

# Sleep Well, Be Well Workshop

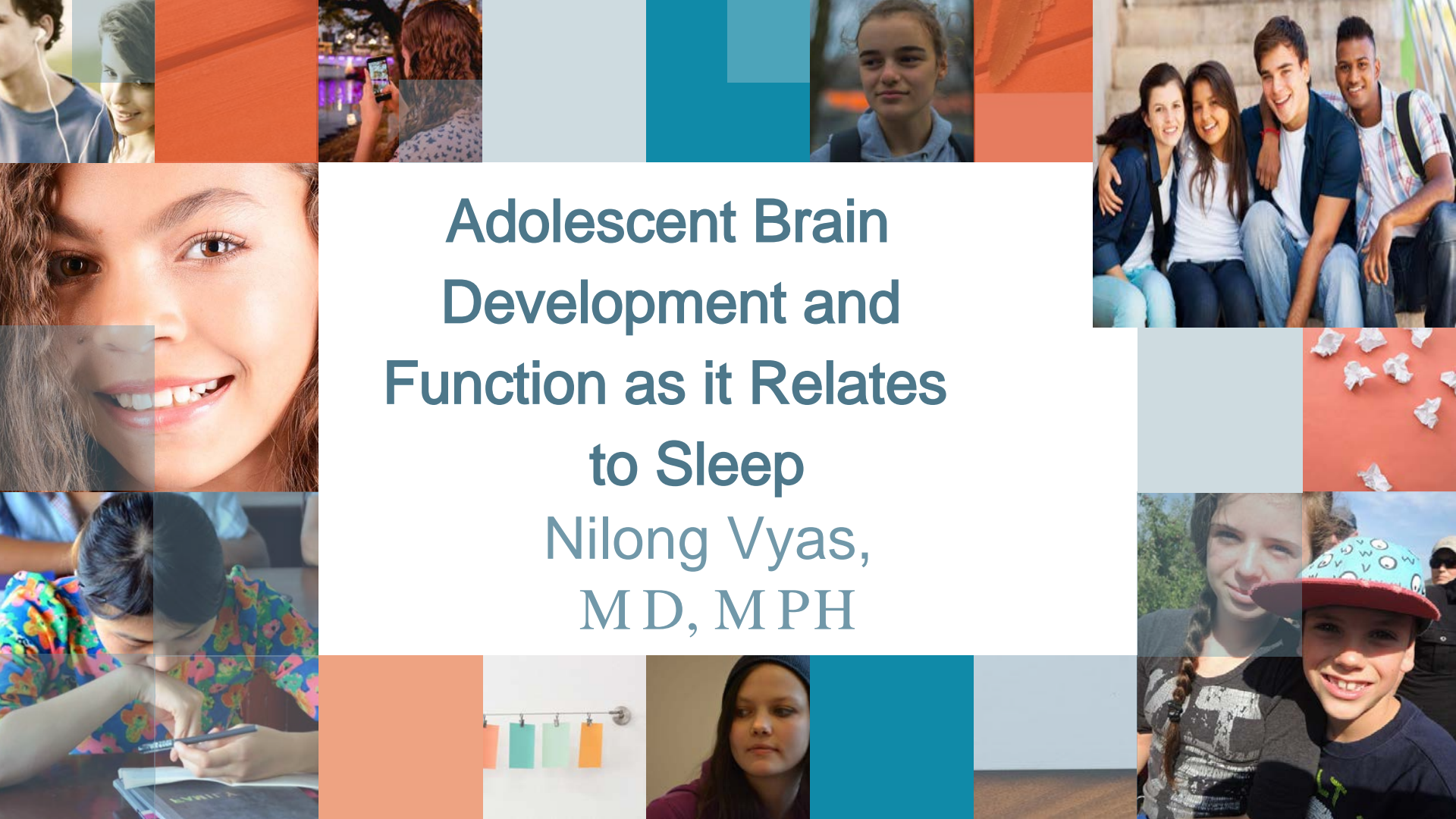
## Nilong Vyas, MD, MPH

8/15/19

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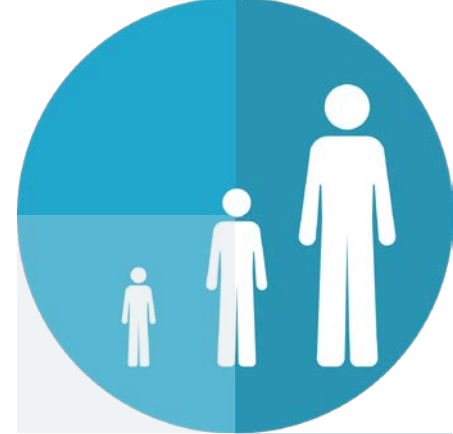


# Adolescent Brain Development and Function as it Relates to Sleep

Nilong Vyas,  
MD, MPH

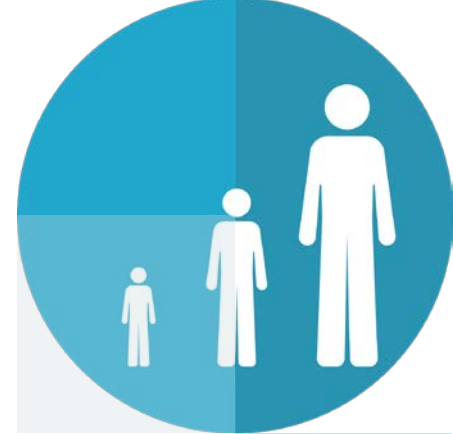
# The Purpose

- Understand the adolescent brain
- Realize the importance of sleep for the teen
- Consequences of lack of sleep
- Understand your role



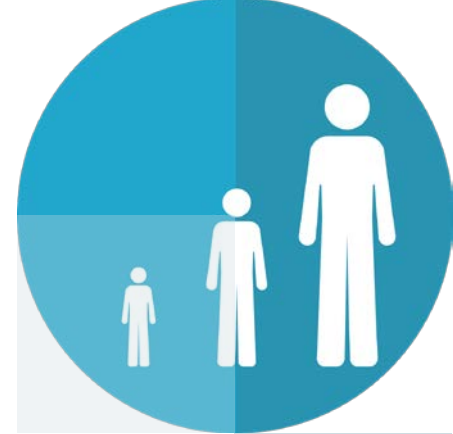
# The Problems

- Deficit in getting information to the adolescent
- Sleep on back burner
- Sleep is seen as a sign of weakness in our society
- Opportunities to educate are missed



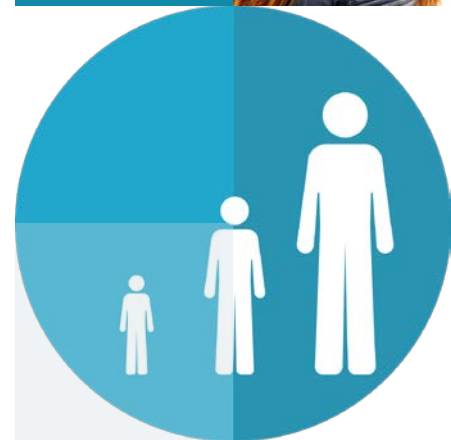
# The Solutions

- Stress sleep importance
- Understand the adolescent brain and sleep's role in development
- Shift the dialogue and behavior



# Learner Outcomes

- Ascertain child's sleep quality
- Tips
  - Families
  - Your practice
  - Teens
- Importance of sleep for the adolescent developing brain



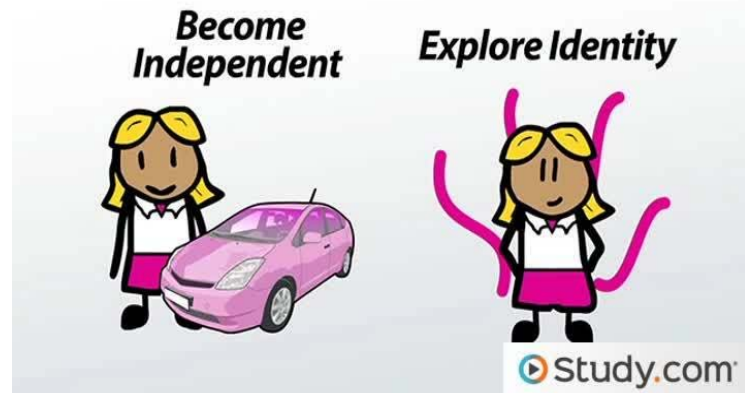
# What is happening in the adolescent brain?

Understanding the Adolescent Brain



# Understanding the Adolescent Brain

- 12-18 years
- Transition from childhood to adulthood
  - Solve problems and make decisions
- Confused and insecure
- Seeking to establish a sense of self
  - Experimentation
- Developing true identity





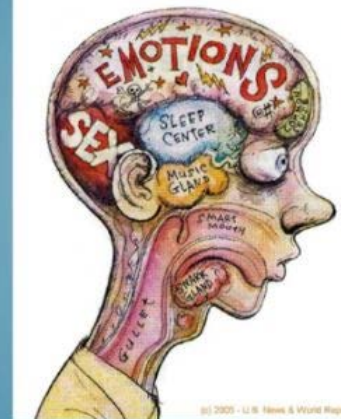
# Understanding the Adolescent Brain

- Immense hormonal and physical changes
- Suboptimal decision -making capabilities
- Immature impulse control
- Heightened response to incentives



# Understanding the Adolescent Brain

- Multitude of studies
  - MRI, EEG, postmortem
- Rapid changes as a result of hormonal shifts
- Role of the amygdala
  - Emotions, impulses, aggression, instinctive behavior

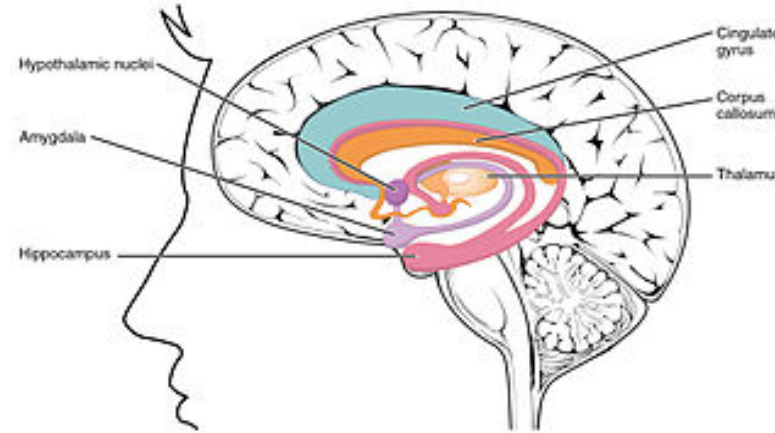


THIS IS YOUR  
BRAIN DURING  
ADOLESCENCE-  
ANY  
QUESTIONS?

Image Source: "New Narrative -  
The Teen Brain," *Aspire Parents*,  
23 Apr. 2013. Web. 2 Jan. 2014.

# Sleep and the Adolescent Brain

- The amygdala
  - The emotional center of the brain
  - Role in the mechanisms of sleep



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# What is happening in the adolescent brain during sleep and the lack of it?

Sleep and the Adolescent Brain  
Lack of Sleep and the Adolescent Brain

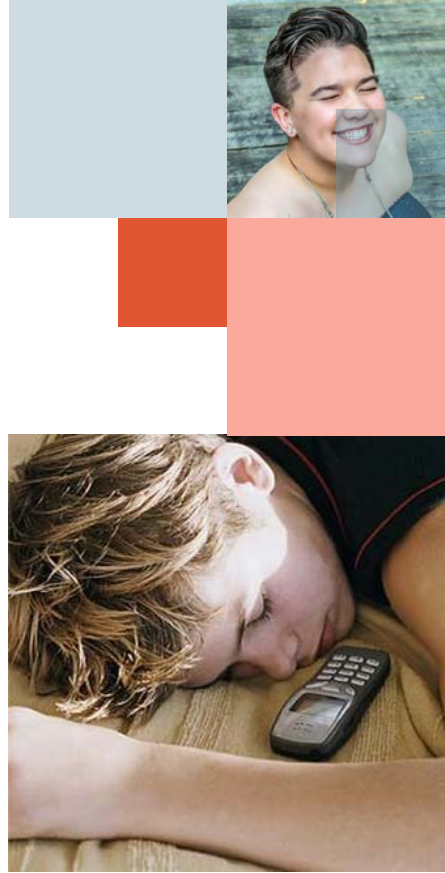
# The Facts

- 8.5-9.5 hours recommended
- Average U.S. adolescent chronically sleep -deprived
- National Sleep Foundation poll
  - <8.5 to 9.5 hours of sleep on school nights
    - 59% of middle schoolers
    - 87% of high school students



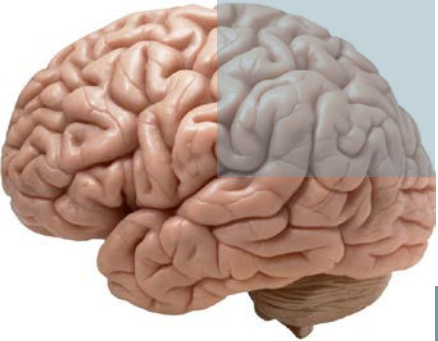
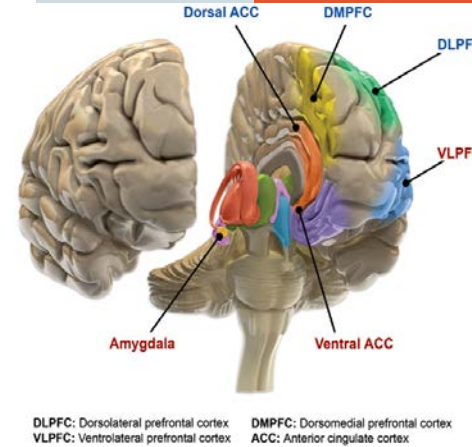
# Sleep Deprivation Causes

- Hormonal time shift
- Sleepier later
- Nightly sleep debt leads to chronic sleep deprivation secondary to school schedules



# Lack of Sleep and the Adolescent Brain

- Deficit between amygdala and vACC (ventral anterior cingulate cortex)
- Emotional issues such as depression and aggression



{6} [Maletic V, Raison C](#)

# Sleep and the Adolescent Brain

- Sleep patterns undergo marked changes
- Highly active endocrine system
  - Increased and decreased hormone secretion



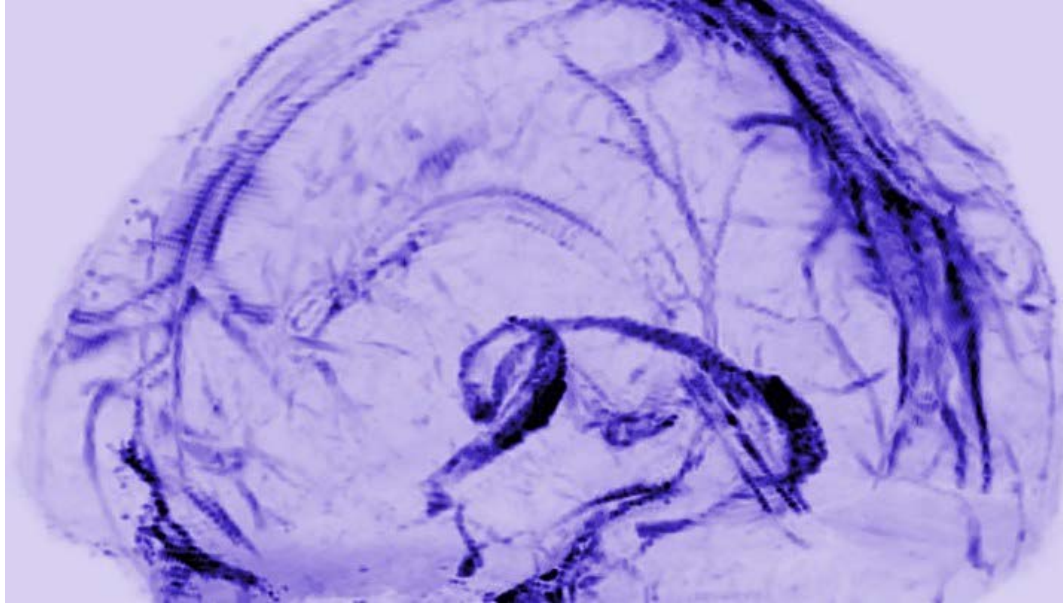


# Lack of Sleep and the Adolescent Brain

- Erratic sleep deregulates hormonal system
- Morbidity
  - Obesity
  - Depression
  - Anxiety
  - Headaches
- Mortality
  - Suicide
  - Accidents



# Sleep and the Adolescent Brain



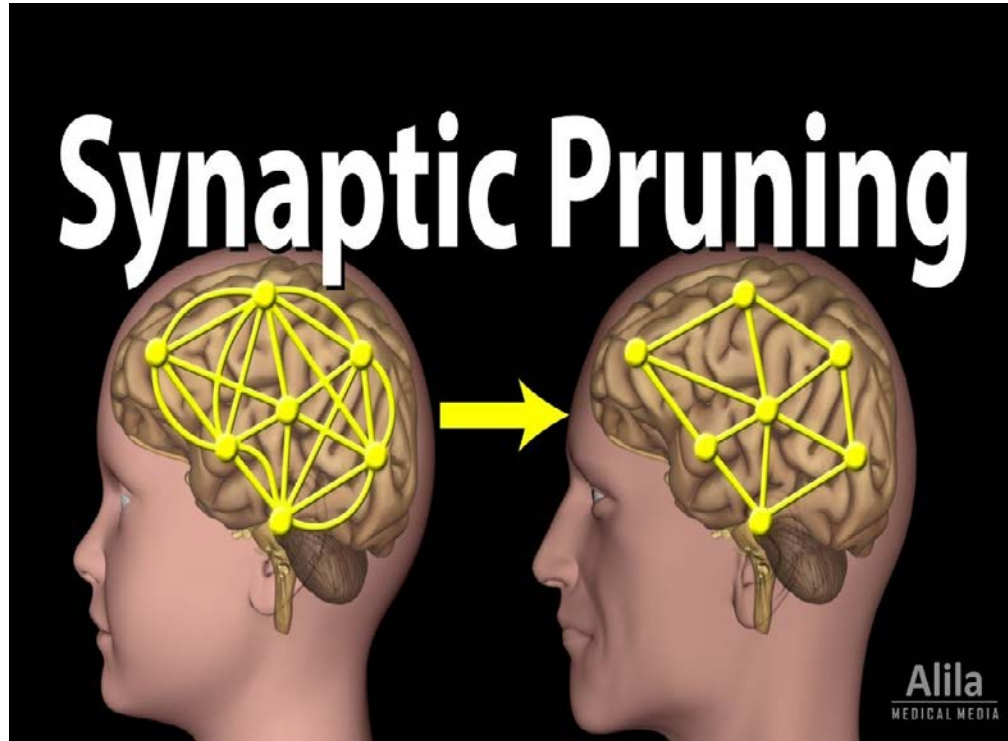
{3} MICHAEL MORGENSTERN

# Sleep and the Adolescent Brain



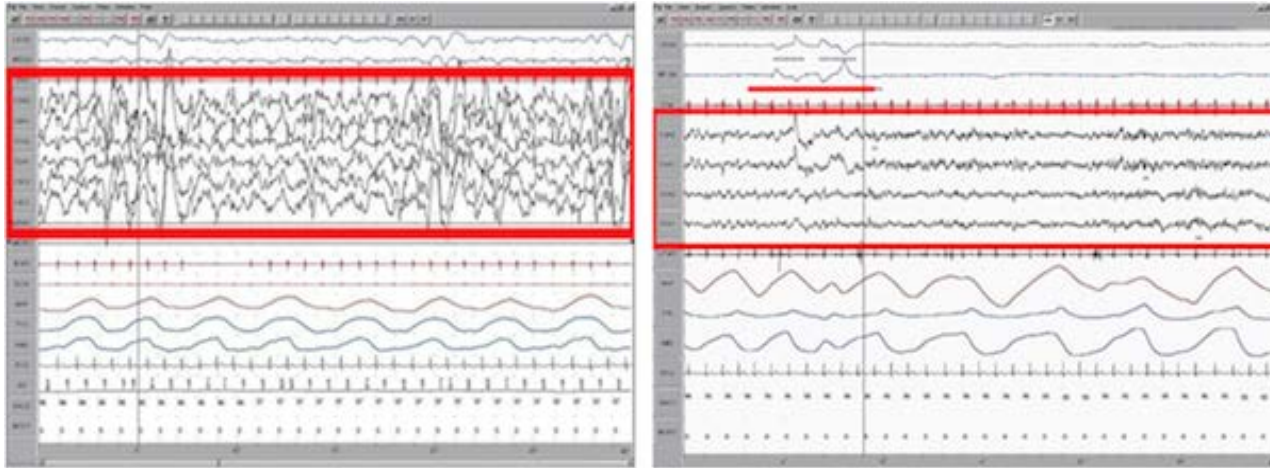
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# Sleep and the Adolescent Brain



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# Sleep and the Adolescent Brain

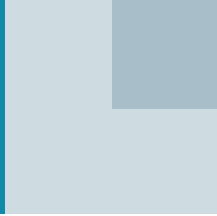


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# What role does lack of sleep play in the adolescent brain?

Lack of Sleep and the Adolescent Brain  
The Effects of Sleep Deprivation



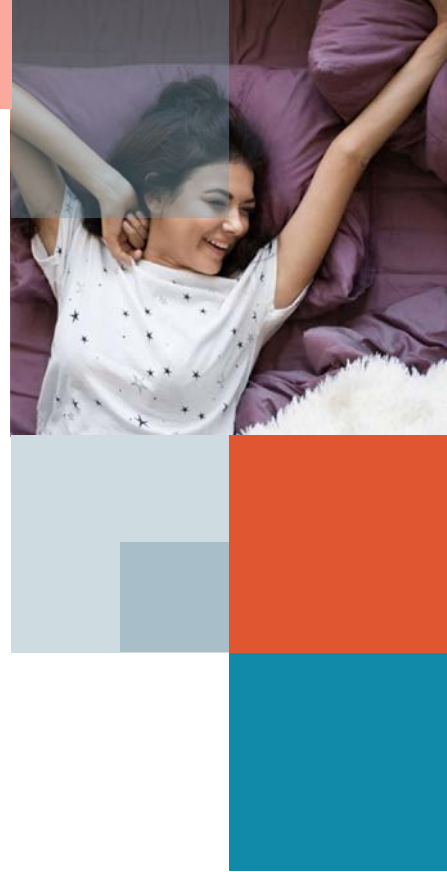
# Lack of Sleep and the Adolescent Brain

- 3,000 students, 8th and 10th grades, aged 12 -16
  - Sleep deprivation: 18.9%
  - Sleep problems: 37.2%
  - Difficulties initiating sleep: 25.5%
  - Reduction in health -related quality of life
  - Greater frequency of health complaints by girls



# The Effects of Sleep Deprivation

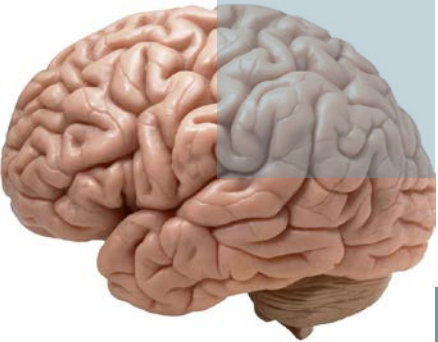
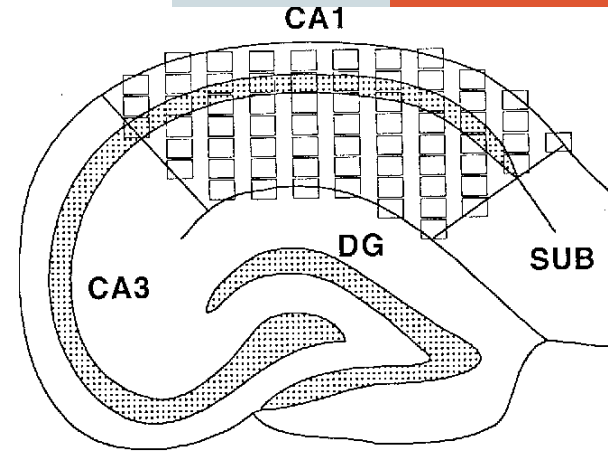
- Memory and learning deficits
- Emotional instability
- Obesity





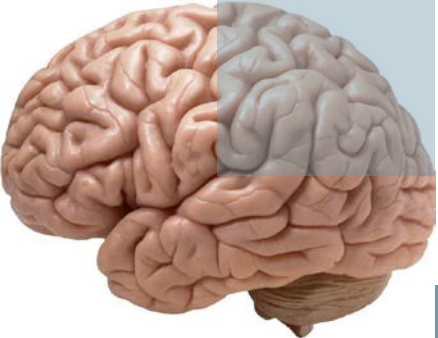
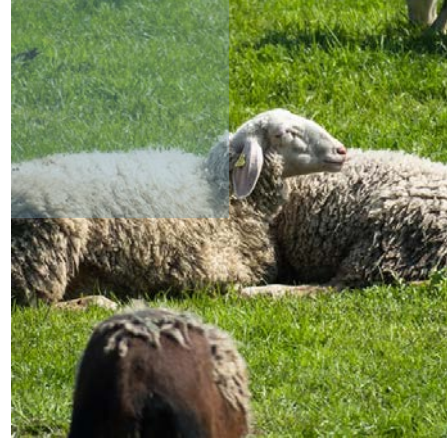
# Memory and Learning

- Interference with neuronal firing in CA1 region of hippocampus
- Inability to learn new information and form long-term memories
- Accumulation of proteins in hippocampus



# Memory and Learning

- *Journal of Neuroscience*
  - Maquet, et al.
  - Human brain demonstrates sleep - dependent plasticity
  - Subjects taught task
    - Sleep deprived
    - Allowed to sleep
      - Enhancement in brain activity for rested



# Memory and Learning

- Adequate sleep = Memory consolidation
- Insufficient sleep = Diminished memory formation process, impaired retrieval of memories



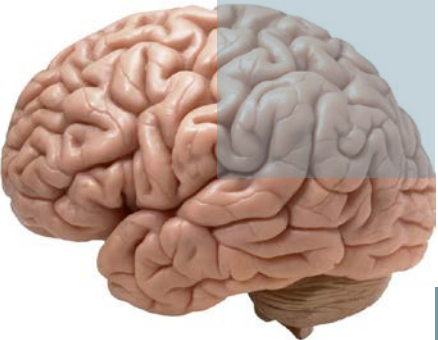
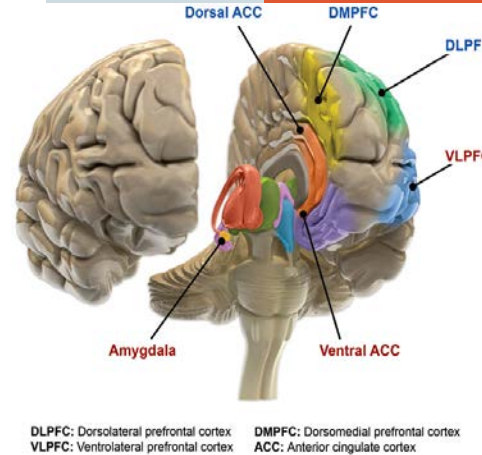
# Memory and Learning

- Concentration difficulties
- Shortened attention span
- Memory impairment
- Reduced academic performance
- Increased sick days secondary to tiredness



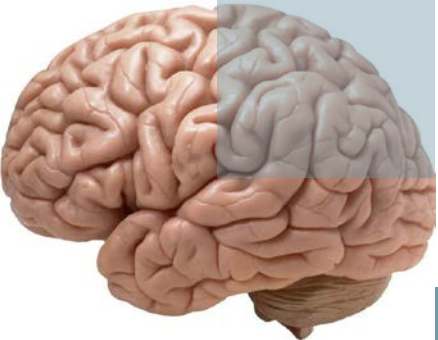
# Emotional Instability

- Ability of the dorsal medial prefrontal cortex (DMPFC) reduced
- Emotional instability



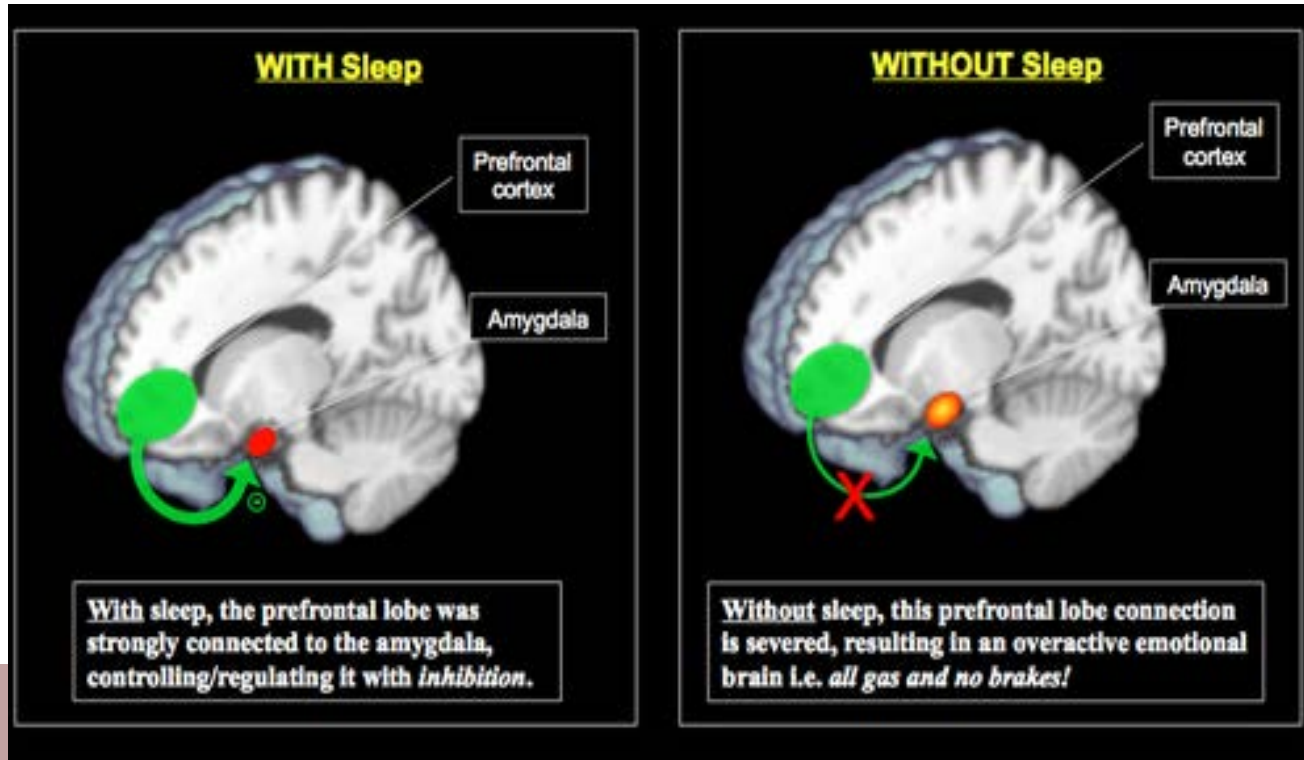
# Emotional Instability

- Bauducco et al. study, *Sleep Health Journal*
  - Sample: 2,767 students between 12-16 years of age
  - Less-than-recommended sleep time experienced “norm-breaking behavior”
  - Breaking social norms are expected for a certain age group





# Emotional Instability



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# Emotional Instability

- Brain 'short circuits'
- Comorbidities become more evident
  - depression, anxiety, ADHD

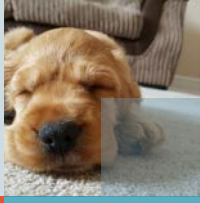




# Emotional Instability

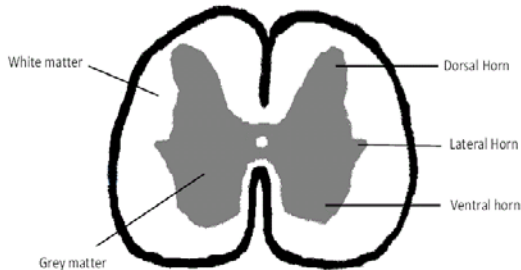
- Depression

- 28,000 high school students
  - 38% increase in sad feelings
  - 58% increase in suicide attempts
- Depressive symptoms 3x more likely
  - excessive daytime sleepiness



# Obesity

- Modulator of neuroendocrine function
  - Metabolic and endocrine alterations
    - Glucose metabolism
      - Decreased glucose tolerance
      - Decreased insulin sensitivity
      - Increased cortisol concentrations
      - Increased levels of ghrelin
      - Decreased leptin



# Obesity

- Heartfelt Study
  - Sample: 383 adolescents 11 - 16 yo
  - Total sleep time
  - Sleep disturbance time
  - Body Mass Index
- Obese adolescents experienced less sleep than non obese
- Odds of obesity: 80%



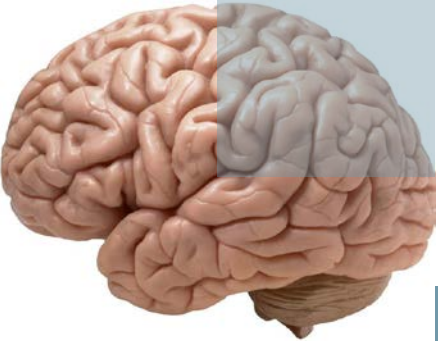
# Obesity

- Review by Cedernaes and colleagues
  - Molecular and behavioral factors
    - Obesity
    - T2DM (type 2 Diabetes Mellitus)
      - Relative Risk: 1.84%
- CARDIA (Coronary Artery Risk Development in Young Adults) study
  - Sleep fragmentation strongly associated with BMI increase



# Sleep and the Adolescent Brain

- Adequate Sleep
  - Capability to learn
    - Memory
  - Emotional stability
  - Obesity risk decreased



# What are the causes of sleep deprivation for the adolescent?

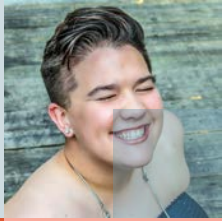
Sleep Deprivation Causes





# Sleep Deprivation Causes

- Hormonal time shift
- Sleepier later
- Nightly 'sleep debt' leads to chronic sleep deprivation secondary to school schedules



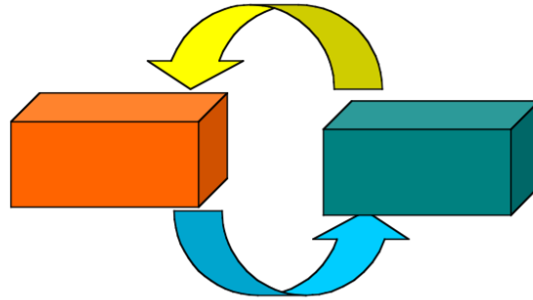
# Sleep Deprivation Causes

- Social attitudes
- Hectic after-school schedule
  - Multiple extracurricular activities
  - Homework, jobs, social commitments
- Screen-based devices
  - Smartphones, TVs, computers, iPads/tablets
    - Internet gaming
  - Light exposure
    - Melatonin
- Medical conditions that affect sleep

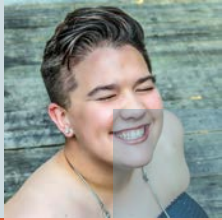


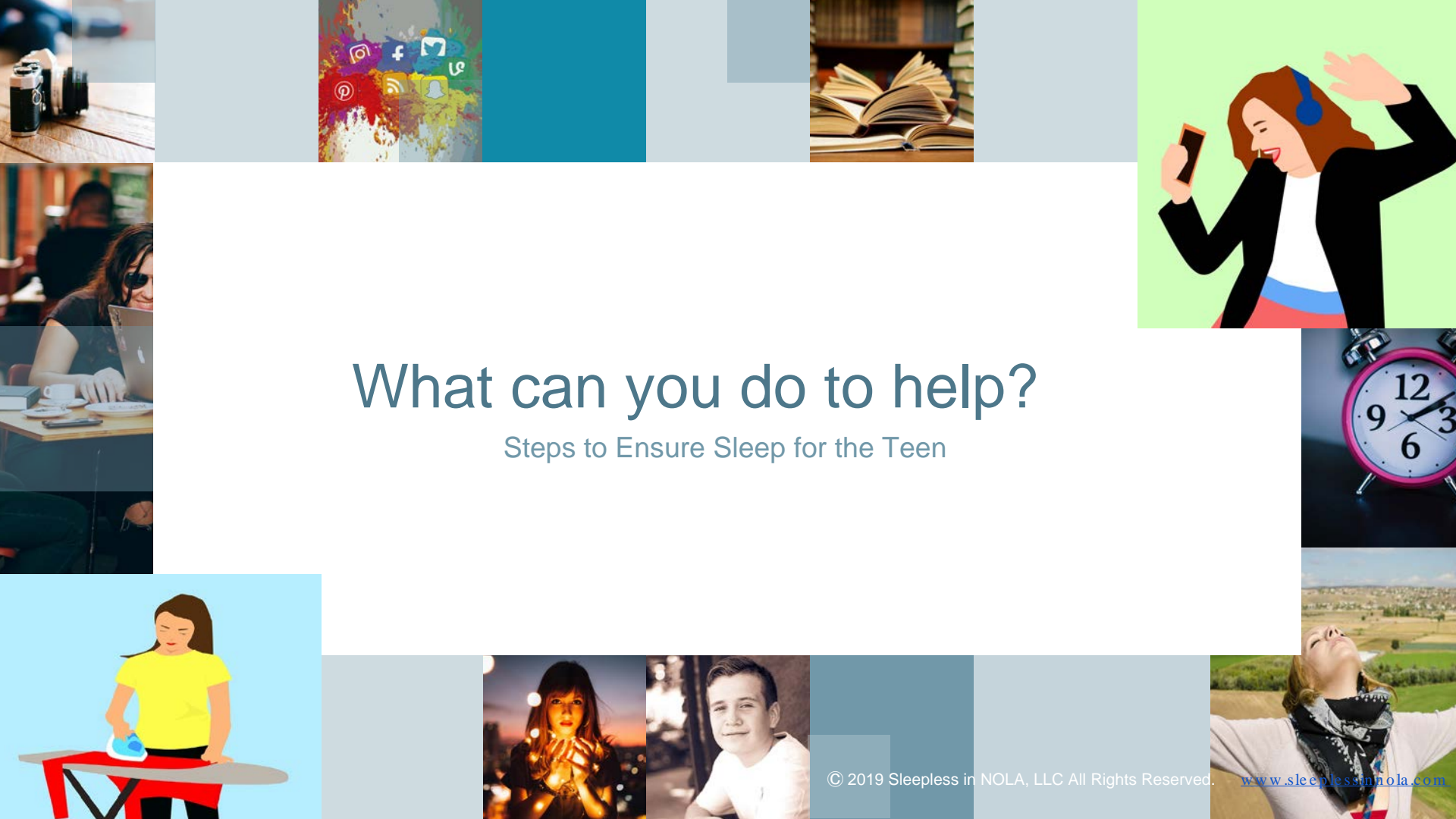


# Sleep Deprivation Causes



A Vicious Cycle

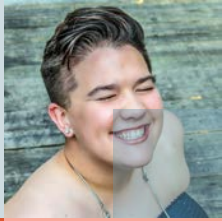




# What can you do to help?

Steps to Ensure Sleep for the Teen

# Steps to Ensure Sleep for the Teen



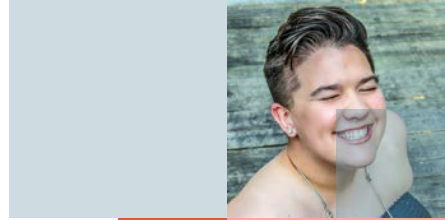
# Steps to Ensure Sleep for the Teen

**we are NOT giraffes**

# Steps to Ensure Sleep for the Teen

## Ask the Right Questions about Screens

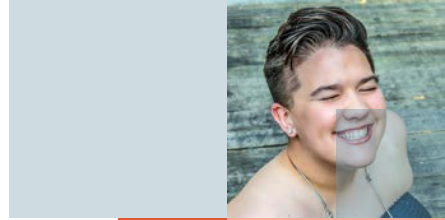
- What time are electronics put away?
  - Blue light exposure
    - Blue light filter
  - Decreased melatonin
    - Encourage turning off devices 1 hour before bedtime
    - Turn off notifications



# Steps to Ensure Sleep for the Teen

## Ask the Right Questions about Screens

- How often are electronics turned on overnight?
  - Wakeful periods overnight
  - Drawn to check their devices
    - 50% reported addiction to device
    - 79% reported checking device hourly





# Steps to Ensure Sleep for the Teen

- Solution:
  - Take smartphones and computers away before bed
    - Use alarm clocks instead of phone's alarm



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## HOW SMARTPHONE LIGHT AFFECTS YOUR BRAIN AND BODY

By disrupting melatonin, **smartphone light** ruins sleep schedules.  
This leads to all kinds of health problems:

Staring at smartphones too long **reduces blinking rates** and causes digital eyestrain, which leaves eyes irritated, dry, and fuzzy.



The disruption to your sleep schedule might leave you distracted and **impair your memory** the next day.



By disrupting melatonin/sleep, smartphone light can also mess with the hormones that control hunger, potentially increasing **obesity risk**.



Over the long term, not getting enough sleep can lead to **neurotoxin buildup** that makes it even harder for you to get good sleep.



A poor night's sleep caused by smartphone light can make it **harder to learn**.



There's a connection between light exposure at night and the disturbed sleep that come with it and an increased risk of **prostate & breast cancers**.



People whose melatonin levels are suppressed and whose body clocks are thrown off by light exposure are more prone to **depression**.



If you're trying to pay attention to something, some research shows having your smartphone nearby **reduces cognitive capacity** and ability to focus.

SOURCES: Nature Neuroscience; Harvard Health Publications; ACS, Sleep Med Rev, American Macular Degeneration Foundation; European Society of Cataract and Refractive Surgeons; JAMA Neurology

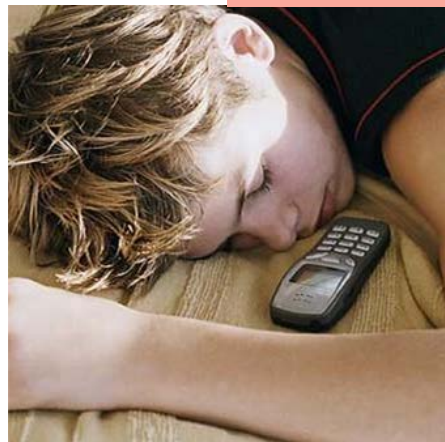
BUSINESS INSIDER

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# Steps to Ensure Sleep for the Teen

## Ask the Right Questions

- How much sleep do you think you get?
- What time do you go to bed and wake up?
  - Encourage a consistent bedtime and wake time.
  - Do not allow sleeping in on weekends.
  - Encourage an early night every Sunday night.
- Do you wear a sleep tracker such as a Fitbit or Apple Watch?
  - Are you surprised by the results?



# Steps to Ensure Sleep for the Teen

## Ask the Right Questions

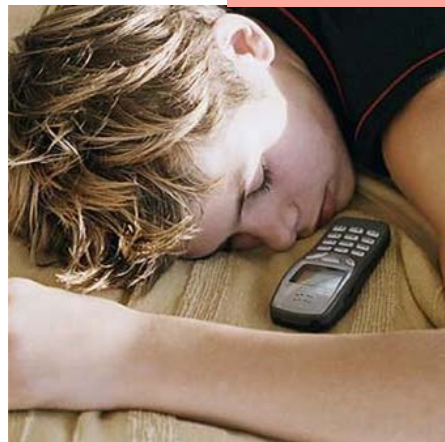
- Set up a comfortable sleep environment
  - Is the bedroom dark and cool?
- Establish/maintain relaxing bedtime routine nightly
  - Brush teeth, pajamas, reading
  - Meditation, mindfulness, conscious relaxation, yoga



# Steps to Ensure Sleep for the Teen

## Tips for Parents:

- Brainstorm with teen
  - Minimize extracurricular activities
  - Start homework during school
  - Decide on time limits for screen time
- Family meals without screens
  - Avoid stimulant drinks in the evening



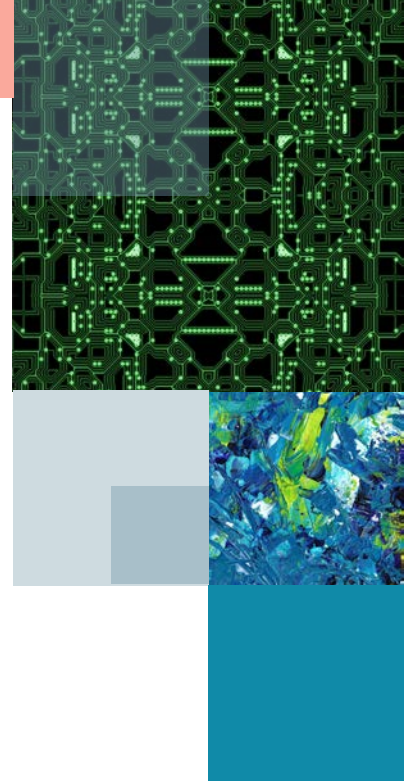
# Steps to Ensure Sleep for the Teen

- Heightened response to incentives
  - Increased bargaining power for the parent
- Prioritize sleep
- Use incentives
  - Find their currency!





# Steps to Ensure Sleep for the Teen



## Good Sleep Hygiene



A Dark, Quiet Sleeping  
Environment



Consistent Bed  
Times



Avoid Caffeine, Heavy  
Meals, + Alcohol Late  
at Night



Banish Electronics from  
the Bedroom



Keeping Pets Out of the  
Bedroom if Needed



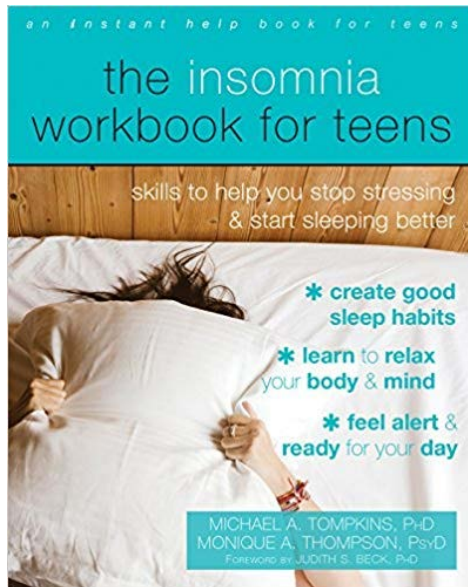
Exercise During  
the Day

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# Steps to Ensure Sleep for the Teen

## *The Insomnia Workbook for Teens*

\*I have no affiliation with this book or it's authors and do not receive any compensation for sales.



# More Research Needed

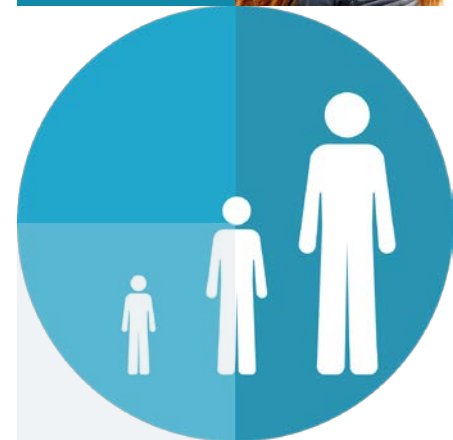


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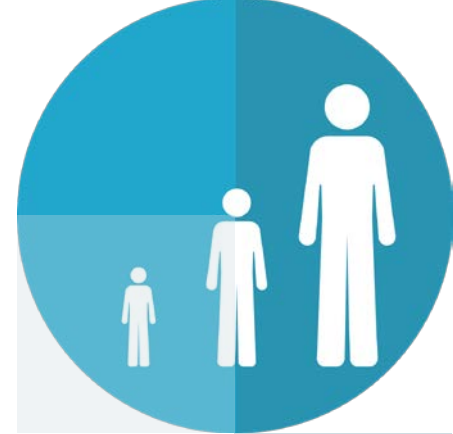
# Learner Outcomes

- Adolescent brain
- Importance of sleep for adolescents
- Negative health effects
- Your role as a healthcare professional
- Educate caregivers
- Advocate for teens
- Discuss teen sleep habits at every interaction



# Changes You May Wish to Make in Practice

- Pearls:
  - Bring up sleep health at every interaction with the teen
  - Teens need 9 hours of sleep per night
  - Ensure they are in bed at least 15 hours from waking
  - Encourage them not to sleep on weekends
  - Limit screen time
  - Dissuade electronic use in the bedroom





HAPPY SLEEP!  
Any Questions?



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Sleep Consultant

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[www.sleeplessinnola.com](http://www.sleeplessinnola.com)

# RESOURCES-IMAGES

1. [Brain during adolescence](#)
2. [Image of amygdala and prefrontal cortex](#)
  - a. [Moody teen cartoon](#)
3. [Image of cleaning brain](#)
  - a. [Glial system](#)
4. [Image of synaptic pruning](#)
5. [Image of EEG delta wave](#)
6. [Image of amygdala](#)
7. [Brain with sleep and without](#)
8. [Brain schematic lack of sleep causes. Slide 31](#)
9. [Teen with pain](#)
10. [Business Insider infographic](#)
11. [Sleep hygiene slide](#)
12. [Brain in bed](#)
13. [Grey/white matter](#)
14. [Video Slide 38](#)
15. [Slide 13 gif](#)
16. [Slide 45](#)
17. [Slide 9](#)
18. [Slide 24](#)

**I HAVE A SLEEPING  
DISORDER. IT'S  
CALLED CHILDREN.**



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# RESOURCES

- [Very well mind. Identity vs confusion](#)
- [Sciencedirect](#)
- [Adolescent brain development and function](#)
- [CDC facts adolescent health](#)
- [How to get rid of negative thoughts](#)
- [Sciencedirect](#)
- [Ncbi](#)
- [Onlinelibrary](#)
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3018343/>
- <https://directorsblog.nih.gov/2017/02/14/how-sleep-resets-the-brain/>
- <https://www.verywellmind.com/identity-versus-confusion-2795735>
- [Betterhealth](#)
- [Importance of Sleep for Mental Health](#)
- [Grey Anatomy of Sleep](#)
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6122651/>
- [Sleep disorders physiology of sleep](#)

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DISORDER. IT'S  
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# RESOURCES

- [Sleep Deprivation Image TED](#)
- [University of California - Davis Health System. "Sleep study reveals how the adolescent brain makes the transition to mature thinking." ScienceDaily. ScienceDaily, 19 March 2013.](#)
- [Sciencedaily.Synaptic Pruning](#)
- [scientificamerican. Sleep -shrinks- the- brain](#)
- [\(Coleman & Hendry, 1990; Feldman & Elliott, 1990 \)](#)
- [Glymphatic System](#)
- [Obesity link](#)
- [SHY hypothesis](#)
- [Sleep and quality of life in teens](#)
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5449130/>

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