



NTSB National Transportation Safety Board

Fatigue Issues In Transportation Safety

Presentation to:

New Jersey Sleep Society Annual
Educational Symposium

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Date: November 13, 2010

Outline

- NTSB Basics
- Fatigue Issues in Transportation
- Future Challenges

NTSB Basics

- Independent agency, investigate transportation accidents, all modes
- Determine probable cause(s) and make recommendations to prevent recurrences
- Conduct special studies and investigations
- Assist victims and their families

Independent

- 5 Members, nominated by the President, confirmed by the Senate
- Members are not investigators
- Safeguards for independence
- Conclusions from facts, not politics

Purpose

- Single focus is *SAFETY*
- Primary product:
Safety recommendations
- Recommendation acceptance rate:
More than 80%

Fatigue Factors

- Sleep
- Diet
- Exercise
- Alcohol/Tobacco
- Age
- Other?

Sleep Issues

- Sleep Disorders, especially OSA
- Accident examples (all modes)
- NTSB recommendations
- Responses

Transportation Risk: OSA

- Lack of awareness
- Falling asleep or fatigue-related decrements in performance
- Up to 7-fold increase in risk of motor vehicle accident
- Risk reduced with treatment

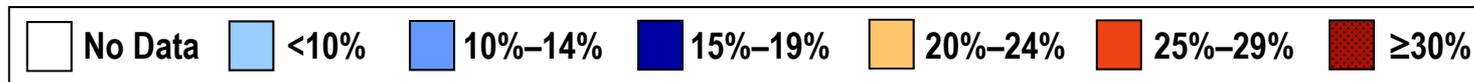
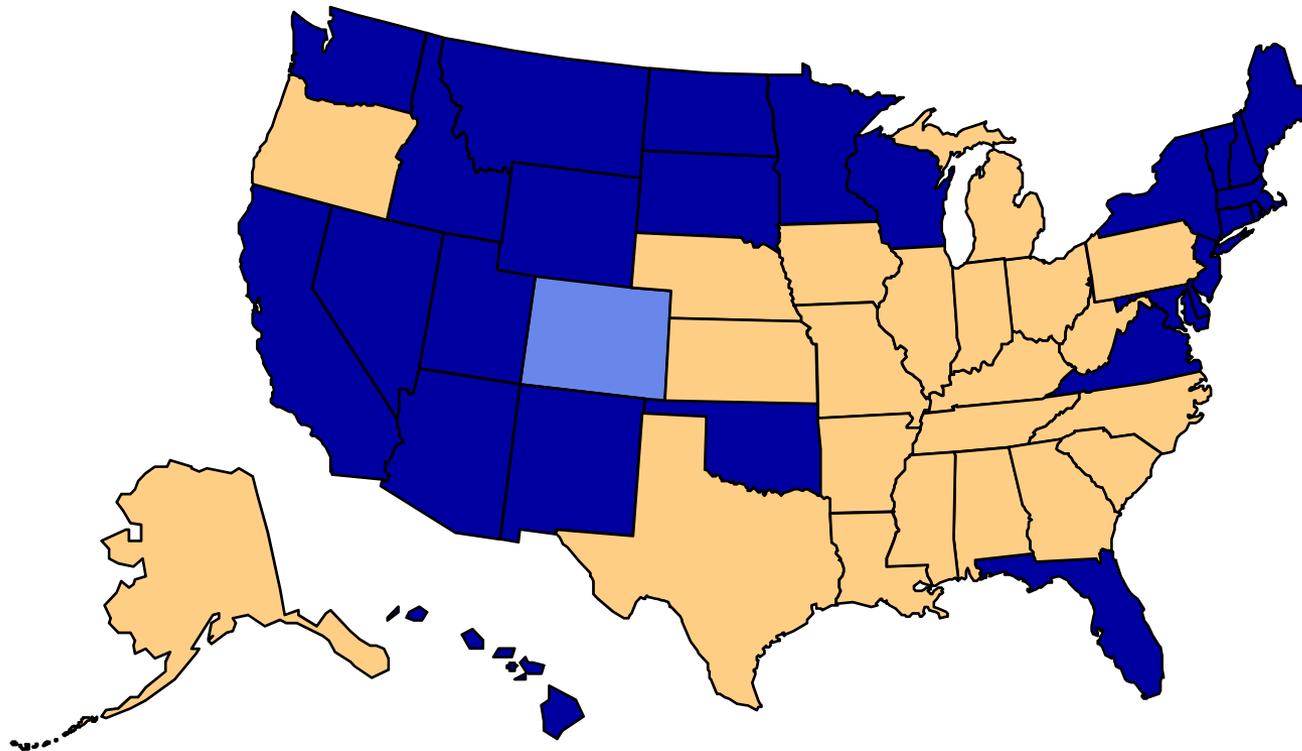
Associations with OSA

- SNORING
- Body mass index (obesity)
- Neck circumference
- High blood pressure
- Pulmonary hypertension, coronary artery disease, congestive heart failure, etc.

Obesity* Among U.S. Adults

BRFSS, 2000

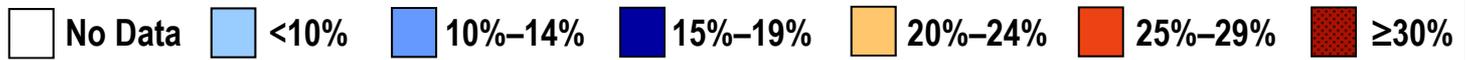
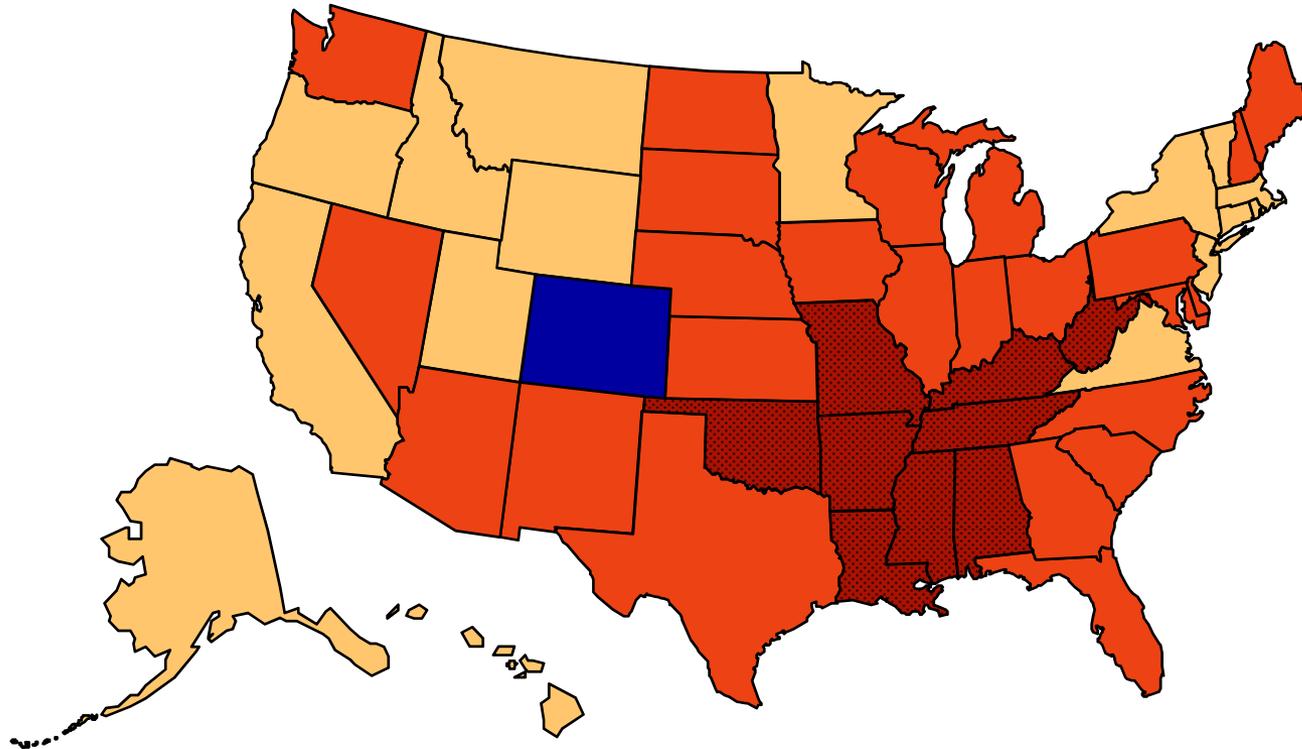
(*BMI ≥ 30 , or ~ 30 lbs. overweight for 5' 4" person)



Obesity* Among U.S. Adults

BRFSS, 2009

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OSA – risk reduction

- Treatment with CPAP (titration)
 - Many cognitive deficits reversible
 - Canadian study → reduced risk of accident

- Operational experience
 - Large trucking company
 - Instituted screening/diagnosis/treatment
 - Reported reduced accidents, reduced health care costs, increased driver retention

Auto Accidents

When I die, I would like to go peacefully,
in my sleep,
like my grandfather did.

Not screaming and yelling
like the passenger in his car.

Jack Handey

Highway – accident

- Jackson, TN – July 2000
- Tractor-trailer approaching worksite at 65 mph
- Struck stopped highway patrol vehicle (lights flashing)
- Fatally injured officer inside patrol vehicle, seriously injured driver of second vehicle



Highway – accident (con't)

- Hospital admission 4 years prior:
 - 5'11", 358 lbs (BMI 49.9); “history c/w sleep apnea,” “significant desaturation”; needed “sleep study, but in need of return to employment”
- Accident 3 years prior – ‘blackout’
 - Sleep study: “severe OSA,” no improvement with CPAP
- ENT surgery, F/U study not done
- Exam 1 year prior to accident – hypothyroidism, not OSA

Highway – accident (con't)

- NTSB Conclusion: The driver's OSA, his untreated hypothyroidism, or complications from either or both conditions predisposed him to impairment or incapacitation including falling asleep at the wheel, while driving.
- NTSB Probable Cause: the driver's incapacitation, owing to the failure of the medical certification process to detect and remove a medically unfit driver from service

Highway – another accident

- Miami, OK –
June 2009
- Vehicle queue
after minor
accident on
interstate



- Tractor-trailer hit queue at 69 mph, no brakes applied
- Overran several vehicles, 10 fatalities
- Continued 270 feet after initial impact

Another highway accident (con't)

- Truck driver
 - Age 76
 - Just below typical OSA screens
 - Typical driving shift was nocturnal
 - Transition back to diurnal during weeks off
 - This trip was first return, after weeks off, to early morning shift
 - Acute sleep deprivation previous evening
- NTSB Probable Cause: the driver's acute sleep loss, circadian disruption associated with his shift work schedule, and mild sleep apnea

Rail - accident

- Clarkston, MI – November, 2001
- Southbound train proceeded through stop signal from a siding, 13 mph
- Northbound train at 30 mph
- 2 crew killed; 2 injured
- OSA was diagnosed or suspected in both southbound crew



Rail – accident (con't)

- Engineer (5'11" and 262 lbs – BMI 36.5):
 - Uncontrolled diabetes
 - Sleep study recommended by MD, ENT
- Conductor: diabetes, depression
 - Sleep study 5 yrs prior – AHI 89
 - CPAP, no titration, persistent snoring, somnolence
- NTSB probable cause:
 - The crewmembers' fatigue, which was primarily due to the engineer's untreated and the conductor's insufficiently treated obstructive sleep apnea

Transit - accident

- Newton, MA – May 2008
- MBTA train struck another at 38 mph
- Operator of striking train killed, one passenger seriously injured
- Disregarded signal
- Struck train visible more than 1000 ft away



Transit – accident (con't)

- Last employer medical exam: 5'5½", 243 lbs (BMI 38.6)
- Prevalence of sleep apnea more than 50% in patients with an average BMI of 40.0
- NTSB report noted that the operator was “at a high risk for having undiagnosed sleep apnea, and she may have been chronically fatigued as a result of the condition.”
- NTSB probable cause – failure of the operator of the striking train to comply with the controlling signal indication, likely as a result of becoming disengaged from her environment consistent with experiencing an episode of micro-sleep

Marine - accident



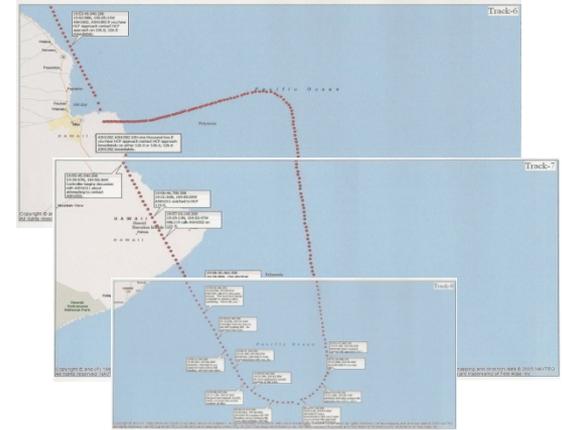
- Inside Passage, AK – June 1995
- Ran aground well-known charted rock, \$27M cost

Marine – accident (con't)

- Pilot (local mariner): 6'1", 310 lbs. (BMI 40.9)
- Long history of sleepiness, 8-9 hrs sleep/night
- Urge to nap frequently
- Snored loudly in all positions
- Treated for depression
- Polysomnography: RDI 68.1; with CPAP, RDI 1.1
- NTSB Probable Cause: Pilot's poor performance, which may have been exacerbated by chronic fatigue from sleep apnea

Aviation - incident

- Honolulu to Hilo – Feb 2008
- 50 minute flight
- Stopped responding to ATC
- Overflew destination
- 26 miles past destination,
Captain called ATC
- Returned for landing



Aviation – incident (con't)

– Captain

- Prior cockpit napping (> once/week)
- Snored loudly; his MD advised regular bedtimes, weight loss, relaxation (no sleep study suggested)
- Most recent certification examination: 6'2", 250 lbs (BMI 32.1); BP 138/80 (on two medications)
- Sleep study: severe OSA – RDI 68.5

– NTSB probable cause:

- The captain and first officer inadvertently falling asleep during the cruise phase of flight. Contributing to the incident were the captain's undiagnosed obstructive sleep apnea and the flight crew's recent work schedules

NTSB Recommendations (all modes)

- NTSB made recommendations separately to all modal transportation administrations (FAA, FMCSA, FRA, FTA, plus USCG), starting 2001
- NTSB generally recommended:
 - Identify diagnosis or risk factors for OSA
 - Screening programs and treatment
 - Guidance for operators, employers and physicians
 - Emphasize that employees who are treated routinely return to work

Responses from Regulators

- No mode has refused to implement NTSB's OSA recommendations
- Coast Guard (marine)
 - Changed CG medical form to include OSA question, issuing alert to all personnel re risks of OSA
 - Increased ability of merchant marine medical evaluators to identify applicants with high risk of OSA
- FMCSA (trucking and motor carriers)
 - Convened industry conference to discuss OSA and promised more concrete actions in near future

Regulator Responses (con't)

– FRA (rail)

- Issued safety advisory concerning issues associated with sleep disorders
- Conducted, and is analyzing results of, study of sleep disorders in rail occupations

– FAA (aviation)

- Screening of pilots for OSA or risk factors has not yet begun
- Developing guidance for pilots and medical examiners to identify OSA and to alert all to risks

Regulator Responses (con't)

- FTA (transit)
 - Working with FRA to develop options to address NTSB recommendations
 - Some transit operators have
 - Revised medical history and examination forms to elicit specific information about past diagnosis of or risk factors for OSA
 - Identified and treated operators at high risk for OSA

Future Challenges

- Sleep
 - Shift changes?
 - Multiple time zones?
- Fatigue
 - Other (non-sleep) factors?
 - Measuring initial fatigue?
 - Monitoring ongoing fatigue while underway?
 - Measuring post-accident fatigue?
- Response to operator fatigue
 - Warning systems
 - Emergency action systems

Thank You!!!



Questions?