

**Research Protocol:** Taxi Driver Survey on Motor Vehicle Safety and Workplace Violence

August 7, 2014

## 1. Project Overview

### 1.1 Title

Taxi Driver Survey on Motor Vehicle Safety and Workplace Violence

### 1.2 Protocol Summary

The study protocol has a two-pronged focus: motor vehicle safety and non-fatal workplace violence. There are two main causes of work-related fatalities among taxicab drivers. The first is homicides, of which half of taxicab driver fatalities accounted for in 2010. The second is motor vehicle incidents, in particular highway-related, which accounted for 42% of taxicab driver fatalities in 2010. Taxicab drivers are an understudied population and difficult to reach for conducting surveys. We've received CDC/NIOSH Intramural funding to survey this population and our intent is to save resources and time by focusing on these two significant occupational safety issues while interviewing taxicab drivers. The same survey will be administered in two different cities (Houston and Los Angeles), each equipped with different types of violence-prevention safety equipment. Specifically, in Houston, a majority of taxicab drivers use security cameras, but a substantial proportion do not. In Los Angeles, approximately half of the taxicab drivers have chosen to install security cameras after decades of mandated partitions, whereas the remaining half have chosen to keep partitions. These real-world scenarios will make for two separate and important comparisons in safety equipment effectiveness.

*Long Term goals and objectives:* The taxicab industry has one of the highest rates of work-related homicides primarily due to robbery, and one of the highest rates of nonfatal work-related motor vehicle injuries. Previous research in the workplace violence field has suggested safety equipment, in particular security cameras installed in taxicabs, plays a significant role in reducing taxicab driver homicides in cities that have installed cameras. Recent NIOSH research found post-implementation homicide rates in cities with camera-equipped taxicabs were 7 times lower than pre-implementation rates and 4 times lower than cities with taxicabs equipped with neither cameras nor partitions. Additionally, municipal regulators and taxi company owners believe security cameras and partitions play dominant roles in preventing workplace violence against taxicab drivers, but there is insufficient scientific evidence for making a decision when mandating violence-prevention safety equipment for taxicabs. Thus, the first **long-term goal** of this proposed project is to develop guidelines for safety equipment installed in taxicabs in preventing workplace violence among taxicab drivers to further mitigate taxicab driver injuries and fatalities. The **first objective** of this project is to compare specific types of safety equipment in taxicab drivers in preventing robberies, assaults and other non-fatal workplace violence events against taxicab drivers.

Motor vehicle safety among workers who drive as a part of their job description is an important public health issue. The second leading cause of fatalities among taxicab drivers is highway-related fatalities and comprises a significant proportion of taxicab driver fatalities. Taxicab driver nonfatal emergency room visits resulting from motor vehicle-related injuries are the highest of any industry, and among the highest occupation. Although taxicab drivers undergo training as part of their licensing requirement, very little is known about their attitudes, knowledge, and behaviors regarding road safety. Therefore, the second **long-term goal** of this proposed project is to provide background

information on road safety and taxicab drivers as foundation for a future, larger study on training and reducing motor vehicle events. The **second objective** of this project is to describe taxicab drivers' experiences with motor vehicle events, road safety attitudes, knowledge and behaviors. For the purposes of this study, motor vehicle events are defined as a crash involving a taxicab where either \$500 of property damage has been sustained or an injury where medical treatment was sought occurred.

*Specific Aims* In order to maximize knowledge gained and public health impact per city, the focus of the cross-sectional study is on two of the leading causes of taxicab driver fatalities: motor vehicle events and workplace violence. The proposed study goals are to: (1) describe the occurrence of motor vehicle events among taxicab drivers, (2) describe the risk factors of motor vehicle events among taxicab drivers, and (3) characterize events of non-fatal workplace violence among taxicab drivers. In order to accomplish the study goals, the corresponding study objectives are: (a) to enumerate the occurrence of motor vehicle crashes within the past 24 months among taxicab drivers in two cities, (b) identify and describe the risk factors and protective factors associated with road safety among taxicab drivers using a validated occupational driver behavior questionnaire in two cities, and (c) characterize non-fatal workplace violence events over a twenty-four-month period among taxicab drivers and compare by type of safety equipment installed in taxicab. For study objective (b) risk/protective factors include constructs of the occupational driver behavior questionnaire, safety climate, driver tenure and taxicab business characteristics, job demands and individual factors. For study objective (c) comparing non-fatal workplace violence events by safety will focus on cameras, but secondarily focus on partitions, GPS, silent alarms, cashless payments systems, safety training, and knowledge of safety practices.

*Project plan and rationale for achieving goals:* This project is to be completed in two cities. One city will be chosen to facilitate comparisons between cameras and not having cameras installed. Only 4 cities in the U.S. with a population adequate for the sample size needed can provide this comparison – Houston, Dallas, Austin and Orlando. Houston was selected because it is the largest city and the partnership with the city for various projects related to workplace violence has been a strong one. An additional city will be chosen to make comparisons of workplace violence events between drivers with cameras installed in cabs and partitions installed in cabs. Only a couple of cities where partitions have been mandated for decades have allowed their drivers to have a choice. Los Angeles was the first such city to do so, and there is now a half and half mix between drivers who have chosen to install cameras and drivers who have chosen to remain with partitions.

*Houston, TX:* Houston is one of only a handful of cities where a specific type of safety equipment is utilized, but not mandated by a city ordinance. Specifically, security cameras are installed in approximately 70% of taxicabs licensed in Houston. Those taxicabs that have security cameras installed are part of one larger company that makes it company policy to have security cameras installed in licensed taxicabs. This provides another unique opportunity to conduct study objective (c) compare workplace violence events over a 1-year period among taxicab drivers by type of safety equipment installed in taxicabs *where the security equipment is not mandated but is a company policy*. Approximately 70% of taxicabs in Houston are equipped with a camera, the remainder is not. The incomplete adoption of security cameras in Houston by taxicab drivers presents a unique opportunity to compare workplace violence events for taxicab drivers in Houston who have a

security camera installed with taxicab drivers in Houston who do not have a security camera installed in their cab. In Houston, taxicab drivers line up each day at the airport to wait for what is usually a large fare. While waiting at the central waiting lot at the international airport, 550 drivers will be recruited to participate in interviews. Examining study objective (c) among Houston taxicab drivers will build on previous research done by the PI at a city level which suggests cities with camera-equipped taxicabs that are required by a company policy experience 5 times lower homicide rates than cities without camera-equipped taxicabs.

Los Angeles, CA: Los Angeles is one of only a few remaining cities where taxicabs were mandated (since the 1970s) to install partitions in their cabs. 2 years ago the regulators in Los Angeles allowed taxicab drivers to choose between installing cameras in taxicabs rather than partitions. Currently, approximately 50% of the taxicab drivers have cabs installed with cameras and the remaining 50% have taxicabs installed with partitions. According to the regulator and city inspectors, there are no instances of both cameras and partitions in a cab at the same time. This would incur costs of both types of safety equipment for the taxicab driver.

Study objectives (a) and (b) are not unique to the city being studied but will be analyzed separately for each city. This allows for the comparison of motor vehicle event risk and protective factors between the two cities, thus increasing the validity and generalizability of the findings. The Taxi Driver Survey does not collect personal information of taxicab drivers and, instead, focuses on the following: type of cab driven, tenure as taxicab driver, time and distance driving taxi each week, job demands, motor vehicle crashes in the past 12 months, workplace violence events in the past 12 months, safety equipment installed in the taxicab, safety training, safe driving behaviors, safety climate of the taxi company, safety knowledge and demographics.

Findings from this cross-sectional study will be used to develop future prevention initiatives for reducing work-related motor vehicle crashes among taxicab drivers. These prevention initiatives, such as reducing driver fatigue through shift work limitations, may take the form of municipal ordinances promulgated by the city regulators or company-wide (such as Yellow Cab) directives designed to impact road safety of a city taxi fleet. Another use of data collected for this study would be to serve as a baseline measure for a future evaluation of safety initiatives implemented at the municipal level. Specifically, Houston is in the process of rolling out a multi-year multi-pronged safety initiative that will target driver training, safety equipment updates, payment transactions and other aspects of the taxicab work environment designed to reduce injuries among taxicab drivers. Data collected during the current study could be used as a baseline measure to evaluate the effectiveness of the safety initiative at a later date as part of a larger study. Finally, contextual data on motor vehicle crashes is not *completely* captured by current surveillance methods (such as the National Electronic Injury Surveillance System (NEISS)-Work Supplement and the Survey of Occupational Injuries and Illnesses (SOII), two national surveillance databases). Such a survey would provide insight into the occurrence of crashes involving taxicabs. Furthermore, data on driving behaviors (errors, speeding, inattention, rule violation and tiredness) in the context of safety climate and role overload can only be obtained directly from taxicab drivers and will provide the perspective needed for designing effective safety interventions.

Findings from this cross-sectional study will be used to understand which violence prevention measures are in use and which are associated with reduced incidents of workplace violence. Findings

from this study will contribute to a sparse literature evaluating the effectiveness of safety measures designed to reduce workplace violence incidents among taxicab drivers. For example, a recent ecological study examining cities where taxicab drivers were equipped with cameras compared to cities where taxicab drivers were not equipped with cameras or partitions. The study found cities with camera-equipped taxicabs experienced 4 times lower homicide rates than cities that did not have camera-equipped taxicabs. There was no statistically significant difference in homicide rates among cities with partition-equipped taxicabs compared to cities that did not have partition-equipped taxicabs. This was one study, and findings from the current study will build on incidence of workplace violence overall and with respect to type of safety equipment installed.

### **1.3 Investigators/collaborators/funding sources**

NIOSH, Analysis and Field Evaluations Branch (AFEB) staff:  
Cammie Chaumont Menéndez, PhD, Epidemiologist, Project Officer  
Captain (CAPT) Marilyn Ridenour, MPH, Nurse Epidemiologist, Co-Project Officer  
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Christina Socias, DrPH, EIS Officer

Funding for NIOSH staff personnel salaries and benefits will be paid by NIOSH's Division of Safety Research.

## **2. Introduction**

### **2.1 Literature review/current state of knowledge about workplace violence and occupational driving behaviors**

#### **2.1.1 The public health problem**

Workplace violence (WPV) remains a significant public health problem and continues to be a leading cause of work-related fatalities and nonfatal incidents. In 2011, violent events accounted for 73,240 nonfatal incidents with a median of 7 days away from work<sup>1</sup> and 458 homicides<sup>2</sup>. Homicide remains a leading cause of occupational fatalities in the United States, and disproportionately affects workers in several industry sectors<sup>3</sup>. Notably, the taxicab industry consistently ranks among the highest work-related homicide rates of any industry, with a homicide rate of roughly 14 per 100,000 taxicab drivers (n=32) compared to a rate of 0.3 per 100,000 (n=458) for the overall population in 2011<sup>4</sup>. The two rates represent a 46-fold difference and, although the taxicab driver homicide rate in the U.S. has experienced a statistically significant decline over the past two decades, there remains a stark difference in annual taxicab driver homicide rates and work-related homicide rates in the general population.

Currently there is a dearth of scientific evidence supporting the effectiveness of safety equipment in preventing workplace violence among taxicab drivers. A NIOSH Alert published in 1993 highlighted the risk factors for workers in certain occupations/industries at high risk for homicide and reported the following: workers in jobs that exchange money with the public, working alone or in small numbers, working late at night/early in the morning, working in high crime areas, guarding valuable property/possessions and working in community settings<sup>5</sup>. Suggested preventive measures

include the following: making high-risk areas visible to more people, installing good external lighting, using drop safes to minimize cash on hand, carrying small amounts of cash, posting signs stating that limited cash is on hand, installing silent alarms, installing surveillance cameras, increasing the number of staff on duty, providing training in conflict resolution and nonviolent response, avoiding resistance during a robbery, providing bullet-proof barriers or enclosures, having police check on workers routinely, and closing establishments during high-risk hours<sup>5</sup>. Most of these measures are applicable to taxicab drivers. However, it is not clear which measures are in widespread use today, and homicides among taxicab drivers remain a significant public health problem. Study objective (c) will allow us to determine which measures are in place in each city (see Questions 27-32 about presence of safety equipment).

Another issue affecting taxicab drivers disproportionately is motor-vehicle related injuries. In 2011, transportation incidents accounted for 58,660 nonfatal incidents with a median of 11 days away from work<sup>1</sup> and 1,075 fatalities<sup>2</sup>. Currently, roadway incidents are the leading cause of work-related fatalities, in particular among workers who frequently use the highway as part of their job tasks. The taxicab industry experiences a significantly high rate of transportation-related incidents, second only to homicides. The taxicab industry experienced transportation-related injury fatalities at a rate of approximately 7 per 100,000 taxicab drivers (n=17) compared to a rate of 0.4 per 100,000 (n=1898) for the overall population in 2011<sup>4</sup>. Furthermore, between 1998 and 2002, the taxicab industry experienced the highest rate of nonfatal work-related motor vehicle injuries treated in emergency departments of all industries<sup>6</sup>.

There is a growing body of literature focused on evaluating driving behavior in the occupational driving context<sup>7,8</sup>. Much of the research is now focused on improving the psychometrics of the instruments used to evaluate self-reported driving behavior<sup>9</sup> and widening the scope of the instruments to include organizational level constructs such as safety climate<sup>9-11</sup> and role overload<sup>12</sup>. Currently there is no literature evaluating these validated instruments and their expanded constructs among taxicab drivers, a significant occupational driving population at high risk for motor-vehicle related injuries. Occupational driving behavior, safety climate, and role overload will be surveyed to meet study objective (b) as they have been found to be important covariates for describing and predicting motor vehicle events such as collisions. As part of their use in data analyses we will run psychometric tests to determine their validity in the taxicab driver population.

## **2.1.2 The effectiveness of prevention programs to reduce WPV in taxicabs**

Theoretical framework: There are two theoretical frameworks in use for describing the effectiveness of safety measures in reducing robberies, and therefore, the predominant contributor to workplace violence in taxicab drivers. Situational Crime Prevention<sup>13</sup> applies Crime Prevention Through Environmental Design<sup>14</sup> (CPTED) constructs such as surveillance, target removal, and access control to various scenarios prone to robbery and other crimes and translates them into crime prevention measures appropriate for a specific form of crime and target (such as driving a taxicab versus managing a convenience store) by increasing the risk of the crime and reducing the reward. The effectiveness of applications to CPTED principles has been evaluated in the convenience store industry<sup>15</sup>. Evidence supports the effectiveness of recommended CPTED components in the convenience store industry, which include employee training in crime prevention and control, a chief

feature of which is non-resistance by giving up the money or goods, good visibility into and within the store with direct line of sight of the cash register, bright interior and exterior lighting, control of access into the store and parking lots, keeping minimum amounts of cash in the registers, and cash control with accompanying signage posted indicating low available cash on hand, use of timed drop safes, and employee cannot open safe. Many of these measures can be translated or directly applied to a taxicab environment. Although mobile work environments present more challenges for some CPTED components like drop safes, the type of crime being committed – robbery – makes the literature for convenience store crime prevention measures applicable and relevant.

### **2.1.3 Translational research approaches for reducing WPV in taxicabs**

Currently the scientific evidence evaluating the use of safety equipment and robbery preventive measures in taxicabs is focused on two major types of safety equipment: security cameras and bullet-resistant partitions. A comprehensive report in 2004 issued by a taxicab advisory group on driver safety summarized available statistics and provided abbreviated case reports on 14 cities. The report was invaluable in summarizing safety equipment usage in other large cities and reporting (when available) on changes in crime among taxicab drivers after installation of safety equipment. However, it is important to build on this large effort by implementing a study designed to evaluate specific objectives based on the assertions presented in this report<sup>16</sup>. Specifically, the case reports suggest security cameras and partitions are effective in reducing violence directed at taxicab drivers. One formal study commissioned by the City of Baltimore evaluated the impact of installing partitions on taxicab driver assaults from 1991 through 1997 within the context of a case study. Twelve months following the partition mandate assaults on taxicab drivers decreased 56% compared with the 12-month period preceding the mandate. While these data are very compelling, they did not account for any confounding factors and did not evaluate an extended time period post-installation to determine if the decrease in assaults was sustained beyond the 12-month evaluation period. While these two studies laid the groundwork for evaluating the impact of the two major types of safety equipment for taxicabs, further research with repeated, longer periods (more than 5 years) of follow-up and adjusting for confounding factors such as current homicide rate trends and background crime was needed to strengthen these early assertions.

Recently, a study funded by NIOSH examined taxicab driver homicides in 26 cities over a 15-year time span. The cities were divided into three groups: cities with camera-equipped taxicabs, cities with partition-equipped taxicabs, and cities with neither. There was both pre-installation and post-installation data available for cities using cameras in their taxicabs, whereas there was only post-installation data available for cities using partitions. Additionally, pre-existing annual trends in taxicab driver homicides and city background crime rates were controlled for<sup>17</sup>. Preliminary analyses revealed cities with cameras experienced a 3-fold reduction in taxicab driver homicides compared with control cities (RR=0.27; 95% CL 0.12, 0.61; p=0.002). There was no statistically significant difference in homicide rates for cities with partitions compared with control cities (RR=1.15; 95% CL 0.80, 1.64; p= 0.575). While this research reinforces previous assertions that security cameras can result in a reduced rate of workplace violence outcomes among taxicab drivers, it is limited by its ecological study design and was intended to lay the groundwork for a more in depth study where individual taxicab drivers could be interviewed regarding different types of safety equipment. The

reduction in homicide rates could only be interpreted at the city level because only city-level data was collected. The planned study will be able to be interpreted at the taxicab driver (individual) level because taxicab drivers will be interviewed regarding their workplace violence experiences and motor vehicle safety behaviors. Therefore, differences in workplace violence rates by type of safety equipment used can be interpreted as those among taxicab drivers, rather than referring to collective experiences of taxicab driver by city.

#### **2.1.4 The validity of measuring occupational driver behaviors for work-related driving**

Newman et al. recently developed the Occupational Driver Behavior Questionnaire (ODBQ), modified from one used on the general driving population, the Manchester Driver Behavior Questionnaire (DBQ)<sup>18</sup>. The ODBQ takes into account the work environment as an additional influence for driving as an occupation. Most importantly, safety climate and role overload were identified as important constructs for examining driving behaviors in the occupational context. Recent research on 248 drivers from a community based nursing organization completed a survey that included the 20-item DBQ, the 12-item ODBQ, a 3-item safety climate scale, and a 4-item safety climate scale<sup>18</sup>. Both safety climate and role overload were found to be significant predictors of the ODBQ, even after adjusting for covariates<sup>18</sup>. Currently, the ODBQ combined with role overload and safety climate is a more sensitive measure of occupational driving safety compared to the DBQ and is an appropriate self-report behavioral assessment tool for the occupational driving context at this time. Administering this tool among a population of light vehicle drivers, such as taxicab drivers, could inform regulators when developing safety initiatives and other intervention measures. Administering the ODBQ is needed to operationalize study objective (b), which describes the risk factors of motor vehicle events among taxicab drivers. Furthermore, the risk factors will be included in the statistical analysis as potential covariates for describing the occurrence of motor vehicle events among taxicab drivers.

#### **2.1.5 Need and justification for proposed research**

The research to date indicates the proposed workplace violence research is needed for many reasons. First, taxicab drivers continue to experience substantially higher homicide rates than the working population overall. Second, there is a growing body of evidence that suggests security cameras are effective in reducing various workplace violence outcomes. Third, there is inconclusive evidence that partitions are effective in reducing workplace violence outcomes. Fourth, with each taxicab driver homicide, regulators are placed under increasing pressure to identify and implement effective means of reducing workplace violence. Fifth, there is no clear solution to reducing robberies and other workplace violence incidents. Thus, there is a need to conduct the proposed research to evaluate multiple components (including but not limited to safety cameras and bullet-resistant partitions) of a comprehensive approach to workplace violence prevention.

Currently there is very limited research on motor vehicle incidents and taxicab drivers. Taxicab drivers are a difficult population to survey, but are a key driving population due to their numbers in large cities, length of time spent driving every day, and driver safety training. In addition to disproportionately higher homicide rates, taxicab drivers also experience disproportionately higher motor vehicle fatal injury rates. Understanding the epidemiology of motor vehicle incidents in this



driving population is important for designing and measuring interventions that will impact driving behaviors.

## **2.2 Specific Aims, Objectives and Questions**

**Specific Aims** In order to maximize knowledge gained and public health impact with one field experience per city, the focus of the study is on two of the leading causes of taxicab driver fatalities: motor vehicle events and workplace violence.

The proposed study goals are:

1. describe the occurrence of motor vehicle events among taxicab drivers,
2. describe the risk factors of motor vehicle events among taxicab drivers (as addressed by the ODBQ and other questions in the survey delineated later),
3. compare events of workplace violence among taxicab drivers by safety equipment (within each city).

In order to accomplish the study goals, the corresponding study objectives with questions to be answered are:

- a. enumerate the occurrence of motor vehicle crashes among taxicab drivers,
  - what is the monthly and weekly average number of motor vehicle crashes?
  - do motor vehicle crashes vary by company, tenure, usage, mileage driven or ownership status?
  - do motor vehicle crashes vary by job demands, safety climate, or both?
  - what is the distribution of motor vehicle crashes that occur on a highway, nonhighway, or involving pedestrians?
  - what is the distribution of injuries that occurred and what was their medical cost?
  - what was the average estimated amount of property damage for each crash?
  - what is the distribution of motor vehicle crashes by individual factors, such as age, marital status and race/ethnicity?
  - what is the distribution of motor vehicle crashes by knowledge of safety practices, self-reported road safety behaviors (OBDQ), or driver training status?
- b. identify and describe the risk factors and protective factors associated with road safety among taxicab drivers,
  - what is the association between job demands, safety climate or both with self-reported road safety behaviors (OBDQ) and motor vehicle crashes?
  - what is the relationship between demographic factors and self-reported road safety behaviors and motor vehicle crashes?
  - how are knowledge of safety practices, self-reported road safety behaviors, driver training status, and camera installation associated with motor vehicle crashes?
  - how is company worked for, job tenure, taxicab usage, mileage driven or ownership status associated with road safety behaviors and motor vehicle crashes?
  - how are the individual constructs of road safety behaviors, namely, errors, ordinary and aggressive violations, speeding, inattention, rule violation and tiredness, associated with motor vehicle crashes? And, furthermore, what is their construct validity (as measured by Cronbach's alpha) in a survey among taxicab drivers?

c. compare workplace violence events separately for each city over a 24-month period among taxicab drivers by type of safety equipment installed in taxicab.

- what is the average number of workplace violence events overall and specific workplace violence events?

- what is the distribution of safety equipment installed in taxicabs?

- what is the distribution of workplace violence events overall by type of safety equipment?

- what is the distribution of specific workplace violence events (e.g., assaults, verbal threats, robberies) by type of safety equipment?

- how are different types of safety equipment associated with workplace violence events overall?

- how are different types of safety equipment associated with specific workplace violence events (e.g., assaults, verbal threats, robberies)?

- how are demographic factors and work history related to workplace violence events overall?

- how are demographic factors and work history related to specific workplace violence events?

- how were cameras used to identify and apprehend suspects?

### **General Approach**

This project is comprised of three phases. For simplicity, Phase 1 and Phase 2 are distinctive only by their geographic location and types of safety equipment used by the city being surveyed. Phase 3 is the dissemination of findings.

#### Phase 1

The survey will be administered to taxicab drivers in Houston while waiting at airport waiting lots. Taxicab drivers will be surveyed onsite with the 30-40-minute survey after verbal assent is obtained. The survey will provide information on individual factors, work history, taxicab driver business aspects (taxicab company, medallion and/or taxicab ownership/leasing, job tenure, time/miles spent driving taxi in a week), road safety behaviors, job demands, safety climate, workplace violence history, safety equipment installed in taxicabs, and motor vehicle events. The information on workplace violence is framed for a time period covering the 12 months prior to responding to the survey. The questions on road safety pertain to typical driving behaviors the taxicab driver is currently exhibiting.

#### Phase 2

The same survey will be administered to taxicab drivers in Los Angeles while waiting at airport waiting lot. Taxicab drivers will be surveyed onsite with the 30-40-minute survey after verbal assent is obtained. The survey will provide information on individual factors, work history, taxicab driver business aspects, road safety behaviors, job demands, safety climate, workplace violence history, safety equipment installed in taxicabs, and motor vehicle events. The information on non-fatal workplace violence is framed for a time period covering the 12 months prior to responding to the survey. The questions on road safety pertain to typical driving behaviors the taxicab driver is currently exhibiting.

#### Phase 3

This phase will focus on dissemination efforts. Findings from this study will provide much needed scientific evidence focused on two important aspects of taxicab driving: motor vehicle safety behaviors using a validated questionnaire and workplace violence experiences. The findings will be communicated via a NIOSH-numbered document, updated NIOSH Fact Sheet, publication in the newsletters used by the industry, a posting on the list-serve used by industry ‘activists’, and the

annual IATR conference which hosts key leaders of the Taxi, Limousine and Paratransit Association (TLPA). Finally, the NIOSH blog on taxicab drivers will be updated and study results will be published in high-profile peer-reviewed health journals. Behind the scenes, the project officers will work with municipal regulatory bodies to translate the research findings to promote a safe and healthful work environment. The regulators in Houston and Los Angeles will serve as a model for successful collaboration with other cities that are often reaching out to NIOSH/DSR when rethinking what ordinances should include to protect drivers and the public.

### **3. Procedures/Methods**

#### **3.1 Study Design**

The same study design is used for both cities. Specifically, a cross-sectional study design will be used to survey taxicab drivers on their work history as a taxicab driver, cab ownership status, motor vehicle crashes, job demands, workplace violence events, safety equipment installed in taxicabs, road safety behaviors, safety climate, knowledge of safety practices, and individual factors. Most of the questions are framed to within the last 24 months of the time the question will be asked.

Inclusion criteria to be in the study are: (1) must be a taxi driver with a valid license to drive a taxi for the city being surveyed for at least 1 year prior to taking the survey and (2) must drive a taxi for at least 30 hours per week for at least 1 year prior to taking the survey. Each specific aim, study objectives and corresponding set of questions can be answered by the survey alone. The surveys will be administered to taxicab drivers as they wait at the airport parking lots, a process that often takes hours.

##### **3.1.1 Audience and stakeholder participation**

Stakeholders include the municipal transportation regulators and city councils who are in the process of re-examining current ordinances requiring specific types of safety equipment. Stakeholders also include the taxicab company owners and safety directors, in addition to community leaders. Finally, a prominent group of stakeholders is the taxicab drivers themselves.

Stakeholder support from the City of Houston, Administration and Regulatory Affairs Department has been secured and will maximize the success of the study. Letters of support have been received from transportation regulators from Houston. The other candidate cities have strong professional affiliations with the International Association of Transportation Regulators the proposed study has been presented and well-received at the International Association of Transportation Regulators' annual conference. The survey was reviewed and critiqued by Craig Leisy, Consumer Affairs Division of Seattle, a leader among the transportation regulators of the IATR. Furthermore, Charles Rathbone, author of the Taxi Memoriam, is a taxicab driver activist and former taxicab driver. He provided input on the Survey as well. Furthermore, the research protocol will be reviewed by several of the stakeholders.

##### **3.1.2 Study timeline**

The following is the timeline for project completion.

<b>Table 3</b>
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<b>Timeline for Project Completion</b>				
<b>Task</b>	<b>FY13</b>	<b>FY14</b>	<b>FY15</b>	<b>FY16</b>
<b><i>Phase I: Taxicab Driver Surveys</i></b>				
1. Complete survey procedures and instruments (completed)	June, 2013			
2. Complete pilot study of survey procedures and instruments	September, 2013			
3. Complete NIOSH protocol and peer-review	September, 2013			
4. Submit to HSRB for approval	Sept, 2013			
5. Submit to OMB for approval	Sept, 2013			
6. Obtain HSRB approval	Nov, 2013			
7. Obtain OMB approval		May, 2014		
8. Award contract for survey, Houston		May, 2014		
9. Recruit survey staff, Houston		June, 2014		
10. Train survey staff in Houston		June, 2014		
11. Print surveys		June, 2014		
12. Complete surveys in Houston		July, 2014		
13. Complete data processing (checking, coding, and keying forms and questionnaires, and electronic database development)		Dec, 2014		
15. Award contract for survey, LA			Mar, 2015	
16. Recruit survey staff, Los Angeles			Apr, 2015	
17. Train survey staff, Los Angeles			May, 2015	
18. Print/Administer survey, LA			June, 2015	
19. Complete data processing (checking, coding, and keying forms and questionnaires, and electronic database development)			Dec., 2015	
20. Complete data analyses				May, 2016
21. Submit papers for publication				June, 2016
22. Present papers at scientific conference				Sept., 2016
23. Present guidelines to IATR				Sept., 2016

### **3.2 Study Population**

#### **3.2.1 Description and source of study population and catchment area**

The target study population will be all licensed taxicab drivers in Houston and Los Angeles who have been licensed for at least 1 year, in their respective cities, and work at least 30 hours per week as a taxicab driver.

### **3.2.2 Definitions**

Licensed taxicab drivers are those who meet the city requirements to drive a taxicab in their city. In 2010 there were approximately 2,270 licensed taxicab drivers in Houston.

### **3.2.3 Participation inclusion criteria**

The following criteria must be met to be included in the survey: (1) licensed to drive a taxicab in the city they are driving a cab in for at least 1 year, (2) work at least 30 hours per week driving a taxicab for the past 1 year in study city, (3) provided verbal assent to participate in study and willing to complete survey.

### **3.2.4 Participation exclusion criteria**

Taxicab drivers who do not meet the inclusion criteria will be excluded.

### **3.2.5 Justification of exclusion of any sub-segment of the population**

Not applicable.

### **3.2.6 Estimated number of participants**

Houston and Los Angeles In Houston approximately 70% of the drivers have cameras installed in their taxicabs. There are currently 2270 licensed cabs and 4400 permitted drivers. Based on the sample size calculations, 500 drivers from each city will be enrolled. In Los Angeles approximately half of the drivers have cameras installed and half have partitions.

### **3.2.7 Sampling, including sample size and statistical power**

We anticipate approaching drivers until we have interviewed at least 500 taxicab drivers in each city (1000 total). For the descriptive aspect of motor vehicle incidents (such as crashes) we assume the outcome rate for drivers is 20%; the precision of the estimate from the survey for the incident rate based on 95% confidence intervals and binomial error distribution will be  $\pm 4\%$ . Assuming the annual rate of the combination of physical and verbal assaults, robberies, and fare evasion is 15%, we will have a precision of  $\pm 3\%$ .

The main comparisons in this study are proportion of non-fatal workplace violence events by presence of security camera installed in taxicab. To estimate the power to determine the effectiveness of the cameras in reducing the combination of physical and verbal assaults, robberies, and fare evasion, we made the following assumptions:

- a) the annual background crime rate without cameras is conservatively estimated at 15% ,
- b) we are able to conduct 500 surveys per city,
- c) the analysis is done with logistic regression (dependent variable is experiencing a workplace violence incident in 12-month timeframe and independent variable is camera installation status),
- d) alpha is set at 0.05.

The following table describes the sample universe and power calculations based on 10,000 simulated data sets by city for each outcome (MVI and violence):

<b>Sample Universe:</b>	<b>Houston, TX</b>	<b>Los Angeles, CA</b>
All Taxicab Drivers	4400	4000
Sample	500	500
80% Response	500	500
Camera users	350 (70%)	250 (50%)
<b>Power</b>		
33% violence reduction (15% to 10%)	0.36	0.38
50% violence reduction (15% to 7.5%)	0.71	0.76

### 3.3 Variables/Interventions

#### 3.3.1 Variables

Proposed data items to be collected in the Taxicab Driver Survey (Attachment 2) will be collected at one time point, during inspection of taxicabs. The data from the survey will be entered into data entry/management software by NIOSH survey operations staff experienced in data entry and management. Data entry checks will be performed by the study manager for QA purposes. No personal identifiers will be recorded onto the survey and verbal assent will be provided by the driver, thus eliminating a record of the driver linked with a consent form.

The following variables will be collected to fully meet the study objectives:

##### Driver tenure:

Length of time as taxicab driver, including in current city (Q1a, Q1b),  
Length of time at current cab company (Q1c, Q1d),  
Ownership status of taxicab and plate/medallion (Q2-5),  
Time spent in a typical day and workweek driving taxicab (Q6,7),  
Number of miles spent in a typical workweek driving taxicab (Q8),  
Fare locations (Q26).

##### Psychosocial variables:

Job demand index (role overload) (Q9-12),  
Safety climate scale (Q49-51),  
Occupational driver behavior construct (with 4 subdimensions: speeding, inattention, rule violation, driving while tired) (Q34-48).

##### Motor vehicle event outcomes (Q13 groupings):

Number, occurrence, circumstances, severity and cost of motor vehicle events.

##### Workplace violence outcomes (Q14-25):

Frequency and occurrence of being yelled at/threatened,  
Frequency and occurrence of fare payment evasions (passenger not paying - this is the most common type of theft),  
Frequency and occurrence of being physically assaulted,  
Frequency and occurrence of carjacking,  
Frequency and occurrence of theft (theft here would be driver's cash, phone, or other items in cab not belonging to passenger),

Frequency and occurrence of armed robbery (robbery used with a gun, knife, or other weapon), Workplace violence incident reporting.

Safety equipment:

Installation, use and perceived safety of: cameras (Q27 groupings), partitions (Q28 groupings), GPS (Q29 grouping), silent alarm (Q30 grouping), cashless payment system (Q31 grouping), window decals (Q27g) safety training (Q32-33 groupings).

Knowledge of safety practices (Q52-57)

Individual factors:

Motor vehicle crashes when not driving taxi (Q58),

Age, gender, race/ethnicity, nativity, education, marital status, religion (because taxicab drivers may be targeted for workplace violence events due to their religion) (Q59-67).

**3.3.2. Outcomes and minimum meaningful differences**

Meaningful differences will consist of significant differences between cabs equipped with cameras and cabs not equipped with cameras in all or one of the following: being yelled at/threatened, fare payment evasion, assault, carjacking, theft, and armed robbery. The occurrence of any motor vehicle crash in the past 12 months will be considered a meaningful outcome. Additionally, validation of psychosocial instruments in an American population of taxicab drivers with an established Australian one is extremely useful and represents the first time these constructs are measured in a taxicab driver population. Here, any results will be useful and meaningful.

**3.4 Data Handling and Analysis**

**3.4.1 Data analysis plan, including statistical methodology**

Data processing: Following quality control and cleaning of data, all forms and questionnaires will be keyed using Statistical Analysis System (SAS) key entry programs. All data will be stored in a SAS database for statistical analysis. All hardcopy records will be kept in locked cabinets and data storage rooms. All electronic files will be kept in secure pass protected folders. Hardcopy records will be hand carried or sent by secured FEDEX to NIOSH.

Statistical analysis plan: The proposed statistical analysis plan addresses each objective of the proposal. They are as follows: (a) to enumerate the occurrence of motor vehicle crashes within the past 12 months among taxicab drivers in two cities, (b) identify and describe the risk factors and protective factors associated with road safety among taxicab drivers using a validated occupational driver behavior questionnaire in two cities, and (c) characterize non-fatal workplace violence events over a twelve-month period among taxicab drivers and compare by type of safety equipment installed in taxicab. For each city a separate set of analyses will be conducted and findings presented independently of the other city.

*Enumerate the occurrence of motor vehicle crashes within the past 12 months among taxicab drivers in each city.* The responses from Questions 13a1, 13b1, 13c1 and 13d1 of the survey (Appendix 2) will be used to create a count of motor vehicle crashes that have occurred in the past 12 months. Likewise, a count of the circumstances, total estimated amount of property damage per crash, number of injuries and number of fatalities will be obtained. Prevalence rates will be defined as the number of crashes per 100

taxicab drivers. The average number of crashes, property damage, injuries and fatalities per driver will be calculated.

*Identify and describe the risk factors and protective factors associated with road safety among taxicab drivers using a validated occupational driver behavior questionnaire in each city.* A multiple logistic regression model will be constructed where the odds of experiencing a crash will be modeled on the following possible covariates:

Driver tenure:

Length of time as taxicab driver, including in current city (Q1a, Q1b),  
Length of time at current cab company (Q1c, Q1d),  
Ownership status of taxicab and plate/medallion (Q2-5),  
Time spent in a typical day and workweek driving taxicab (Q6,7),  
Number of miles spent in a typical workweek driving taxicab (Q8),  
Fare locations (Q26).

Psychosocial variables:

Job demand index (role overload) (Q9-12),  
Safety climate scale (Q49-51),  
Occupational driver behavior construct (with 4 subdimensions: speeding, inattention, rule violation, driving while tired) (Q34-48).

Individual factors:

Motor vehicle crashes when not driving taxi (Q58),  
Age, gender, race/ethnicity, nativity, education, marital status, religion (because taxicab drivers may be targeted for workplace violence events due to their religion) (Q59-67).

The covariates will be selected after they have gone through a predetermined selection process where they meet the following criteria: a) in univariate analysis with the outcome (reported crash event) they must be statistically significant at  $p < 0.25$ , b) not be collinear with any other potential covariate at a value greater than 0.60 and at a significance of  $p < 0.10$ , and c) remain statistically significant during the model building process ( $p < 0.05$ ).

*Characterize non-fatal workplace violence events over a twelve-month period among taxicab drivers and compare by type of safety equipment installed in taxicab.* The number of workplace violence events will be obtained for each event (Q14, Q16, Q18, Q20, Q22, Q24) and for a total of workplace violence events (Q14+Q16+Q18+Q20+Q22+Q24). For each type of safety equipment, a difference in proportions will be calculated to compare the total number of workplace violence events by presence of camera (Q27), partition use (Q28), GPS (Q29), silent alarm (Q30), cashless payment system (Q31), and safety training (Q32). Univariate logistic regression models will evaluate the significance of each type of safety equipment in describing the occurrence of workplace violence events. Multiple logistic regression models will include each statistically significant form of safety equipment from the univariate models altogether in one model. Then the following potential covariates will be evaluated in the model-building process:



Driver tenure:

Length of time as taxicab driver, including in current city (Q1a, Q1b),  
Length of time at current cab company (Q1c, Q1d),  
Ownership status of taxicab and plate/medallion (Q2-5),  
Time spent in a typical day and workweek driving taxicab (Q6,7),  
Number of miles spent in a typical workweek driving taxicab (Q8),  
Fare locations (Q26).

Psychosocial variables:

Job demand index (role overload) (Q9-12),  
Safety climate scale (Q49-51),  
Occupational driver behavior construct (with 4 subdimensions: speeding, inattention, rule violation, driving while tired) (Q34-48).

Individual factors:

Age, gender, race/ethnicity, nativity, education, marital status, and religion (hate crimes) (Q59-67).

The effectiveness of cameras, in addition to other safety measures, will be evaluated using the Wald test statistic generated in the final logistic model. We will be able to compare unadjusted (univariate models) and adjusted (multivariable models) estimates for each type of safety equipment utilized.

Mock tables for presenting results

The following tables are meant to provide insight into how data elements (*indicated by question number*) will likely be used and presented in presentations, publications, and other dissemination tools. Each set of tables depicted here will be constructed for each city separately.

Table Xa. Occurrence of motor vehicle events among taxicab drivers in past 12 months.		
	Number	Proportion Surveyed
Crashes, Total (Q13)		
With injuries (Q13a3, Q13b3, Q13c3, Q13d3)		
With fatalities (Q13a4, Q13b4, Q13c4, Q13d4)		
With property damage (Q13a2.1-2, Q13b2.1-2, Q13c2.1-2, Q13d2.1-2)		
<\$500		
\$500 - \$1000		
>\$1000		
With medical costs (Q13a.2.3, Q13b2.3, Q13c.2.3, Q13d.2.3)		
<\$500		
\$500 - \$1000		
>\$1000		
Circumstances (Q13a.1, Q13b.1, Q13c.1, Q13d.1)		

Taxicab struck another vehicle				
Taxicab run off road or hit an animal/object				
Another vehicle struck the taxicab				
Taxicab struck a pedestrian				
Taxicab struck a cyclist				
Time of day of crash (Q13a.1.a)				
10pm – 12am				
12am – 4am				
4am – 7am				
7am – 10am				
10am – 1pm, etc.				
Location of crash (Q13.a.1.c)				
Highway				
Non-highway				
Weather conditions at time of crash				
Clear				
Cloudy				
Fog, Smog, Smoke				
Etc.				
Table Xb. Frequency of motor vehicle crashes in the past 12 months by business characteristics.				
	<u>Overall</u>		<u>Among drivers reporting &gt;x Crashes</u>	
	No.	%	No.	%
Taxicab company (Q1b)				
Company A				
Company B				
Company ...				
Tenure as licensed driver (Q1a)				
<1 yr				
1-5 yrs				
6-10 yrs				
>10 yrs				
Tenure as licensed driver for current company (Q1c)				
<1 yr				
1-5 yrs				
6-10 yrs				

>10 yrs				
Taxicab ownership (Q2)				
Own				
Lease				
Taxicab plate/medallion ownership (Q3)				
Own				
Lease				
Taxicab or plate is subleased (Q4)				
Long term (Q5)				
Weekly				
Daily				
Taxi use, daily (Q6)				
<10 hours				
10-14 hours				
15-19 hours				
≥20 hours				
Hours driving taxi, per week (Q7)				
≤15 hours				
16-20 hours				
21-25 hours ....				
Miles driving taxi, per week (Q8)				
1000-1500 miles				
1501-2000 miles ...				

Table Xc. Frequency of motor vehicle crashes in past 12 months by job demands, safety climate, knowledge of safety practices, self-reported road safety behaviors, and driver training status.

	Overall		Among drivers reporting >x crashes					
	No.	%	No.	%	With injuries		With >\$500 property damage	
					No.	%	No.	%
Job Demands (Q9-Q12)								
81-100%								
61-80%								
41-60%								
21-40%								

20% or less								
Safety Climate (Q49-Q51)								
81-100%								
61-80%								
41-60%								
21-40%								
20% or less								
Knowledge of Safety Practices (Q52-Q57)								
81-100%								
61-80%								
41-60%								
21-40%								
20% or less								
Occupational Driving Behavior Questionnaire (OBDQ) (Q34-48)								
81-100%								
61-80%								
41-60%								
21-40%								
20% or less								
Received Driver Safety Training (Q32)								
In the past 6 months (Q32a)								
In the past 12 months								

Table Xd. Frequency of motor vehicle crashes in past 12 months by individual factors of driver.

	Overall		Among drivers reporting >x crashes					
	No.	%	No.	%	With injuries		With >\$500 property damage	
					No.	%	No.	%
Age (Q59)								
<21 years								
21-25 years								
26-30 years								
31-35 years, ...								
Gender (Q60)								

Male								
Female								
Race/ethnicity (Q61, Q62)								
Non-Hispanic White								
Non-Hispanic Black								
Hispanic								
Asian, ...								
Nativity (Q63, Q64)								
Born in the U.S.								
Born in X Country								
Born in X Country								
Born in X Country,....								
Born in other country								
Educational attainment (Q65)								
Grade/secondary school								
High school/trade school, ....								
Marital status (Q66)								
Married/Long-term relationship								
Separated/Divorced								
Widowed/Single								

Table Xe. Prevalence rate ratios for psychosocial factors and motor vehicle crashes in past 12 months.

	Among drivers reporting any crashes		Among drivers reporting >x crashes					
	PRR	95% CI	PRR	95% CI	With injuries		With >\$500 property damage	
					PRR	95% CI	PRR	95% CI
Job Demands (Q9-Q12)								
81-100%								
61-80%								
41-60%								
21-40%								
20% or less								

Safety Climate (Q49-Q51)								
81-100%								
61-80%								
41-60%								
21-40%								
20% or less								
Knowledge of Safety Practices (Q52-Q57)								
81-100%								
61-80%								
41-60%								
21-40%								
20% or less								
Occupational Driving Behavior Questionnaire (OBDQ) (Q34-48)								
81-100%								
61-80%								
41-60%								
21-40%								
20% or less								
Received Driver Safety Training (Q32)								
In the past 6 months (Q32a)								
In the past 12 months								

Table Xf. Prevalence rate ratios for motor vehicle crashes in past 12 months by individual factors of driver.

	Among drivers reporting any crashes		Among drivers reporting >x crashes					
	PRR	95% CI	PRR	95% CI	With injuries		With >\$500 property damage	
					PRR	95% CI	PRR	95% CI
Age (Q59)								
<21 years								
21-25 years								
26-30 years								
31-35 years, ...								

Gender (Q60)								
Male								
Female								
Race/ethnicity (Q61, Q62)								
Non-Hispanic White								
Non-Hispanic Black								
Hispanic								
Asian, ...								
Nativity (Q63, Q64)								
Born in the U.S.								
Born in X Country								
Born in X Country								
Born in X Country,....								
Born in other country								
Educational attainment (Q65)								
Grade/secondary school								
High school/trade school, ....								
Marital status (Q66)								
Married/Long-term relationship								
Separated/Divorced								
Widowed/Single								

Table Xg. Association of potential covariates with odds of experiencing motor vehicle crashes in past 12 using univariate logistic regression.

	Drivers reporting any crashes		Drivers reporting >x crashes					
	OR	95% CI	OR	95% CI	With injuries		With >\$500 property damage	
					OR	95% CI	OR	95% CI
<b>Driver tenure</b>								
Taxicab company (Q1b)								
Company A								
Company B								
Company ...								

Tenure as licensed driver (Q1a)								
<1 yr								
1-5 yrs								
6-10 yrs								
>10 yrs								
Tenure as licensed driver for current company (Q1c)								
<1 yr								
1-5 yrs								
6-10 yrs								
>10 yrs								
Taxicab ownership (Q2)								
Own								
Lease								
Taxicab plate/medallion ownership (Q3)								
Own								
Lease								
Taxicab or plate is subleased (Q4)								
Long term (Q5)								
Weekly								
Daily								
Taxi use, daily (Q6)								
<10 hours								
10-14 hours								
15-19 hours								
≥20 hours								
Hours driving taxi, per week (Q7)								
≤15 hours								
16-20 hours								
21-25 hours ....								
Miles driving taxi, per week (Q8)								
1000-1500 miles								
1501-2000 miles ...								
Predominant Location of Pick Up (Q26)								
Airport								



Downtown, ...								
<b>Psychosocial Variables</b>								
Job Demands (Q9-Q12)								
81-100%								
61-80%								
41-60%								
21-40%								
20% or less								
Safety Climate (Q49-Q51)								
81-100%								
61-80%								
41-60%								
21-40%								
20% or less								
Knowledge of Safety Practices (Q52-Q57)								
81-100%								
61-80%								
41-60%								
21-40%								
20% or less								
Occupational Driving Behavior Questionnaire (OBDQ) (Q34-48)								
81-100%								
61-80%								
41-60%								
21-40%								
20% or less								
Received Driver Safety Training (Q32)								
In the past 6 months (Q32a)								
In the past 12 months								
Received no driver safety training								
<b>Individual Variables</b>								
Age (Q59)								
<21 years								
21-25 years								
26-30 years								
31-35 years, ...								

Gender (Q60)								
Male								
Female								
Race/ethnicity (Q61, Q62)								
Non-Hispanic White								
Non-Hispanic Black								
Hispanic								
Asian, ...								
Nativity (Q63, Q64)								
Born in the U.S.								
Born in X Country								
Born in X Country								
Born in X Country,....								
Born in other country								
Educational attainment (Q65)								
Grade/secondary school								
High school/trade school, ....								
Marital status (Q66)								
Married/Long-term relationship								
Separated/Divorced								
Widowed/Single								

Table Xh. Multivariate logistic regression models with covariates statistically significantly associated with odds of experiencing motor vehicle crashes in past 12 months.

	Drivers reporting any crashes		Drivers reporting >x crashes					
	OR <sub>adj</sub>	95% CI	OR <sub>adj</sub>	95% CI	With injuries		With >\$500 property damage	
					OR <sub>adj</sub>	95% CI	OR <sub>adj</sub>	95% CI
<b>Driver tenure</b>								
Variables associated with outcomes:								
Variable 1								
Variable 2...								
Variable X								

<b>Psychosocial Variables</b>								
Variables associated with outcomes:								
Variable 1								
Variable 2....								
Variable X								
<b>Individual Variables</b>								
Variables associated with outcomes:								
Variable 1								
Variable 2....								
Variable X								

Table Xi. Frequency of workplace violence events overall and by type, per driver surveyed.				
	In the past 12 months			
	No.	%	Average	Range
No events reported			-	-
Any event reported (Q14, Q16, Q18, Q20, Q22, Q24)				
Sometimes				
Monthly				
Weekly				
Daily				
Verbally assaulted (Q14)				
Sometimes				
Monthly				
Weekly				
Daily				
Theft of service (Q16)				
Sometimes				
Monthly				
Weekly				
Daily				
Physically assaulted (Q18)				
Sometimes				
Monthly				
Weekly				
Daily				

Carjacked (Q20)				
Sometimes				
Monthly				
Weekly				
Daily				
Property theft (Q22)				
Sometimes				
Monthly				
Weekly				
Daily				
Armed robbery (Q24)				
Sometimes				
Monthly				
Weekly				
Daily				

Table Xj. Distribution of safety equipment installation and usage in taxicabs.		
	Distribution	
	No.	%
<b>Safety equipment</b>		
Security camera (Q27)		
Camera decal (Q27g)		
Partition (Q28)		
GPS dispatch (Q29)		
Silent alarm (Q30)		
Cashless payment system (Q31)		
Safety training (Q32)		
<b>Safety equipment usage</b>		
Images recorded by camera used by police (Q27c)		
Proportion of time partition closed at night (Q28a)		
50-74%		
75-100%		
Proportion of time partition closed during day (Q28a)		
50-74%		
75-100%		
Use automatic dispatch (Q29a)		
<3 times		
3-5 times, ....		
Activated silent alarm (Q30a)		

<3 times		
3-5 times, ...		
Cashless payment system usage (Q31a)		
<25%		
25-49%		
50-74%		
75%-100%		

Table Xk. Distribution of safety equipment installed and usage in taxicabs and by workplace violence events, per driver surveyed.

	Any WPV event		Verbal assault		Fare evasion		Physical assault		Carjack		Property theft		Armed robbery	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<b>Safety equipment</b>														
Security camera (Q27)														
Camera decal (Q27g)														
Partition (Q28)														
GPS dispatch (Q29)														
Silent alarm (Q30)														
Cashless payment system (Q31)														
Safety training (Q32)														
<b>Safety equipment usage</b>														
Images recorded by camera used by police (Q27c)														
Proportion of time partition closed at night (Q28a)														
50-74%														
75-100%														
Proportion of time partition closed during day (Q28a)														
50-74%														
75-100%														
Use automatic dispatch (Q29a)														
<3 times														
3-5 times, ....														
Activated silent alarm (Q30a)														
<3 times														
3-5 times, ...														
Cashless payment system usage (Q31a)														
<25%														
25-49%														
50-74%														
75%-100%														

Table Xl. Perceived effectiveness of safety equipment and work-related support regarding safety equipment.		
	Number	Proportion Surveyed
Camera not functioning properly (Q27a)		
Reason 1		
Reason 2, ...		
Camera inspection (Q27b)		
Within 6 months		
Within 12 months		
Types of incidents camera recorded (Q27d)		
Verbal assault		
Within 24 months		
Within 12 months		
Within 6 months		
Theft of service		
Within 24 months		
Within 12 months		
Within 6 months, ...		
Camera images not recorded/useful (Q27e)		
Reason 1 (Q27e1)		
Reason 2 ...		
Safety training (Q32)		
Within 24 months		
Within 12 months		
Within 6 months ...		
Length of safety training (Q33)		
<8 hours		
8-16 hours, ...		
Perceived benefit from training (Q32b)		
Yes/Maybe		
No		
Perceived benefit from safety equipment (Q33+Q31b+Q30b+Q29b+Q28b+Q27f)		
Index range		
Reporting of workplace violence incidents		

(Q15+Q17+Q19+Q21+Q23+Q25)		

Xm. Association of potential covariates with workplace violence events in past 12 months using univariate logistic regression.		
	OR	95% CI
<b>Driver Tenure</b>		
Taxicab company (Q1b)		
Company A		
Company B		
Company ...		
Tenure as licensed driver (Q1a)		
<1 yr		
1-5 yrs		
6-10 yrs		
>10 yrs		
Tenure as licensed driver for current company (Q1c)		
<1 yr		
1-5 yrs		
6-10 yrs		
>10 yrs		
Taxicab ownership (Q2)		
Own		
Lease		
Taxicab plate/medallion ownership (Q3)		
Own		
Lease		
Taxicab or plate is subleased (Q4)		
Long term (Q5)		
Weekly		
Daily		
Taxi use, daily (Q6)		
<10 hours		
10-14 hours		
15-19 hours		
≥20 hours		



Hours driving taxi, per week (Q7)		
≤15 hours		
16-20 hours		
21-25 hours ....		
Miles driving taxi, per week (Q8)		
1000-1500 miles		
1501-2000 miles ...		
Predominant Location of Pick Up (Q26)		
Airport		
Downtown, ...		
<b>Psychosocial Variables</b>		
Job Demands (Q9-Q12)		
81-100%		
61-80%		
41-60%		
21-40%		
20% or less		
Safety Climate (Q49-Q51)		
81-100%		
61-80%		
41-60%		
21-40%		
20% or less		
Knowledge of Safety Practices (Q52-Q57)		
81-100%		
61-80%		
41-60%		
21-40%		
20% or less		
Occupational Driving Behavior Questionnaire (OBDQ) (Q34-48)		
81-100%		
61-80%		
41-60%		
21-40%		
20% or less		

Received Driver Safety Training (Q32)		
In the past 6 months (Q32a)		
In the past 12 months		
Received no driver safety training		
<b>Individual Variables</b>		
Age (Q59)		
<21 years		
21-25 years		
26-30 years		
31-35 years, ...		
Gender (Q60)		
Male		
Female		
Race/ethnicity (Q61, Q62)		
Non-Hispanic White		
Non-Hispanic Black		
Hispanic		
Asian, ...		
Nativity (Q63, Q64)		
Born in the U.S.		
Born in X Country		
Born in X Country		
Born in X Country,....		
Born in other country		
Educational attainment (Q65)		
Grade/secondary school		
High school/trade school, ....		
Marital status (Q66)		
Married/Long-term relationship		
Separated/Divorced		
Widowed/Single		
Religion (Q67)		
Islam		
Buddhism		
Christianity, ...		

<b>Safety equipment installation</b>		
Security camera (Q27)		
Camera decal (Q27g)		
Partition (Q28)		
GPS dispatch (Q29)		
Silent alarm (Q30)		
Cashless payment system (Q31)		
Safety training (Q32)		

Table Xn. Multivariate logistic regression models with covariates statistically significantly associated with odds of experiencing workplace violence incidents in past 12 months.

	Drivers reporting any workplace violence incidents	
	OR <sub>adj</sub>	95% CI
<b>Driver tenure</b>		
Variables associated with outcomes:		
Variable 1		
Variable 2...		
Variable X		
<b>Psychosocial Variables</b>		
Variables associated with outcomes:		
Variable 1		
Variable 2....		
Variable X		
<b>Individual Variables</b>		
Variables associated with outcomes:		
Variable 1		
Variable 2....		
Variable X		
<b>Safety Equipment Installation</b>		
Variable 1		
Variable 2....		
Variable X		

### 3.4.2 Data collection methods

Survey Team recruitment: Survey staff will be employed under contract to conduct survey administration shifts at the airport waiting lot in each city. It is proposed to employ a survey team of a study manager and 3-5 survey staff on-site in each city to complete the survey. The NIOSH Principle

Investigators/Project Manager for the study will interview and approve all contract survey staff to confirm their competency to conduct interviews.

Survey Protocol: Study managers and survey staff will be trained in conducting surveys approximately 1-2 weeks before the inspection periods begin. Each employee will have a list of licensed drivers and will cross off their names once they have provided informed assent (Appendix 1) and identity is verified. A driver who wants to participate in the study and has his name crossed off will assume to have already participated in the survey and will not be allowed to participate twice. Study participants will be surveyed near their cab, for the convenience of the driver. The survey was pilot tested and is expected to take 20-30 minutes to complete (Appendix 2). Once completed, the driver will be issued a \$25 check card in compensation for his time.

Following completion of the interviews, the study manager will collect the surveys each week from surveyors. The study manager will do quality assurance checks on completion of forms and surveys, return documents to the surveyors for correction if necessary, and FedEx documents to NIOSH weekly.

Pilot Test Survey: The survey was reviewed and revised with input from several staff members in the City of Houston Department of Administrative and Regulatory Affairs for clarity and relevance to taxicab drivers. Furthermore, a long time taxicab driver turned activist against violence directed at taxicab drivers and a long serving taxicab regulator were instrumental in the development phase of the survey.

Surveys were administered to 9 taxicab drivers. Questions on road safety behaviors were taken from previously validated surveys administered to workers who drive medium-sized vehicles for a living. The surveys were pilot-tested by the NIOSH project officer (Dr. Cammie Chaumont Menéndez). The pilot test identified survey questions that drivers could or would not answer, questions which needed clarity, and the procedure to successfully complete a survey. Following completion of the pilot study, the taxicab driver survey was revised. For example, it is helpful to drivers to hold up a card listing the anchors for questions that are part of a scale and require the drivers to respond within a continuum (1 through 10). Holding up the card while asking the question will help the driver with organizing his thoughts to provide the most accurate response.

Surveyor Training: NIOSH PIs will train survey staff in each city on survey procedures. Training will include procedures for obtaining assent from drivers, texts for introduction to taxicab drivers, and survey administration procedures. Taxicab driver interviews for 1-2 days in the beginning of the inspection period will be conducted by the project officers and surveyors together to complete training for taxicab driver surveys. Training will also be given to study managers on QA procedures, security of records and submissions of forms and questionnaires to NIOSH.

Quality control and data editing: A NIOSH program manager will be available to help the survey team throughout the survey. Weekly conference calls will be held with the survey teams in each city to keep a log of problems and solutions. NIOSH data editing staff will receive forms, and check forms and surveys for completeness and errors. Because no identifying information of the taxicab driver will be given to survey staff, surveys will need to be reviewed before the compensation is given to ensure all

questions have been answered. Any errors in application of the survey administration protocol will be discussed with survey staff to ensure adherence to the survey protocol.

*Minimizing nonparticipation:* Taxicab drivers are a difficult population to reach and generally choose this occupation because of its independence and autonomy. Because the drivers will be compensated for their time and, based on many conversations between the project officer and taxicab drivers in the past, the topic of workplace violence is of interest to them, there is expected to be minimal nonparticipation. The compensation is considered necessary because the time spent at the airport waiting lot is usually used to line up fares later on in the day or network with other taxicab drivers regarding work-related issues. Furthermore, due to time constraints and wariness of drivers to be linked to any data, drivers will not be asked to provide their names.

### **3.4.3 Information management and analysis software**

*Data entry, editing and management, including handling data collection forms, different versions of data and data storage and disposition*

All surveys will be computer-entered by NIOSH personnel into SAS databases for data editing and management. The data will be processed using a double blind entry method. This process in which the data is entered twice provides assurance that the data has been entered accurately. NIOSH will clean, edit, code, and key hard copy records as necessary.

*Quality control/assurance*

Data editing will include careful scrutiny of the entered data for errors in accuracy, consistency and completeness that were either missed at the time of manual form review or which occurred at the time of data entry. In addition, 20% of all entered records will be sampled and checked against hard-copy forms. Codebooks will be created for all databases.

*Bias in data collection, measurement and analysis*

There could be bias due to nonresponse. This is expected to be minimal because the drivers will be compensated for their time. However, the number of motor vehicle incidents is tracked by Yellow Cab, which operates 70% of the taxicabs. Objective measures of motor vehicle crashes, and violence/theft (at least that reported) can be obtained from management to make a limited comparison with that reported by taxicab drivers. This comparison is limited only to drivers who driver for Yellow Cab, but it will provide a measure of potential bias. The internal validity of the safety climate, job demand index, and the occupational driving behavior constructs will be assessed using Cronbach alphas and compared with measurements of occupational drivers in other populations.

*Limitations*

There is concern for limited participation of taxicab drivers, who, as a population, generally like to remain anonymous. We have worked with industry regulators and experienced taxicab drivers to develop a survey that will be as minimally invasive as possible. Furthermore, the survey is comprehensive and covers two significant causes of injury in this population. There is the possibility the

survey is a little too comprehensive, but we have pilot tested it and can administer the survey in about 30 minutes.

#### *Data security*

NIOSH will maintain the security and privacy of all individual records in accordance with the Federal Privacy Act. No disclosure of any employee's data received by interview will be given to any party without written permission from the taxicab driver. All electronic data transfers will be conducted using a secure encoded FTP website.

Any scientific journal articles stemming from this NIOSH research will be reported/published in a summarized, anonymous format, with no personal identifiers disclosed. Names of drivers and companies will not be disclosed. Data used in NIOSH research projects is governed by the Freedom of Information Act ([HTTP://WWW.HHS.GOV/FOIA/](http://www.hhs.gov/foia/)) and The Privacy Act ([HTTP://WWW.USDOJ.GOV/OIP/PRIVSTAT.HTM](http://www.usdoj.gov/oip/privstat.htm)).

All surveys and forms with personal identifiers received by NIOSH will be kept in a locked file and in a locked room, and in secure computer hard drive files which can only be accessed by the project officer or staff data analysts working on the project. Release of these files will be made only by the project officer to data editing, statistical, and computer programming staff who have a need to access the files for merging of the data to a master file which will also be kept in a secure location and on a secured computer file available only by the project officer. Personal identifiers will be removed from all master files when used for statistical analyses to safe guard personal identifiers appearing on any printouts.

### **3.4 Handling of Unexpected or Adverse Events**

If any incident or an adverse event (such as a participant does not get compensated or a driver is upset by discussing past violent events) happens in connection with this research study, NIOSH will notify the HSRB within 2 days.

### **3.5 Dissemination, Notification, and Reporting of Results**

#### *Notifying participants of the study findings*

Publications and results of this study will be provided to the participating city regulators, the company owners, and the International Association of Transportation Regulators and Taxi, Livery, and Para Transit Association.

#### *Disseminating results to public*

Results will be disseminated to industry regulators in other cities, company owners, published in peer-review journals and taxi/transportation trade journals, and posted on the NIOSH website for general public access. Presentations will be made at scientific conferences to reach the public health and criminology community and at trade association meetings to reach the public transportation.

### 3.6 Budget

The total discretionary budget for this project is \$135,000 (\$5,000 in FY13, \$50,000 in FY14, \$50,000 in FY15 and \$30,000 in FY16).

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