

Studying A Mobile and Hard-To-Reach Population: Survey of Long-Haul U.S. Truck Driver Safety and Health

W. Karl Sieber¹, Richard Kanwal¹, Cynthia Robinson¹, Jan Birdsye¹, Edward Hitchcock¹, Guang-Xiang Chen¹, Stephanie Pratt¹, Jennifer Beaupre²
¹National Institute for Occupational Safety and Health, Cincinnati, Ohio, U.S. and ²National Institute for Occupational Safety and Health, Morgantown, W. Va., U.S.
 8th International Conference on Survey Methods in Transport, Annecy, France, May 25-31, 2008

Abstract: The U.S. National Institute for Occupational Safety and Health (NIOSH) is developing a national survey to obtain data on occupational health and safety issues of long-haul U.S. truck drivers. Questionnaire data characterizing health status, working conditions, and other risk factors will be collected from approximately 2,000 long-haul truck drivers stopping at 40 truck stops or other locations along U.S. freight transport corridors. Most previous U.S. studies have focused on injury or fatigue, rather than health.

1. Introduction

The U.S. National Institute for Occupational Safety and Health (NIOSH) is developing a national survey to obtain data on occupational safety and health issues of long-haul U.S. truck drivers. Limited data available have shown that long-haul truck drivers are at increased risk for chronic disease and traumatic injuries. The purpose of this survey is to address such health and safety concerns among long-haul U.S. truck drivers. Data on the point prevalence of disease, health and safety conditions, and occupational risk factors will be collected.

Long-Haul Truck Drivers

- The U.S. truck driver fatality rate is 11 times that of the general U.S. worker population.
- U.S. truck drivers have the second highest number of non-fatal injuries among occupations.
- Increased risk for coronary heart disease (CHD), diabetes, and lung cancer has been reported for long-haul truck drivers in many European and U.S. studies.
- Fatigue and sleep disorders (sleep apnea) have been shown to be associated with truck crashes in numerous U.S., Australian, and European studies.

By Type of Freight carried:	Employees		Estimated Number and Percent of Establishments	
	Number	Percent	Number	Percent
General Freight Transportation	583,710	76	64,877	55
Specialized Freight Transport	187,850	24	52,347	45
Total	771,560	100	117,224	100

By Type of Trip:	Employees		Estimated Number and Percent of Establishments	
	Number	Percent	Number	Percent
Local	216,852	28	63,725	54
Long Distance	554,708	72	53,499	46
Total	771,560	100	117,220	100

*Source: 2000 U.S. County Business Patterns, May 2006 U.S. Occupational Employment and Wage Estimates.

2. Objectives

- Provide baseline data about long-haul truck drivers' health and safety, including prevalence of selected health conditions and risk factors.
- Identify the risk factors associated with poor health and safety outcomes within the long-haul truck driver population.
- Provide information to drivers, the trucking industry, and the transportation research community that will guide health and safety promotion, interventions, and future research directions.

3. Methods

Study Design:

- Intercept study of long-haul truck drivers stopping at truck stops or other locations
- Cross sectional study design
- Long-haul truck drivers to be interviewed at truck stops or other locations along freight transport corridors
- Stratification of interview locations into 5 geographic regions (shown on map)
- Number of truck stops selected in each region proportional to traffic load within that region

Study Eligibility:

- Must have been a long-haul driver for at least 12 months
- Must have driven a vehicle over 26,000 lb. (11,793 kg) gross vehicle weight

Study Questionnaire:

- Content based on stakeholder input
- Most questions from other validated questionnaires
- Focus groups and cognitive interviews conducted
- 30 minute interviewer-administered questionnaire

Study Conduct:

- 2 pilot tests to be performed:
 - Test logistics and administrative strategies at locations
 - Test questionnaire administration procedures
- Cash incentive to encourage participation
- Expected participation rate 80%
- Field phase expected 2009-2010



Questionnaire Content

Category	Risk Factor	Outcome
Demographics	Age, race, gender	All
Work History	Employment history Owner-operator Over the road vs. packet express	All
Driving Practice	Solo vs. team driving	All
Stress	Work organization Hazardous driving conditions	Driver Injury Hypertension
Chronic Disease	Smoking, Alcohol Use, Obesity	Hypertension
Occupational Injuries	Fatigue	Driver injury
	Sleep disorders	Truck accident
Fatigue	Work and sleep schedules	Demotivation, Injury
Sleep disorders	Snoring, Obesity	Sleep apnea

Study Plan at Truck Stops

Identify truck stops along U.S. freight corridors. Stratify by geographic region and traffic load. Systematic selection of truck stops for survey.

Preliminary interview to determine eligibility for survey. If driver is eligible and agrees to participate:

Administration of short version of questionnaire if driver's time is limited. Administration of entire questionnaire if driver agrees.



Estimated Daily Long Haul Traffic on the National Traffic System Within Geographic Regions, 2002*



*Source: U.S. FHWA Freight Analysis Framework

3. Methods - Sample Size Calculation

1. Calculate sample size N for random sample based on expected proportions:

$$N = \left[\frac{z^2}{D} \right] \cdot [p(1-p)]$$

Where P = Population prevalence. Proportion of population with characteristic or health condition of interest

N = Number of questionnaires needed

D = Desired precision for prevalence estimate P

z = Normal value at level of significance α

2. Calculate Design Effect = $\frac{\text{variance (cluster sample)}}{\text{variance (simple random sample)}}$
 The truck stop is a cluster.

3. N corrected for correlation among responses at each cluster:
 $N^* = N^* (\text{design effect})$

4. Precision D corrected for correlation:
 $D^* = D^* \sqrt{(\text{design effect})}$



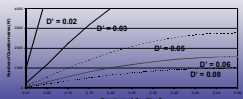
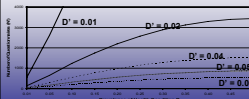
4. Results

Relation of Precision (D) and Design Effect (Deff)

Uncorrected Precision (D)	Precision Corrected for Design Effect (D*)			
	Deff=1.0	Deff=1.2	Deff=1.5	Deff=2.0
0.01	0.01	0.01	0.01	0.02
0.02	0.02	0.02	0.03	0.03
0.03	0.03	0.04	0.04	0.05
0.04	0.04	0.05	0.06	0.06
0.05	0.05	0.06	0.07	0.08

Number of Questionnaires Required To Establish Prevalence (P) of Health Condition With Precision (D) and 95% Confidence ($\alpha=0.05$) Design Effect (Deff) = 1.2

Number of Questionnaires Required To Establish Prevalence (P) of Health Condition With Precision (D) and 95% Confidence ($\alpha=0.05$) Design Effect (Deff) = 2.0



Population Prevalence (P) of Selected Chronic Conditions for U.S. Males, 45-64 years of age, 2002-2005

Condition	Prevalence*
Hypertension	31.0%
Diabetes	10.6%
Coronary Heart Disease	9.2%
Cancer (all types)	6.7%

*self-reported data, 2002-2005, U.S. National Health Interview Survey

5. Discussion

The number of questionnaires required to establish prevalence may be determined based on the precision required for the estimate and design effect. Greater sample sizes are required with increased design effects. Precision decreases with increased design effect.

Design effects between 1.2 and 2.0 are expected in this survey (Belman et al. unpublished data). We estimate needing approximately 2000 questionnaires to determine prevalence data for conditions of interest in this survey at a precision $D^*=0.04$.

We estimate approximately 40 truck stops should be visited to obtain 2,000 completed questionnaires based on length of questionnaires, number of interviewers, and time spent administering at each location.

Survey locations should be located along high truck volume freight corridors in each geographic region.

Questionnaire length should be minimal. Suggested lengths have varied from 5 to 45 minutes.

Personal interviews are preferred in this population. From focus groups, neither computer-assisted interviews nor self-administration were desired. A mail questionnaire is not appropriate when many long-haul drivers may spend limited time 'at home'.

From stakeholder comments, long-haul truck drivers carrying single truckloads (TL drivers) primarily stop at truck stops, while drivers carrying less than truckload (LTL) freight loads may most often stop at truck terminals. Alternative locations are being considered to include representation from these types of long-haul drivers.

Strengths of Approach:

- Standardized questions used whenever possible for comparison of results with other data sets
- Methodology designed for difficult-to-reach, mobile population
- Non-response bias to be assessed with preliminary interview and short survey
- Representative population-based sample
- High participation rate expected (80%)

Limitations of Approach:

- Cross-sectional design prevents determination of cause and effect.
- Self-reported data is subject to recall and interviewer bias. Subjects may misclassify exposure or health outcome status.
- Possible bias due to TL drivers stopping predominantly at truck stops.
- No collection of medical screening information.



6. Conclusions

The research will provide comparison data for future studies on the occupational safety and health status of a high-risk worker population. The results will:

- furnish needed safety and health information to government, industry and labor, and
- stimulate future research and advocacy to benefit truck drivers.

7. References

Federal Highway Administration [1999]. Commercial truck driver fatigue, alertness, and countermeasures survey. U.S. Department of Transportation, Federal Highway Administration, Office of Motor Carrier Research, DOT Publication No. FHWA-MCRT-99-006

National Health Interview Survey. Chronic conditions (self-reported) among all adults: U.S., 2003-2005. Available at: <http://209.217.72.34/HIDA/TableView/tableView.aspx?ReportId=221>

Freight Analysis Framework: Federal Highway Administration (FHWA) Freight Management and Operations. Available at: http://ops.fhwa.dot.gov/freight/freight_analysis/iaf/index.htm

Belman DL, AK Monaco, TJ Brooks [2005]. Sailors on the Concrete Sea: A Portrait of Truck Drivers' Work and Lives. East Lansing, Michigan: Michigan State University Press.

May 2006 Occupational Employment and Wage Estimates. Available at: <http://www.bls.gov/oes/>

2006 County Business Patterns. Available at: <http://www.census.gov/cbp/view/cbpview.html>