The Vital Role of Sleep for Safety, Health, and Performance

Mark R. Rosekind, Ph.D.
Board Member

6th Annual Meeting
Integrated Sleep Medicine Society Japan
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1) determining the probable cause of transportation accidents

2) making recommendations to prevent their recurrence
All Modes
Independent Federal Agency: Created in 1967

- >140,500 accident investigations
- 14,000+ safety recommendations
- ~2,300 organizations/ recipients
- 82% acceptance rate
Challenges of a 24/7 Society
Four Fatigue Factors +

- Sleep loss
- Extended wakefulness
- Circadian/time of day
- Sleep disorders
- Other considerations
Uncontrolled In-Flight Collision with Terrain
AIA Flight 808, Douglas DC-8-61, N814CK
U.S. NAS, Guantanamo Bay, Cuba, August 18, 1993

First NTSB aviation accident investigation
to cite fatigue as probable cause

- acute sleep loss, sleep debt, circadian disruption
Crew Sleep History

<table>
<thead>
<tr>
<th>Date</th>
<th>Capt. Sleep</th>
<th>F/O Sleep</th>
<th>F/E Sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/16/93</td>
<td>8 h, 9 h, 2 h, 17.5 h, 5 h, 23.5 h</td>
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Accident MGUM
Observed Performance Effects

- Degraded decision-making
- Visual/cognitive fixation
- Poor communication/coordination
- Slowed reaction time
“The National Transportation Safety Board determines that the probable causes of this accident were the impaired judgment, decision making, and flying abilities of the captain and flight crew due to the effects of fatigue…”
Probable Cause (fatigue)

“... failure of the crew of the striking train to comply with the signal indication requiring them to operate in accordance with restricted speed requirements and stop short of the standing train because they had fallen asleep due to fatigue resulting from their irregular work schedules and their medical conditions.”
Miami, Oklahoma (June 26, 2009)
Fatigue Factors

- Off work for 3 weeks: day active/night sleep schedule
- 3am to 3pm shift work/drive schedule (since 1997)
- Early bedtime (2 hr phase advance in sleep time)
- Obtained min 3 hrs/max 5 hrs sleep prior to accident
- Subsequently diagnosed with mild sleep apnea
10 fatalities
3 serious injuries
2 minor injuries
5 no injuries

Source: Oklahoma State Police
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. . . .”
Animation of Accident Reconstruction

Motorcoach Run Off Road-Collision with Bridge Signpost

Interstate Highway 95 Southbound
New York, New York
March 12, 2011
HWY11MH005
‘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.”
Asiana 214 (July 6, 2013)
San Francisco, CA (SFO)

3 fatalities
49 seriously injured
Probable Cause

Contributing to the accident were . . .

(5) flight crew fatigue, which likely degraded their performance.
Fatal Aviation Accidents
(examples: fatigue cited)

• 8/97  Guam: 228 fatalities
• 6/99  Little Rock AK: 11 fatal
• 10/04 Kirksville MO: 11 fatalities
• 8/06  Lexington KY: 49 fatalities
• 7/08  Owatonna MN: 8 fatalities
• 2/09  Buffalo NY: 49 fatalities
• 6/09  Santa Fe NM: 2 fatalities
• 7/13  San Francisco, CA: 3 fatalities
Honorable John K. Lauber:

No Accident ≠ Safe Operation
Go! Flight 1002

- early starts, multiple segment days, sleep apnea

NTSB
Most Wanted List

A program to increase the public's awareness of, and support for, actions 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 1990 - 2011
• ~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
NTSB Safety Recommendations: Fatigue Status (May, 2012)

- Total: 194
- Open: 48
- Closed: 146
- CUN*: 26

CUN = closed unacceptable
Health: Sleep Disorders

- sleep apnea
- restless legs
- parasomnias
- jet lag
- shift work
- narcolepsy
- hypersomnia
- sleep phase
- REM behavior
- insomnia
Fatigue Risks

Fatigue can degrade every aspect of human capability.
Fatigue Risks

- awake/alert
- asleep
- reduced performance
- variability
Fatigue Risks

• degraded 20 – 50% +:
  - reaction time
  - memory
  - communication
  - situational awareness

• increased:
  - irritability
  - apathy
  - attentional lapses
  - microsleeps
Alertness Reports Often Inaccurate

Subjective alertness

Physiological alertness

Adapted from Sasaki et al., 1986
Success requires . . .

A culture change that supports different attitudes and behaviors
Your Personal Role/Responsibility

Be an educator

Challenge attitudes

Enact change

Personal life

Family

Workplace

Organization

Model good sleep behavior
#40 Ceremonial Swearing In
Good sleep is vital for . . .

- safety
- health
- performance