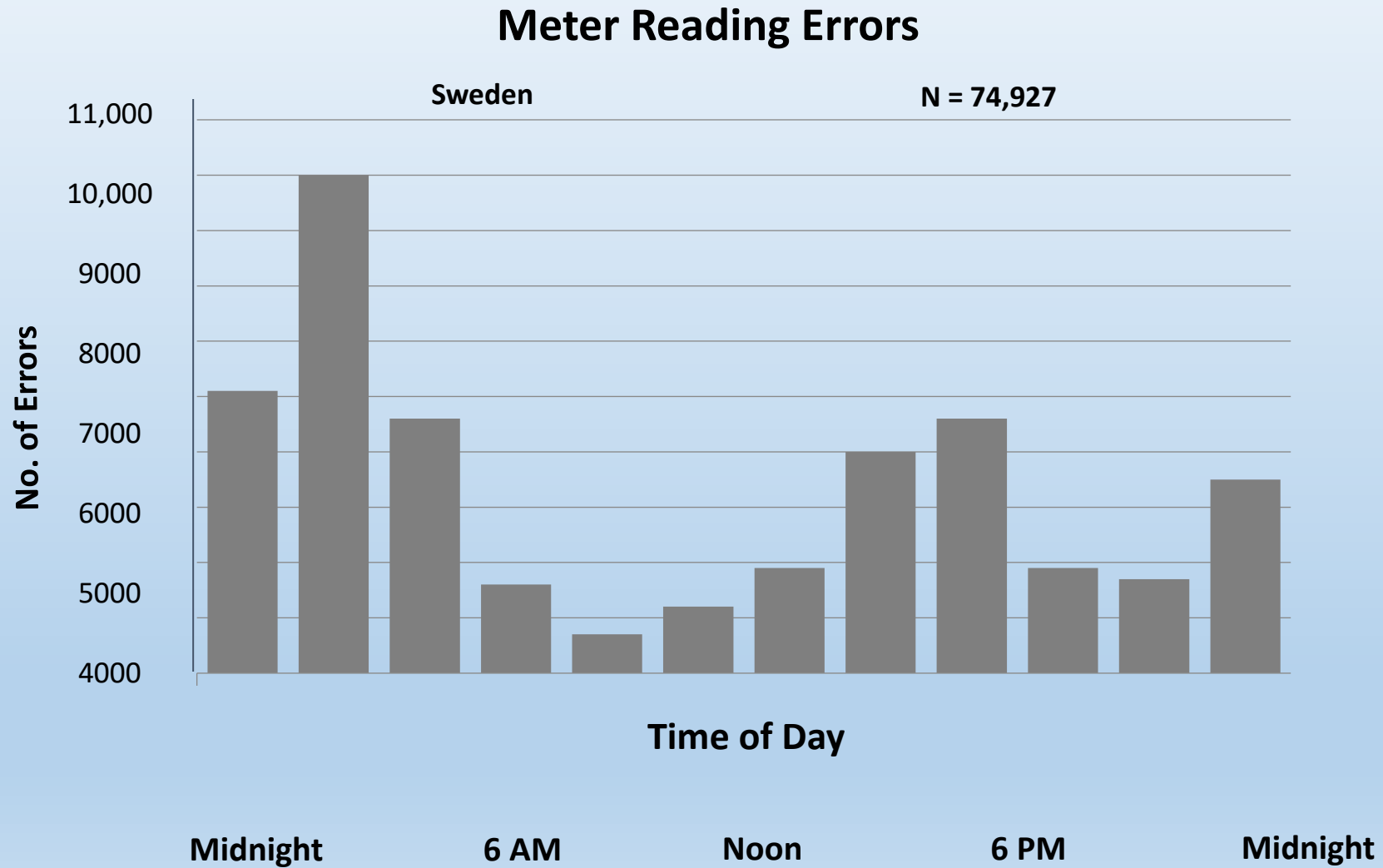
Why Do We Feel Sleepy?

- 2 processes determine how sleepy we are and how long we sleep
 - **Homeostatic sleep drive (Sleep Gas Tank):**
 - How long you have been awake
 - Linear and cumulative—one gets progressively more tired with each passing hour (“sleep load” increases)
 - At 40 hours of no sleep nearly everyone falls asleep
 - **Circadian rhythm (Biologic Clock):**
 - Process driven by our Biologic Clock (time of day)
 - Cyclical—periods of sleepiness occur at roughly the same times each day
 - You cannot change this

Circadian Rhythm



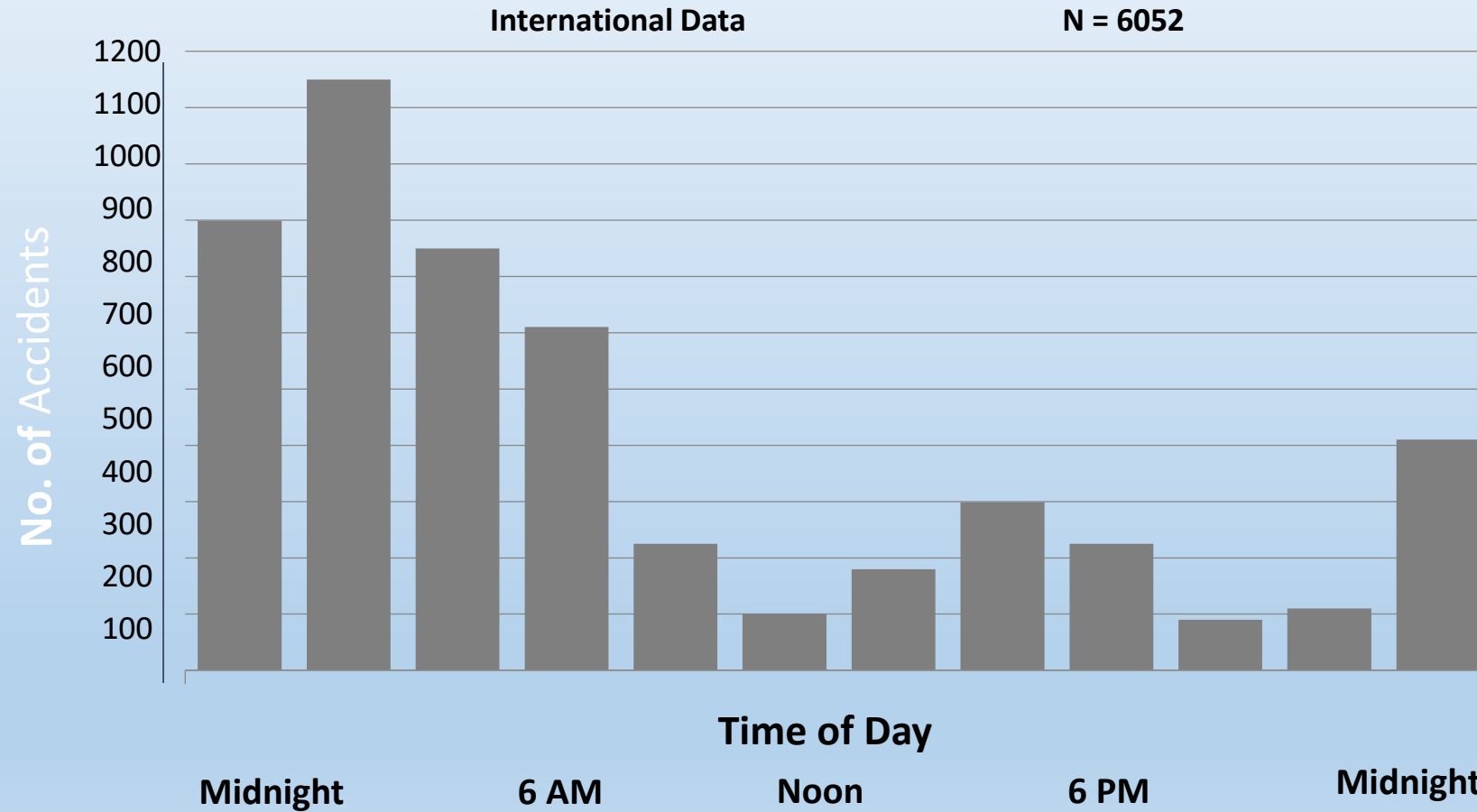
Performance Errors



Mitler MM, et al. *Sleep*. 1988.

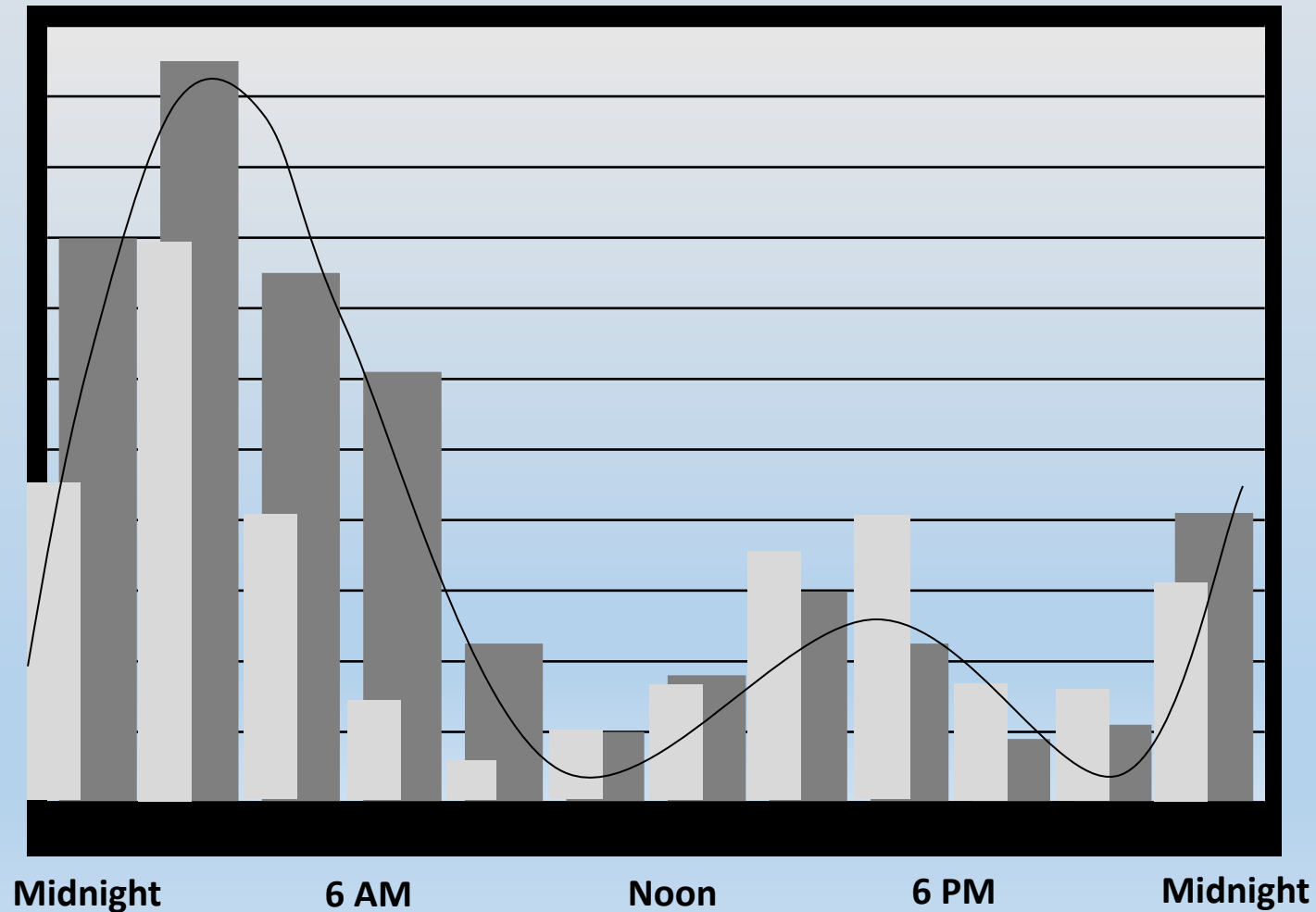
Vehicle Accident Data

Fatigue-Related Accidents



Mitler MM, et al. *Sleep*. 1988.

Overlay of Accident Data, Performance Errors, and Circadian Rhythm



Performance Enhancement with Sleep

EFFECTS OF SLEEP EXTENSION ON ATHLETIC PERFORMANCE

DOI: 10.5665/SLEEP.1132

The Effects of Sleep Extension on the Athletic Performance of Collegiate Basketball Players

Cheri D. Mah, MS¹; Kenneth E. Mah, MD, MS¹; Eric J. Kezirian, MD, MPH²; William C. Dement, MD, PhD¹

SHORT NOTE

<http://dx.doi.org/10.5665/sleep.3248>

The Impact of Circadian Misalignment on Athletic Performance in Professional Football Players

Roger S. Smith, DO¹; Bradley Efron, PhD²; Cheri D. Mah, MS³; Atul Malhotra, MD⁴

¹Brigham and Women's Hospital Sleep Disorders Program, Harvard Medical School, Boston MA; ²Department of Statistics, Stanford University, Stanford CA; ³Stanford Sleep Disorders Clinic and Research Laboratory, Stanford University, Stanford CA; ⁴Department of Medicine, University of California San Diego, La Jolla, CA

EFFECTS OF SHIFTING THE TIMING OF SLEEP ON TRAINING EFFECTIVENESS

<http://dx.doi.org/10.5665/sleep.2002>

Accommodating Adolescent Sleep-Wake Patterns: The Effects of Shifting the Timing of Sleep on Training Effectiveness

Nita Lewis Miller, PhD; Anthony P. Tivaryanas, MD, PhD; Lawrence G. Shattuck, PhD

Naval Postgraduate School, Monterey, CA

Performance Enhancement with Sleep

- Increase sleep in collegiate basketball players: 110.9 ± 79.7 minutes
- Improved: sprint times, free throw % (9%) and 3 point % (9.2%)
- **Optimal Sleep is beneficial in Reaching Key Athletic Performance**

- Assessed 40 years of outcomes of East Coast vs West Coast football teams
- On Night Games, West Coast teams were at peak of Circadian Performance
- West Coast Teams beat point spread 2 times as often as East Coast Teams
- This pattern was not present for day games
- **Human Performance is likely enhanced at one's Circadian Peak**

- Compared Basic Trainees: usual sleep period 2030-0430 vs 2300-0700
- Intervention group slept 31 more minutes, ↓ fatigue, ↑ sleep quality
- **Mental health and marksmanship improved by sleeping IAW Biologic Clock**

Adenosine, Sleep and



- Adenosine
 - Increases during wakefulness
 - Induces sleep
- Caffeine
 - Most common substance to promote wakefulness
 - Average intake for American adults: 280 mg/daily
 - Non-selective adenosine antagonist
 - Decrease slow wave activity
 - Affects the arousal threshold

Sleep Myth Busters

Common Belief	FACT or FICTION?	The fact(s)
I am one of those people who can get by with less than 7—8 hours of sleep.	FICTION	Very few people can maintain high levels of effectiveness on less than 7—8 hours of sleep. You might FEEL as though you are getting by okay, but your performance is degraded.
Needing to sleep is a sign of laziness or weakness.	FICTION	Sleep is a brain-based, biological need just like food, water, and air. Just as thirst is a sign of insufficient hydration, sleepiness is a sign of sleep debt (not enough sleep)
If I am in top physical condition, I can better resist sleep loss.	FICTION	Physical conditioning does NOT reduce normal sleep requirements; it does not compensate for sleep restriction effects on mental effectiveness
I can train myself, practice, or adapt to getting by with less sleep.	FICTION	The brain does not “adapt” to less sleep. As noted above, you might FEEL as though you are getting by okay, but your performance is degraded.

What is Good Sleep Hygiene?

- Keep a consistent sleep schedule
- Set a bedtime that is early enough for you to get at least 7-8 hours of sleep.
- Don't go to bed unless you are sleepy.
- Establish a relaxing bedtime routine.
- Use your bed only for sleep and sex.
- Make your bedroom quiet and relaxing. Keep the room at a comfortable, cool temperature.
- Limit exposure to bright light in the evenings.
- Turn off electronic devices at least 30 minutes before bedtime.
- Don't eat a large meal before bedtime. If you are hungry at night, eat a light, healthy snack.
- Exercise regularly and maintain a healthy diet.
- Avoid consuming caffeine in the afternoon or evening.
- Avoid consuming alcohol before bedtime.
- Reduce your fluid intake before bedtime.

<https://sleepeducation.org/healthy-sleep/healthy-sleep-habits/>

Sleep In America Poll: Technology Is Ruining Our Sleep

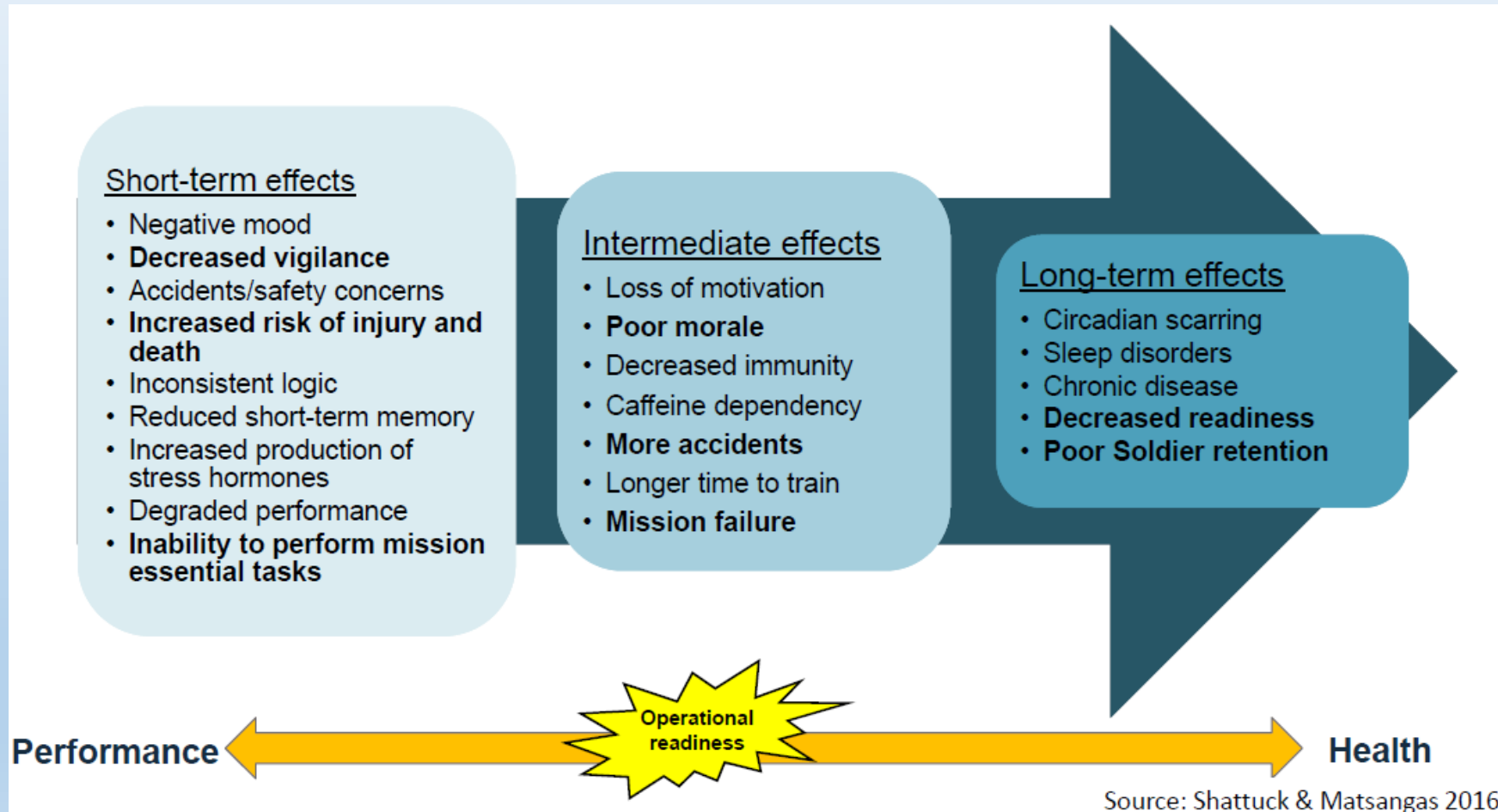


http://www.huffingtonpost.com/2011/03/07/sleep-in-america-poll_n_832457.html

Is Napping Acceptable?

- Depends
- Duration:
 - Ideal: 20-30 minutes
 - Longer naps can affect nighttime sleep
- Timing:
 - Early afternoon: 1200-1300
 - Later in day: more likely to affect nighttime sleep
- How often:
 - Daily: are you receiving adequate nighttime sleep
 - Occasionally: appropriate replacement for insufficient sleep
- Potential benefits:
 - Improves performance
 - Best substitute for lack of sleep is Sleep

Poor Sleep Results in Sleep Casualties



Insomnia – We have all been there...



What is Insomnia?

- Difficulty initiating sleep
- Difficulty maintaining sleep
- Waking up too early
- Daytime fatigue
- Non-restorative sleep
- Impairment in functioning
- Not obtaining enough sleep despite having an opportunity to obtain adequate sleep



**GOAL: Get 7 to 9 hours
of sleep every night**

Prevalence of Insomnia

- 30 to 35 % have brief symptoms of insomnia
- 15 to 20 % have short-term insomnia lasting less than 3 months
- 10 % have a chronic insomnia disorder

WHAT CAUSES INSOMNIA?



CROSSING TIME ZONES



BLUE LIGHT



STRESS



ALCOHOL, SMOKING OR CAFFEINE



HEAVY FOOD



MEDICINES



ENVIRONMENTAL FACTORS



UNCOMFORTABLE BED OR PILLOW

Additional Factors that Affect Sleep

- Acute stressors (i.e. death in the family, loss of employment)
- Chronic pain
- Bruxism
- Acid reflux, asthma, heart failure, traumatic brain injury/concussions
- Mood – anxiety, depression, PTSD

Additional Factors that Affect Sleep

- Restless legs syndrome / periodic limb movements of sleep
- Obstructive sleep apnea
- Nightmares
- Circadian rhythm disorders

“But doc, I can just take a medication...right?”

Insomnia & Sleeping Aids: A Snapshot

An estimated **50 to 70 million** Americans suffer from sleep disorders or sleep deprivation.

It is estimated that Americans spend more than **\$41 billion** on sleep aids and remedies.

More than **60 million** Americans take sleep medications every year.



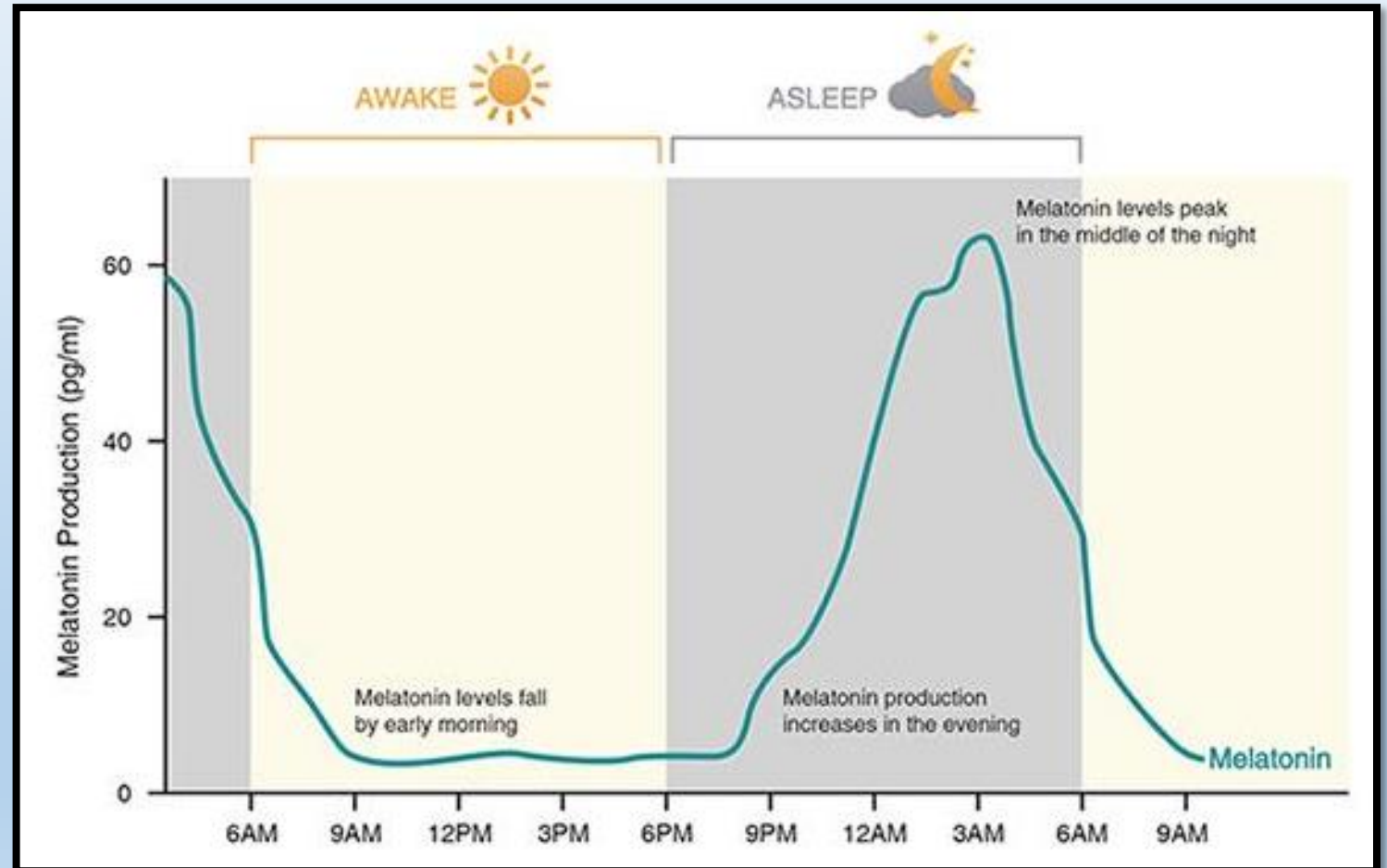
Penn Medicine

Which medications are FDA-approved for insomnia?

1. Diphenhydramine (Benadryl)
2. Doxepin (Sinequan)
3. Zolpidem (Ambien)
4. Quietapine (Seroquel)
5. Trazodone (Desyrel)
6. Ramelteon (Rozerem)
7. Eszopiclone (Lunesta)
7. Mirtazapine (Remeron)
9. Zaleplon (Sonata)
10. Temazepam (Restoril)
11. Suvorexant (Belsomra)

But which commonly used “sleep aid” is NOT
on this FDA-approved list???

Melatonin – Over-the-counter



Side Effects of Medical Therapy for Insomnia

- Sleep walking, sleep driving
- Residual sedation
- Withdrawal
- Impaired cognitive performance
- Potential for accidents
- Tolerance and/or lack of effectiveness



The Right Sleep Medicines, or None at All?

- Sleep aids – acute
- Behavioral approaches – long lasting

Is Ambien the answer?
Consider the risks...



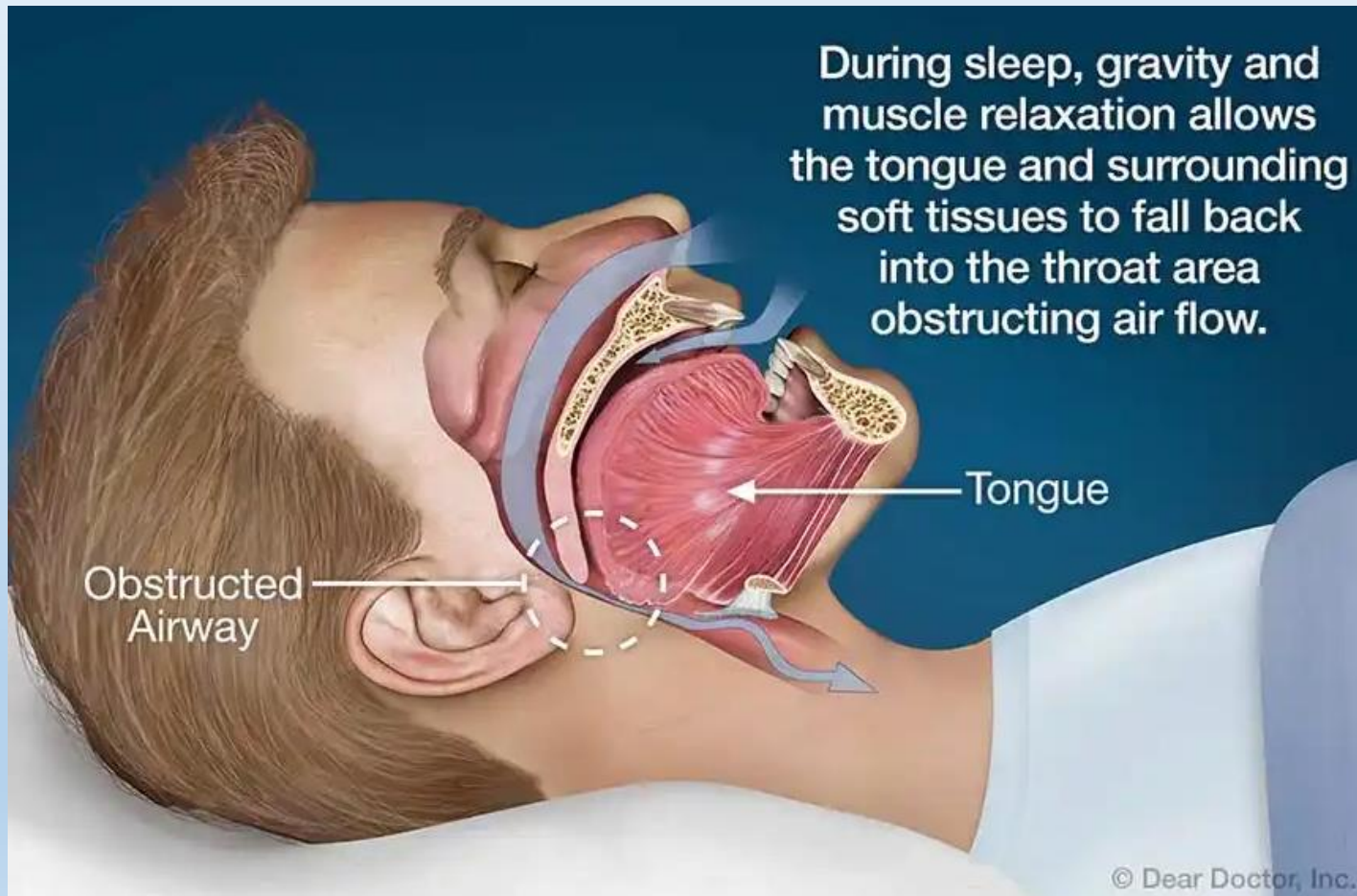
Cognitive Behavioral Therapy for Insomnia (CBTi)

- Short-term effects (2 to 4 weeks)
- Long-term effects (6 months to 2 years)
- Minimal side effects
- Continue to use skills once treatment is complete
- Equally and more effective than pharmacological treatment

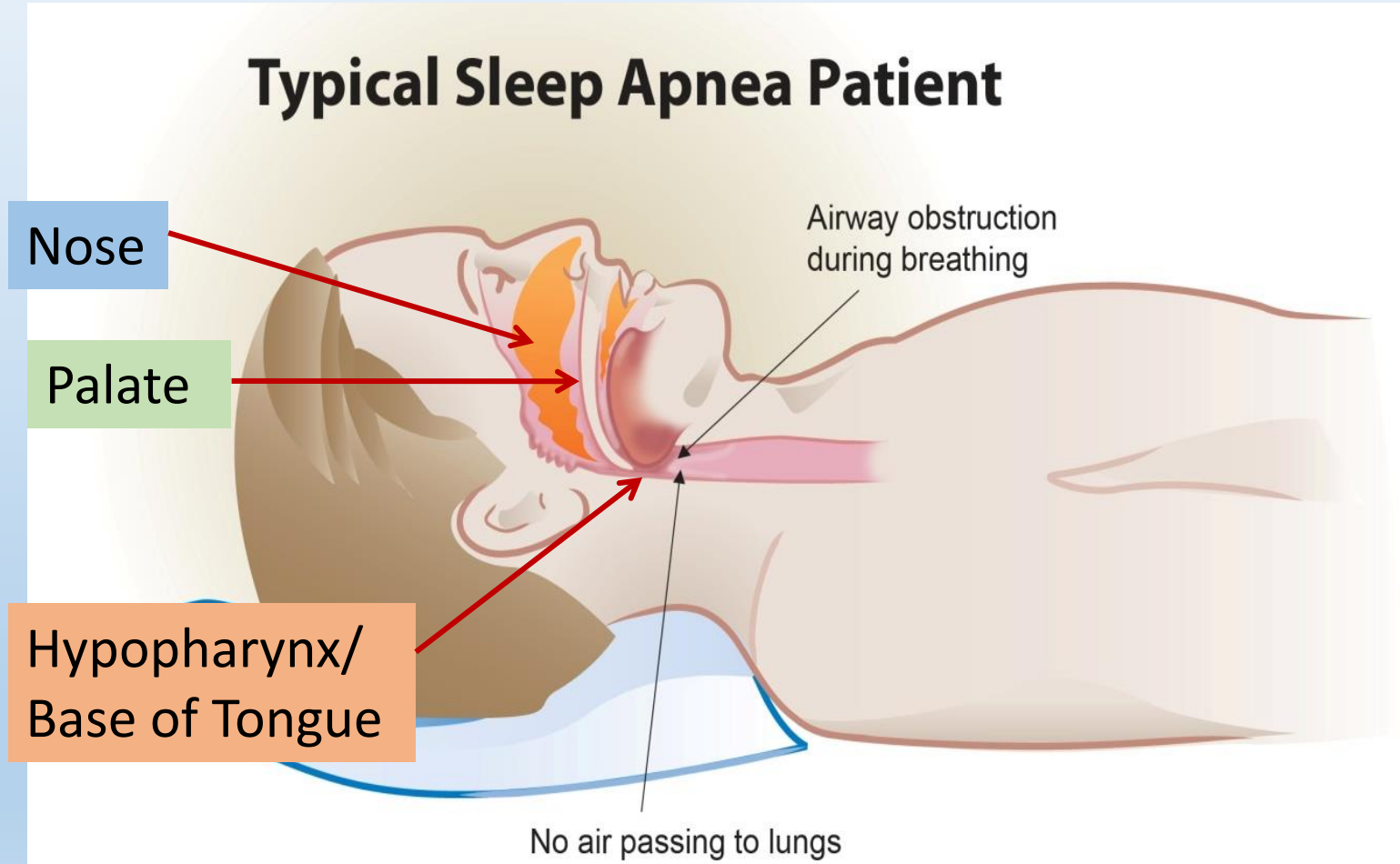
Components of CBTI

- Sleep restriction
- Stimulus control
- Time monitoring behavior
- Sleep education/practices
- Cognitive therapy
- Relaxation therapy

Obstructive sleep apnea



Sites / Levels of obstruction in OSA



Features Suggesting Obstructive Sleep Apnea (OSA)

- Loud snoring
- Witnessed pauses in breathing or gasping
- Obesity (body mass index > 30)
- Neck size > 17 inches males or > 16 inches females
- Excessive daytime somnolence (sleepiness)
- High blood pressure, irregular heart rhythm

Other Symptoms of OSA

- Morning headaches
- Impotence
- Decreased concentration, memory
- Nocturia
- Dry, sore mouth
- Insomnia

Positive Airway Pressure

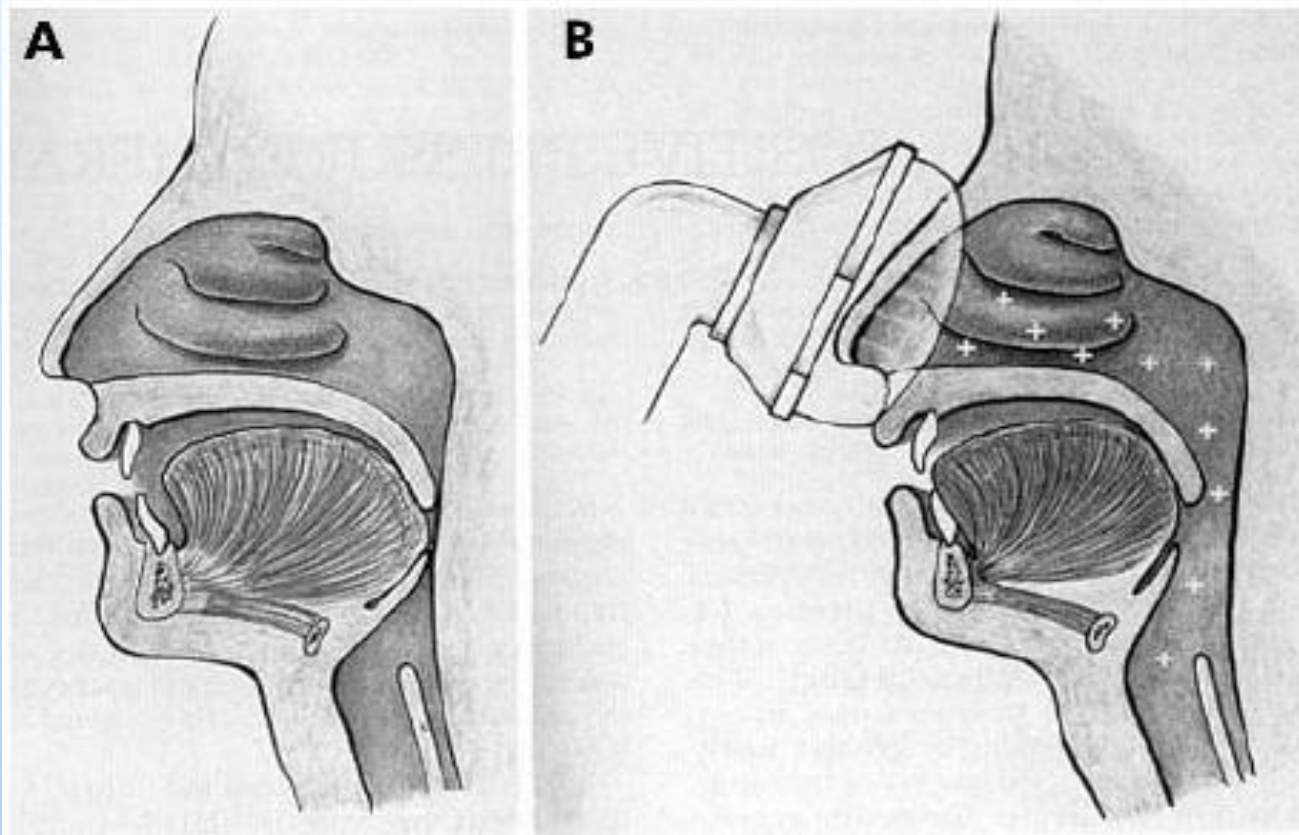


Figure 1 Mechanism by which positive pressure stents open the upper airway. Note the closure of the oropharynx by the soft palate, reducing air leak through the mouth. Reprinted with permission from the slide set of the American Academy of Sleep Medicine.



A Few Rules to Sleep Better

1. Avoid bright light 1 hour prior to sleep, to include TV/phones/tablets.
2. Reduce your time in bed (TIB) to match your sleep time + 30 minutes.
3. If not sleeping, get out of bed, do something relaxing.
4. Don't go to bed unless you are sleepy.
5. Don't stay in bed unless you are asleep.
6. Wake up at the same time every day, no matter how much sleep you got the night before.
7. Do not look at a clock at night. Make sure you have to leave your bed to turn off the alarm.

You don't choose sleep.
Sleep chooses you.