Asleep at the Wheel: Understanding and Preventing Drowsy Driving
April 23, 2018

Sleep Deprivation and Crash Risk

Shannon S. Sullivan MD
Clinical Associate Professor
Division of Sleep Medicine
Stanford University
shannons.s.sullivan@stanford.edu
Conflict of Interest Disclosures for Speakers

1. I do not have any potential conflicts to disclose.

☐ 2. I wish to disclose the following potential conflicts of interest:

<table>
<thead>
<tr>
<th>Type of Potential Conflict</th>
<th>Details of Potential Conflict</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant/Research Support</td>
<td></td>
</tr>
<tr>
<td>Consultant</td>
<td></td>
</tr>
<tr>
<td>Speakers’ Bureaus</td>
<td></td>
</tr>
<tr>
<td>Financial support</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

☐ 3. The material presented in this lecture has no relationship with any of these potential conflicts, OR

☐ 4. This talk presents material that is related to one or more of these potential conflicts, and the following objective references are provided as support for this lecture:

1. 
2. 
3.

Asleep at the Wheel: Understanding and Preventing Drowsy Driving
Asleep at the Wheel: A Crash Course

Quality

Timing

Quantity
How Much Sleep Do We Need?

• National Sleep Foundation, 2015: healthy adults ages 18-64 y: sleep 7-9 hours daily
• American Academy of Sleep Medicine/Sleep Research Society, 2015: healthy adults aged 18-60 should sleep for at least 7 hours (9+ hours for young adults; if sick; or recovering from sleep debt
• CDC, 2017: at least 7 hours per night

Hirshkowitz et al, 2015; Watson et al, 2015; https://www.cdc.gov/sleep/about_sleep/how_much_sleep.html
Sleep: How much are we getting?

• Overall, 65.2% of the US population reports getting at least 7 hrs per night
  – 444,306 adult respondents in all 50 states and the District of Columbia
  – Two other major population estimates report 60.1% (NHANES) and 71.6% (NHIS)

~83.6 million U.S. adults sleep <7 hours
Percentage of adults who reported ≥7 hours of sleep per 24-hours, by state — CDC, 2014

Lower % healthy sleep duration mirrors distribution for obesity, diabetes, and death rates from heart disease and stroke

Growing Sleeplessness in the U.S…

• In the past 70 years, the average reported sleep duration of American adults:
  – declined from 8 hours daily to 6.8 hours daily

• Impacts of electricity, changing workforce demands, consumer electronics

• Percent of Americans sleeping less than 6 hours:
  – Increased from <3% U.S. population to now 25-30% of employed Americans

Sources: Jones, JM Gallup Poll Dec 8-8 2013; Colten et al. 2006
Impacts of Sleep Deprivation

• Altered judgement/ greater impulsivity
• Slow reaction times
• Decreases the accuracy of responses
• Long lapses in attention
• Excessive sleepiness
• Microsleeps

Accidents?

Sleep Deprivation and Accident Risk: Asleep at the Wheel in the last 30 days

Habitual sleep duration ≤ 6 hours is associated with a 2.6-fold increased risk of falling asleep while driving

Sleep Deprivation and Drowsy Driving

- What about individual differences in impairment from sleep deprivation?

- Does perception of being impaired from sleep deprivation make a difference?

Perception of impairment quickly plateaus in the chronically sleep deprived, but performance continues to decline.

Lack of sleepiness: Protective? (No.)

Compared to sleeping 7-8h:
- For every hour decrease in habitual sleep duration, the odds of motor vehicle crash increase by 13% 
- ...and by 22% in those who did not report sleepiness

- Sleeping 6 hours increased odds of crash by 33%
- Sleeping 5 hours increased odds of crash by 47%

Motor Vehicle Crash Risk

Gottlieb et al, BMC Medicine, 2018
Sleep Deprivation in Young Drivers and Crash Risk

- Recommended sleep duration longer, 8-10 hours
- CDC 2016: 69% (> 2/3!) of students in grades 9 to 12 reported sleeping less than eight hours on an average school night.
  - This is much worse than the situation for adults: overall ~1/3 adults report getting too little sleep
Young People Are Especially Vulnerable to Fall-Asleep Crashes

55% occurred in drivers ≤ 25yrs

N = 4333 drowsy driving crashes
Young People May Be More Susceptible to Sleep Deprivation

After 24 hours of sleep deprivation

Philip, JSR, 2004
Sleep Deprivation in Young Drivers and Crash Risk

- Prospective study of 17-14 year old drivers, n = 20,822
- Sleeping 6 or fewer hours per night increased crash risk by 20%.
- Less weekend sleep was significantly associated with an increased risk for run-off-road crashes, 55%
- Crashes were more likely to occur between 8 pm and 6 am. (Time of day matters!)

Martiniuk, JAMA Pediatrics, 2013
What About Acute Sleep Deprivation?

- Case-control study of 7,234 drivers involved in 4,571 crashes
- 2005-2008
- Accidents involved at least one light vehicle that was towed due to damage, resulted in an emergency medical services dispatch, and were subject to on-scene multidisciplinary investigations
Risk for a Drowsy Driving Crash if:

- Usually sleep for less than 5 hours daily
- Have slept for less than 7 hours in the past 24 hours
- Have slept for ≥1 hour less than usual in the past 24 hours

**IMPACT OF SLEEP ON CRASH RISK**

Crash rates of sleep-deprived drivers compared to drivers who get the expert-recommended 7+ hours of sleep.

<table>
<thead>
<tr>
<th>Total hours of sleep in past 24 hours</th>
<th>Crash Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4:00</td>
<td>11.5</td>
</tr>
<tr>
<td>4-4:59</td>
<td>4.3</td>
</tr>
<tr>
<td>5-5:59</td>
<td>1.9</td>
</tr>
<tr>
<td>6-6:59</td>
<td>1.3</td>
</tr>
</tbody>
</table>


AAA.com/DrowsyDriving
How Much Does One Short Night of Sleep Impact Crash Risk?

Driving after only 4-5 hours of sleep increases your crash risk to the same level as driving with a blood alcohol level at or slightly above the legal limit for alcohol.
Remember: Drowsy Driving Performance is Similar to Drunk Driving

- Being awake for at least 18 hours is the same as someone having a blood content (BAC) of 0.05%.
- Being awake for at least 24 hours is equal to having a blood alcohol content of 0.10%.
  
  This is higher than the legal limit (0.08% BAC) in all states.

- PLUS: sleep deprivation increases the effect of even low amounts of alcohol (0.025-0.35%).

Sleep Deprivation Augments Effects of Alcohol on Driving

Alcohol at BAC 0.03%, plus with sleep deprivation (5 hours of sleep) increased microsleeps, impaired driving-simulator performance, and reduced ability to detect impairment in performance.
How Common is Drowsy Driving?

National Sleep Foundation Polls

• 60% of adults have driven while sleepy
• 37% of adults have fallen asleep at the wheel
• Of those, 13% fall asleep while driving at least 1/month
• 4% say they have caused a crash by falling asleep while driving
• 50 to 70% of teenagers have driven drowsy in last year
• 15% of teenagers drive drowsy at least 1/week

How Big of Problem is Drowsy Driving?

• Sleepiness while driving is associated with a 2.5-fold increase in the relative risk of motor vehicle crash

• AAA Foundation for Traffic Safety (Tefft, 2012)
  – Estimated 7% of all crashes in which a vehicle is towed
  – 13% of crashes that result in hospital admission
  – and 16.5% of all fatal crashes involve a drowsy driver

• National Highway Traffic Safety Administration; Annually:
  – ~83,000 police-reported crashes are the direct result of driver fatigue
  – 1,550 deaths
  – 71,000 injuries
  – $12.5 billion in monetary losses

Tip of the Iceberg? Difficult to attribute crash to sleepiness

• Naturalistic driving study of > 3,500 drivers
• Monitored continuously for months using in-vehicle cameras
• Drowsiness was assessed by percentage of time that a person’s eyes are closed.
• Drowsiness was identified in ~9% of all crashes and 10.6%–10.8% of crashes that resulted in significant property damage, airbag deployment, or injury.

Take Home Points

• 1 in 3 Americans is chronically getting less than the recommended amount of sleep
• Sleep deprivation is associated with increased crash risk
• Not feeling sleepy does not mitigate the increased crash risk due to sleep deprivation
• Along with sleep quality problems and timing, sleep deprivation is a major contributor to drowsy driving and crash risk
One in every three of YOU may not be getting enough sleep...

Needs:

- public awareness and public education about sleep health;
- worksite shift policies that promote healthy sleep durations, particularly medical professionals and emergency response and transportation industry personnel;
- and opportunities for multiple stakeholders to dialogue regarding the importance of healthy sleep duration
Understand and Prevent Drowsy Driving

Arrive Safely!
Resources…
Prevent Drowsy Driving: Stay Awake at the Wheel!

One in five fatal accidents on American roads involves a drowsy driver, according to a recent report from the AAA Foundation for Traffic Safety. Unfortunately, driving while fatigued is common in today's world, yet the consequences can be tragic.

The National Healthy Sleep Awareness Project urges every driver to take responsibility for staying "Awake at the Wheel" by making it a daily priority to get sufficient sleep, refusing to drive when sleep deprived, recognizing the signs of drowsiness, and pulling off the road to a safe location when sleepy.

"Drowsiness is similar to alcohol in how it compromises driving ability by reducing alertness and attentiveness, delaying reaction times, and hindering decision-making skills," said Dr. Nathaniel Watson, president of the American Academy of Sleep Medicine. "Drowsy driving is deadly, but it can be prevented."

How can you prevent drowsy driving?

Getting seven to nine hours of nightly sleep is the best way to prevent drowsy driving. Drivers should also avoid driving late at night or alone, and they should share the driving with another passenger on long trips.

Full over or have another passenger take the wheel if you experience any of the following warning signs of drowsy driving:

- You keep yawning or are unable to keep your eyes open.
- You catch yourself "nodding off" and have trouble keeping your head up.
- You can't remember driving the last few miles.
- You end up too close to cars in front of you.
- You miss road signs or drive past your turn.
- You drift into the other lane of traffic.
- You drift onto the "rumble strips" or onto the shoulder of the road.

Updated Sept. 28, 2015

Each year in the U.S., drowsy driving causes an estimated:

- 6% of crashes requiring a tow truck
- 7% of crashes involving injuries
- 13% of crashes involving hospitalization
- 21% of crashes in which a person was killed

Each year in the U.S., drowsy driving causes an average of:

- 328,000 crashes
- 109,000 crashes that result in injuries
- 6,400 fatal crashes

Source: AAA Foundation for Traffic Safety, November 2014
Most crashes or near-misses happen at the times you would expect drivers to be tired: 4 to 6 a.m., midnight to 2 a.m. and 2 to 4 p.m., according to NSF.

https://www.cdc.gov/features/dsdrowsydriving/index.html

**Drowsy Driving**

Drive alert and stay unhurt.

Learn the risks of drowsy driving and how to protect yourself.

Drowsy driving is a major problem in the United States. The risk, danger, and sometimes tragic results of drowsy driving are alarming. Drowsy driving is the dangerous combination of driving and sleepiness or fatigue. This usually happens when a driver has not slept enough, but it can also happen due to untreated sleep disorders, medications, drinking alcohol, and shift work.

**What is Drowsy Driving?**

Operating a motor vehicle while fatigued or sleepy is commonly referred to as “drowsy driving.”

**The Impact of Drowsy Driving**

Drowsy driving poses a serious risk not only for one’s own health and safety, but also for the other people on the road.

The National Highway Traffic Safety Administration estimates that between 2005 and 2009 drowsy driving was responsible for an annual average of:

- 83,000 crashes
- 37,000 injury crashes
- 886 fatal crashes (846 fatalities in 2014)

These estimates are conservative, though, and up to 6,000 fatal crashes each year may be caused by drowsy drivers.

**How Often Do Americans Fall Asleep While Driving?**

- Approximately 1 out of 25 adults aged 18 years and older surveyed reported that they had fallen asleep while driving in the past 30 days.
- Individuals who snored or slept 6 hours or less per day were more likely to fall asleep while driving.

**How Does Sleepiness Affect Driving?**

Falling asleep at the wheel is very dangerous, but being sleepy affects your ability to drive safely even if you don’t fall asleep. Drowsiness—
Drowsy Driving

Overview

Drowsy driving kills. It claimed 846 lives in 2014. NHTSA is working with the Centers for Disease Control and Prevention and the National Institutes for Health to expand our understanding of drowsy driving so that we can reduce related deaths and injuries and help people avoid being a drowsy-driving statistic.

Find Out What NHTSA Is Doing To Help Combat Drowsy Driving

846
DEATHS FROM DROWSY-DRIVING-RELATED CRASHES IN 2014

https://www.nhtsa.gov/risky-driving/drowsy-driving
Please use the Lifesavers Conference Mobile App to evaluate this presentation.