



**National  
Transportation  
Safety Board**

# Fatigue: A Motor Vehicle Crash Risk

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Association for the Advancement of Automotive Medicine  
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# NATIONAL TRANSPORTATION SAFETY BOARD

- 1) determining the probable cause of transportation accidents**
- 2) making recommendations to prevent their recurrence**







# All Modes



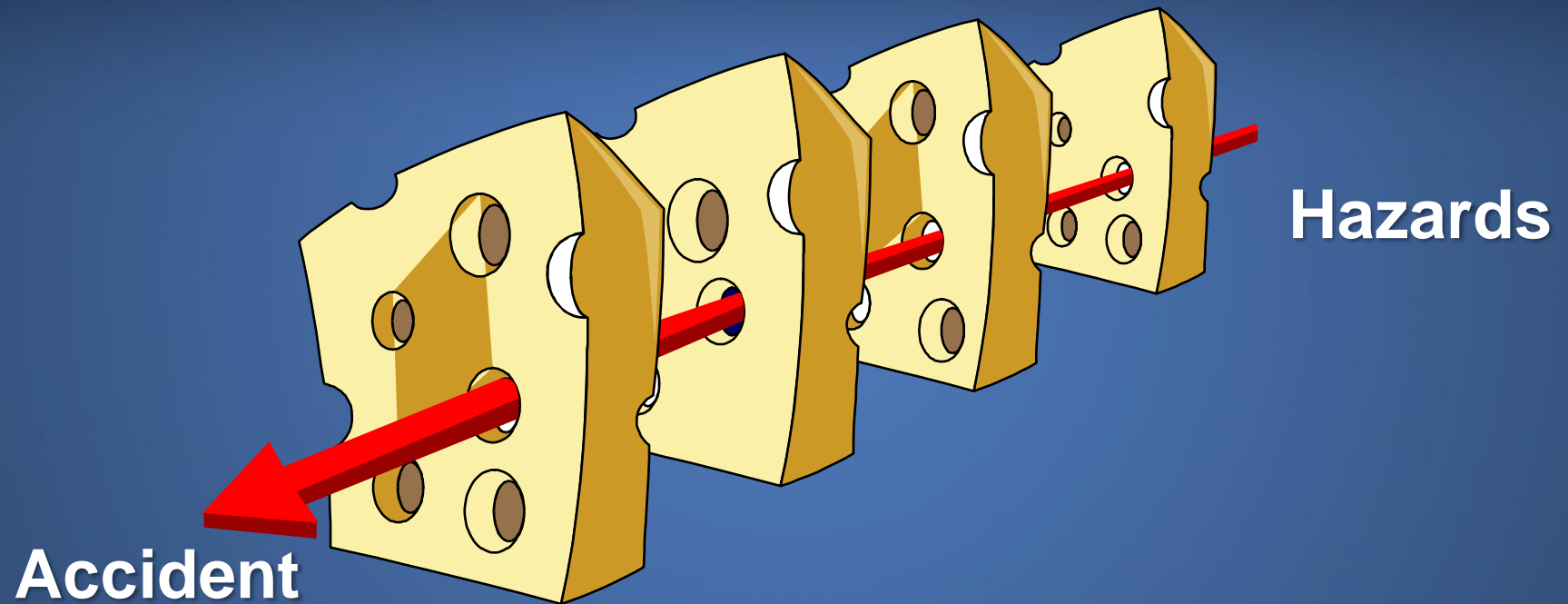
# Independent Federal Agency: Created in 1967

- ~ 132,000 accident investigations
- 13,500+ safety recommendations
- ~ 2,500 organizations/recipients
- 82% acceptance rate





# “Swiss Cheese” Model (Reason)



Successive layers of defenses, barriers, and safeguards

# NTSB Characterized as:

‘moral compass and industry conscience’

NTSB Chairman Deborah A.P. Hersman



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#1: Fatigue is a safety risk.



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**Animation of Accident Reconstruction**

**Motorcoach Run Off Road-Collision with  
Bridge Signpost**

Interstate Highway 95 Southbound  
New York, New York  
March 12, 2011

HWY11MH005

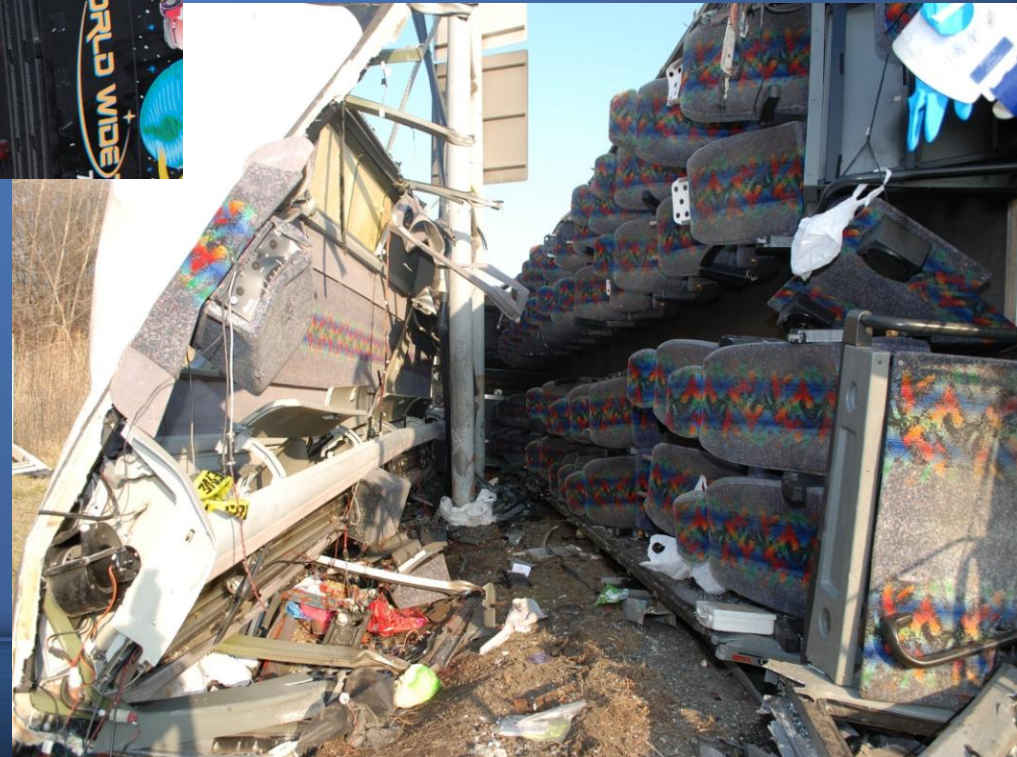


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# 'Bronx Bus', New York, NY (March 12, 2011)



15 fatalities  
17 injuries



# Probable Cause

“The National Transportation Safety Board determines that the probable cause of the accident was the motorcoach driver's failure to control the motorcoach due to fatigue resulting from failure to obtain adequate sleep, poor sleep quality, and the time of day at which the accident occurred.”



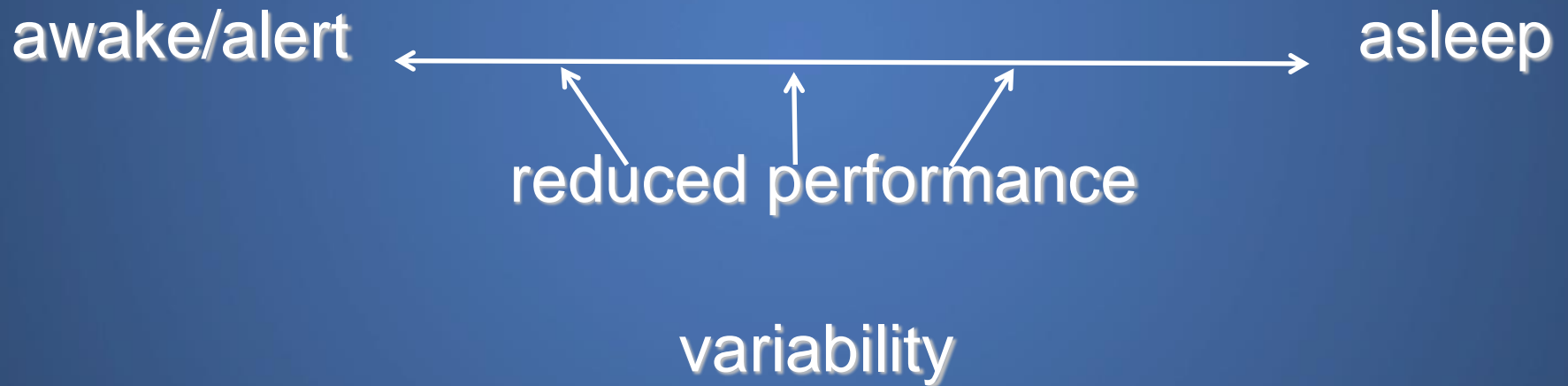


# Fatigue Risks

Fatigue can degrade  
every aspect of  
human capability.



# Fatigue Risks



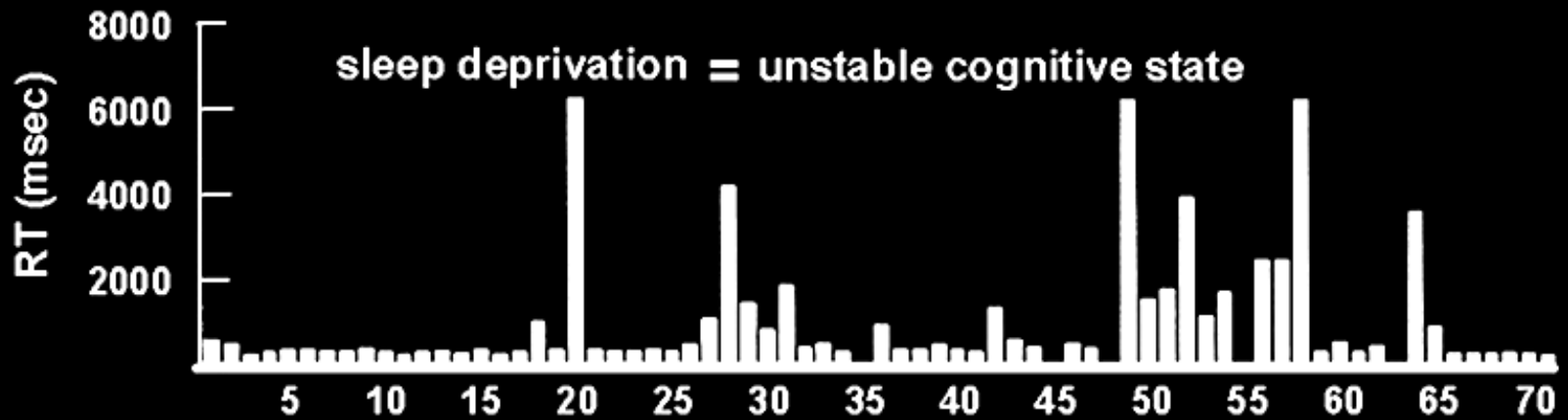
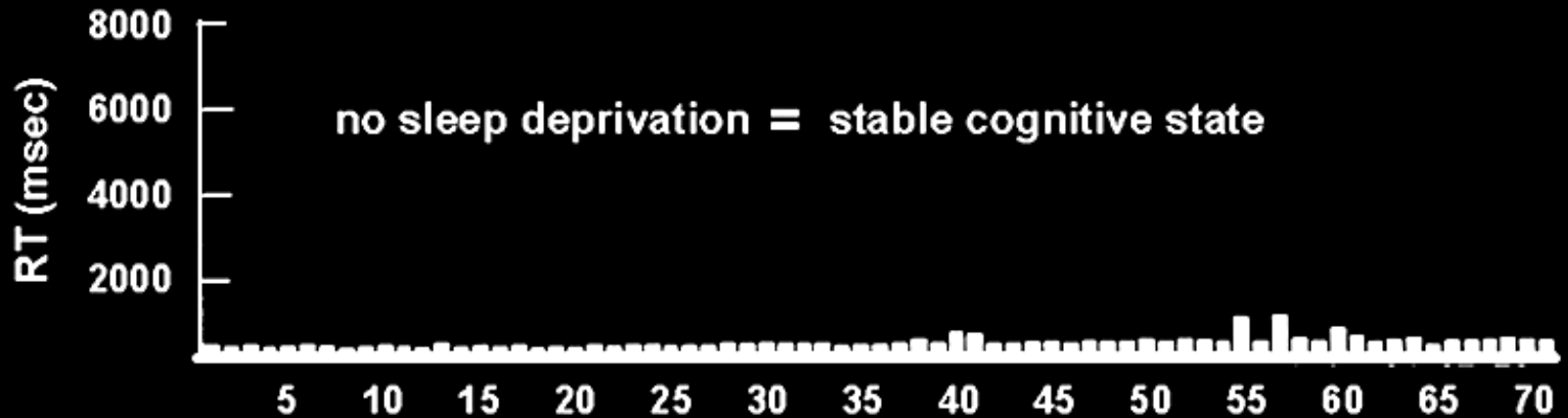
# Fatigue Risks

- degraded 20 – 50%+:
  - reaction time
  - memory
  - communication
  - situational awareness
  - judgment
  - attention
  - mood
- increased:
  - irritability
  - apathy
  - attentional lapses
  - microsleeps





# Fatigue and Reaction Times



consecutive RTs across a 10-min PVT performance task

**#2: Physiological factors create  
fatigue-related safety risks.**



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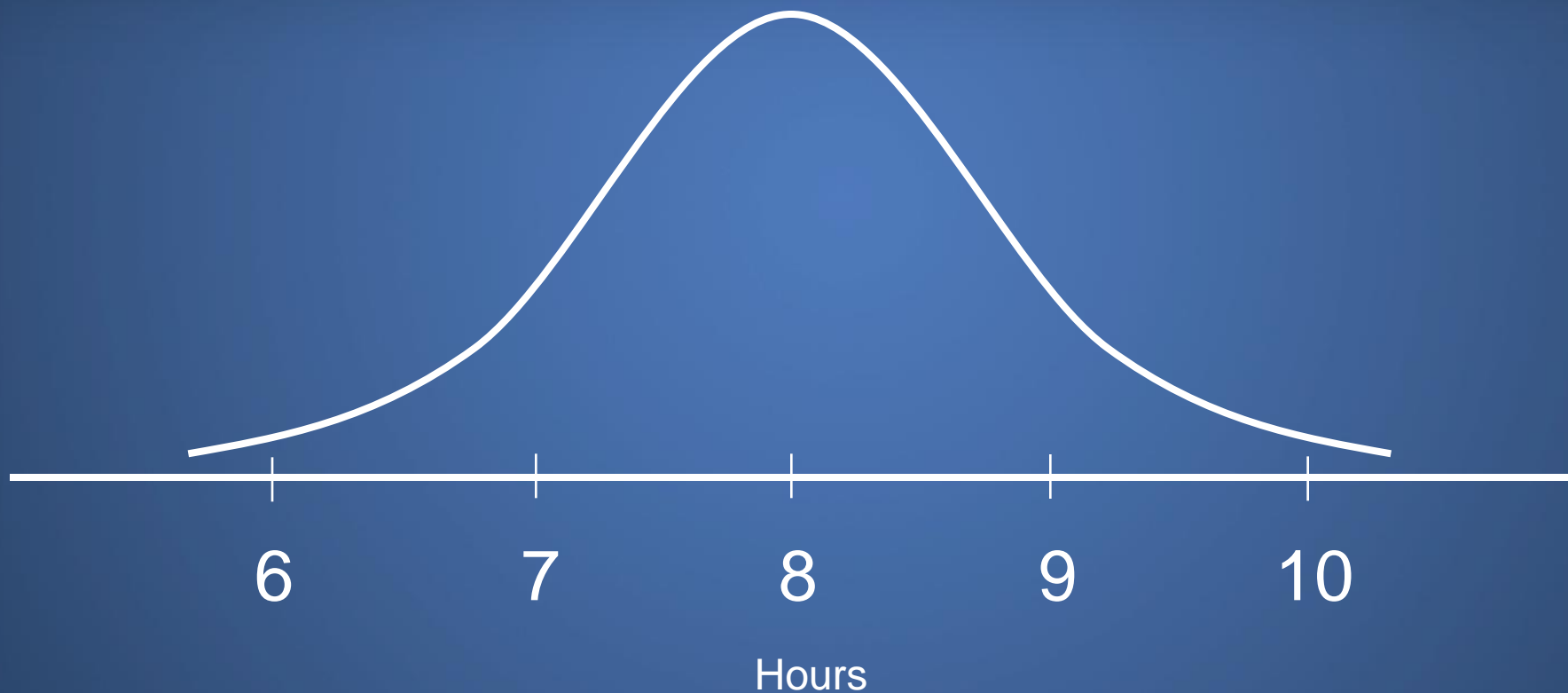
# Fatigue Factors

- sleep
- circadian clock
- hours awake
- sleep disorders

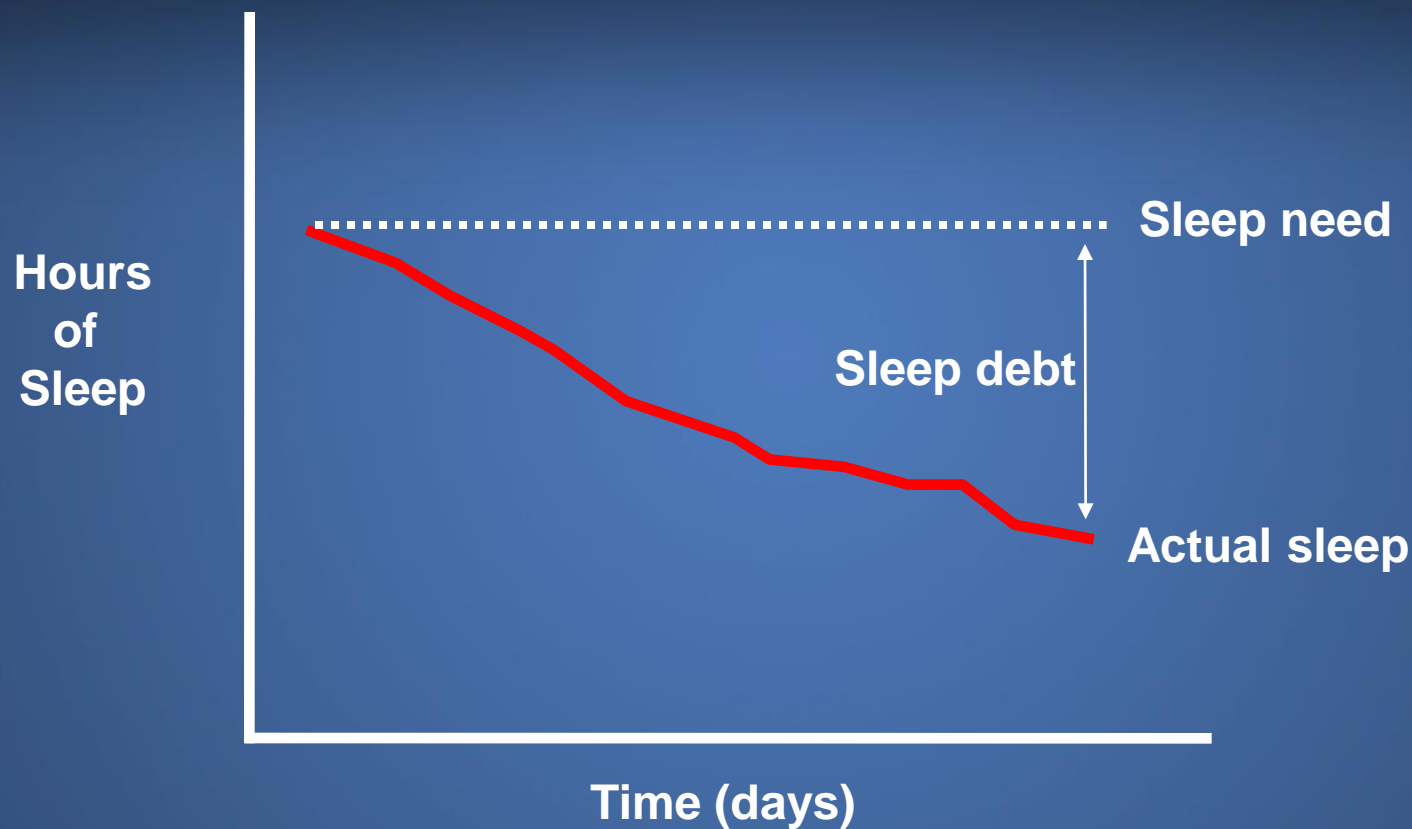




# Sleep Requirement



# Cumulative Sleep Debt



Sleep Need – Actual Sleep = Sleep Debt

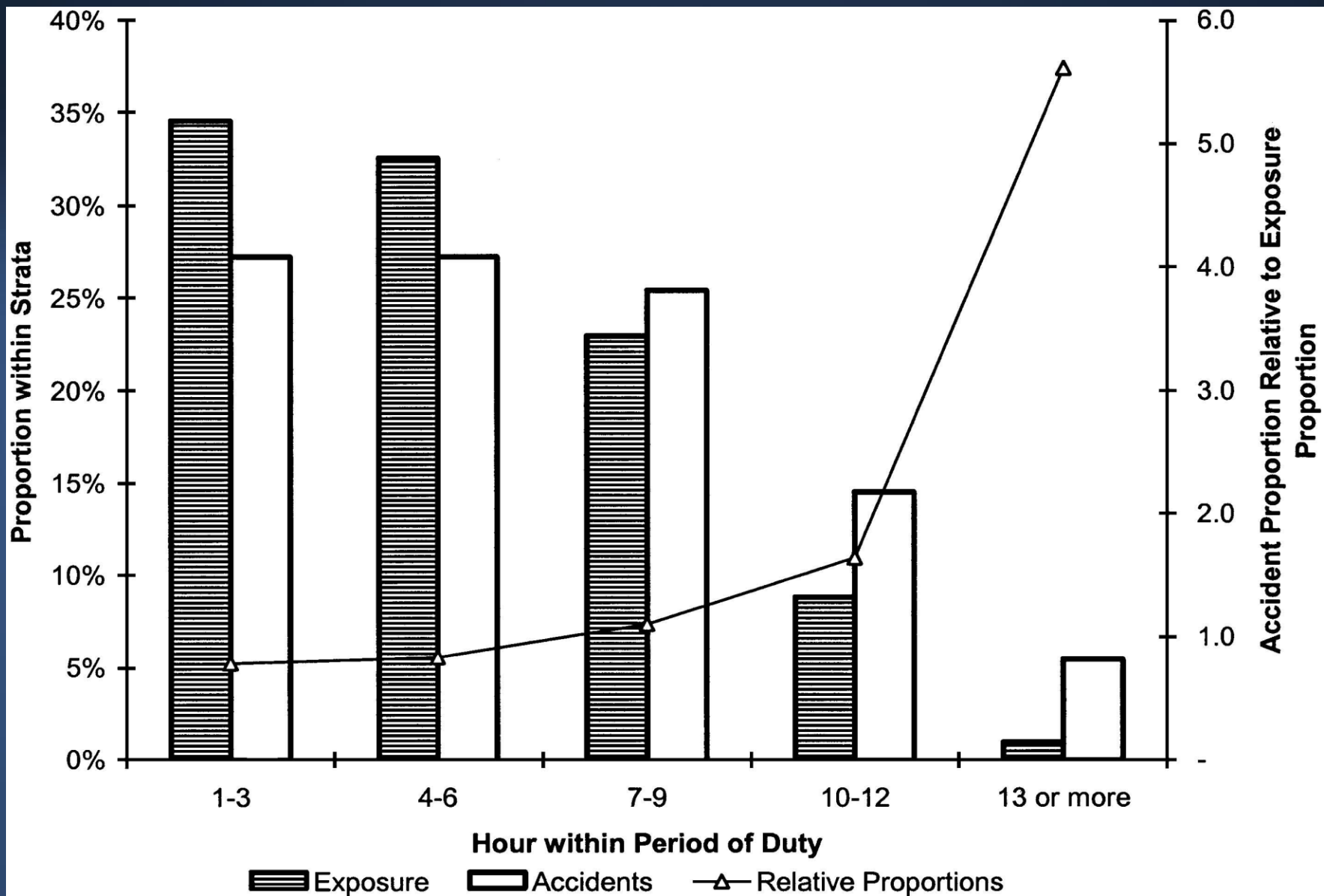
Sleep debt grows cumulatively over time



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# Sleep Loss and Alcohol: Performance Equivalents

<u>Sleep loss (hrs)</u>	<u>12oz Beers</u>	<u>BrEC%</u>
2	2 - 3	.045%
4	5 - 6	.095%
6	7 - 8	.102%
8	10 - 11	.190%



# Sleep Apnea is a Safety Risk

- > 6 times increased risk for car crash
- SA performance = .06 - .08 BAC





# Miami, OK (June 26, 2009)

10 fatalities  
3 serious injuries  
2 minor injuries  
5 no injuries

Ford  
Windstar



Hyundai  
Sonata

Kia  
Spectra

# Probable Cause (fatigue)

“ . . . driver’s fatigue, caused by the combined effects of acute sleep loss, circadian disruption associated with his shift work schedule, and mild sleep apnea, which resulted in the driver’s failure to react to slowing and stopped traffic ahead by applying the brakes or performing any evasive maneuver to avoid colliding with the traffic queue. . . . ”





# #3: NTSB recommendations that address fatigue.






# NTSB Safety Recommendations: Fatigue

- 40 years ago: May 10, 1972
- “Revise FAR 135 to provide adequate flight and duty time limitations.” (A-72-55)
- Classified “Closed-Unacceptable”





Home > Transportation Safety > Most Wanted List

SHARE    ...

## MOST WANTED LIST

A program to increase the public's awareness of, and support for, action to adopt safety steps that can help prevent accidents and save lives. The following are ten of the current issues.



Addressing Human Fatigue



General Aviation Safety



Safety Management Systems



Runway Safety



Bus Occupant Safety



Pilot & Air Traffic Controller Professionalism



Recorders



Teen Driver Safety



Addressing Alcohol-Impaired Driving



Motorcycle Safety





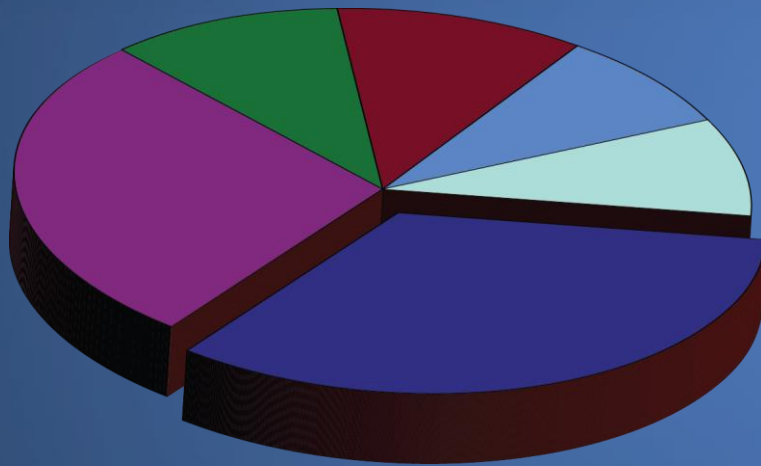
# NTSB Safety Recommendations: Fatigue

- MOST WANTED since 1990
- ~200 fatigue recommendations



# Complex Issue:

## Requires Multiple Solutions



- Scheduling Policies and Practices
- Education/Awareness
- Organizational Strategies
- Healthy Sleep
- Vehicle and Environmental Strategies
- Research and Evaluation



# Scheduling Policies and Practices

Victoria, Texas, January 2, 2008



Victoria, Texas Fire Department

- Day sleep, night drive, ~ 4 am WOCL



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# NTSB Fatigue Recommendations: Hours of Service / Scheduling

- Science-based hours of service
- Allow for at least 8 hours of uninterrupted sleep
- Fatigue mitigation strategies in the hours-of-service regulations for passenger-carrying drivers who operate during the nighttime window of circadian low
- Reduce schedule irregularity and unpredictability



# NTSB Fatigue Recommendations: Education/Strategies

- Develop a fatigue education and countermeasures training program
- Educate operators and schedulers
- Include information on use of strategies: naps, caffeine, etc.
- Review and update materials





# Sleep Apnea

Mexican Hat, UT, January 6, 2008



- 360 rollover, 50/53 ejected, 9 fatalities, OSA (-CPAP)



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# NTSB Fatigue Recommendations: Sleep Apnea/Health Related

- Develop standard medical exam to screen for sleep disorders; require its use
- Educate companies and individuals about sleep disorder detection and treatment, and the sedating effects of certain drugs
- Ensure drivers with apnea are effectively treated before granting unrestricted medical certification



# NTSB Fatigue Recommendations: Fatigue Management Systems

- Develop guidance based on empirical and scientific evidence for operators to establish fatigue management systems
- Establish an ongoing program to monitor, evaluate, report on, and continuously improve fatigue management programs implemented by motor carriers to identify, mitigate, and continuously reduce fatigue-related risks for drivers.



# Significant Discrepancy

- Underestimate prevalence
- Individual risk



# Significant Discrepancy: Underestimate Prevalence

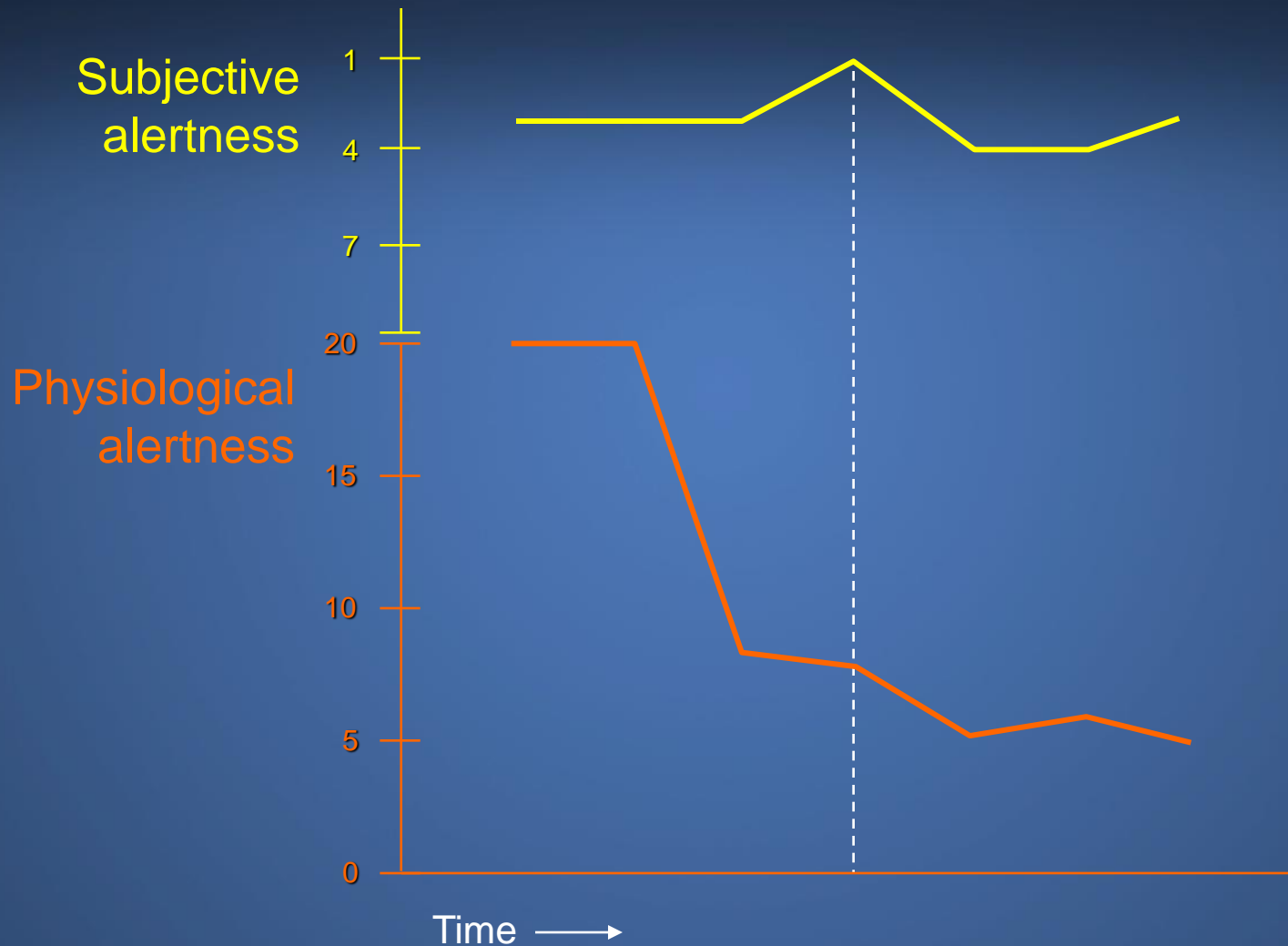
- all crashes involving drowsy drivers: ~ 80%
- fatal crashes involving drowsy drivers: > 350%

AAA Foundation for Traffic Safety





# Alertness Reports Often Inaccurate



Adapted from Sasaki et al., 1986

Good sleep, safe travels.



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