



# School Start-Time and the Importance of Adolescent Sleep

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# Agenda

## 1. Why We Sleep

## 2. Adolescent Sleep

- **Adolescent Sleep Recommendations**

## 3. Adolescent Health and Sleep

- **Mental Wellness**
- **Physical Health**

## 4. Sleep and Learning

## 5. Impacts of Severe Sleep Disruption

## 6. Sleep and the U.S. Education System

## 7. Positive Impacts of Delayed School Start-Time

- **A Review of the Supporting Literature**

## 8. Other Considerations

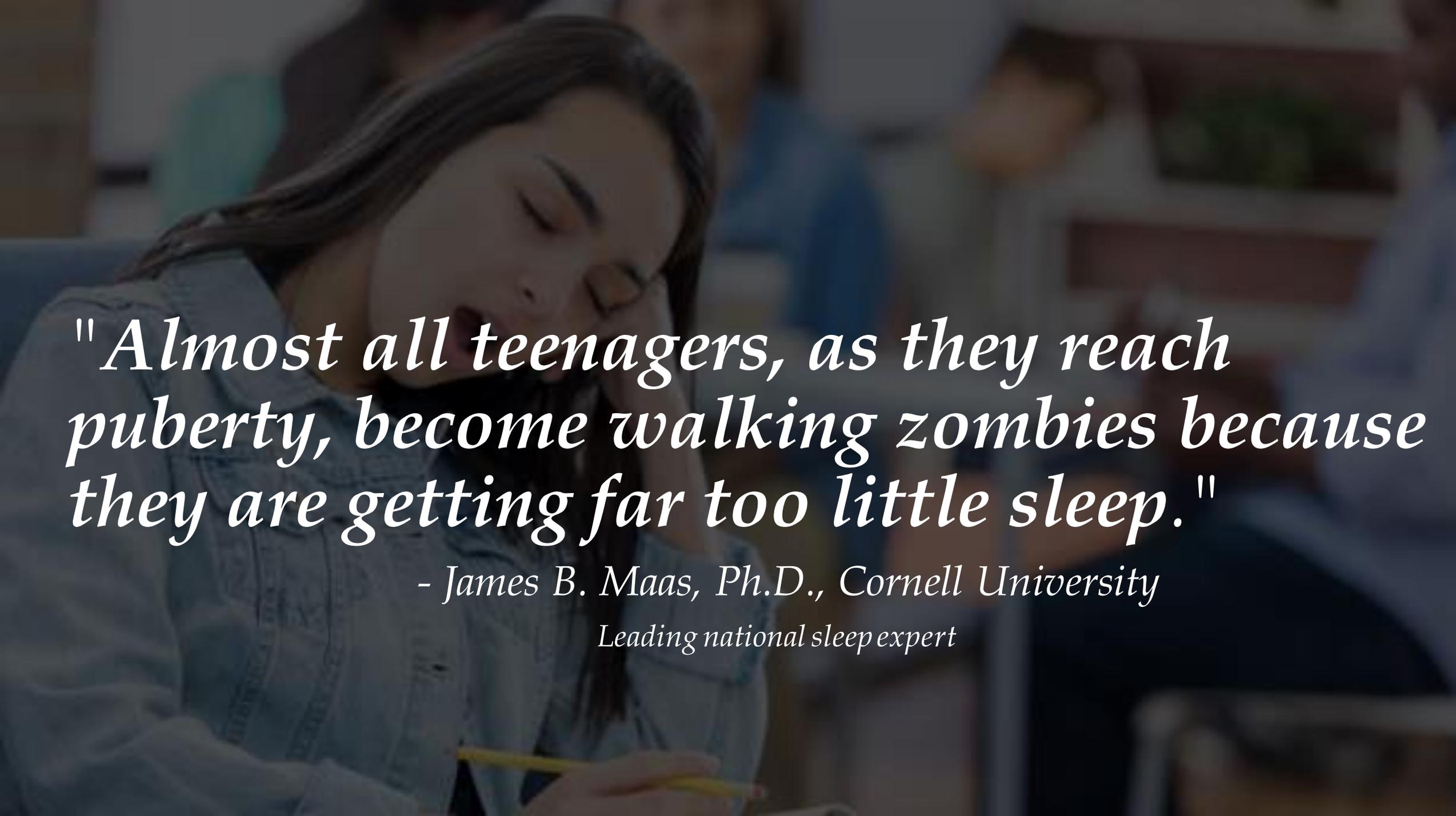
## 9. Summary: Benefits of Delayed School Start-Time

# Why Do We Sleep?

- "The universal healthcare provider" (107).
- Restorative to our body and essential to our ability to function.

*"Numerous functions of the brain are restored by, and depend upon, sleep. No one type of sleep accomplishes all. Each stage of sleep – light NREM, deep NREM sleep, and REM sleep - offer different brain benefits at different times of night. Thus, no one type of sleep is more essential than another. Losing out on any one of these types of sleep will cause brain impairment" (108).*





*"Almost all teenagers, as they reach puberty, become walking zombies because they are getting far too little sleep."*

*- James B. Maas, Ph.D., Cornell University*

*Leading national sleep expert*

# How is Adolescent Sleep Different?

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**Beginning at the onset of puberty (~12 y.o.), adolescents develop as much as a two-hour sleep-wake cycle delay.**

Later sleep onset and wake-up times - as compared to sleep cycles in middle childhood (8-12 y.o.).

This occurs for all adolescents, regardless of cultural background.



**Delayed evening onset of natural Melatonin secretion ("phase delay").**

Why we see a shift from ideal functioning in morning in children to evening in adolescents.

Peak wakefulness is still occurring around 9pm.

Difficulty falling asleep before 11pm; ideal wake time becomes 8am.

Their inability to fall asleep is not a form of rebellion.



**Sleeping later on weekends/days off does not help**

Further disrupts circadian sleep cycles and decreases daytime alertness



**National Sleep Foundation**

8.5-9.5 hours of sleep per night



**American Academy of Pediatrics**

8-10 hours of sleep per night



**However, most teens are getting less than 7 hours per night.**

1996: 71.5%

2012: 63%

2019: likely has decreased even further due to technology, caffeine consumption, etc.



Due to phase delay in adolescents, onset of "sleepiness" (melatonin secretion) can be delayed until **10:30pm - 11pm**, making the ideal wake time **8:00am - 8:30am**.

# Adolescent Sleep Recommendations

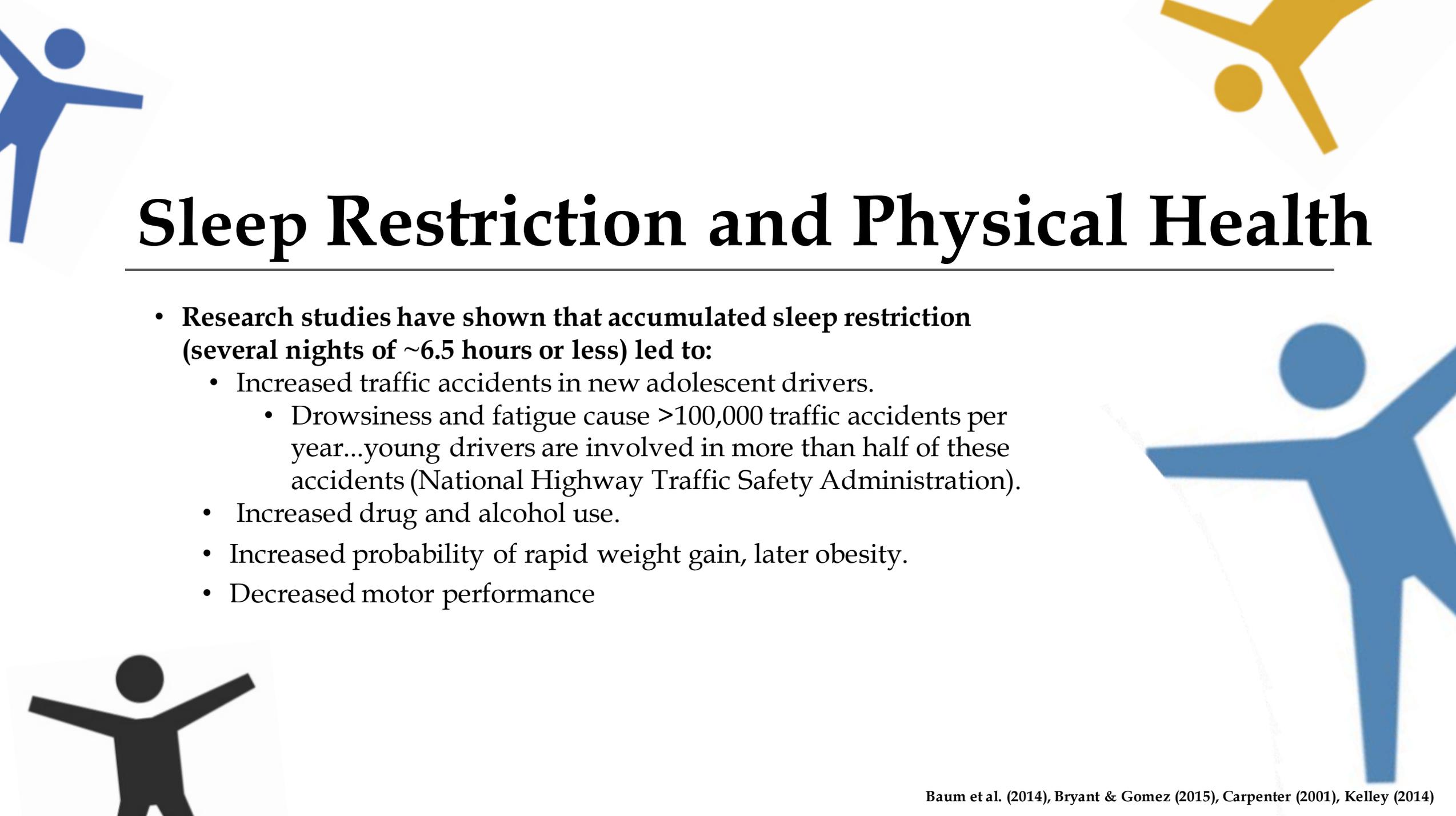
# Sleep Restriction and Mental Wellness

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"Bankrupting the sleep of a teenager could make all the difference in the tipping point between psychological wellness and lifelong psychiatric illness" (309).



- **Accumulated sleep restriction (several nights of ~6.5 hours or less) may lead to:**
  - Impairment in mood regulation, ability to focus/maintain attention, behavioral control.
  - Decreased emotion regulation ability (reported by parents and adolescents).
    - Led to disproportionate emotional reactions; exaggerated responses to small triggers.
  - Increased nervousness, increased "edginess", tension, anger, anxiety
  - Lower frustration tolerance, which may impact academic and socio-emotional domains
  - Increase in impulsivity and risk-taking behaviors.
  - Increased risk for use of stimulants (whether prescribed or not).
  - May be associated with suicidal ideation.

The slide features four stylized human figures in various poses. One is blue in the top left, one is yellow in the top right, one is blue in the middle right, and one is black in the bottom left. The title 'Sleep Restriction and Physical Health' is centered in a large, bold, black font, underlined.

# Sleep Restriction and Physical Health

- **Research studies have shown that accumulated sleep restriction (several nights of ~6.5 hours or less) led to:**
  - Increased traffic accidents in new adolescent drivers.
    - Drowsiness and fatigue cause >100,000 traffic accidents per year...young drivers are involved in more than half of these accidents (National Highway Traffic Safety Administration).
  - Increased drug and alcohol use.
  - Increased probability of rapid weight gain, later obesity.
  - Decreased motor performance

# Sleep and Learning: Adolescent Academic Performance

- Sleep is integral to memory function
- Learning is, put simply, the task of making new memories.
- Fact-based learning depends upon optimal Hippocampal function.
  - Hippocampus provides a short-term storage space for new information and new memories.
- Individuals with a greater number of accumulated sleep hours can experience up to a **20% learning advantage** over those with a fewer number of accumulated sleep hours.
- Sleep *after* learning is equally important.
  - Helps us to solidify and "file away" newly learned information into the part of our brain responsible for long-term memory storage.
- Sleep restriction leads to:
  - Poorer communication
  - Decreased concentration and cognitive performance

**Summary:  
The Impact  
of Severe  
Sleep  
Disruption**  
(Kelley et al., 2014)

Table 1. The impact of severe sleep disruption.

Cognitive responses	Emotional responses	Somatic responses
<i>Reduced:</i>	<i>Increased:</i>	<i>Increased risk of:</i>
Concentration	Motor skills mistakes	Metabolic abnormalities
Performance	Stimulant use	Diabetes II
Attention	Sedative use	Weight gain
Memory encoding	Alcohol use/misuse	Cardiovascular disease
Memory consolidation	Exhaustion	Disorders of the hypothalamo-pituitary-adrenal (HPA) axis
Multi-tasking	Irritability	Reduced immunity
Decision-making	Mood fluctuations	Drowsiness
Creativity	Anxiety	Micro-sleeps
Productivity	Depressed mood	Unintended sleep
Socialization	Frustration/anger	Bodily sensations of pain and cold
Communication	Impulsivity	Hypertension
Empathy		



# Sleep and the U.S. Education System

- More than 80% of public high schools start school before 8:15am.
- Nearly 50% of those public high schools start school before 7:20am.
  - School buses for a 7:20am start time can begin as early as 5:45am.
  - In these extreme cases, we are asking adolescents to wake up as early as 5:00am.
    - 5am is not the same to an adolescent as it is to an adult with a fully matured neurological system.
- When we ask adolescents to function successfully in a state of chronic sleep deprivation, we are **unnecessarily taxing the mental health, physical health, cognitive and emotional functioning** of humans who are not yet fully matured.
  - This creates several risks and detriments to our adolescent populations.

# Positive Impacts of Delayed School Start-Time

- **American Academy of Pediatrics (2014)**
  - Starting school at least thirty (30) minutes later led to:
    - Decreased assistance needed with waking on school days
    - Lower rates of adolescent fatigue
    - Fewer visits to school nurse/health center for fatigue-related symptoms
    - Decreased rates of depressive symptoms
    - Lower driving risk – different schools have reported 16.5%-70% reduction in adolescent (16-18 y.o.) crashes
- Schools that have implemented a delayed start-time of 8:35am or later have seen:
  - Improved attendance
  - Improved grades when compared to schools starting at 7:15am-7:30am
  - An average 3-point increase in standardized test scores



# Delayed School Start-Time: A Review of the Supporting Literature

- Hansen et al., 2005; Jenni et al., 2005; Czeisler, 2009; Giedd, 2009; Hagenauer et al., 2009; Foster et al., 2013
  - Research studies yielding concrete benefits to later school start-times
- Comprehensive reviews of later start times yielded better sleep, health, learning... "enormous potential payoff" with little to no associated economic cost.
  - Kirkby et al., 2011; Jacob & Rockoff, 2011
  - Wahlstrom, 2002
    - N=50,000
    - Seven public high schools in Minneapolis Public School District
  - Wahlstrom, 2014
    - Later replicated Wahlstrom (2002) in public schools in three other states
- Carrell et al., 2011
  - U.S. Air Force Academy, improved academic performance of first-year students (18-19 y.o.) when start-time moved from 7:00am to 7:50am
  -
- Cortes et al., 2010
  - Examined students in 82 Chicago Public High Schools
  - Poorer academic performance in first-period classes

## Other Considerations

- **Economic and Logistical Concerns (Walker, 2017)**
  - Financial burden of altering bus schedules, teacher schedules, after-school activities (Kirby et al., 2011)
    - Jacob & Rockloff (2011)
      - \$150 per student increase in transportation costs alone
      - However, \$17,500 gain in average student earnings due to higher grades and graduation rates
    - Disruption to caregiver schedules
      - Do these changes impact families with working parents in a negative way?
- **Even with an increase in available sleep time, will adolescents obtain a greater number of sleep hours? (Owens, 2010)**

# Summary: Benefits of Delayed School Start-Time

- **Mental Health**
  - *Adolescence = the most susceptible phase of life for developing depression, anxiety, schizophrenia, and suicidality.*
  - Sleep duration is negatively correlated with maladaptive behaviors and mood regulation difficulty.
    - Increased sleep = better behavioral decisions, improved mood regulation
  - Anxious and depressive symptoms are both positively correlated with restricted sleep.
    - Increased sleep = lower likelihood of development of anxious and depressive symptoms
- **Physical Health**
  - Rapid weight gain, obesity
    - Increased sleep = increased likelihood of development of "healthy habits" and better choices regarding nutrition (sugar, caffeine) and physical activity
  - Automobile-related risks
    - Increased sleep = lower automobile accident rates
  - Substance Use
    - Increased sleep = lower behavioral impulsivity; lesser need for use of stimulants
- **Cognitive/Academic Function**
  - Daytime fatigue negatively correlated with measures of school achievement and teacher behavior ratings.
    - Increased sleep = improved classroom behaviors, peer relations, concentration, communication, motor function, and overall academic performance.

## Additional Resources

American Academy of Pediatrics (AAP)

- Childhood Sleep Guidelines

American Academy of Sleep Medicine (AASM)

- [www.sleepeducation.com](http://www.sleepeducation.com)

Centers for Disease Control and Prevention (CDC)

- [www.cdc.gov/healthyschools/sleep.htm](http://www.cdc.gov/healthyschools/sleep.htm)

Cleveland Clinic Foundation (CCF)

National Sleep Foundation (NSF)

*Why We Sleep*, Matthew Walker, Ph.D. (2017)

# Questions?



Please feel free to reach out.



Additionally, please feel free to contact us to request copies of the literature presented today.



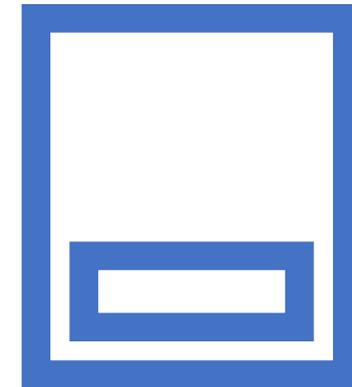
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