The changing character of fatal work injuries

The 1993 Census of Fatal Occupational Injuries reveals that most job-related fatalities now occur in service-producing industries, such as trucking firms and retailing; highway fatalities and homicide are leading events

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Traditional images of workers killed on factory floors and at construction sites no longer square with the worksites of most Americans and the jobs in which they are most likely to be fatally injured. Nationally, about 5 of every 100,000 workers were fatally injured on the job. Recent data from the Bureau of Labor Statistics Census of Fatal Occupational Injuries show that two-thirds of the 6,271 fatal work injuries in 1993 resulted in deaths in transportation-related incidents or because of assaults and violent acts.[1] By contrast, deadly contacts with heavy objects, machinery, and equipment, one of the more traditional classifications of fatalities, accounted for about one-sixth of the total number of fatalities. (See table 1.)

This article summarizes major findings from the 1993 BLS fatality census, a program that provides accurate and verifiable counts of fatal work injuries and profiles where and how these deaths occurred and worker groups that were affected.

Highlights of the 1993 census

Highway-related fatalities. Highway traffic incidents[2] led all other fatal events, accounting for 20 percent of the 6,271 fatal occupational injuries. About half of the highway deaths resulted from collisions between two or more vehicles, a fifth from overturned vehicles, and the remainder mainly from crashing into a stationary object, such as a telephone pole or bridge abutment. The following tabulation shows the various types of work-related fatal highway incidents:

	Number	*Percent*
Total highway fatalities	1,232	100
Collision between vehicles	652	53
Moving in same direction	99	8
Head-on	244	20
At intersection	120	10
Moving and standing vehicle	52	4
Collision with stationary object	188	15
Noncollision	333	27
Jackknifed, overturned	235	19
Ran off highway	57	5
Other or unspecified	59	5

Half of the 1,232 workers killed in highway motor vehicle incidents were driving or riding in a truck—usually a tractor trailer rig, or to a lesser extent, a pickup truck. About a quarter were killed in automobiles. Highway fatalities typically occurred during daylight hours, between 9 a.m and 4 p.m.

Violence at work. Homicide[3] was the second leading cause of job-related deaths, accounting for 17 percent of fatal injuries to workers. Robbery was the primary motive for homicide at work; roughly 1 of 7 victims of workplace homicide was killed by a coworker or personal associate. The following shows the circumstances involved in job-related homicides:

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	Number	*Percent*
Total, job-related homicides	1,063	100
Robberies and miscellaneous crimes	793	75
Work associates	106	10
Coworker, former coworker	59	6
Customer, client	43	4
Police in the line of duty	67	6
Security guard in the line of duty	52	5
Personal acquaintances	45	4
Victim's husband, ex-husband	15	1
Boyfriend, ex-boyfriend	11	1
Other relative	6	1
Other acquaintance	11	1

Approximately half of all homicide victims were workers in retail establishments, such as grocery stores and eating and drinking places. Eleven percent of homicide victims were police and security guards killed in the line of duty. Taxicab drivers also were at particular risk of being shot while working.

About four-fifths of the 1,063 workplace homicide victims were men. But homicide was, by far, the most frequent type of fatal injury for female workers, accounting for 39 percent of their 481 fatal injuries. By comparison, homicides were 17 percent of the 5,790 fatal injuries to men at work. Most of the homicide victims were shot (82 percent); 9 percent were stabbed; the others were beaten, strangled, purposely run over by a vehicle, or killed by fire.

The 1993 census also found that:

- On average, 17 fatal work injuries occurred each day.
- The average age of a fatally injured worker was 42.
- 169 workers under the age of 20 were killed; they were primarily homicide victims in retail establishments or involved in various farm-related incidents.
- 20 percent of job-related fatalities were transportation-related incidents occurring off the highway (such as on farms, in parking lots, or at other industrial sites); workers struck by vehicles; and incidents involving air, water, or rail transport.
- Falls accounted for 10 percent of the fatal work injuries; workers struck by falling or flying objects accounted for 9 percent; electrocutions and workers caught in or under equipment each accounted for 5 percent.
- Occupations with the largest share of fatalities were motor vehicle operators (primarily truck-drivers—12 percent), farming occupations (10 percent), sales occupations (9 percent), and construction trades workers (9 percent).
- The three most dangerous occupations were logging, fishing, and aircraft piloting—each with more than 100 fatalities per 100,000 workers. (The national average was about 5 per 100,000 workers.)
- The number of fatalities was about evenly distributed among seven industry groups. The fatality rate was highest in mining and agriculture, each with 26 fatalities per 100,000 workers; the service industries had one of the lowest rates, at 2 fatalities per 100,000 workers.

Experimental fatality rates

If comparable employment data or hours of exposure are available by occupation, industry, or other demographic characteristics, rates can be calculated to examine the possibility of occurrence of a fatality. Frequencies (absolute numbers) indicate the magnitude of the problem for a given employment group and a fatality rate depicts the risk of incurring a fatal injury faced by workers within the employment group. Thus, rates allow users to compare the risk of a fatal injury among various groups of workers.

BLS has developed experimental fatality rates using annual average employment estimates from the 1993 Current Population Survey (CPS). (See appendix for notes on developing fatality rates.)

Census of Fatal Occupational Injury rates were calculated for major industry divisions, selected occupations, and other demographic characteristics. These rates do not measure the independent effect of a single characteristic, such as age, sex, industry, or occupation. Rates, however, are useful in identifying potential "high risk" groups for further study, such as older workers and the self-employed. Many safety experts consider aggregates of fatalities equally important in developing intervention strategies. For example, a single fatality in a rare occupation, say, elephant training, would result in a high fatality rate for the occupation, yet the magnitude of the problem is small because few workers are employed as elephant trainers.[4]

National fatality profile

Nationally, highway traffic deaths and homicides combined accounted for one-third of the deaths that occurred to workers who were fatally injured. Although fatalities occurred among all occupations and industries, the risk of fatal injury and how workers died varied among occupations and industries. (State profiles of worker fatalities may differ from the corresponding national profile and are discussed later.)

Occupation and event or exposure. Fishers experienced the highest rate of fatal work injury;

155 of every 100,000 fishers were fatally injured while working during 1993. (See table 2.) Three-fourths of these fatalities resulted from falling from a boat or because the boat capsized.

Loggers and timber cutters, with the second highest injury fatality rate of 133, were fatally injured most often by falling trees. Most of the remaining deaths in this occupation occurred in various types of transport-related incidents.

Workers in farming-related occupations accounted for 10 percent of all fatal work injuries, but represent only 3 percent of the Nation's employment total. They were fatally injured in transportation-related incidents—both on the highway and on the farm—and were caught in or struck by various types of farm machinery.

The fatality rate for workers in sales occupations was relatively low, at 4 per 100,000 workers, but salesworkers incurred nearly 10 percent of all fatal work injuries. This occupational grouping, which includes supervisors and proprietors of retail establishments, salesclerks, and cashiers, accounted for one-third of all workplace homicides.

One of every eight workers who was fatally injured drove a truck or a taxicab for a living. Truckdrivers and driver salesworkers died primarily in motor vehicle traffic incidents, but taxi drivers more often died as a result of homicide. Airplane pilots and navigators were fatally injured at a rate of 103 deaths per 100,000 workers. Virtually all their deaths were in aircraft crashes.

Construction trade workers such as carpenters and electricians accounted for 9 percent of all fatal work injuries and were fatally injured at a rate of 11 per 100,000 workers. Structural metal workers, with the highest rate of fatal injury among the construction trades (76 per 100,000), had 34 deaths that resulted primarily from falls. About half of the fatalities to electricians and electrical power installers and repairers were electrocutions. Laborers in construction were exposed to a variety of life-threatening hazards: highway motor vehicle injuries; being struck by a vehicle; trench cave-ins; being struck by falling objects; falls; and electrocutions.

Protective service occupations accounted for more than half of fatalities to workers in the service occupations, which also include cleaning and building services, food preparation, private household workers, and health services. Firefighters incurred a relatively small number of fatalities, but their rate of fatal injury on the job was three times the national rate and was the highest among the protective service occupations. Nearly half of their deaths occurred as a result of fires and explosions, and about one-third resulted from transport-related incidents. Homicide accounted for more than half the fatalities to police and detectives; the remainder were primarily transport related, including highway motor vehicle incidents and being struck by a vehicle. Security guards also incurred a large proportion of their deaths by homicide.

Executives, administrators, and managers accounted for about 7 percent of the fatal work injuries, with about two-thirds of their fatalities caused by homicides and suicides and by transportation-related incidents.

Table 1. **Fatal occupational injuries by event or exposure, 1993**

Event or exposure[1]	Fatalities	
	Number	Percent
Total	6,271	100
Transportation incidents	2,482	40
Highway	1,232	20
Collision between vehicles, mobile equipment	652	10
Vehicle struck stationary object or equipment	188	3
Noncollision	333	5
Jackknifed or overturned—no collision	235	4
Ran off highway—no collision	57	1
Nonhighway (farm, industrial premises)	392	6
Overturned	212	3
Fell from and struck by vehicle, mobile equipment	87	1
Aircraft	280	4
Worker struck by a vehicle	361	6
Water vehicle	119	2
Railway	85	1
Assaults and violent acts	1,309	21
Homicides	1,063	17
Shooting	874	14
Stabbing	95	2
Self-inflicted injury	215	3
Assaults by animals	31	([2])
Contact with objects and equipment	1,039	17
Struck by object	563	9
Struck by falling object	345	6
Struck by flying object	81	1
Caught in or compressed by equipment or objects	308	5
Caught in running equipment or machinery	150	2
Compressed or pinched by rolling, sliding, or shifting objects	56	1
Caught in or crushed in collapsing materials	138	2
Falls	611	10
Exposure to harmful substances or environments	590	9
Contact with electric current	324	5
Exposure to caustic, noxious, or allergenic substances	116	2
Oxygen deficiency	111	2
Drowning, submersion	89	1
Fires and explosions	201	3
Other events or exposures[3]	38	1

[1] Based on the 1992 BLS Occupational Injury and Illness Classification Structures. The event describes the manner in which the injury was inflicted or produced.

[2] Less than 0.5 percent.

[3] Includes the category "Bodily reaction and exertion."

NOTE: Totals for major categories may include subcategories not shown separately. Percentages may not add to totals because of rounding.

SOURCE: Census of Fatal Occupational Injuries, 1993.

Worker characteristics. Men, the self-employed, and workers aged 55 and older appear to have a higher risk of workplace fatality relative to their share of employment. (See table 3.)

Most noticeable about the data on the type of fatalities among certain worker groups is the pro-

Table 2. **Fatal occupational injuries by occupation and event or exposure, 1993**

Occupation[1]	Number of fatalities	Event or exposure (percent): Transportation incidents	Assaults and violent acts	Contact with objects and equipment	Falls	Exposure to harmful substances or environments	Fires and explosions	Employment (thousands)[2]	Fatalities per 100,000 employed[3]
Total	6,271	40	21	17	10	9	3	120,791	5
Managerial and professional specialty	681	42	32	7	8	9	1	32,280	2
Executive, administrative, and managerial	427	35	37	10	9	7	1	15,376	3
Professional specialty	254	54	22	4	6	11	2	16,904	2
Technical, sales, and administrative support	842	37	53	3	3	3	1	36,814	2
Technicians and related support occupations	167	81	4	4	4	5	2	4,014	4
Airplane pilots and navigators	104	98	—	—	—	—	—	101	103
Sales occupations	556	22	70	2	2	2	1	14,245	4
Administrative support occupations, including clerical	119	40	43	7	5	4	—	18,555	1
Service occupations	539	28	46	5	8	8	5	16,522	3
Protective service occupations	288	34	48	3	4	5	6	2,152	13
Firefighting and fire prevention occupations, including supervisors	39	36	—	—	8	—	46	244	16
Police and detectives, including supervisors	149	42	51	4	—	—	—	1,019	15
Guards, including supervisors	100	21	62	—	6	9	—	889	11
Farming, forestry, and fishing	961	46	5	33	5	10	1	3,326	28
Farming operators and managers	409	52	4	32	3	7	2	1,170	35
Other agricultural and related occupations	319	40	8	27	10	14	1	1,963	16
Farm workers, including supervisors	209	52	7	27	3	10	1	838	24
Forestry and logging occupations	142	20	—	69	5	4	—	132	108
Timber cutting and logging occupations	124	18	—	73	3	4	—	93	133
Fishers, hunters, and trappers	91	75	—	3	—	21	—	61	149
Fishers	79	73	—	4	—	23	—	51	155
Precision production, craft, and repair	1,095	20	9	22	24	20	5	13,326	8
Mechanics and repairers	317	23	15	27	9	19	7	4,416	7
Construction trades	565	18	4	14	37	22	4	5,004	11
Carpenters	96	17	—	15	48	17	—	1,276	7
Electricians	78	13	—	—	23	53	6	666	12
Electrical power installers and repairers	42	12	—	7	19	57	—	110	38
Structural metal workers	34	—	9	21	62	—	—	45	76
Operators, fabricators, and laborers	1,959	50	12	18	8	7	4	17,038	11
Machine operators, assemblers, and inspectors	205	11	9	37	9	14	19	7,415	3
Transportation and material-moving occupations	1,182	67	13	11	5	3	1	5,004	24
Motor vehicle operators	917	71	15	8	3	2	1	3,825	24
Truckdrivers	731	80	4	9	3	2	1	2,786	26
Driver-sales workers	41	76	17	7	—	—	—	178	23
Taxicab drivers and chauffeurs	113	13	86	—	—	—	—	225	50
Material-moving equipment operators	180	44	4	33	11	7	2	1,009	18
Handlers, equipment cleaners, helpers, and laborers	572	30	12	25	15	13	4	4,619	12
Construction laborers	218	29	3	29	22	14	2	658	33
Laborers, except construction	202	32	8	28	12	14	6	1,127	18
Military	121	64	9	11	5	6	5	1,485	8

[1] Based on the 1990 Occupational Classification System developed by the Bureau of the Census.

[2] The employment is an annual average of employed civilians 16 years of age and older, plus resident Armed Forces, from the 1993 Current Population Survey (CPS).

[3] Experimental measure, using CPS employment data. This rate represents the number of fatal occupational injuries per 100,000 employed, and was calculated as follows:

$$N/W \times 100{,}000,$$

where N = number of fatal work injuries and W = employment based on the 1993 CPS.

N was adjusted to maintain consistency with employment coverage (W) in the rate calculation.

NOTE: Totals for major categories may include subcategories not shown separately. Percentages may not add to totals because of rounding. Dashes indicate no data reported or data that do not meet publication guidelines. There were 73 fatalities for which there was insufficient information to determine an occupation classification.

SOURCE: Census of Fatal Occupational Injuries, 1993.

portion of homicides among Asians and Pacific Islanders and female workers who were fatally injured. The proportion reflects at least in part the jobs typically held by these workers. Both groups have a high proportion of employment in retail trade. Other workers with an unusually high proportion of fatalities due to homicide include the self-employed; workers 16 and 17 years old; Hispanics; and nonwhites, except American Indians.

The slightly higher than average proportion of fatal contacts with objects and equipment for the self-employed and the younger age groups is explained in part by these groups' employment on farms. Farm workers are often struck by falling trees, caught in farm machinery, and engulfed in collapsing grain in silos or other storage facilities. Loggers who were primarily struck by falling trees added to the toll for the self-employed.

Industry and event or exposure. Agriculture, forestry, and fishing and mining had the highest rates of fatal work injury of all industry divisions. (See table 4.) The rate for agricultural services was particularly high, with 94 workers killed per 100,000 workers employed. Workers in this industrial group perform activities such as crop planting, dusting, and harvesting; veterinary and other livestock services; and landscape and other horticultural services. In addition to incurring transportation-related injuries, landscape and horticultural workers were at risk of suffering fatal injury from falling trees, falls from trees, and contact with electric current. Workers in

Table 3. **Fatal occupational injuries by selected worker characteristics and event or exposure, 1993**

Characteristics	Number of fatalities	Event or exposure (percent)						Employment (thousands)[1]	Fatalities per 100,000 employed[2]
		Transportation incidents	Assaults and violent acts	Contact with objects and equipment	Falls	Exposure to harmful substances or environments	Fires and explosions		
Total	6,271	40	21	17	10	9	3	120,791	5
Employment status									
Wage and salary workers	4,981	41	19	16	10	10	4	110,133	5
Self-employed[3]	1,290	34	28	21	8	7	2	10,658	12
Sex and age									
Men	5,790	40	19	17	10	10	3	66,029	9
Women	481	40	42	6	4	6	2	54,761	1
Both sexes:									
Under 16 years	29	34	21	28	—	10	—	—	—
16 to 17 years	39	38	28	21	8	—	—	2,142	2
18 to 19 years	101	42	19	14	6	16	4	3,388	3
20 to 24 years	502	35	21	19	6	15	4	12,613	4
25 to 34 years	1,510	40	22	14	8	12	3	32,703	5
35 to 44 years	1,576	38	22	17	10	9	4	32,691	5
45 to 54 years	1,193	40	21	16	11	9	3	22,450	5
55 to 64 years	801	42	19	18	12	5	2	11,313	7
65 years and older	514	43	17	20	13	4	2	3,409	15
Race or Hispanic origin									
White	5,106	42	18	17	10	10	3	103,917	5
Black	664	33	28	17	8	10	4	12,444	5
Asian or Pacific Islander	190	16	66	4	7	5	—	—	—
American Indian, Aleut, Eskimo	47	40	17	11	9	15	9	—	—
Other or unknown race	263	37	33	13	9	5	2	—	—
Hispanic[4]	604	29	34	15	10	9	3	9,272	6

[1] The employment is an annual average of employed civilians 16 years of age and older, plus resident Armed Forces, from the 1993 Current Population Survey (CPS).

[2] Experimental measure using CPS employment data. This rate represents the number of fatal occupational injuries per 100,000 employed and was calculated as follows:

$$N/W \times 100{,}000,$$

where N = number of fatal work injuries and W = employment based on the 1993 CPS. N was adjusted to maintain consistency with employment coverage (W) in the rate calculation.

[3] Includes paid and unpaid family workers and may include owners of incorporated businesses or members of partnership.

[4] Persons identified as Hispanic may be of any race. Hispanic employment does not include resident Armed Forces.

NOTE: Percentages may not add to totals because of rounding. Dashes indicate no data reported or data that do not meet publication guidelines.

SOURCE: Census of Fatal Occupational Injuries, 1993.

other agriculture-related industries died in highway vehicle incidents, in tractor rollovers, or from running machinery or were engulfed in grain.

Although mining had the second lowest number of fatalities among industry divisions, its fatal work injury rate was tied with that of agriculture, forestry, and fishing. Among fatalities in coal mining, 70 percent were caused by contact with objects such as large rocks or equipment or mine cave-ins.

Table 4. **Fatal occupational injuries by industry and event or exposure, 1993**

Industry	SIC code[1]	Number of fatalities	Event or exposure (percent): Transportation incidents	Assaults and violent acts	Contact with objects and equipment	Falls	Exposure to harmful substances or environments	Fires and explosions	Employment (thousands)[2]	Fatalities per 100,000 employed[3]
Total	....	6,271	40	21	17	10	9	3	120,791	5
Private industry	....	5,590	38	21	18	10	10	3	100,791	6
Agriculture, forestry and fishing	....	855	51	5	26	6	11	1	3,172	26
Agricultural production—crops	01	398	59	3	27	2	7	2	900	43
Agricultural production—livestock	02	209	39	10	35	4	10	—	1,160	17
Agricultural services	07	153	33	8	22	20	17	—	163	94
Mining	....	174	27	3	42	8	14	5	669	26
Coal mining	12	40	12	—	70	—	15	—	114	35
Oil and gas extraction	13	94	33	4	32	10	15	4	371	25
Construction	....	924	25	4	20	30	17	3	6,724	14
General building contractors	15	152	23	5	21	38	10	3	—	—
Heavy construction, except building	16	255	37	3	29	11	16	4	—	—
Special trades contractors	17	517	20	4	16	36	20	4	—	—
Manufacturing	....	762	29	9	36	8	11	6	19,444	4
Food and kindred products	20	82	35	10	24	10	15	6	1,760	5
Lumber and wood products	24	204	28	2	63	3	—	—	704	29
Transportation and public utilities	....	890	65	16	8	3	5	2	6,867	13
Local and interurban passenger transportation	41	130	18	78	—	—	—	—	472	28
Trucking and warehousing	42	467	79	5	9	2	2	1	2,163	22
Transportation by air	45	79	87	—	5	4	—	—	724	11
Electric, gas, and sanitary services	49	72	38	7	19	6	22	8	1,597	5
Wholesale trade	....	250	55	15	13	8	4	4	4,598	5
Retail trade	....	784	18	70	5	2	3	1	20,070	4
Food stores	54	223	7	89	—	2	—	—	3,412	6
Automotive dealers and service stations	55	138	28	54	8	3	4	—	2,041	7
Eating and drinking places	58	199	15	76	3	2	4	—	6,036	3
Finance, insurance, and real estate	....	116	31	40	3	15	11	—	7,728	2
Services		758	35	28	10	9	13	4	31,516	2
Business services	73	188	32	26	9	15	12	4	4,643	4
Automotive repair, services, and parking	75	116	22	32	22	3	11	9	1,470	8
Government[4]	....	681	52	23	7	7	6	5	20,001	3
Federal (including resident Armed Forces)	....	186	61	16	7	7	4	4	4,941	4
State	....	146	64	18	5	5	5	2	4,905	3
Local	....	340	42	30	7	7	7	7	10,155	3
Police protection	9221	87	44	49	3	—	—	—	—	—

[1] *Standard Industrial Classification Manual*, 1987 edition.

[2] The employment is an annual average of employed civilians 16 years of age and older, plus resident Armed Forces, from the 1993 Current Population Survey (CPS).

[3] Experimental measure using CPS employment data. This rate represents the number of fatal occupational injuries per 100,000 employed and was calculated as follows:

$$N/W \times 100{,}000,$$

where N = number of fatal work injuries and W = employment based on the 1993 CPS.

N was adjusted to maintain consistency with employment coverage (W) in the rate calculation.

[4] Includes fatalities to workers employed by government organizations, regardless of industry.

NOTE: Totals for major categories may include subcategories not shown separately. Percentages may not add to totals because of rounding. Dashes indicate no data reported or data that do not meet publication guidelines. There were 77 fatalities for which there was insufficient information to determine a specific industry classification, although a distinction between private and government was made for each.

SOURCE: Census of Fatal Occupational Injuries, 1993.

Workers in the manufacture of lumber and wood products died at a rate of nearly 30 workers per 100,000. Fatally injured workers in this industry were primarily loggers and timber cutters who were killed by falling trees or in transportation-related incidents.

Local and intercity passenger transport and trucking and warehousing also were particularly hazardous for their workers. High rates in these industries reflect the frequency with which taxicab drivers were murdered while on the job and truckdrivers killed on the highway.

Location and event or exposure. One-fourth of fatal incidents occurred on a street or highway, primarily the result of motor vehicle incidents. About one-fifth occurred at a construction site, warehouse, factory, or other industrial site. (See table 5.)

About 1 of every 7 fatalities occurred in a public building such as a grocery or other retail store, office building, restaurant, or school. These fatalities were primarily the result of homicides, as were a large proportion of the fatalities that occurred in parking lots, apartment buildings, and residential institutions.

The primary causes of fatal injuries on farms were transportation-related incidents, such as tractor rollovers and falls from tractors, and in various contacts with objects and equipment, such as running machinery, falling objects, or collapsing grain or other materials.

State fatality profiles

Ten States combined accounted for about half of the fatal job-related injuries: California, Florida, Georgia, Illinois, Louisiana, New York, North Carolina, Pennsylvania, Tennessee, and Texas. In contrast, half of the remaining States had fewer than 100 fatalities each. Homicide was the leading cause of death in about one-third of the States, while highway traffic fatalities led all other categories in most of the remaining States. Participating State agencies are expected to release their data later this year.

When comparing fatality rates among States, one must consider the industry mix in the States. For example, a State with a large agricultural economy should not be compared with a State having a large manufacturing economy; agriculture has one of the highest fatality rates, and manufacturing has one of the lowest.

In addition, transportation-related fatalities, particularly plane crashes, should not be used in calculating State rates because the denominator used in the calculation is the number of workers employed in the State, while the victims, the numerator, may be workers who are traveling but are employed in other States. Thus, because the numerator and denominator do not cover the same population, calculating the risk of a fatal work injury would be misleading.

States are using up to 25 independent data sources to identify, substantiate, and code the circumstances of work-related fatalities. The major data sources include death certificates marked "at work"; workers' compensation reports and claims; Occupational Safety and Health Administration, State farm bureau, police, coroner, and medical examiner reports; and newspaper stories. As States identify additional sources of occupational fatality information, their census counts will be more complete. An increase in the fatality counts should not be automatically construed as a failure of safety efforts, but possibly an improvement in identifying and capturing vital information that can be analyzed and used to save lives.

In addition, the number of fatalities and their characteristics can change markedly from year to year, particularly among States. For example, the floods of the Mississippi River in 1993 put many workers in the bordering States in harm's way. These types of natural disasters would affect the comparison of 1993 data with those of any other year at the State and national levels.

While comparisons of fatality rates among States may be difficult to analyze, individual State data are useful for injury prevention. Absolute numbers are equally important in monitoring the magnitude of a problem in a State. The information can be used to alert employers and employees of serious injuries and how they occur; policymakers can judge the magnitude of a specific hazard to justify prevention programs; and researchers can isolate the circumstances surrounding specific problems, such as homicides in retail trade, and develop strategies for prevention.

Possible uses of the data

Although BLS had been measuring workplace safety since 1912, the 1992 national census was a "quantum leap" in accuracy.[5]

The safety and health community previously lacked detailed information needed to assess the full scope of incidents leading to workplace fatalities. The wealth of information compiled by the Census of Fatal Occupational Injuries will yield vital insights that may help prevent fatal on-the-job injuries many safety experts regard as sentinel events in that their occurrence indicates a failure in preventive practices.[6]

The national database will help users generate fatality profiles for specific industries and populations and study fatalities involving certain types of machinery or events and hazardous work

activities. This information is invaluable in targeting injury prevention efforts. These studies also help identify workplace standards that require revision and highlight areas in which intervention strategies need to be developed.

About the census

Collection methods. The Census of Fatal Occupational Injuries program is a cooperative venture in which the operating costs are shared equally by State and Federal Governments. States are responsible for data collection, follow-up procedures, and coding. About 20 data elements, including the demographic characteristics of the decedent and circumstances of the fatal event, are coded according to standard instructions. Up to 10 additional data elements are coded, depending on the availability of information on the fatal injury.

Information collected for each reported fatality case includes the industry of the employer, equipment or machines involved, activity the worker was performing at the time of the incident, occupation of the worker, and location of the incident.

States obtain this information from death certificates, workers' compensation reports, and other reports provided by State administrative agencies. Additional information is provided to

Table 5. **Fatal occupational injuries by location of incident and event or exposure, 1993**

Location	Number of fatalities	Event or exposure (percent)[1]					
		Transportation incidents	Assaults and violent acts	Contact with objects and equipment	Falls	Exposure to harmful substances or environments	Fires and explosions
Total	6,271	40	21	17	10	9	3
Street or highway	1,740	85	8	3	1	2	—
Industrial place or premises	1,373	15	8	33	21	15	7
Industrial place and premises, unspecified	230	5	7	43	11	20	12
Dockyard	39	28	8	28	23	10	—
Loading platform, factory or store	73	18	7	40	16	14	4
Railway yard, including railway line, tracks	85	76	7	4	7	4	—
Warehouse	75	15	27	24	21	12	—
Construction site	398	11	3	30	38	15	2
Industrial place or premises, n.e.c.	380	9	13	34	14	19	11
Other specified place[2]	1,016	42	17	18	8	12	3
Parking lot, garage (employer's premises)	149	15	50	12	7	9	7
Parking lot, garage (except employer's premises)	62	11	44	23	6	10	5
River	69	72	4	6	—	14	—
Sea	120	72	—	3	6	17	—
Public building[3]	964	1	76	4	9	6	3
Market, grocery or other commodity	244	—	95	—	3	2	—
Office building	125	—	72	6	9	11	2
Restaurant, cafe	127	—	83	—	4	9	2
Shop, commercial store (except grocery)	225	2	78	6	6	2	6
School (State, public, private)	40	—	28	10	32	15	10
Farm	641	47	5	32	5	9	1
Farm buildings	66	6	6	44	23	18	—
Farm land under cultivation, fields, meadows	207	66	3	23	2	5	—
Private residence[4]	231	5	26	13	28	20	7
Apartment	50	—	42	—	28	18	8
Mine, quarry	104	13	—	59	8	13	4
Mine	48	8	—	73	—	10	—
Place for recreation and sport	71	23	13	10	17	37	—
Residential institution[5]	37	—	46	22	8	8	11
Unspecified place	94	19	19	14	17	18	4

[1] Based on the 1992 BLS Occupational Industry and Illness Classification Structure.

[2] Includes primarily outdoor areas such as bodies of water, woods, noncultivated fields, and parking lots.

[3] Buildings and adjacent grounds used by the general public or a particular group, such as hotels, restaurants, stores, office buildings, courthouses, and schools.

[4] These fatalities occurred primarily to repair or maintenance workers or to police while on duty.

[5] Includes children's home, dormitory, hospital, jail nursing home, and reform school.

NOTE: Totals for major categories may include subcategories not shown separately. Percentages may not add to totals because of rounding. Dashes indicate no data reported or data that do not meet publication criteria.

n.e.c. = not elsewhere classified.

SOURCE: Census of Fatal Occupational Injuries, 1993.

States from Federal agencies, such as the Department of Labor's Occupational Safety and Health Administration, Employment Standards Administration, and Mine Safety and Health Administration. Overall, in 1993, State agencies collected approximately 20,000 individual source documents, or an average of about three documents from different sources for each fatality case. (See table 6.) To avoid duplication, source documents are matched using the decedent's name and other information.

To ensure an accurate count of fatal occupational injuries, the census program requires that for each case, the work relationship (that is, whether a fatality is work related) be substantiated by two or more independent source documents or a source document and a followup questionnaire. Followup questionnaires are sent to the employer or to another contact that has knowledge of the incident. The followup questionnaire also is used to collect information missing from the source documents. Nonresponse to the questionnaire or inconsistent data results in further followup by telephone.

At the conclusion of the collection period, fatalities for which the State has only one source document are reviewed by BLS. The fatality is included in the national data base only if the State and BLS agree that there is sufficient information on the source document to determine that the fatality is work related. (See the appendix for an explanation of how cases with only one source document are processed.)

For a fatality to be considered within the scope of the program, the decedent must have been employed (working for pay, compensation, or profit or in the family business) at the time of the event and engaged in a legal work activity[7] or present at the site of the incident as a job requirement. This definition allows all injury-related[8] fatalities that occur while a person is in a work status to be included in the census; it is generally broader than the criteria used by Federal and State agencies administering specific laws or regulations.

Partial information on fatal occupational illnesses (nontraumatic conditions such as asbestosis and occupational cancers) is being compiled primarily from State workers' compensation reports. Because of the latency period of many occupational illnesses and the difficulty associated with linking illnesses to work, it is not possible to compile a complete count of all fatal illnesses in a particular year. Thus, information on illness-related deaths is excluded from this article.[9]

Safety and health researchers, policy officials, and others involved in promoting safety in the workplace may examine a research file made available to them through a letter of agreement with BLS to protect the confidentiality of data sources.[10] Because census data are collected under a pledge of confidentiality, data that identify the deceased or the company are deleted from the data base.

Background. The BLS census counts and verifies all fatal work injuries, providing detailed information about how the injury occurred, the machinery and equipment involved, and demographic characteristics of the fatally injured worker (for example, age, gender, and race). The development of the Census of Fatal Occupational Injuries program included several years of testing before it was begun in the 50 States and the District of Columbia in 1992. Information from the first national census was published in the October 1993 issue of the *Monthly Labor Review*.[11]

The development of the BLS census was a result of recommendations in 1987 by the National Academy of Sciences[12] and other safety and health organizations that emphasized the need to obtain detailed characteristics on fatal workplace injuries on a timely basis to develop and put in place effective safety measures. The recommendations included using multiple data sources such as death certificates and workers'

Table 6. **Source documents used to compile information on fatal work injuries, 1993**

Source document	Fatalities	
	Number	Percent
Total[1]	6,271	100
Death certificates	4,409	78
State workers' compensation reports	2,244	36
Coroner, medical examiner, and autopsy reports	3,195	51
Occupational Safety and Health Administration (OSHA) reports[2]	1,840	29
News media	2,332	37
Followup questionnaires[3]	1,310	21
State motor vehicle reports	332	5
Other Federal reports[4]	283	5
Other reports[5]	3,775	61

[1] The total number of source documents exceeds the total of verified cases because two or more source documents were used to substantiate each case. Some source documents were received only upon request. In general, these included autopsy, coroner, and medical examiner reports; followup questionnaires; and State motor vehicle reports. The number of death certificates shown are those received through "formal arrangements" and marked "at work."

[2] This figure is not a comprehensive count of fatalities reported to, or investigated by, OSHA, but represents the available OSHA reports used to identify or substantiate a work injury fatality in the Census of Fatal Occupational Injuries program.

[3] Includes telephone followup for missing data and clarifying inconsistent data.

[4] Includes reports received from the Mine Safety and Health Administration, Employment Standards Administration, National Institute for Occupational Safety and Health's Fatal Accident Circumstances and Epidemiology program, Department of Justice, Department of Energy, and National Transportation Safety Board.

[5] Includes reports received from other organizations, such as State farm bureaus, local police departments, emergency medical services, and the National Association of Chiefs of Police.

SOURCE: Census of Fatal Occupational Injuries, 1993.

compensation reports to identify and profile fatal work injuries for all workers, including the self-employed.

The Keystone Dialogue Group further recommended developing a "consensus method" to count work-related fatalities.[13] The group stated that the "development of an accepted count of workplace deaths should mute controversy on this issue stemming from the variety of estimates coming from different sources." In this regard, fatality estimates made by various organizations at that time varied greatly from 3,000 to 11,000 deaths nationally per year.[14]

The census approach to compiling data on fatal work injuries was first tested in a BLS cooperative effort with the Texas Department of Health in 1988.[15] This approach was tested again in Texas and Colorado in 1990 to determine whether the same kind of data could be obtained from multiple data sources on a current basis.[16] In 1991, the Census of Fatal Occupational Injuries was initially begun in 32 States and New York City. In 1992, the census covered the 50 States and the District of Columbia.[17] □

Footnotes

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[1] Transportation-related incidents include fatalities involving land (either on or off the highway), air, water, or rail transport. It includes injuries to occupants of vehicles and to pedestrians or other nonpassengers. Assaults and violent acts include homicides, self-inflicted injuries, and attacks by animals.

[2] Highway fatalities include deaths to vehicle occupants resulting from traffic incidents occurring on the public roadway, shoulder, or surrounding area. They exclude incidents occurring entirely off the roadway, such as in parking lots, on industrial premises, and on farms; incidents involving trains; and deaths to pedestrians or other nonpassengers.

[3] Homicide is generally defined as the intentional taking of another's life or killing another while committing a crime.

[4] Mark Purschwitz and John Shutske, "Agricultural Injury Denominator Data." Paper presented at the American Society of Agricultural Engineers meeting, Spokane, WA, June 1993.

[5] Statements made by U.S. Secretary of Labor Robert B. Reich and Acting Commissioner of Labor Statistics William Barron at the first national Census of Fatal Occupational Injuries news conference, Washington, Oct. 1, 1993.

[6] Scott J. N. McNabb, Centers for Disease Control and Prevention, presentation at the CFOI national conference, Washington, Sept. 9, 1992.

[7] Work is defined as duties, activities, or tasks that produce a product or result; that are done in exchange for money, goods, services, profit, or benefit; and that are legal activities in the United States. Fatalities that occur while a person is commuting to and from work are excluded from the counts in the Census of Fatal Occupational Injuries.

[8] A traumatic injury is defined as any unintentional or intentional wound or damage to the body resulting from acute exposure to energy—such as heat or electricity or kinetic energy from a crash—or from the absence of such essentials as heat or oxygen caused by a specific event, incident, or series of events within a single workday or shift. Included are open wounds, intracranial and internal injuries, heatstroke, hypothermia, asphyxiation, acute poisoning resulting from a short-term exposure (limited to the worker's shift), suicide and homicide, and work injuries listed as underlying or contributory cause of death.

[9] A total of 1,466 fatal occupational illness cases were collected and coded in 1993. These cases were primarily heart attacks that occurred at work. For a more complete discussion of the difficulties involved in capturing information on occupational illnesses, both fatal and nonfatal, see Harvey J. Hilaski, "Understanding statistics on occupational illnesses," *Monthly Labor Review*, March 1981, pp. 25–29.

[10] The 1992 Census of Fatal Occupational Injuries research file is available on diskette upon request. The 1993 research file will be available in February 1995. For information on obtaining an application form to request the research file, contact Guy Toscano at (202) 606–6175.

[11] Guy A. Toscano and Janice Windau, "Fatal work injuries from the 1992 national census," *Monthly Labor Review*, October 1993, pp. 39–48.

[12] *Counting Injuries and Illnesses in the Workplace: Proposals for a Better System* (National Research Council, National Academy Press, 1987).

[13] "Keystone National Policy Dialogue on Work-Related Illness and Injury Recordkeeping," final paper of Keystone Center, January 1989.

[14] The BLS Survey of Occupational Injuries and Illnesses estimated that 2,900 work-related fatalities occurred in 1990. For the same year, the National Safety Council estimated 10,500 work-related fatalities. The National Institute for Occupational Safety and Health's National Traumatic Occupational Fatality program estimated 5,700 work-related deaths for 1989, the latest year for which data from that program are available.

The BLS survey produces national estimates of nonfatal occupational injuries and illnesses from a sample of about 280,000 private sector establishments. Estimates of occupational fatalities derived from the survey data were lower than other estimates due to the exclusion of various workers from survey coverage: the self-employed, public sector employees, and employees of private households. The estimates from the survey also excluded fatalities for workers in establishments with fewer than 11 employees. Deriving figures for occupational fatalities—a relatively rare event—from a sample survey is believed to play a part in the low figures. See *Occupational Injuries and Illnesses in the*

United States by Industry, 1990, Bulletin 2399 (Bureau of Labor Statistics, April 1992).

National Safety Council estimates cover unintentional injury-related deaths of persons in the civilian work force, 14 years and older, except for private household workers. (Homicides and suicides are excluded.) See *Accident Facts: 1991 Edition* (National Safety Council, 1991).

The National Institute for Occupational Safety and Heath estimates cover traumatic injuries (intentional and unintentional) of persons 16 years and older identified on the death certificate as occurring at work. Death certificates cover all deaths occurring in the State, but only those death certificates identifying a fatal injury as one that occurred at work are used to compile the number of fatal occupational injuries. Some fatal work injuries, particularly those resulting from motor vehicle accidents, may not be considered work related by persons completing the death certificate. See *National Traumatic Occupational Fatalities: 1980–1985* (National Institute for Occupational Safety and Health, March 1989).

State and Federal workers' compensation reports also fail to capture a census of fatal occupational injuries. The self-employed, employees of small farms, private households, and railroads and seasonal employees are generally excluded from workers' compensation coverage. See Nancy Stout and Catherine Bell, "Effectiveness of Source Documents for Identifying Fatal Occupational Injuries: A Synthesis of Studies," *American Journal of Public Health*, June 1991, pp. 725–28.

[15] The study, which collected fatality data retrospectively for 1986, showed that (1) multiple data sources, including, at times, a followup questionnaire, are needed to produce a comprehensive and accurate count of fatal occupational injuries; (2) matching individual fatalities across data sources is feasible; (3) for each incident, characteristics of the worker and circumstances are commonly available from various administrative reports; and (4) timeliness is important in maximizing respondents' recall to verify information and reduce the number of those who fail to respond because they have relocated. See Janice Windau and Donna Goodrich, "Testing a census approach to compiling data on fatal work injuries," *Monthly Labor Review*, December 1990, pp. 47–49.

[16] This study, which was conducted in cooperation with the Texas Workers' Compensation Commission and the Colorado Department of Health, was successfully concluded on May 1, 1991. The test also confirmed the importance of using multiple data sources, because no single system captures all fatal work injuries. See Guy Toscano and Janice Windau, "Further testing of a census approach to compiling data on fatal work injuries," *Monthly Labor Review*, October 1991, pp. 33–36.

[17] *Fatal Workplace Injuries in 1992: A Collection of Data and Analysis*, Report 870 (Bureau of Labor Statistics, April 1993).

APPENDIX: Measurement techniques and limits

Identification and verification of work-related fatalities. Because some State laws and regulations prohibit enumerators from contacting the next of kin, it was not possible to independently verify work relationship (whether a fatality is job related) for 277 fatal work injuries in 1993; however, the information on the initiating source document for these cases was sufficient to determine that the circumstances of the incident were likely to be job related. Data for these fatalities, which primarily affected self-employed workers, are included in the Census of Fatal Occupational Injuries counts. An additional 49 fatalities submitted by States were not included because the initiating source document had insufficient information to determine work relationship, which could not be verified by an independent source document or a followup questionnaire.

States may identify additional fatal work injuries after data collection ends for a reference year. In addition, other fatalities excluded from the published count because of insufficient information to determine work relationship may be subsequently verified as work related. States, therefore, have up to 1 year to update their initial published counts. This procedure ensures that fatality data are disseminated as quickly as possible and that legitimate cases are not excluded from the counts. As data collection methods improve, future fatal work injury counts may become more complete.

The BLS fatality data reported 6,083 fatal work injuries in calendar year 1992. As a result of the procedure to update the previous year's counts, an additional 134 job-related fatalities have been identified, bringing the total job-related fatality count for 1992 to 6,217. The revised tables for 1992, with more detailed 1993 data, will be included in a forthcoming comprehensive report.

Federal/State agency coverage. The Census of Fatal Occupational Injuries includes data for all fatal work injuries, whether they are covered by the Occupational Safety and Health Administration (OSHA) or other Federal or State agencies, or are outside the scope of regulatory coverage. Any comparison between the BLS census counts and those released by other agencies should take into account the different coverage and definitions being used.

Several Federal and State agencies have jurisdiction over workplace safety and health. OSHA and affiliated agencies in States with approved safety programs cover the largest portion of U.S. workers. However, injuries and illnesses occurring in several other industries, such as coal, metal and nonmetal mining, and transportation on water, rails, or in the air, are excluded from OSHA coverage because they are covered by other Federal agencies, such as the Mine Safety and Health Administration, the U.S. Coast Guard, the Federal Railroad Administration, and the Federal Aviation Administration. Fatalities occurring in industries regulated by Federal agencies other than OSHA accounted for about 11 percent of the fatal work injuries in 1993.

Fatalities occurring among several other groups of workers are generally not covered by any Federal or State agencies. These groups include self-employed and unpaid family workers, which accounted for about 21 percent of fatalities; laborers on small farms, accounting for about 5 percent of fatalities; and State and local government employees in States without OSHA-approved safety programs, about 4 percent. (About one-half of the States have approved OSHA safety programs that cover State and local government employees.)

Experimental fatality rates. When comparable employment data or exposure hours are available, injury

fatality rates can be calculated to examine risk. Rates are generally calculated for occupations, industry groups, or demographic characteristics such as age and gender to determine the risk of injury in specific employment groups compared with others.

A fatal work injury incidence rate represents the number of persons in a worker group who sustain a fatal work injury divided by the total number at risk per unit of time. Fatality rates may be calculated differently to measure the incidence of a fatal work injury for groups of workers. An hours-based rate would measure the fatality risk per standardized length of exposure; an employment-based rate measures the fatality risk for those employed in a particular period. A fatality rate can be produced for a group of workers, for example, by hours of exposure or for those employed during a particular day, week, month, or year.

Each type of rate has a different purpose. An employment-based fatality rate measures the incidence of a fatal injury for all workers in the group, regardless of exposure time. It does not account for fewer fatalities among part-time workers than for full-time workers because of their reduced hours exposed to the work environment. An hours-based fatality rate accounts for the different exposure durations among workers. Hours-based measurements are especially useful in industry and occupational comparisons in which the number of workers at risk can vary greatly among industry or occupational groups for a particular period.

Fatality counts from the Census of Fatal Occupational Injuries can be combined with information on employment or hours at work to produce a fatal work injury rate. Because neither hours at work nor number of persons employed are collected in the BLS census, the fatality rates in the tables were calculated using the employment estimates from the Current Population Survey (CPS)—a household survey conducted for the Bureau of Labor Statistics by the Bureau of the Census. The CPS annual average employment estimates are based on the number of workers employed during the week which includes the 12th day of each month.

The fatality rates in the tables presented in this article relate the total number of workplace deaths in 1993 to the average number of workers facing that risk for various groups. These measurements are developmental and do not reflect the movement of persons into and out of the labor force, the length of their workweek or workyear, or the effect of multiple jobholders. BLS will continue its research on fatality rates by exposure hours and by employment.

The rates shown in the tables were calculated as follows:

$$(N/W) \times 100{,}000,$$

where:

N = the number of fatally injured workers in a particular group (for example, the construction industry) and,

W = the annual average number of workers employed in that group (the employment is an annual average of employed civilian workers 16 years of age and older, plus resident Armed Forces, from the Current Population Survey, 1993).

The ratio N/W is multiplied by 100,000; the rate is expressed as a whole number and represents the number of fatal work injuries per 100,000 workers.

Adjustments were made to N to maintain consistency with the CPS employment W, which excludes workers under 16 years of age. There were 29 total fatalities of workers under the age of 16 that were not included in the fatality rate calculations. The following is an illustration:

Work fatalities totaled 6,271 in 1993. Total annual average employment in 1993 was 120,791,000 workers (119,306,000 civilian workers 16 years of age and older and 1,485,000 resident Armed Forces). N must be adjusted to be consistent with W, because 29 fatally injured workers were under the age of 16 years. So,

$$N = 6{,}271 - 29 = 6{,}242, \text{ and}$$
$$W = 120{,}791{,}000.$$

$$\text{Therefore, } (6{,}242/120{,}791{,}000) \times 100{,}000 = 5,$$
$$\text{or 5 fatalities per 100,000 workers.}$$

(Note that adjustments of N are not reflected in the "Number" and "Percent" columns in the tables of this article, which include all fatalities regardless of age.)

The CPS employment data used to calculate rates are estimates that are based upon a sample of persons employed rather than a complete count. Therefore, the employment estimates and fatality rates have sampling errors; that is, they may differ from figures that would have been obtained if it had been possible to take a complete census of employed persons. See "Explanatory Notes on Household Data" in the January 1993 issue of the BLS monthly periodical, *Employment and Earnings*, for an explanation of CPS sampling and estimation procedures and standard error tables. Because the relative sampling error of a fatality rate is approximately equal to the relative sampling error of the CPS employment used in the calculation of the rate, the sampling error tables can be used for constructing confidence intervals for the CPS employment and the fatality rates.