Community Information Session
SLEEP SCIENCE AND SCHOOL START TIMES
INTRODUCTION
Dr. Brian Troop, Superintendent

THE SCIENCE BEHIND SLEEP AND IMPACT TO STUDENTS
Dr. Lydia Hackenberg, WellSpan Clinical Psychology
Dr. Meera Ranganathan, WellSpan Pulmonary and Sleep Medicine

PANEL DISCUSSION
Dr. Lydia Hackenberg, WellSpan Clinical Psychology
Dr. Rick Hornberger, EASD Assistant Superintendent of Secondary Education
Dr. Meera Ranganathan, WellSpan Pulmonary and Sleep Medicine
Mrs. Jennifer Weiser, EASD Department Supervisor

ADDITIONAL QUESTIONS
WHY?
Why are we here tonight?
Why are we looking at adjusted start times?
Why do we believe this is something that could benefit our students?
Why are we taking time to look at all aspects?
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).

Walker (2017)
"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?

- 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

Keyes (2014), Owens et al. (2010)
<table>
<thead>
<tr>
<th>ADOLESCENT SLEEP RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>National Sleep Foundation</strong></td>
</tr>
<tr>
<td><strong>American Academy of Pediatrics</strong></td>
</tr>
</tbody>
</table>

**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 10:30 – 11 PM, making the ideal wake time 8 - 8:30 AM.**
"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.

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

Baum et al. (2014), Bryant & Gomez (2015), Carpenter (2001), Kelley (2014)
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

Walker (2017)
### Table 1. The impact of severe sleep disruption.

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

It is not a passive state, but essential for health, wellbeing and day time functioning.
Adolescents NEED 8.5 to 9.25 hours of sleep per night.

7 out of 10 U.S. adolescents get 7 hours or less per night.
STAGES OF SLEEP

HYPNOMGRAM

- Awake
- REM
- Stage 1: Growth hormone released, brain recovery, executive functioning
- Stage 3
- Memory consolidation, learning

Hours of Sleep:

0 1 2 3 4 5 6 7 8 9
STAGES OF SLEEP

HYPNOGRAM

- Awake
- REM
- Stage 1: Growth hormone released, brain recovery, executive functioning
- Stage 3

Hours of Sleep

Memory
PROCESS S – SLEEP HOMEOSTASIS

sleep need

6a  time of day  9p  6a

W  S
PROCESS C – CIRCADIAN RHYTHM

sleep need

6a  time of day  9p  6a
CIRCADIAN MISALIGNMENT
The American Academy of Sleep Medicine recommends the following hours of sleep on a regular basis for optimal health at each stage of life.
EXTRINSIC SLEEP DISRUPTORS
THE PERFECT STORM

- Sleep Loss
- School Start Time
- Biological Phase Delay
- Caffeine
- Electronic Devices
- Curricular & Extracurricular Activities
DEFICIENT SLEEP IN TEENAGERS

- Mood and Affect Changes
- Behavior Issues
  - Aggression
  - Hyperactivity
  - Impulse control
- Risk Taking Behaviors
  - Poor judgment and increased accidents
- Neurocognitive Changes
  - Attention
  - Memory
  - Executive Functioning
- Weight Gain
  - Increased caloric intake with increased carbohydrates and fat
Multiple studies have demonstrated the benefit of a later school start time.

- Students Getting 8+ Hours Sleep/Night
- Better Academic Outcomes
- Better Attendance Rates
- Higher Graduation Rates
- Reduced Tardiness
- Less Depression
- Less Caffeine Use
- Fewer Car Crashes
STUDENTS DO NOT STAY UP LATER, BUT THEY DO WAKE UP LATER.
WHAT ABOUT SPORTS?

• Wilton, CT had increased participation and winning season following change
• Stanford athletes increased time in bed to 10 hours/night
  • Basketball – Faster sprint (0.7 seconds), more accurate free throws (9%), improved mood, decreased fatigues
  • Football – 20 yard and 40 yard dash improved by 0.10 seconds
  • Swimming – faster 15m sprints (0.51 seconds), faster reaction time off blocks (0.15 seconds), faster turns (0.10 seconds)
RECOMMENDS STARTING MIDDLE/HIGH SCHOOLS NO EARLIER THAN 8:30 AM

- American Academy of Pediatrics
- Centers for Disease Control and Prevention
- American Medical Association
- American Academy of Sleep Medicine
- American Academy of Child and Adolescent Psychiatrists
- American Psychological Association
- American Thoracic Society
- National Sleep Foundation
- National Educational Association
- National Parent Teacher Association
TAKE HOME MESSAGES

• Sleep is essential for learning, growth, and development

• Adolescents significantly sleep deprived, with school start times as one of the strongest contributing factors

• Changing start times is NOT coddling students, but setting them up for success in life.
• 1096 students participated in the survey in grades 7-12

• 80.5% of students get less than the 8-10 hours of sleep recommended by research on school nights.

• 52% of the students getting less than the recommended sleep are getting between seven and eight hours of sleep.

• 23.2% of students always or often take a nap after school.

• 89.4% of those students who always or often take a nap after school get less than the recommended amount of sleep on school nights.

• 85% of students reported that they get 8 or more hours of sleep when they are able to sleep in.

• 67% students always or often feel tired or sleepy during the school day.

• 94% have felt tired during the school day on occasion.

• 15% of those students that feel tired or sleepy during the school day get the recommended hours of sleep on school nights.
STAY UP TO DATE!

www.EASDPA.org

- Related Links
  - Various Journals, Publications, Scientific Research
- Submit Questions
- Survey Summary
PANEL DISCUSSION

• Dr. Lydia Hackenberg, WellSpan Clinical Psychology
• Dr. Rick Hornberger, EASD Assistant Superintendent of Secondary Education
• Dr. Meera Ranganathan, WellSpan Pulmonary and Sleep Medicine
• Mrs. Jennifer Weiser, EASD Department Supervisor & EHS English Language Arts Teacher
• Continue to work on logistics
  • Transportation
  • After-School Care
  • Extra-Curricular Details
  • Identify potential start and end times for each level (K-4, 5-6, 7-8, 9-12)

• Recommendation to School Board in January or February

• Communication to Parents, Guardians, and Community

• Implementation Work at District
QUESTIONS?

SLEEP SCIENCE AND SCHOOL START TIMES