

## **Kentucky Occupational Safety and Health Surveillance Program**

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## List of Abbreviations

Adult Blood Lead Epidemiology and Surveillance program	ABLES
Behavioral Risk Factor Surveillance System	BRFSS
Bureau of Labor Statistics	BLS
Census of Fatal Occupational Injuries	CFOI
Centers for Disease Control and Prevention	CDC
Certified Drivers License	CDL
Collision Report and Analysis for Safer Highways	CRASH
Commercial Large Truck Drivers	CLTDs
Commercial Vehicle Enforcement	CVE
Council of State and Territorial Epidemiologists	CSTE
United States Department of Labor	DOL
Emergency Department	ED
Fatality Assessment and Control Evaluation program	FACE
Federal Motor Carrier Safety Administration	FMCSA
Governor's Executive Committee on Highway Safety	GECHS
Kentucky	KY
Kentucky Department for Workers' Claims	DWC
Kentucky Motor Transport Association	KMTA
Kentucky Occupational Safety and Health Surveillance Program	KOSHS
Commercial Vehicle Enforcement	CVE
Lexington Fayette Urban County Government	LFUCG
Motor Vehicle Collisions	MVC
National Association of Women in Construction	NAWIC
National Highway Transportation Safety Administration	NHTSA
National Institute for Occupational Safety and Health	NIOSH
National Safety Council	NSC
North American Industry Classification System	NAICS
Occupational Safety and Health Administration	OSHA
Semi Truck Collisions	STCs
Years of Potential Life Lost	YPLL

## **Abstract**

The Kentucky Occupational Safety and Health Surveillance (KOSHS) program is an expanded program that includes a fundamental occupational injury and illness surveillance program and a Fatality Assessment and Control Evaluation program. This final progress report for the Kentucky expanded KOSHS program covers only a two-year grant funded period from July 1, 2008 - June 30, 2010, in contrast to other states with expanded Occupational Safety and Health Surveillance programs who were funded for five years.

Kentucky ranked as the 14<sup>th</sup> -worst state for fatal occupational injury rates in 2008, down from the 8<sup>th</sup> worst in 2004 (John Sestito, NIOSH, personal communication), but was still 59% above the national rate (5.9 KY deaths/ 100,000 workers compared to 3.7 US deaths/ 100,000 workers in 2008), and is among the states with the highest nonfatal occupational injury and illness incidence rates (8<sup>th</sup> worst) (BLS, 2009). These elevated rates are attributable in part to the concentration of KY workers in higher-risk industry sectors, but nevertheless are clear indications of the need for further work to lower the state's burden of occupational injuries and illnesses.

The specific aims of the KOSHS and FACE programs from July 1, 2008- June 30, 2010, were to: 1) maintain comprehensive multi-source population-based surveillance of occupational injuries and illnesses occurring in Kentucky using 20 indicators; 2) establish a state-specific indicator for the population-based surveillance of occupational falls; 3) sustain the "Kentucky- Working to Save Lives" consortium; 4) apply nonparametric statistical analysis methods to the CRASH data set; 5) provide targeted worker and employer groups with a sound evidence basis for improved worker safety; 6) conduct comprehensive and timely multi-source surveillance of all occupational fatalities occurring in Kentucky; 7) perform on-site investigations of selected fatality cases involving motor vehicle collisions; 8) perform a case-control study to determine the association between the number of passengers and injury severity in older male driver motor vehicle collisions; 9) develop and disseminate fatality narratives of interpersonal violence-related occupational homicides utilizing multiple sources of data; and 10) perform a process, impact, and outcome evaluation of the major activities conducted.

Epidemiological analyses of transportation industry injuries (the effect of passengers on older semi truck driver at-fault collisions), and unintentional poisonings were performed (methadone-related poisonings, and dermal exposure to organic solvents among farmers). Alternative surveillance data sources were explored (admission intake data) and alternate methods for analysis of data were developed (kth nearest neighbor (kNN) approach) and utilized (narrative text analysis) to identify new and existing risk factors for an occupational injury.

Partnerships were formed and expanded that resulted in the development of interventions (bucket truck video, fuel shutoff valve prototype, and worker safety presentation) to be used as educational and engineering controls. Implemented process changes by companies included the mandated use of chains on dump trucks hauling asphalt, the prohibition of vehicle repair by truck drivers, and the mandated use of safety belts within the sleeper berth of semi trucks.

Epidemiological analyses, and worker fatality reports, were used to inform public policy. A fatality report on a trucker who died when exiting an interstate off-ramp with a 0.6% blood level of cocaine was produced and distributed by the FACE program. The release of this report was brought to the attention of Kentucky state senators who proposed legislation to require an employer of any driver with a CDL who tests positive for drugs/alcohol to notify the Transportation Cabinet within five business days. FACE personnel testified before the Kentucky General Assembly's Interim Joint Committee on Transportation in 2008 and provided copies of the fatality report, three similar fatality reports, and trucking hazard alerts to members of the committee. The bill will be resubmitted in 2011. Also, KOSHS personnel contributed to the 2010 KY Strategic Highway Safety Plan through participation in the commercial vehicle emphasis area and the KY Traffic Records Advisory committee. In addition, The KY Transportation Cabinet has now mandated that concrete median barriers being constructed include emergency access points.

A process, impact and outcome evaluation of major activities was performed and results showed that the KOSHS program has been effective in the population-based surveillance of traumatic injuries among workers. The system was useful, met its objectives, and had an impact on targeted industries and sectors. The epidemiological results and interventions can be utilized in the workplace for worker safety training programs. The formation of partnerships and policy development can be shared between states to reduce the burden of occupational injuries.

## **Section 1.**

### **Highlights/Significant Findings**

In the exploration of alternative surveillance data sources, emergency department admission intake data was analyzed for work-relatedness and payment source (Nicholson *et al.* 2008). Twenty percent of all self-reported work-related injuries were not billed to workers' compensation, were not covered by personal health insurance, and a higher proportion occurred among Hispanics. Also, a narrative text analysis of agricultural tractor fatality reports showed that the operation of a tractor with an attached bucket, muddy terrain, and being thrown from the tractor were independent risk factors for being declared "dead at the scene" (Bunn *et al.* 2008).

Regarding the surveillance of chemical exposures at work, a study was published on dermal exposure of farmers to organic solvents (Bunn *et al.* 2009). A survey questionnaire was administered to 31 Kentucky farmers in 2008, and dermal exposure assessment was conducted in 10 farmers while farmers performed farm machinery maintenance/repair tasks. Toluene and xylene were identified at high concentrations in dermal patches that the farmers wore while repairing/ maintaining their farm machinery. The results showed the need for further studies to characterize and evaluate chemical exposures in larger samples of farmers.

The KOSHS program has directed prevention efforts and performed a number of epidemiological studies in the area of unintentional poisonings. A hazard alert entitled "Truck Drivers in Fatal Crashes after Substance Abuse", was published and disseminated to trucking companies. A KOSHS staff member was a contributing consultant for a University of Kentucky report on methamphetamine and other drug use (Turner and Walker, 2008). Also, a peer-reviewed publication was published on methadone related poisonings in Kentucky using multiple data sources. Six of the methadone-related poisoning victims had reported workers' claims as the payer on hospitalization billing forms (Bunn *et al.* 2010). A fatality report on a trucker who died when exiting an interstate off-ramp with a 0.6% blood level of cocaine was produced and distributed by the FACE program. The release of this report was brought to the attention of Kentucky state senators who proposed legislation to require an employer of any driver with a CDL who tests positive for drugs/alcohol to notify the Transportation Cabinet within five business days. FACE personnel testified before the Kentucky General Assembly's Interim Joint Committee on Transportation in 2008 and provided copies of the fatality report, three similar fatality reports, and trucking hazard alerts to members of the committee. The bill will be resubmitted in 2011.

The prevention of transportation industry injuries was a primary focus of the grant. A retrospective population-based case-control study was conducted to determine whether semi truck driver age, gender, and the presence of passengers affected the likelihood that a semi truck driver would be at-fault in a semi truck collision (STC) with another vehicle (Bunn *et al.* 2009). The results showed that solo semi truck drivers, aged 65 and over, were at highest risk for at-fault STCs with other vehicles. However, the presence of passengers in the semi truck had a protective effect for semi truck drivers aged 65 and older. The study results can be used to inform long-distance driving performed by solo vs. team semi truck drivers.

A non-parametric method based on the kth nearest neighbor (kNN) approach was developed and applied to three case-control studies to determine relative risk gender-related motor vehicle crashes, and commercial truck driver collisions related to geographical locations (Pavlov *et al.* 2009; Slavova *et al.* 2008; Slavova *et al.* 2008).

A partnership with the Lexington-Fayette Urban County Government (LFUCG) used FACE data in the production of a safety training video to prevent bucket truck lift injuries. The video is available on our web site at <http://www.kiprc.uky.edu/face.html>. Following the production of this video, a second partnership was formed in June 2009 with the LFUCG Department of Environmental Quality to develop a safety management system for the Division of Waste Management.

A significant need identified by stakeholders was the number of small companies in KY without worker safety programs. A worker safety program presentation, including true stories and statistics, was developed geared to new and established small business owners. The worker safety program presentation was uploaded onto our website and a link to our program was added to the One-Stop Business Licensing Program on the KY Secretary of State's website that provides information to individuals establishing new businesses. A new partnership was recently formed between the Department of Workers' Claims (DWC), KY OSHA, and the KOSHS program. In May 2010, a panel presentation was given on the value of a worker safety program using our worker safety presentation and DWC and KY OSHA presentations. Numerous

employers commented that the presentation was pivotal in raising awareness about the necessity of having a worker safety program in terms of cost savings due to reduced workers' compensation premiums, reduced OSHA fines, and reduced injuries. In September 2009, an article on the value of a worker safety program was published in the Kentucky Bench and Bar (Costich, Bunn and Robertson, 2009). The purpose of the article was to inform lawyers of the presentation as a resource for new business clients, and to raise awareness and encourage adoption of a worker safety program among new small business owners. Also, the worker safety presentation was included in the November 2009 NIOSH e-news.

Based on KY FACE report #07KY070, "Semi-Tractor Trailer Driver Hauling Chicken Dies after Striking a Rock Wall", a fuel shut-off valve prototype for refrigerated trailers was designed. The semi truck driver was incinerated after crashing and diesel fuel dripped onto an exhaust pipe from the refrigerated semi tractor causing a fire; the fuel line was compromised during the collision. Students from the University of Kentucky, College of Engineering, designed a fuel supply shutoff prototype with a signal to alert the driver when the fuel flow has stopped and an override switch. The prototype was successful, and will next be tested on a semi refrigeration unit. The same fatality report also contained a recommendation to construct emergency access in concrete median barriers to allow the passage of EMS personnel. The collision scene was not reached for approximately 20 minutes because EMS personnel had to drive north, approximately ten miles on the interstate, exit, and then drive back up to the scene five more miles away. In July 2009, after many conversations with the KY Transportation Cabinet, cable barriers and concrete barriers in the median are now being constructed with breaks every two miles to allow passage of emergency personnel.

### **Translation of Findings**

Analyses and investigations of commercial motor vehicle driver fatalities have resulted in a number of new partnerships between KY FACE personnel and personnel from the transportation industry and federal agencies. This new investigative initiative resulted in a procedural change for a road construction company. Fatality report # 05KY036 entitled "Dump Truck Driver Dies after Unintentional Release of Asphalt" recommended that tailgate chains should always be secured to the dump truck. After this incident occurred, the company made the securing of tailgates with chains mandatory practice for all dump trucks. The fatality report from this incident and the company procedural changes were published in the trade magazine *Asphalt Pro* in December 2007. A second Kentucky FACE fatality report was published in *Asphalt Pro* in June/July 2008 on an asphalt hauler who was trying to repair a colleague's haul truck while in line to be loaded and was fatally caught in the power take off shaft. The company now prohibits workers from repairing their own and others' haul vehicles.

### **Outcomes/Relevance/Impact**

Following are examples of how KOSHS publications and interventions were used by companies:

- A. Fifteen survey responses were received after mailing the annual KOSHS report in April 2009. Of the fifteen respondents, twelve read the report from cover-to-cover, four used the publication to supplement training or courses, ten used the publication to assist in research and 13 shared the information.
- B. A follow-up phone survey was conducted 3 months after mass transportation mailings of hazard alerts and fatality reports in KY to 1700 employers in 2007 and to 10,000 employers in 2009. Of the employers surveyed in 2009 (n=10), all employers ranked the materials as excellent (mean score 4.6 out of 5), all thought the information was easy to understand, five planned to use or used the information for toolbox training, four used the information for general safety training, and all employers thought the suggested recommendations were practical for their company. One company mentioned that they now have a stricter seat belt policy because of the mailing.
- C. Nine electronic evaluations were received pertaining to our forklift hazard alert disseminated in spring 2010 and all rated the publication as "excellent". Company responses included: 1) "will incorporate materials into safety program"; 2) "each employee will be shown this FACE report and will receive additional forklift safety training"- Pressure Tech, Inc; 3) "Is it possible to be added to the distribution list for the Haz alerts? A co-worker has been forwarding to me and I find them quite useful"- Papa John's; 4) "I appreciate the work that you folks do"- Owensboro Municipal Utilities; 5) "Nice review and reminder that equipment used regularly can still be very dangerous if we are not careful to follow safety rules each and every time. Thanks."- First Class Transportation; and 6) "I will complete an individual audit to ensure the information covered is included in our program".

## **SECTION 2.** **Scientific Report**

### **A. Background**

The Kentucky Occupational Safety and Health Surveillance (KOSHS) program is an expanded program that includes a fundamental occupational injury and illness surveillance program and a Fatality Assessment and Control Evaluation (FACE) program. This final progress report for the Kentucky expanded KOSHS program covers only a two-year grant funded period from July 1, 2008- June 30, 2010, in contrast to other states with expanded Occupational Safety and Health Surveillance programs who were funded for five years.

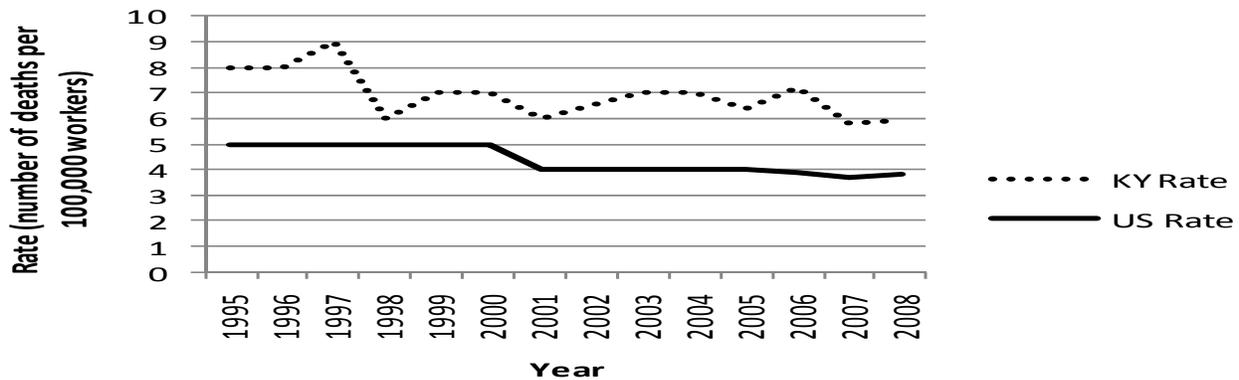
In 2008, 5,214 fatal work-related injuries were reported by the Census of Fatal Occupational Injuries (CFOI) (US Bureau of Labor Statistics) with a US fatality rate of 3.7/100,000 full-time equivalent workers, and the estimated total cost for fatal and nonfatal work-related unintentional injuries was \$183 billion dollars (National Safety Council [NSC], 2010). Included in that amount were wage and productivity losses of \$88.4 billion, medical expenses of \$38.3 billion, administrative costs of \$37.7 billion, and motor-vehicle damage costs of \$2.1 billion. Kentucky's work-related fatality rate in 2008 was 5.9/100,000 full-time workers, significantly higher than the US worker fatality rate.

Kentucky ranked as the 14<sup>th</sup> -worst state for fatal occupational injury rates in 2008, down from the 8<sup>th</sup> worst in 2004 (John Sestito, NIOSH, personal communication), but was still 59% above the national rate (5.9 KY deaths/ 100,000 workers compared to 3.7 US deaths/ 100,000 workers in 2008), and is among the states with the highest nonfatal occupational injury and illness incidence rates (8<sup>th</sup> worst) (BLS, 2009). The KY nonfatal worker injury rate was 4,700 injuries and illnesses/100,000 workers compared to a nationwide worker injury rate of 3,900 injuries and illnesses/100,000 workers (BLS, 2010). KY FACE program data indicate that a total of 1,868 years of potential life were lost (YPLL) in 2008 due to work-related fatal injuries. Lost future productivity attributable to these fatal injuries was estimated to be \$81 million dollars. In addition, the Kentucky motor vehicle death rate per miles traveled is 8<sup>th</sup> highest in the nation. These elevated rates are attributable in part to the concentration of KY workers in higher-risk industry sectors, but nevertheless are clear indications of the need for further work to lower the state's burden of occupational injuries and illnesses.

Kentucky has the 7<sup>th</sup> highest workers' compensation premium rate in the nation (\$2.96 per \$100 of payroll) (Department of Consumer & Business Services, Salem, OR, 2009). The highest average workers' claims costs were associated with motor vehicle injuries (\$51,113), and falls and slips (\$26,942) in 2006-2007 (NSC, 2010). For the same time period, the average total incurred costs per claim by nature of injury were highest for amputations (\$48,098) and fracture/crush/dislocation injuries (\$32,019). This tremendous economic and social burden clearly supports enhanced surveillance as well as the continued need for targeted injury prevention strategies and interventions in the workplace.

From 1994 through 2008, 1,920 KY workers were killed on the job, averaging 128 per year (KY FACE data). Figure 1 compares 1995-2008 KY worker fatality rates with the U.S. using FACE data (It should be noted that the occupational fatality rate increased in 2006 because there were 23 worker deaths from a single airplane crash). In 2008, 105 worker deaths were recorded by the FACE program, with a fatality rate of 5.9 deaths per 100,000 workers. Kentucky's occupational fatality rates were highest in the agriculture, mining, construction, and transportation industries.

**Figure 1. Rate of Fatal Work-Related Injuries in Kentucky and U.S., 1994-2008.**



## **B. Specific Aims**

The specific aims for the **fundamental** occupational injury and illness surveillance (KOSHS) program from July 1, 2008- June 30, 2010, were to:

1. Maintain comprehensive multi-source population-based surveillance of occupational injuries and illnesses occurring in Kentucky using 20 indicators. Tracked indicators include the 19 occupational injury and illness indicators recommended by the Council of State and Territorial Epidemiologists [CSTE] in collaboration with the National Institute for Occupational Safety and Health [NIOSH], and one state-specific indicator, occupational motor vehicle collisions.
2. Establish a state-specific indicator for the comprehensive multi-source population-based surveillance of occupational falls, including older worker falls, utilizing a) Workers' Claims data; and b) inpatient hospitalization discharge data.
3. Sustain the "Kentucky- Working to Save Lives" consortium, established by the KOSHS program in 2006, by partnering with state and local public health agencies, unions, work-related organizations, legislators, companies, and other community-based stakeholders to target major occupational injury and illness issues specific to Kentucky. The consortium will be charged with the development of a statewide occupational injury prevention plan to be incorporated into the 2010 Strategic Plan for Developing Core Capacity for Injury Prevention and Control in Kentucky currently being drafted by the Kentucky Injury Prevention and Research Center and the Kentucky Department for Public Health (KDPH) with input from a large number of stakeholders.
4. Apply nonparametric statistical analysis methods to the CRASH data set to identify geographic areas of Kentucky highways with the highest probability of commercial vehicle and coal truck crashes.
5. Provide targeted worker and employer groups with a sound evidence basis for improved worker safety by analyzing and disseminating occupational injury and illness surveillance data, fact sheets, newsletters, web-based information, presentations, and peer-reviewed publications for impact at both the state and national levels.
6. Perform a process, impact, and outcome evaluation of the major activities conducted.

The specific aims for the **FACE** study from July 1, 2008 to June 30, 2010, were to:

- 1) Conduct comprehensive and timely multi-source surveillance of all occupational fatalities occurring in Kentucky, and to identify opportunities for intervention and prevention activities.

- 2) Perform on-site investigations of selected fatality cases involving motor vehicle collisions in the transportation sector, and fatalities in the logging industry, in addition to the NIOSH-recommended priority areas for investigation (machine-, youth-, immigrant worker-, and highway work zone- related fatalities).
- 3) Perform a case-control study to determine the association between the number of passengers and injury severity in older male driver motor vehicle collisions.
- 4) Develop and disseminate fatality narratives of interpersonal violence-related occupational homicides utilizing multiple sources of data including FACE surveillance data, Adult Protective Services agency data, domestic violence protection orders, stalking/no contact orders, and police reports.
- 5) Provide targeted worker and employer groups with a sound evidence basis for improved worker safety by analyzing and disseminating occupational fatality surveillance data, investigation reports, fact sheets, newsletters, web-based information, presentations, and peer-reviewed publications for impact at both the state and national levels.
- 6) Perform a process, impact, and outcome evaluation of the major activities conducted.

### **C. Procedures and Methodology (summarized from 2007 grant proposal)**

**Fundamental (KOSHS)** occupational injury and illness surveillance program methods:

#### **C.1. Maintain comprehensive multi-source population-based surveillance of occupational injuries and illnesses occurring in Kentucky using 20 indicators of occupational injuries and illnesses.**

Public access resources include BLS Survey of Occupational Injuries and Illnesses, BLS Current Population Survey, Year 2000 US standard population data, US Census State Population data, National Academy of Social Insurance, CFI, Bureau of Census County Business Patterns, OSHA annual reports, BLS statistics on covered employers and wages, and professional trade organization data. Authorized resources (permission granted to the KOSHS program to use data) include data from the KY inpatient hospitalization discharge set, death certificates, DWC, ABLES, FACE, CRASH, KY Cancer Registry data, and KY Regional Poison Center data. Authority to use the state and national agency resources is based on specific agreements as well as an authorization provided to KIPRC under contract with the Kentucky Department for Public Health (Kentucky Revised Statutes 211.190).

#### **FACE data**

**Special Initiative:** FACE program investigative reports describe the fatal incident as well as the events before and after the incident, and contain prevention recommendations. These reports are available for dissemination to employers and employees for safety training purposes. FACE reports may also be used to identify new and emerging risk factors for an occupational injury for research. In addition, information contained in the reports is suitable for drafting new worker safety and health legislation and regulations. In our **expanded** program, FACE investigations are being focused on commercial vehicle collisions in the transportation and coal industries. To address these areas, a new partnership has been formed with the Commercial Vehicle Enforcement (CVE) division. While CVE is performing enforcement inspections, injury prevention materials are being distributed to truck drivers. In addition, CVE holds public information sessions, and the KOSHS and FACE programs are providing fatality reports, Haz Alerts, data, and presentations for inclusion in these sessions.

#### **CRASH data**

From 1994-2005, there were 470 occupational MVC fatalities in Kentucky; MVCs are the leading cause of worker death (30%). *Fatal and nonfatal occupational motor vehicle collisions* are one of our state-specific worker safety indicators (Indicator #20). CRASH data contains valuable information such as unit type, number of people injured and/or killed, injury severity, human factors involved, and for the estimation of occupational motor vehicle fatality rates based on the number of workers employed.

MVC data is routinely collected on all MVCs occurring in Kentucky (includes both residents and non-residents) by the Kentucky State Police and entered into the Kentucky CRASH electronic files. The fatal MVC CRASH data is sent to the Fatality Analysis Reporting System (FARS) that contains data on all fatal MVCs occurring each year in the 50 states, the District of Columbia, and Puerto Rico. The FARS system is operated by the National Highway Traffic Safety Administration (NHTSA). The CRASH electronic file contains all MVC information but excludes personal identifiers. Data is made available quarterly to KIPRC for analysis. Data is currently available for 1998-2007.

The inclusion criteria for obtaining occupational fatal and nonfatal MVC data from the CRASH database will be based on:

- 1) Identified as a “commercial vehicle” in the uniform police traffic collision report
- 2) Unit type: bus, emergency vehicles – in response and not in response, military vehicle, other publicly owned vehicle, railroad train, school bus, taxicab, truck tractor & semi-trailer, truck & trailer, truck – single unit, or truck – other combination
- 3) NCIC type: auto carrier, fire truck, asphalt distributor, garbage or refuse, ambulance, loader truck, armored truck, carry-all, chassis and cab, lunch wagon, coach, refrigerated van, concrete mixer, truck trailer /semi, dump, tanker, truck tractor/diesel, truck tractor/gasoline, flatbed or platform, tow truck, flatrack, or utility.
- 4) Type of cargo carried.

### **C.2. Establish a state-specific indicator for the comprehensive multi-source population-based surveillance of worker occupational falls, including older worker falls (Indicator #21).**

Surveillance of worker falls will be performed using inpatient hospitalization discharge, and OWC data sets. Hospital discharge cases will be selected that have an ICD-9-CM external cause of injury of E880-E888 for falls, and a payer code of workers compensation. Selection criteria for worker claim cases are IAIBCEDIN injury code as falls and slips. To analyze trends within the state, data will be collected from the year 2000 forward to present.

### **C.3. Sustain and expand the Kentucky- Working to Save Lives consortium established in 2006.**

**New Initiative:** The Kentucky- Working to Save Lives consortium will be expanded to develop a statewide occupational injury prevention plan for incorporation into the 2010 Strategic Plan for Developing Core Capacity for Injury Prevention and Control in Kentucky currently being drafted by the Kentucky Injury Prevention and Research Center and the Kentucky Department for Public Health (KDPH) with input from a large number of stakeholders. The vision of the consortium is to raise awareness of occupational injuries and illnesses at the public and policy making levels, and to develop data dissemination strategies to increase awareness and reduce Kentucky occupational injuries and illnesses. The mission is to enhance partnerships for the development of effective workplace interventions. Three workgroups have been established within the consortium: 1) Occupational Driver Injuries, 2) Communication and Education; and 3) Data Collection. We are proposing to add strategic direction through the development of goals and objectives, actions, and performance indicators. We will begin implementation planning by identifying barriers and critical success factors, and then develop strategies to achieve the strategic direction by controlling the critical success factors and overcoming the barriers.

### **C.4. Apply nonparametric statistical analysis methods to identify geographic areas of KY highways with the highest probabilities of commercial vehicle and coal truck crashes.**

Geographical Information Systems (GIS) can successfully manipulate and display spatial count data (e.g., mapped locations of injuries), maps of grouped data (e.g., injury rate by county), and contour maps of interpolated values of interest. However, these maps are not sufficient for making statistical inference. In order to better understand and interpret the geographical distribution of a particular type of injury, it is useful to create smoothed injury maps and identify the geographical areas of elevated injury risk. Currently, only a few statistical packages have the ability to create smoothed risk maps and none of them have the option to test a hypothesis or to construct confidence intervals for determining risk at a particular geographic location.

We are currently working on a new statistical method for risk identification based on the “k-th nearest neighbor (kNNI) statistics. The method provides a theoretically justified approach for obtaining confidence bounds of the relative risk and critical regions for a given level of significance and power when testing hypotheses about the relative risk without using computationally dependent algorithms. Preliminary applications of the method to the CRASH data set showed that 1) for ages over 50, out-of-state occupational drivers have a significantly higher collision risk compared to in-state drivers; and 2) women drivers between 35 and 38 years of age are at higher risk of a collision than male drivers.

Proposed research will be focused on 1) refining the statistical properties of the kNNI method for identifying geographic highway areas of elevated relative risk; and 2) applying the method to CRASH data to identify specific coordinates on Kentucky highways with an elevated risk for injury collisions involving coal truck drivers and commercial motor vehicle drivers.

#### **C.5. Analyzing and disseminating occupational injury and illness surveillance data, fact sheets, newsletters, web-based information, presentations, and peer-reviewed publications.**

The information, recommendations, and risk factors identified from surveillance and research will be disseminated for program planning and evaluation, and formulating new research hypotheses. KOSHS employs a dissemination coordinator for 20 hours per week to attend to this activity. The program maintains a database of stakeholders in specific industries/occupations for the distribution of reports, Haz Alerts, and newsletters, based on the nature of the report (industry, occupation, and cause of injury/death).

There will be targeted outreach to foster implementation of KY state-specific priority area research findings:

1. Transportation industry motor vehicle case reports, Haz Alerts, and other publications will be disseminated to employers on our transportation dissemination list, reaching 6000 transportation employers/employees.
2. Construction surveillance data results, Haz alerts, fatality reports, newsletters and publications will be disseminated to 373 employers on our dissemination list.

KOSHS will continue producing Haz Alerts, newsletters, and peer-reviewed publications to be distributed at statewide conferences and meetings such as the Governor’s Safety and Health conference and the State Coroner’s conferences. These presentations serve to expand our network of notification sources and increase the number of requests for KOSHS and FACE data and presentation materials.

Surveillance data will be analyzed with descriptive and advanced statistics using SAS, Microsoft Access and Excel. Basic descriptive analysis will be completed on all available variables in the datasets to assess data quality and to describe the cases. Missing variables will be assessed. Routine cross tabulations will be performed to assess relationships between variables. Outliers will be investigated for accuracy. Non-parametric statistics will be run on all non-normally distributed variables and chi-square, t-tests, and regression analysis will be used where appropriate.

Results of these analyses will be used in a number of ways. For communication with the media, we will tailor messages to influence positive changes in safety-related behavior. We will develop fact sheets, Haz Alerts, newsletters, reports, articles, and other dissemination materials. Reports will be generated that include rate-based comparisons, incidence rates, trends, magnitude of injury and illness, the geographic distribution of occupational injury and illness, injury costs, demographics, occupational and medical characteristics, route of exposure, and other contributors.

#### **C.6. Process, impact and outcome evaluation of the major activities conducted.**

Evaluation of the indicators, prevention, and dissemination components of the KOSHS program began in 2005 and will continue. The evaluation addresses the extent to which the KOSHS project is having an impact on reducing occupational injuries and illnesses in Kentucky, evaluate its goals, and assess the project’s efficiency. It will be primarily a process and impact evaluation resulting in descriptive statistics and a quantitative analysis. The following evaluation activities are proposed:

### Prevention and Dissemination

*Process Evaluation:* Process evaluation will document the quantity of reports, and Haz Alerts that we develop and disseminate. We will also determine the route information is received (e-mail, US mail, FAX).

*Impact Evaluation:* We will determine what audiences are receiving the prevention materials (e.g. employers, researchers, advocates, regulators, safety educators, employees) and how they rate them.

Self-reported telephone and mailed anonymous reply surveys will be utilized to determine the quality and usefulness of materials. The phone survey will be conducted approximately 3 months after the receipt of reports. We will ask whether the publication was useful, raised awareness of hazards, provided feasible recommendations, influenced working conditions, made recommendations that supervisors and workers would follow, and were used to change curriculum/training.

*Outcome:* The outcome of chief interest for KOSHS is evidence that reductions in all occupational injuries and illnesses resulted at least in part from dissemination and intervention activities of the KOSHS project. It is important to acknowledge from an epidemiological standpoint that one cannot eliminate the influence of factors outside the KOSHS program that impact occupational injuries/illnesses, so KY KOSHS will evaluate the burden of transportation injuries as the primary evaluation outcome of chief interest since much of our effort is focused in this area.

The KOSHS program is conducting numerous activities related to the prevention of occupational motor vehicle collisions including participation in the Governor's Executive Committee on Highway Safety, the Kentucky Motor Transport Association, and the Study Advisory Committee for the evaluation of Kentucky Vehicle Enforcement activities. We also staff a booth at the Mid-America Truck Show every year to disseminate prevention information, and we produce transportation fatality reports. We are involved in community awareness campaigns with Kentucky Vehicle Enforcement to distribute prevention information at inspection stops and in public information sessions. Our new emphasis on transportation industry MVC injuries will yield additional analysis of transportation industry injury rates and trends.

## **FACE methods**

### **C.7. Methods for Surveillance**

*New Initiatives:* Since motor vehicle collisions are the primary cause of death in Kentucky workers, variables for fatal occupational motor vehicle collisions (e.g., vehicle type, roadway type, number of lanes, collision with primary object) available from the CRASH dataset were added to the FACE database. Data from the investigation of occupational MVC fatalities complements the surveillance of *fatal and nonfatal occupational motor vehicle collisions* as our state-specific worker safety indicator (Indicator #20) that is proposed under the "fundamental" grant application this year. Comprehensive MVC data is routinely collected by the KY State Police and entered in the CRASH electronic files. Data made available to KIPRC for analysis includes all MVC information but excludes personal identifiers. Data is currently available for 1998-2007 (first 2 quarters). For the new initiative, we will use data from the Workers' Claims dataset to add new variables in the FACE data set to examine 1) hire date and injury date to determine length of time on the job when fatal injury occurred; 2) disposition of the Workers' Claims award; and 3) wages earned.

Kentucky's occupational fatality rate may be influenced by the amount of substance abuse among the state's residents. Kentucky ranks 2<sup>nd</sup> in the nation (Substance Abuse and Mental Health Services Administration, 2005) for the percentage of persons 26 years of age and older who used pain relievers nonmedically, and ranks 10<sup>th</sup> for cocaine use. For illicit drug use other than marijuana in the past month, Kentucky ranks 7<sup>th</sup> in the nation. In 2005, there were five confirmed positive drug results for 33 fatal occupational motor vehicle collisions (10 known negative and 18 still to be collected) (FACE data). Variables will be established in the database to explore altered risk of occupational injuries due to substance abuse. We will add variables on 1) whether or not a toxicology analysis was performed; 2) positive and negative drug results; and 3) the type of drug(s) found, from toxicology report data which is typically provided with the autopsy report.

### **C.8. Methods for On-site Investigations**

*Continuation of FACE Investigative Initiative:* MVCs are the leading cause of worker deaths in Kentucky (30%) and have increased from 28 in 2001 to 39 in 2005. Most occur in the transportation sector: from 1994-2005, there were 184 transportation industry-specific MVC worker deaths. Of the 17 transportation MVC deaths in 2005, 14 were in semi trucks. Additionally, from 2002 to 2006, there were 395 dump truck driver injuries and nine fatalities among dump truck drivers. These statistics identify *transportation sector-specific worker deaths in semi trucks and dump trucks* as a state priority area of focus for investigation.

Based on preliminary work in this area in Kentucky, using CRASH and FACE data, semi-trucks are more frequently involved in fatal occupational MVCs (45% of all fatal occupational MVCs), and most occur on 4-lane highways. The most frequent human factors involved in a KY fatal occupational MVC are driver fatigue/falling asleep and distraction/inattention. In a follow-up retrospective population-based case-control study, sleepiness/fatigue (Odds Ratio [OR]= 21.03), distraction/inattention (OR=3.16), age of 51 years and older (OR=2.94), and nonuse of seat belts (8.21) increased the odds that a commercial vehicle collision would be fatal (Bunn *et al.* 2005). These initial studies indicate the need for more information on employer safety management practices such as safety training, dispatcher scheduling, company assistance with loading and unloading, hours of service per day, monetary compensation per mile driven, type of route driven (fixed route, variable route), presence of team drivers, and schedule irregularity. The identification of good safety management practices as prevention interventions in the workplace is necessary to reduce the number of occupational MVC deaths in the transportation industry. In addition, individual risk factors such as health status, substance abuse, and number of hours of sleep will target worker population-specific interventions. Collision characteristics such as vehicle type, number of lanes, highway type, time of day, and length of time on job will also be included and this information is available in the KY CRASH and Workers' claims datasets for which we already have access to. These data elements, derived from FACE employer interviews and CRASH reports, will be included in our MVC fatality reports.

The reports will help define the risk factors for occupational MVCs and will be disseminated through two different avenues:

1) Transportation sector reports will be discussed in the Governor's Executive Committee on Highway Safety, a group that includes the KY State Police Commissioner and Governor's Representative for Highway Safety, the Commissioner for KY Vehicle Enforcement, and the KY Motor Transport Association, as well as the director of KIPRC. This information has already influenced vehicle enforcement by supporting a positive drug test result law in Kentucky. A database of 6000 employers/employees in the transportation sector who regularly receive and rely on FACE transportation-related reports and Haz alerts for safety training purposes will be maintained

2) All MVC fatality reports will be disseminated through our state-specific Kentucky-Working to Save Lives consortium established with our fundamental occupational safety and health grant.

### **C.9. Case-Control Study of Motor Vehicle Injury Collisions Among Older Male Drivers**

*New Initiative:* In the year 2000, on- and off the job- motor vehicle collisions cost employers approximately \$60 billion annually, including \$18.4 billion in risk premiums, and \$16.3 billion in fringe benefit costs. Older driver age has been associated with an increased risk for injury fatalities. In working drivers, older truck drivers are more likely to fall asleep at the wheel, and suffer an injury fatality. When comparing occupational vs. nonoccupational drivers in motor vehicle collisions, the human factors more frequently involved in an occupational motor vehicle collision are driver distraction/ inattention and fatigue, whereas alcohol and speed are the primary human factors for a nonoccupational motor vehicle collision.

In a preliminary study performed at the University of Kentucky, it was found that older drivers were safer at night when carrying two or more passengers. The effect of passengers on severe injury/fatality motor vehicle collisions among older working male drivers is unknown when compared to older nonworking male drivers. A retrospective population-based case-control study will be performed to determine the association between the number of passengers and incapacitating/fatal injuries in occupational and non-occupational motor vehicle collisions among older male drivers ( $\geq$  50 years of age). Kentucky CRASH data will be analyzed from the years 2000-2006. Inclusion criteria will be based on 1) Person type (driver) and position

in vehicle (driver's position); and 2) Classification of motor vehicle collision: a) Incapacitating injury/fatality (cases); and b) No injury/non-incapacitating injury (controls). The primary variables of interest will be: 1) at fault vs. not at fault; 2) weather; 3) time of day; 4) alcohol; 5) speed; 6) driver distraction/inattention; 7) restraint use; and 8) fatigue.

A descriptive analysis will be performed to characterize the driver factors (e.g. restraint use, human factors, at-fault vs. not at fault, vehicle occupant gender mix, etc.) and collision attributes (e.g. speed limit, roadway character, precollision vehicle action, time of day, weather, number of lanes) involved in a motor vehicle injury collision and summary statistics will be generated. A bivariate analysis of association between exposure variables and outcome (no injury vs. severe/fatal injury) will be undertaken. Odds ratios and 95% confidence intervals will be calculated using the Mantel-Haenszel method and a conditional logistic regression model using stepwise selection will be utilized.

The results of this study have the potential to influence public policy in regard to the presence of passengers and their potential positive effect on working drivers, particularly in long-distance driving performed by team drivers vs. solo drivers in commercial trucking operations.

#### **C.10. Development of Fatality Narratives of Interpersonal Violence-Related Occupational Homicides**

*New Initiative:* In the year 2000, injuries and deaths from violence were reported to cost at least \$70 billion. Homicides in the workplace cost approximately \$6.5 billion from 1992-2001. The southern region of the US that includes Kentucky has the highest workplace homicide rate in the country (0.06 deaths/100,000 workers in the South compared to 0.03 in the Northeast and in the Midwest, and 0.04 in the West) and almost half of the workplace homicides occur in the South. Since 1994, Kentucky has recorded 118 workplace homicides, the 5<sup>th</sup> leading cause of KY worker deaths, and 85% involved firearms.

Corrine Peek-Asa from the University of Iowa divided workplace violence into 4 distinct categories- I: Criminal Intent, which accounts for 85% of all workplace homicides nationwide; II: Customer/Client, 3% of workplace homicides; III: Worker-on-Worker, 7%; and IV: Personal Relationship, 5%, including domestic violence victims. Nationally, while Type I workplace homicides have declined significantly in the past decade, Type IV workplace homicides have declined significantly less than the other three types. Of the 118 occupational homicides in Kentucky, preliminary FACE surveillance data indicate that 19% of the deaths involved a Type IV relationship, more than triple the national estimates.

The use of fatality narratives in safety training of worker populations has been demonstrated to communicate hazards effectively and promote changes in worksite practices and to serve as a useful information resource. Fatality narratives are usually one page in length and contain a narrative paragraph plus best practice recommendations. The recommendations contain both specific and general industry controls addressing human factors, supervisory procedures and recommendations for communication.

Using the FACE occupational homicide surveillance database that includes Adult Protective Services (statewide domestic violence) data, court records (domestic violence protection orders and stalking/no contact orders), and police reports, fatality narratives for Type IV workplace homicides will be developed for 24 of the 28 total homicides involving interpersonal violence. Data variables provided by the FACE occupational homicide database include occupation, industry, age, gender (victim/perpetrator relationship and status), weapon, cause of death, and location. The Adult Protective Services data, domestic violence protection orders and stalking-no contact orders, and police reports recorded in the database document a prior history of domestic violence and help identify additional risk factors for an occupational homicide.

The use of domestic violence-related police reports provides additional information on the fatal and previous offenses, location and date of occurrence, presence of drugs and/or alcohol, injury type, whether the case was prosecutable, relationship between suspect and victim, and weapon used. Adult Protective Services data potentially includes dates and types of previous maltreatment, family development stages, education level, employment status, and sequence of domestic violence-related events.

The fatality narratives will help to identify the specific worker populations at risk and the recommendations will employ multidisciplinary behavioral, administrative, and environmental approaches for employers to supplement workplace violence training.

### **C.11. Methods for Dissemination and Prevention Activities**

There will be targeted outreach to foster implementation of KY-specific priority area research findings:

3. Logging-related reports will be sent by e-mail or US mail to 278 employers in our logging database, organizations such as the Forest Resources Association, which reaches 4,500 persons and uses selected KY FACE reports for its *Safety Alerts*, and the University of Kentucky, Department of Forestry, which offers the Certified Master Logger program, reaching 2,500 master loggers per year. With the UK Department of Forestry, newsletters, hazard alerts, our logging video, and case reports are incorporated in the master logger program certification training for new participants and continuing education. FACE fatality data are published in the *Kentucky Log Jam* that is disseminated to Master Loggers and aligned professionals. hazard alerts are used in monthly safety trainings (tailgate trainings) by Master loggers. All safety materials are available on our website to download for free.
4. Transportation industry motor vehicle case reports, Haz Alerts, and other publications will be disseminated to employers on our transportation dissemination list, reaching 6000 transportation employers and employees. They will also be disseminated and discussed in the Governor's Executive Committee on Highway Safety, a group that includes the KY State Police Commissioner and Governor's Representative for Highway Safety, the Commissioner for KY Vehicle Enforcement, and the KY Motor Transport Association. Also on the committee are the KY Transportation Cabinet Deputy Secretary, the Commissioner of Vehicle Regulation, the Commissioner of Highways, the Directors of the Division of Driver Safety, Division of Maintenance, and Division of Traffic Operators, the Highway Safety Operations manager, the Federal Motor Carrier Safety Administration, the Transportation Research Center, the Kentucky Chiefs of Police Association, the Kentucky Sheriff's Association, the KY Board of Emergency Medical Services, the KY Office of Insurance, and the KY Administrative Office of the Courts.

KY FACE will continue producing hazard alerts, newsletters, and peer-reviewed publications to be distributed at statewide conferences and meetings such as the Governor's Safety and Health conference and the State Coroner's conferences. These presentations serve to expand our network of notification sources and increase the number of requests for FACE data and presentation materials. Based on our presentation at the Governor's Safety and Health conference this last May, we have been asked to give presentations on the prevention of occupational fatalities at the International Municipal Signal Association meeting in August 2007.

An annual report will be produced and disseminated containing industry-specific, occupation-specific, and cause of death-specific statistics. The years of potential life lost and future lost productivity in the major industries will be calculated.

### **C.12. Methods for Evaluation**

Evaluation of the surveillance, investigation, and prevention and dissemination components of the FACE program, which began in 2002, will be continued. The additional evaluation endpoints described in this proposal will be useful for the further determination of the long-term impact of the FACE program on the reduction of occupational fatalities. The evaluation will continue to address the extent to which the FACE project is having an impact on reducing occupational fatalities in Kentucky, evaluate its goals, and assess the project's efficiency. It will be primarily a process and impact evaluation resulting in descriptive statistics, and a quantitative analysis. The following evaluation activities are proposed:

#### Surveillance

Credible evidence will be gathered on:

- 1) Flexibility- The ability of the system to adapt to the addition of new variables and information fields will be assessed to determine how well the system is responding to new demands and changing information needs. The addition of the substance abuse variable will be the test of flexibility.
- 2) Data quality- Data completeness will be assessed for all variables and missing data analyzed. Accuracy and completeness will be measured by comparing a sample of 25 first reports with death certificate data.
- 3) Acceptability- Agency participation rates and timeliness of reporting of deaths by various agencies to the FACE program will be monitored.
- 4) Sensitivity/representativeness- Comparisons with the CFOI program will be done routinely as before.
- 5) Positive predictive value – The percentage of initial reports that are noncases (false positives) or uncertain will be calculated, and all reported cases will be confirmed through multiple sources, including the local coroner.
- 6) Timeliness- The time between a fatal work incident and notification of the FACE program will continue to be monitored.

### Investigations

Investigations will be assessed in several dimensions:

- a. The usefulness of case data and interview information gathered from investigations for effective public action;
- b. The costs of investigations, including personnel time and financial resources;
- c. The percent of in-scope cases investigated and completed;
- d. The number of cases where the root cause of the work fatality was determined; and
- e. The time to complete an investigation and the time between initial notification and investigation initiation.

### Prevention and Dissemination

*Process Evaluation:* The process evaluation will document the quantity of case reports and Haz Alerts that we develop and the quantity of reports and hazard alerts that we disseminate. We will also calculate the number of case reports and hazard alerts by distribution route (e-mail, US mail, fax).

*Impact Evaluation:* We will determine what audiences are receiving the prevention material (e.g. employers, researchers, advocates, regulators, safety educators, employees) and how they rate them. Self-reported telephone surveys and mailed anonymous reply surveys will be used to determine the quality and utility of materials, and to assess changes in worksite practice based on the report recommendations received. The self-reported phone survey will be conducted approximately three months after the receipt of evaluation reports. We will ask whether the publication was useful, raised awareness of hazards, provided feasible recommendations, influenced working conditions, made recommendations that supervisors and workers would follow, and was used to change curriculum/training.

*Outcome* – The outcome of chief interest for FACE is evidence that reductions in all occupational fatalities resulted at least in part from dissemination and intervention activities of the FACE project. It is important to acknowledge from an epidemiological standpoint that one cannot eliminate the influence of factors outside the FACE program that impact occupational fatalities. For this reason, KY FACE will evaluate transportation injuries and logging injuries as primary evaluation outcomes of chief interest.

- a. The FACE program has conducted numerous activities related to the prevention of transportation fatalities including distribution of prevention materials during community awareness campaigns in conjunction with Kentucky Vehicle Enforcement, the production of six transportation fatality reports (10 more will be produced by the end of this fiscal year), and a booth at the Mid-America Truck Show. With our new emphasis on transportation industry MVC fatalities, we will perform additional analysis of transportation fatality rates and trends.

- b. Logging industry fatality rates and trends, another outcome measurement, will continue to be calculated. FACE program materials such as a logging video entitled "Logging Safety- Loading and unloading logs safely" are incorporated into the Kentucky Master Logger training, logging fatality reports are produced, and data are published in the *Kentucky LogJam*, a newsletter for Master Loggers and aligned professionals. Logging fatality rates have decreased significantly from 1994-2005 and the logging fatality rates will continue to be monitored with the proposed study. The Master Logger program relies on our case reports for new and continuing education of Master Loggers in Kentucky.

## **D. Results and Discussion**

### **D. 1. Surveillance Data and Epidemiological Analyses**

Annual reports were compiled and disseminated in Spring 2009 and Spring 2010 for all 19 indicators and four KY-specific indicators for the KOSHS program. The KY-specific indicators were: 1) fatal and nonfatal occupational motor vehicle collisions (MVCs) using CRASH data; 2) occupational MVCs using DWC first reports of injury and claims; 3) occupational falls using DWC first reports of injury and claims; and 4) public sector worker injuries. Annual reports for the FACE program were also produced in Fall 2008 and Fall 2009 that included industry and occupation statistics as well as the years of potential life lost. The most common external cause of death for KY workers was MVCs (30%). Occupational MVC deaths were studied for injury prevention research purposes (Bunn *et al.* 2009) by KOSHS and FACE personnel, and many prevention materials were developed to raise awareness of MVCs as an occupational problem in Kentucky. Our new state-specific indicator on public sector worker injuries added in Spring 2010 led to the identification of volunteer firefighters as a high injury risk occupational group. Using that data, we applied for a Susan Harwood grant in Summer 2010 to train firefighters on heat exhaustion and fall prevention.

In the exploration of alternative surveillance data sources, emergency department admission intake data from the University of Kentucky was analyzed for work-relatedness and payment source (Nicholson *et al.* 2008). Twenty percent of all self-reported work-related injuries were not billed to workers' compensation, and were not covered by personal health insurance. A higher proportion of the work-related injuries occurred among Hispanics, among workers under the age of 25, and within the construction industry.

Narrative information in fatality investigation reports contains data elements not routinely analyzed with coded occupational injury surveillance data. A narrative text analysis of 69 FACE agricultural tractor fatality reports from 1994-2004 was the basis for a multiple logistic regression analysis for association between identified exposure variables and the outcomes of interest (Bunn *et al.* 2008). The operation of a tractor with an attached bucket, muddy terrain, and being thrown from the tractor were independent risk factors for being declared "dead at the scene". A tractor rollover and the operation of a tractor on a slope were independent risk factors for being crushed by a tractor. The study concluded that narrative text analysis of FACE fatality investigation reports was a valuable tool for the identification of additional factors contributing to tractor fatalities that can inform farm safety training, identify new areas for agricultural interventions, and support the development of new agricultural engineering strategies.

Regarding the surveillance and analysis of chemical exposures at work, a pilot study was conducted and recently published on dermal exposure of farmers to organic solvents (Bunn *et al.* 2009). A survey questionnaire was administered to 31 Kentucky farmers in 2008, and dermal exposure assessment was conducted in 10 farmers while farmers performed farm machinery maintenance/repair tasks. Toluene and xylene were identified at high concentrations in dermal patches that the farmers wore while repairing/maintaining their farm machinery. The results showed the need for further studies to characterize and evaluate chemical exposures in larger samples of farmers.

In the expansion of existing occupational injury and illness surveillance data sources, input was provided to the Kentucky Department for Public Health to develop a new death certificate and to expand the A3 electronic death certificate files which became effective July 1, 2010. A narrative field, expanded education

and ethnicity questions, and 2 transportation- related fields were added to the new death certificate and A3 electronic file.

### **Work-Related Poisonings**

Unintentional poisonings were the second leading cause of injury in the United States (CDC, 2008) in 2005 after motor vehicle injuries. Unintentional poisonings at work resulted in 34 hospitalizations in the years 2003-2007 in KY. The KOSHS program has directed prevention efforts and performed a number of studies in the area of unintentional poisonings. A hazard alert entitled "Truck Drivers in Fatal Crashes after Substance Abuse", was published and disseminated to trucking companies. Also, a KOSHS staff member was a contributing consultant for a University of Kentucky report on methamphetamine and other drug use (Turner and Walker, 2008). In addition, a peer-reviewed publication was produced on methadone related poisonings in Kentucky using multiple data sources. Six of the methadone-related poisoning victims had reported workers' claims as the payer on hospitalization billing forms associated with the methadone-related poisonings (Bunn *et al.* 2010).

Substance abuse has been documented in a number of KY fatal occupational MVCs that were investigated (n=15). A fatality report on a trucker who died when exiting an interstate off-ramp with a 0.6% blood level of cocaine was produced and distributed by the FACE program. One of the prevention recommendations in the report was that "a statewide database containing commercial driver positive drug/alcohol test results should be identified". The release of this report was brought to the attention of Kentucky state senators who proposed legislation to require an employer of any driver with a CDL who tests positive for drugs/alcohol to notify the Transportation Cabinet within five business days. The CDL holder would then be disqualified from driving until proof was received of successful completion of drug/ alcohol rehabilitation. FACE personnel testified before the Kentucky General Assembly's Interim Joint Committee on Transportation in 2008 and provided copies of the fatality report, three similar fatality reports, and trucking hazard alerts to members of the committee. The bill will be resubmitted in 2011.

### **Occupational Motor Vehicle Collisions**

In 2008, there were 11,898 occupational MVCs in Kentucky, a decrease from 12,673 in 2007, with 126 drivers or occupants killed and 2,676 people injured. The occupational driver motor vehicle fatality rate was 6.6/100,000 employed persons in 2008, and has been decreasing since the year 2004 when the rate was 12.3/100,000 employed. A number of prevention materials have been produced to address occupational MVCs. Three hazard alerts, and one peer-reviewed publication were published and disseminated. In addition, a video on the prevention of bucket truck injuries was produced by the Lexington Fayette Urban County Government (LFUCG) which contained an interview with KOSHS personnel and utilized bucket truck fatality data. The video is available on our FACE and KOSHS websites.

A retrospective population-based case-control study was conducted by KOSHS personnel to determine whether semi truck driver age, gender, and the presence of passengers affected the likelihood that a semi truck driver would be at-fault in a semi truck collision (STC) with another vehicle (Bunn *et al.* 2009). The results from the final multiple logistic regression analysis showed that solo semi truck drivers, aged 65 and over, were at highest risk for at-fault STCs with other vehicles. However, the presence of passengers in the semi truck had a protective effect for semi truck drivers aged 65 and older. The results of this study have the potential to inform public policy in regard to the presence of passengers and their positive protective effect on older semi truck drivers, particularly in long-distance driving performed by solo vs. team semi truck drivers.

In 2006, fire departments responded to over 278,000 vehicle fires (National Fire Protection Association). From 2005-2008, there were 17 fatal occupational collisions in KY involving semi tractors which caught on fire, and four related FACE reports have been produced. Based on KY FACE report #07KY070, "Semi-Tractor Trailer Driver Hauling Chicken Dies after Striking a Rock Wall", a fuel shut-off valve prototype for refrigerated trailers was designed. The semi truck driver crashed and was incinerated when diesel fuel dripped onto an exhaust pipe from the refrigerated semi tractor and caused a fire. The fuel line from the refrigeration unit on the trailer had been compromised during the collision. Students from the University of

Kentucky, College of Engineering, designed a fuel supply shutoff prototype for refrigeration units when a fuel line is compromised. The shutoff system was designed with a signal to alert the driver when the fuel flow has been stopped and will have an override switch. The prototype was successful, so the next step will be to test the fuel supply shutoff on a semi refrigeration unit.

#### **D. 2. Nonparametric Statistical Analysis Methods to Identify Geographic Areas of KY Highways with the Highest Probabilities of Commercial Vehicle and Coal Truck Crashes**

The KOSHS research team made a significant contribution to the statistical field by developing and implementing the k-th Nearest Neighbor (kNN) relative risk estimator as an exploratory tool for relative risk assessment in injury research. The concept of relative risk was initially motivated by epidemiological studies where disease cases were recorded with their spatial positions. The question of interest was to identify if the risk of contracting the disease changed over a geographical region. The pattern of occurrence of cases was considered to be related to the population distribution within the region. The existing and popular methods for relative risk assessment are historically developed for rare events (cancer, infectious diseases) risk assessment and are computationally intensive. However, the analysis of injury data is very different from analyses of infectious diseases, bioterrorism, and cancer surveillance data. Injury surveillance gathers and integrates data from a variety of sources, each with large datasets. The construction of state maps to determine injury risk for certain populations or industries required a new statistical approach and KOSHS researchers were successful in developing and implementing such a tool known as kNN relative risk (RR) estimator (Pavlov *et al.* 2009).

The kNN RR estimator is asymptotically unbiased and consistent for large samples (Slavova *et al.* 2008; the hypothesis testing based on the kNN estimator is straightforward due to the closed form of the asymptotic distribution (Pavlov *et al.* 2009), and has been applied successfully in Kentucky injury surveillance studies to identify areas of high risk of collisions for certain populations.

The method was applied to a case-control study in which the relative risk of motor vehicle crashes caused by female drivers was compared to male drivers in the state of Kentucky as a function of age and the time of the crash. Female drivers were more likely to be at fault in collisions during the morning hours from 7:30 to 9:00 with a peak around 8:30am. The leading human factors recorded on police crash reports for both genders were inattention (cited in about one third of the collisions), and failure to yield the right of way. Male drivers were at higher risk of at-fault collisions during the late evening and early morning hours (Pavlov *et al.* 2009).

In another KOSHS study, the nonparametric kNN method was applied to the CRASH dataset to identify areas within the state where older large truck drivers were at higher risk for at-fault collisions in order to improve our injury prevention education programs. Our exploratory analysis showed that older commercial drivers were at higher risk for at-fault collisions mainly in two geographical areas of the state, off the interstates. Curvy and graded/hillcrest roads and one- and two- lane roads increased the odds that the driver would be at fault in a collision. This information was shared with CVE to target commercial vehicle enforcement in these areas (Slavova *et al.* 2008).

A third study was presented at the International Workshop in Applied Probability to identify the geographical locations where commercial large truck drivers (CLTD) are at a higher risk of being at fault in a collision at night versus the daytime hours. Results showed that CLTDs were at higher risk for at-fault collisions at night in two geographical areas - in the northern part of the state and in western Kentucky. Most of the night collisions (70%) in the northern area occurred at two truck stops off interstate I-75 (Walton-Verona Rd and Richwood Rd). Inattention and misjudged clearance were the factors most often cited for the collisions. Ongoing commercial development, increased semi truck traffic congestion, and the limited parking capacity of the two existing truck stops were possible contributing factors for the increased risk. The second area of high relative risk occurred on the highway- mainly on I-65 or the Western Kentucky Parkway in Hardin and Hart counties involving single vehicle collisions (44%) or a sideswipe in the same

traffic direction (35%) The lack of enough rest areas and truck stops for drivers to utilize when sleepy or fatigued could be a contributing factor for the higher risk of night collisions in this geographical area. The hypothesis was supported by the high number of collisions where drivers fell asleep. The identification of specific geographic locations (two truck stops in northern Kentucky and along a specific stretch of I-65 in western Kentucky) were be used to inform agencies (i.e. CVE and the Kentucky Department of Transportation) and organizations (Federal Motor Carrier Safety Administration and Kentucky Motor Transport Association) and to direct occupational injury prevention efforts to reduce the risk of commercial motor vehicle collisions in Kentucky.

### **D.3. Partnership Building and the “Working to Save Lives” Consortium.**

#### **Partnerships**

Public industry sector A partnership with the Lexington-Fayette Urban County Government (LFUCG) used FACE data in the production of a safety training video to prevent bucket truck lift injuries. The video is available on our web site at <http://www.kiprc.uky.edu/face.html>. Following the production of this video, a second partnership was formed in June 2009 with the LFUCG Department of Environmental Quality to develop a safety management system for the Division of Waste Management. The purpose of the system is to identify work-related injuries and at-risk worker populations, to describe trends to educate workers about job hazards, and to guide regulatory action. KY FACE analyzed vehicle accident claims and Workers' Compensation claims for the years 2003-2008, which led to the identification of targeted emphasis areas for worker injury reductions, and the development of prevention strategies to be included in the safety management system.

Transportation sector Important partnerships were formed to collaborate on new projects, to disseminate prevention information, and to raise safety awareness within the trucking community. Our partnership with CVE continues to address the prevention of commercial vehicle collisions. Interventions include community awareness campaigns involving the dissemination of fatality reports and publications to commercial truck drivers in Kentucky at weigh stations. In this partnership with KY Commercial Vehicle Enforcement, 100 packets of prevention information and resources were distributed to 100 truck drivers at a weigh station in Northern Kentucky in November 2009 for Driver Appreciation Days, and this partnership will be an annual event. Second, KOSHS personnel have been members of the Governor's Executive Committee on Highway Safety (GECHS) since 2007 and FACE personnel are members of the Highway Fatality Review Team, formed out of the GECHS in January 2009. Emphasis areas include the prevention of commercial vehicle fatalities, and pedestrian fatalities.

A KOSHS personnel member is the chair of the Kentucky Traffic Records Advisory Committee which provides input on the improvement of traffic records systems within KY. Recommended projects for funding for years 2009-2011 were 1) the continuation of funding for the collection of emergency department data which began in January 2008; 2) a project to collect emergency medical services (EMS) run data in Fall 2010; and 3) a project to expand the trauma reporting system in Kentucky.

General A partnership was formed with the US Department of Labor (DOL) in April 2009. The FACE program now provides the US DOL newspapers articles on Kentucky worker deaths related to agricultural and migrant worker deaths.

The KOSHS program partnership with the KY DWC was expanded in June 2009 to provide the KOSHS program with the entire DWC dataset of first reports of injuries and claims. Previously, the KOSHS program only received the electronic files of first reports of injuries and claims for the individual indicators that were included in the annual occupational injury indicator report.

A new partnership was formed with the Kentucky Chamber of Commerce in September 2009. The KY Chamber of Commerce now disseminates hazard alert and fatality reports from the KOSHS and FACE

programs. They were also supportive of the worker safety presentation by helping to advertize the panel presentations on the value of a worker safety program.

A partnership with the Foundation for a Healthy Kentucky was formed in 2009. Data from our KOSHS and FACE programs on non-fatal injuries and illnesses, work-related hospitalizations, and fatal work injuries is being used as indicator data on their *Kentucky Health Facts* website.

### **Multi-State Collaborations**

Of the 15 states currently funded to perform occupational safety and health surveillance, KY was among 10 states who collaborated on the addition of a Behavioral Risk Factor Surveillance System module in 2007 concerning self-reported occupational injuries. This state-added module 1) estimated the degree of underreporting of worker self-reported occupational injuries by the KY DWC, and 2) provided an indication of the true burden of occupational injuries in KY by including self-employed worker injuries (the DWC does not routinely include self-employed injury claims since an employer only needs to have workers' claims coverage if there is more than one employee). The data served two primary purposes: 1) to estimate the prevalence of workers with work-related injuries in KY and in the other nine states; and 2) to determine the magnitude of underreporting to the KY DWC and among the ten states. An MMWR article was recently published on this multi-state collaboration (CDC, 2010).

### **“Working to Save Lives” Consortium**

Occupational injuries were recognized as one of the top five injury prevention priorities for the state. The advisory committee, established in May 2006, serves to foster collaborations and shares resources between the various stakeholders in the state to improve worker safety and health. A list-serve was established for communication among stakeholders between meetings. The advisory committee is very active and two major products have been produced to date. First, a statewide occupational injury prevention plan was developed and incorporated into the 2010 KY Strategic Plan for Developing Core Capacity for Injury Prevention and Control. Recommended action steps for the prevention of occupational injuries included the provision of KY OSHA resources to KY employers, education of employers on the value of a worker safety program, promotion of partnerships between resource providers and employers, dissemination of occupational injury prevention information to smaller employers, and the provision of baseline occupational injury surveillance data to inform employers, monitor trends and make state comparisons.

A significant need identified by stakeholders was the number of small companies in KY without worker safety programs. A worker safety program presentation, including true stories and statistics, was developed geared to new and established small business owners. The presentation contained information on workers' compensation, basic elements and implementation of a worker safety plan, and how workers' compensation premiums were impacted by the variation in the quality (or even presence) of a worker safety plan. The worker safety program presentation was uploaded onto our website and a link to our program was added to the One-Stop Business Licensing Program on the KY Secretary of State's website that provides information to individuals establishing new businesses. The worker safety program has been presented to the Small Business Advocacy Commission, the Kentucky Cabinet for Economic Development, the Small Business Development Center, the US Army Corps of Engineers, and others.

A new partnership was recently formed between the KY Department of Workers' Claims (DWC), KY OSHA, and the KOSHS program. In May 2010, a panel presentation was given in Owensboro, KY, on the value of a worker safety program using our worker safety presentation and presentations by both the DWC and KY OSHA. The panel presentation was geared towards those individuals who recently opened a business within the last year. The KY Secretary of State kindly provided the electronic file with the names and addresses of all individuals who had applied for a business license within the past year, KY OSHA printed the postcard invitations, and the DWC paid the postage. Thirty attendees were present and the response was overwhelmingly in favor of these types of presentations. Numerous employers commented that the presentations was pivotal in raising awareness about the necessity of having a worker safety

program in terms of cost savings due to reduced workers' compensation premiums, potential OSHA fines, and reduced injuries.

In September 2009, an article on the value of a worker safety program was written by KOSHS program personnel and published in the Kentucky Bench and Bar, a bi-monthly publication of the Kentucky Bench and Bar (Costich, Bunn and Robertson, 2009). The purpose of the article was to inform lawyers of the presentation as a resource for new business clients, and to raise awareness and encourage adoption of a worker safety program among new small business owners. Also, the worker safety presentation was included in the November 2009 NIOSH e-news and the following response was received from Jeffrey Camplin, Administrator of the Environmental Practice Specialty (EPS), member of American Society of Safety Engineers (ASSE's) Editorial Review Board, and president of Camplin Environmental Services in Rosemont, IL.:

"I just reviewed your PowerPoint presentation on 'Safety can make me money'. It was a link on the NIOSH News email. The presentation was great. I have asked the (ASSE) to post the link to your work on their Business of Safety webpage <http://www.asse.org/practicespecialties/bosc/index.php>. In addition, I am revising my chapter in the ASSE 'Safety Professional's Handbook' on safety management and would like to add a link to your work in the book. I cover the same material; however, it would be nice to have your presentation available as well. Great job! You have made a great contribution to the field of safety."

### **Policy**

KOSHS program personnel formed a partnership with the Kentucky Equal Justice Center and the KY AFL-CIO to address the misclassification of worker employment status and workers' compensation, including the drain on workers' compensation funds, the impact on health providers and payers, sources of data, and worker injury stories. The partners submitted a legislative bill for the 2009 legislative session on the misclassification of employment status (fines were proposed for those employers who intentionally misclassify their worker) and want to use FACE and KOSHS stories to bolster the bill which will be resubmitted in the 2011 legislative session.

Substance abuse has been documented in a number of KY fatal occupational MVCs that were investigated (n=15). A fatality report on a trucker who died when exiting an interstate off-ramp with a 0.6% blood level of cocaine was produced and distributed by the FACE program. One of the prevention recommendations in the report was that "a statewide database containing commercial driver positive drug/alcohol test results should be identified". The release of this report was brought to the attention of Kentucky state senators who proposed legislation to require an employer of any driver with a CDL who tests positive for drugs/alcohol to notify the Transportation Cabinet within 5 business days. The CDL holder would then be disqualified from driving until proof was received of successful completion of drug/ alcohol rehabilitation. FACE personnel testified before the Kentucky General Assembly's Interim Joint Committee on Transportation in 2008 and provided copies of the fatality report, three similar fatality reports, and trucking hazard alerts to members of the committee. The bill will be resubmitted in 2011.

KOSHS personnel participated on the KY Commercial Vehicle Committee which provided input for the Commercial Vehicle emphasis area of the 2010 KY Strategic Highway Safety Plan developed by the KY Transportation Cabinet. The 2010 KY Strategic Highway Safety Plan contains a number of important recommendations: a) safety training for small trucking companies; b) increased number of truck rest havens; c) distribution of KOSHS materials at 24 rest stops and 4 truck havens in KY; and d) a recommendation for a positive drug test law similar to one mentioned in the above paragraph.

Based on KY FACE report #07KY070, "Semi-Tractor Trailer Driver Hauling Chicken Dies after Striking a Rock Wall", a fuel shut-off valve prototype for refrigerated trailers was designed. The semi truck driver was incinerated after crashing when diesel fuel dripped onto an exhaust pipe from the refrigerated semi tractor and caused a fire; the fuel line was compromised during the collision. Students from the University of Kentucky, College of Engineering, designed a fuel supply shutoff prototype for refrigeration units when a

fuel line is compromised. The shutoff system was designed with a signal to alert the driver when the fuel flow has stopped and has an override switch. The prototype was successful, and the fuel supply shutoff will next be tested on a semi refrigeration unit. The same fatality report also contained a recommendation to construct breaks in concrete median barriers to allow the passage of EMS personnel. The collision scene was not reached for approximately 20 minutes because EMS personnel had to drive north, approximately ten miles on the interstate, exit, and then drive back up to the scene five more miles away. In July 2009, after many conversations with the KY Transportation Cabinet, cable barriers and concrete barriers in the median are now being constructed with breaks every two miles to allow passage of emergency personnel.

### **D.3. Dissemination of Surveillance data and Results**

A partnership was formed with the Kentucky Motor Transport Association (KMTA) in 2006. Members such as the Great West Casualty Company routinely use our fatality reports and distribute them to their 1,800 members and 45,000 drivers. Fatality reports are routinely disseminated through the KMTA and members are consulted when fatalities occur. KOSHS personnel are members of the Safety Council within the KMTA, and KOSHS and FACE personnel routinely consult with other members on trucker safety recommendations and intervention development for the Kentucky trucking industry.

### **Website Activity**

Detailed descriptive and statistical analyses were performed periodically to understand trends, define new focus areas, and to respond to data requests from media, governmental agencies and researchers. Website activity from July 1 2008- June 30 2010 included 9,703 hits and 8,457 visits to the FACE and KOSHS website. Within the Kentucky Injury Prevention and Research Center website, fatality report #04KY101 was downloaded 8,175 times, #05KY036 was downloaded 10,220 times, #07KY070 was downloaded 3,974 times and #06KY079 was downloaded 3,912 times during the grant-funded period.

### **Media**

- E. University of Kentucky News Release, "Worker Safety Program Makes Sense and Saves Cents", August 4, 2010.
- F. University of Kentucky News Release. "KIPRC Raises Trauma Awareness". May 19, 2010.
- G. Lexington Herald Leader, "Worker Safety Program Makes Sense". July 13, 2010.
- H. NIOSH e-news, "Kentucky's Worker Safety Program". November 2009.
- I. Advanced Safety and Health e-newsletter, "Kentucky- Above Average Occupational Fatality Rate". December 2008.

### **Presentations (Selected)**

1. Bunn TL. Injuries Among Solid Waste Collectors in the Private vs. Public Sectors, Council of State and Territorial Epidemiologists meeting, Portland, OR, June 2010.
2. Bunn TL. How stories impact policy: transportation injury prevention in Kentucky, Council of State and Territorial Epidemiologists meeting, Portland OR, June 2010.
3. Robertson M. Worker safety management programs protect workers and make small businesses money, Council of State and Territorial Epidemiologists meeting, Portland OR, June 2010.
4. Bunn TL, KY State Worker Injuries, KY Personnel Cabinet, Frankfort, KY, May 2010.
5. Bunn TL, Robertson M. The KOSHS program. KY Governor's Safety and Health conference, Louisville, KY, May 2010.
6. Robertson M. A worker safety program saves cents and makes sense, Owensboro, KY, May 2010.
7. Robertson M. Small business worker safety presentation, Associated Builders and Contractors Kentuckiana, Louisville, KY, April 2010.
8. Robertson M. Small business worker safety presentation, Associated Builders and Contractors Kentuckiana, Bowling Green, KY, April 2010.
9. Bunn TL, Robertson M, Robeson S. KOSHS and FACE programs, NIOSH Division of Surveillance, Hazard Evaluations, and Field Studies, Cincinnati, OH, April 2010.
10. Bunn TL. Methadone-related poisonings in Kentucky. Safe States meeting, Ann Arbor, MI.

11. Bunn TL. KY KOSHS and FACE programs, Annual KY Coroners conference, Louisville KY, April 2010.
12. Robertson M. Small business worker safety presentation, Associated Builders and Contractors Kentuckiana, Frankfort, KY, March 2010.
13. Bunn TL. Methadone –related poisonings in Kentucky, Center for Drug and Alcohol Research, Lexington KY, February 2010.
14. Robertson M. A safety program can make me money?, Society of Army Mechanical Engineers, Louisville KY, January 2010.
15. Robertson M. The value of a worker safety program, Kentucky Motor Transport Association, Louisville KY, October 2009.
16. Robertson M. The value of a worker safety program, Eastern Kentucky University, Richmond KY, February 2009.
17. Bunn TL, Robertson M. The value of a worker safety program, Department of Workers' Claims, Frankfort, KY, August 2008.
18. Robertson M. The Kentucky FDACE program, Bluegrass Community and Technical College. Lawrenceburg, KY, February 2009.
19. Bunn TL, Robertson M. The value of a worker safety program, Small Business Advocacy Commission, Frankfort, KY, September 2008.
20. Robertson M, Bunn TL. The value of a worker safety program, Cabinet for Economic Development, Frankfort, KY, August 2008.
21. Bunn, T.L., Liu, Y, Lee, K, Robertson, M, Yu, L. Farmer exposure to organic solvents during the maintenance and repair of farm machinery: a pilot study. American Public Health Association meeting, Philadelphia, PA. November 2009.
22. Bunn, TL, Robertson, MA. What are you driving at?-----Motor vehicle injuries among truck drivers in Kentucky, Kentucky Governor's Safety and Health Conference, Louisville, KY. May 2009.
23. Robertson M. The value of a worker safety program. National association of Women in Construction. January 2009.
24. Bunn, TL, Slavova, S, Bathke, A. The effects of passengers on large truck collisions involving older male drivers. National Occupational Injury Research Symposium 2008, Pittsburgh, PA. October 2008.
25. Bunn, T.L., The effect of passengers on large truck collisions among older male truck drivers, Council of State and Territorial Epidemiologists meeting, Denver, CO. June 2008.

### **Conference Presentation**

Slavova, S., Pavlov, D., Bunn, T., Kryscio, R., Estimating Relative Risk in the Plane Using k-th Nearest Neighbor Approach, International Workshop in Applied Probability, France, 2008.

### **Hazard Alerts**

1. Truck Drivers in Fatal Crashes After Substance Abuse, Volume 6, Issue 2, August 2008.
2. Transportation Industry Injuries- Characteristics and Causes, Volume 1, Issue 1, August 2008.
3. Occupational Suicides, March 2009.
4. Workers Electrocuted While Working in Elevated Buckets, Volume 7, Issue 2, September 2009.
5. Workers Killed While Working With Granite, Volume 7, Issue 3, October 2009.
6. Truck Drivers Killed After Exiting Semi Tractors and Being Struck by Other Semi Tractors in Distribution Center, Volume 7, Issue 4, November 2009.
7. Residential Tree Trimmers Killed While Working, Volume 8, Issue 1, March 2010.
8. Workers Killed While Working with Forklifts, Volume 8, Issue 2, March 2010.
9. Workers Killed While Collecting Solid Waste, Volume 8, Issue 3, June 2010.

### **Peer-Reviewed Publications**

1. Centers for Disease Control and Prevention: [2010]. Proportion of workers who were work-injured and payment by workers' compensation systems - 10 states, 2007. MMWR Morb Mortal Wkly Rep. 59(29):897-900.
2. Bunn TL, Yu L, Spiller HA, Singleton M: [2010]. Surveillance of methadone-related poisonings in Kentucky using multiple data sources. Pharmacoepidemiol Drug Saf. 19(2):124-31.

3. Bunn TL, Liu, Y, Lee K, Robertson M, Yu L: [2009]. Farmer exposure to organic solvents during the maintenance and repair of farm machinery: a pilot study. *Am J Ind Med* 52(12):973-981.
4. Bunn TL, Yu L, Slavova S, Bathke A: [2009]. The Effects of Semi Truck Driver Age, and Gender, and the Presence of Passengers on Collisions with Other Vehicles. *Traffic Inj Prev* 10(3):266-272.
5. Nicholson VJ, Bunn TL, Costich JF: [2008]. Disparities in work-related injuries associated with worker compensation coverage status. *Am J Ind Med.* 51(6):393-8.
6. Bunn TL, Slavova S, Spiller HA, Colvin J, Bathke A, Nicholson VJ: [2008]. The effect of poison control center consultation on accidental poisoning inpatient hospitalizations with preexisting medical conditions. *J Toxicol Environ Health A.* 71(4):283-8.
7. Pavlov D, Slavova S, Kryscio R: [2009]. Estimating Relative Risk on the Line Using Nearest Neighbor Statistics, *Methods and Computing in Applied Probability* 11(2):249-265.
8. Slavova S, Bunn T, Kryscio R: [2008]. Consistency of the k-th Nearest Neighbor Estimator of the Relative Risk and its Application to Injury Surveillance, *Mathematics and Education in Mathematics* 232-238.
9. Bunn TL, Slavova S, Hall L: [2008]. Narrative text analysis of Kentucky tractor fatality reports. *Accid Anal Prev* 40(2):419-25.

#### Non-Peer Reviewed Publications

1. Costich JF, Bunn TL, Robertson M. 2009. Worker safety programs make sense and save cents. *KY Bench and Bar.* 73(5):45.
2. Terry Bunn, Contributing consultant for the following publication- Turner S., Walker, R. Report on methamphetamine and other drug use in Kentucky, University of Kentucky, 2008.
3. Kentucky County Health Profiles, September 2008.
4. Forest Resources Association, Log Truck Rollover Fatality, *Forest Operations Review*, 10(4) Fall 2008.

#### D.4. On-site Investigations

From January 1994- June 2010, the KY FACE program conducted 192 investigations and produced 154 final reports. The root cause was determined in 80% of all completed fatality reports. The nature of the investigations to date is summarized in Table 1. From July 1, 2008- June 30, 2010, 11 fatality investigation reports were produced (7 motor vehicle collisions and 4 falls).

**B. Table 1. Summary of Fatality Case Investigations (January 1994-June 2010).**

Investigations by Industry	N	Investigations by Cause (E-code)	N
Agricultural			
Overturns	28	Machine	73
Run-overs	11	Struck by Falling Object	20
Agricultural machine	11	Fall	21
MVC	5	Motor Vehicle	33
Thrown from/struck by	3	Other	7
Other	1		
Manufacturing	1		
Logging	27		
Other	8		
Construction	31		
Retail	2		
Services	2		
Transportation/Public Utilities	24		
<b>Total</b>	<b>154</b>	<b>Total</b>	<b>154</b>

#### D.5. Case-Control Study of Motor Vehicle Injury Collisions Among Older Male Drivers

A retrospective population-based case-control study was conducted by FACE personnel to determine whether semi truck driver age, gender, and the presence of passengers affected the likelihood that a semi truck driver would be at-fault in a semi truck collision (STC) with another vehicle (Bunn *et al.* 2009). Cases were identified as semi truck drivers in at-fault STCs with other vehicles, and controls were semi truck drivers in not-at-fault STCs with other vehicles, using the KY CRASH electronic database from 2000-2006. The results showed that solo semi truck drivers aged 65 and over were the age group at highest risk for at-fault STCs with other vehicles. However, the presence of passengers in the semi truck had a protective effect for semi truck drivers aged 65 and older. The results of this study have the potential to inform public policy in regard to the presence of passengers and their positive protective effect on older (aged 65 and older) semi truck drivers, particularly in long-distance driving performed by solo semi truck drivers vs. team semi truck drivers.

#### **D.6. Development of Interpersonal Violence-Related Occupational Homicide Fatality Narratives**

Twenty-four homicide fatality narratives were developed and produced. Dissemination of the homicide fatality narratives was targeted to the KY Domestic Violence Association, and the Kentucky Sexual Assault program, for use as interventions and the development of prevention strategies. The occupational homicide narratives were further disseminated through the KY FACE program to companies to raise awareness of domestic violence that can spill over into the workplace.

Based on a social worker death in 2006, a safety management guide entitled "Prevention of Workplace Violence: Safety Management Guide For Social Workers" was developed in Summer 2010, and is in the process of being approved by the Department for Community-Based Services for supplemental violence prevention training of their social workers. The guide contains information on the definition of workplace violence, the development of an emergency response plan, risk assessment and safety strategies, critical events procedures, and available resources.

#### **D.7. Evaluation**

##### **Potential Outcomes**

The following examples illustrate industry responses to KOSHS and FACE publications and materials:

- A. The KOSHS worker safety program presentation was delivered to the NAWIC in Fall 2008. The owner of Parsons Electric said, "This hits home, especially the slides that explain what an injury costs the company with a 5% profit margin. I'm taking this to my safety director and other officers of the company."
- B. The worker safety program was presented to the Small Business Advocacy Commission in Fall 2008. A member business owner said, "I didn't know I had to have a safety program for my company. When I return to the office, I will address this."
- C. A safety director of Boland Maloney Lumber Co, Inc., who received our transportation reports in April 2009, said "I was amazed at the detail describing the circumstances of the crash. It is the first publication I have ever seen that went to the trouble to describe the road conditions, weather conditions, even the temperature range for that day. Excellent information and extremely useful. Most reports do not give enough information on the circumstances leading to the crash to be very useful." Also, B&M Motorsports, LLC, said they would like to receive these reports monthly and that the reports contained great information.
- D. After the KOSHS worker safety program panel presentation in May 2010, an insurance representative approached KOSHS personnel and said that the presentation was "dead on and I will tell my regional agents to get trained in workers' compensation".
- E. In an anonymous evaluation of the KOSHS program presentation on the occupational injury and illness indicators at the 2010 Governor's Safety and Health conference in Louisville, KY, in May 2010, a self-described company safety person said that the "indicators are new data for safety representatives to use and made me aware of the big picture. Keep up the good work".

- F. After our truck driver hazard alert was disseminated in Fall 2009, the following anonymous mail response was received, "thought it was very useful information. Some things that drivers take for granted and need to be made aware of. Great info!"
- G. After our FACE report #07KY091 on a sleeper berth death was disseminated in Spring 2010, five online surveys were received and four rated the publication as "good" or "excellent". Responses included: 1) "I will include sleeper berth safety in all company SOP material"; 2) I will post information for drivers to view, talk about DUIs"- TS Trucking; and 3) "Team drivers will now use sleeper berth restraint system (mandatory)...Gets your attention".

### **Intermediate Outcomes**

Following are examples of how KOSHS publications and interventions were used by companies:

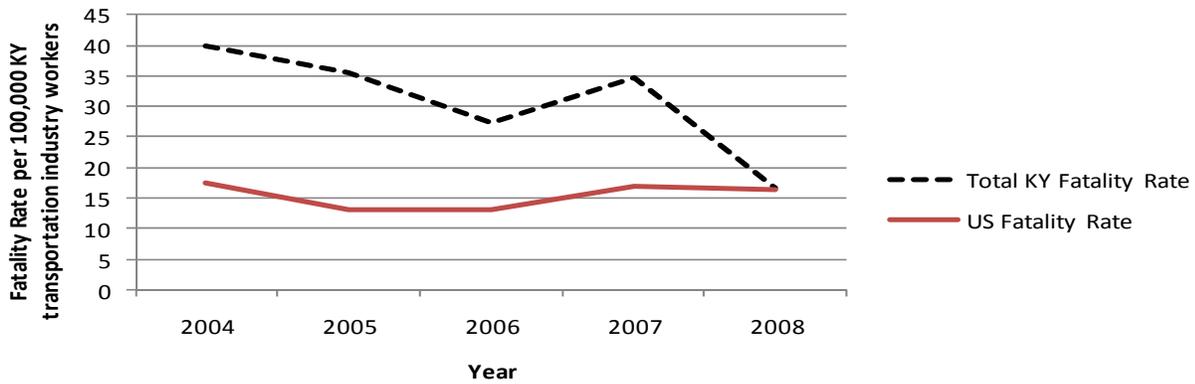
- D. Fifteen survey responses were received after mailing the annual KOSHS report in April 2009. Of the fifteen respondents, twelve read the report from cover-to-cover, four used the publication to supplement training or courses, ten used the publication to assist in research and 13 shared the information.
- E. A follow-up phone survey was conducted 3 months after mass transportation mailings of hazard alerts and fatality reports in KY to 1700 employers in 2007 and to 10,000 employers in 2009. Of the employers surveyed in 2009 (n=10), all employers ranked the materials as excellent (mean score 4.6 out of 5), all thought the information was easy to understand, five plan to use or used the information for toolbox training, four plan to use or used the information for general safety training, and all employers thought the suggested recommendations were practical for their company. One company mentioned that they now have a stricter seat belt policy because of the mailing.
- F. Nine electronic evaluations were received pertaining to our forklift hazard alert disseminated in spring 2010 and all rated the publication as "excellent". Company responses included: 1) "will incorporate materials into safety program"; 2)"each employee will be shown this FACE report and will receive additional forklift safety training"- Pressure Tech, Inc; 3) "Is it possible to be added to the distribution list for the Haz alerts? A co-worker has been forwarding to me and I find them quite useful"- Papa John's; 4) "I appreciate the work that you folks do"- Owensboro Municipal Utilities; 5) "Nice review and reminder that equipment used regularly can still be very dangerous if we are not careful to follow safety rules each and every time. Thanks."- First Class Transportation; and 6) "I will complete an individual audit to ensure the information covered is included in our program".

### **End Outcomes**

It is impossible to eliminate or take into account all the possible influences on the burden of occupational injuries, so KOSHS decided to evaluate the burden of fatal occupational injuries, transportation industry, and occupational motor vehicle injuries.

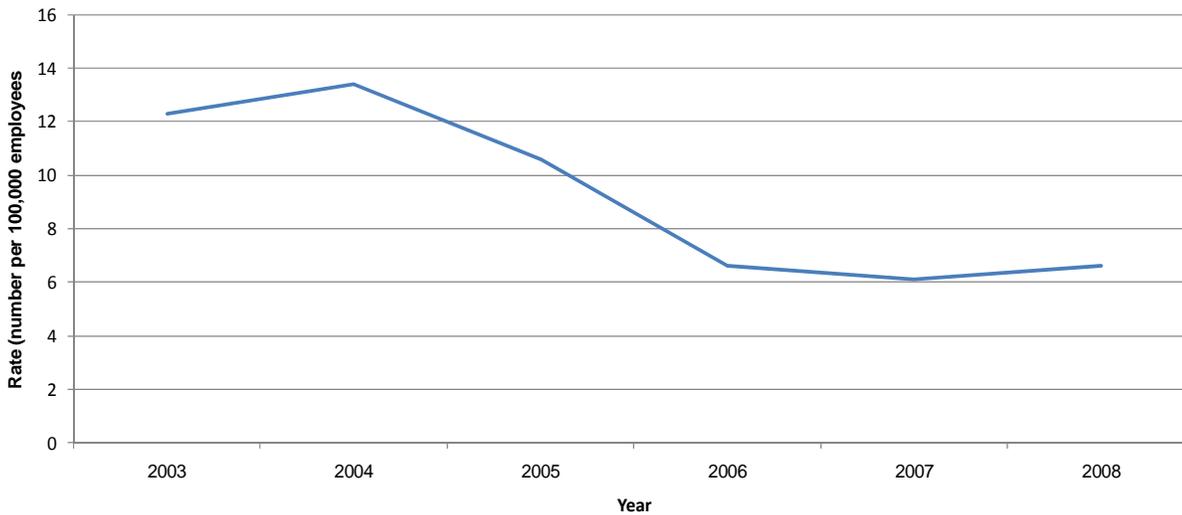
Kentucky transportation industry (NAICS 48-49) fatality rates have significantly decreased since 2004 ( $p=0.09$ ) (Figure 2).

**Figure 2. Crude Fatality Rates for Transportation Industry Workers, 2004-2008.**



There was a statistically significant decrease in the occupational MVC fatality rate from 2004-2008 (Figure 3) (note: the number of Kentucky employees who drive for companies is not known so the number of employed persons in KY was used as the denominator) ( $p= 0.01$ ).

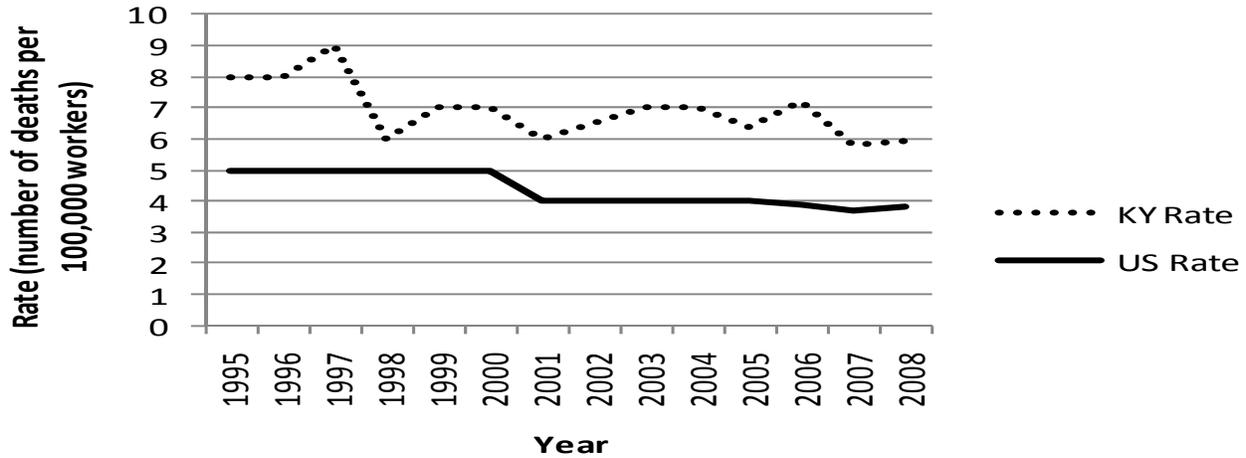
**Figure 3. Occupational Motor Vehicle Fatality Rates, 2003-2008.**



### Fatal Occupational Injuries

Between 1994 (when the FACE program was initiated in KY) and 2008, occupational fatality rates significantly decreased in Kentucky ( $p= 0.01$  by linear regression) and in the US (Figure 4), although KY's occupational fatality rate is still significantly higher than the US occupational fatality rate.

**Figure 4. Occupational Fatality Rates for Kentucky, 1994-2008.**



#### D.8. R2P

Analyses and investigations of commercial motor vehicle driver fatalities have resulted in a number of new partnerships between KY FACE personnel and personnel from the transportation industry and federal agencies. This new investigative initiative resulted in a procedural change for a road construction company. Fatality report # 05KY036 entitled “Dump Truck Driver Dies after Unintentional Release of Asphalt” recommended that tailgate chains should always be secured to the dump truck. The report said: “The driver can choose to not hook the chains and dump the full load into one big pile, or hook the chains and spread the rock slowly in a line. When asphalt is unloaded, chains are not usually used. The tailgate is released, and the bed is raised in increments to allow the asphalt to slide out of the truck bed. As a backup safety mechanism when hauling asphalt or any other material including rock, the chains should be secured tightly to the side of the truck. Chains should be secured before the bed is loaded with material and unsecured when the truck reaches its destination and is preparing to dump its load. Securing the chains would provide the driver a backup safety feature if the tailgate trip handle failed”.

After this incident occurred, the company made the securing of tailgates with chains mandatory practice for all dump trucks. Now, when a dump truck is loaded, the tailgates are secured with chains to the sides of the dump truck before the driver is given the weight ticket and allowed to leave the facility. The chains are then released when the dump truck is ready to dump the load. Equipment/procedural changes were instituted due to the recommendation above in report #05KY036 regarding the use of chains to secure tail gates on dump trucks. The fatality report from this incident and the company procedural changes were published in the trade magazine *Asphalt Pro* in December 2007. A second Kentucky FACE fatality report was published in *Asphalt Pro* in June/July 2008 on an asphalt hauler who was trying to repair a colleague’s haul truck while in line to be loaded and was fatally caught in the power take off shaft. The company now prohibits workers from repairing their own and others’ haul vehicles.

#### 4.e. Conclusions

The KOSHS and FACE programs have fulfilled their objectives of identifying industry sectors, occupations, and worker populations at high risk for work injuries and illnesses, and advancing the usefulness of surveillance data at the federal, state, and local levels for the prevention of occupational injuries and illness hazards. Additionally, targeted strategies for the dissemination of occupational injury/illness data were developed and implemented using a sector-based approach, with the ultimate goal of reducing occupational injuries/illnesses in KY and in the US.

Prevention materials produced by the programs have been used for training purposes such as new worker and new task training, and continuing education such as toolbox talks and seminars, and they have

also been used by companies to institute changes. The recommendations in the fatality reports are cost-effective, realistic approaches for the reduction of occupational injuries.

In achieving the specific aims of the KOSHS program, valuable partnerships were formed, and collaborations resulted in many injury prevention interventions and research publications. With the development of the worker safety program presentation by the advisory committee, many new and small businesses were reached with resources to develop a worker safety program at little or no cost.

Partnerships that targeted the prevention of occupational motor vehicle collisions resulted in a number of peer-reviewed publications, hazard alerts, and other reports. Fatality reports contained recommendations that were utilized to inform policy making (cable and concrete barrier access by emergency personnel, and positive drug testing legislation), develop new interventions (bucket truck injury prevention video and fuel shut-off valve prototype), and many resulted in process changes (mandated use of chains on dump trucks, prohibition of employees doing own repair work, and mandated use of sleeper berth restraints). Partnerships were expanded with the Transportation Cabinet that resulted in the incorporation of recommendations to reduce the burden of collisions among commercial vehicle drivers in the KY Strategic Highway Safety Plan, and new funding for the collection of emergency department data and EMS run data within the Traffic Records Advisory Group.

Significant reductions were observed in the total KY fatal occupational injury rate, the occupational motor vehicle fatality rate, and the transportation industry fatality rate. The KOSHS and FACE programs have been effective in the population-based surveillance of non-fatal and fatal injuries among workers. The system has been useful, is meeting its objectives, and is having an impact within targeted industries and sectors.

## **Publications**

Centers for Disease Control and Prevention: [2010]. Proportion of workers who were work-injured and payment by workers' compensation systems - 10 states, 2007. *MMWR Morb Mortal Wkly Rep.* 59(29):897-900.

Note: This study resulted from partnerships- fundamental specific aim #3

Bunn TL, Yu L, Spiller HA, Singleton M: [2010]. Surveillance of methadone-related poisonings in Kentucky using multiple data sources. *Pharmacoepidemiol Drug Saf.* 19(2):124-31.

Note: This study resulted from analysis of surveillance data- fundamental specific aim #1

Bunn TL, Yu L, Slavova S, Bathke A: [2009] The Effects of Semi Truck Driver Age, and Gender, and the Presence of Passengers on Collisions with Other Vehicles. *Traffic Injury Prevention* 10(3):266-272.

Note: This study resulted from analysis of CRASH data- FACE specific aim #3

Bunn TL, Liu, Y, Lee K, Robertson M, Yu L: [2009]. Farmer exposure to organic solvents during the maintenance and repair of farm machinery: a pilot study. *Am J Ind Med* 52(12):973-981.

Note: This study resulted from analysis of surveillance data- fundamental aim #1

Pavlov D, Slavova S, Kryscio R: [2009]. Estimating Relative Risk on the Line Using Nearest Neighbor Statistics, *Methodology and Computing in Applied Probability* 11(2):249-265.

Note: This study resulted from analysis of surveillance data- fundamental aim #4

Nicholson VJ, Bunn TL, Costich JF: [2008]. Disparities in work-related injuries associated with worker compensation coverage status. *American Journal of Industrial Medicine* 51(6):393-8.

Note: this study resulted from the exploration of alternative data sources- fundamental aim #5

Program Director/Principal Investigator (Last, First, Middle): Bunn, Terry Lee

Bunn TL, Slavova S, Hall L: [2008]. Narrative text analysis of Kentucky tractor fatality reports. Accident Analysis and Prevention. 40(2):419-25. Epub 2007 Aug 9.

Note: This study resulted from analysis of FACE reports- FACE aim #5

Bunn TL, Slavova S, Spiller HA, Colvin J, Bathke A, Nicholson VJ: [2008]. The effect of poison control center consultation on accidental poisoning inpatient hospitalizations with preexisting medical conditions. J Toxicol Environ Health A. 71(4):283-8.

Note: This study resulted from analysis of surveillance data- fundamental aim #5

Slavova S, Bunn T, Kryscio R: [2008]. Consistency of the k-th Nearest Neighbor Estimator of the Relative Risk and its Application to Injury Surveillance, Mathematics and Education in Mathematics 232-238.

Note: This study resulted from analysis of surveillance data- fundamental aim #4

## **Inclusion of Gender and Minority Study Subjects**

### **A. Inclusion of women**

Women were included in the project. Women comprised approximately 76% of the study population. No data were excluded from the project due to gender, race, or ethnicity. Women and minorities participated in the project the same way as all other participants.

### **B. Inclusion of minorities**

Data on minorities were included in the proposed project. Since declaration of race and/or ethnicity was not required for participation, most racial and ethnic proportions of the study population were unknown. No data were excluded from the project due to gender, race, or ethnicity. Women and minorities participated in the project the same way as all other participants.

The gender and minority exclusion table is attached.

### **C. Inclusion of Children**

Secondary surveillance data on children 16-21 years of age was included in the project. Personal identifiers such as name and address were not included in the data collected. Data were collected in the same manner as adults and were collected by KIPRC as a bona fide agent of the KDPH. Children were included in this proposal because the occupational safety and health indicators recommended by CSTE and NIOSH for occupational safety and health surveillance included workers 16 years of age and older for numerator and denominator data.

### **D. Materials Available for Other Investigators**

All dissemination products including Haz Alerts, newsletters, fatality reports, annual project reports, and presentations are available for use by other investigators and are available on our website <http://www.kiprc.uky.edu/KOSHS.html> or by request on our website. Regarding data, surveillance data entered and retained in the electronic database (excluding names, address, employers, among others) may also be available to researchers.