
Traumatic Occupational Fatalities in South Carolina, 1989-90

PHILLIP W. STONE, MD, MPH

Dr. Stone is Clinical Assistant Professor in the Department of Family and Preventive Medicine at the University of South Carolina's School of Medicine.

Brenda Colley, PhD, formerly of the Office of Vital Records and Public Health Statistics, Department of Health and Environmental Control, State of South Carolina, now with the Centers for Disease Control and Prevention, assisted the author in using and interpreting the public access data base.

Tearsheet requests to Phillip W. Stone, MD; USC School of Medicine, Division of Preventive Medicine, Columbia, SC 29208; tel.: (803) 434-3934; fax.: (803) 434-7529.

Synopsis

Death certificates for South Carolina for 1989 and 1990 were examined to identify deaths resulting from injury incurred in the workplace. There were 277 deaths in that category in the 2-year period, an average yearly rate for traumatic occupational fatalities of 8.84 per 100,000 workers. The groups of industries with the highest fatality rates were transportation-communication-utilities, construction, and agriculture-fishing-forestry. The leading

causes of death were injuries from motor vehicle crash, homicide, and falls. The traumatic occupational fatality rate for men was about 13 times greater than that for women; however, a much higher proportion of women died from homicide on the job.

The findings in general reflect trends reported in other studies. The death rates for workers in South Carolina for 1989-90, however, were higher than national averages for 1980-88. National data for 1989-90 were not available for comparison. The data suggest that more effective injury prevention efforts need to be applied to such causes of on-the-job injury as motor vehicle crash, homicide, and falls. Those three categories accounted for more than 56 percent of all traumatic occupational fatalities in South Carolina in 1989 and 1990. Motor vehicle crash prevention efforts particularly are needed in the transportation-communication-utilities industries. The findings show that particular efforts need to be directed to the retail trade category for prevention of homicide and to the construction industry for prevention of falls.

SEVERE INJURY IN THE WORKPLACE has been identified as 1 of 10 leading problem areas in occupational safety and health by the Public Health Service's National Institute for Occupational Safety and Health (NIOSH) (1).

NIOSH has reported that injury in the workplace may be the primary threat to the health and well-being of America's workers. NIOSH estimates that at least 10 million persons suffer traumatic injury on the job each year. About 30 percent of those injuries are severe or fatal, including such types of injury as amputation, fracture, severe laceration, eye loss, acute poisoning, and burns. From 7,000 to 10,000 fatalities occur each year as a result of injuries at work. In the period 1980-85, more than 150,000 years of potential life were lost each year from fatal injuries in the workplace (2, 3). Those years of potential life lost to traumatic occupational fatalities may be more than all years lost to occupational disease, because young workers tend to have a greater prevalence of occupational

injury than older workers, who tend to have longer occupational disease latency, morbidity, and resulting death.

The Public Health Service (PHS) has set a national health objective for the year 2000 to lower the death rate for occupational injury to no more than 4 per 100,000 full-time workers. PHS specifically identified the mining, construction, transportation, and agricultural industries for special attention (4).

Severe occupational injuries have an important economic impact. In 1983, 80 million workdays were lost because of injury at work, resulting in about \$33.4 billion in direct and indirect costs from lost wages, medical expenses, and administrative costs. The separate costs of such injuries in terms of physical and emotional suffering are incalculable (2).

Despite the magnitude of that economic loss, the statistics may be underestimations of the problems. More accurate statistics on many problems in

occupational safety and health are unavailable, largely owing to a lack of uniformity in data sources, methods of data collection and reporting, and case definitions.

In an effort to obtain more complete and accurate information on work related diseases and death, NIOSH worked with the States during the 1980s to offer training for State death certificate coders, who use the 1980 census classification system to code both the usual occupation of those dying from an occupational injury and the industry in which they were working at the time of injury (5).

A recent synthesis of studies performed by NIOSH's Division of Safety Research shows death certificates to be the single most useful source of data for identifying traumatic occupational fatalities (6). The average rates of capture for sources of data on occupational fatalities were reported as 81 percent for death certificates, 61 percent for medical examiner's records, 57 percent for Workers' Compensation reports, and 32 percent for Occupational Safety and Health Administration (OSHA) reports.

NIOSH began the National Traumatic Occupational Fatality Project in 1985 to examine the problem (3). Source documents for the project were death certificates from 50 States, the City of New York, and the District of Columbia. Death certificates were included for those 16 years and older if the certificate showed a code for an injury as either an immediate, an underlying, or a contributory cause of death and if the injury was incurred at work. External causes of injury are coded on death certificates using the International Classification of Diseases codes E800 through E999 (7).

The NIOSH report provided national level data on occupational fatalities, including age, race or ethnicity, sex, occupation, and death rates for specific industries or groups of industries. The death rate for occupational injury during the period 1980-85 was 7.8 per 100,000 workers. Four groups of industries, mining, transportation-communications-utilities, construction, and agriculture-fishing-forestry, had much higher death rates than other groups or industries. Summarizing additional data (including unpublished data) from the National Traumatic Occupational Fatality Project data base gives an average national rate for occupational fatalities of about 7 per 100,000 workers for the period 1980-88 (3, 4).

The results of a study that used similar techniques to examine traumatic occupational fatalities in California have been reported by Cone and

coworkers (8). They examined data for 1983 from California death certificates as well as from California's Division of Labor Statistics and its Occupational Safety and Health Administration. In general, California rates for occupational fatalities were similar to the national rates reported by NIOSH. The overall rate for occupational fatalities in California in 1983 was 5.48 per 100,000 workers. Agriculture, construction, and transportation-utilities were among the industry groups with the highest mortality rates.

Schnitzer and Bender studied traumatic occupational fatalities in Alaska for the period 1980-85 and found higher overall death rates than for the nation or California (9). The average annual traumatic occupational fatality rate for the 6-year period in Alaska was 36.3 per 100,000 workers. The leading causes of death in the Alaska study were related to drowning as well as to aircraft crash, presumably reflecting the significant travel requirements characteristic of major industries in the State.

Detailed statistics are not available on the magnitude of the problem of traumatic occupational fatalities in South Carolina. The State of South Carolina's Department of Health and Environmental Control (DHEC) makes nonconfidential death certificate information available to researchers. We used that data base in examining on-the-job fatal injuries occurring in the State and in calculating death rates by industry, sex, and race or ethnicity. We chose death certificates as a data source because of their sensitivity in capturing occupational fatalities and because of the availability of the DHEC data base.

Methods

The public access data file of DHEC's Office of Vital Records and Public Health Statistics contains demographic data, information on the cause of death, industry and occupation codes, and the injury-at-work item from all death certificates completed in South Carolina for the years 1989 and 1990. Although death certificate data for previous years are available from the public access file, 1989 is the first year with complete industry and occupation coding and the injury-at-work variable.

Funeral directors in South Carolina list on death certificates the decedents' occupation and industry. This information is translated into the appropriate industry-occupation code, using the 1980 census system. Previous surveys have shown that only 0.3 percent of industry-occupation entries on South

Carolina death certificates were incomplete (5). Death certificates were analyzed using the SAS Statistical Package, version 5.18 (10). Certificates were included that met the previously mentioned NIOSH project criteria.

Denominator data for nonfarm employment were obtained from the State of South Carolina's Employment Security Commission, Labor Market Information Division, in cooperation with the U.S. Department of Labor's Bureau of Labor Statistics (11). Statistics on employment in agriculture-fishing-forestry for 1989 were obtained from the State of South Carolina's Statistical Abstract (12). No employment statistics for agriculture-fishing-forestry for 1990 were available at the time the study was performed, and 1989 denominator data were used to estimate 1990 rates for that industry. For all other industries, specific yearly employment statistics were available.

Results

There were 277 fatal occupational injuries in South Carolina during the period 1989-90 that met the study criteria. Some demographic characteristics of that group are shown in table 1. Tables 2 and 3 list the numbers of deaths by industry and cause. Table 2 shows industry-specific death rates. Age-specific data were not available for employed persons in South Carolina during that period and age-specific death rates were not calculated. Fatality rates for subgroups with fewer than 10 subjects in the numerator were not calculated owing to their instability.

For the 2-year period, the death rate for men (15.9 per 100,000) was more than 13 times the rate for women (1.2 per 100,000). About 84 percent of the deaths resulted from unintentional injury, 13 percent were homicide, and 3 percent were suicide.

Although the death rate for women was much lower than that for men, a striking statistic emerged: 10 percent of deaths among men were from homicide, compared with 56 percent of deaths among women. Seventy percent of homicides of women were the result of shooting, 20 percent were the result of stabbing, and 10 percent were the result of striking with a blunt object. Half of the homicides of women at work occurred in the retail trade industry.

Overall, fatality rates were about 21 percent higher for nonwhites (10.19 per 100,000) than whites (8.40 per 100,000). Nonwhite workers had higher death rates for the categories of homicide, falling, struck by a falling object, and caught in

Table 1. Demographic characteristics of traumatic occupational fatalities in South Carolina, 1989-90

Characteristic	1989	1990	1989 and 1990 combined
Number	133	144	277
Sex:			
Percent men	91.7	95.1	93.5
Percent women	8.3	4.9	6.5
Race and ethnicity:			
Percent white	66.2	73.6	70.0
Percent nonwhite	33.8	26.4	30.0
Mean age at death (years)	38.6	40.4	39.5
Median age at death (years)	35.0	39.0	37.0
Mean years of education	11.6	11.8	11.7
Age range (years)	17-74	17-89	17-89
Years of potential life lost	3,392	3,672	7,064

Table 2. Traumatic occupational fatalities by industry group, South Carolina, 1989-90

Industry	Deaths	Deaths per 100,000 workers per year
Transportation-communications-utilities	58	44.17
Construction	71	36.60
Agriculture-fishing-forestry	22	25.58
Manufacturing	42	5.44
Retail trade	23	4.09
Services	21	3.67
All government	20	3.59
Wholesale trade	9	...
Finance-insurance-real estate	3	...
Noncodable	8	...
All industry	277	8.84

NOTE: Rates not calculated for industries with fewer than 10 deaths.

Table 3. Traumatic occupational fatalities, by cause of death, South Carolina, 1989-90

Cause	Number	Deaths per 100,000 workers per year
Motor vehicle crash	90	2.87
Homicide	35	1.12
Fall	31	0.99
Caught in machinery	25	0.80
Struck by falling object	25	0.80
Electrocution	19	0.61
Air transportation crash	16	0.51
Self-inflicted injury	8	...
Mechanical suffocation	7	...
Drowning	5	...
Carbon monoxide poisoning	4	...
Fire	3	...
Excessive heat	2	...
Water transportation crash	2	...
Other	5	...

NOTE: Rates not calculated for items with fewer than 10 deaths.

machinery. White workers had higher death rates for motor vehicle crash, electrocution, and aircraft crash. Nonwhite workers who received fatal injuries at work were, on average, about 1.7 years older than white workers who died, and the nonwhite workers had about 1 year less school.

Motor vehicle crash was by far the leading cause of occupational injury death (32 percent) and resulted in 57 percent of the deaths in the transportation-communication-utilities industry group. Homicide was the second most frequent cause of occupational fatality (13 percent) and accounted for 52 percent of the deaths in the retail trade industry. Falling was the third most frequent cause (11 percent) and accounted for 37 percent of the deaths in the construction industry. Construction, transportation-communication-utilities, and manufacturing had the largest number of fatal occupational injuries. The highest rates were in the transportation-communication-utilities, construction, and agriculture-fishing-forestry groups of industries (table 3).

Discussion

Although a direct comparison of death rates from differing periods is not strictly appropriate, no national level data for occupational fatalities for 1989-90 were available for comparison with the South Carolina data. The general trend in that death rate nationally has been a decline from 9.1 per 100,000 in 1980 to 5.9 per 100,000 in 1988 (3, and unpublished data from the National Traumatic Occupational Fatality Project data base, provided by Suzanne Kisner, Statistician, NIOSH, May 13, 1992).

Without an unforeseen rise in the national death rate data, it would appear that South Carolina has a higher traumatic occupational fatality rate from occupational injury than the national rate. Death rates for specific industry groups were higher in South Carolina than comparable national averages in construction, transportation-communication-utilities, and agriculture. Except for the industry-specific death rates, data from this analysis appear similar to the findings from other studies. Specifically, industry groups with high national death rates also had high death rates in South Carolina, such as transportation-communication-utilities, construction, and agriculture-fishing-forestry. The only exception was mining: at a national level, mining consistently has been one of the most dangerous industries. The mining industry is very small in South Carolina, however, and there were

no occupational fatalities in mining reported for 1989-90.

As in other studies, motor vehicle crash and homicide were the two leading causes of occupational fatality, yet those causes have not been covered under the regulatory authority of the Occupational Safety and Health Administration. Until recently, they were not considered for traditional forms of intervention by occupational safety and health professionals. Studies such as this have the potential to increase awareness of the problems and to encourage research and implementation of preventive interventions for such causes of on-the-job deaths as motor vehicle crash and homicide.

A contributing factor for occupational fatality from motor vehicle crash appears to be employment in an industry with high proportions of work involving driving on public highways. The industry with the highest rate of fatality involving a motor vehicle was transportation-communication-utilities. That finding concurs with other research in motor vehicle crash injury (3, 13).

As with the national level data, a much higher proportion of women than men in the workplace died by homicide. Work that involves frequent interaction with the public and exchange of money has been identified with high risk for violent assault, and women may be seen as vulnerable to robbery and assault (14) in this situation. The overall death rate for nonwhite workers was higher than for white workers, in keeping with national and California data.

The limitations of the study essentially involve the use of death certificate data, such as errors in coding and underreporting of essential elements on the certificate (industry, occupation, cause of death, and injury at work). DHEC death certificate coders are trained to record appropriate industry and occupation codes, and South Carolina data are audited periodically for completeness of this information.

Death certificate coders have been trained to record the usual industry and occupation of the decedent, which may not be that person's industry or occupation at the time of death. That may result in inaccuracies in some data. For injury research, more accurate information is obtained if certificates are coded for industry and occupation at the time of death.

Another limitation of the study may be the use of the public access data file. That file listed only the underlying cause of death, and contributing causes of death were not included. Inclusion of only underlying causes of death was likely to have

resulted in an underestimation of the total number of deaths from injury at work.

A measure is available of how many deaths can be missed by looking only at the underlying causes of death, not including contributory causes (15, 16). The State Office of Vital Records and Public Health Statistics has calculated the ratio of the number of times a particular code was mentioned on the death certificate to the number of times that code was selected as the underlying cause of death. A ratio close to 1.0 indicates that a particular code was mentioned as the underlying cause of death on almost all certificates on which that code appeared. A ratio greater than 1.0 indicates that a particular code was mentioned on the certificate as other than the underlying cause of death, for example, as a contributory cause of death. A ratio greater than 1.0 suggests that an investigator would miss cases if using only the underlying cause of death for a given cause of death.

The ratios for deaths from motor vehicle crash, homicide, suicide, and drowning were 1.0 to 1.2 in South Carolina for 1989 and 1990. For falls, the ratio ranged from 1.8 to 2.1, indicating that only about half of all deaths related to falls would be picked up if an investigator were looking only at underlying causes of death. For other E codes, including the other causes of death listed in table 3, the ratio ranged from 3.0 to 3.5, indicating that significant underestimation of deaths from these causes may have occurred.

In summary, underestimation of the numbers of deaths and the death rates from the categories of falling, struck by a falling object, caught in machinery, electrocution, aircraft crash, mechanical suffocation, carbon monoxide poisoning, excessive heat, and water transportation crash may have occurred because of the use of the public access file. The underestimation could have skewed the relative importance of some causes of on-the-job death. However, underestimations of deaths from motor vehicle crash, homicide, suicide, and drowning were unlikely. Despite the limitations, quite high fatality rates were seen for workers in South Carolina, compared to some other studies, and the trends in this study reflect those reported by others.

Deaths from injuries sustained at work represented about 5.4 percent of all deaths from injury of persons 16 years and older in South Carolina for 1989-90. Because that is a substantial percentage, analysis of those deaths is an important public health endeavor. Further study is warranted, particularly with reference to characterizing the events surrounding an injury and identifying environmen-

tal, procedural, and human factors involved in causing that injury. Identification, implementation, and analysis of preventive interventions for fatal occupational injuries can save lives among working men and women. Such research offers insights into preventing on-the-job as well as off-the-job injuries.

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Deaths Among the Homeless in Fulton County, GA, 1988-90

RANDY HANZLICK, MD
R. GIBSON PARRISH, MD

Dr. Hanzlick is an Assistant Professor of Forensic Pathology, Emory University School of Medicine, and a Forensic Pathologist with the Centers for Disease Control and Prevention, Atlanta. Dr. Parrish is Chief, Surveillance and Information Systems Section, Medical Examiner/Coroner Information Sharing Program, Surveillance and Programs Branch, Division of Environmental Hazards and Health Effects, National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta.

Cooperating in the study were Saleh Zaki, MD, Fulton County Medical Examiner, and Anita Beaty, Executive Director, Atlanta Task Force for the Homeless.

Tearsheet requests to Randy Hanzlick, MD, 916 Cumberland Rd., NE, Atlanta, GA 30306; tel. 404-616-6621.

Synopsis

The circumstances surrounding the deaths of 128 homeless persons investigated by the Fulton County, GA, Medical Examiner's Office during the period 1988-90 and the demographic characteristics of the deceased were studied and analyzed. Empha-

sis was placed on cause and manner of death, unintentional injuries, and alcohol-related mortality.

Ninety-eight percent of those who died were men, 55 percent occurred outdoors, 55 percent were due to natural causes, and 42 percent resulted from injuries, most of which were unintentional. The average age at death was 46 years, and 80 percent of those who died were found dead. Nearly half of the deaths (47 percent) were related to the acute or chronic effects of alcohol; the blood of 45 percent tested positive for ethanol; of that 45 percent, 75 percent had a blood ethanol concentration that exceeded 0.1 grams per deciliter.

Mortality patterns among the homeless persons in the study were similar to those previously reported in Fulton County and in San Francisco, CA. Available data indicate that mortality prevention strategies for the homeless in Fulton County should target alcohol abuse and unintentional injuries. Further studies are needed to document regional mortality patterns of the homeless.

IN FULTON COUNTY, GA, (1990 population 648,951), an estimated 10,000 to 15,000 persons are homeless, according to Anita Beaty, Executive Director of the Atlanta Task Force for the Homeless, in January 1992. Only two reports of mortality patterns among the homeless are available (1,2). To characterize deaths among the homeless further, we reviewed the investigative records of the Fulton County Medical Examiner (FCME) for homeless persons who died during the 3-year period from 1988 through 1990.

Methods

Decedents were classified as homeless at the time of death if (a) they were residing at a shelter for the homeless; (b) they had no current, valid, residential address; or (c) they were residing at a place not usually considered to be habitable. The

manner of death was determined by the FCME to be due to either natural or external causes. Deaths from natural causes are those due solely to disease or the aging process. Deaths from external causes are those that are usually injury- or drug-caused. They are categorized as unintentional (accidental), or intentional (homicide or suicide). Deaths of unknown manner were classified as undetermined. Cause and manner of death determinations were based on reported circumstances, known medical history, scene investigation, and autopsy when indicated.

Results

General demographics. Among the 128 persons identified as homeless who died, 125 were men, 77 were black, 49 white, 2 unknown. The average age at death was 46 years (standard deviation, 12 years;