



Sleep, Circadian Rhythms and Drowsy Driving: Why YOU are at Highest Risk

Judith Owens MD MPH
Director of Sleep Medicine
Boston Children's Hospital

Sobering Statistics

- Motor vehicle crashes are the number one killer of teens in the US
 - An average of 7 teens age 16 to 19 die in car crashes daily
- New drivers are 4x more likely to be killed and 14x more likely to be injured than any other group
- By a 2-to-1 margin, teens are more likely to kill someone with them than themselves
- Teenage drivers are statistically more likely to be in a car crash than drivers from any other age group
- Nearly 40% of MA 2012 traffic fatalities were drivers between the ages of 16 and 20

Drowsy Driving in Teens

- Drivers 16-25 years are involved in more than 50% of the 100,000 police-reported fatigue-related traffic crashes each year
- NSF poll: 68% of HS seniors have driven while drowsy; 15% at least 1x/week
- AAA Foundation survey (2014):
 - One in seven licensed drivers ages 16-24 admits they had fallen sleep at least once while driving in the past year
 - Teens (17-24yo) who slept the least were 21% more likely to have been involved in a crash than those who got more sleep
 - Those who got ≤ 6 hours sleep on the weekend were 55% more likely to be in a crash than those who slept more

Sleep in Adolescents

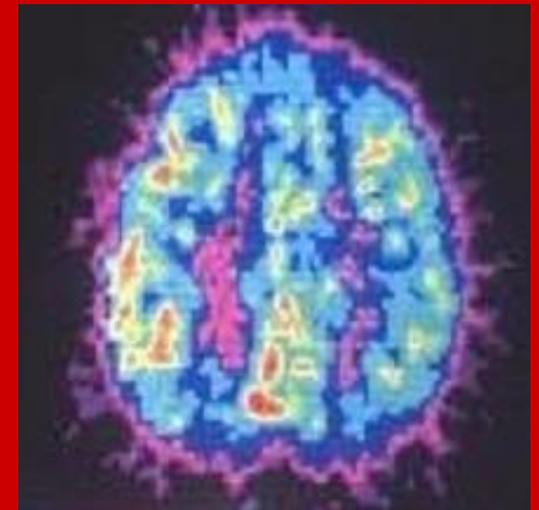
- All adolescents experience a normal shift in circadian rhythms associated with puberty
- This results in a biologically-based shift (delay) of up to several hours in both the natural fall sleep and morning wake times
- On a practical level, this means that it's almost impossible for the average adolescent to fall asleep much before 11pm on a regular basis
- Teens cannot “make” themselves fall asleep earlier

Sleep in Adolescents

- Adolescents are biologically programmed to wake at 8am or later
- But high school students are often required to wake for the day (and drive to school) during the lowest level of alertness during the 24 hour day
 - Your “ 6am” is like our “3am”
- For optimal health, safety and achievement the average sleep high school student needs 8-10 hours of sleep
- BUT less than 30% of potential teen drivers get the minimal recommended amount of sleep

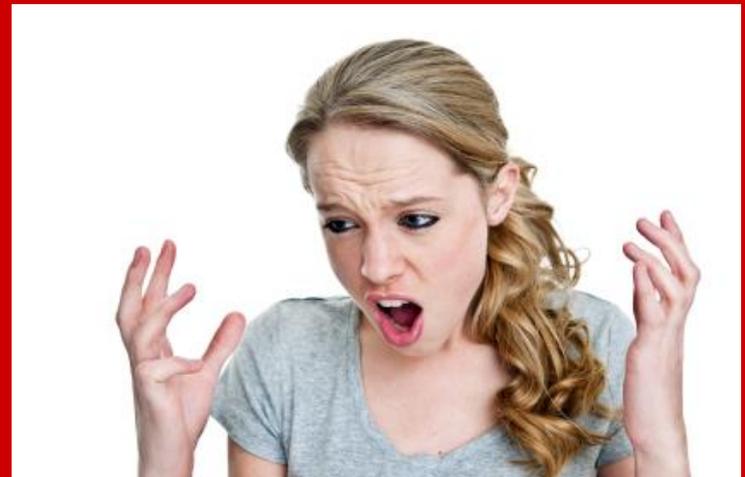
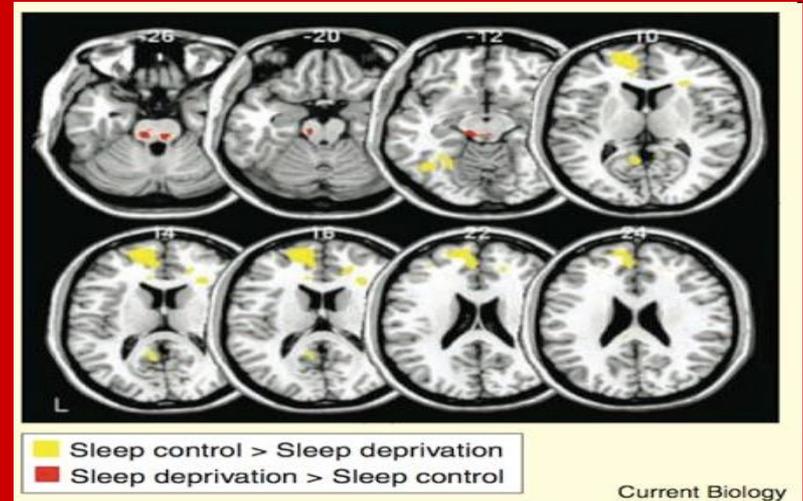
Sleep and Cognitive Function

- Sleep loss impacts attention, vigilance and reaction time
- Sleep loss has selective effects on the prefrontal cortex (PFC) and “executive functions”
 - Flexibility
 - Planning
 - Problem-solving
 - Decision-making
 - Judgment
 - Monitoring, modifying and inhibiting behavior
- The PFC has its most rapid development during adolescence



Sleep and Emotional Regulation

- Sleep impacts response to positive and negative stimuli:
 - Increased response of the “emotional brain”
 - Weaker links to the PFC
 - Results in heightened emotional response with less control (→ “road rage”?)



Sleep and Risk Taking Behaviors

- Selective areas of the brain important for reward-related function are undergoing important changes in adolescence
- Studies suggest insufficient sleep is linked to changes in reward-related decision making
 - Sleep-deprived individuals perceive less negative consequences of their risk-taking behavior and thus take more risks



Sleep Loss and Other Injury-Related Risk Behaviors*

- >50,000 high school students
 - 60% 9th graders, 77% 12th graders reporting \leq 7 hrs sleep
 - Injury risk behaviors significantly more frequent in students sleeping \leq 7 vs 9hrs
 - Infrequent bicycle helmet use
 - Infrequent seatbelt use
 - Texting while driving
 - Rode with drinking driver
 - Drinking and driving (increased 8 vs 9 hrs)

Drowsy Driving

- Impairments are equivalent to those associated with moderate alcohol intoxication (3-4 beers)
- Impairments are exacerbated by also using alcohol, drugs
- Impairments are NOT sufficiently reduced by consuming caffeine





So What Do We Do About All This?
Finding Solutions

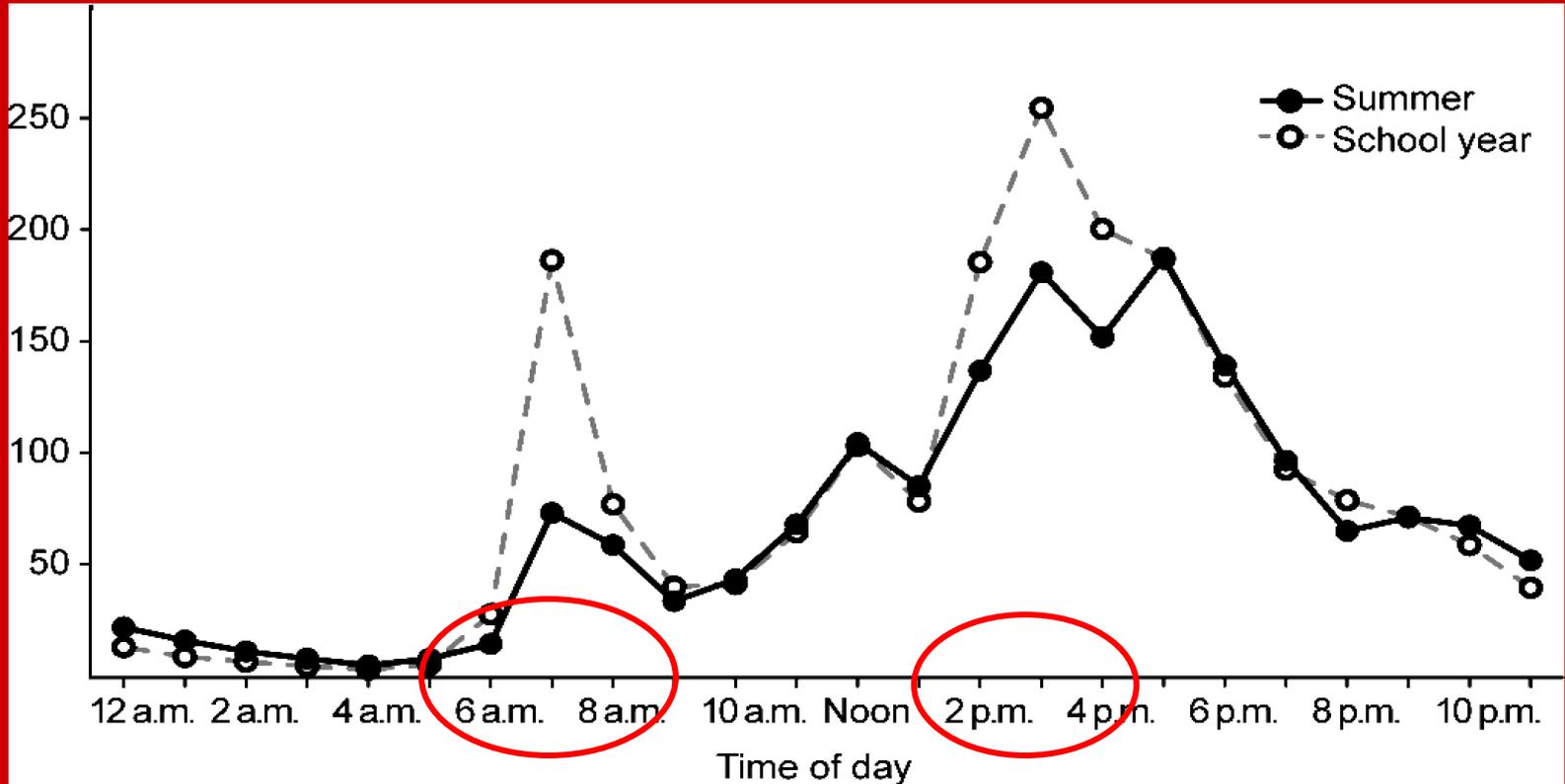
Recognize Signs of Drowsy Driving

- Trouble focusing on the road
- Difficulty keeping your eyes open
- Nodding
- Yawning repeatedly
- Drifting from your lane, missing signs or exits
- Not remembering driving the last few miles
- Closing your eyes at stoplights

Know Risk Factors for Drowsy Driving

- Driving long distances without breaks
- Driving alone or on a boring road
- Driving at high risk times of day

Police-reported crashes
in 16-17 year old drivers



Drowsy Driving: What Does and Does Not Work

What doesn't work:

- Turning up the radio
- Opening the car window
- Chewing gum
- Blowing cold air (water) on your face
- Slapping (pinching) yourself hard
- Promising yourself a reward for staying awake

What works:

- AVOID driving if drowsy.
- If you are really sleepy, get a ride home, take a taxi, or use public transportation
- Stop driving if you notice the warning signs of sleepiness

What Parents Can Do

- Know the signs of insufficient sleep in adolescents
- Set limits on after-school activities and jobs
- Be a good sleep role model
- Establish household rules regarding sleep duration and “fitness for driving”
- Do not allow teen drivers to get behind the wheel if they are experiencing chronic sleep loss (< 7 hours/night) and/or are impaired by sleepiness
 - “No ZZZs, no keys”



What Legislation Can Do

- Restrict late night and early morning driving for JO (MA 12:30am – 5am)
- Mandate incorporation of information on drowsy driving in driver education curriculum*
- Mandate educating law enforcement officers to inquire about sleep loss/sleepiness as a potential contributor in teen car crashes
- Require stricter penalties for drowsy driving-related accidents

*But as of 3/2017, only 17 states do so

What Technology Can (and Can't) Do

- Drowsiness detection and alerting devices
 - Common versions do this by tracking how often you depart from the center of your lane over a set period of time *or* track when you deviate from your regular driving patterns *or* monitor drooping eyelids/head bobbing
 - BUT will not steer you back to your lane
 - Does not replace getting enough sleep!

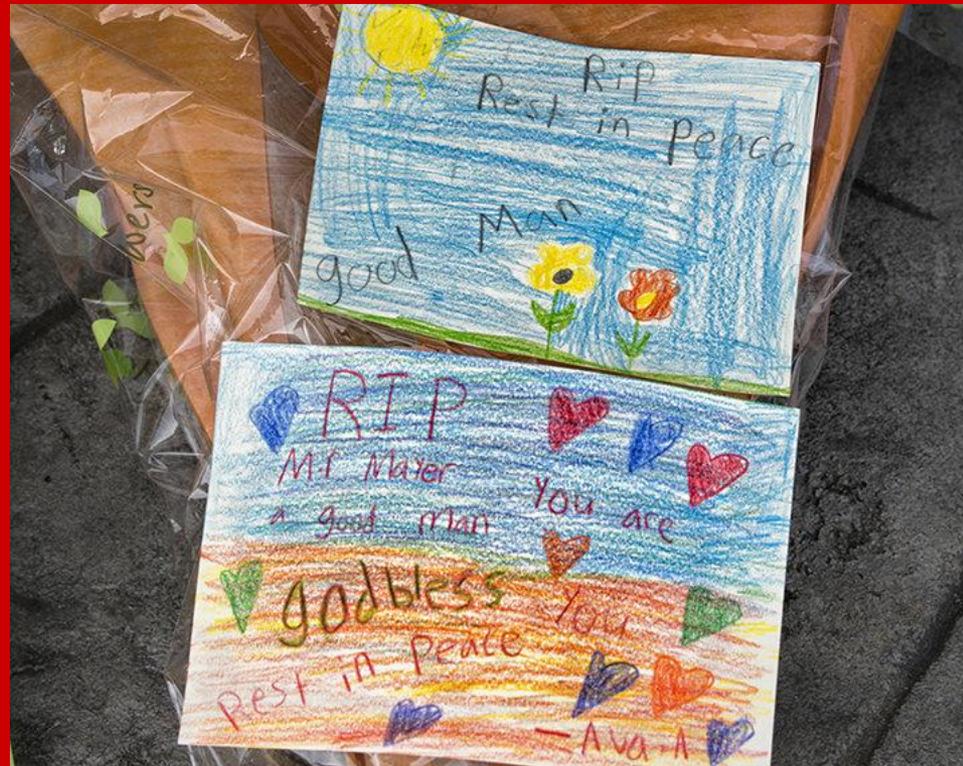


The Impact of School Start Times

- Healthy school start times for HS students (8:30a or later) are associated with improvements in safety
 - Kentucky: 7:30 to 8:40a start time; teens involved in car crashes down by 16% (vs 9% increase in the rest of the state)
 - Virginia: Adolescent crash rates VA Beach (7:20a) vs Chesapeake (8:40a) 40% higher and peak 1 hour earlier
 - CDC study (2014): Reduction crash rates in 16-18yo by as much as 65-70% (Minnesota, Colorado, Wyoming)

Student driver kills school superintendent out jogging

New York Post April 19, 2016



A senior at Robbinsville High School was heading south just before sunrise at 6:12 am when she struck Robbinsville public schools superintendent Dr. Steve Meyer, 52 year old father of 3, and his dog. He died at the scene. Robbinsville HS starts at 7:30 am.



Thank you! Comments/Questions?