

**Deaths and DALYs from Occupational Injuries
(in thousands)**

Region	Deaths	DALYs
EME	14	540
FSE	10	405
IND	15	655
CHI	20	1,039
OAI	12	566
SSA	10	550
LAC	9	429
MEC	9	461
World	99	4,645

A United States burden of disease study which will include an analysis of occupational injuries and diseases is underway.

Session 6: Nonfatal Injuries in Construction

Construction Injury Rates May Exceed National Estimates: Evidence from the Construction of Denver International Airport (DIA)—Glazner JE, Borgerding JA, Lowery JT, Bondy J, Kreiss K

Aim. To describe occupational injury rates and workers' compensation (WC) payment rates on a major construction project.

Background. Most injury rate estimates rely on survey data (Bureau of Labor Statistics (BLS)), analysis of WC claims, emergency room surveillance and proportionate mortality studies. These may suffer from underreporting and/or imprecise estimates of the number of workers at risk. Construction of DIA, with 31 million person hours on 2,843 contracts held by 769 contractors, provided a unique opportunity to describe the magnitude of injury on a major construction project.

Methods. The airport owner implemented a project-wide WC insurance plan for all on-site workers involved in airport construction. All claims were recorded in a centralized database, as was payroll according to job classification. Injuries were treated at an on-site clinic operated by a designated medical provider; claims were generated whenever treatment was rendered. Using a computer file with all claims, payroll by contract (allowing calculation of hours at risk), and company characteristics, we calculated injury and payment rates by construction sector, company size, and year.

Results. DIA's total injury rates were over twice BLS's rates for the construction industry for each year of construction. Lost-work-time (LWT) injury rates were more comparable, but DIA's were slightly higher. The order of injury rates by SIC code was the same in both data sets, with SIC 17 (special trades) having the highest rates. Total injury rates for DIA's small contractors (1-19 employees) were three times BLS's reported rates and at least twice BLS's rates for all other company size categories. Injury rates declined significantly after the first year of DIA construction, coincident with a several-fold increase in project safety personnel. DIA's total WC payment rate of \$7.06 per \$100 payroll was 11 percent higher than expected loss rates reported by the National Council on Compensation Insurance, in contrast to the two-fold differential between injury occurrence at DIA and BLS survey data.

Conclusion. Complete reporting, facilitated by the existence of a single WC plan, an on-site medical clinic and designated medical

providers, produced injury rates significantly higher than previously reported. The relatively small difference between payment rates and expected loss rates suggests that underreporting is concentrated in the area of minor injuries, which we found to be associated at the contract level with major injuries. Our results suggest that underreporting of WC claims occurs and may result in sizable underestimates of the burden of injury in construction.

✓ Risk Factors for Injury Among Construction Workers on the Denver International Airport (DIA) Project—Lowery JT, Borgerding JA, Zhen B, Glazner JE, Bondy J, Kreiss K

Aim. To identify risk factors for work-related injury on the Denver International Airport construction project, which generated over 31 million person-hours, employing 32,000 workers from 769 companies to complete 2,843 contracts.

Methods. We obtained workers' compensation claims data from an administrative database established under the project's owner-controlled insurance plan, which covered all on-site employees and provided on-site medical care through designated providers. We calculated injury rates by contract and over contract strata of interest by linking claims data with employee demographic information, company and contract characteristics, and contract payroll. We determined that injury rates among contracts held by the same company were independent using generalized estimating equations, enabling us to examine contract-specific factors in relation to total injuries, lost-work-time (LWT) injuries, and non-LWT injuries in Poisson regression models. To control for inherent risk of work in the model, we included expected loss rates (ELRs), which we calculated for contracts using Colorado-specific ELRs provided by the National Council on Compensation Insurance for each job classification. We used logistic regression to determine the association between LWT and non-LWT injuries on a contract level, controlling for person-hours at risk and ELRs.

Results. Injury rates were highest during the first year of construction, at the beginning of contracts and among older workers. Risk for total and non-LWT injuries was elevated for building construction contracts, contracts for special trades companies (SIC 17), contracts with payroll over \$1 million and those with overtime payroll greater than 20 percent. Risk for LWT injuries, on the other hand, was increased for site development contracts and contracts starting in the first year of construction. Large companies (250+ employees) had significantly lower risk for all injuries.

Contracts experiencing one or more minor injuries were four times as likely to have at least one major injury [OR=4.0, 95%CI(2.9,5.5)].

Conclusion. Our finding of increased risk of LWT injury for contracts starting in the first year of the project suggests that enhancement of the project's safety infrastructure during the second year of construction was effective in reducing serious work-site injuries. The absence of correlation between injury rates among contracts belonging to the same company suggests that targeting of safety resources at the level of the contract may be an effective approach to injury prevention. Interventions focused on contracts with considerable overtime work, contracts of special trades companies (SIC 17), and those belonging to small and mid-sized companies may yield reductions in injury rates. Furthermore, efforts to provide adequate site-specific training to workers new to a construction site or new to a contract may also reduce injury burden on large construction sites. The joint occurrence of minor and major

NOIRS Abstracts

injuries on a contract level suggests that surveillance of minor injuries may be useful in identifying opportunities for prevention of major injuries.

Trade-specific Injury Rates at a Large Construction Project—Welch LS, Hunting K, Aleali R

Construction as an industry has a high injury rate, as documented in annual BLS surveys and other data sources. CFOI contains trade-specific data that allows a determination of rates for fatal injuries for specific trades, but trade-specific data is not readily available for non-fatal injuries. Surveillance data is collected in order to design, implement and evaluate prevention programs. Trade-specific surveillance data for construction workers is necessary if we are to understand the causes of injuries, and find ways to prevent them.

We have monitored injuries from a large construction project from 1990-1997. All injuries were treated at the George Washington University emergency department, and data on each injury was abstracted. We have obtained hours worked through the project by contractor and developed trade specific rates for this project. We will present these trade specific rates, discuss how these data differ from BLS data, and compare our rates to trade specific data collected on other large construction sites. We will also present a model for implementing trade specific surveillance on other construction sites.

Occupational Injury and Fatality Patterns of Females Employed in the Construction Industry: Kentucky, 1991-95—Mays J, Kidd P, Struttman T

Purpose. In Kentucky, almost 10% (n=7250) of the construction industry workforce is female. Recent studies have identified risks in the construction industry that are particular to females. However, epidemiologic studies of females employed in the construction industry are scarce. This study provides important epidemiologic information useful in targeting interventions for females employed in the construction industry.

Research Data. This investigation used data from the Kentucky Department of Workers Claims from 1991-95 to describe both the injury and fatality patterns of females employed in the construction industry in Kentucky. The data set contained information on sector of employment, age, gender, number of months employed, time on that particular job, body part injured, nature, extent, and cause of injury, and days of work lost.

Methods. The data were obtained electronically from the Kentucky Department of Workers Claims. Injury and fatality patterns of females are described and compared across several key stratification variables. Where appropriate, injury and fatality patterns of females are compared to males to determine differences in the characteristics of the injury or fatality. Analysis of variance and chi-square tests are used to test for statistical significance.

Results. Seven hundred and sixty-eight claims for females employed in the construction industry were filed with the Commonwealth of Kentucky's Department of Worker's Claims from 1991-1995. Less than 1 percent (n=4) of the 768 claims were fatalities, 0.1% (n=1) was a permanent total disability claim, 1.0% (n=8) was a permanent partial disability claim, 52.3% (n=402) were temporary disability claims, 43.6% (n=335) were lost time claims, and 2.3%

(n=18) were no lost time claims. The average number of days lost for females was 19.8 and did not differ significantly from males (18.0 days). The body region injured differed significantly between females and males ($p<0.001$) with females having a higher proportion of injuries to multiple body parts than males (17.8% vs. 10.3). Regarding nature of injury, females had a significantly higher proportion than males of contusions (11.8% versus 7.4%, $p<0.001$), carpal tunnel syndrome (2.3% versus 0.3%, $p<0.001$), and "all other cumulative injuries" (12.8% versus 1.7%, $p<0.001$). Most of the claims filed for females were in the special trades sector (43.0%) versus heavy construction (39.8%) or general contracting (17.2%). However, while 39.8% of claims filed by females were in heavy construction, only 23.9% of claims for males were in this sector ($p<0.001$). Specifically, 35.6% of all claims filed for females were for those employed in highway, street, and bridge construction (SIC = 1611, 1622) compared to only 17.7% for males ($p<0.001$). In addition, a significantly higher proportion of claims for females versus males reported trucks, cars, highway vehicles, or earth moving vehicles involved in road construction as the source of the injury (10.0% versus 6.3%, $p<0.001$).

Conclusion. These findings suggest that interventions designed to reduce the number and severity of occupational injuries and fatalities of females employed in the construction industry should be focused on the heavy construction industry, particularly road, highway, and bridge construction.

Injuries Among N.C. Residential Construction Workers, 1986-1994—Dement JM, Lipscomb H

All computerized workers' compensation claims for 7400 N.C. Homebuilders Association (NCHA) members and their subcontractors for the period 1986-1994 were obtained from their compensation insurance carrier. Average annual incidence density rates (cases/200,000 work hours) were calculated for all claims, claims involving medical costs or paid lost work time and by mechanism, nature and body part injured. Incidence density rates were calculated separately for each residential construction craft.

A total of 31,133 worker's compensation claims were filed by homebuilders during 1986-1994. Of these claims, 10,680 claims were for minor medical costs (less than \$2000) without lost work time beyond the date of injury. A total of 7199 claims involved paid lost work time which begins after the seventh day away from work in North Carolina. An additional 3543 claims involving medical costs of \$2000 or less and no paid lost time occurred. For the seven years studied, the following average rates of filing claims by claim type were observed.

	Cases/200,000 hrs	
Overall	Paid Lost Work Day	Medical or Lost Time
16.40	3.79	10.78

Twenty-six work related deaths occurred among residential construction workers during the seven years studied. Vehicle accidents (n=6) were observed to be the major known cause followed by falls (n=3), being struck by an object (n=3), electric shock (n=2), and contact with energy or chemicals (n=2).

Highest rates for cases involving medical costs or paid lost time by mechanism of injury were observed for being struck by an object (3.1), lifting/movement (1.97), falls from a different level (1.13), striking against an object (0.87) and falls on the same level (0.46).