Fatigue and Sleep Factors Related to Safety Critical Events

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What we have:

- Pop.: 4-8 Million Commercial Truck Drivers
- ~286,000 Crashes, 31,000 injuries, 4,000 annual fatalities
- 10-20% of crashes associated with medical conditions (large truck causation study)
- Common occupational health issues include:
  - Obesity, CVD, DM, Hyperlipidemia, OSA, tobacco
- Relatively sparse data on risks of crashes (FMCSA, MEPs, MRB)
  - Increasing data on immediate crash cause (e.g. eyes off road)
  - Little data on other factors
- Evidence-based prevention relatively ill-defined

Study Objective

These analyses assess relationships between self-reported measures of sleep quality and duration and SCEs while adjusting for age, gender, Body Mass Index, and diagnosis of a sleep problem among a large (n=817) population of truck drivers.

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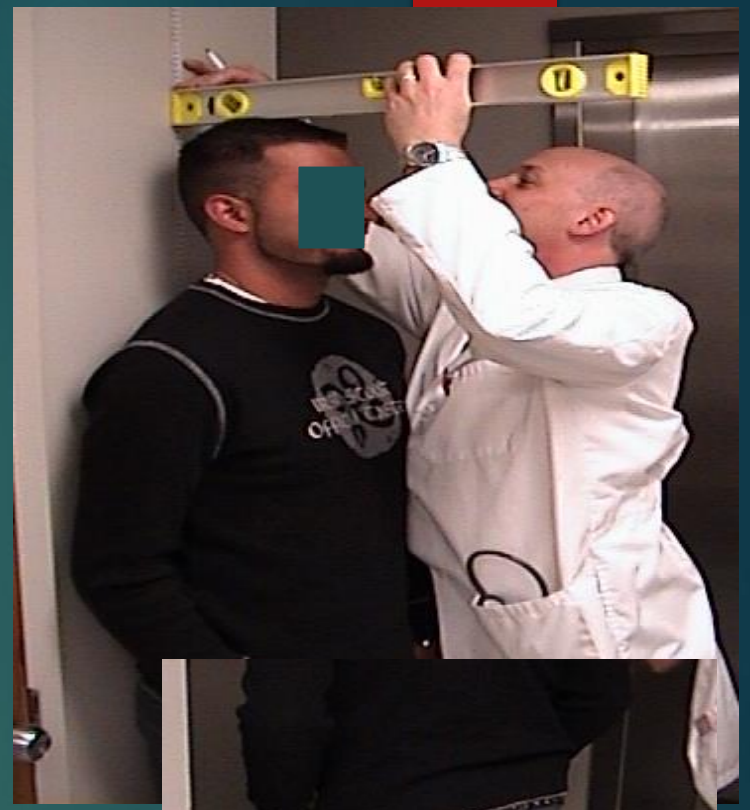
Methods

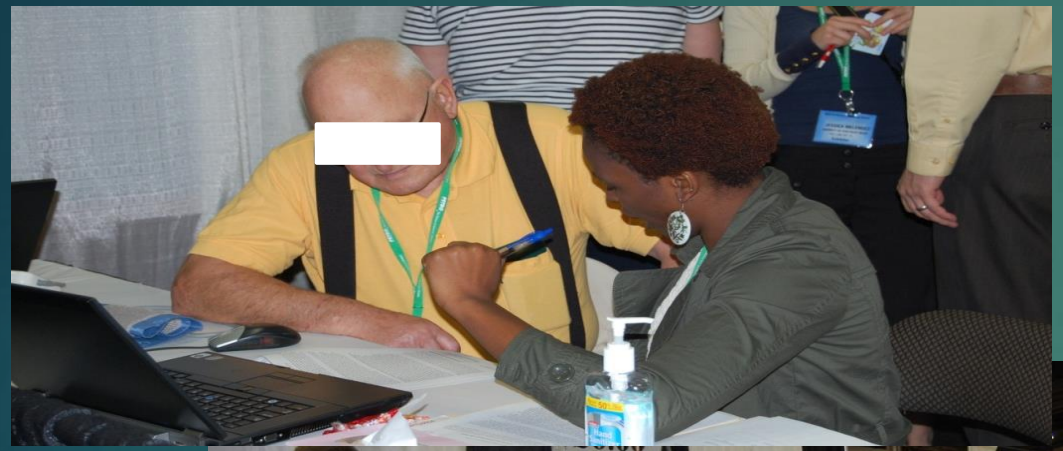
Study Design: Cross Sectional.

N=812 Drivers from 46 States

- All drivers had current CDL
- Driving for 1 year or more
- Laptop questionnaire
- ~ 1 hour to complete
- Measured Weight, Height, Lipids, BP
- $20 gift card
- Certificate of Confidentiality



Enrollment



- Computerized Questionnaire
  - Crash, Near Miss history
  - Personal Factors
  - Medical history
  - Occupational Factors
  - Psychosocial factors

Fatigue Measures

- How often during the past month has your sleep been restless?
- When on the road, on average, about how many total hours of sleep do you get per 24 hour period? (Don't count time you are laying awake or trying to fall asleep.)
- Have you ever been told by a physician or other health care provider that you have Sleep disorders, pauses in breathing while asleep, daytime sleepiness, loud snoring?
- How often are you mentally exhausted after work?

Safety critical events (SCE)

- In the past month, about how many near miss truck accidents did you experience?
  - For this question, "near miss truck accident" means you had to take some evasive action to avoid a crash (brake hard, swerve steering, etc.)

- Have you ever had any reportable motor vehicle accidents as a professional driver? _____yes _____no

Statistical Analysis

- Statistics analyzed with SAS 9.4 software
- Logistic Regression Analysis
  - Odds Ratios (OR)
  - 95% Confidence Intervals (95% CI)
- Crude and Adjusted models created to assess potential relationships between Fatigue measures and SCEs

Table 1. Demographic Factors of Truck Drivers	Mean	SD
Age	47.3	10.5
Body Mass Index Category	Frequency	Percent
Underweight	5	0.61
Normal Weight	80	9.79
Overweight	225	27.54
Obese	393	48.10
Morbidly Obese	114	13.95
Gender		
Female	112	13.71
Male	705	86.29
Diagnosed with a Sleep problem	100	12.24
Mentally Exhausted		
Never	162	19.83
Seldom	383	46.88
Often	215	26.32
Always	57	6.98
Help you stay awake while you drive?	525	64.26

Table 1. Demographic Factors of Truck Drivers	Frequency	Percent
Average Hours of Sleep Per Night while on the Road		
Less than 4	16	1.97
4 to 5	85	10.44
5 1/2	26	3.19
6	128	15.72
6 1/2	63	7.74
7	105	12.9
7 1/2	52	6.39
8	130	15.97
8 1/2	48	5.90
9	37	4.55
More than 9	64	7.86
I Sleep at Home Every Night	60	7.37
At Least 1 “Near Miss” in the past month	387	47.37
At Least 1 D.O.T. Reportable crash in their Lifetime	326	39.90

Table 2. Adjusted Odds Ratios and 95% Confidence Intervals for Relationships between Factors and Safety Critical Events		
	Near Misses	Reportable Crashes
	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Age (per year)	0.99 (0.97, 0.99)*	1.03 (1.01, 1.04)*
Gender		
Female	0.94 (0.61, 1.45)	0.45 (0.28, 0.72)*
Diagnosed with a Sleep problem	1.59 (1.00, 2.53)*	0.81 (0.51, 1.29)
Mentally Exhausted		
Never	1.00 (Reference)	1.00 (Reference)
Seldom	1.77 (1.18, 2.66)*	0.84 (0.56, 1.24)
Often	2.28 (1.45, 3.58)*	0.92 (0.59, 1.44)
Always	5.00 (2.46, 10.16)*	1.96 (1.02, 3.76)*
Help you stay awake while you drive?	1.57 (1.15, 2.15)*	1.32 (0.96, 1.80)

*p<0.05. factors were adjusted for Age, Gender, BMI, Hours of Sleep, Diagnosed Sleep Problem, Mentally Exhausted, and help to stay awake.

Table 2. Adjusted Odds Ratios and 95% Confidence Intervals for Relationships between Factors and Safety Critical Events

	Near Misses	Reportable Crashes
	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Average Hours of Sleep Per Night while on the Road		
Less than 4	5.16 (1.55, 17.16)*	1.61 (0.43, 5.98)
4 to 5	2.07 (1.01, 4.27)*	2.52 (1.18, 5.38)*
5 1/2	2.45 (0.92, 6.50)	2.73 (0.99, 7.55)
6	3.51 (1.79, 6.87)*	1.99 (0.98, 4.04)
6 1/2	2.51 (1.17, 5.37)*	1.97 (0.88, 4.43)
7	2.17 (1.09, 4.33)*	3.53 (1.71, 7.29)*
7 1/2	2.25 (1.01, 4.99)*	3.71 (1.62, 8.49)*
8	1.84 (0.94, 3.58)	2.88 (1.43, 5.81)*
8 1/2	1.81 (0.80, 4.11)	2.99 (1.29, 6.95)*
9	1.41 (0.57, 3.49)	1.83 (0.72, 4.68)
More than 9	1.00 (Reference)	1.00 (Reference)
I Sleep at Home Every Night	1.72 (0.79, 3.74)	2.33 (1.04, 5.24)

*p<0.05. factors were adjusted for Age, Gender, BMI, Hours of Sleep, Diagnosed Sleep Problem, Mentally Exhausted, and help to stay awake.

Table 2. Adjusted Odds Ratios and 95% Confidence Intervals for Relationships between Factors and Safety Critical Events		
	Near Misses	Reportable Crashes
	Odds Ratio (95% CI)	Odds Ratio (95% CI)
How well do you sleep at night		
Very Well	1.00 (Reference)	1.00 (Reference)
Well	**1.46* (1.01, 2.11)**	1.36 (0.93, 2.00)
Fair	1.40 (0.93, 2.10)	0.88 (0.57, 1.36)
Poorly	1.77 (0.85, 3.69)	1.02 (0.46, 2.23)
Very poorly	**8.70* (1.02, 74.37)**	0.47 (0.08, 2.66)
Restless Sleep		
Never	1.00 (Reference)	1.00 (Reference)
Seldom	**1.97* (1.37, 2.83)**	**1.88* (1.28, 2.76)**
Often	**2.03* (1.31, 3.16)**	1.46 (0.91, 2.36)
Always	**2.70* (1.36, 5.34)**	1.29 (0.63, 2.67)

*p<0.05. factors were adjusted for Age, Gender, BMI, Hours of Sleep, Diagnosed Sleep Problem, Mentally Exhausted, and help to stay awake.

Discussion

- Many factors related to lifetime history of reportable crash
- Preliminary analyses: many associated factors associated with near misses in this large population of truck drivers.
- Multiple factors consistent between the two outcomes to suggest possible causal relationship
- Meaningful differences between the two outcomes
  - Driving tenure (Protective in near miss)

Other interesting results

- Female Gender protective for Lifetime Crashes
- Increasing Age Protective for Near-Misses in the past month
- BMI had no relationship with these outcomes after adjustment for other measures

Discussion

- Strengths
  - Large study
  - Assessment of many factors
  - Many states, variety of drivers
  - Demographics of drivers similar to other studies
- Weaknesses
  - Cross sectional study design
  - Self reported crash and near miss outcomes
  - Preliminary analyses, further analyses needed

Questions?

- This research was supported in part by a grant from the Centers for Disease Control and Prevention (NIOSH), 1R01OH009155-01.
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