

tional estimates. In 1995, there were 391 emergency departments that provided data for the survey. Hospital staff were asked to complete Patient Record forms for a systematic random sample of patient visits occurring during a randomly assigned 4-week reporting period. The number of Patient Record forms completed for EDs was 21,911, of which 1,058 were work-related. Work-related visits were defined as visits for injuries that occurred while the patient was engaged in work-related activity on or off the employer's premises. Data were collected on up to three external causes of injury, up to three physician's diagnoses, procedures provided, and diagnostic and screening services ordered or provided.

**Findings.** Of the 37.2 million ED visits that were for injury, nearly 13 percent were related to work (4.8 million). One-fifth of injury-related ED visits for persons 18-64 years were related to work. Open wound of finger was the leading diagnosis for work-related ED visits. About seventy percent of visits were made by males (73.8 percent). The leading external cause of injury for work-related ED visits was overexertion and strenuous movements. Wound care was provided at 33.7 percent of work-related visits, and 8.0 percent had orthopedic care provided. Some form of imaging was performed or ordered for 64 percent of visits, with extremity X-ray being the most frequent (29.0 percent). Three-quarters of work-related ED visits had worker's compensation as an expected source of insurance. The work relationship was unknown for a quarter of injury-related ED visits.

**Conclusions.** The average total cost for an emergency department visit has been found to be \$209, totaling a billion dollars annually for work-related visits. Work-related visits comprise a small but significant portion of the health care provided in emergency departments. It has been estimated that 30% of injuries to the hands and feet could possibly be prevented by the wearing of appropriate personal protective gear in the workplace. Since open wound to finger and contusion of lower limb were the top two diagnoses for work-related emergency department visits in 1995, determining appropriate preventive action may result in financial savings for industry and health care systems.

### **Surveillance of Work Injuries Using Hospital Discharge Data—** Trent RB

In a growing number of states, records of hospital stays, hospital discharge files, are coded for cause of injury with one or more E-codes from the International Classification of Diseases, Ninth Edition. Discharge records also include information on the patient, treatment, outcome, and charges. When the payer is coded as workers compensation the condition can be considered work-related as determined by the clinicians assessment of the patient's history. Using 1995 discharges from California's 587 acute care hospitals, we identified nonfatally injured patients age 16-64 where the expected payer was workers compensation (N=7,622, or 6%) and other payers (N=111,081, or 94%). We compared work versus nonwork patients and found that work injuries are distinct from nonwork injuries. Work injuries were 6 in 10 of all machine injuries, 5 in 10 of electrical injuries, and about 2 of 10 injuries due to explosions, struck bys, and fire/flames. We confirmed this pattern when we looked at fatal work injuries (using modified NTOF methods) and found that work injuries comprised the majority of injuries due to machines, explosions, electricity, and struck bys.

Within broad injury types, work injuries may be common for some specific etiologies and not others. For example, falls are the most common hospitalized injury, comprising 9% of work injuries and 6% of nonwork injuries. However, some specific types of falls are much more likely to be work related. Examples are falls from scaffolds (56% work related), ladders (23%), buildings (18%), and to a lower level (17%). In contrast, there are very few work related falls from wheelchairs (3%) or playground equipment (2%).

Hospital discharge data have several strengths for work injury surveillance: (1) one can document serious nonfatal work injuries in a number of states using a passive, uniform system, (2) for severe, nonfatal injuries, hospital discharge data are likely to be highly specific and sensitive, (3) differences between work and nonwork injuries can be examined, and (4) some specific types of injuries are so often work related (e.g., scaffold falls) as to be useful sentinels for work injury problems.

Weaknesses of hospital discharge data for work injury surveillance: (1) injury event narratives are not computerized or even centralized, (2) unlike the ANSI Z16 system, E-codes are not designed specifically to document work injuries, and (3) industry and occupation is not available, precluding the development of rates specific for risk.

**Conclusion:** hospital discharge data offer a useful, easy way to document severe work injuries, contrast them with nonwork injuries, and locate sentinel injuries. Hospital discharge data lack detail on work injury circumstances, occupation, and industry and therefore cannot replace analyses based on existing systems such as physicians reports, absences from work, or workers compensation claims.

### **Occupational Injury Surveillance Using the Alaska Trauma Registry—**Husberg B, Conway G

**Introduction.** From 1980 to 1989 Alaska had the highest rate of any state for occupational fatalities, 34.8 deaths per 100,000 workers per year, five times higher than the U.S. average of 7.0 deaths per 100,000 workers per year. The majority of the occupational fatalities occurred in the fishing, logging, and aviation industries. The Alaska Trauma Registry (ATR) provides a population-based tool for occupational injury surveillance for moderate to severe injuries. Each hospital in Alaska participates in contributing data to the ATR.

**Methods.** To be included in the ATR, patients either have to be admitted to a hospital, transferred from an Emergency Department (ED) to a facility with a higher level of care, or declared dead in the hospital's ED. Data for the ATR is collected retrospectively from medical record charts and the information is sent to the Alaska Department of Health and Social Services, Division of Public Health, Section of Community Health and Emergency Medical Services to be compiled into the ATR. Data fields related to occupational injury surveillance go through additional cleaning and coding by personnel at the National Institute for Occupational Safety and Health, Division of Safety Research, Alaska Field Station. Cause of the injury can be examined via the ICD-9-CM "E-Code" and the injury description narrative.

Results. Currently the ATR has information for 20,842 cases from January 1991 through December 1995; 2,421 (12%) of these injuries were classified as occupational injuries. There are 40 fatalities among the occupational injuries (1.7%). Commercial fishing, construction, and logging led the industry categories for number of occupational injuries. The most common causes of injuries in the fishing industry were caused by machinery onboard vessel (74), fall between levels (38), and cuts (13). There are a wide variety of machines used on fishing vessels: a hydraulic lifting platform known as a crab pot launcher was the most common machine mentioned in causing injury. In the construction industry, different types of falls lead all causes with falls from or out of building or other structure (64), fall on or from ladder (43), and fall on or from scaffolding (36). The top three causes in the logging industry were being struck by an object (94), falls (33), and machinery (28).

Conclusions. The main causes of occupational fatalities in Alaska have been drowning (primarily in commercial fishermen) and trauma related to aircraft crashes. With the emphasis of the ATR primarily on non-fatal injuries, we have identified further areas of study for crab fishing injuries, falls in construction, and logging-related injuries in Alaska. As it is population-based, ATR data can be used to calculate injury incidence rates. The use of rates in injury surveillance will make the ATR data useful for industries to prioritize areas for injury prevention.

## Session 15: Occupational Injuries in Automobile Manufacturing

### *Using Injury Surveillance and Workers' Compensation Data to Facilitate Injury Prevention Activities*—Pastula S, Reeve G

During the past five years, the authors have directed an effort to design a near real-time data analysis system for occupational injuries in the North American locations of a major automobile manufacturer. The major obstacle for the project was obtaining conceptual support from certain areas within the company that did not initially accept the premise that such a data system was really needed in order to reduce injuries. This initial lack of support was based on a fundamental misconception about the utility of injury incidence data in the real-time environment of large manufacturing plants. The rationale of this misconception is best illustrated by the following statement: "You don't need a sophisticated data system to reduce injuries. You go out on the shop floor, look at the jobs, make a list of the "bad" jobs, and then fix them." However, in a plant with 3,000 to 5,000 workers, the number of "bad" jobs always exceeds the available capacity to fix them. Therefore, timely plant-based injury surveillance is critical to correctly prioritize the redesign of jobs that can or do cause injuries. Injury surveillance must include not only data about rates and types of injuries, but also cost information for all occupational injuries regardless of OSHA recordability. In addition, surveillance must continue after the "bad" job has been redesigned in order to determine: whether the changes have decreased the injuries of initial concern; and, did not result in a subsequent increase in injuries of a different type.

Several examples which illustrate the need for timely injury surveillance data in the manufacturing environment will be presented. These examples include: the occurrence of a new set of injuries

following a process change that was made to solve a specific injury problem; an effective use of injury cost data to facilitate a product design change; and, a rapid evaluation of a work-hardening program which prevented its company-wide implementation.

### *Fatal and Non-Fatal Incidents Associated with Forklifts and Other Powered Industrial Vehicle Incidents*—Collins JW, Baker SP, Smith GS, Kisner SM, Landen DD, Warner M, Johnston, JJ

This research examines the circumstances of work-related injuries and fatalities involving powered industrial vehicles (PIVs), which include forklifts or other mobile power-driven vehicles used to carry, push, pull, lift, or stack material. Descriptive analyses were conducted on 946 PIV-related fatalities in the National Traumatic Occupational Fatality (NTOF) surveillance system from 1980 through 1993 and 916 incidents in 54 U.S. automobile manufacturing plants from July 1989 to June 1992. The NTOF surveillance system provides data from death certificates from the 50 states, the District of Columbia, and New York City. Death Certificates are collected for persons 16 years of age and older who died of external causes and for whom the certifier indicated that the fatality was associated with an injury while on the job. The automotive surveillance system is run jointly by the medical and safety departments in the plant and includes information on employee characteristics, characteristics of the workplace and injury-producing event, and description of the injury.

The three most common types of fatal incidents in the NTOF database involved PIV overturns (22%), pedestrian struck by PIV (20%), and decedent crushed by forklift (17%). The highest frequency of fatalities by industry division occurred in manufacturing (33%), transportation, communication and public utilities (16%), and construction (14%). The highest fatality rate by industry occurred in wholesale trade, mining, and agriculture/forestry/fishery. The highest forklift-related fatality rates by occupation occurred to laborers and transport operators.

The 916 PIV-related incidents in the automotive surveillance system resulted in 913 injuries and three fatalities. Of the 913 injury incidents, 41% (372 of 913) of the injuries resulted in an employee missing work. The 372 lost workday incidents resulted in a total of 22,730 lost workdays, an average of 61 days away from work per lost workday incident. The three most common types of injury incidents in the automotive manufacturing surveillance system involved pedestrians being struck by PIVs (n=35%), PIV collisions with fixed objects/other PIVs (n=16%), and mounting/dismounting PIVs (15%). Recommendations are presented with regard to the factory environment, vehicle safety features, and driver and pedestrian training for reducing the risk of powered industrial vehicle incidents.

### *The Incidence of Injuries Involving Robots in a Large Manufacturing Company*—Pastula S, Howe J, Smitt R, Reeve G

Robots are in wide-spread use in the automotive manufacturing environment. Robots work side by side with people in the plants, and the robots are programmed and repaired by these same workers. In recent years, there has been a growing discussion of the possibility to change safety standards for robots. This discussion has been driven in large part by a presumable absence of reports of