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

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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 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 ≤ 7 hrs sleep
  - Injury risk behaviors significantly more frequent in students sleeping ≤ 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)

*CDC MMWR 4/8/16
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
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!

MyCarDoesWhat.org
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?