Towards Zero Deaths Conference

Attacking the Roadway
Sleep Zombies

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Sleep Problems in Young Adults:
A Public Health Crisis

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Scientific Director, Center for College Sleep
Student Sleep Problems– In their own words

As a society, we get 20% less sleep than our ancestors only 100 years ago.
Sleep is an acquired habit. Cells don't sleep. Fish swim in the water all night. Even a horse doesn't sleep. A man doesn't need any sleep.

-Thomas Edison
Yet, sleep is required for life.

### Required Sleep Amounts

<table>
<thead>
<tr>
<th>Age Group</th>
<th>0 - 2 months:</th>
<th>2 - 12 months:</th>
<th>12 mo - 18 mo:</th>
<th>18 mo - 3 years:</th>
<th>3 - 5 years:</th>
<th>5 - 12 years:</th>
<th>On Average:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Newborns/Infants</strong></td>
<td>10.5-18 hours</td>
<td>14-15 hours</td>
<td>13-15 hours</td>
<td>12-14 hours</td>
<td>11-13 hours</td>
<td>10-11 hours</td>
<td>9.25 hours</td>
</tr>
<tr>
<td><strong>Toddlers/Children</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7-9 hours</td>
</tr>
<tr>
<td><strong>Adolescents</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Adults/Older Persons</strong></td>
<td></td>
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</tr>
</tbody>
</table>

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Chinese man dies after Euro 2012 viewing marathon

A football obsessed man from Changsha in south-central China has reportedly died after staying up for 11 successive nights to watch Euro 2012 matches.

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Bank of America Intern Dies After Reportedly Working Three Straight Days With Little Sleep

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### Sleep Stages

<table>
<thead>
<tr>
<th></th>
<th>Awake</th>
<th>NREM</th>
<th>REM</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEG</td>
<td>Fast, asynch</td>
<td>Slow, synch</td>
<td>Fast, async</td>
</tr>
<tr>
<td>Sensation</td>
<td>Vivid, external</td>
<td>Dull, Absent</td>
<td>Vivid, internal</td>
</tr>
<tr>
<td>Thought</td>
<td>Voluntary</td>
<td>Idle</td>
<td>Vivid, illogical</td>
</tr>
<tr>
<td>Movement</td>
<td>Voluntary</td>
<td>Rare, involuntary</td>
<td>Muscle paralysis</td>
</tr>
<tr>
<td>Eye moves</td>
<td>Often</td>
<td>Rare</td>
<td>Often</td>
</tr>
</tbody>
</table>

Different stages of sleep accomplish different tasks.

- Cellular repair; Gylmphatic clearance; Neuroendocrine balance; Immune responses
- Emotional “Reset” Button; Memory Processing; “Offline” Problem Solving
Sleep Perception

*Figure 1.*—The number of subjects accurately detecting sleep during each nap length tallied and analyzed for differences in sleep detection as a function of sleep length shows an increase in the number of individuals correctly detecting sleep as a function of the duration of sleep.

Sleep Drives Metabolite Clearance from the Adult Brain.
Xie et al. (2013) *Science*
Sleep timing is controlled by synchronizing four processes.

Teens and Sleep

• Teens are biologically more alert in the evening, as compared to younger children. Their natural time for bed is around 10:45 pm, and the brain remains in the ‘sleep’ mode until about 8:00 AM. This makes it difficult or impossible to fall asleep early enough to achieve the recommended 8-10 hours of sleep when schools start before 8:30 AM.

• A teenager who gets less than 8 hours of sleep per night is more likely to use cigarettes, alcohol, drugs and be sexually active than those who get the recommended 8-10 hours of sleep.
We have a culture of Sleep Deprivation

High School Start Times in Minnesota 2016-2017

<table>
<thead>
<tr>
<th>Start Time</th>
<th>Number of districts with that start time</th>
<th>Enrollment in grades 9-12 affected by the start time</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30 a.m. or later</td>
<td>43</td>
<td>31,248 (13%)</td>
</tr>
<tr>
<td>8:15-8:29 a.m.</td>
<td>138</td>
<td>59,841 (25%)</td>
</tr>
<tr>
<td>8:00-8:14 a.m.</td>
<td>107</td>
<td>66,735 (28%)</td>
</tr>
<tr>
<td>Before 8 a.m.</td>
<td>37</td>
<td>81,975 (34%)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>325 Districts</strong></td>
<td><strong>239,799 Students</strong></td>
</tr>
</tbody>
</table>

Source: Center for Applied Research and Educational Improvement (CARE) 2012, 2016

87% of high school students in MN start before 8:30 am impacting over 200,000 teenagers
Later High School Start Times Are Associated with Reduced Accidents

The first year in college is associated with an abrupt shift in sleep schedule.

High School Data from 2006 Sleep in America Poll (n = 1,602)

Lund et al. 2010 J. Adolescent Health
Self-reports in college students show inconsistent, insufficient & low quality sleep.

- Mean total sleep time was 7.02 hours
- Only 11.6% got >8hrs sleep a night
- 20% pulled all-nighters at least once in the last month
- 35% stayed up until 3AM at least once a week
- 15% fell asleep in class >1x/week

Only 37% of male students and 33% of female students met the criteria for healthy sleep on the PSQI.

Lund et al., 2010

Within the last 12 months, have any of the following been traumatic or very difficult for you to handle?

42% of students report having sleep difficulties
The majority of students experience social jetlag, irregular schedules, and inadequate sleep.

Social Jetlag: Equivalent to Flying from Chicago to LA and back every weekend.
Or worse...

A Tale of Two Sleep Schedules
Circadian Temperature Rhythms
Regular and Erratic Schedule

What’s contributing to this poor sleep?

- No parental supervision
- Late night meetings / workouts
- Rx MEDS
- Irregular Schedules
- Social Pressure To stay up late
- Stress
- Noisy environments
- Depression
- Roommates
- Alcohol
- Academic Pressure To get up early
- Poor time management
- Technology In the Bedroom
- Caffeinated drinks in PM
- Delayed Phase Syndrome
Campus stores often promote pharmacological “solutions” to sleep problems.

• 70% sell energy beverages on campus
• 60% sell energy nutritional supplements
• 40% sell caffeine pills

The Sleep Cycle app tracks sleep patterns and the alarm function increases the probability of waking while in REM sleep.
Normal Night

Caffeine induced SWS suppression

Normal Night

Alcohol induced REM suppression
Inadequate Sleep Hygiene Disorder

Insomnia for at least one month + presence of at least one of the following:

- Frequent daytime napping
- Highly variable bedtimes or rising times
- Routine use of nicotine, alcohol or caffeine
- Mentally stimulating, physically activating, or emotionally disturbing activities in bed
- Spending excessive amounts of time in bed and/or using bed for non-sleep/sex purposes

What does it really mean to be sleepy?
**The Stanford Sleepiness Scale**

http://web.stanford.edu/~dement/sss.html

**Degree of Sleepiness**

| Feeling active, vital, alert, or wide awake | 1 |
| Functioning at high levels, but not at peak; able to concentrate | 2 |
| Awake, but relaxed; responsive but not fully alert | 3 |
| Somewhat foggy, let down | 4 |
| Foggy; losing interest in remaining awake; slowed down | 5 |
| Sleepy, woozy, fighting sleep; prefer to lie down | 6 |
| No longer fighting sleep, sleep onset soon; having dream-like thoughts | 7 |
| Asleep | X |

**Epworth Sleepiness Scale (ESS)**

<table>
<thead>
<tr>
<th>Situation</th>
<th>Chance of dozing (0–3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting and reading</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Watching television</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Sitting inactive in a public place—for example, a theater or meeting</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>As a passenger in a car for an hour without a break</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Lying down to rest in the afternoon</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Sitting and talking to someone</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Sitting quietly after lunch (when you've had no alcohol)</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>In a car, while stopped in traffic</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td><strong>Total Score</strong></td>
<td></td>
</tr>
</tbody>
</table>

*0 = would never doze; 1 = slight chance of dozing; 2 = moderate chance of dozing; 3 = high chance of dozing*  
*Johns MW. Sleep. 1991;14:540.*
Sleep deprivation

- Irritability
- Cognitive impairment
- Memory lapses or loss
- Impaired moral judgement
- Severe yawning
- Hallucinations
- Symptoms similar to ADHD

- Impaired immune system

- Increased heart rate variability
  Risk of heart disease

- Decreased reaction time and accuracy
- Tremors
- Aches

Other:
- Growth suppression
- Risk of obesity
- Decreased temperature

Consequences of poor sleep in college students

- Decreased academic & performance
- Increased Depression
- Insulin Resistance

- Slowed Reaction Time
- Increased Stress & Anxiety
- Increased BP

- Increased Accident Risk
- Increased interpersonal problems
- Weight Gain

- Inc. Risk-Taking Behavior
- Inc. drug abuse
- Decreased Immunity
Chronic Mild Sleep Deprivation & Cognition

- Subjects slept for 4-6 hours a night for 14 consecutive nights
- Deficits in cognitive performance equivalent to 3 days without sleep
- Subjects reported not feeling sleepy
  (Nat. Institute of Health, 2003)

Sleep Deprivation & Cognition

- **Cognitive performance:**
  - Tracking task on computer
  - No change for 12 hrs
  - Drops from 12-24 hrs
  - Rebounds 24-29 hrs!

- **Conclusion:**
  - Performance declines between 12 and 6 a.m. due to fatigue and Circadian rhythm.
    Nature 1997
Each additional day per week a student experiences sleep problems raises the probability of dropping a course by 10% and lowering their cumulative GPA by 0.02.

Hartmann and Prichard 2017
Last 12 months Injury Rate:

Non-Athlete - 11.3%
- OK Sleep - 7.1%
- Sleep Difficulties - 14.8%

Varsity Athlete - 26.3%
- OK Sleep - 18.4%
- Sleep Difficulties - 34.4%

N=103,233  NCHA-II Spring 2011 Cohort

Behavioral Risk Factor Surveillance System, CDC 2009

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Unintentionally fell asleep during day at least once in the past month</th>
<th>Nodded off or fell asleep while driving in the past month</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 to &lt;25</td>
<td>43.7%</td>
<td>4.5%</td>
</tr>
<tr>
<td>25 to &lt;35</td>
<td>36.1%</td>
<td>7.2%</td>
</tr>
<tr>
<td>35 to &lt;45</td>
<td>34.0%</td>
<td>5.7%</td>
</tr>
<tr>
<td>45 to &lt;55</td>
<td>35.3%</td>
<td>3.9%</td>
</tr>
<tr>
<td>55 to &lt;65</td>
<td>36.5%</td>
<td>3.1%</td>
</tr>
<tr>
<td>≥65</td>
<td>44.6%</td>
<td>2.0%</td>
</tr>
</tbody>
</table>

http://www.cdc.gov/features/dssleep/
Sleeping Behind the Wheel

100,000 sleep-related crashes per year; 1,500 fatalities and 71,000 injuries; 51% of adults report driving drowsy; 17% dozed off at the wheel.

People who drive after being awake for 17 to 19 hours performed worse than those with a blood alcohol level of .05.

Prior Lake track star returning from college meet dies in car crash

By Dith Groves

Masa et al. 2000

Masa et al. 2000
College Sleep Environmental Scan

How Sleep Friendly Is Your Campus?

Poor sleep has a detrimental effect on academic success similar in magnitude to marijuana use and high-risk drinking.

College Sleep Environmental Scan

- The College Sleep Environmental Scan is a free tool designed to help analyze how sleep-friendly campus culture is and how it can be improved.
- Free data provided to help evaluate existing measures and make changes to improve your campus.
- Participating institutions receive an evidence-based medication bibliography and yearly aggregate report.

Center for College Sleep

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