Why are Teens Susceptible to Driving Fatigue?
Meeting Number 10
July 6th, 2015
For audio, please dial 1-866-835-7973

Today’s Agenda

- Why are teens susceptible to driving fatigue?
- Updates from CSN

Meeting Orientation Slide

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Presenter

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Why are teens susceptible to driving fatigue?
Mary A Carskadon, PhD
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Adolescent Sleep—
patterns shaped at an awkward intersection of biology, behavior, and modern life style

Overview

- Teen biology and sleep
- Teen behavior and sleep
- Teen driving and sleep

Teen sleep biology—
two important processes

- The circadian timing system
- The sleep-wake homeostatic system
Circadian Timing System

Sleep pressure oscillates daily (circadian)


Chronotype and Adolescence

- Time of weekend midsleep
- 2nd decade = marked delay
- “Biological marker for the end of adolescence?”

Roenneberg et al., Current Biol., 2004.

Melatonin Phase and Puberty

- Melatonin = ‘hormone of darkness’
- Melatonin = start of brain’s nighttime
- Adolescence = later timing of melatonin onset


Circadian Rhythms Summary

- Timing gets later across adolescence
- Chronotype is later
- Melatonin phase is later
- Result: late night sleep is favored (so, too, late morning rise)
Sleep-Wake System

Sleep pressure rises when awake
Sleep pressure falls when asleep


Measures of Sleep Pressure

- Slow wave (NREM stages 3+4) sleep [qualitative: deep sleep]
- Slow-wave activity (SWA) in sleep [quantitative: slow EEG waves]

Changes of Slow Wave Sleep and EEG Slow Waves (SWA)

Jenni & Carskadon, Sleep, 2004

Across puberty, SWA recovery is unchanged, but accumulation rate slows

Jenni, Achermann & Carskadon Sleep, 2005

Tanner Stages 1/2

Tanner Stage 5

Decay Time Constant $t_d = 2.5$ h
Rise Time Constant $t_r = 12.1$ h

$t_i = 8.9$ h
Summary of Sleep Pressure Change

- Recovery sleep process does not change across adolescence
  - Need for sleep is stable
- Accumulation of sleep pressure slows
  - Staying awake longer is a bit easier

Result: late nights are easier to achieve, but the same amount of sleep is needed

Teen behavior and sleep

- Psychosocial context
- School start time

Psychosocial Context

- Exertion/establishment of autonomy
- Employment
- Substances [no child needs caffeine]
- 'Screen time' at night
- Social networking at night
- New loves and loves lost
- ...and much much more...
- School schedule

School Start Time (SST)
Schools start early in the US

- Middle school (grades 6-8)
  - 2001 National Household Education Survey
  - ~50% before 8:00 am
  - <25% after 8:30 am

- High school (grades 9-12)
  - 2005 US: >50% start before 8:00 am
  - 2005 Kansas: 2/3 start before 8:00 am; 99% start at 8:30 am or earlier
  - 2010-11 NYC: 10% at 7:30 am or before; 80% at 8:30 or before

Sleepiness in high school students

- 10th graders
- Start time = 0720
- Sleeping about 7 hours a night

Carskadon et al. Sleep, 1998

American Academy of Pediatrics

School Start Times for Adolescents

August 25, 2014

American Academy of Pediatrics

In most districts, middle and high schools should aim for a starting time of no earlier than 8:30 am.
Sleep loss consequences: US Teens

Amount of Sleep 7 h 6 h 5 h <5 h
Drunk Driving
Contemplated Suicide
Attempted Suicide

Teen crashes and sleep
- Impact of school start time

Teen crashes and school bells
- Lexington, KY [Danner & Phillips, Sleep Med, 2008]
  - From 0800-0900 in Lexington school district
  - Lexington county teen crash rate down 16.5%; rest of KY rate up 7.8%
- Two SE Virginia towns [Vorona et al., Clin Slp Med, 2011]
  - Virginia Beach: SST = 0725; teen crash rate = 65.8/1000
  - Chesapeake: SST = 0840–5; teen crash rate = 46.6/1000
Teen crashes and school bells

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<th>Time 1 SST</th>
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Wahlstrom, CDC Final Report, February, 2014

Drivers’ ages in fall-asleep crashes

Time of fall-asleep crashes in ages 16-25
(Pack et al, 1995)

Strategies
- Driver’s education materials
- Driver’s manuals
- Driver’s license examinations
- Insurer discount programs
- Public safety campaigns
- Graduated licensure laws
Summary

- Not enough sleep
- Fatigue: early morning, after school, late at night
- Short sleep and fatigue can influence driving safety
  - sleepiness
  - distractibility
  - impulsivity

What’s New at CSN

- New Funding!
New CSN Components

**Goal:** Reduce child death and injury-related hospitalizations and emergency department visits by 100,000 over the next three years

1. National Coordinated Child Safety Initiative (NCCSI)
2. Training & Technical Assistance
3. Child Safety Collaborative Innovation & Improvement Network (CS CoIIN)

What is a CoIIN

- Based on the IHI Breakthrough Series Model
- A way to spread best practices
- Action oriented, strategy focused, team based and data driven

Questions?

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617-618-2178
Upcoming Webinars & Reminders

- **August**: Presentations from North Dakota & Montana
- **September**: Wrapping up the CoP

Thank you for your participation

Please take a moment to complete our short evaluation:
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Questions or Comments? Contact:
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