National Highway Traffic Safety Administration

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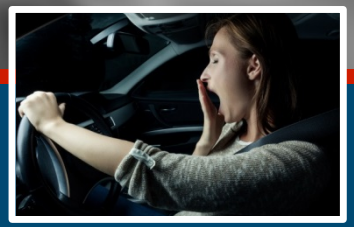
# Asleep at the Wheel: A Nation of Drowsy Drivers

**Panel 1: Drowsy Driving Measurement and Problem ID**
**J. Stephen Higgins, Ph.D.**
**NHTSA Office of Behavioral Safety Research**



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# Improving our understanding

- Reminder from the previous presentation:
  - "800 fatalities in 2013 *reported* to have involved a drowsy driver (2.4% of all fatalities)"
  - Limitations based on reporting in FARS & GES
- Other research estimates higher incidence
  - Also has limitations (representativeness, reporting, n)
- What research methods lead to valid estimates?

- What methods can give us richer data? Answer questions beyond how many drowsy driving crashes?

# What methodology?


Simulator


Naturalistic

Investigation


Police Reports

# Data from investigations

## Data Sources

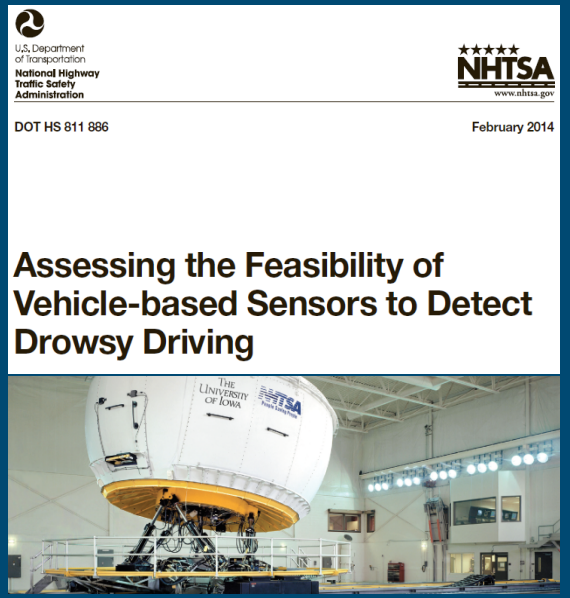
- National Automotive Sampling System Crashworthiness Data System (CDS)
- National Motor Vehicle Crash Causation Survey (NMVCCS)
  - Data collected 6 a.m.-midnight
- Case-control studies (hospital admittance)

## Features

- Sometimes ongoing/frequent data collection
- Potential for good overall crash number estimate (sampling/n)
- Dependent on availability of driver/witness
- Dependent on skill/training of investigator
- After the fact

# Simulator

- NHTSA Project with University of Iowa (NADS)
- Driver Monitoring of Inattention and Impairment Using Vehicle Equipment (DrIIVE)
  - Phase 1 Drowsy Driving Study
    - 72 male and female participants
    - Daytime, early night, late night (within subject)
    - 3 age groups: 21-34, 38-51, 55-68
    - Multiple objective and subjective measures of fatigue
    - Random Forest and Hidden Markov Model based algorithms



# The DrIIVE Study

- Performance-based algorithms:
  - based on driving performance measures can detect sleep restriction
  - specific to drowsy driving (i.e., alcohol algorithm not good predictor).
  - potential for earlier detection of drowsiness than PERCLOS
- Potential for algorithms to detect driver state independent of self-report
- Does not tell us overall incidence or risk without cross-validation

# Naturalistic Driving Studies

- 100-Car Study
  - Showed positive relationship between drowsiness and crash-risk
  - Limited sample size
- SHRP2 Naturalistic Driving Study
  - ~2 petabytes of data
    - 3 years, 6 U.S. locations, 5.4 million trips, 3,147 drivers, ~50 million driving miles
    - Continuously collected data on vehicle position, speed, acceleration, steering and brake activity, forward radar and forward/backward video data, and interior video data of driver's face and hands. Also psychological batteries (e.g., cognitive measures)

# Naturalistic Driving Data

- Relationship between drowsy driving and crash risk
- Identify drowsy driving during trips
- Identify driver-critical reasons for crashes, near-misses, other safety critical events
- Identify individual differences that correlate with drowsy driving (demographics, personality characteristics, etc.)
- Can’t tell us overall numbers or be generalized to whole population

# Linking methodologies

- Linking variables across datasets/methods
- Model building across datasets/methods
- Different questions answered with different methods/data
- Validate findings across datasets/methods
- Just awarded project: "Quantifying Drowsy Driving"


# J. Stephen Higgins, Ph.D.

james.higgins@dot.gov

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