

Monday, August 29, 2011
Alexandria, VA

SCREENING FOR OBSTRUCTIVE SLEEP APNEA IN COMMERCIAL VEHICLE OPERATORS

Indira Gurubhagavatula, MD, MPH
Assistant Professor of Medicine
University of Pennsylvania Medical Center
Director, Sleep Disorders Clinic
Philadelphia VA Medical Center



MY BACKGROUND

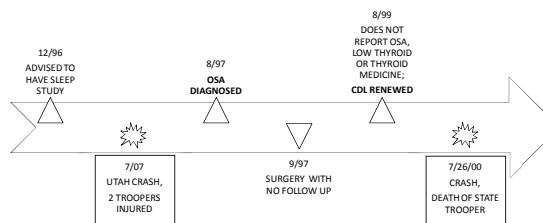
- FMCSA-funded study of commercial drivers
 - Screening for sleep apnea
 - Laboratory measures of sleepiness
- NIH – NIOSH/CDC-funded study of screening for sleep apnea in commercial drivers
 - In progress
- Screening commercial vehicle operators for sleep apnea

Jackson, Tennessee, July 26, 2000



Tennessee State Trooper Killed
Driver of Chevy Blazer Seriously Injured

TIMELINE OF EVENTS LEADING TO CRASH



<http://www.awakeorhighly.org/Legal/Engum26July20007Naccident.shtml>

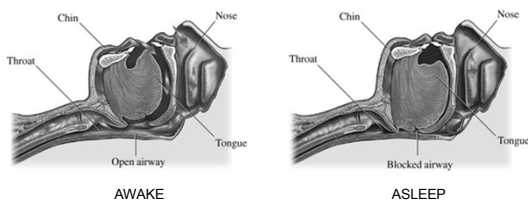
OUTCOME

- Pleaded guilty to
 - vehicular homicide by recklessness
 - aggravated assault with a deadly weapon
- Driver and company responsible for paying \$3.25 million judgment to trooper's family

OUTLINE

- Symptoms, prevalence, risk factors
- Consequences
- Diagnosis
- Treatment
- Industry initiatives
- Available guidelines
- Recommendations

WHAT IS SLEEP APNEA?



<http://content.revolutionhealth.com/content/images/v5551303.jpg>

http://www.thetmjcenter.com/sleep_apnea.jpg

WHAT IS SLEEP APNEA?

Recurrent stops in breathing (apneas) or decrements in airflow (hypopneas) during sleep

Fall in oxygen level (hypoxia)

- high blood pressure
- heart attack
- stroke

Arousal from sleep

Neuro-cognitive effects
SLEEPINESS
- crash risk

SYMPTOMS OF OSA

DURING SLEEP

- loud snoring
- choking during sleep
- gasping/snorting
- witnessed apneas
- nighttime urination

DURING WAKEFULNESS

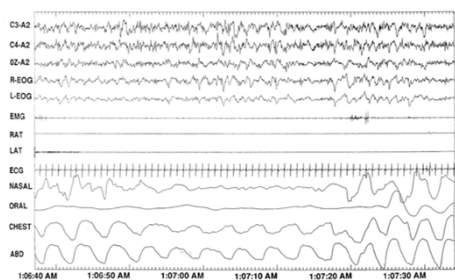
- sleepiness despite adequate sleep duration
- low mood, memory, concentration
- Reduced attention, reaction time
- Morning headache
- Impotence

worse with weight gain, alcohol

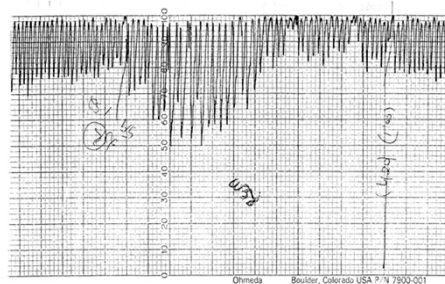
WHO IS AT RISK FOR OSA?

Airway crowding	Demographic	"Floppy" airway	Nose problems
<ul style="list-style-type: none"> • Central obesity • Large tongue • Jaw set back • Large tonsils 	<ul style="list-style-type: none"> • Middle age • Male gender • Heredity • Race • Menopause 	<ul style="list-style-type: none"> • Alcohol • Narcotics • Sedatives • Age • Low thyroid function 	<ul style="list-style-type: none"> • Deviated septum • Polyps, allergies • Smoking

EXAMPLE OF AN APNEA



OSA AND OXYGEN LEVEL DURING SLEEP



APNEA-HYPOPNEA INDEX

APNEAS + HYPOPNEAS
HOURS OF SLEEP

Severity	AHI (events/hour)
None	[0-5)
Mild	[5-15)
Moderate	[15-30)
Severe	≥ 30

IS SEVERE SLEEP APNEA COMMON IN COMMERCIAL DRIVERS?

COMMERCIAL DRIVERS		
FMCSA	AUSTRALIA	STANFORD
4.7%	10.6%	10%

prevalence of AHI ≥ 30 events/hour

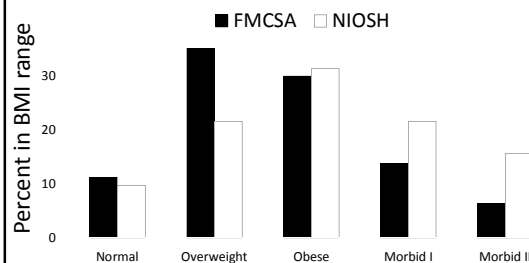
Pack et al. FMCSA Pub. #DOT-RT-02-030, Washington, DC, 2002
Howard et al. AJRCOM (170):1014, 2004
Stoohs et al. Chest (107):1275, 1995

WHY IS APNEA SO COMMON IN COMMERCIAL DRIVERS?

Airway crowding	Demographic	"Floppy" airway	Nose problems
<ul style="list-style-type: none"> Central obesity Large tongue Jaw set back Large tonsils 	<ul style="list-style-type: none"> Middle age Male gender Heredity Race Menopause 	<ul style="list-style-type: none"> Alcohol Narcotics Sedatives Age Low thyroid function 	<ul style="list-style-type: none"> Deviated septum Polyps, allergies Smoking

Pack et al. FMCSA Pub. #DOT-RT-02-030, Washington, DC, 2002
Howard et al. AJRCOM (170):1014, 2004
Stoohs et al. Chest (107):1275, 1995

BMI DISTRIBUTION IN TWO COHORTS OF CDL HOLDERS



Pack et al. FMCSA Pub. #DOT-RT-02-030, Washington, DC, 2002
NIOSH/CDC R01 OH-009149-3, 2011

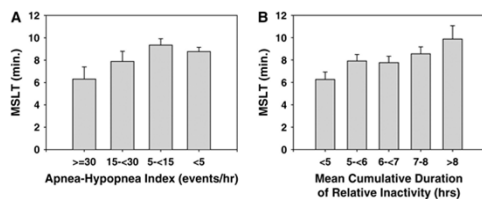
WHY IS OSA IN COMMERCIAL DRIVERS OF PARTICULAR IMPORTANCE?

CDL HOLDER SELF-REPORTS

		102 CDL HOLDERS	250 VETERANS
Sleepiness while driving	Slight	25 (24.5%)	22 (9.1%)
	Moderate	4 (3.9%)	5 (2.1%)
	High	0 (0%)	4 (1.7%)
Accidents	Ever	68 (67%)	
	Single-vehicle	13 (13%)	
	Sleepy	4 (3.9%)	

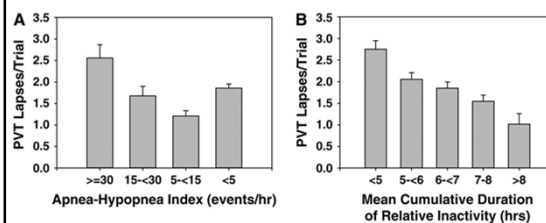
NIOSH/CDC R01 OH-009149-3
K23 RR10068
V64 PILOT PROJECT GRANT

ESTIMATES OF OBJECTIVELY MEASURED SLEEPINESS IN COMMERCIAL DRIVERS



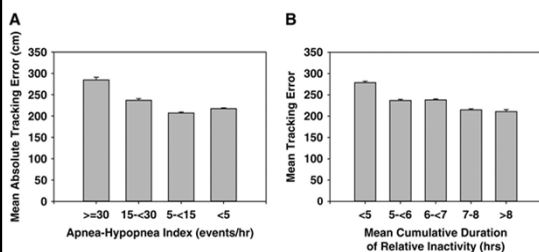
Pack et al, AJRCCM 174(4): 446, 2006

ESTIMATED LAPSES DURING PSYCHOMOTOR VIGILANCE TESTING IN COMMERCIAL DRIVERS



Pack et al, AJRCCM 174(4): 446, 2006

ESTIMATED DIVIDED ATTENTION DRIVING ERRORS IN COMMERCIAL DRIVERS



Pack et al, AJRCCM 174(4): 446, 2006

SLEEPINESS AND CRASHES IN CMV OPERATORS

Sleepiness has been attributed to:

- 31-41% of crashes of commercial vehicles
- 1500-2000 deaths/year
- For each fatality, there are 25 injuries
- For each accident resulting in injury, there are 3.7 crashes with property damage

FMCSA, NTSB, NHTSA, AAA FOUNDATION FOR TRAFFIC SAFETY

COST OF CMV CRASHES (2008 DOLLARS)

	Fatal	Injury	Property Damage Only	TOTAL
2009	\$23 billion	\$20 billion	\$5 billion	\$48 billion

Non-fatal crash	\$91,112/crash
Fatal crash	\$3.6 million/crash

<http://www.fmcsa.dot.gov/documents/facts-research/CMV-Facts.pdf>
<http://www.fmcsa.dot.gov/facts-research/facts-figures/analysis-statistics/cmvsfacts.htm>

SLEEP STUDY

- Brain waves
- Eye movement
- Chin, leg muscles
- Chest and abdomen effort
- Airflow, snoring
- Oxygen level



85% of cases remain undiagnosed

PORTABLE SLEEP STUDY

Brain waves

Eye movement

Chin, leg muscles

- Chest and abdomen effort
- Airflow, snoring
- Oxygen level



<http://www.fette-thimm.de/img/tembleta400.jpg>

USEFULNESS OF SCREENING TOOLS IN PREDICTING SEVERE APNEA IN 57 CDL HOLDERS

	Neck circumference	BMI	oximetry	Self-assembled study	Full sleep study
AUC*	0.68	0.72	0.91	0.96	1
N	57	57	57	57	57

*Area under receiver-operating characteristic curve
0.5 = poor, 1=perfect

NIOSHCDC R01 OH-009149-3

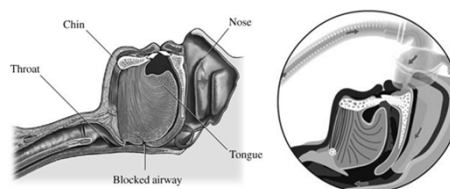
TREATMENT OF OSA: CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP)



http://www.apneasante.com/img/la/images/cpap_cpap3.png

<http://www.bluewaterdeepclinic.com/images/cpap.jpg>

TREATMENT OF OSA: CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP)



<http://www.sleepwise.com.au/images/0912193045.gif>
http://www.rnmed.com.au/images/cpap_treatment.jpg

TREATMENT FOR OSA

- Wear CPAP during sleep (in berth)
- Lose weight
- Avoid sedatives, alcohol, narcotics
- Make sure nasal passages are open
- Follow safe driving habits
- Monitor blood pressure, heart health

WHAT ARE THE BENEFITS OF CPAP?

- Lowers crash risk
- Improves alertness
- Improves performance on driving simulator
- Lowers blood pressure
- Raises oxygen level
- Lowers AHI
- More efficient work performance
- Reduces health care costs

CPAP AND MOTOR VEHICLE CRASH RISK: REVIEW AND META-ANALYSIS

Continuous Positive Airway Pressure Reduces Risk of Motor Vehicle Crash among Drivers with Obstructive Sleep Apnea: Systematic Review and Meta-analysis

Stephen Tregear, PhD¹, James Roeder, PhD, MPH², Karen Schoeller, MD, SM³, Barbara Phillips, MD, MSPH⁴

¹MANTIS Consulting Group, McLean, VA; ²ECRI Institute, Plymouth Meeting, PA; ³Division of Pulmonary, Critical Care and Sleep Medicine, Department of Internal Medicine, University of Kentucky College of Medicine, Lexington, KY

9 studies of crash risk in OSA patients showed that after treatment with CPAP:

- Crash risk dropped
 - risk ratio = 0.278, 95% CI: 0.22 to 0.35; $P < 0.001$
- Daytime sleepiness improved after one night
- Simulated driving performance improved within 2-7 days

funded by FMCSA GS-10F-0177N/DTMC75-06-F-00039
Tregear, Sleep, 33(10):1373, 2010

DATA FROM 9 STUDIES SHOW THAT AFTER CPAP,

CRASH RISK DROPS,

	Rate Ratio
Barbe	0.407
George	0.333
Findley	0.090
Horstmann	0.255
Scharf	0.286
Yamamoto	0.039
Krieger	0.313
Cassel	0.188
Engleman (injury)	0.200
	0.278

TO RATES
SIMILAR TO
RATES IN THOSE
WITH NO OSA

funded by FMCSA GS-10F-0177N/DTMC75-06-F-00039
Tregear, Sleep, 33(10):1373, 2010

INDUSTRY INITIATIVES: Waste Management, Inc.

The Long-Term Health Plan and Disability Cost Benefit of Obstructive Sleep Apnea Treatment in a Commercial Motor Vehicle Driver Population

Benjamin Hoffman, MD, MPH, Dustin D. Wingenbach, MBA, Amy N. Kagey, MS, Justin L. Schaneman, MS, and David Kasper

12 months before vs 24 months after CPAP

	OSA + CPAP	OSA, no CPAP
Missed workdays	↓	No Change
Disability claimant rates	↓	
Total health plan and disability costs	↓↓ > \$6,000 (41%)	

Hoffman, JOEM 52(5): 473, 2010

INDUSTRY INITIATIVES: SCHNEIDER TRUCKING N=348 DRIVERS WITH OSA

PMPM health care spending	↓ >\$500 (47.8%) ($p < .0001$)
Preventable driving accidents (225 FT-CPAP-treated drivers)	↓ 73%
Driver retention rate, compared to 2004 global corporate rate	↑ 2.29 times

"CPAP as a treatment for sleep apnea yielded very high returns... produces both short and long-term savings and reduces hospitalizations."

Don Osterberg, Sleep Apnea & Trucking Conference, BWI Airport, 5/12/2010

http://www.sleephealth.com/Collateral/Documents/English-US/Schneider_TB_Symposium_Paper.pdf

INDUSTRY INITIATIVES: JB HUNT

- Clinical trial in progress
- Partnered with two sleep provider groups to screen drivers for apnea
- Will assess
 - Compliance
 - Health care costs
 - Accident rates

HOW DO WE KNOW PATIENTS ARE USING CPAP?

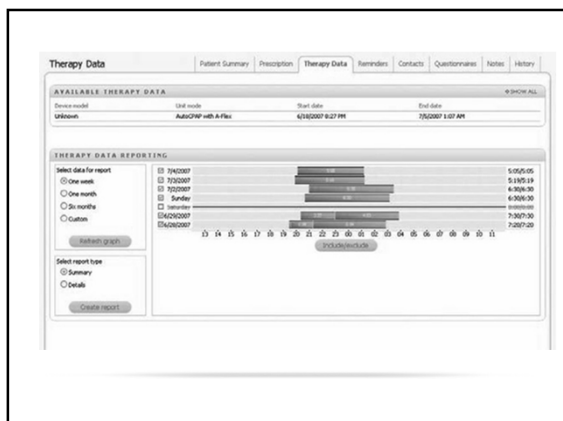
MONITORING SYSTEMS

- Data cards
- SD cards
- Remote/wireless

REPORTED DATA

- Hours of use
- Pressure level
- Residual apnea
- Mask leak

Issues can be addressed in "real" time



SCREENING AND MANAGEMENT GUIDELINES FOR OSA IN COMMERCIAL DRIVERS

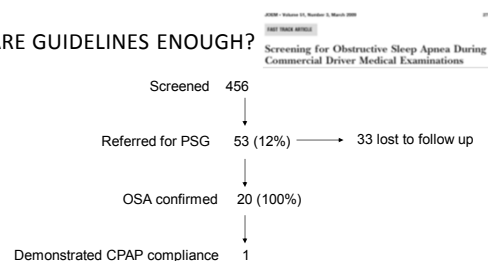
TWO SETS OF GUIDELINES ARE AVAILABLE FOR SCREENING AND TREATMENT

FMCSA TRI-SOCIETY TASK FORCE

- When to keep driver
 - in-service
 - conditional in-service
 - out-of-service
- Diagnosis
- Treatment
- Reinstatement after out of service

<http://www.fmcsa.dot.gov/rules-regulations/TOPICS/mep/report/Sleep-MEP-Panel-Recommendations-508.pdf>
Hartenbaum, CHEST, 130:902, 2008

ARE GUIDELINES ENOUGH?



"Drivers identified by the consensus criteria have a high likelihood of OSA. Drivers' poor compliance with PSGs and OSA treatment support federally mandated screening of commercial drivers"

Parks, JOEM, 51 (3): 275, 2009

SUMMARY

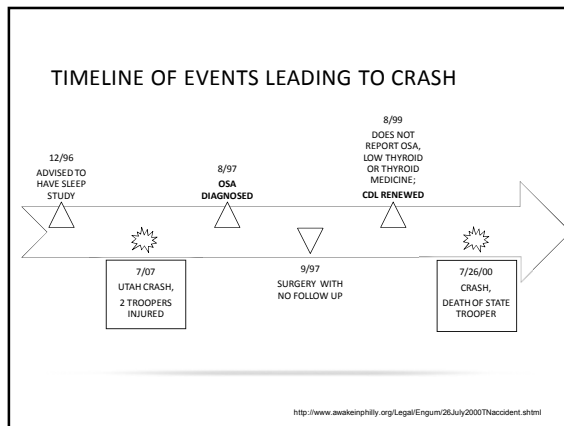
- SLEEP APNEA IS
 - COMMON IN COMMERCIAL DRIVERS
 - CAUSES SLEEPINESS
 - LINKED TO CRASHES
 - CAN BE DIAGNOSED IN THE HOME
- CPAP TREATMENT IS
 - INEXPENSIVE
 - ACCESSIBLE
 - REDUCES CRASHES AND LOWERS COSTS
 - TRACKABLE IN REAL-TIME

TWO SETS OF GUIDELINES ARE AVAILABLE FOR SCREENING AND EVALUATING FITNESS FOR DUTY

NOT ENOUGH DRIVERS ARE GETTING HELPED

WHAT NEXT?





ACKNOWLEDGEMENTS

Allan Pack, MD, PhD
Greg Maislin, MS, MA
Sharon Hurley, BA
Lindsay Wick, MS
Christian Morales, MD
Kim Halscheid, BA

Sleep Lab Technologists
Beth Staley
William Wieland
Haideliza Soto - Calderon
Funding sources
• FMCSA
• NIOSH/CDC
R01 OH-009149-3

QUESTIONS?