
Sleep 101

Peter L. Franzen, PhD

Associate Professor of Psychiatry and Clinical and Translational Science

Sleep Summit

The Pittsburgh Study

October 14, 2022



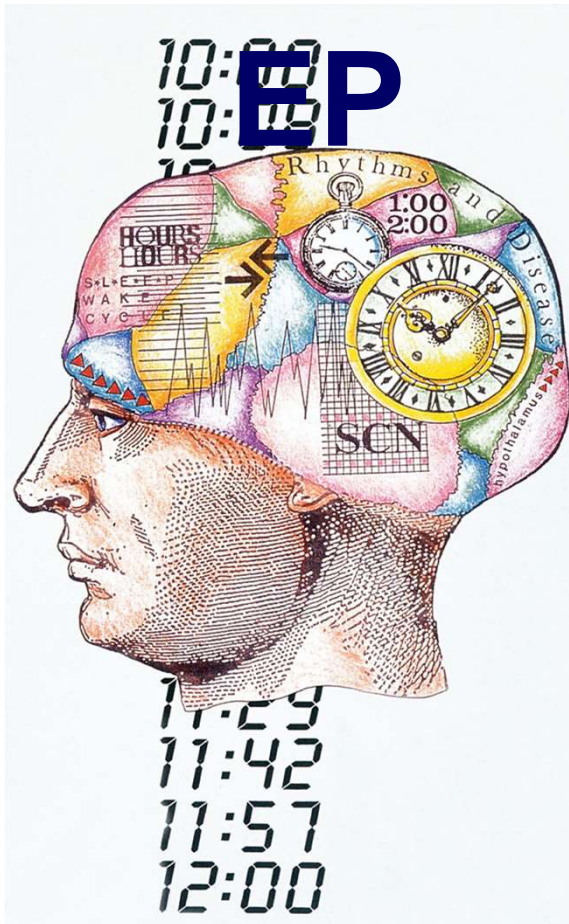


- 1. How does sleep change across development?
- 2. Why does it matter?

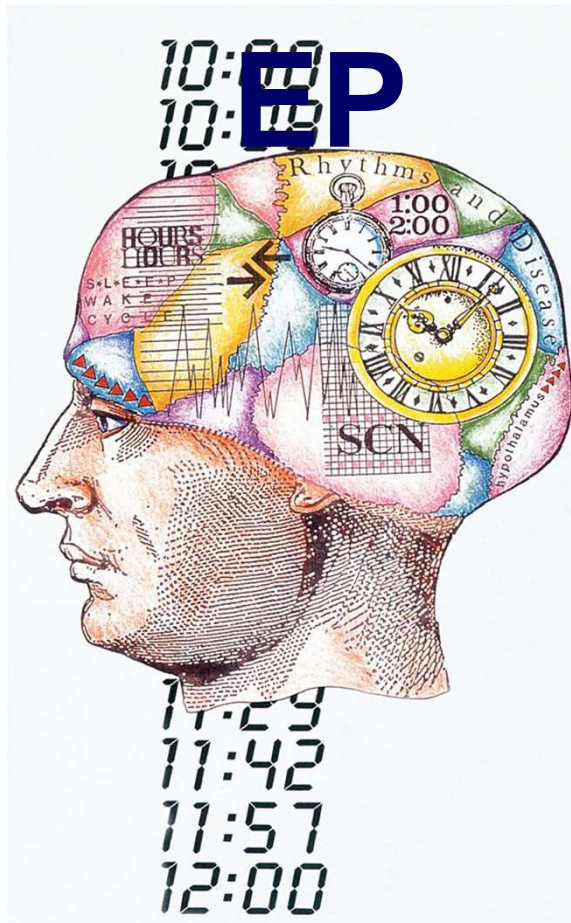


SLE

Why does *it* matter?



SLE



Cognition

Think
Learn

Concentrate
Remember

Insight

Emotions

Mood

Mental

Health

Stress Social Interactions

Behavior

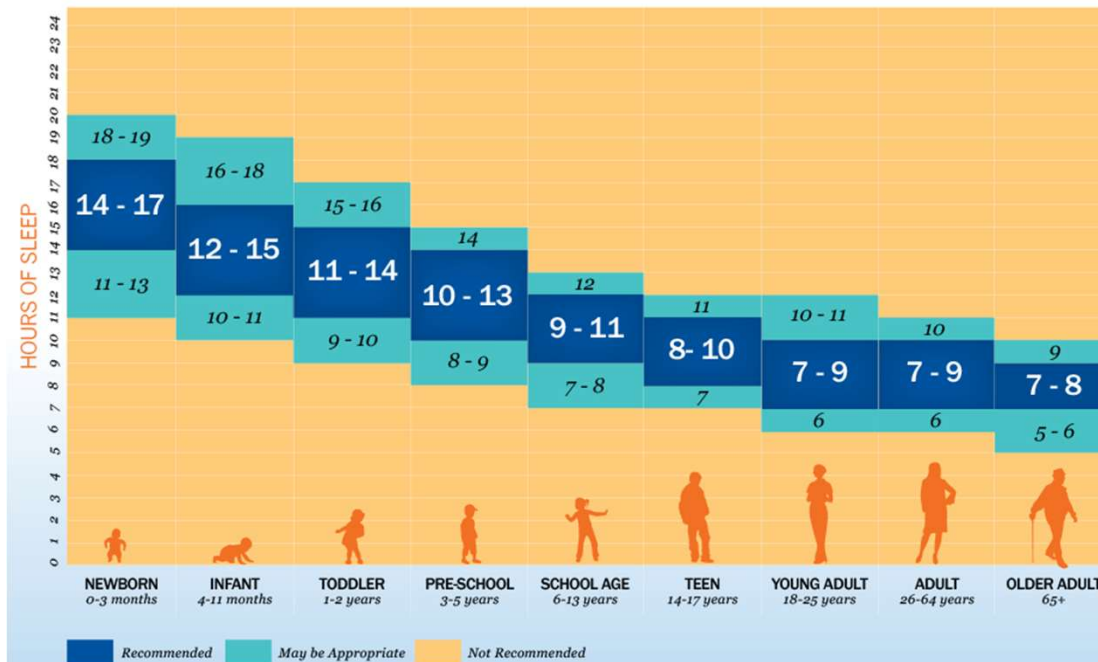
Accidents

Motor Skills

Health

Immune System
Metabolism
Insulin

2015 SLEEP DURATION RECOMMENDATIONS

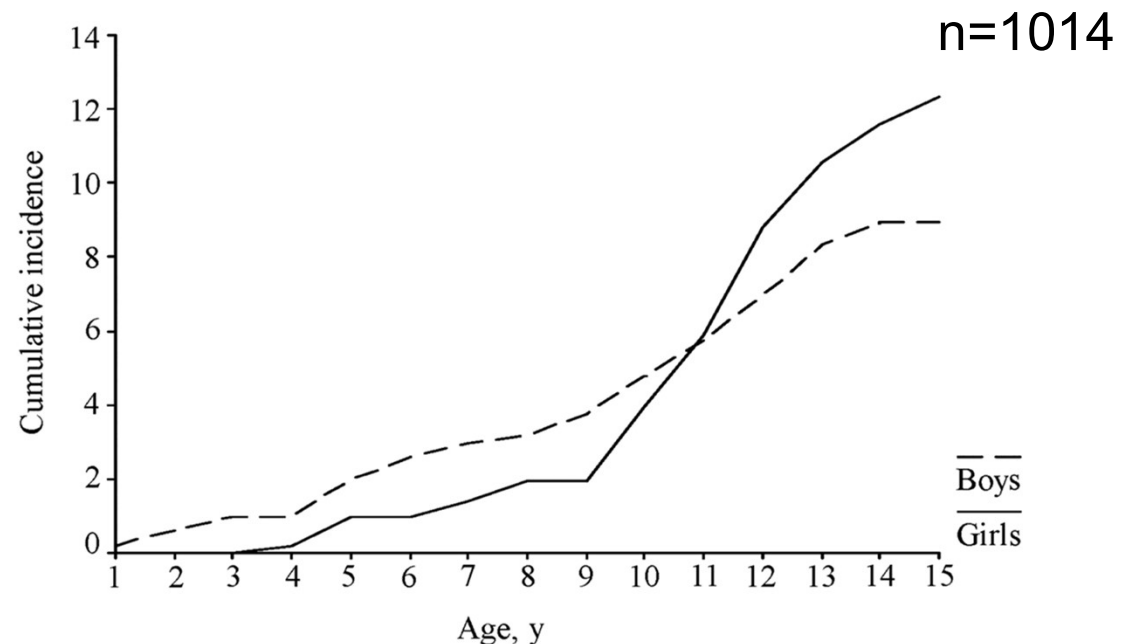


SLEEPFOUNDATION.ORG | SLEEP.ORG

Hirshkowitz M, The National Sleep Foundation's sleep time duration recommendations: methodology and results summary, Sleep Health (2015), <http://dx.doi.org/10.1016/j.sleh.2014.12.010>

Insomnia increases during adolescence

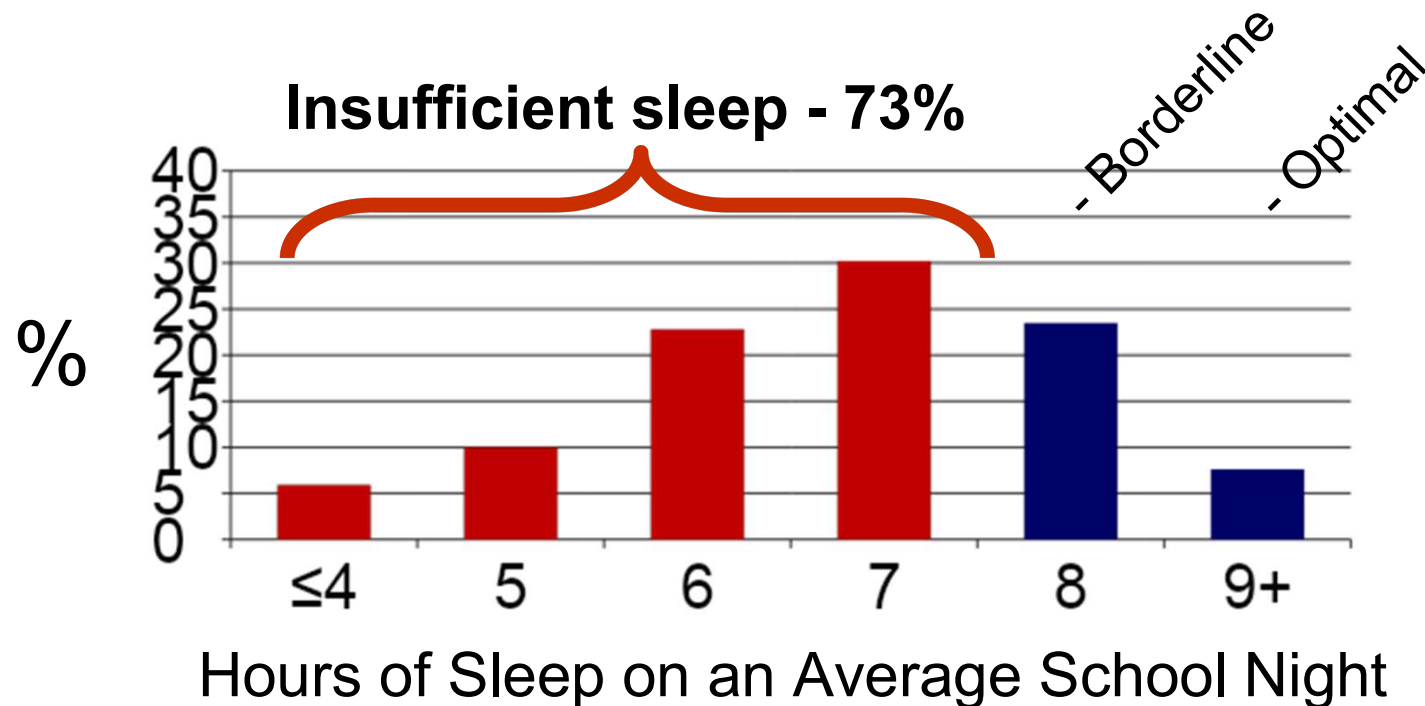
- Community-based study of adolescents 13-16 years
- Lifetime prevalence 10.7%, with 53% comorbid with a psychiatric disorder.
- Rate increases over adolescence
- Onset of menses associated with 2.75 fold increased risk of insomnia



Johnson et al., 2006, *Pediatrics*

Epidemic of sleep deprivation in teens

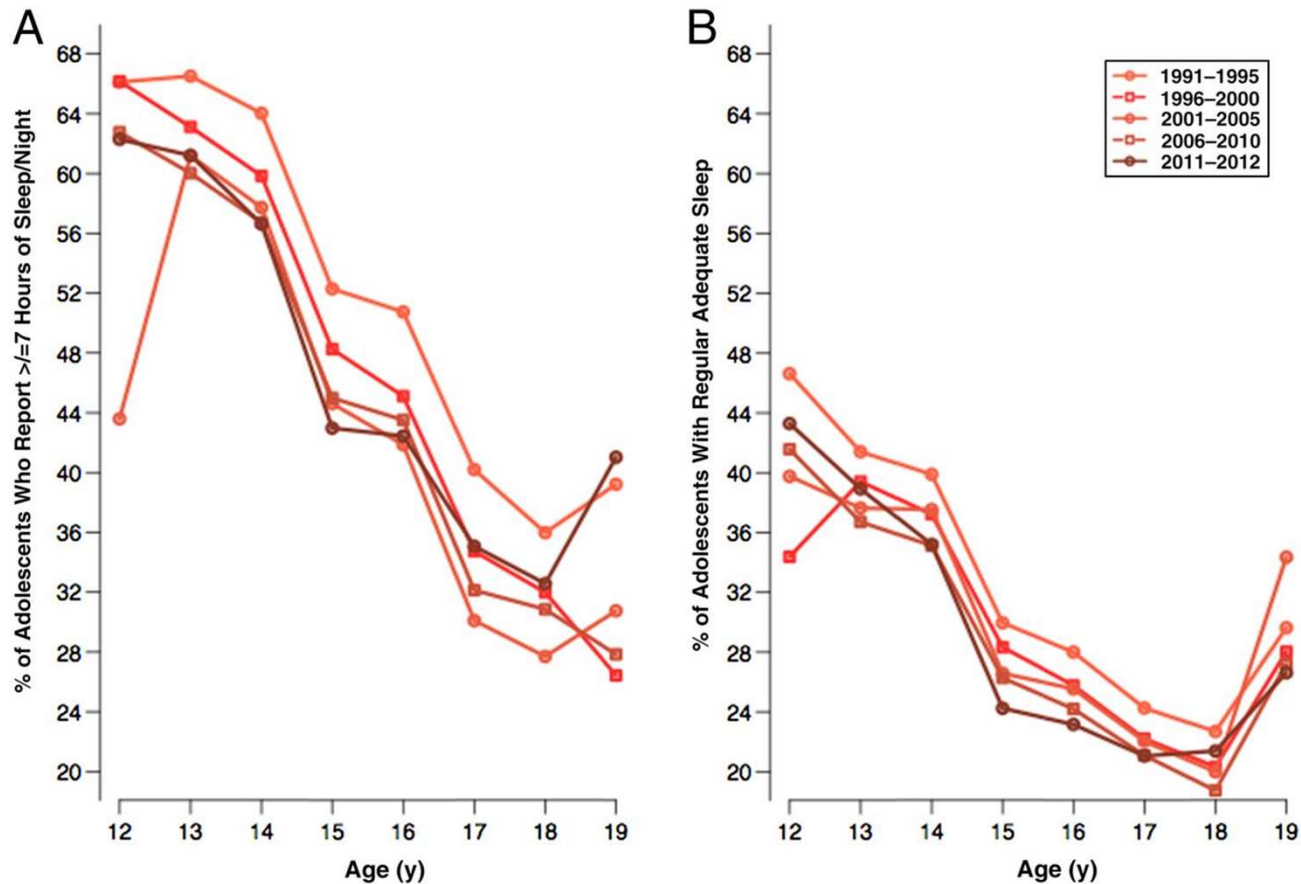
- CDC - Youth Risk Behavior Survey (YRBS), 4 waves: 2007–2013
n = 52,718 US high school students



Basch, et al. (2014). *Prev Chronic Dis*

N = 272,077

% with ≥ 7 hours sleep % with adequate sleep



Keyes et. al (2015). *Pediatrics*.

Q: Why is short sleep so common in teens?

A: School / sleep squeeze

Result of unique **biological** and **social/environmental** influences during adolescence.

Biological changes begin post-puberty

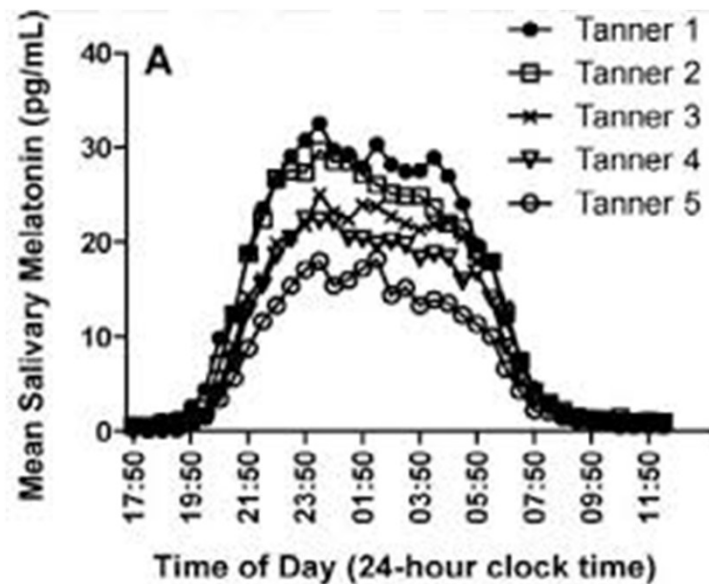
Why is Short Sleep So Common In Teens?

Biological Changes In Sleep at Puberty



Circadian rhythms shift later
(delayed melatonin onset)

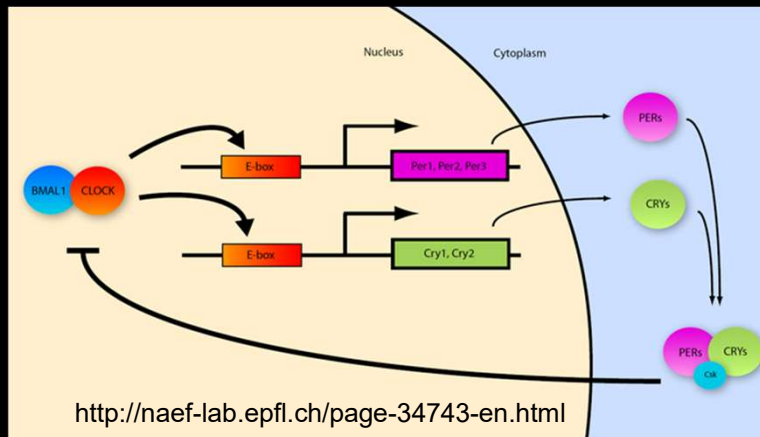
Sleep becomes lighter



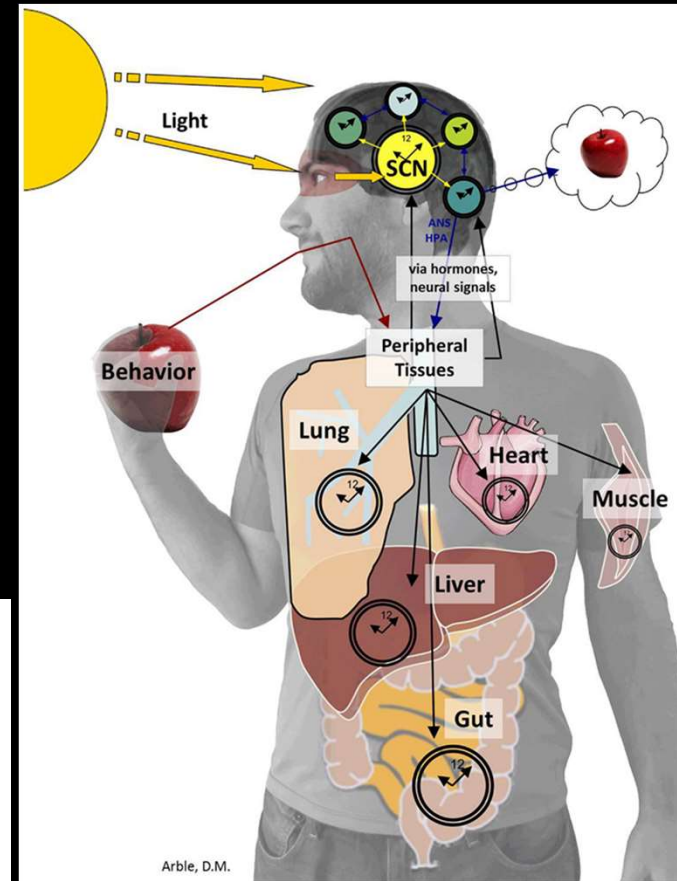
Crowley, Acebo, Carskadon, 2011, Dev Psychobiol

...leads to preference for later bed and wake times

Circadian Rhythms: Clocks everywhere



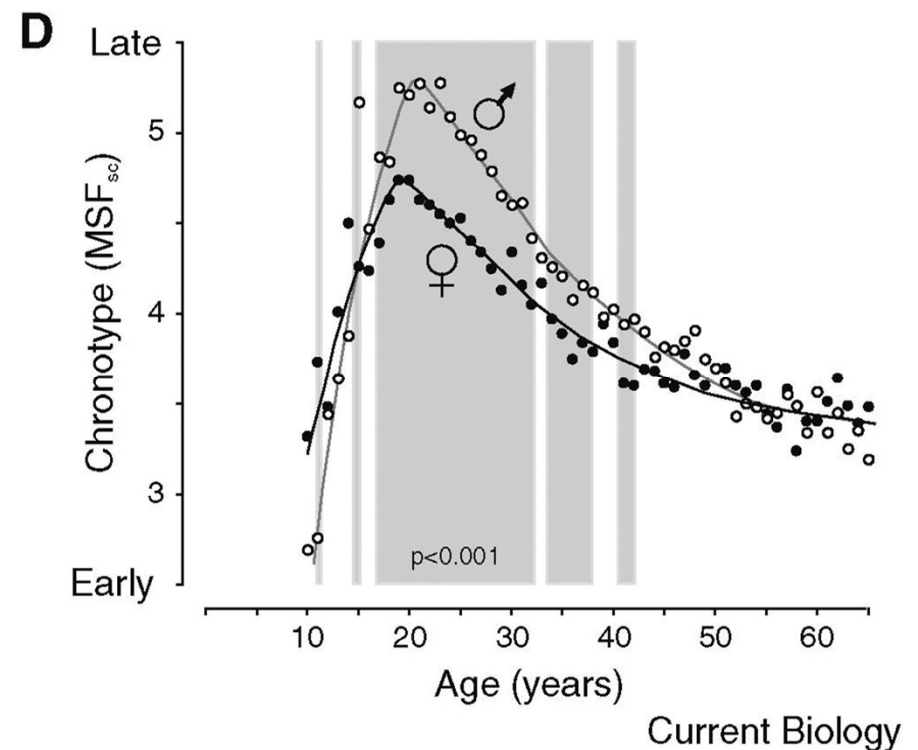
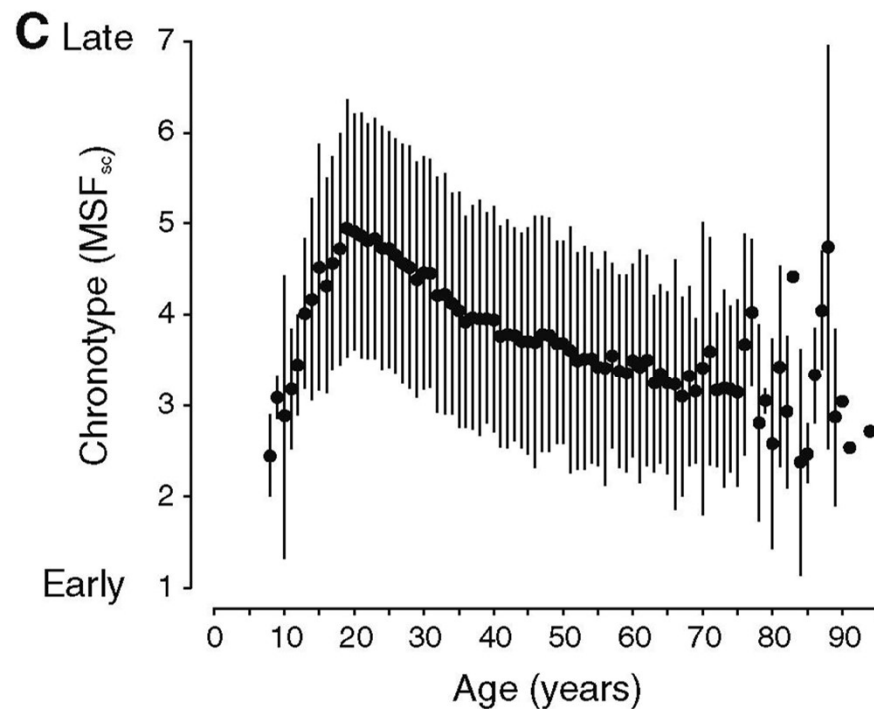
Timing is everything: U.S. trio earns Nobel for work on the body's biological clock



Arble & Sandoval (2013) *Front. Neurosci*

A marker for the end of Adolescence?

Time of midsleep on “free” days



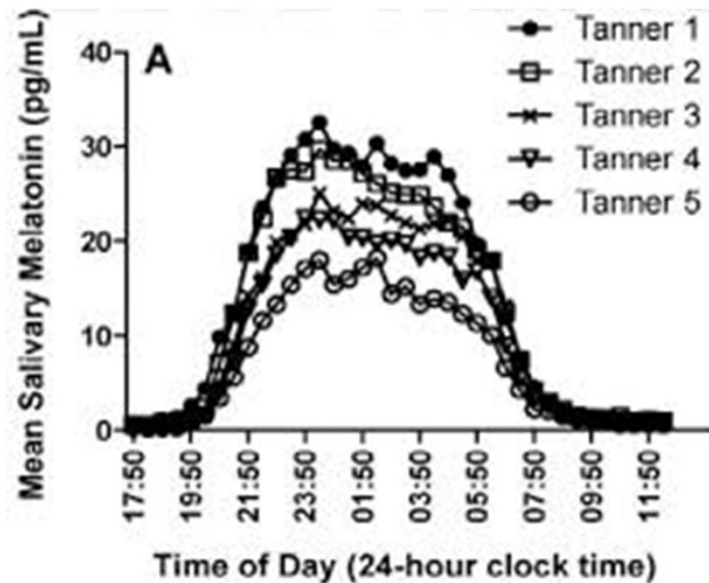
Roenneberg, et al., 2004, Current Biology

Why is Short Sleep So Common In Teens?

Biological Changes In Sleep at Puberty



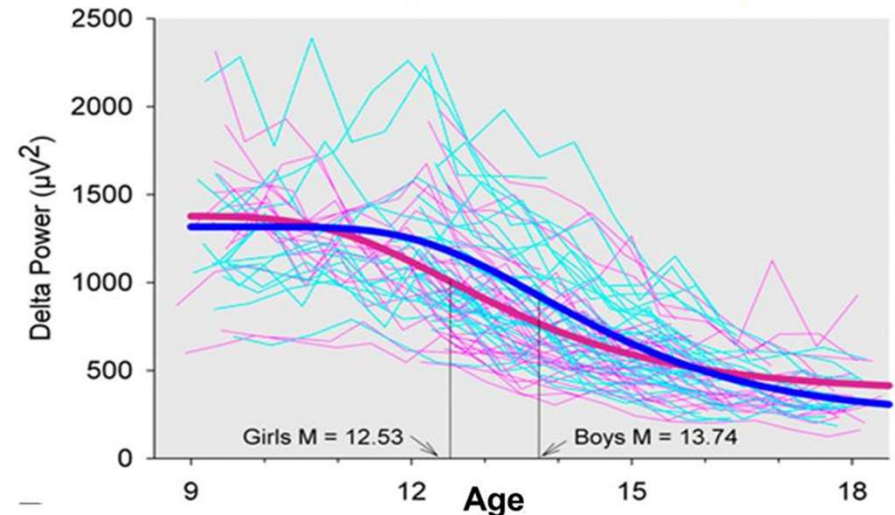
Circadian rhythms shift later
(delayed melatonin onset)



Crowley, Acebo, Carskadon, 2011, Dev Psychobiol

Sleep becomes lighter

Slow wave sleep declines by 40%

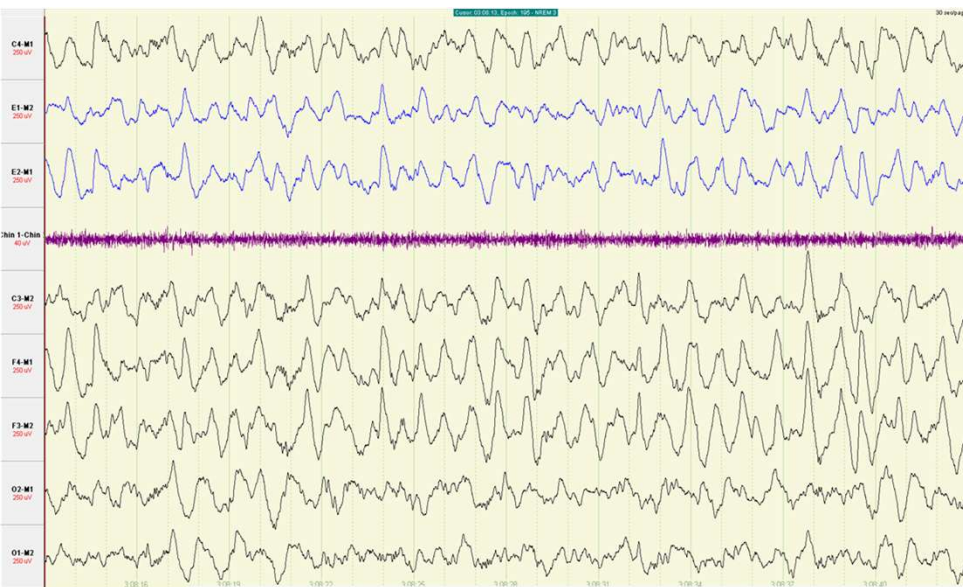


Campbell, et al., 2012, PNAS.

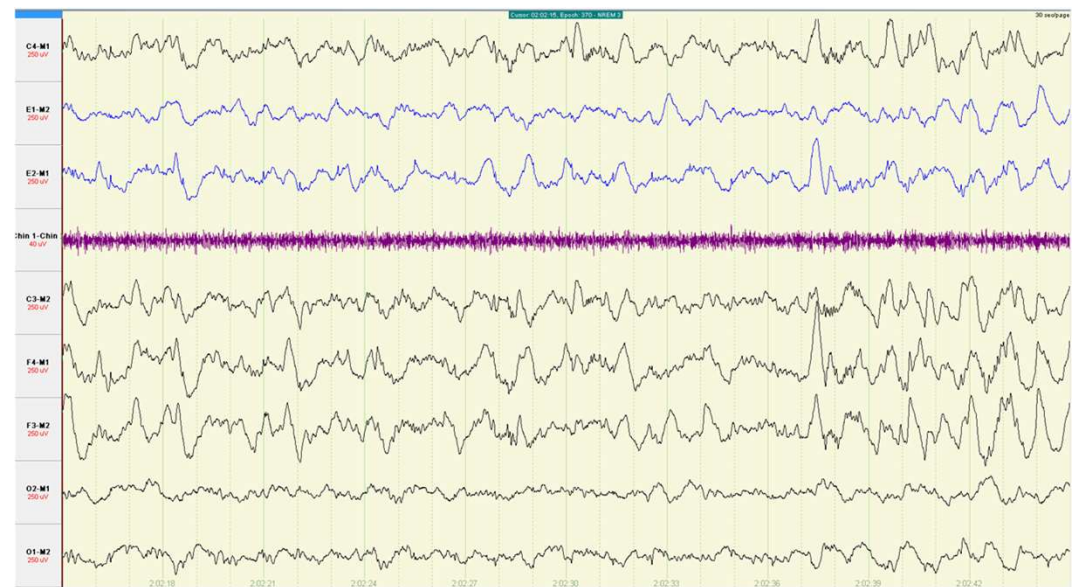
...leads to preference for later bed and wake times

Slow wave sleep

Adolescent



Adult



Why is Short Sleep So Common In Teens?

Social & Environmental Changes in Sleep at Puberty

Decrease in parental control



Homework & after school activities



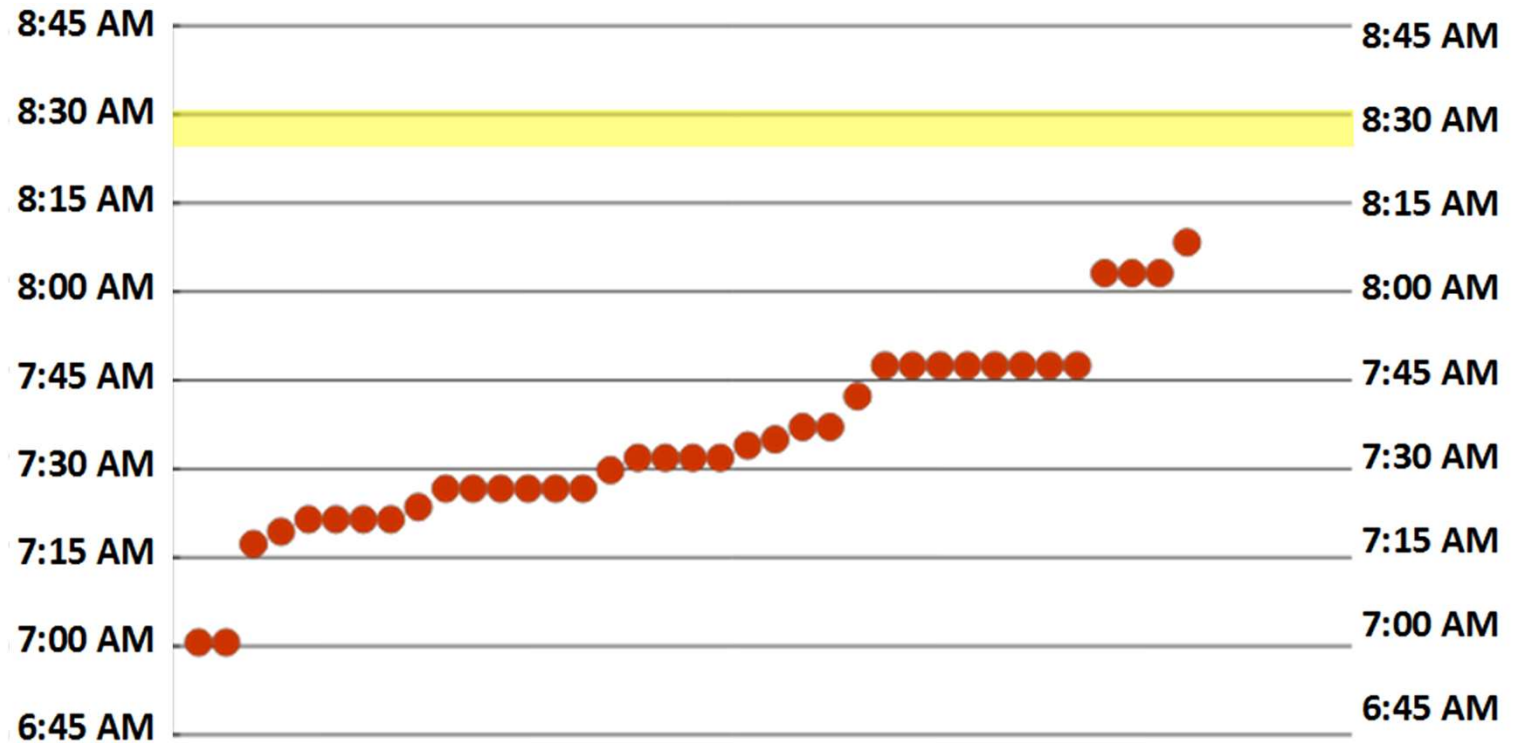
Use of social media
(& exposure to light)



Early school start times

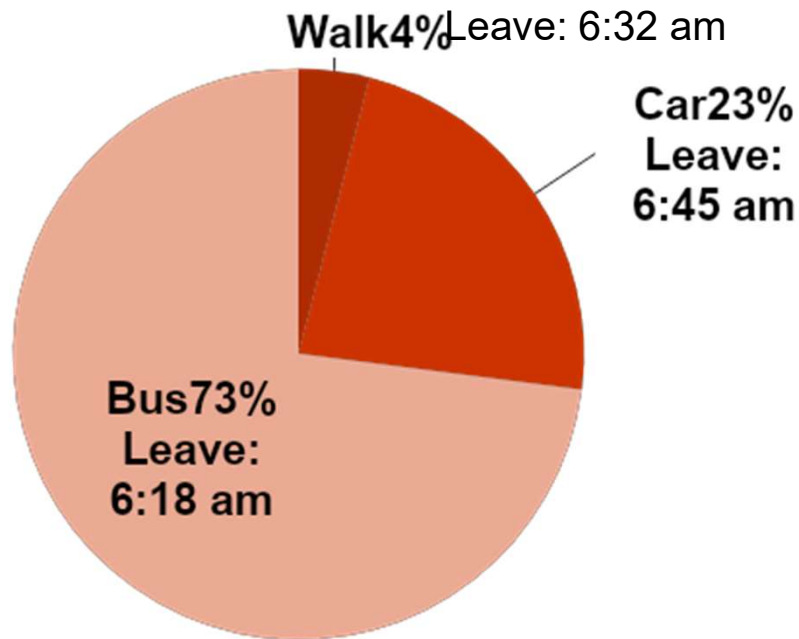


High School Start Times in Allegheny County

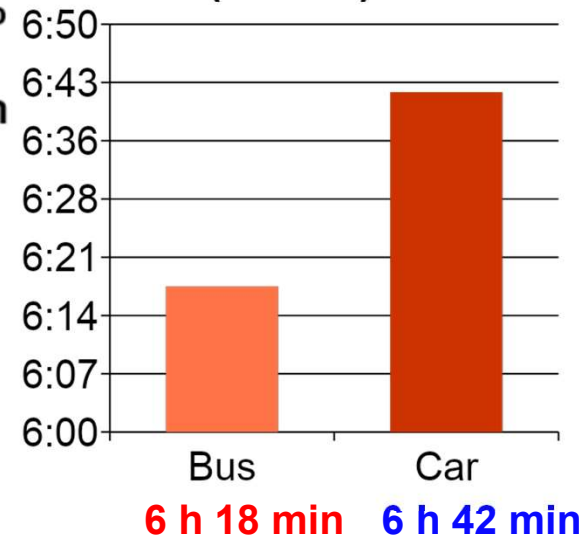


Transportation matters: What time do you leave for school?

- Average: 6:25 AM
- ## How do you travel to school?

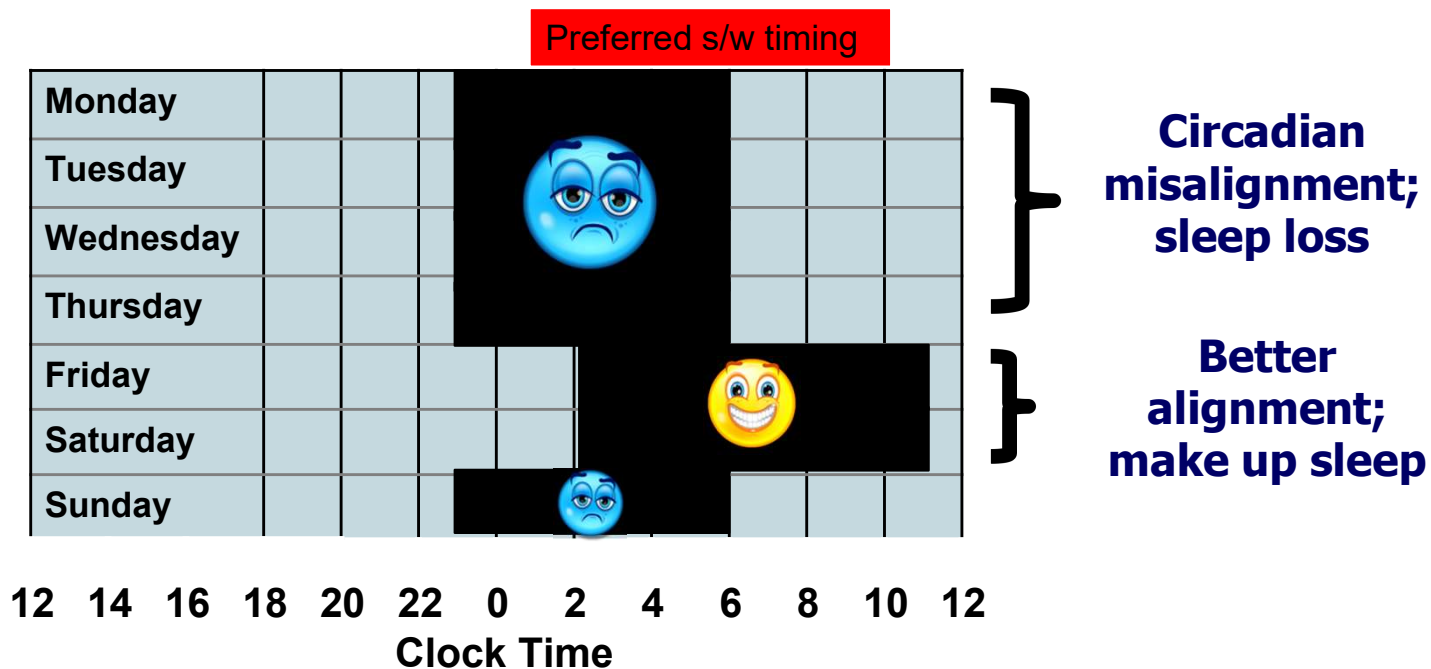


Average
Sleep Duration
(Hours)



Delayed circadian timing during adolescence leads to chronic circadian misalignment

- Circadian and preferred sleep timing shift later (delay) during adolescence
- Mismatch with early school start times



Courtesy of Brant Hasler, PhD



Why does *when* or *how much* we sleep matter?



Consequences of Insufficient Sleep:

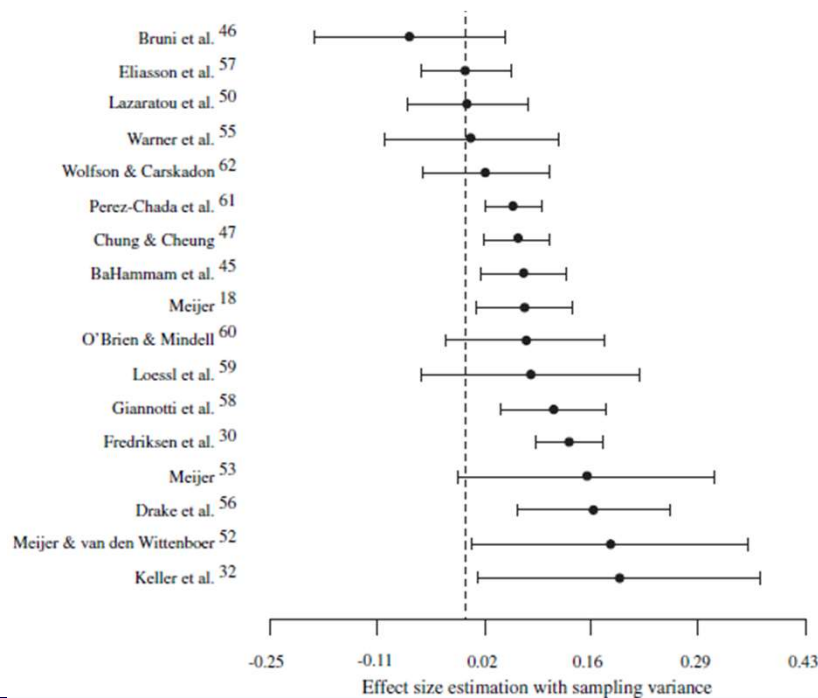
- Lower grades & achievement test scores
 - Falling asleep in school
 - More days tardy or absent
 - Car crashes
 - Depression
 - Suicide
 - Substance use
 - Violence and risk taking
 - Weight gain / obesity
 - Sports injuries
-

Consequences of insufficient sleep in adolescents

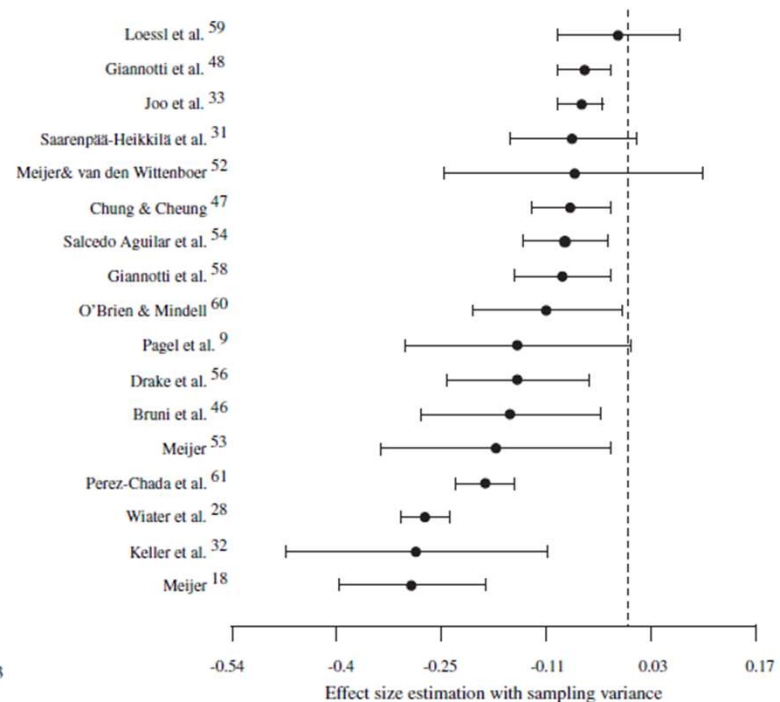
■ Academic Performance

- 3 meta-analyses of 16 studies (Dewald, et al., 2010)
- Sleep quality also examined

Sleep Duration

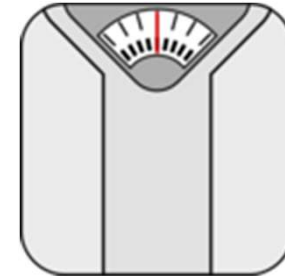


Sleepiness



Consequences of short sleep: Physical health

- Overweight/obesity
 - Link between short sleep and overweight, obesity in middle school, high school
- High blood pressure and diabetes linked to short sleep duration
- Impairs immune function, and thus, healing and recovery
- Short sleep duration in adolescence in girls predicted increased risk of high cholesterol as a young adult ([Gangwisch, et al., 2010, SLEEP](#))



Consequences of insufficient sleep in adolescents

- Increased sports-related injuries
 - 7th-12th graders in California school (Milewski, et al., 2012 abstract)
 - Those who slept 8+ hours were 68% less likely to be injured
 - Risk also increased for higher grade level
 - Independent of gender, amount of sports participation per year, # of sports, strength training

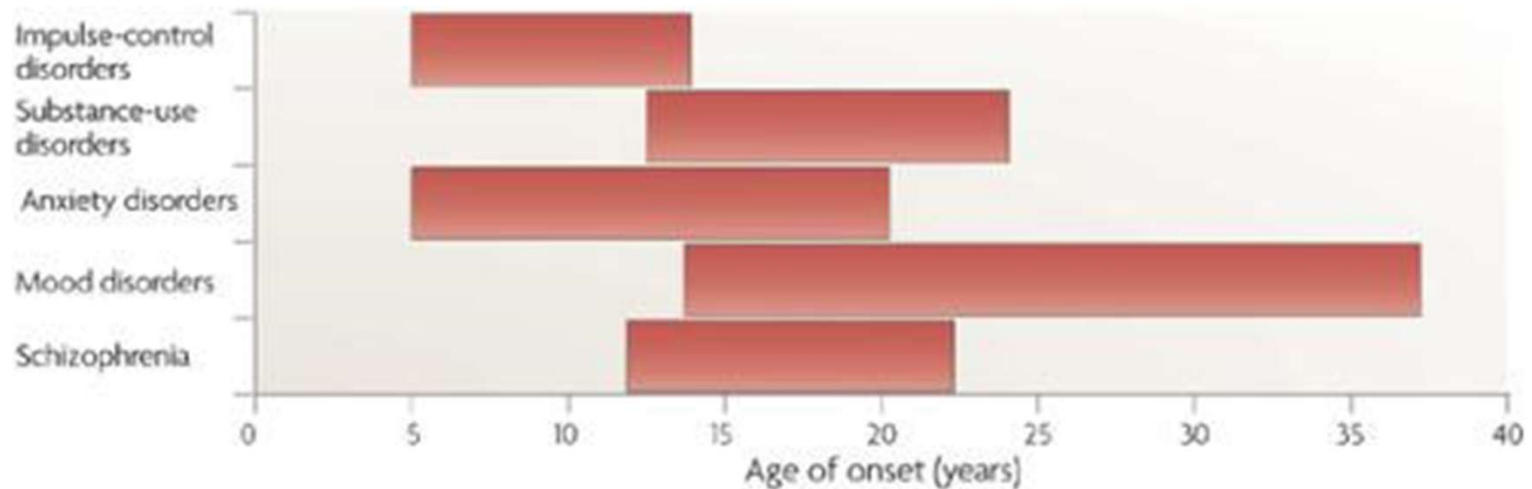


Consequences of insufficient sleep in adolescents



- Motor Vehicle Accidents
 - Leading cause of death in teenagers (CDC, 2012)
 - In 2010, 22% of drivers ages 15–20 had been drinking
- Teen drivers ages 16–19 are 3x more likely to be in a fatal crash vs. drivers 20+
- Teen drivers are at the **highest risk** of car accidents due to falling asleep, accounting for 50% of all crashes
- NSF poll (2006): 68% of HS seniors reported driving while drowsy; 15% reported drowsy driving at least *once a week*

Adolescence: A period of vulnerability that may be further exacerbated by sleep loss

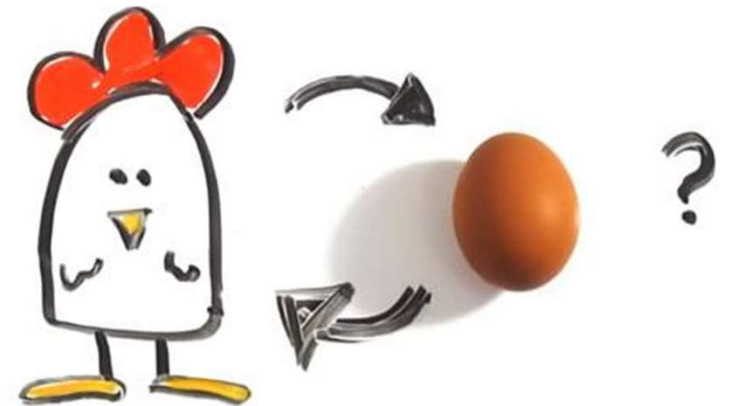


Nature Reviews | Neuroscience

Sleep and Youth Psychiatric Disorders

Sleep is disturbed in youth with psychiatric disorders

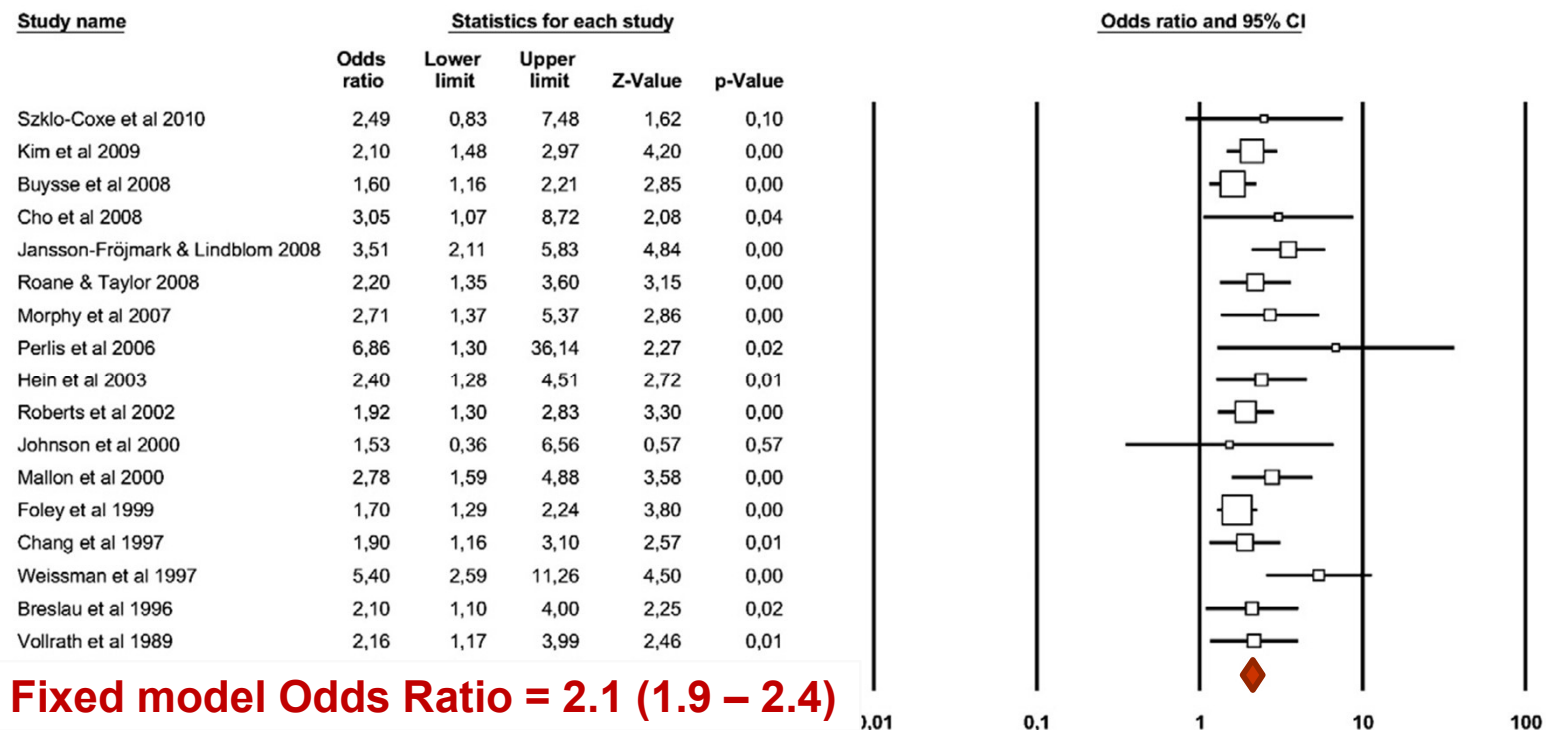
- depression & bipolar
- anxiety
- ADHD
- substance use disorders



Sleep problems are:

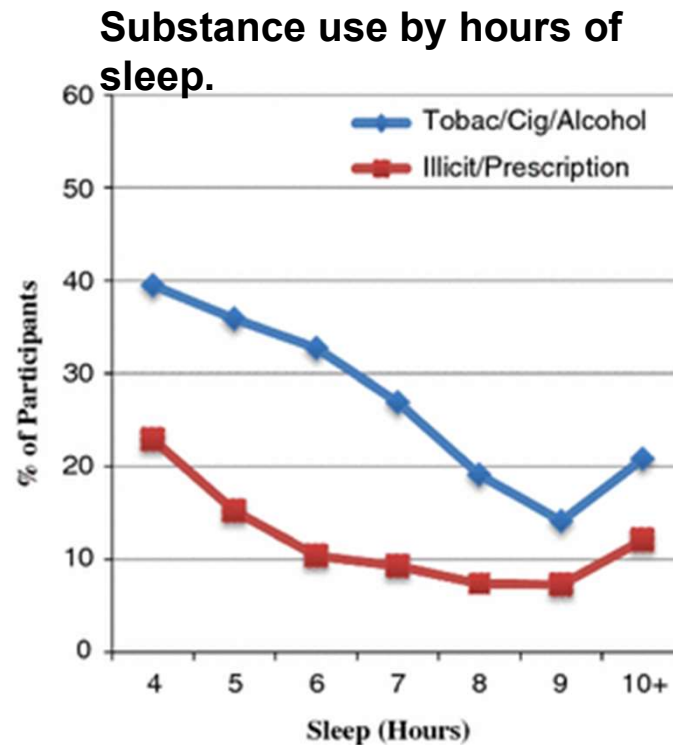
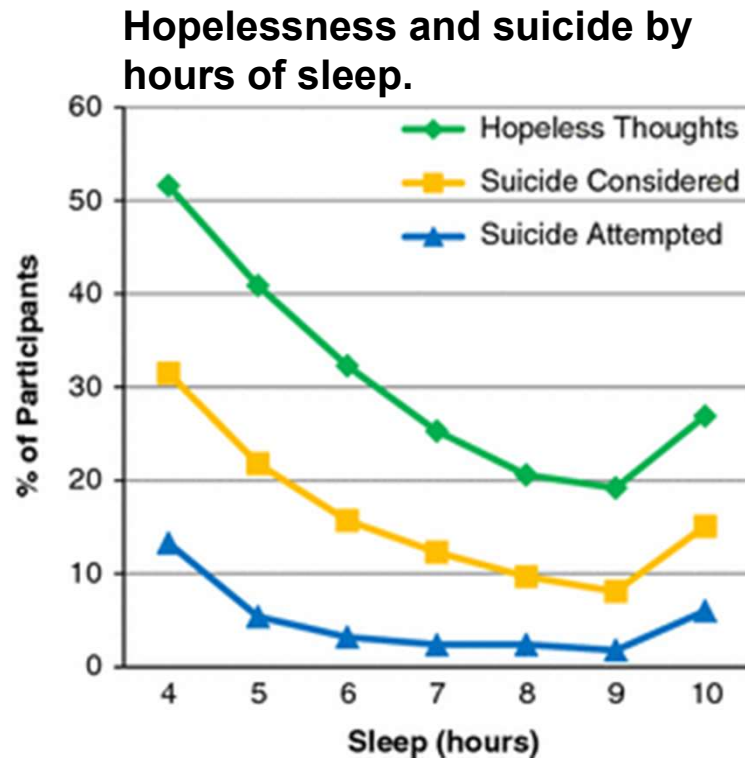
- a risk factor for developing psychiatric disorders
- symptoms of psychiatric disorders
- associated with worse outcomes in patients with psychiatric disorders

Meta-analysis of the effects of insomnia on future depression



Baglioni, et al., *J Affect Disord*, 2011

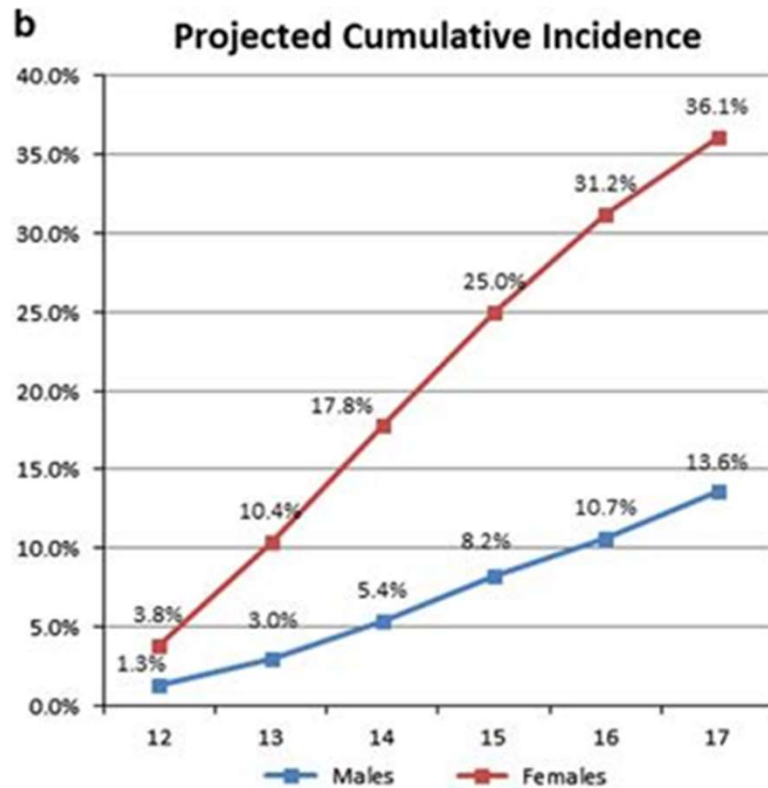
The “dose” of sleep loss increases negative consequences: Fairfax County VA (n=27,939) Winsler, et al. 2015, *J Youth Adolesc*



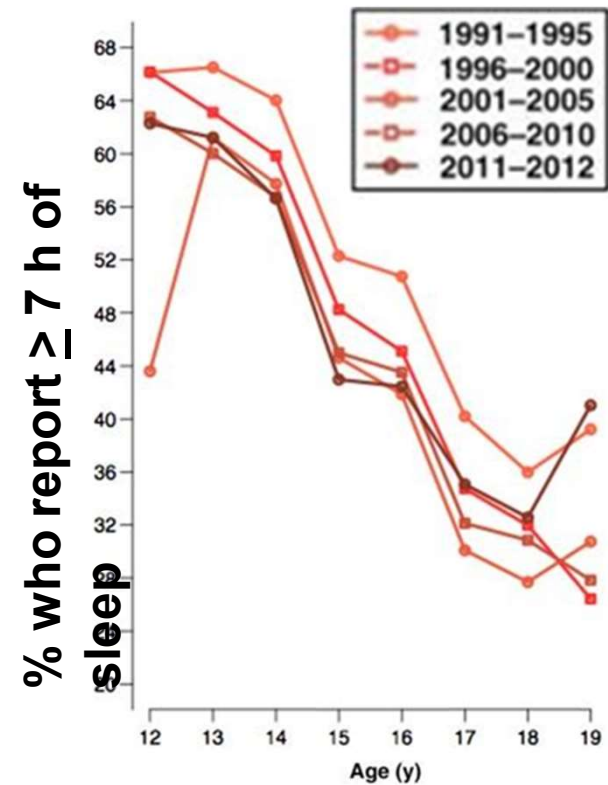
Note: Each hour less of sleep is associated with a significant increase in odds of the outcome, p 's < .001

Winsler, et al. 2015. Journal of Youth and Adolescence

Sleep loss and depression are both extremely prevalent during adolescence

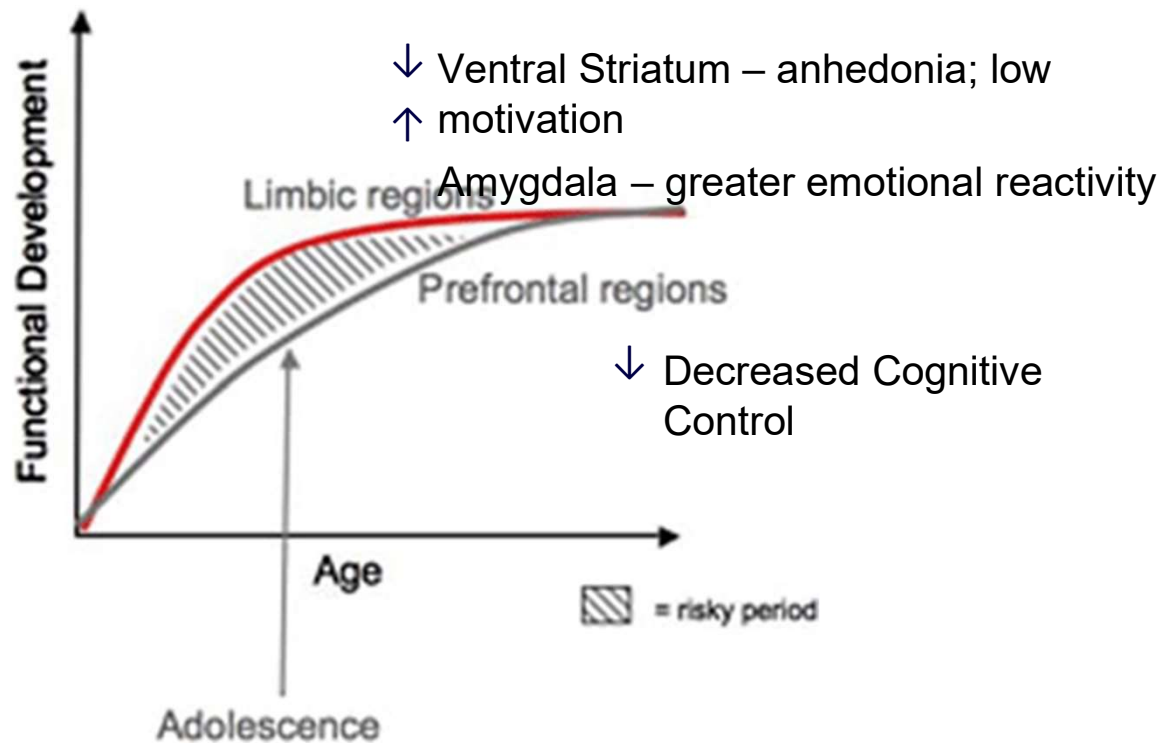


Breslau et al., 2017, *Translational Psychiatry*



Keyes et al., 2015, *Pediatrics*

Adolescence: A period of vulnerability that may be further exacerbated by sleep loss



Casey, Jones, & Hare (2008). *Annals of the New York Academy of Sciences*, 114.

Consequences of insufficient sleep in adolescents

- **Mood**
 - Greater depressive symptoms (Pasch et al. 2011; Roberts & Duong, 2014); suicidal ideation, attempts, and death (Goldstein et al. 2008; Wong et al. 2012)
 - **Increased substance use**
 - Short sleep is associated with more caffeine, smoking, alcohol, substance use, and stimulant abuse (Mcknight-Eily, et al. 2011; Hasler et al. 2017; Terry-McElrath et al., 2017)
 - **Increased risk taking behavior**
 - Violence, unsafe behaviors, drug use and sexual activities more common in short sleepers (O'Brien & Mindell, 2005; Owens et al., 2017)
 - **Delinquent behavior**
 - Short sleep duration and delayed bedtimes were directly associated at age 16 (but not ages 22 or 28) in National Longitudinal Study of Adolescent Health (Peach & Gaultney, 2013)
 - Partly mediated by increased sensation seeking and reduced impulse control
-

Discussion Ideas

- In what ways can parents help support kids getting more sleep?
 - Are there ways that schools can help support kids getting more sleep?
 - Would starting schools later in the day allow teens to get more sleep, or will they just stay up later?
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