

Burning More Than the Midnight Oil: Sleep Deprivation in Teens

Satellite Conference and Live Webcast
 Tuesday, May 5, 2015
 1:00 – 2:30 pm Central Time

Produced by the Alabama Department of Public Health
 Video Communications and Distance Learning Division

Faculty

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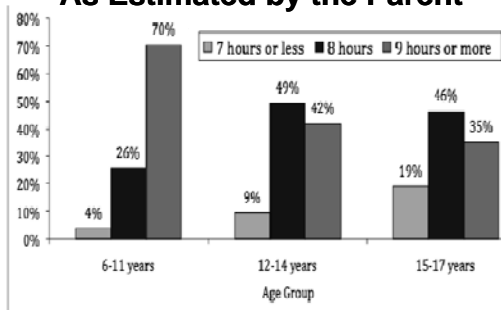
Outline - Sleep Deprivation in Teens

- Is it a problem?
- What's the physiology?
- What can we do?

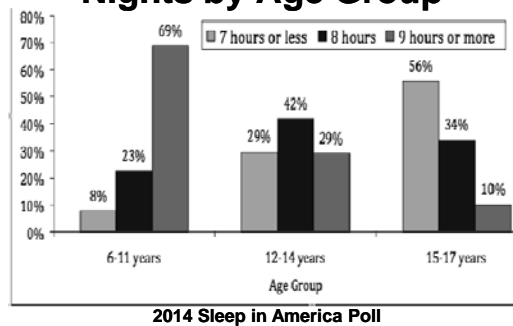
Sleep in Teens Today



Amount of Sleep the Child Needs As Estimated by the Parent



Sleep Duration on School Nights by Age Group




**Sleep in Teens Today
Ideal Sleep Time**



**9 HOURS
15 MINUTES**

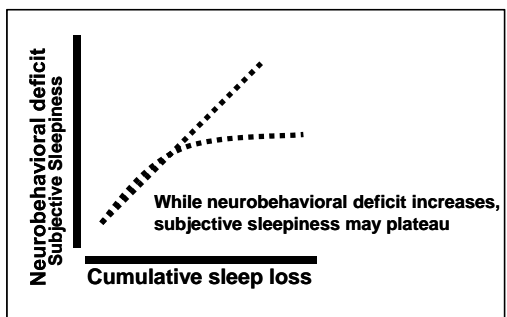
**Consequences of Sleep Deprivation
Does it really matter?**



**Sleep Deprivation
Adults**



Sleep Deprivation

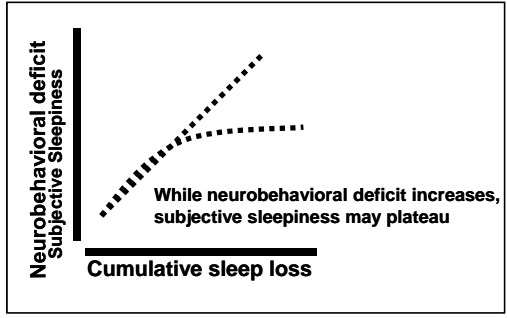


While neurobehavioral deficit increases, subjective sleepiness may plateau

**OMG...Maybe Resident
Work Hours Are Good?**

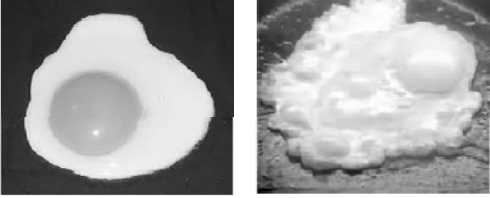


Sleep Deprivation



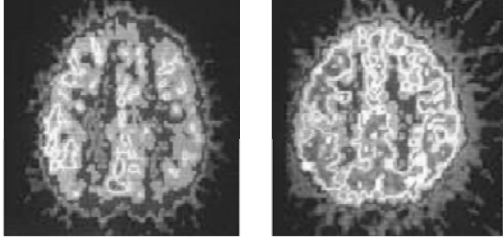
While neurobehavioral deficit increases, subjective sleepiness may plateau

Sleep Deprivation



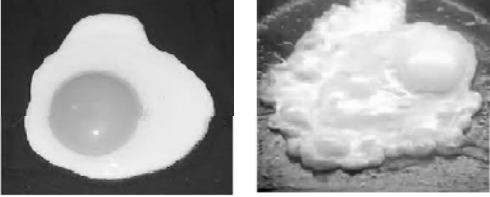
- This is your brain
- This is your brain without sleep

Sleep Deprivation



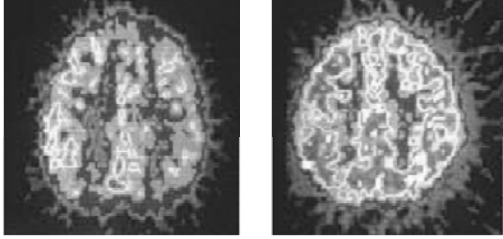
- Brain with sleep
- Brain without sleep

Sleep Deprivation

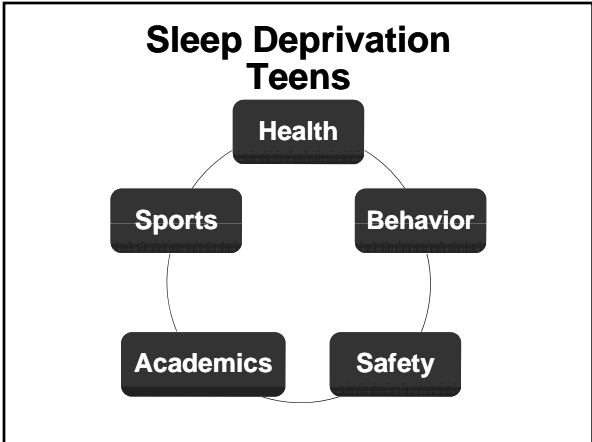


- This is your brain
- This is your brain without sleep

Sleep Deprivation




- Brain with sleep
- Brain without sleep



**Sleep Deprivation
Physical Health**

- Increased cardiometabolic risk
- Increased obesity
- Increased purging, fasting and diet pills
- Increased IBS



Sleep Deprivation Physical Health

- Decreased growth
- Increased neurologic problems (seizure, headache)



Sleep Deprivation Mental Health

- Increased depression
- Increased anxiety
- Increased suicidality
- Increased suicide attempts
- Decreased impulse control



Sleep Deprivation Mental Health

- Higher Kessler Psychological Distress score
- Lower self esteem

Sleep Deprivation - Safety Risk Taking Behavior

- Delinquency
 - Property (stealing)
 - Violence (fighting)
- Impulse control
- Sensation seeking (Thrill seeking)

Sleep Deprivation - Safety Risk Taking Behavior

- Increased drunk driving
- Increased substance abuse
 - Alcohol, binge drinking, cigarettes, marijuana
 - Caffeine – Early, heavy use may lead to other drugs

Sleep Deprivation Safety

- Injury
 - Double the unintentional injury risk
 - Nearly double the pedestrian injury risk (virtual)

Sleep Deprivation Safety

- **Motor Vehicle Crashes**
 - Increased number of crashes
 - Increased chance of numerous crashes
 - Increased “run off the road” crashes

Sleep Deprivation - Safety Drowsy Driving


- **1% of all motor vehicle crashes; 4% of crashes involving fatality**
- **Drivers under 25 years involved in >50% of police - report fatigue - related traffic crashes each year**

Sleep Deprivation - Safety Drowsy Driving

- **NSF poll:**
 - **68% of HS seniors have driven while drowsy;**
 - **15% at least 1 time per week**
- **Impairments related to sleep loss equal or greater than those due to alcohol intoxication**

Katie had everything going for her...




Sleep Deprivation Safety Drowsy Driving



Katie Drentlaw
February 4, 1980 – April 25, 1998

...except enough SLEEP.


18-year old Katie Drentlaw had just accepted a full college scholarship for track and field. Despite being tired, she decided to make the three and a half hour drive home after viewing an all-day competition. She had just 1.2 miles to go when she fell asleep at the wheel and crashed into a steel embankment. She was killed instantly.

Other Alab. - Author Alab.

Drowsy Driving What About Alabama?

- **3.4% of people in Alabama report falling asleep driving during the preceding 30 days (CDC 2010)**



Drowsy Driving What About Alabama?

- **No laws or license restrictions regarding drowsy driving**
- **No requirement for doctors to report sleep disorders**
- **No drowsy driving info part of driver’s education**

Sleep Deprivation Academics

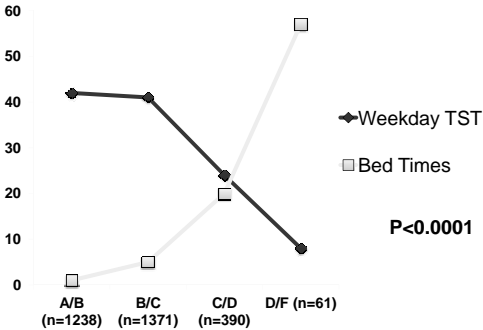
- Multiple studies show that decreased sleep duration is associated with lower academic achievement



Sleep Deprivation Academics

- National Science Foundation Poll
 - 28% fall asleep in school at least 1x/week
 - 22% fall asleep doing homework
- “A” students
 - Sleep 15 minutes more than B students
 - Sleep 26 minutes more than C students
 - Sleep 36 minutes more than D student

Minute Variability vs. Grades



Sleep Deprivation Sports

- Slowing of psychomotor vigilance (athletes)
- Decreased performance
 - Accuracy
 - Consistency



Sleep Deprivation Sports

- Conversely – Increasing sleep time increases consistency, accuracy, and psychomotor vigilance



Sleep Deprivation Sports Psychomotor Vigilance

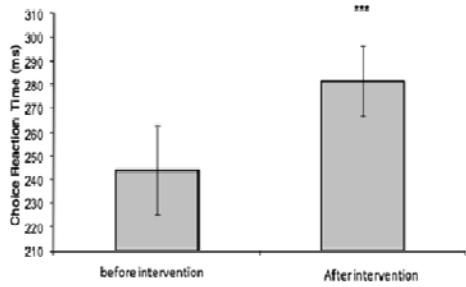
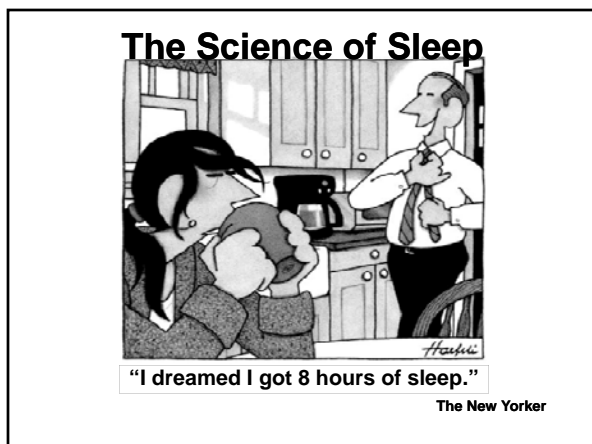
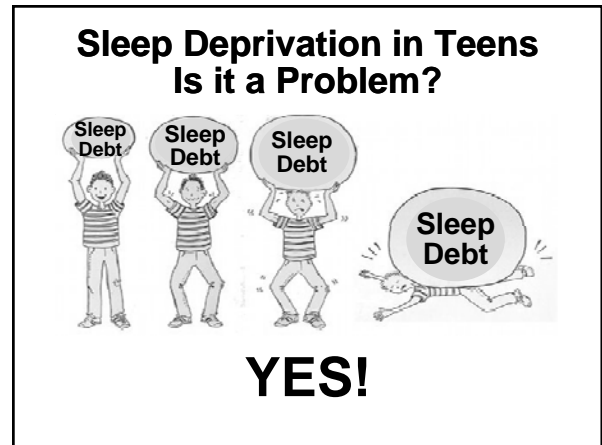
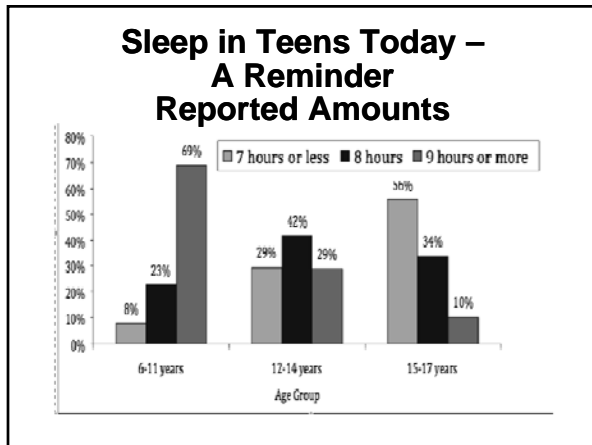
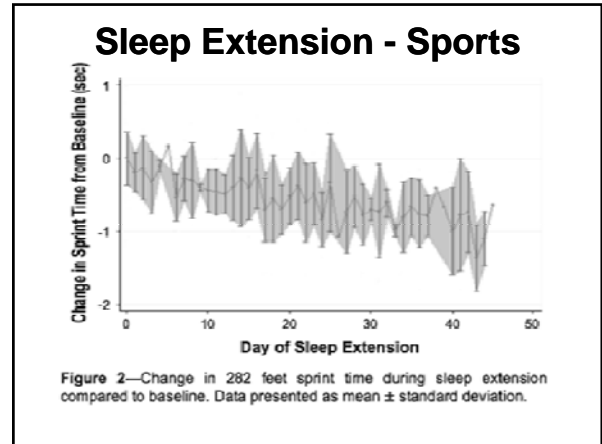
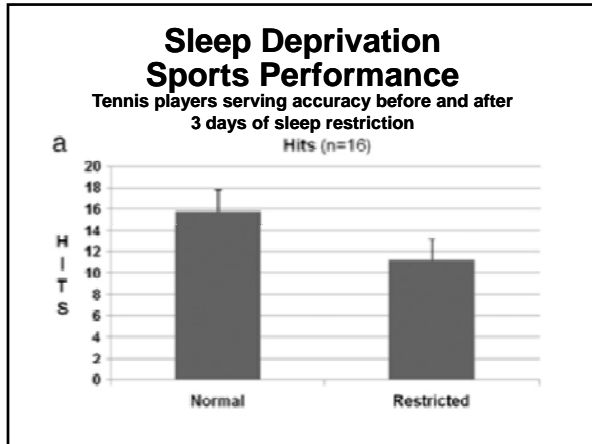
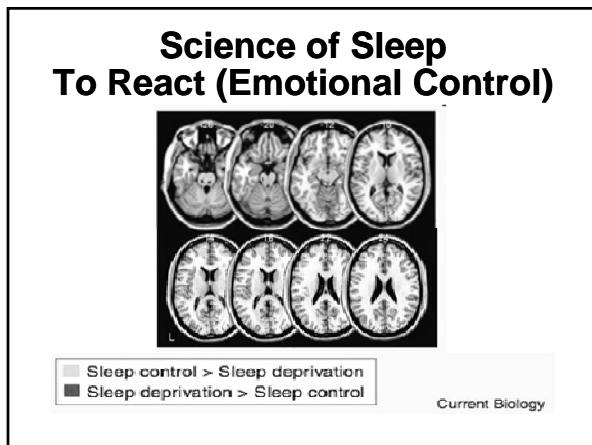
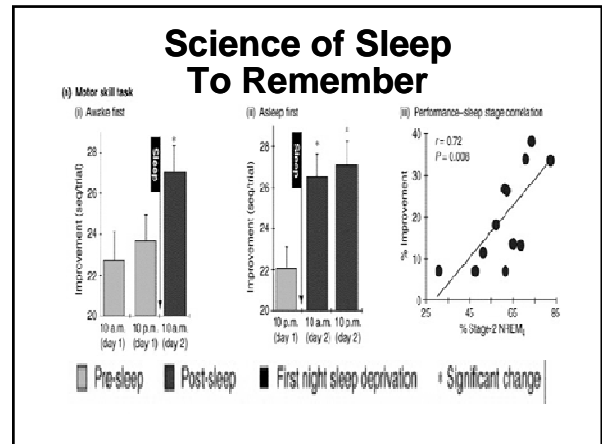
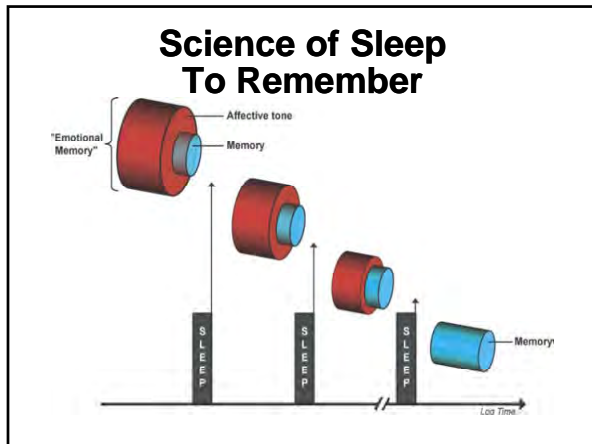


Fig. 3: Mean choice reaction time of subjects before and after intervention (***) P<0.005



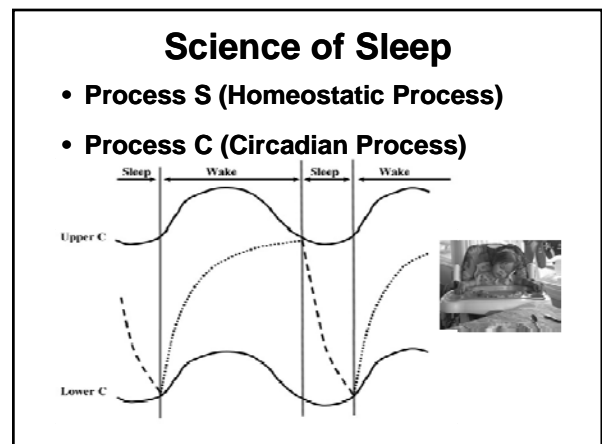
Science of Sleep Why Do We Need Sleep?

- To remember
- To react
- To regulate (Heal)




- ### Science of Sleep To React (Emotional Control)
- Sleep - deprived volunteers viewed emotional images
 - Increased response of the “emotional brain” (amygdala)
 - Weaker connection amygdala – PFC = less emotional control

- ### Science of Sleep To Regulate
- Numerous studies demonstrate sleep is necessary to mediate health
 - Ghrelin and Leptin
 - Interleukins and Cytokines
 - Insulin and Cortisol
 - Cardiovascular function
 - Cell reproduction (Cancer)




Science of Sleep It Changes

- Sleep need decreases through life
- Newborns → Toddlers → School Age → Teens → Adults




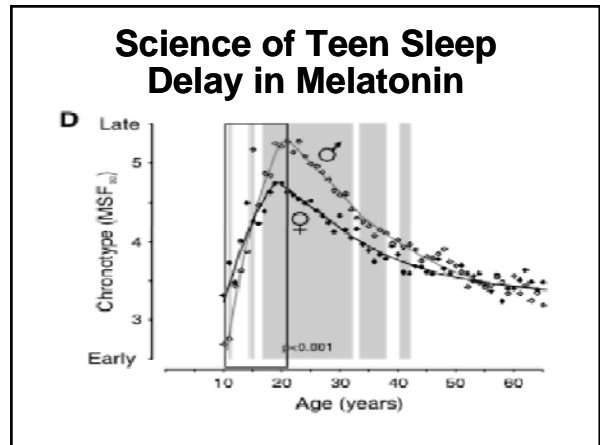
Science of Sleep It Changes

- Our bodies will only stay awake so long




Science of Teen Sleep

- Process S requires more hours awake to cause sleepiness
- Process C demonstrates a natural delay in melatonin release


Physiology of Teen Sleep Delay in Melatonin

- Species manifesting Juvenile Phase Delay
 - Homo sapiens (humans)
 - Macca mulatta (Rhesus monkeys)
 - Octodon degus (degu) [some ?]




Physiology of Teen Sleep Delay in Melatonin

- Rattus norvegicus (laboratory rat)
- Mus musculus (laboratory mouse)
- Psammomys obesus (fat sand rat)




Physiology of Teen Sleep Delay in Sleep Phase Observed Worldwide

- 6 Continents – Developed and Undeveloped Countries




Teen Sleep – The Perfect Storm



**Physiology
+
Environment**

Circadian Misalignment


Science of Teen Sleep Physiology

- Teens are biologically programmed to go to sleep after 11:00 pm




Science of Teen Sleep Physiology

- Likewise, teens are biologically programmed to wake up after 8:00 am



Science of Teen Sleep Environment



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“Tommy can't play now, but he might be able to squeeze you in between soccer and his piano lesson.”

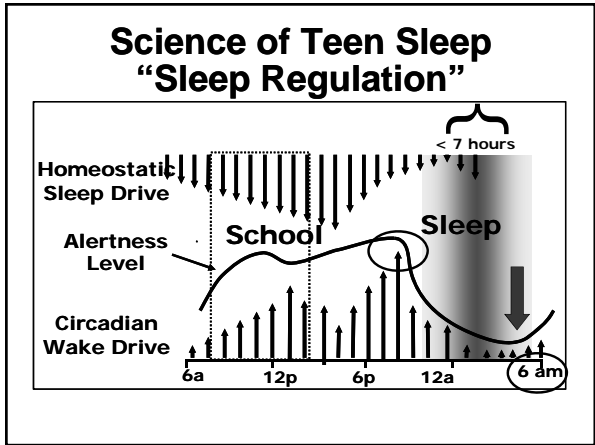
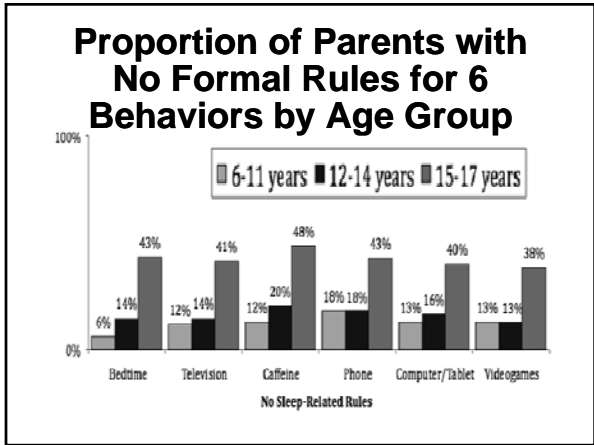
Science of Teen Sleep Environment

- School start times
- Sports
- Extracurricular activities
- Jobs
- Bus schedules
- Social commitments

Science of Teen Sleep Environment

- **ELECTRONICS** and the 24 HOUR SOCIETY

Courtesy of DavesDailyDose.com




Science of Teen Sleep Weekend Make-up Sleep

- Discrepancy between weekday and weekend bedtime / wake-up associated with learning deficits and behavior problems
- Results in greater difficulty sleeping on Sunday night

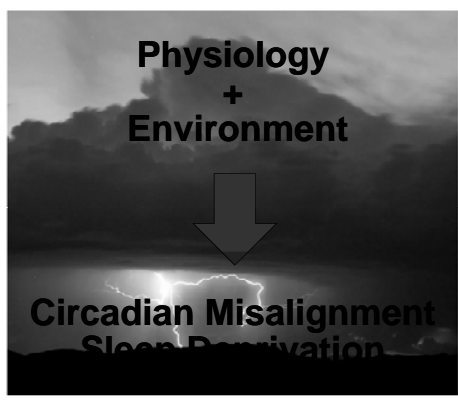
Science of Teen Sleep Weekend Make-up Sleep

- Leads to a permanent "Jet Lag"
 - Can last days – 1 day for every time zone crossed
 - GI problems, fatigue, somnolence, depressed mood

Physiology of Teen Sleep
Ideal Sleep Time



9 HOURS
15 MINUTES



Physiology
+
Environment

↓

Circadian Misalignment
Sleep Deprivation

So What Can We Do?

- Educate
- Advocate

What Can We Do?

- Educate
 - Importance of bedtimes
 - Kids without parent set bedtimes sleep 30 minutes LESS a night than kids with set bedtimes

What Can We Do?

- Educate
 - Impact of electronic devices
 - Kids with electronics in their bedrooms sleep 30 minutes LESS a night than kids without electronics

What Can We Do?

- Educate
 - Importance of schedule and limit - setting
 - Schedules should be maintained on weekends to avoid weekend oversleep and social “jet lag”

What Can We Do?

- **Advocate**
 - **Drowsy driving**
 - <http://sleepfoundation.org/drowsy-driving-advocacy>
 - **Drowsy driving education in drivers education**
 - **Delayed school start times (AAP Statement)**

AAP Statement PEDIATRICS[®]

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

School Start Times for Adolescents
 ADOLESCENT SLEEP WORKING GROUP and COMMITTEE ON
 ADOLESCENCE, AND COUNCIL ON SCHOOL HEALTH
Pediatrics; originally published online August 25, 2014;
 DOI: 10.1542/peds.2014-1697

AAP Statement Highlights

- **Teens in the United States are chronically sleep deprived, yet physiologically they cannot go to sleep routinely before 11:00 pm and cannot wake routinely before 8:00 am**

AAP Statement Highlights

- **Sleep deprivation negatively impacts learning, mood, behavior, safety and health**
- **Junior High and High Schools should not start before 8:30 am**

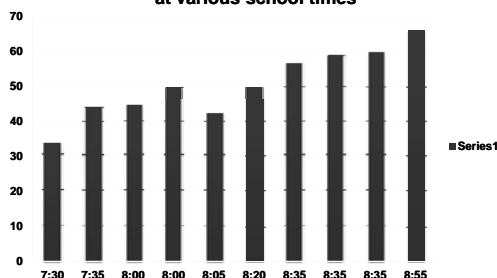
Supporting Data Delayed School Start / Quantity of Sleep

Table 4. Percent of High School Students Sleeping At Least 8 Hours Per School Night by School Start Time

| School Start Time | 7:30 AM | 7:35 AM | 8:00 AM | 8:00 AM | 8:05 AM | 8:20 AM | 8:35 AM | 8:35 AM | 8:35 AM | 8:55 AM |
|-----------------------|------------------------------------|--------------------------|------------------------------------|----------------------|------------------------------------|--------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| School Year | 2010-2011 | 2011-2012 | 2011-2012 | 2010-2011 | 2011-2012 | 2010-2011 | 2010-2011 | 2010-2011 | 2010-2011 | 2012-2013 |
| District & State | Boulder Valley School District, CO | Teton County Schools, WY | Boulder Valley School District, CO | Mahomet District, MN | Boulder Valley School District, CO | St. Louis Park High School, MN | South Washington Co., MN | South Washington Co., MN | South Washington Co., MN | Teton County Schools, WY |
| School | Fairview High School | Jackson Hole High School | Boulder High School | Mahomet High School | Fairview High School | St. Louis Park High School | Woodbury High School | East Ridge High School | Park High School | Jackson Hole High School |
| Sample Size | 333 | 446 | 1379 | 884 | 1353 | 902 | 1249 | 960 | 1407 | 459 |
| Sleep ≥ 8 hours/night | 33.6% | 44.2% | 44.5% | 49.7% | 42.5% | 49.8% | 57.8% | 58.9% | 60.8% | 66.2% |

Supporting Data Sleep Time in Teens

Percent of teens getting >8 hours sleep at various school times



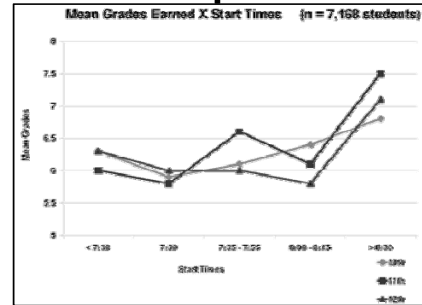
Supporting Data Teen Mood Improvements

Table 14. High School Students' Mean Depression Scale Scores by Amount of Sleep

| Sleep Group | M | SD | t | p | d |
|-------------|-------|------|-------|---------|------|
| < 8 hrs. | 16.50 | 6.33 | 20.96 | < 0.001 | 0.44 |
| ≥ 8 hrs. | 13.80 | 5.81 | | | |

PARENTS overwhelmingly reported their **TEENS** were easier to live with

Supporting Data Academic Improvements



Supporting Data Motor Vehicle Crashes

- Decreased crash rates in several districts
 - 16% (Kentucky)
 - 65% (Minnesota)
 - 70% (Wyoming)



In Conclusion ...a Word From Ben Stein



In Conclusion ...a Word From Ben Stein

“Sleep makes people calmer, more alert, less fearful – just plain happier, or so I see around me and in me. I am sure that if this great nation were to concentrate on getting more sleep, we would be a happier, more confident people, and that by itself would be a major achievement.”

Thank You



My Family



- AAP
- COA/UAB
- Judy Owens
- John Garcia



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- Sleep Deprivation Academics – Information courtesy of Judy Owens and National Sleep Foundation
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- Asian J Sports Med. 2012 Mar;3(1):15-20. (Sports Psychomotor Vigilance Graph)

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