

# Safety and Health: The Role of Sleep and Circadian Rhythms

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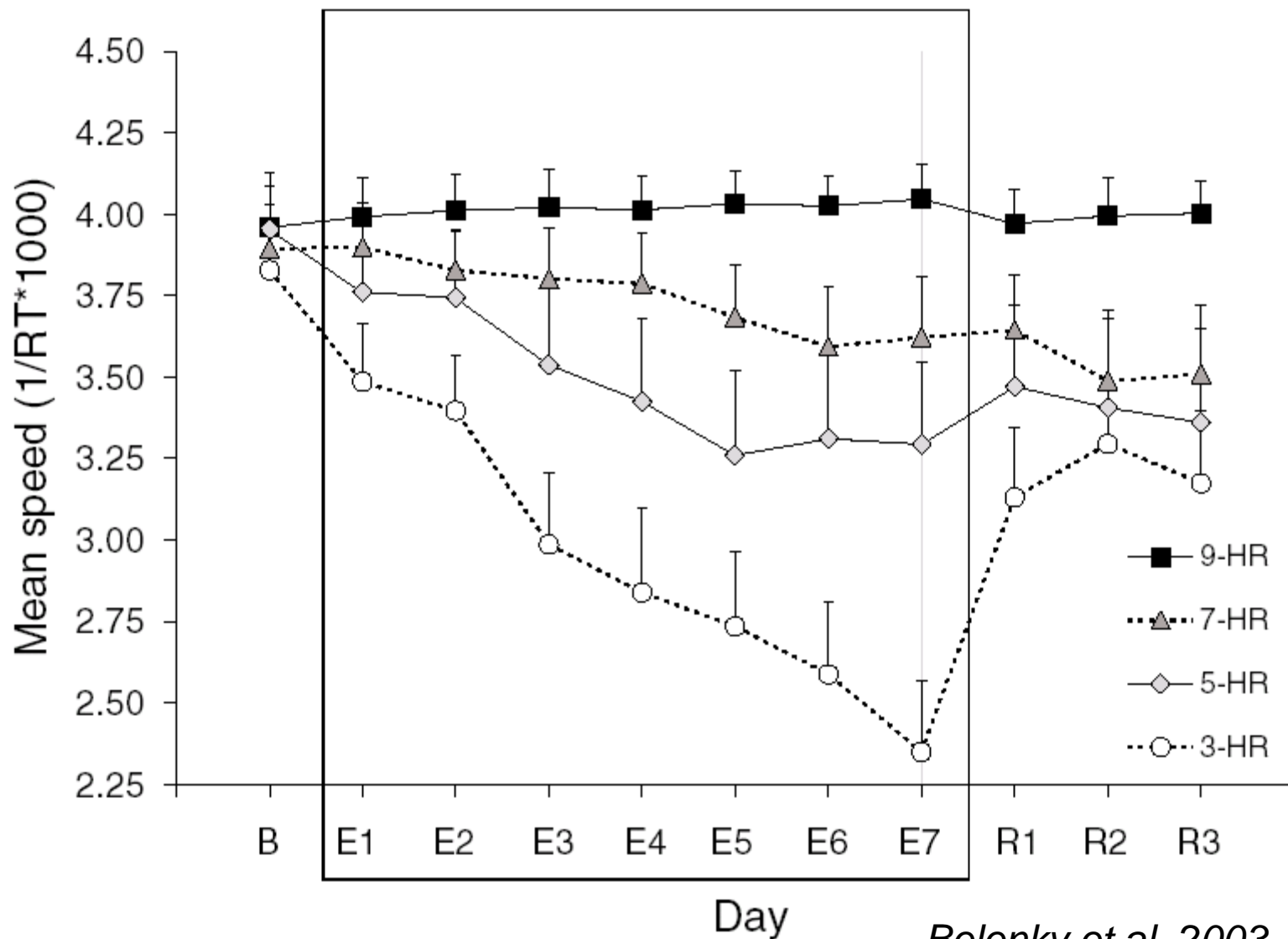


Giugno-Luglio 99 ~~June~~ July 99

How tired is too tired?

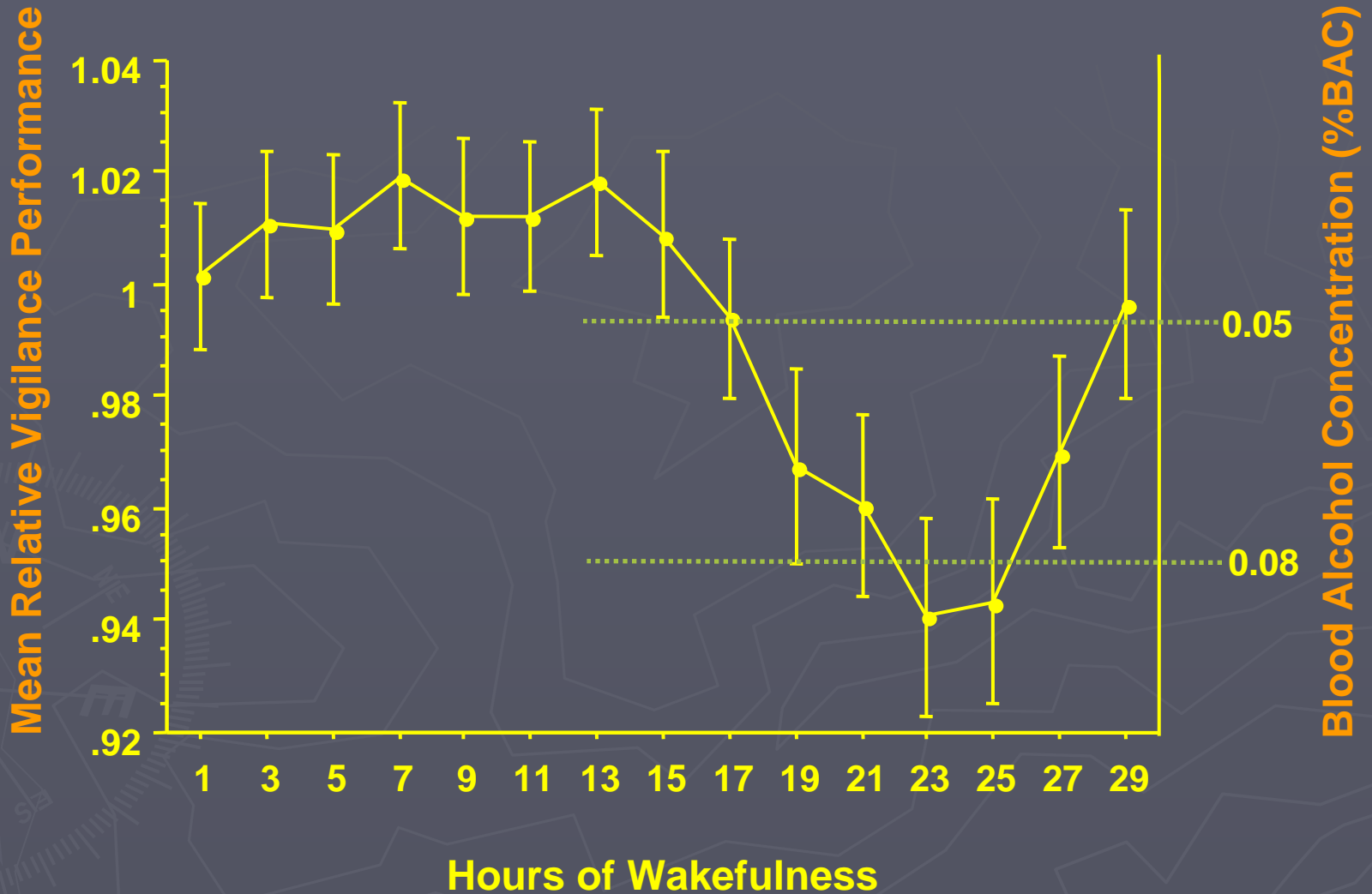
F A I D

# Partial Sleep Debt: Impact on Performance

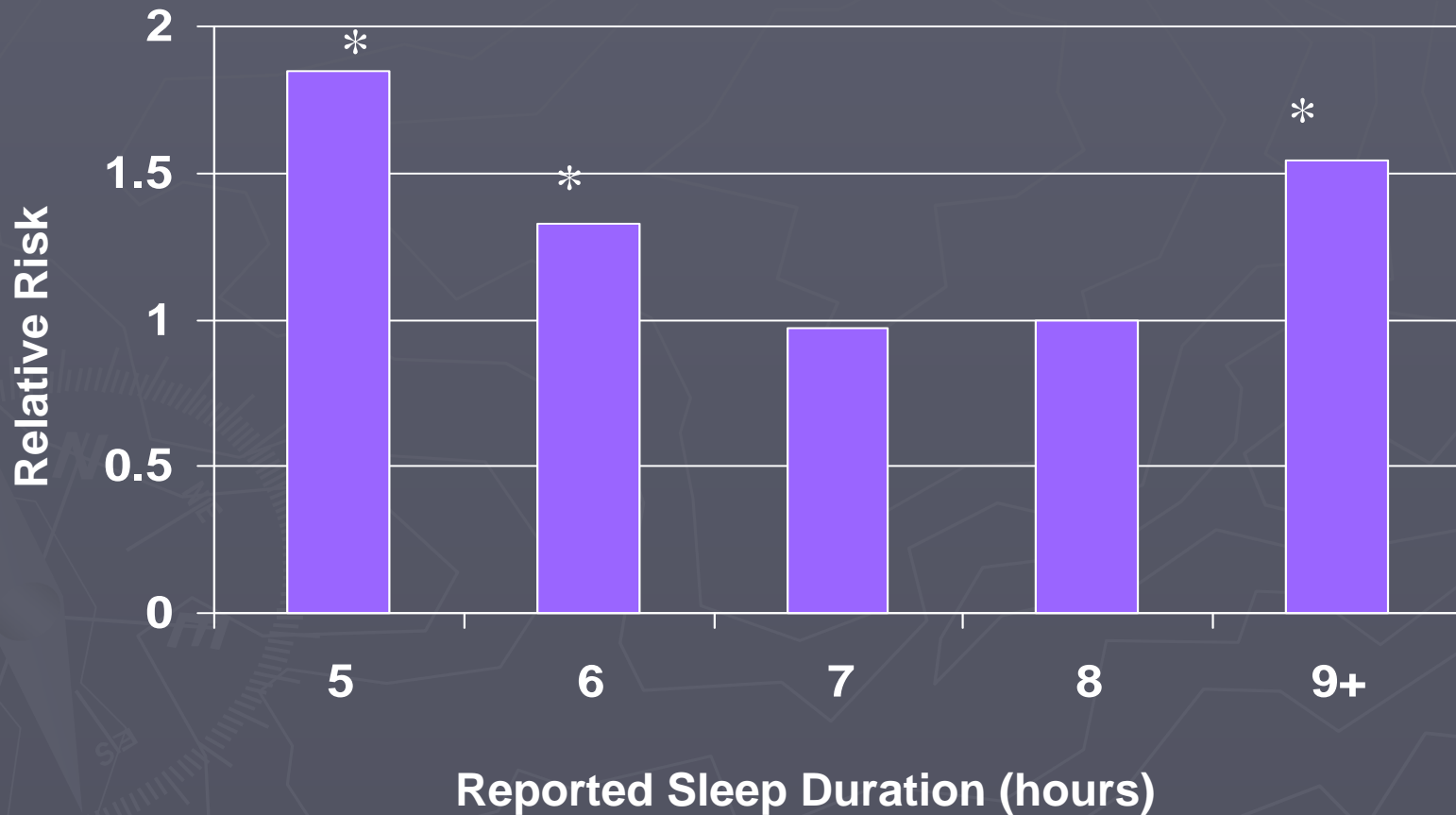


*Belenky et al, 2003*

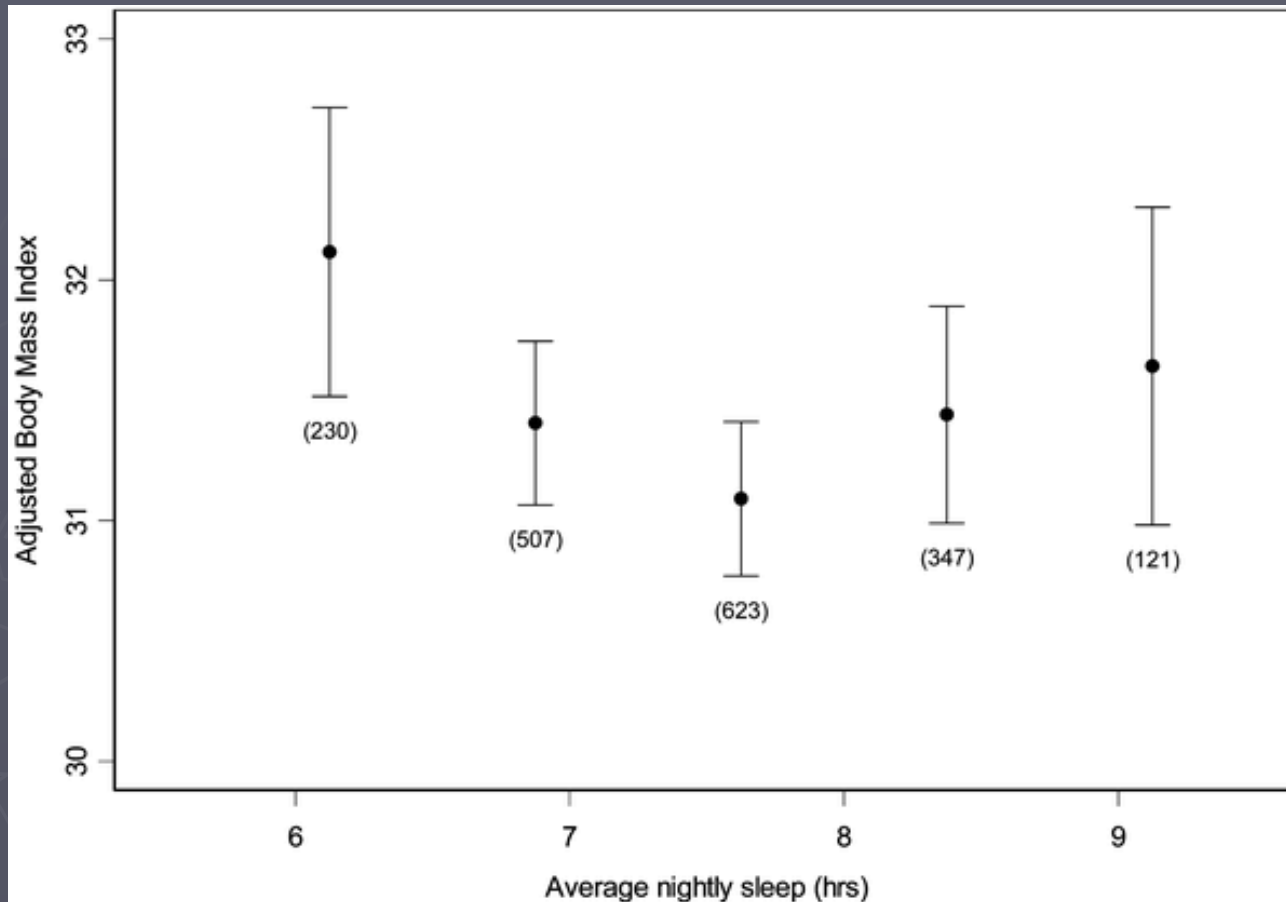
# Expressing The Performance Impairment Due to Fatigue as a Blood Alcohol Equivalent



# Age-adjusted Relative Risks of Symptomatic Diabetes (1187 cases)



# Sleep duration and body mass index



Low leptin associated with short sleep

Taheri et al, 2004 PLoS

Wisconsin Sleep Cohort Study

National Sleep  
Foundation  
IISI North America

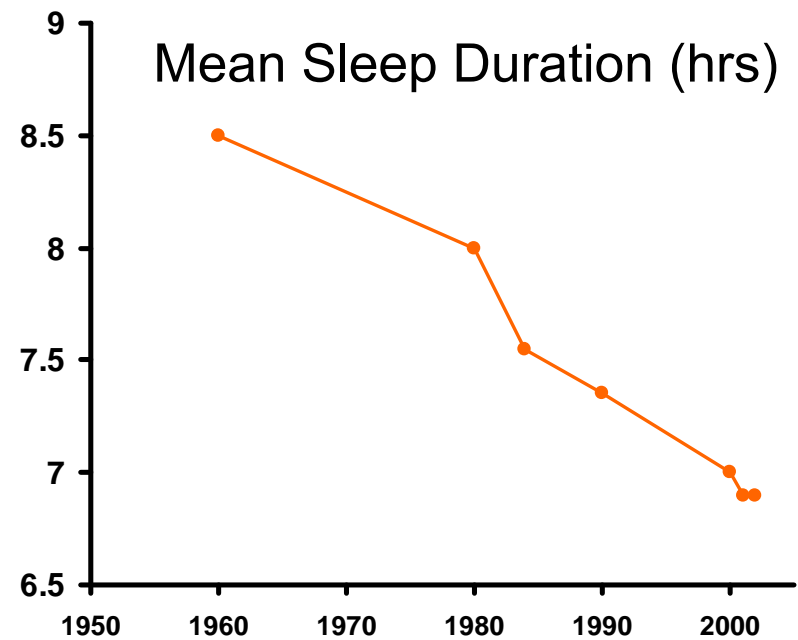
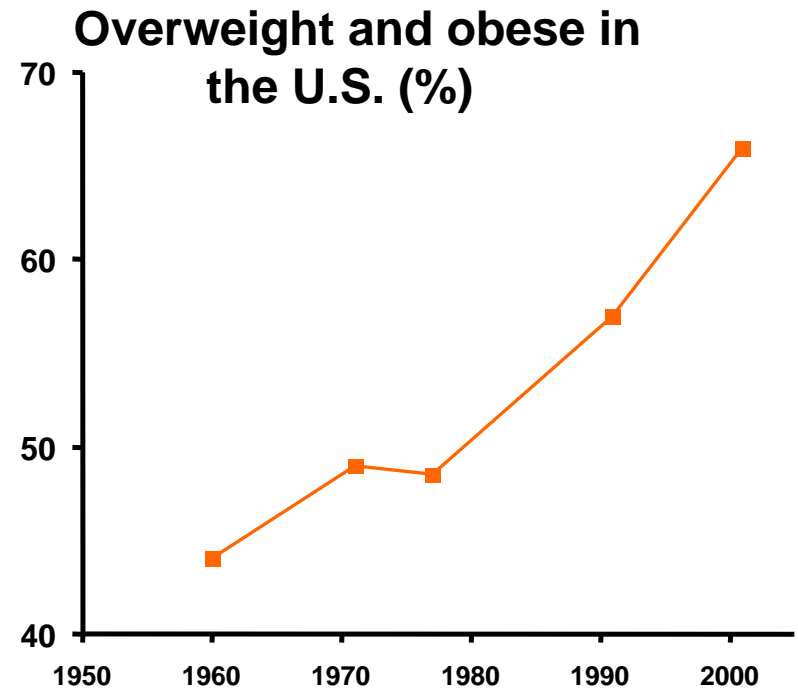
## Sleep Loss and Obesity: Interacting Epidemics

March 28, 2006

### SOURCES

Obesity: CDC (NHES, NHANES)

Sleep: Roffwarg *Science* 1966, NHIS (unpublished data), National Sleep Foundation polls, Hale *J Public Health* 2005

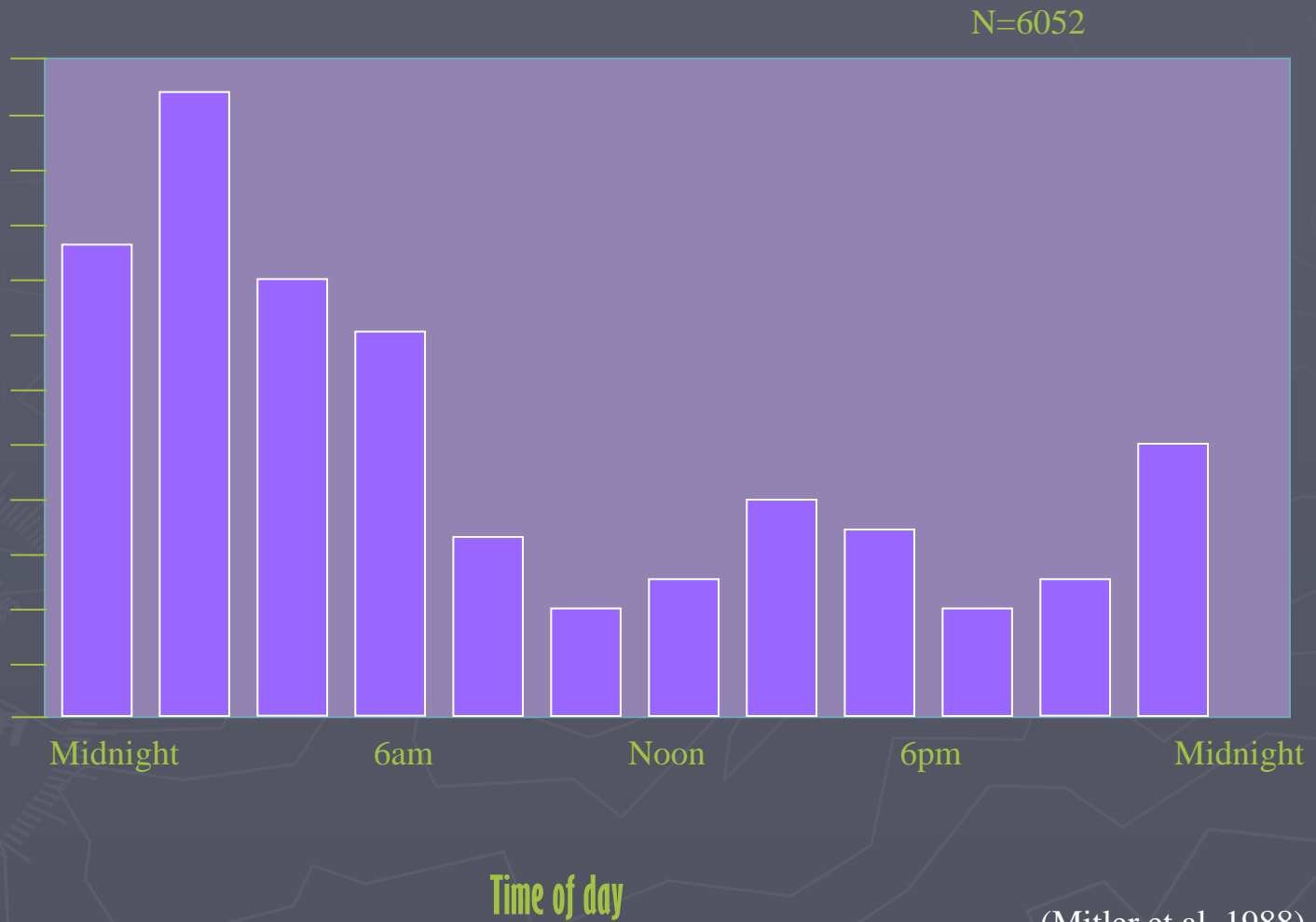


# Safety and Health

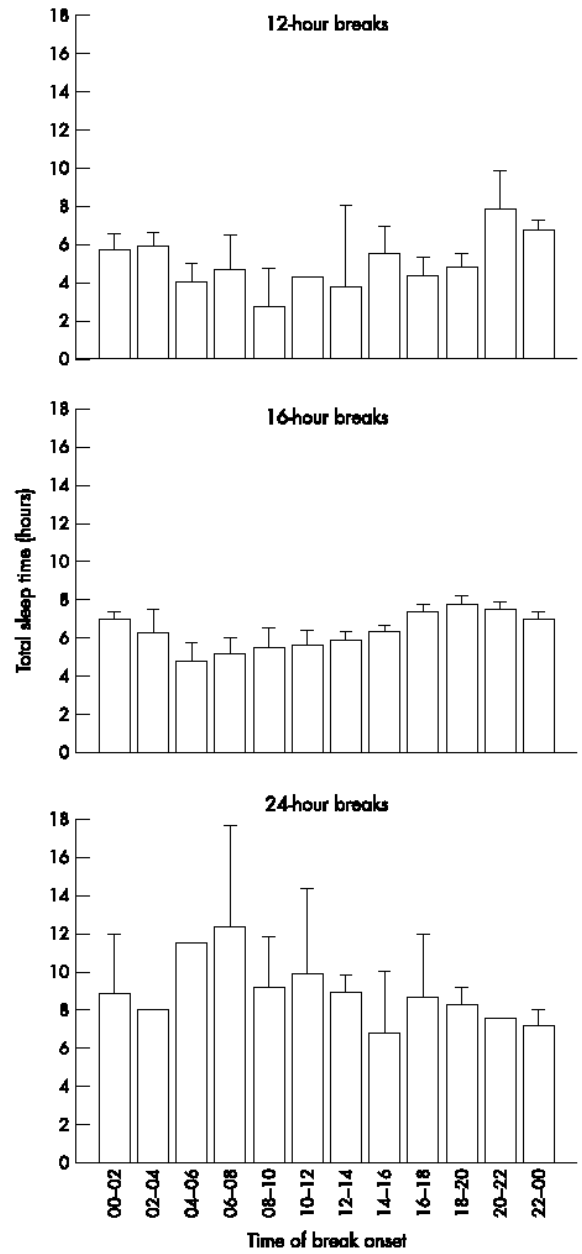
- ▶ Short sleep duration (6 hours or less) and circadian disruption are associated with poor performance, cardio-metabolic health outcomes and reductions in mood.
- ▶ Short sleep duration can be due to any number of reasons including: inadequate sleep opportunity, sleep disorders or sleeping at a sub-optimal circadian time of day (shift work, "social jet lag").



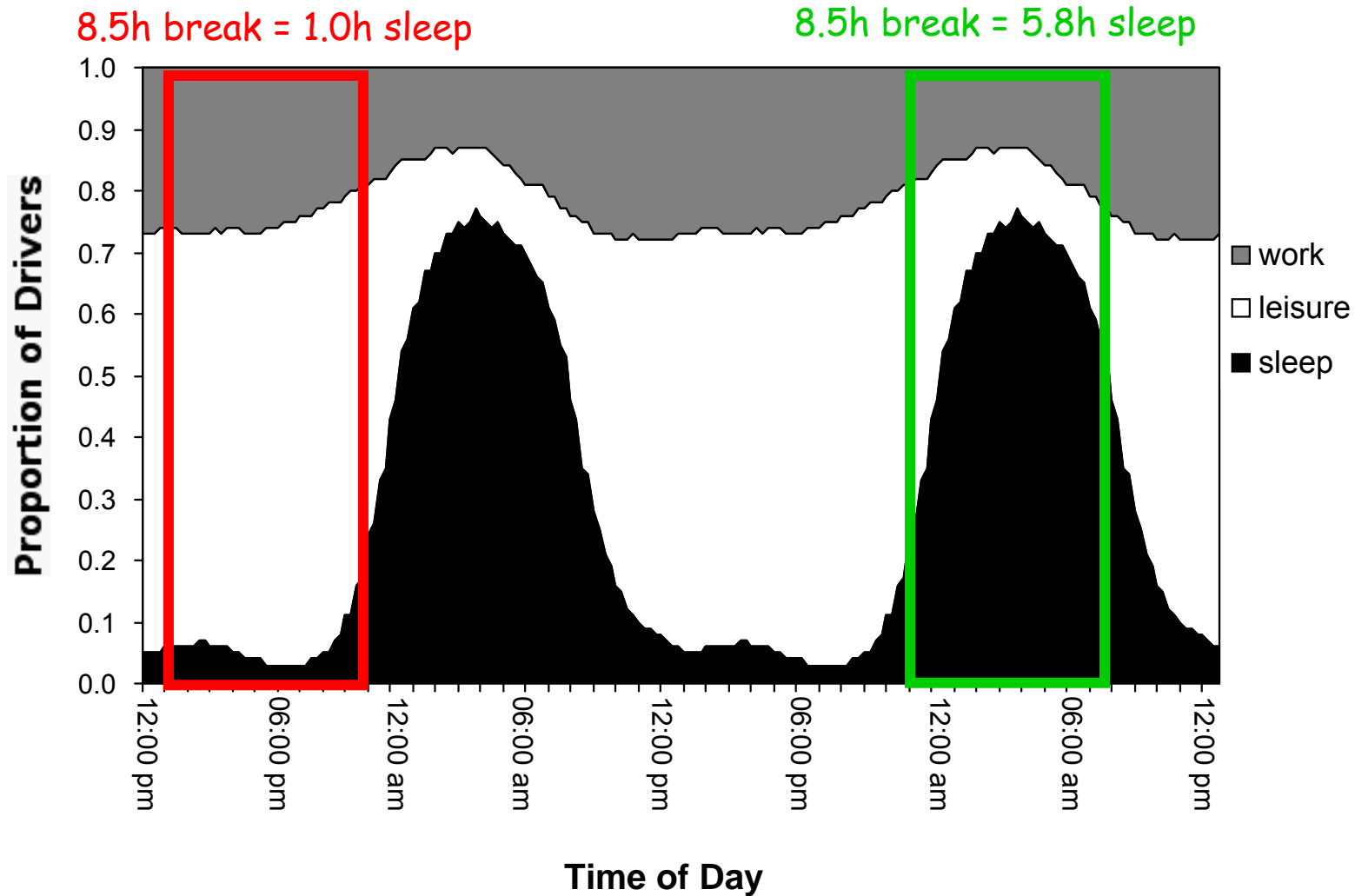
# Fatigue-related Accidents



(Mitler et al. 1988)



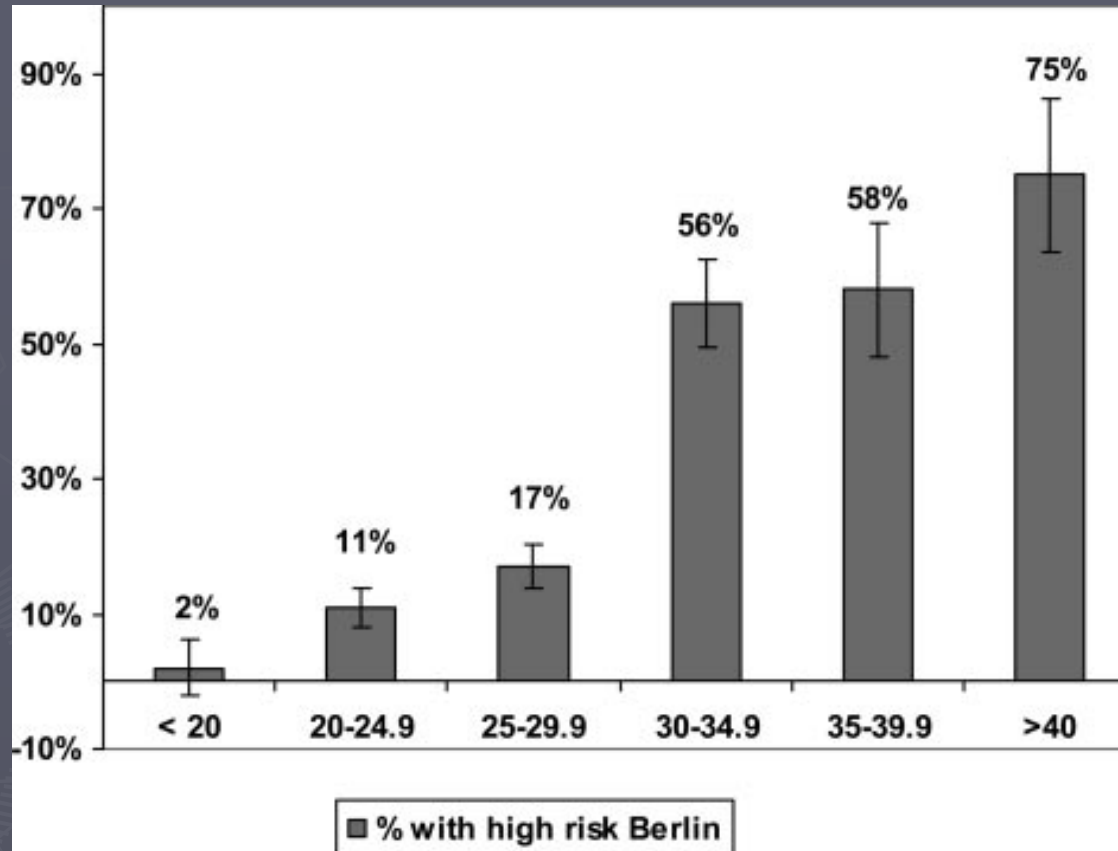
# Timing & Duration of Breaks Influences Sleep Duration



# Impact of Shift Work on Health

- ▶ Higher body mass index
- ▶ Increased risk of cancer
- ▶ Increased metabolic dysfunction (e.g. type II diabetes)
- ▶ Increase risk of cardiovascular disease
- ▶ Circadian rhythm sleep disorder: Shift Work Disorder
- ▶ Increase in gastrointestinal and reproductive disorders

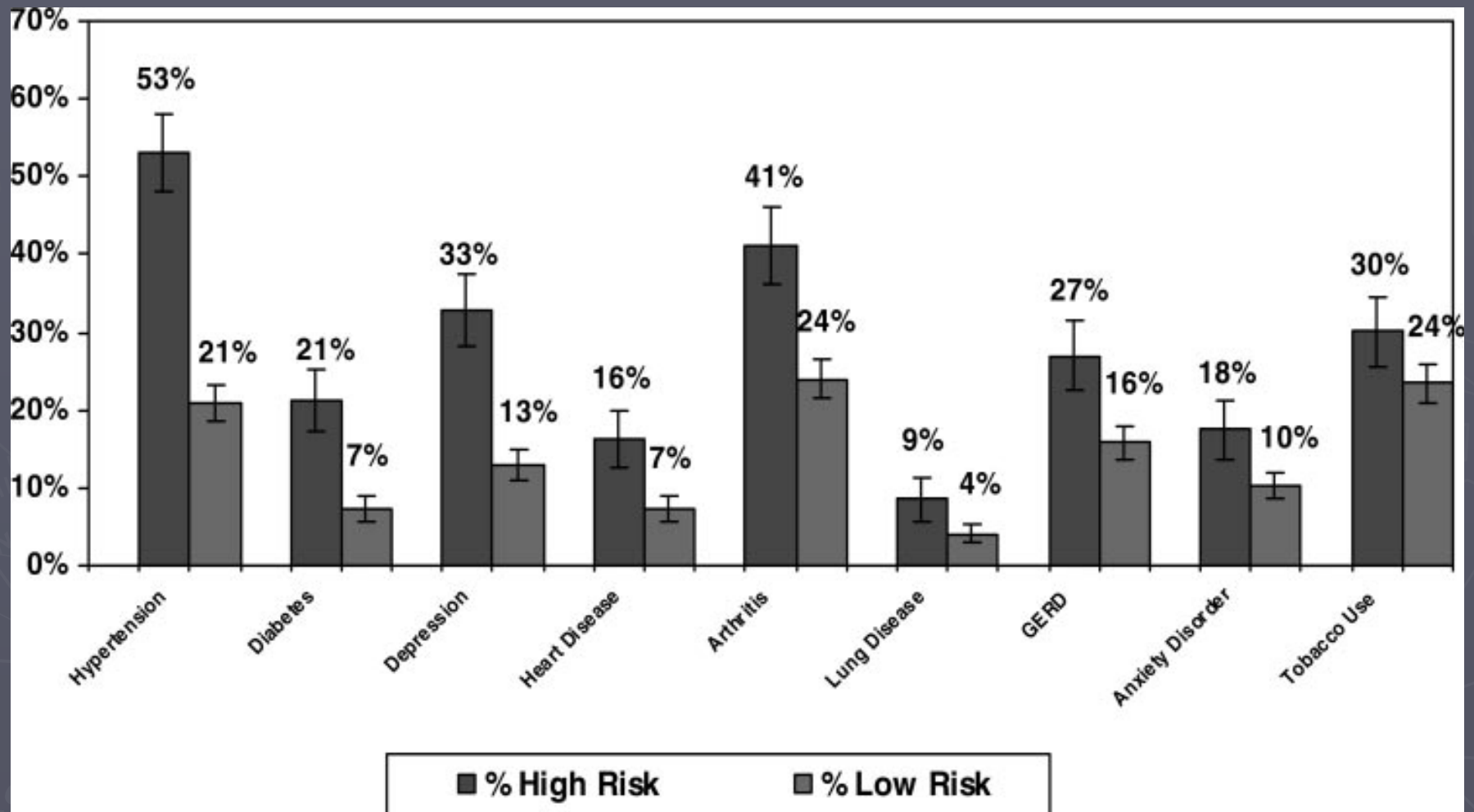
## Risk for Obstructive Sleep Apnea by Body Mass Index



Prevalence of positive Berlin questionnaire scores by BMI.

(Hiestand et al. 2006).

## Risk for Obstructive Sleep Apnea and Prevalence of Chronic Illness



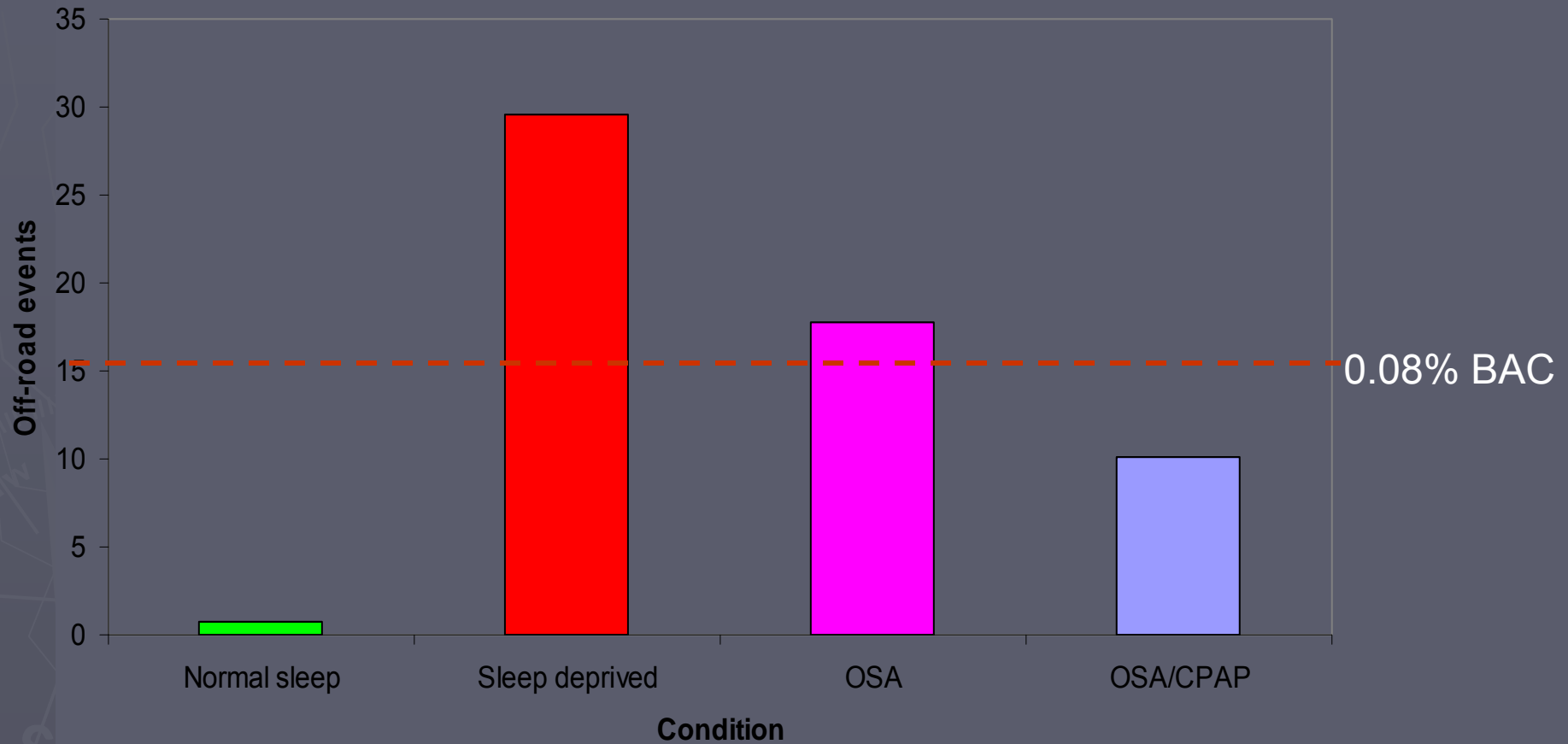
Prevalence of chronic illnesses among individuals with high-risk Berlin questionnaire score. Individuals were asked, "Have you ever been told by a doctor that you have any of the following medical conditions.

(Hiestand et al. 2006).

# Body Mass Index (BMI)

- ▶ There is discussion in some sectors of the transportation industry, in particular trucking, that are suggesting that anyone with a BMI of greater than 35 kg/m<sup>2</sup> be automatically referred for evaluation by a sleep specialist to determine whether they have obstructive sleep apnea.

# Obstructive Sleep Apnea Off-road events



Acute sleep deprivation 24hrs

Adapted from Hack et al. (2001)