

SLEEP SCIENCE: WHAT A SNOOZE!

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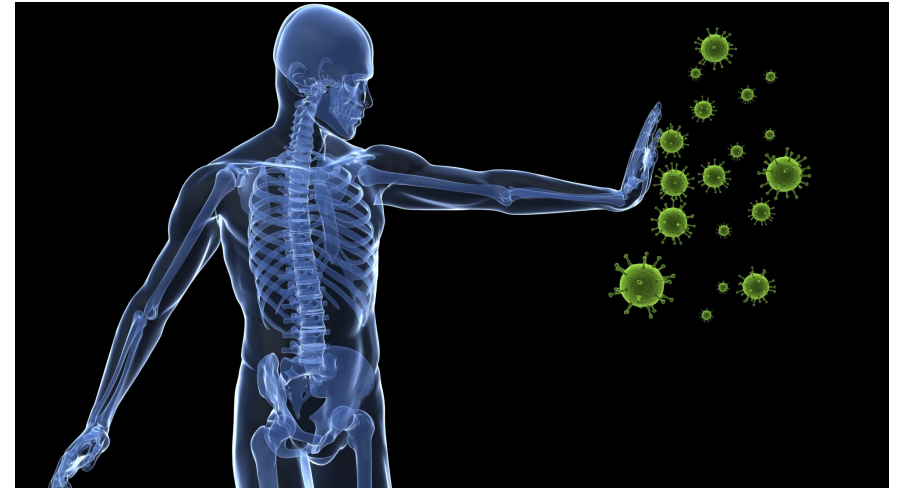
SLEEP AND THE IMMUNE SYSTEM

Annissa Furr, PhD



IMMUNE SYSTEM

The human immune system is a complex network of organs, cells, chemicals, proteins, and other components that defend you from getting infections.



WHAT DOES
THE IMMUNE
SYSTEM DO
WHILE YOU
ARE
SLEEPING?

- Sleep and the immune system are tightly connected
- Cytokines are produced and released during sleep (some ONLY during sleep)
- Cytokines are proteins that mount a defense against infectious agents
- Cytokines and other chemicals also influence the endocrine system



SLEEP DEPRIVATION

According to the CDC...

“Adults need 7 or more hours of sleep per night for the best health and wellbeing.¹ Short sleep duration is defined as less than 7 hours of sleep per 24-hour period”



HOW MANY
HOURS (ON
AVERAGE) DO
YOU SLEEP
EACH NIGHT?



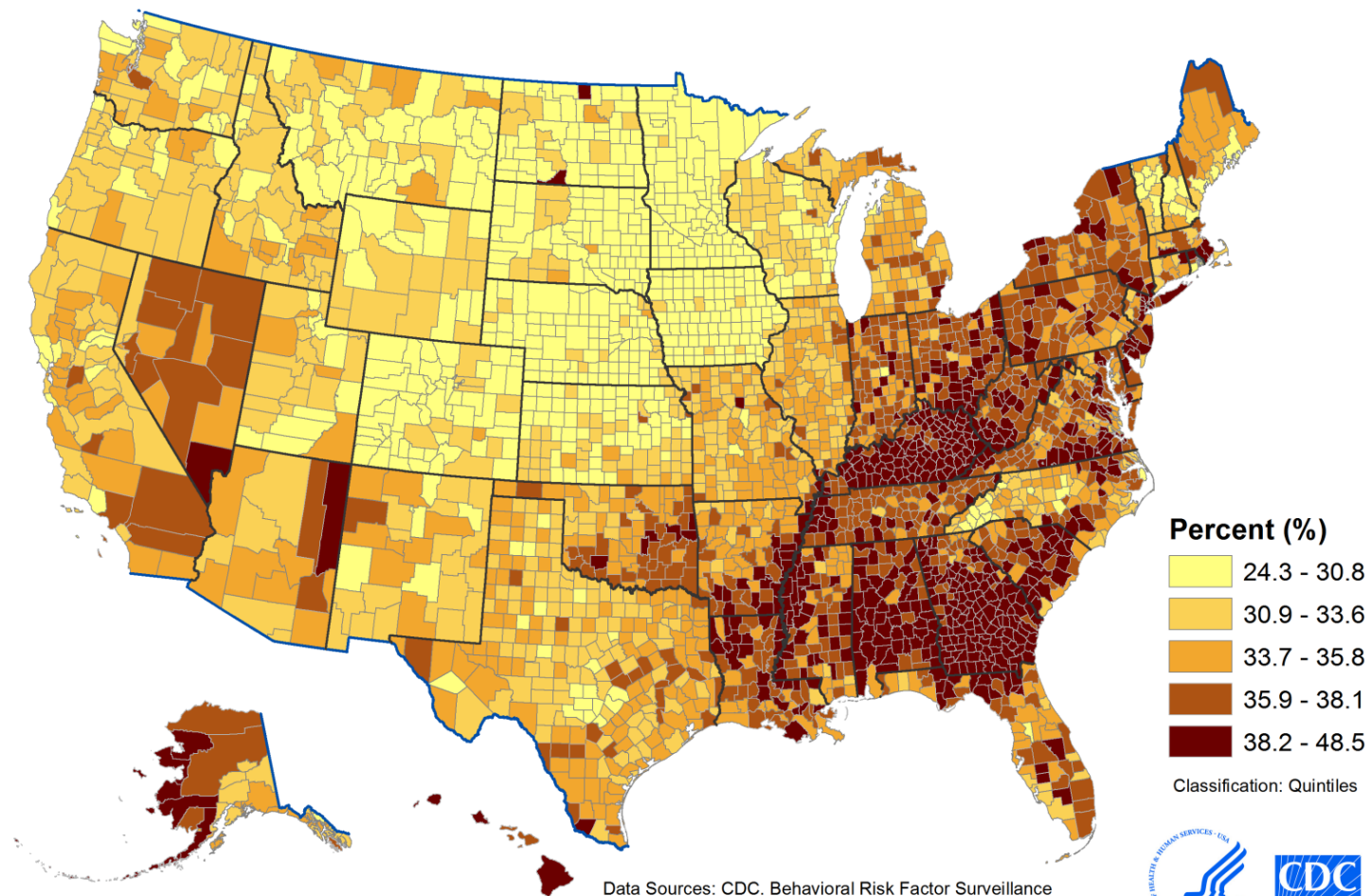
AVERAGE HOURS OF SLEEP PER NIGHT IN THE U.S.



HOW DOES BEING A PARENT AFFECT SLEEP?

No. of children	Average hours sleep per year	Average hours lost compared to none parents
5	2,281	(Surplus of 44)
4	2,226	99 hours lost
3	2,317	8 hours lost
2	2,306	19 hours lost
1	2,270	55 hours lost
0	2,325	

Image credit: <https://www.chemist-4-u.com/sleep-study/>



Data Sources: CDC Behavioral Risk Factor Surveillance System 2014, Census 2010, ACS 2010-2014

Method from Zhang X et al. Am J Epidemiol 2014;179 (8):1025-1033



Date: 6/1/2016

PREVALENCE OF
SHORT SLEEP
DURATION (<7
HOURS) FOR
ADULTS AGED ≥
18 YEARS, BY
COUNTY,
UNITED STATES,
2014

EFFECTS OF
SLEEP
DEPRIVATION
ON IMMUNE
FUNCTION

- Sleep deprivation seems to impact the migration of almost all white blood cells (WBCs)
- Migration slows, and the number of WBCs circulating is reduced
- Natural Killer (NK) cell activity significantly reduced

EFFECTS OF
SLEEP
DEPRIVATION
ON IMMUNE
FUNCTION

- B and T cell proliferation slows down
- Cell adhesion molecules are increased:
 - **Intracellular adhesion molecule (ICAM) -1** is increased, which increases vascular permeability. Could lead to atherosclerosis.
 - **E-selectin** plays a role in tumor adhesion to tissue, cardiovascular disease

PRO-INFLAMMATORY CHEMICAL INCREASE AFTER SLEEP DEPRIVATION

- IL-1 , IL-6*, IL-17, TNF- α increase after sleep deprivation- all are pro-inflammatory immune system chemicals
- Can lead to chronic inflammation and related to formation of cancer, autoimmune disease, neurodegenerative diseases

*IL-6 is the hallmark inflammation cytokine

SLEEP DEPRIVATION AND IMMUNOLOGICAL MEMORY RESPONSE

- The immune system has a complicated memory system that offers protection from reinfection
- Sleep deprivation impairs the development of the memory response- specifically the formation of NEW memory developments
- This can impact the effectiveness of vaccines

RESTORING THE SLEEP CYCLE

Neurological function decrease from sleep deprivation can take 5+ days to recover

Immune system recovery appears to be much shorter.

8 hours sleep following deprivation returned most levels to normal

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MELATONIN

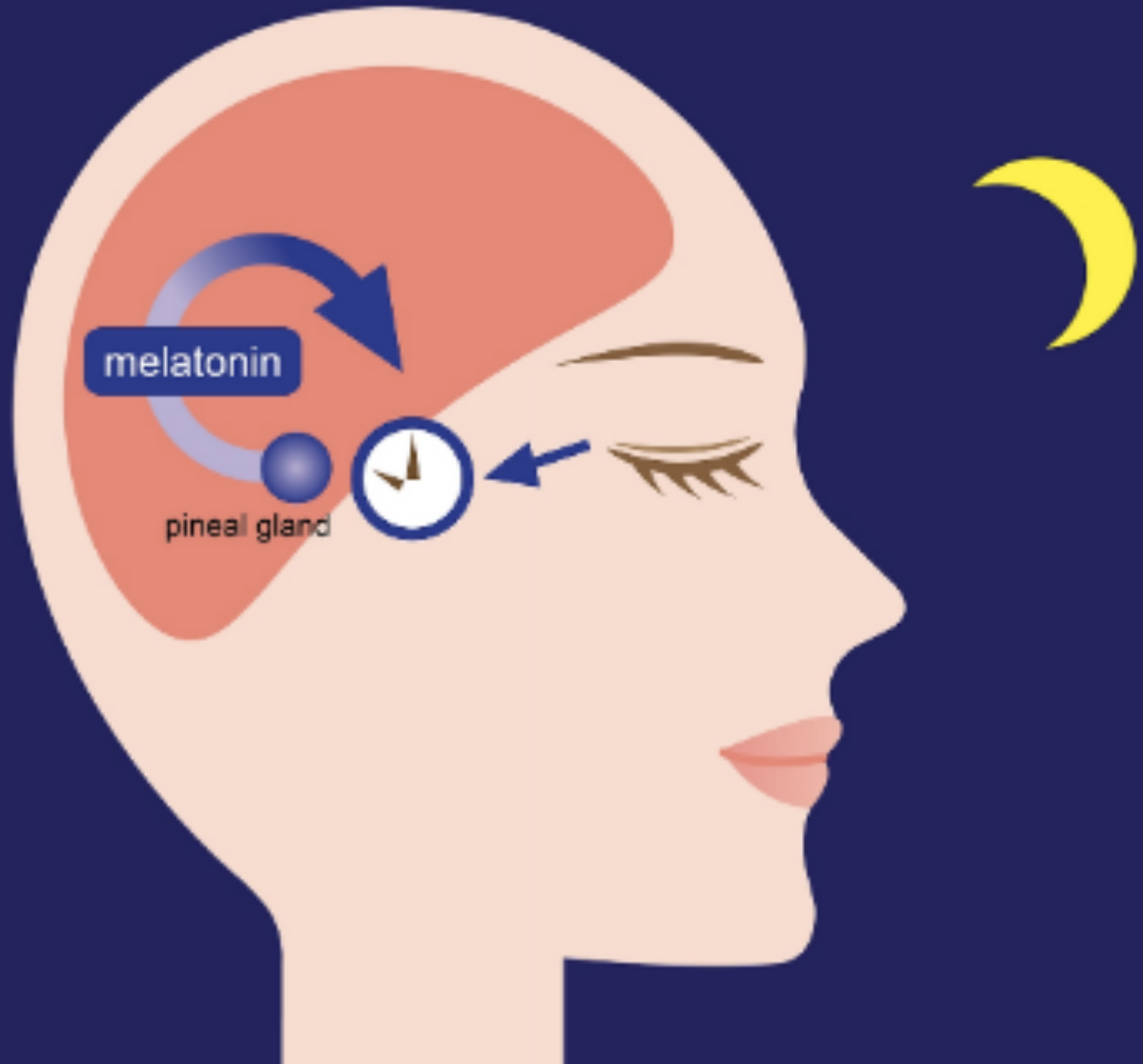
Tyra Hall-Pogar, PhD

DOES
MELATONIN
HELP YOU
GO TO
SLEEP?

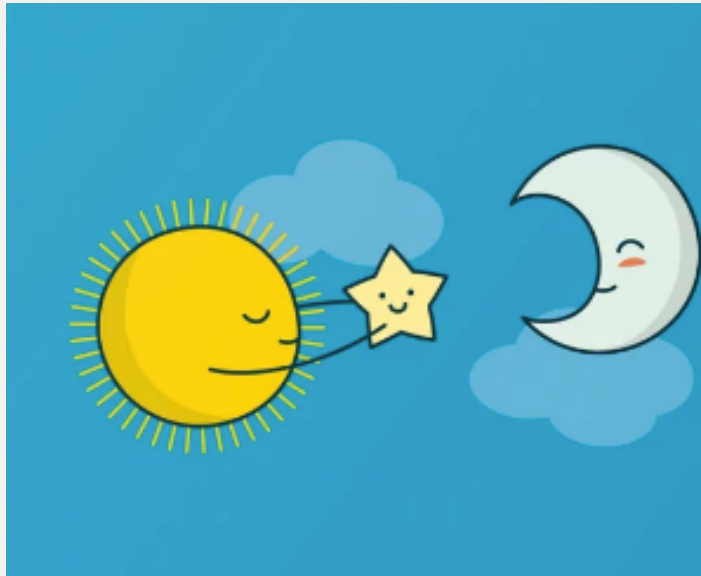
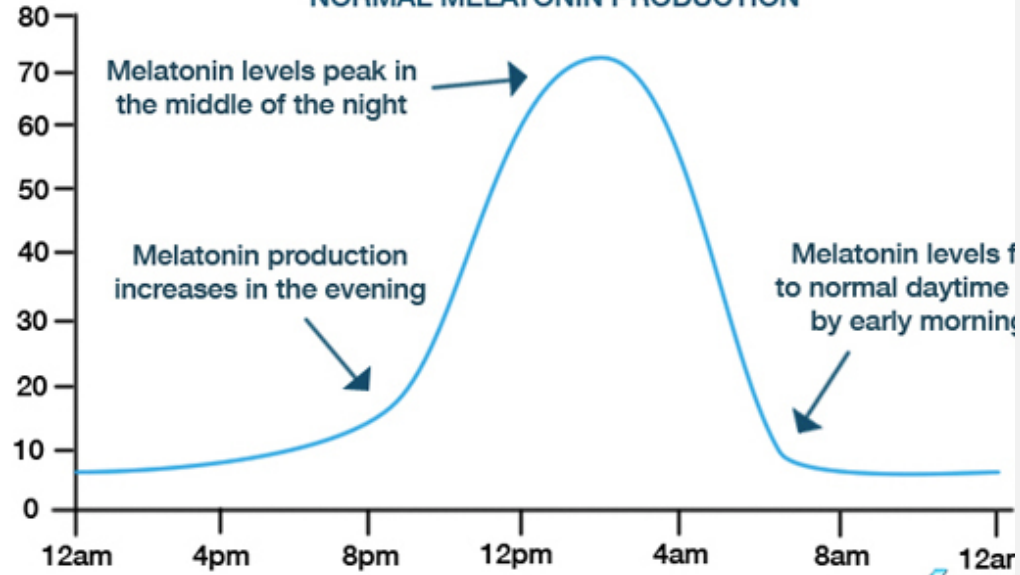


HOW DOES IT WORK?

- Melatonin supplementation has been increasingly seen as an effective solution to help with occasional sleeplessness.



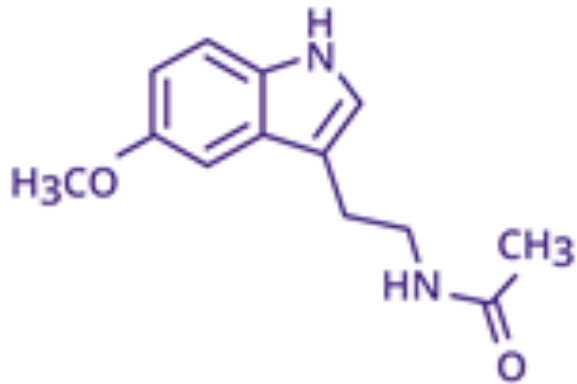
NORMAL MELATONIN PRODUCTION



SLEEP TIPS

- Since light stops melatonin production
 - Think about making your sleeping space dark and limiting your exposure to electronics and other bright lights before bedtime
- If you wake up feeling drowsy, open your curtains to let the sunlight in.
 - This will help stop your normal melatonin production?

CHEMICAL STRUCTURE OF MELATONIN



- Naturally produced by the pineal gland
- Commonly known as the “sleep hormone”
- Some foods like tart cherries and walnuts have low levels of melatonin

STAGES OF SLEEP

The 4 Stages of Sleep



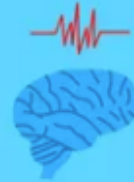
NREM Stage 1

- transition period between wakefulness and sleep
- lasts around 5 to 10 minutes



NREM Stage 3

- muscles relax
- blood pressure and breathing rate drop
- deepest sleep occurs



NREM Stage 2

- body temperature drops and heart rate begins to slow
- brain begins to produce sleep spindles
- lasts approximately 20 minutes

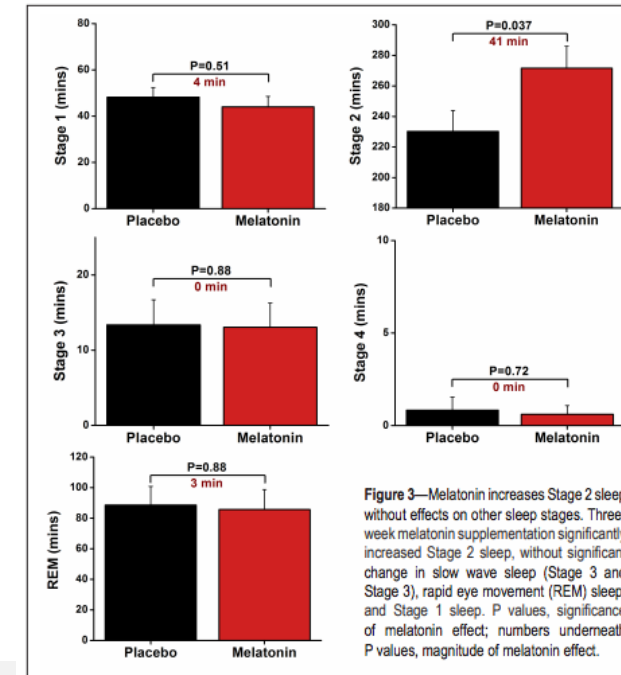
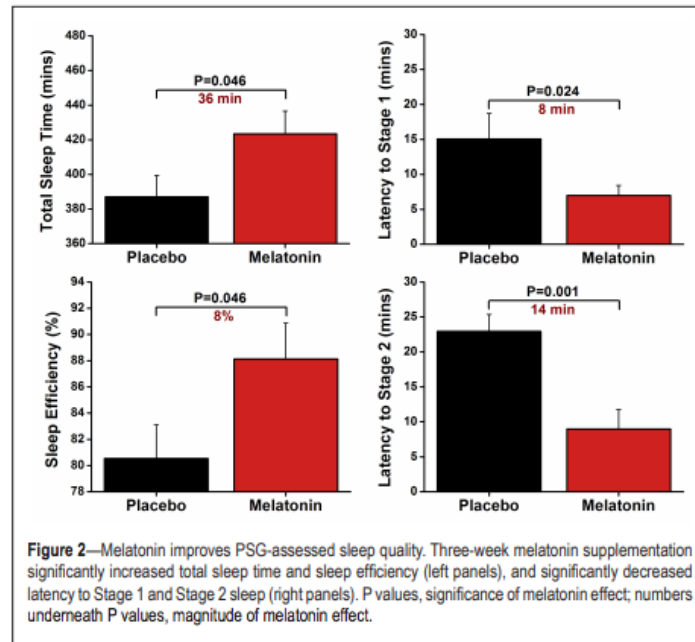


REM Sleep

- brain becomes more active
- body becomes relaxed and immobilized
- dreams occur
- eyes move rapidly

Repeated Melatonin Supplementation Improves Sleep in Hypertensive Patients Treated with Beta-Blockers: A Randomized Controlled Trial

Frank A.J.L. Scheer, PhD^{1,2}; Christopher J. Morris, PhD^{1,2}; Joanna I. Garcia, BA¹; Carolina Smales, BSc¹; Erin E. Kelly, MSc¹; Jenny Marks, MPH¹; Atul Malhotra, MD^{1,2}; Steven A. Shea, PhD^{1,2,3}



BUT DOES IT WORK?

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SLEEP HYGIENE

Amy Smith, Professor





BEDTIME ROUTINE

- Take a bath – the rise, then fall of body temperature can cause drowsiness
- Get into pajamas
- Do something relaxing
- Turn down the lights
- Avoid stressful activities
- If you tend to take your problems to bed, try writing them down or making a list for the next day
- Avoid too many liquids before bed

SLEEP ENVIRONMENT

- Create a restful bedroom
- A dark, cool room is most conducive to sleep (60-75°F)
- Remove electronics
- If possible, avoid other activities in the bedroom such as work
- Eliminate clutter
- Keep pets out if they wake you in the night
- Comfortable pillows, mattress, and linens





STEADY SCHEDULE

- Consistent sleep schedule, even on weekends
- Set your internal clock
- Avoid clock watching at night

SLEEP HYGIENE

Bedtime routine

Sleep environment

Steady schedule

Exercise

Food and caffeine

Amount of sleep

Bed is for sleep

Get up and try again

Avoid naps

Don't watch the clock

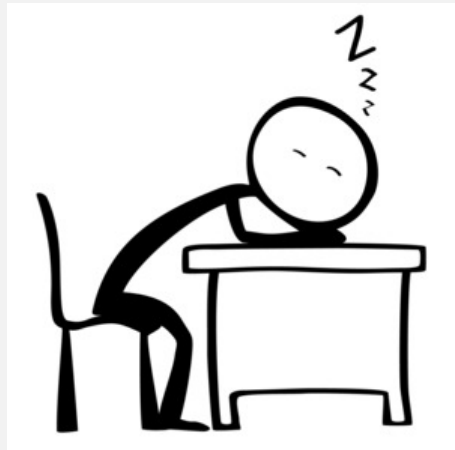
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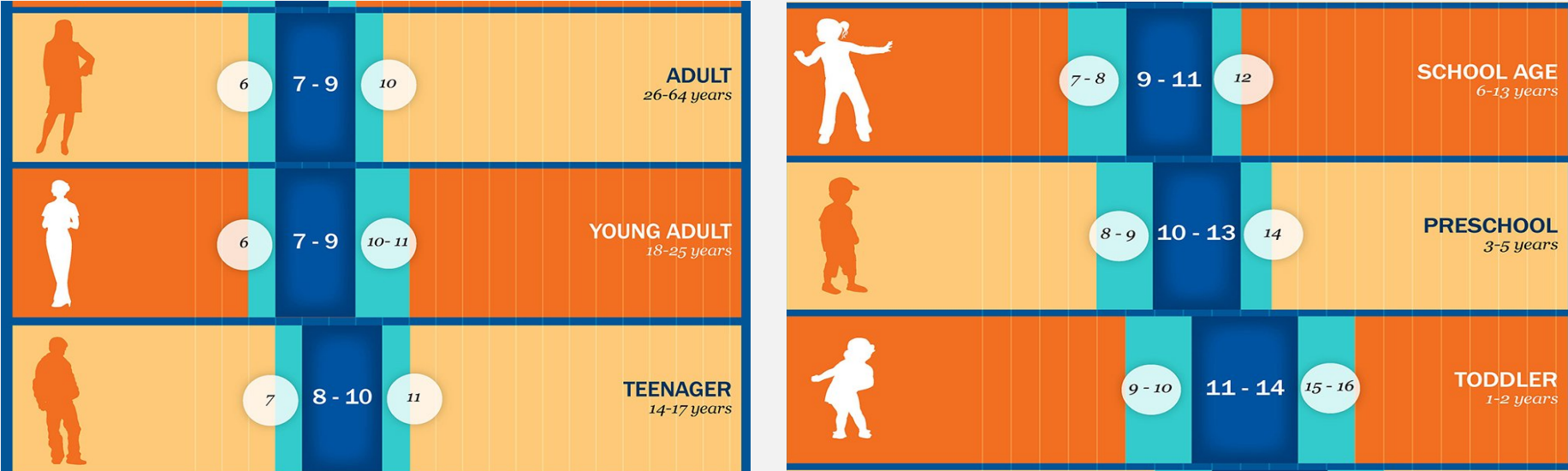


School Start Times and Sleep in Teens

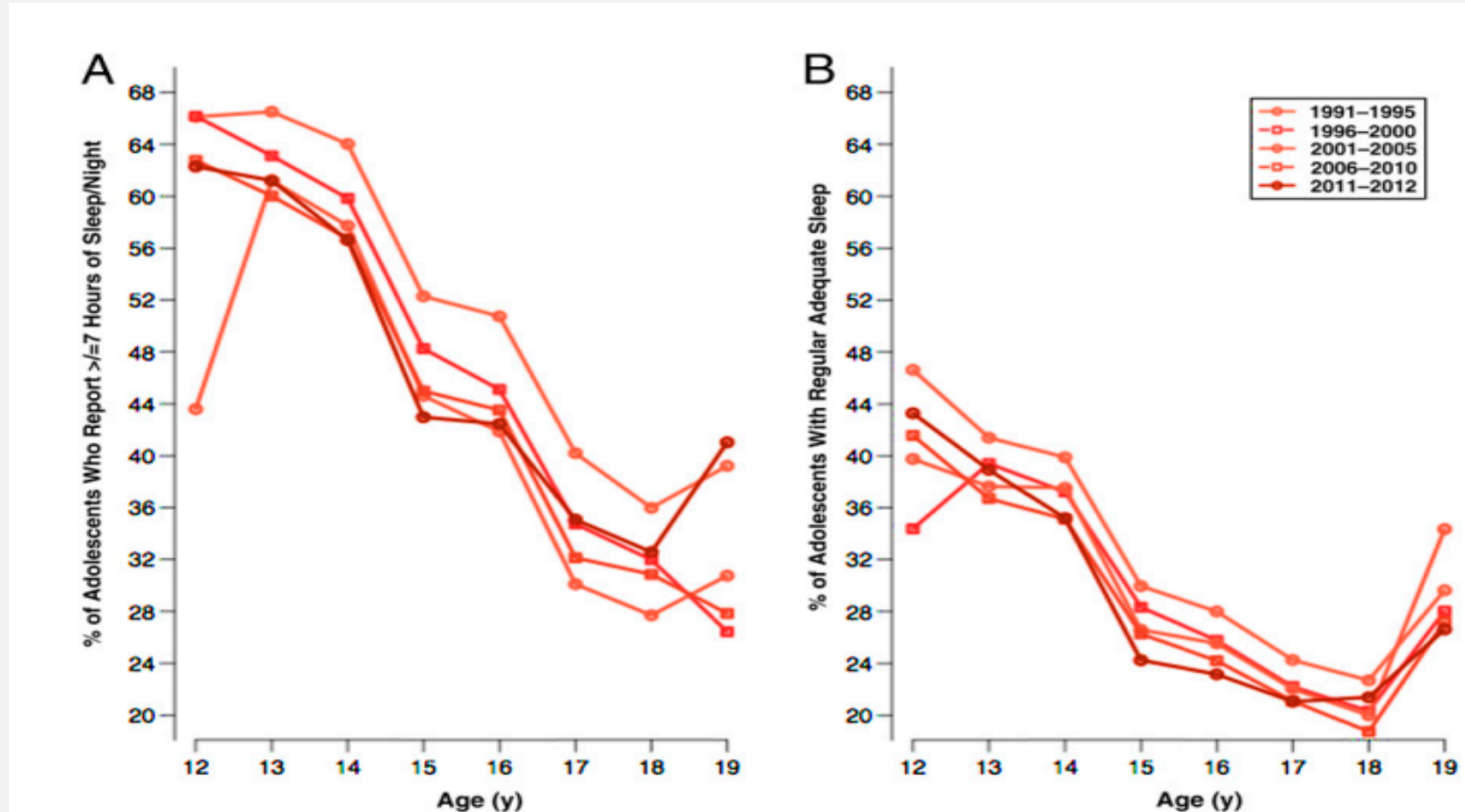
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RECOMMENDED HOURS OF SLEEP

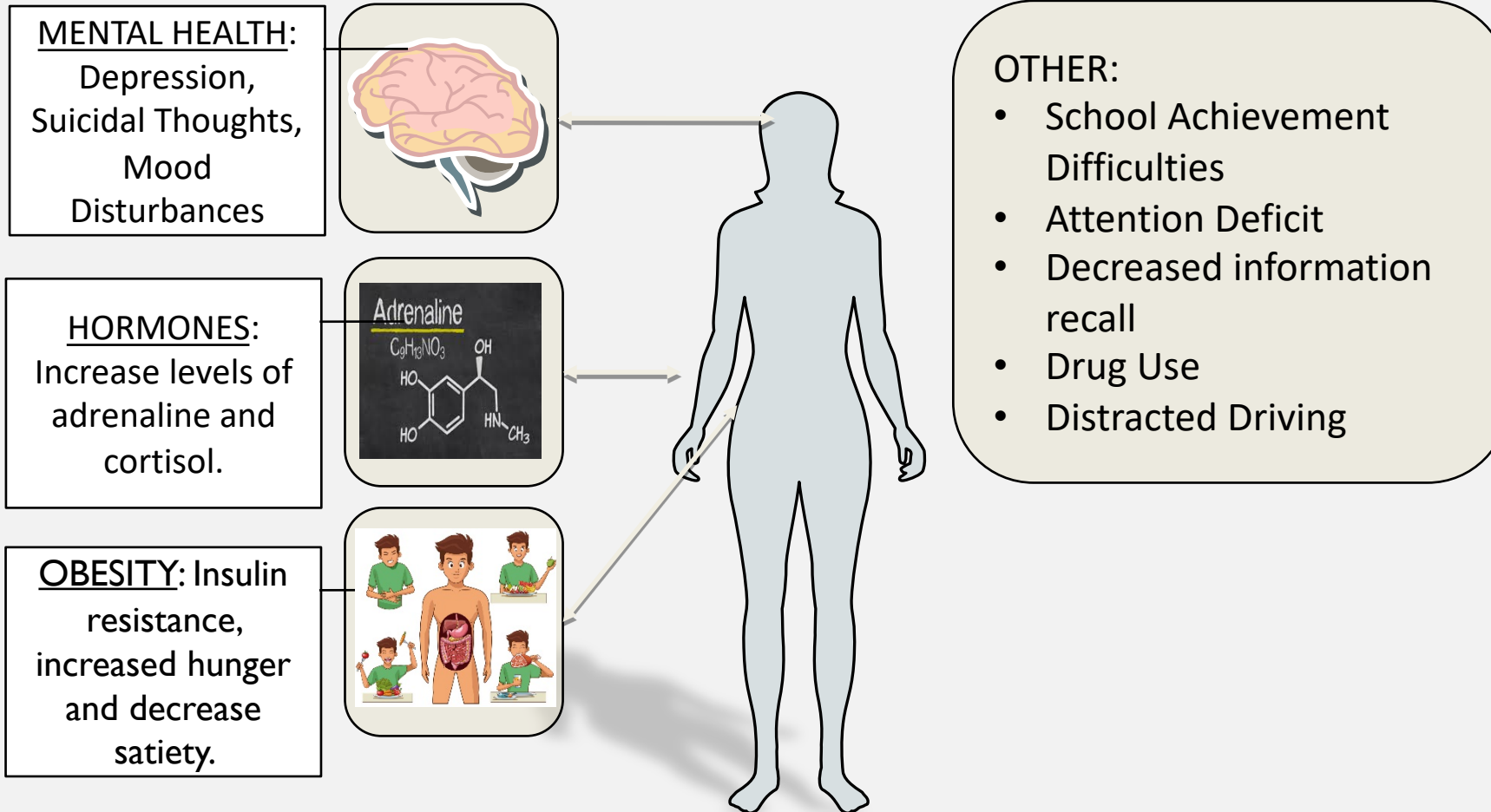


IS SLEEP DEPRIVATION A PROBLEM?



Keyes, K. M., Maslowsky, J., Hamilton, A., & Schulenberg, J. (2015). The Great Sleep Recession: Changes in Sleep Duration Among US Adolescents, 1991–2012. *Pediatrics*, 135(3), 460–468. doi: 10.1542/peds.2014-2707

IMPACT OF SLEEP DEPRIVATION IN TEENS



SOLUTIONS

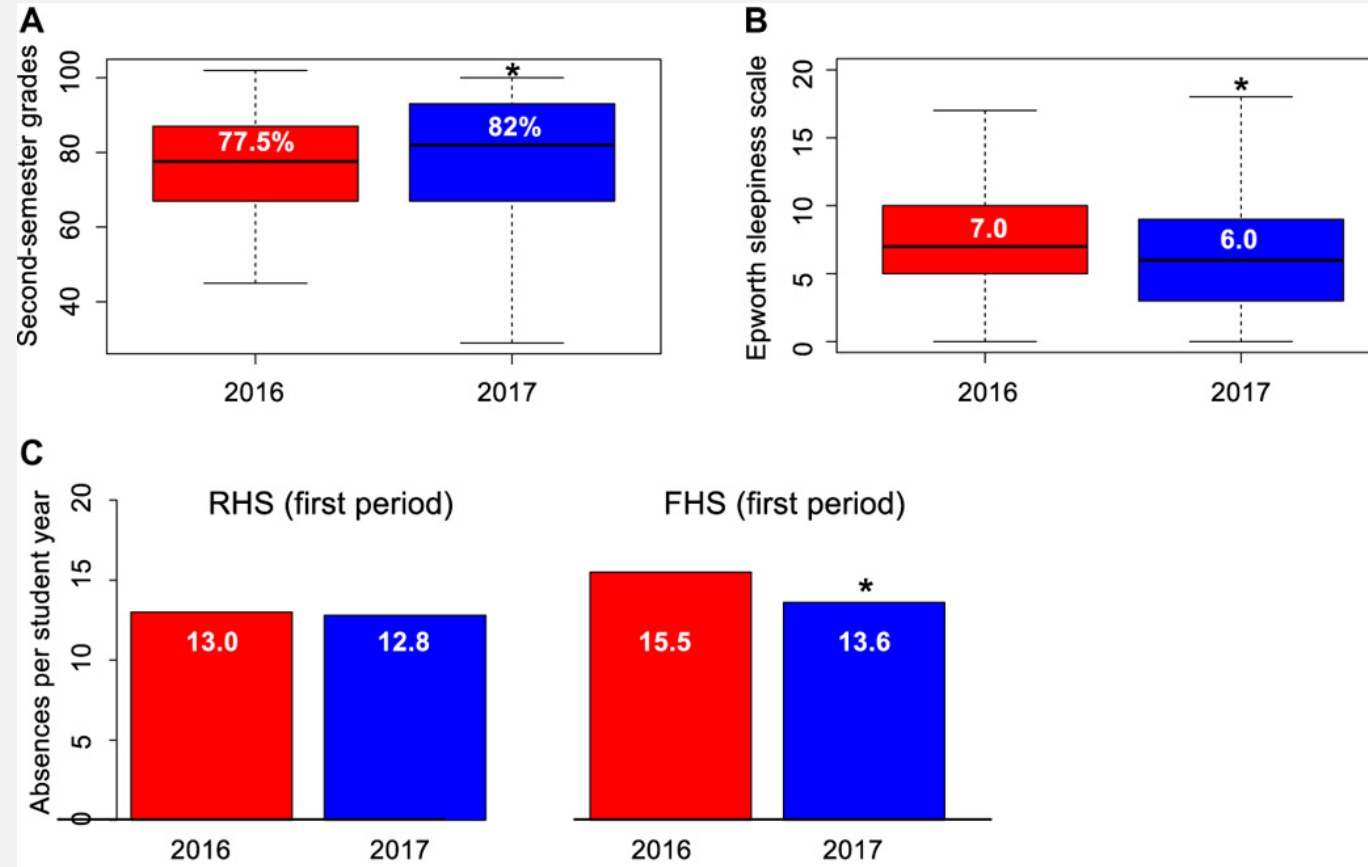


- 1 Discuss Importance of Sleep
- 2 Leverage the Power of the body
- 3 Beware of medical conditions
- 4 Create a sleep-promoting environment
- 5 Take Advantage of technology
- 6 Advocate for later school starting times

POLL

- What is your high school or middle school start time?
- What is the average start time for public schools in the U.S.?
 - A. 7:30 AM
 - B. 7:50 AM
 - C. 8:10 AM
 - D. 9:00 AM

SLEEPMORE SEATTLE: THE RESULTS

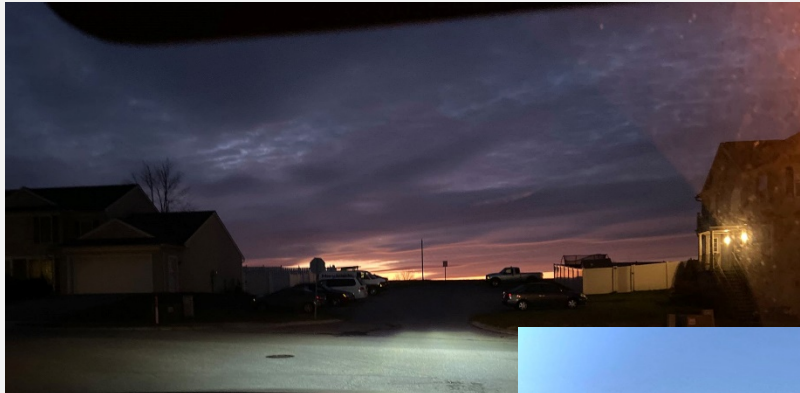


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In the meantime...

Lower Merion wants elementary school students to start earlier, and high schoolers to arrive later. Some parents aren't happy

by Maddie Hanna | Updated: December 13, 2019



OPINION

Wake up, Pennsylvania: Teens need more sleep, later school start times | Opinion

Updated: October 21, 2019 - 11:18 AM

EDUCATION

No more buses in the dark. Miami-Dade schools could start no earlier than 8 a.m.



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