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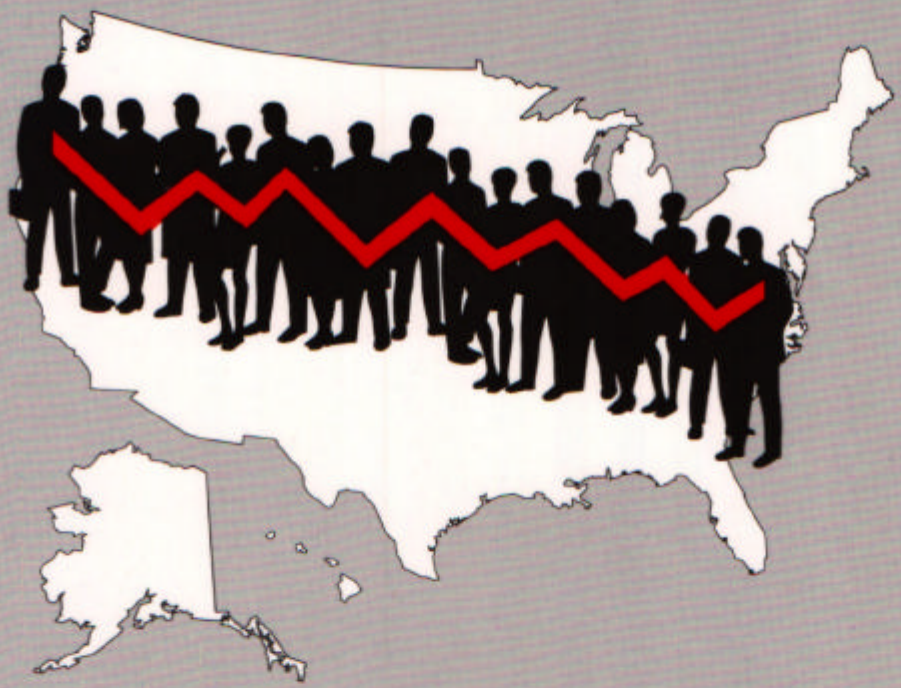
Fatal Injuries to Workers in the United States, 1980-1989: A Decade of Surveillance



National and State Profiles

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

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August 1993

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FOREWORD

We dedicate this report to the faces behind the numbers...to the individuals who have lost their lives at work and to the families and friends left behind. If you see only the numbers in this book, you have missed the point. Each number, each death counted, represents a life, the life of an American worker, a life cut short while simply trying to earn a living.

Death on the job is a problem that affects us all. It is a mainstream public health problem that rarely receives mainstream public attention. We must recognize that every father, mother, every young man and young woman killed at work is a loss to our community and to our future as a nation. A child grows up without a parent, parents grow old without children, neighbors live on without a friend, and on and on.

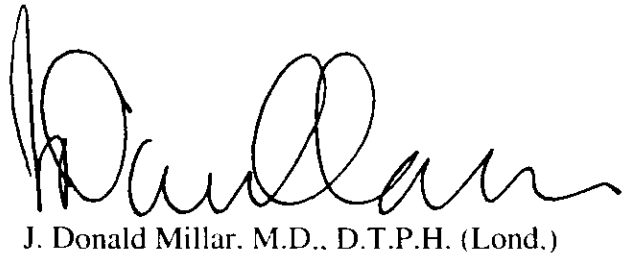
On average, 17 American workers die each day in this country; as a nation, we have come to accept this as a matter of course. Each day the stories of work-related fatalities are buried along with the victims. Incidents are reported as "horrible accidents" with no mention of prevention, no recognition of the work-relatedness, and no sense of outrage that they occurred. The most visible occupational fatalities in history occurred on January 28, 1986, as the Space Shuttle Challenger exploded in flames over Cape Canaveral. Six astronauts and a high-school teacher were killed...earning a living, doing their job. The nation was shocked and horrified.

On that same day, January 28, 1986, at least 16 other Americans lost their lives while doing the same thing—simply earning a living, doing their job. Where was the horror? Where was the outrage?

During the course of that day, a retail manager and a special investigator were shot to death, the manager of a manufacturing plant and the president of a drilling company died of burns from explosions, a lineman was electrocuted, two plasterers fell to their deaths from a scaffold, a driller died of asphyxiation after falling into an oil well, two loggers were killed falling from a rigging cable, another logger died of a skull fracture after being pinned by a log against his truck, a coal miner was crushed by falling rock, and two truckers, a farm laborer and a teacher died in separate motor vehicle crashes. These workers, ranging in age from 16 to 81 years old, all went to work that day and died as a result of it...simply trying to earn a living.

Why weren't we shocked? When the Challenger exploded, it was a totally unexpected occurrence. We, as a nation, became accustomed to men and women soaring smoothly through space and coming home safely. Astronauts are not supposed to die doing their job. Other workers are not supposed to die either.

While we can do nothing to bring back the dead, we can act vigorously to protect the living. Prevention calls for a focus on the *living*. As you look at the data in this book, remember each worker who died, and mourn his or her death. But remembering is not enough. We must take the knowledge presented here and act! In almost every instance reported, the fatal "accident" could have been readily prevented. The years of life lost were wasted. Working together *now*, we can assure that the children of these workers do not have to die...simply trying to earn a living.



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The success of the National Traumatic Occupational Fatalities (NTOF) surveillance system is due in large part to the help and cooperation of state vital records offices. We are grateful to the state vital registrars and their staffs for providing these valuable data.

EXECUTIVE SUMMARY

Death from work-related injuries is a major public health problem. The National Institute for Occupational Safety and Health collects and automates death certificates from the 52 vital statistics reporting units in the 50 states, New York City, and the District of Columbia for workers 16 years of age or older who died as a result of a work-related injury. Analysis of occupational injury deaths by demographic, employment, and injury characteristics facilitates effective use of resources aimed at preventing injuries in the workplace. In looking at these data, it is important to note the distinction between rates and actual number of deaths. Rates depict the risk faced by workers, and numbers indicate the magnitude of the problem or the number of lives that would be saved if these injuries had been prevented.

- From 1980 through 1989, 63,589 workers died from injuries sustained while working; 62,289 (98%) were workers in the civilian labor force.

- For 1980 through 1989, the average annual occupational fatality rate for the U.S. civilian work force was 7.0 per 100,000 workers.

- The leading causes of occupational injury death in the United States were motor vehicle crashes (23%), machine-related incidents (14%), homicides (12%), falls (10%), electrocutions (7%), and being struck by falling objects (7%).

- Leading causes of death vary by gender; the leading cause of death for females was homicide (41%), while homicide accounted for 10% of the occupational injury deaths among males.

- 80% of those who died from occupational injury were White, 11% were Black, 6% were Hispanic, 2% were Asian and Pacific Islanders, less than 1% were American Indians/Alaska Natives, and 1% of the cases were of other or unknown race/ethnicity.

- Black workers had the highest fatality rate per 100,000 workers (6.5), followed by Whites (5.8) and workers of Other races (4.9).

- The age group with the largest number of occupational injury fatalities was the 25-29 year old age group (14%); followed by the 30-34 year old age group (13%), and the 20-24 year old age group (12%).

- Workers 65 years and older had the highest fatality rate of all age groups, with 14.6 deaths per 100,000 workers. Workers 65 years and older also had the highest rates of work-related injury death in every occupation division and in every industry division except mining.

- The fatality rate for males (9.8 per 100,000 workers) was 12 times higher than for females (0.8 per 100,000 workers).

- Civilian fatal occupational injuries decreased 23%; from 7,405 in 1980 to 5,714 in 1989.

- The average annual fatality rate per 100,000 civilian workers also decreased, from 8.9 in 1980 to 5.6 in 1989—a 37% decrease.

- The largest number of fatalities occurred in the construction (18%), transportation/communication/public utilities (18%), manufacturing (14%), and agriculture/forestry/fishing (12%) industry divisions.

- The mining industry had the highest average annual fatality rate per 100,000 workers (31.9); followed by construction (25.6), transportation/communication/public utilities (23.3), and agriculture/forestry/fishing (18.3).

- The occupation divisions with the largest number of fatalities were precision production/craft/repair (19%), transportation/material movers (19%), laborers (13%), and farmers foresters/fishers (12%).

- The occupation division of transportation/material movers had the highest average annual fatality rate per 100,000 workers (25.6); followed by farmers/foresters/fishers (21.3), laborers (17.2), and precision production/craft/repair occupations (9.3).

- The greatest number of fatal occupational injuries occurred in Texas (6,664), California (6,623), Florida (3,681), Illinois (2,853), and Pennsylvania (2,564).

- The states with the highest occupational injury fatality rates for the private sector were Alaska (34.8), Wyoming (29.0), Montana (20.9), Idaho (16.7), and West Virginia (15.7).

Surveillance data such as those gathered through the National Traumatic Occupational Fatalities system, allow the description of the nature and magnitude of the occupational injury problem in the U.S., the identification of potential risk factors, the generation of hypotheses for further research, and the setting of research and prevention priorities. These data provide the foundation for the next decade of research and prevention efforts aimed at reducing fatal injuries to workers in the U.S.

US

Fatal Injuries to Workers in the United States, 1980-1989: A Decade of Surveillance

INTRODUCTION

The Occupational Safety and Health Act of 1970 was enacted "to assure so far as possible every working man and woman in the nation safe and healthful working conditions." [1] Death from injuries at work is a major public health problem. A number of studies have estimated the extent of occupational injury deaths occurring in the U.S. each year.[2-5] The results have varied widely and have provided limited information about the injuries or their circumstances. The National Traumatic Occupational Fatalities (NTOF) surveillance system was developed by the National Institute for Occupational Safety and Health (NIOSH), to fill gaps in the knowledge of work-related injury deaths in the U.S. by providing a census of occupational injury deaths for all U.S. workers.

Analysis of occupational injury deaths by demographic, employment, and injury characteristics facilitates effective use of resources aimed at preventing injuries in the workplace. Surveillance data such as those gathered through the NTOF system allow the description of the nature and magnitude of the occupational injury problem in the U.S., the identification of potential risk factors, the generation of hypotheses for further research, and the setting of research and prevention priorities. Ongoing surveillance systems also enable the monitoring of trends over time and offer the potential to evaluate prevention efforts. A report on occupational injury mortality in the U.S. for the years 1980-1985, based on data collected by the NTOF system, has previously been published.[6] The present document extends the period of analysis to a decade, and provides a more comprehensive summary of fatal occupational injuries for the U.S., as a whole; and examines for the first time, the patterns of work-related injury fatalities in every state.

METHODS

Death Certificates

Information in the NTOF surveillance system is taken directly from death certificates. To gather data for the system, NIOSH collects and automates death certificates from the 52 vital statistics reporting units in the 50 states, New York City, and the District of Columbia for workers 16 years of age or older for whom an external cause of death (International Classification of Diseases, Ninth Revision;[7] E800-E999) was noted, and for whom the certifier entered a positive response to the "Injury at Work?" item.

The NTOF data contain variables useful for describing characteristics of victims as well as injury circumstances—including demographic, employment, and cause of death variables. In addition to coded data, narrative text from the death certificate for industry, occupation, causes of death, and injury description is entered and maintained.

Death certificates were utilized for this surveillance system because they are available for all workers who died during the period, regardless of size or nature of employment, coverage by workers' compensation

systems, or other jurisdictional restrictions. State-based studies show that death certificates identify a greater proportion of occupational trauma fatalities than any other single source. Although these studies did not include NTOF per se, they indicate that death certificates capture 67% to 90% of all fatal work injuries.[8]

The limitations of death certificates as a source of occupational injury fatality surveillance have been discussed by several authors.[2,6,9,10] The primary issues of concern in the use of death certificates are the ability to identify and to retrieve the certificates that meet the study criteria. Studies indicate that motor vehicle crashes and homicides are the external causes of death most likely to be missed in death certificate surveillance of occupational injuries.[9,10] For the period 1980 through 1984, data on work-related homicides and suicides were not available from four states—Louisiana, Nebraska, New York, and Oklahoma. In subsequent years, data were obtained from those states as procedures were altered to allow retrieval of this information. All tables and figures reflect actual data obtained from the states; denominator data were not adjusted to reflect years for which some data were missing.

Each vital statistics reporting unit is responsible for identifying and providing cases that meet the NTOF criteria. For the period of data analyzed in this report, there were no standardized guidelines for the completion of the "Injury at Work?" item on the death certificate. Thus, this item on the death certificate, which is one of the three criteria for inclusion in the NTOF surveillance system, was subject to certifier interpretation. Although the lack of standardized reporting of this item may result in both false positives—if a liberal definition of injury "at work" was used—and false negatives—if a very restrictive definition was used or the item was left blank, the numbers reported here are apt to represent the minimum number of work-related deaths that occurred in the U.S. during the period.

To improve the quality of occupational injury fatality reporting, national guidelines for completing the "Injury at Work?" item were developed and disseminated in 1992 by the Association for Vital Records and Health Statistics, NIOSH, the National Center for Health Statistics, and the National Center for Environmental Health. These guidelines have been distributed nationally to medical examiners and coroners through state Vital Registrars and should improve future death certificate surveillance of fatal occupational injuries (See Appendix I).

Occupation, Industry, and Cause of Death Coding

Employment information was coded from the usual industry and occupation narratives from the death certificate using software developed by NIOSH; cases which could not be assigned a code by the software were hand-coded by the Bureau of the Census. Occupation narratives were coded into 11 major divisions of occupation according to the 1980 Bureau of the Census classification scheme;[11] industry narratives were coded into the 10 standard industrial divisions according to the Standard Industrial Classification Manual, 1987.[12] Death certificates for which no occupation or industry entry was present or for which the entry was too vague were coded into the "not classified" group. Certificates which had entries such as "housewife" or "student" were also coded into the "not classified" group. Appendix II provides explanations of the abbreviations for occupation and industry divisions on figures and tables.

Death certificates query for the "usual" occupation and industry of the person who died, which may not necessarily reflect the occupation or industry engaged in at the time of the fatal injury. Studies comparing death certificate entries for usual occu-

pation and industry to employment information for occupation and industry at the time of death, found agreement for occupation to be 64% to 74% of the cases,[13-18] and for industry to be 60% to 76% of the cases.[13-18] Though the query on death certificates is for "usual" occupation and industry, some studies indicate that the death certificate entries may actually better reflect occupation or industry at time of death than usual, lifetime employment.[16-18]

Cause of death codes are assigned based upon the ICD-9 supplementary chapter for the classification of external causes of injury and poisoning.[7] The codes from this chapter, denoted with a preceding "E," cover the spectrum of unintentional and intentional causes of death. The grouping of the E-Codes for these analyses followed the rubrics established in the ICD-9. A table which provides the actual E-code rubrics included in each of the groupings is shown in Appendix III.

Employment Data

Because no single source of employment data provides information by state, industry, occupation, and demographic characteristics, employment estimates used in calculating occupational injury fatality rates were derived from several sources. Employment data used to calculate rates for the total civilian workforce, by industry division, by cause, by state, and by year were taken from County Business Patterns (CBP), an establishment-based census of employers.[19] CBP data do not include agricultural production, public administration, the self-employed, or workers in managerial occupations. The employment data for agricultural production were derived from the 1982 Census of Agriculture, Bureau of the Census,[20] and the data for public administration from annual average employment data from the Bureau of Labor Statistics (BLS) household surveys.[21] Denominators for the calculation of rates by occupation divisions, age, race, and gender were also taken from the BLS annual average employment data from household surveys. Rates for occupation divisions by age groups are presented for 1983 through 1989 only, due to the availability of comparable denominator data.

Fatality rates were calculated as average annual deaths per 100,000 workers. Rates were not calculated for cells with less than three cases due to the instability of rates based on small numbers. Frequencies and rates are presented for the civilian workforce only, because denominator data were not available for military personnel. State-specific rates were calculated for private sector employment only; public administration as well as the military were excluded due to the lack of comparable denominator data.

The numbers and rates presented here are based on data that are consistent across the U.S., to facilitate comparisons between states. These numbers may differ from numbers generated by other surveillance or data collection systems. Within states, workers' compensation systems, departments of employment security, medical examiners' offices, or other agencies may collect occupational injury information or employment information which may result in different rate calculations or tabulations for causes of work-related injury deaths and other demographic and employment characteristics. Within the present analysis, rates calculated using establishment-based employment data will differ from those generated using employment data from household surveys.

Mapping

To map geographic distributions of work-related fatality rates for the U.S., for high-risk industries, and for the leading causes of death, the fatality rates for the 50 states and the District of Columbia were grouped into five categories based on the population standard deviation of the overall U.S. occupational fatality rate (or the rate for that industry or cause of death):

Very high—fatality rates more than two standard deviations (s.d.) above the average rate;

High—fatality rates greater than one s.d., but less than two s.d. above the average;

Moderately high—fatality rates greater than the average rate but less than one s.d. above the average;

Moderately low—fatality rates less than the average rate but less than one s.d. below the average;

Low—fatality rates more than one s.d. below the average rate but greater than zero.

Rates for the 51 reporting entities generally do not exhibit distributions that are normal and do not constitute a sample. Therefore, implications based on the probabilities of the standard normal distribution are not valid for these five categories. For mapping purposes, this method of categorizing states identifies those states with extreme values better than defining categories based on percentiles.

It should be noted that all tabulations and calculations by state are provided for state of death, and therefore may not represent either state of residence, state of employment, or state where the injury occurred.

Years of Potential Life Lost

The years of potential life lost (YPLL) before age 65 were calculated for the 10-year period. Although several methods are available for calculating YPLL,[22] the method used in this report is based on years of potential employment. The YPLL for each fatal case was determined by subtracting the victim's age at the time of death from potential retirement age of 65 years. The YPLL rates for 1980 through 1989 were calculated as the sum of the YPLL for a given year divided by the sum of the workers for that year, then multiplied by 100,000. YPLL rates were calculated only for civilian workers.

RESULTS

For the 10-year period from 1980 through 1989, 63,589 workers died from injuries sustained at work; an average of 6,359 deaths per year. Of the total, 62,289 (98%) occupational injury deaths involved workers in the civilian labor force. The average annual occupational fatality rate for the U.S. civilian work force was 7.0 per 100,000 workers.

During the decade, the number of civilian fatal occupational injuries decreased, although not consistently, from a high of 7,405 in 1980 to 5,714 in 1989 (**Figure US-1**); this represents a 23% decrease in the number of occupational deaths over the 10-year period. The annual fatality rate per 100,000 civilian workers (**Figure US-1**) also decreased from the maximum in 1980 (8.9 per 100,000 workers) to a minimum in 1989 (5.6 per 100,000 workers)—a 37% decrease.

The civilian YPLL rates decreased from the maximum of 231.2 per 100,000 workers in 1980, to a minimum of 135.8 per 100,000 workers in 1989, representing a 41% decrease (**Figure US-2**).

Gender, Race and Age Groups

Although males accounted for 56% of the civilian workforce for the period,[21] males accounted for 94% of the fatal occupational injuries reported in NTOF. The fatality rate for males (9.8 per 100,000 workers) was 12 times higher than for females (0.8 per 100,000 workers). Unintentional injuries, defined as all deaths with external cause of death codes E800 through E949, accounted for 85% of the male injury deaths and 53% of female injury deaths. In contrast, the proportion of injury deaths by homicide (E960-E969) and suicide (E950-E959) were higher for females, with homicide accounting for 41% and suicide for 4% of the female injury deaths, compared to homicide (10%) and suicide (3%) for males. However, as

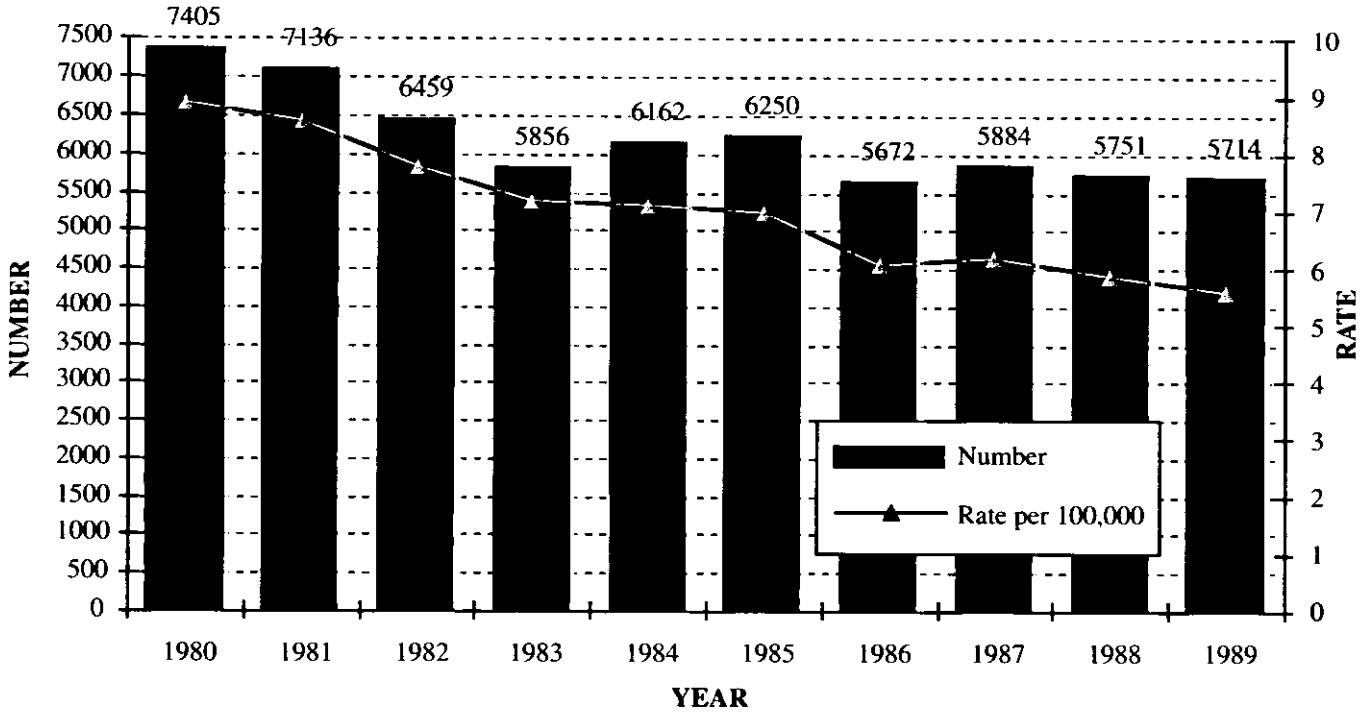

Figure US-1. *Distribution and Rate of Traumatic Occupational Fatalities by Year, US, 1980-1989.*

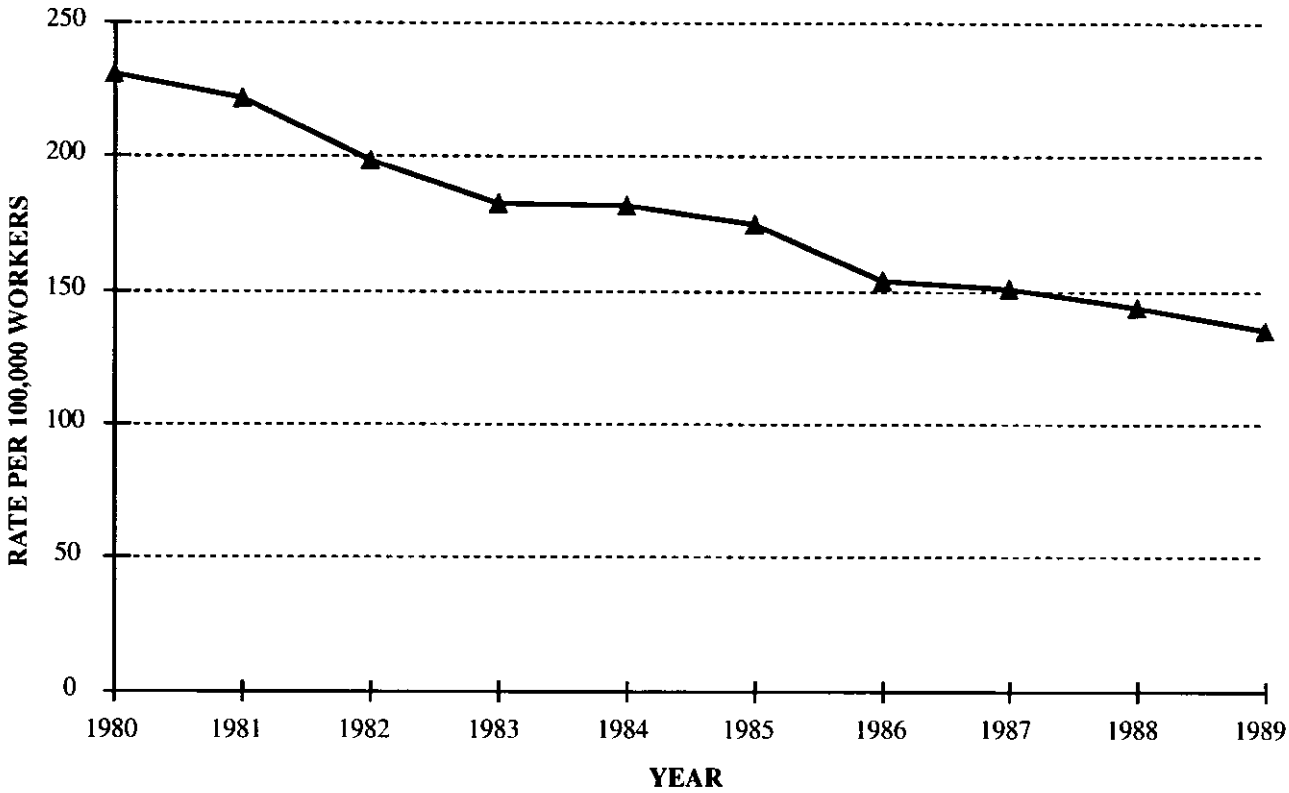

Figure US-2. *Rate of Years of Potential Life Lost (YPLL) to Traumatic Occupational Fatalities by Year, US, 1980-1989.*

can be seen in **Table US-1**, males had higher fatality rates for all three manners of death.

Table US-1. *Average Annual Rate (per 100,000 workers) of Traumatic Occupational Fatalities by Manner of Death and Gender, US, 1980-1989.*

Manner of Death	Male	Female
Unintentional	8.34	0.43
Homicide	1.02	0.33
Suicide	0.30	0.04

The distribution of occupational injury deaths by **race/ethnicity** indicates that 49,837 were White (80%), 6,739 were Black (11%), 3,830 were Hispanic (6%), 919 were Asian and Pacific Islanders (2%), 307 were American Indians/Alaska Natives (0.5%), and 654 of the cases were of other or unknown race/ethnicity (1%) (**Figure US-3**). Fatality rates were calculated for the race categories, White (including Hispanics), Black, and Other, for which corresponding denominator data were available. The highest fatality rate by race was for Blacks (6.5 per 100,000 workers), followed by Whites (5.8 per 100,000 workers), and workers of Other races (4.9 per 100,000 workers).

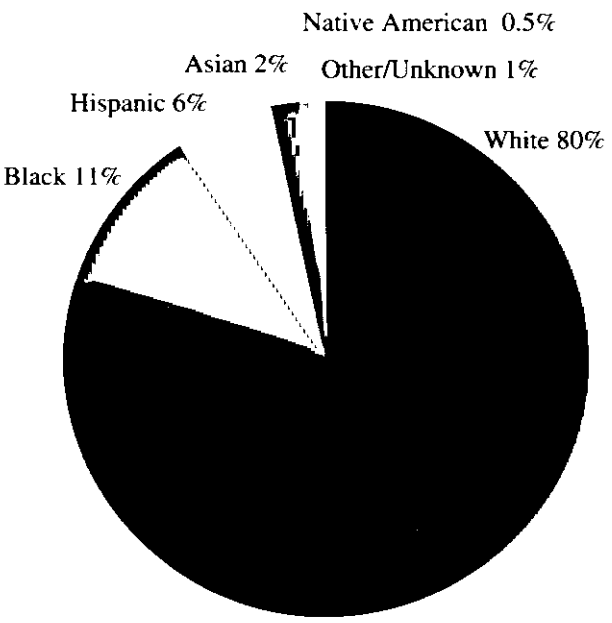

Figure US-3. *Distribution of Traumatic Occupational Fatalities by Race/Ethnicity, US, 1980-1989.*

Workers of Other races had the highest homicide rate (1.6 per 100,000 workers), followed by Blacks (1.4 per 100,000 workers), and Whites (0.6 per 100,000 workers). Blacks had the lowest suicide rate at 0.1 per 100,000 workers, which was nearly half the rate of the other two race categories.

Figure US-4 shows the average annual rate of occupational injury deaths by year and race category. The rate of occupational injury deaths per 100,000 workers generally decreased over the period of the study, with rates for Black workers consistently higher than the rates for Whites and workers of Other races.

The frequency and rate of occupational injury deaths by **age group** is presented in **Figure US-5**. The age group that accounted for the largest number of occupational fatalities was the 25-29 year old age group (14%), followed by the 30-34 year old age group (13%), and the 20-24 year old age group (12%). The age group 65 years and older had the highest fatality rate with 14.6 deaths per 100,000 workers, followed by the 60-64 year old age group (7.9 per 100,000 workers), and the 55-59 year old age group (7.3 per 100,000 workers). In comparison, the 16-19 year old age group had the lowest fatality rate with 3.9 per 100,000 workers.

As with the overall fatality rate, the rates for homicide and suicide increased with age. The highest homicide and suicide rates per 100,000 workers were reported for the age group 65 years and older (2.0 for homicide and 0.4 for suicide); followed by the 60-64 year old age group for homicide (1.0) and the 55-59 year old age group for suicide (0.3).

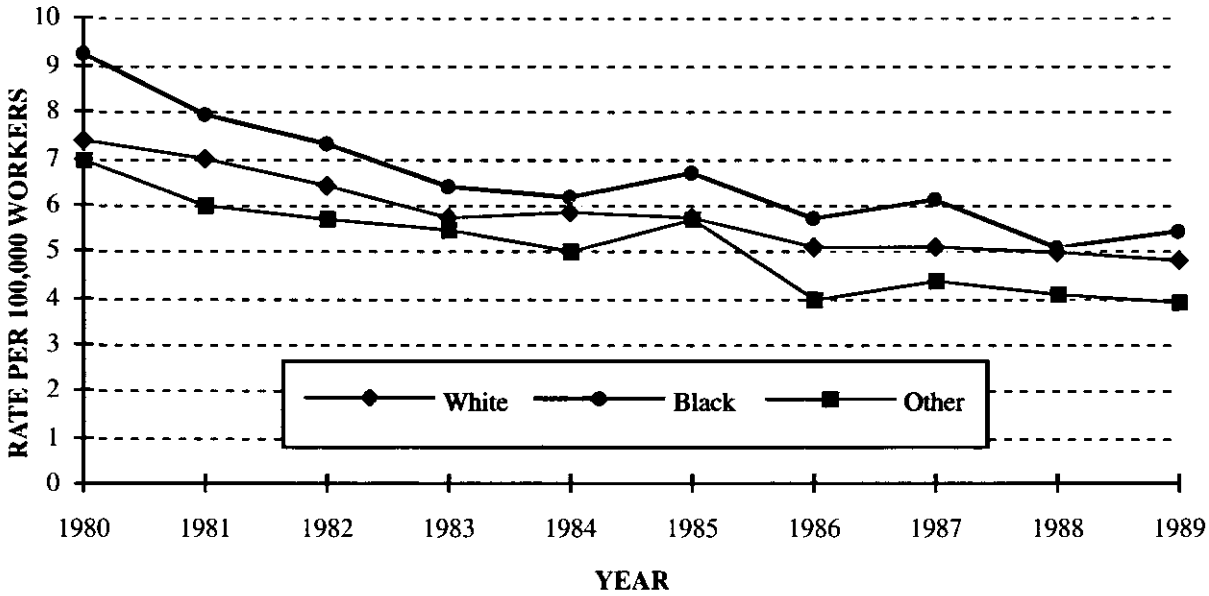

Figure US-4. *Rate of Traumatic Occupational Fatalities by Race and Year, US, 1980-1989.*

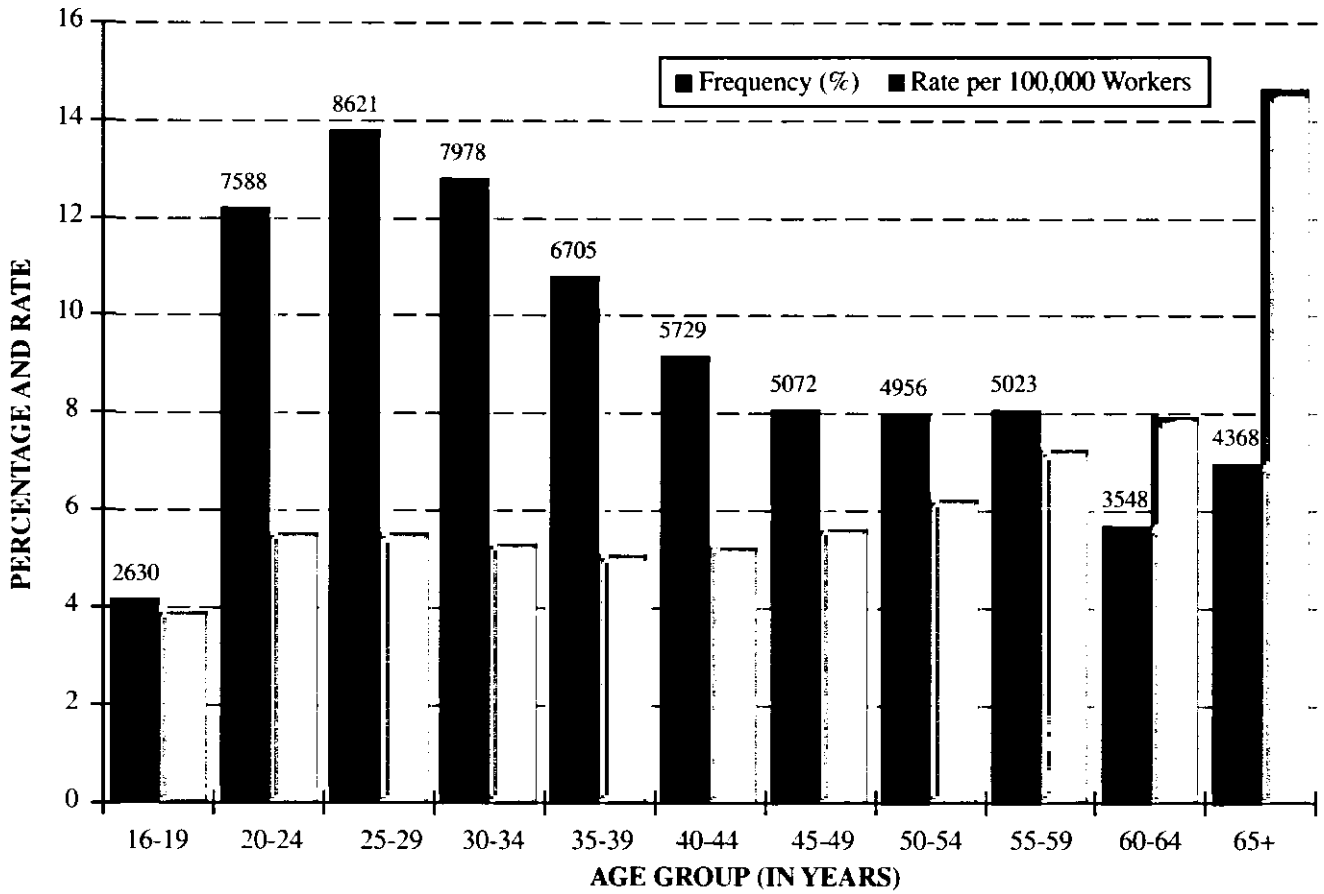

Figure US-5. *Distribution and Average Annual Rate of Traumatic Occupational Fatalities by Age Group, US, 1980-1989.*

Age group-specific rates for males and females are shown in **Figure US-6**. Males have consistently higher rates than females in every age group. The highest fatality rates occur in the age group 65 years and older for both males and females.

Figure US-7 shows the average annual rate of occupational injury death by year and age group. Rates were consistently highest for workers aged 65 years and older. The rates generally decreased over time, although the pattern is not as clear for workers in the age groups 55-64 years and 65 years and older.

Cause of Death

The leading causes of occupational injury death in the United States were motor vehicle crashes (23%), machine-related incidents (14%), homicides (12%), falls (10%), electrocutions (7%) and being struck by falling objects (7%).

To calculate the fatality rates by cause of death, the same denominator was used for all causes of death—the total employed civilian population; therefore, the relative magnitude of the fatality rates is the same as

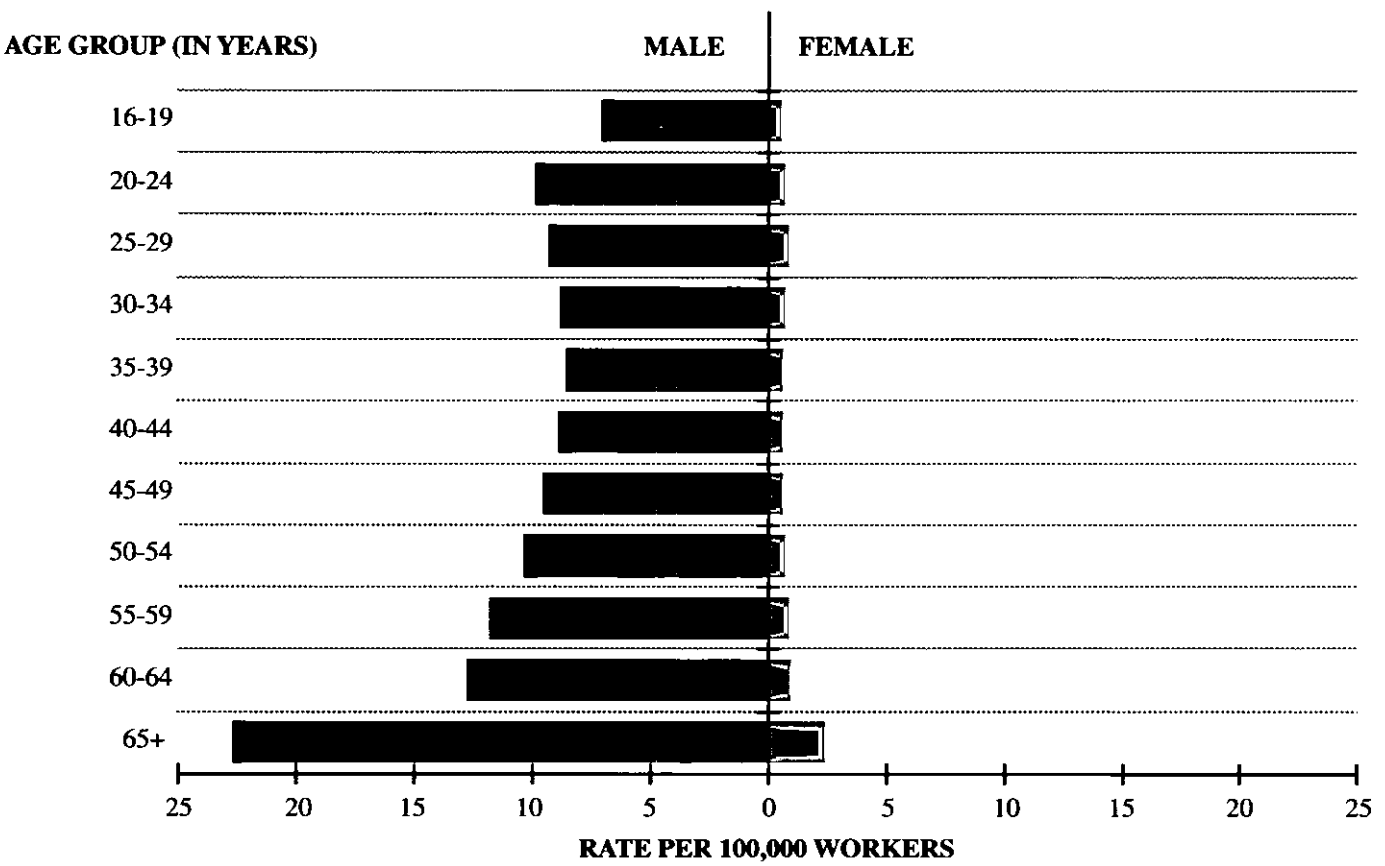

Figure US-6. *Average Annual Rate of Traumatic Occupational Fatalities by Age Group and Gender, US, 1980-1989.*

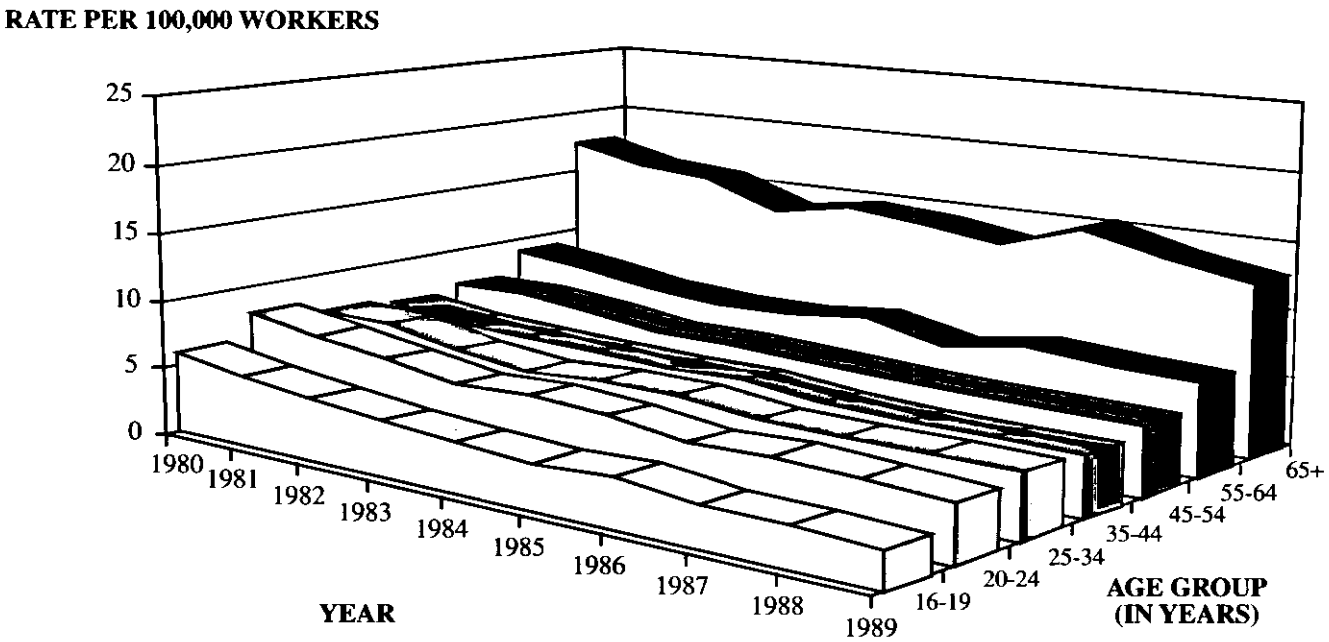

Figure US-7. *Rate of Traumatic Occupational Fatalities by Age Group and Year, US, 1980-1989.*

that for the distribution (percent of total) of fatalities by cause of death. **Table US-2** depicts the average annual rate of fatalities by cause of death and industry division. The fatality rates per 100,000 workers for the six leading causes of death were: motor vehicle-related incidents, 1.6; machine-related incidents, 1.0; homicides, 0.9; falls, 0.7; electrocutions, 0.5; and struck by falling object incidents, 0.5.

Fatality rates for each of the leading causes of work-related injury death were examined by state of death. **Figures US-8** through **US-13** show the geographic distribution (by state) of rates for work-related motor vehicle deaths, machine-related deaths, homicides, fatal falls, electrocution fatalities, and deaths as a result of being struck by a falling object, respectively.

Industry Divisions

Figure US-14 shows both the proportion and rate of work-related injury deaths by industry division. The industry divisions in the U.S. with the largest number of fatalities were construction (18%), transportation/communication/public utilities (18%), manufacturing (14%), and agriculture/forestry/fishing (12%). The mining industry had the highest average annual fatality rate per 100,000 workers at 31.9; this was followed by construction (25.6), transportation/communication/public utilities (23.3), and agriculture/forestry/fishing (18.3).

Motor vehicle-related incidents accounted for the highest fatality rate per 100,000 workers in three industry divisions (**Table US-2**): transportation/communication/public utilities (11.4), public administration (1.9), and wholesale trade (0.9). Homicide was one of the four leading causes of death for each of these industry divisions.

Machine-related incidents accounted for the highest rate per 100,000 workers in three industry divisions: mining (7.4), agriculture/forestry/fishing (6.3), and

Table US-2. Average Annual Rate (per 100,000 workers) of Traumatic Occupational Fatalities by Cause of Death and Industry Division, US, 1980-1989.*

CAUSE OF DEATH	TOTAL*	AG/FOR/ FISH	MINING	CONSTRUC-TION	MANUFAC-TURING	TRANS/ COMM/PU	WHOLESALE TRADE	RETAIL TRADE	FINANCE/ INSUR/RE	SERVICE	PUBLIC ADMIN
Motor Vehicle (E810-E829,E846-E849)	1.61	**2.88**	**5.27**	**3.72**	**0.62**	**11.44**	**0.93**	**0.39**	0.30	**0.54**	**1.87**
Machine (E919)	0.95	**6.28**	**7.39**	3.50	**0.85**	1.24	**0.26**	0.09	0.10	0.19	0.28
Homicide (E960-E969)†	0.85	0.57	0.48	0.65	0.27	**1.47**	**0.19**	**1.66**	**0.39**	**0.61**	**1.54**
Fall (E880-E888)	0.67	0.90	1.89	**6.56**	0.36	0.85	0.17	0.11	0.13	**0.26**	0.27
Electrocution (E925)	0.50	1.20	2.27	**3.99**	0.25	1.45	0.09	0.05	0.03	0.14	0.16
Struck by Falling Object (E916)	0.46	**1.32**	**4.33**	1.95	**0.64**	0.70	0.10	0.06	0.02	0.13	0.13
Air Transport (E840-E845)	0.29	0.44	0.66	0.18	0.08	**2.00**	0.07	0.03	0.10	0.15	**1.06**
Suicide (E950-E959)	0.22	0.41	0.15	0.36	0.12	0.29	0.09	**0.18**	**0.15**	0.23	0.28
Explosion (E923,E921)	0.19	0.15	2.46	0.53	0.25	0.36	0.09	0.04	0.008	0.09	0.09
Other	0.17	0.36	0.45	0.51	0.17	0.34	0.04	0.07	0.04	0.07	0.30
Flying Object/Caught In (E917-E918)	0.17	0.34	1.36	0.72	0.21	0.45	0.05	0.02	0.02	0.05	0.05
Nature/Environment (E900-E909,E928)	0.17	0.92	1.42	0.59	0.14	0.31	0.03	0.02	0.01	0.05	0.10
Suffocation (E911-E913)	0.14	0.34	0.83	1.12	0.08	0.16	0.08	0.01	0.01	0.03	0.05
Water Transport (E830-E838)	0.14	1.19	0.42	0.17	0.03	0.68	0.02	0.03	--	0.03	0.12
Fire (E890-E899)	0.13	0.21	0.89	0.33	0.15	0.17	0.05	0.05	0.01	0.07	0.19
Poisoning (E850-E858,E860-E869)	0.11	0.21	0.78	0.30	0.10	0.26	0.04	0.03	0.01	0.08	0.06
Drowning (E910)	0.10	0.47	0.55	0.29	0.04	0.26	0.02	0.01	0.01	0.07	0.11
Rail Transport (E800-E807)	0.05	0.03	0.13	0.05	0.02	0.73	0.01	0.002	--	0.004	--
Unknown/Undet (E980-E989,BLANK)	0.05	0.11	0.17	0.10	0.02	0.14	0.01	0.03	0.01	0.02	0.07
TOTAL	**6.98**	**18.33**	**31.91**	**25.61**	**4.39**	**23.30**	**2.36**	**2.89**	**1.37**	**2.81**	**6.73**

*Totals include cases for which industry could not be classified (7%).
†Homicide data for New York, Oklahoma, Louisiana and Nebraska were not available for earlier years.
--Rates were not calculated for cells with <3 cases due to instability of rates based on small numbers.
Shading denotes the leading causes of death in each industry group.

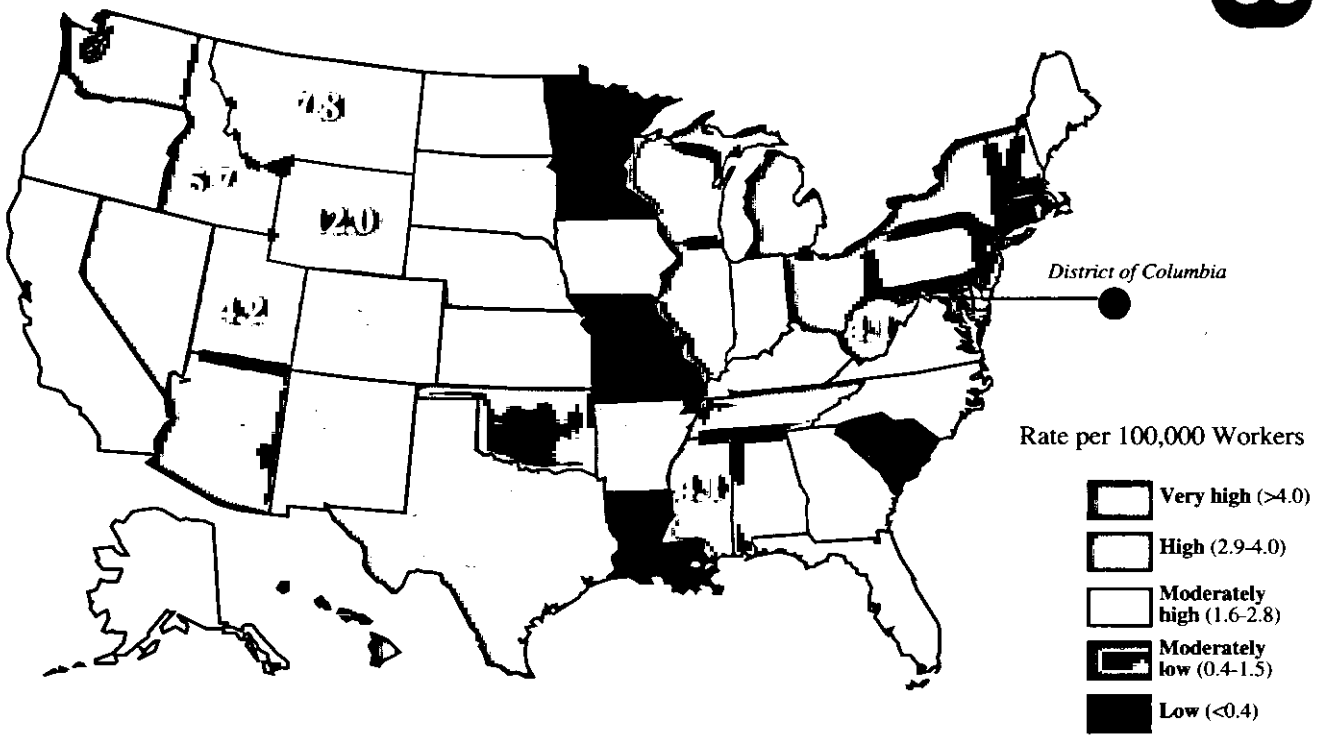

Figure US-8. *Average Annual Rate of Motor-Vehicle-Related Traumatic Occupational Fatalities by State, US, 1980-1989.*

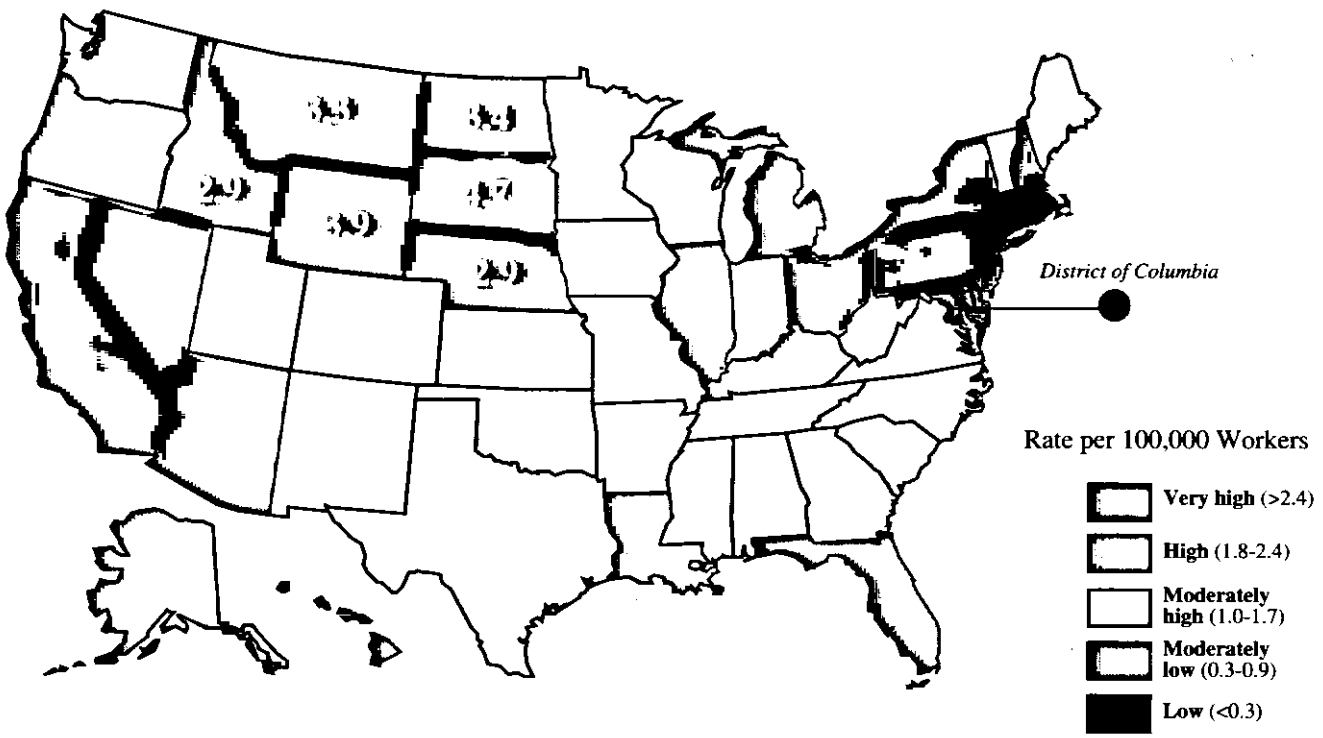

Figure US-9. *Average Annual Rate of Machine-Related Traumatic Occupational Fatalities by State, US, 1980-1989.*

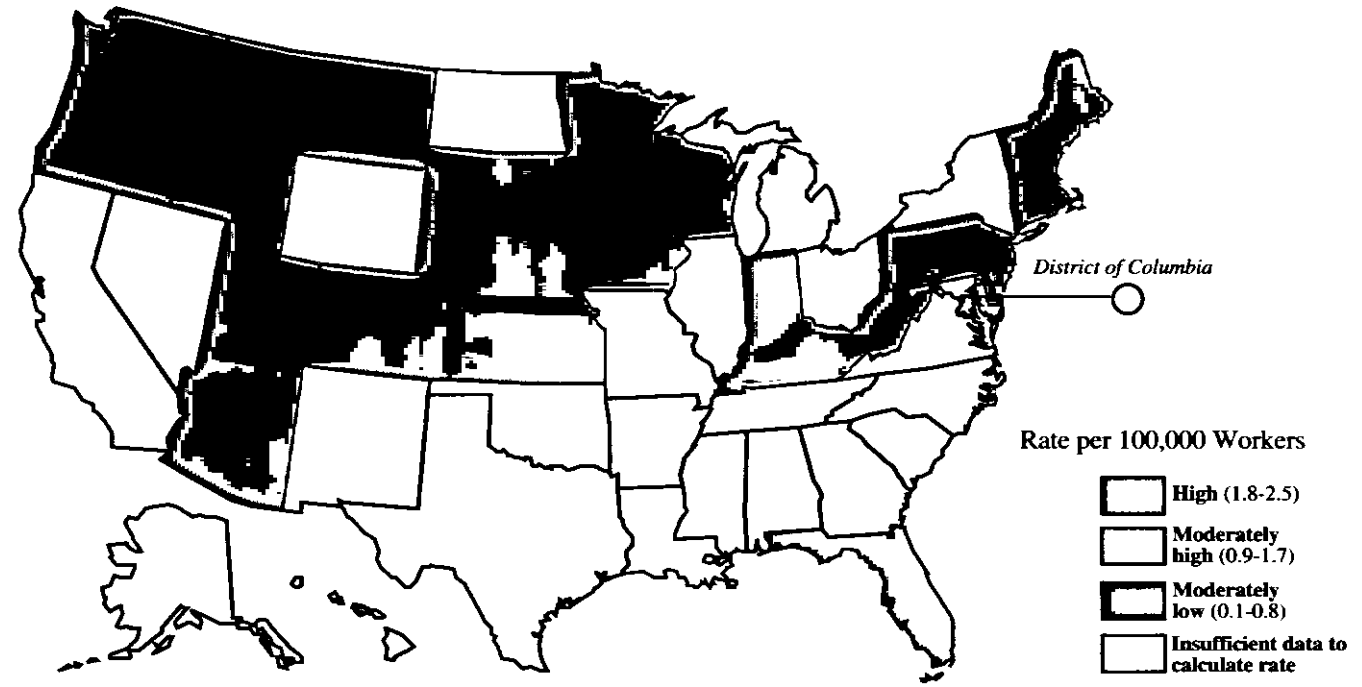

Figure US-10. *Average Annual Rate of Traumatic Occupational Fatalities due to Homicide by State, US, 1980-1989.*

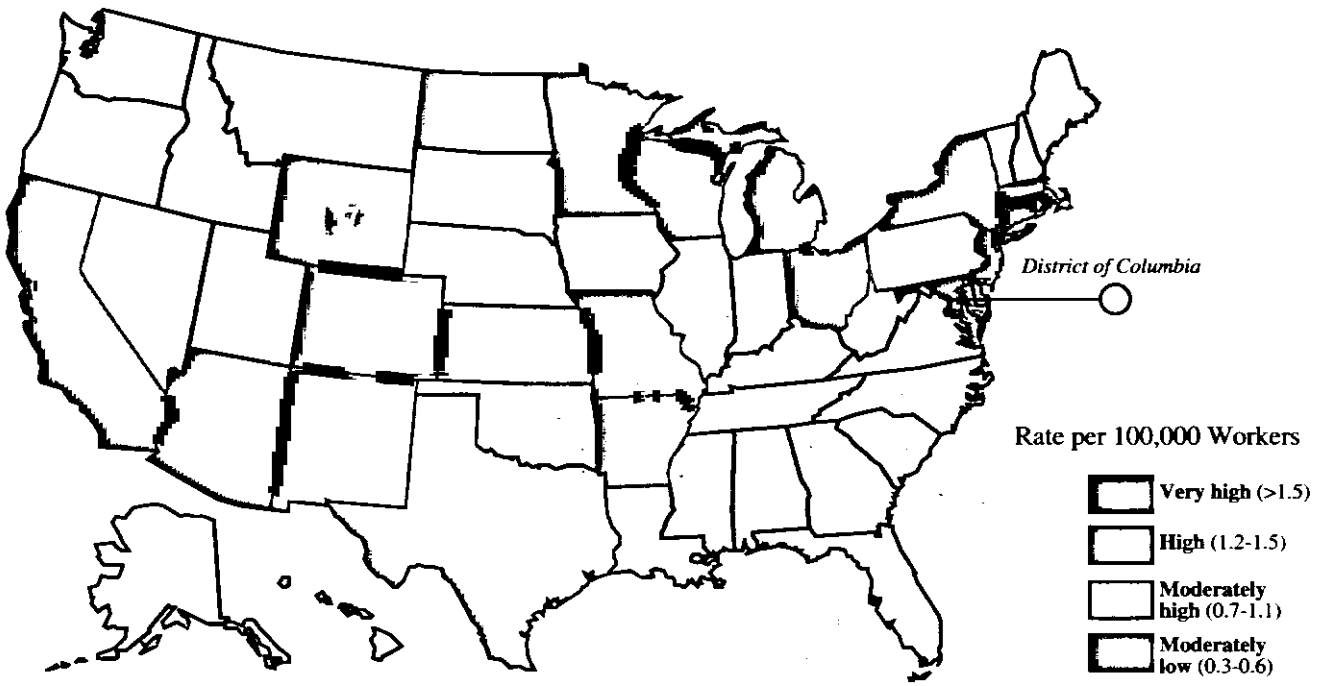

Figure US-11. *Average Annual Rate of Fall-Related Traumatic Occupational Fatalities by State, US, 1980-1989.*

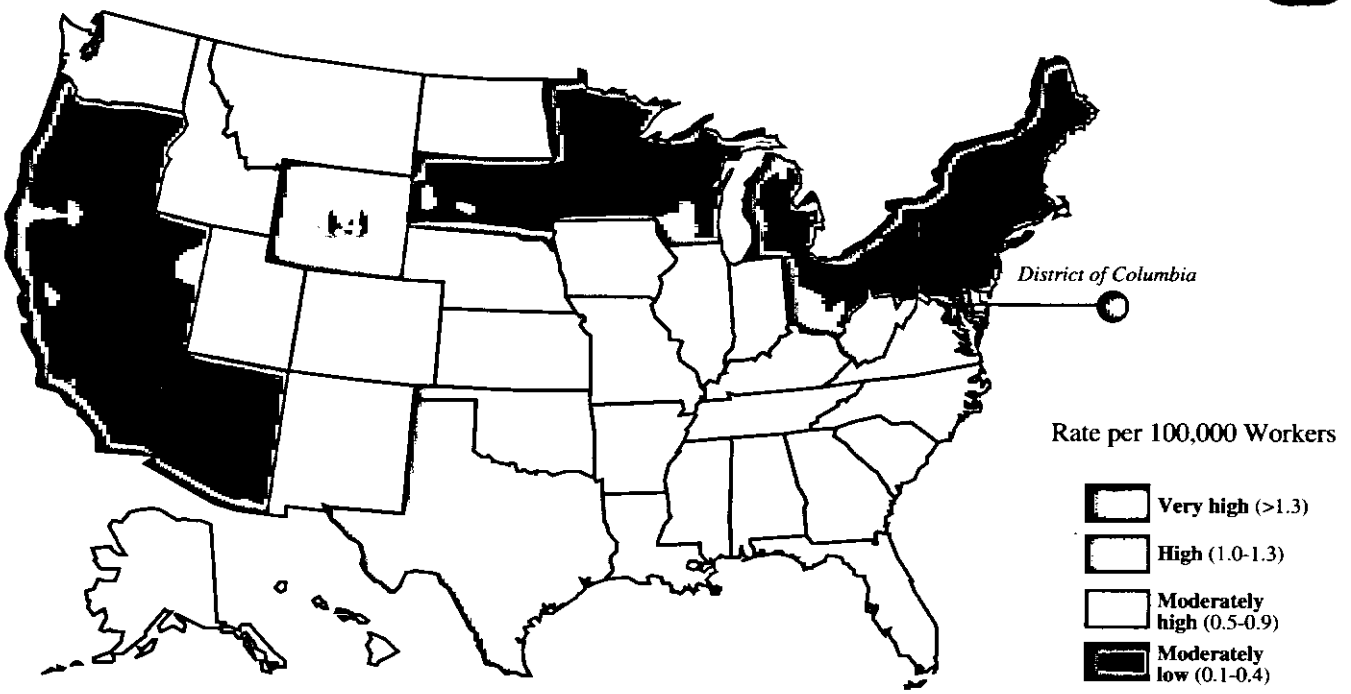

Figure US-12. *Average Annual Rate of Traumatic Occupational Fatalities due to Electrocution by State, US, 1980-1989.*

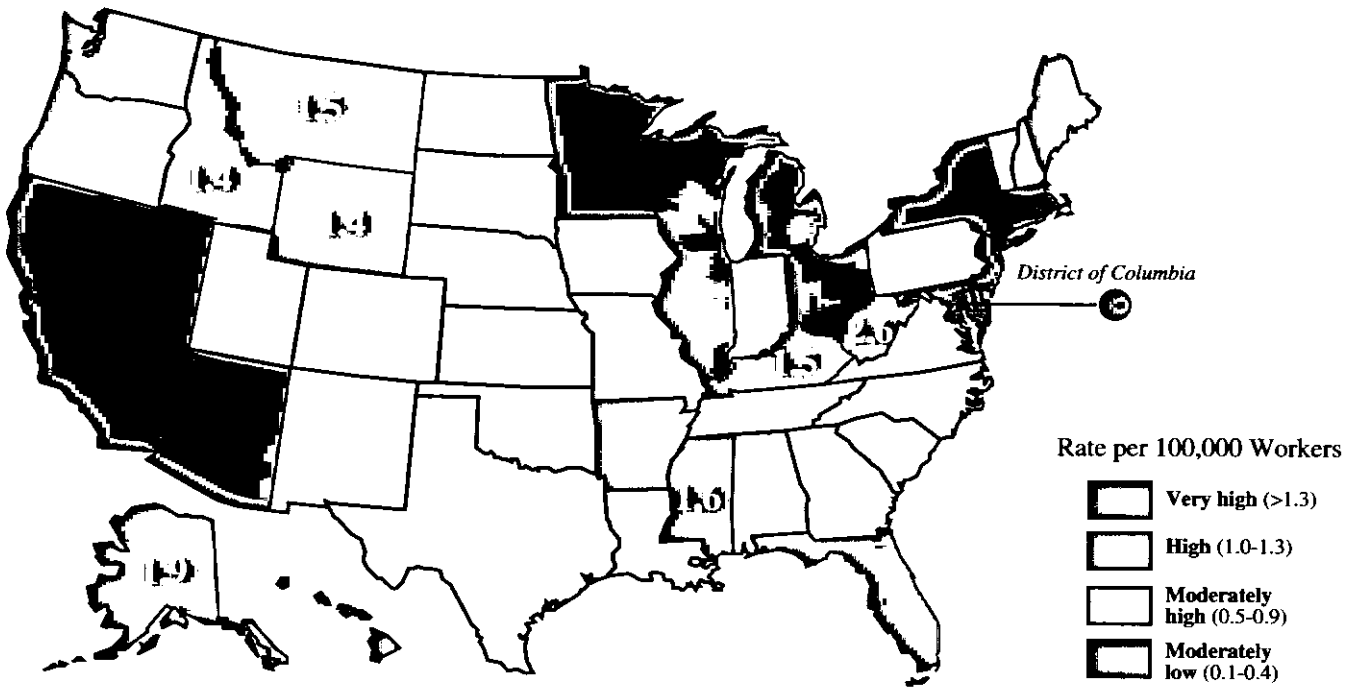

Figure US-13. *Average Annual Rate of Traumatic Occupational Fatalities due to being Struck by Falling Object by State, US, 1980-1989.*

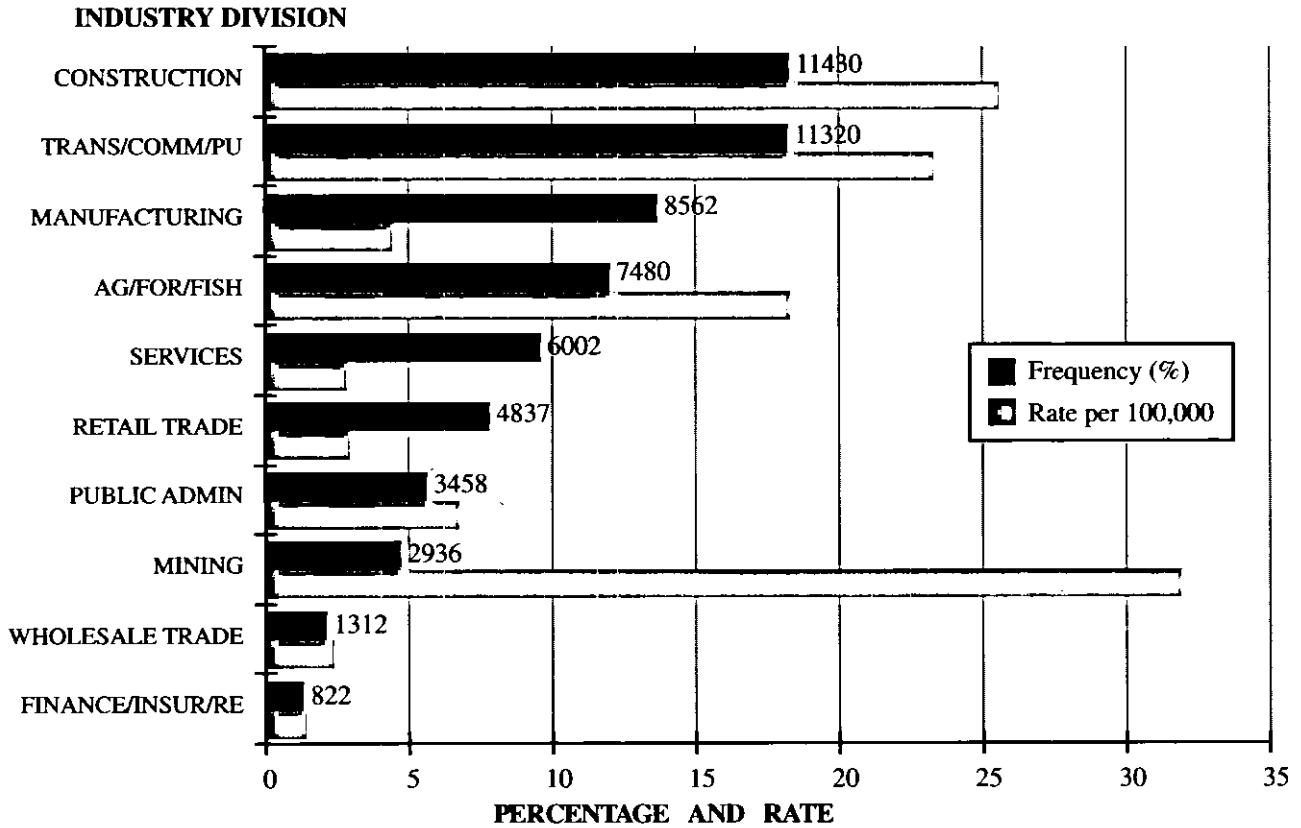

Figure US-14. *Distribution and Average Annual Rate of Traumatic Occupational Fatalities by Industry Division, US, 1980-1989.*

manufacturing (0.9). Motor vehicle-related incidents accounted for the second or third highest fatality rate in these industries.

Homicide and motor vehicle-related incidents, respectively, accounted for the two highest fatality rates per 100,000 workers in three industry divisions: retail trade (1.7 and 0.4), services (0.6 and 0.5), and finance/insurance/real estate (0.4 and 0.3). Fatality rates for suicide and fall incidents were the third and fourth highest rates in these industries.

Fall incidents accounted for the highest fatality rate in the construction industry (6.6). This fatality rate was followed by the fatality rates for electrocution, motor vehicle-related, and machine-related incidents.

Age group-specific rates by industry division are shown in **Table US-3**. Workers 65 years of age or older had the highest rates of occupational injury death in every industry division except mining. In mining, workers 16 to 19 years, and 20 to 24 years and those 65 years and older, experienced high rates of work-related fatalities.

Fatality rates for each of the highest risk industry divisions are examined by state of death. **Figures US-15** through **US-18** show the geographic distribution of rates for occupational injury deaths in the four highest risk industry divisions: mining, construction, transportation/communication/public utilities, and agriculture/forestry/fishing.

The rate of occupational injury death for each of the industry divisions is shown by year in **Figure US-19**. The four highest risk industries—mining, construction, transportation/communication/public utilities, and agriculture/forestry/fishing—are notably

Table US-3. *Average Annual Rate (per 100,000 workers) of Traumatic Occupational Fatalities by Industry Division and Age Group, US, 1980-1989.*

	AGE GROUP (IN YEARS)						
INDUSTRY DIVISION	**16-19**	**20-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65+**
AG/FOR/FISH	8.5	18.9	17.9	17.4	21.5	26.5	52.3
MINING	72.9	50.3	32.1	26.0	26.8	26.5	60.8
CONSTRUCTION	14.4	16.6	15.3	15.5	17.5	22.6	38.5
MANUFACTURING	3.9	4.0	3.5	3.5	4.1	5.3	15.4
TRANS/COMM/PU	13.6	15.6	14.6	14.0	15.7	18.9	40.4
WHOLESALE TRADE	3.4	3.3	3.0	2.2	3.1	3.9	5.1
RETAIL TRADE	0.7	1.7	2.6	3.2	3.8	5.4	8.8
FINANCE/INSUR/RE	0.6	0.6	0.9	1.1	1.4	2.1	3.6
SERVICES	1.3	1.8	1.6	1.6	1.9	2.4	4.1
PUBLIC ADMIN	9.4	11.1	7.7	5.6	4.8	6.1	12.1

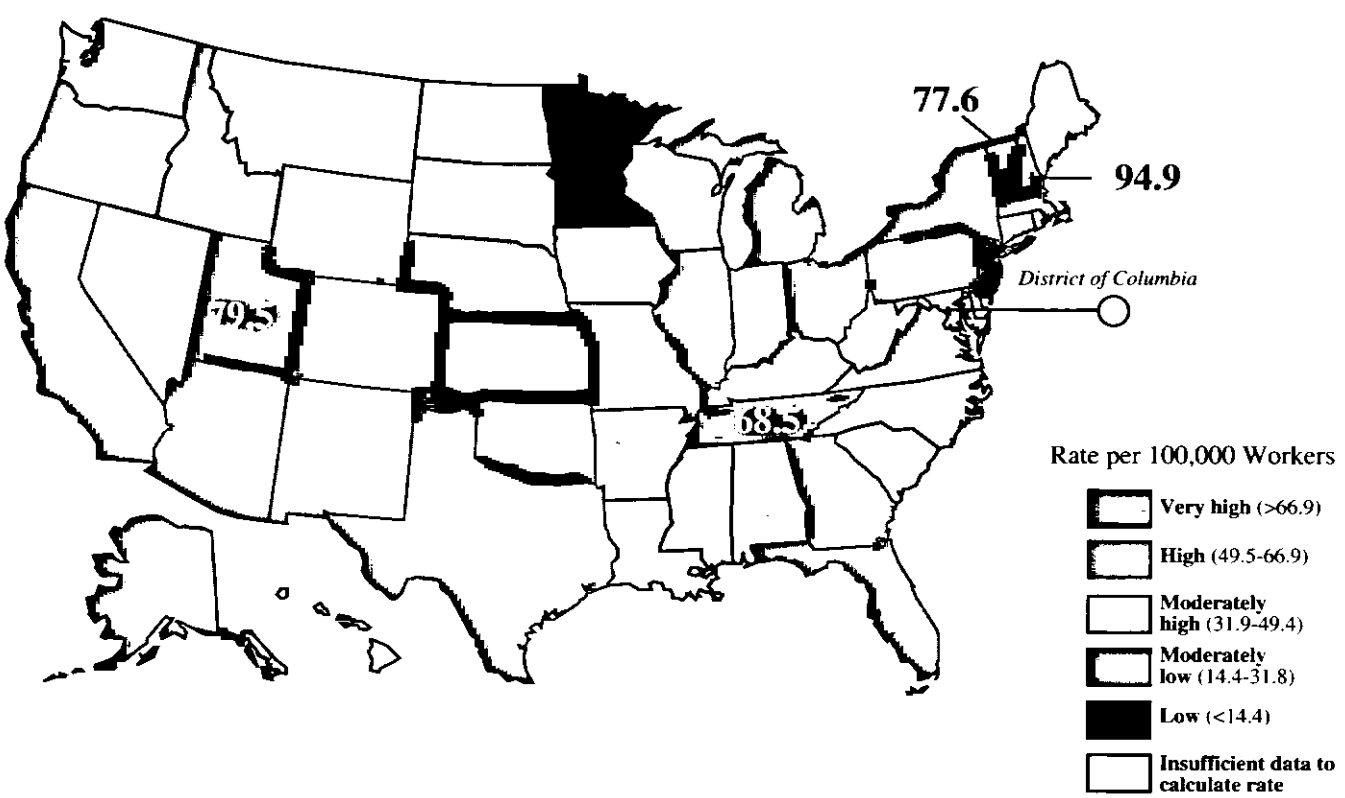

Figure US-15. *Average Annual Rate of Traumatic Occupational Fatalities in the Mining Industry by State, US, 1980-1989.*

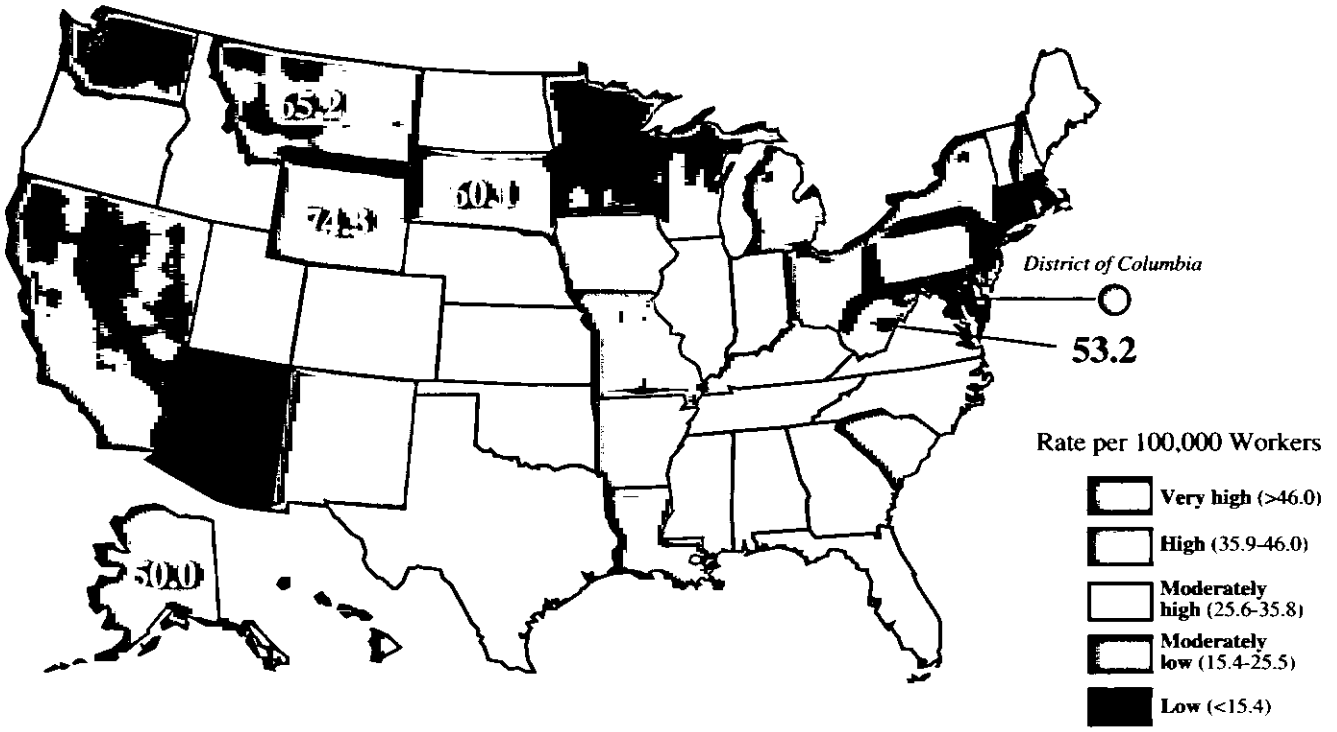

Figure US-16. *Average Annual Rate of Traumatic Occupational Fatalities in the Construction Industry by State, US, 1980-1989.*

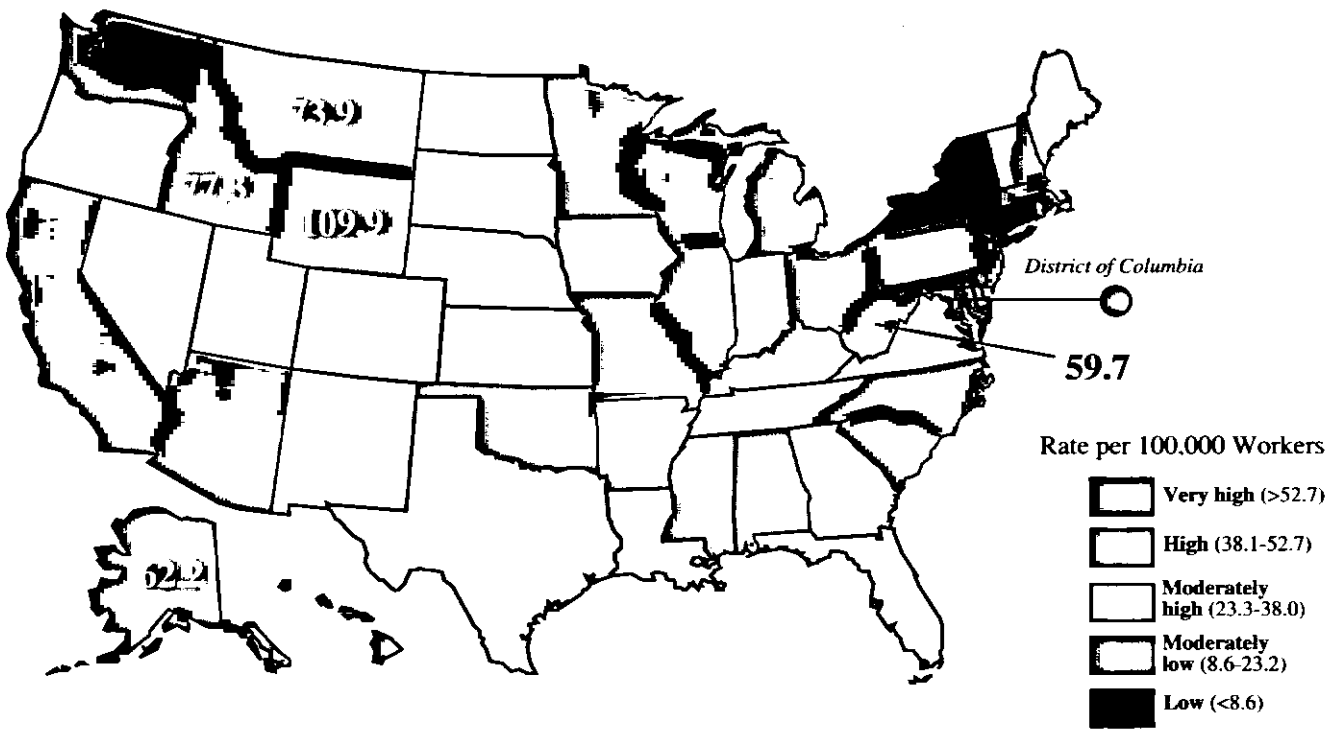

Figure US-17. *Average Annual Rate of Traumatic Occupational Fatalities in the Transportation/Communications/Public Utilities Industry by State, US, 1980-1989.*

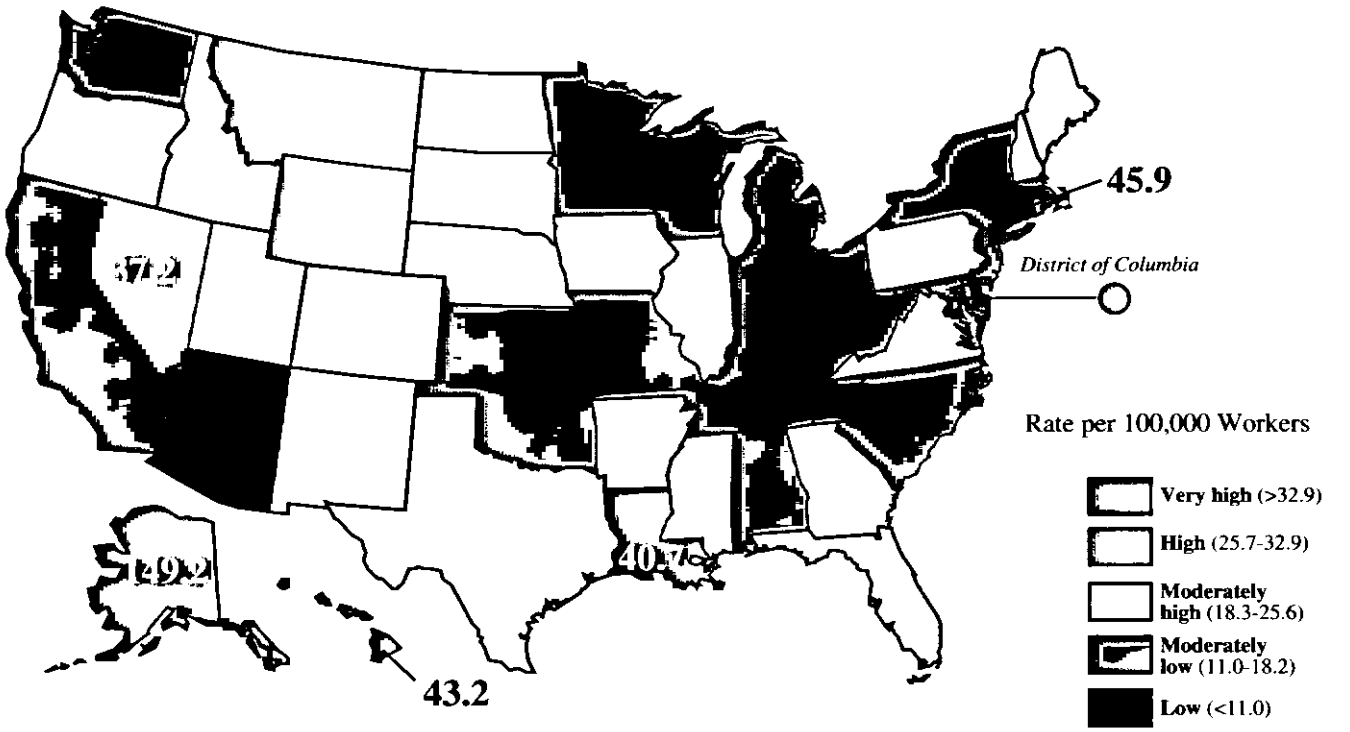

Figure US-18. *Average Annual Rate of Traumatic Occupational Fatalities in the Agriculture/Forestry/Fishing Industry by State, US, 1980-1989.*

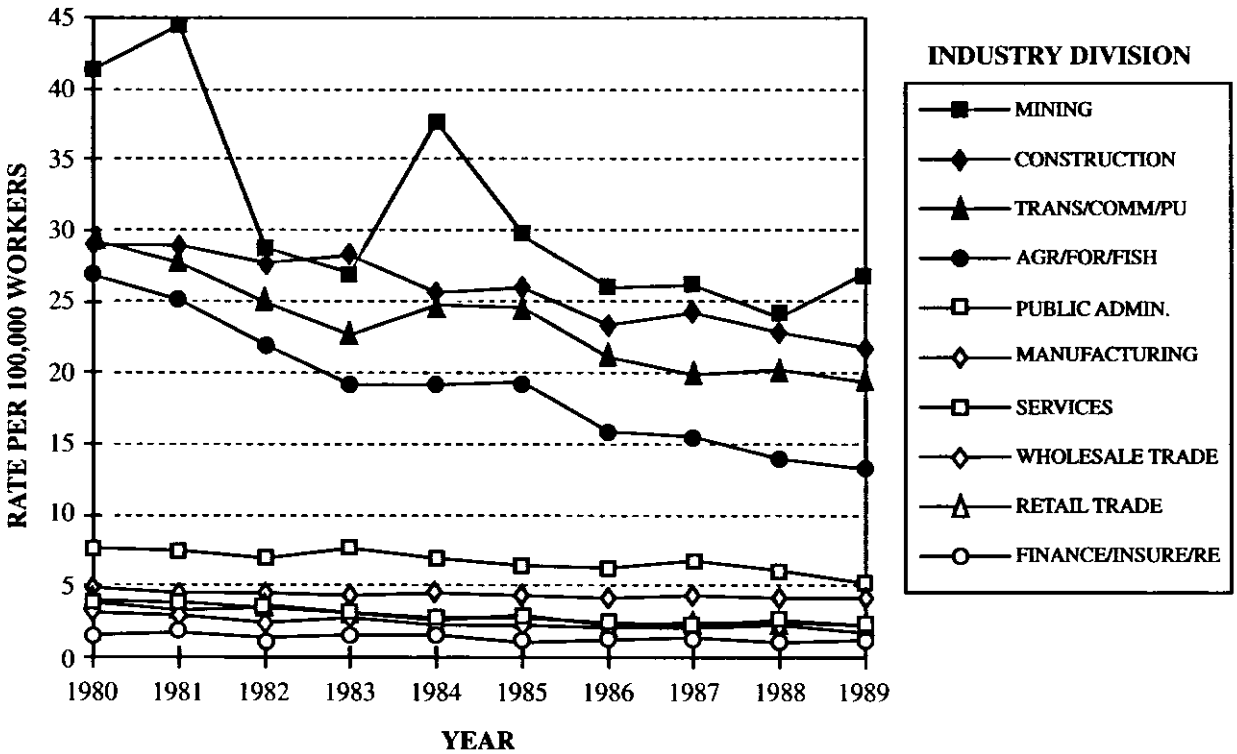

Figure US-19. *Rate of Traumatic Occupational Fatalities by Industry Division and Year, US, 1980-1989.*

and consistently higher than all other industry divisions. Note that most industries show a slight but relatively consistent decline in fatal injuries over the decade. The erratic pattern of fatalities in the mining industry is due in part to annual differences in the number of multiple-fatality events. In 1980, 1981, and 1984, there were substantially more incidents that resulted in three or more deaths than there were in other years during the decade. For example, a single mining disaster, which killed 27 workers, contributed to the high mining rate in 1984.

Occupation Divisions

Figure US-20 shows both the proportion and rate of work-related injury deaths by occupation division. The occupation divisions in the U.S. with the largest number of fatalities were precision production/craft/repair (crafts) (19%), transportation/material movers (19%), laborers (13%), and farmers/foresters/fishers (12%). The occupation division of transportation/material movers had the highest average annual fatality rate per 100,000 workers with 25.6, followed by farmers/foresters/fishers (21.3), laborers (17.2), and precision production/craft/repair occupations (9.3).

Table US-4 presents the average annual rate of work-related injury deaths by occupation division and cause of death. Motor vehicle-related incidents accounted for the highest fatality rate per 100,000 workers in the occupation divisions of transportation/material movers (14.2), laborers (2.8), and professional specialties (0.4). Machine-related incidents accounted for the second highest fatality rate in transportation/material movers and laborers while

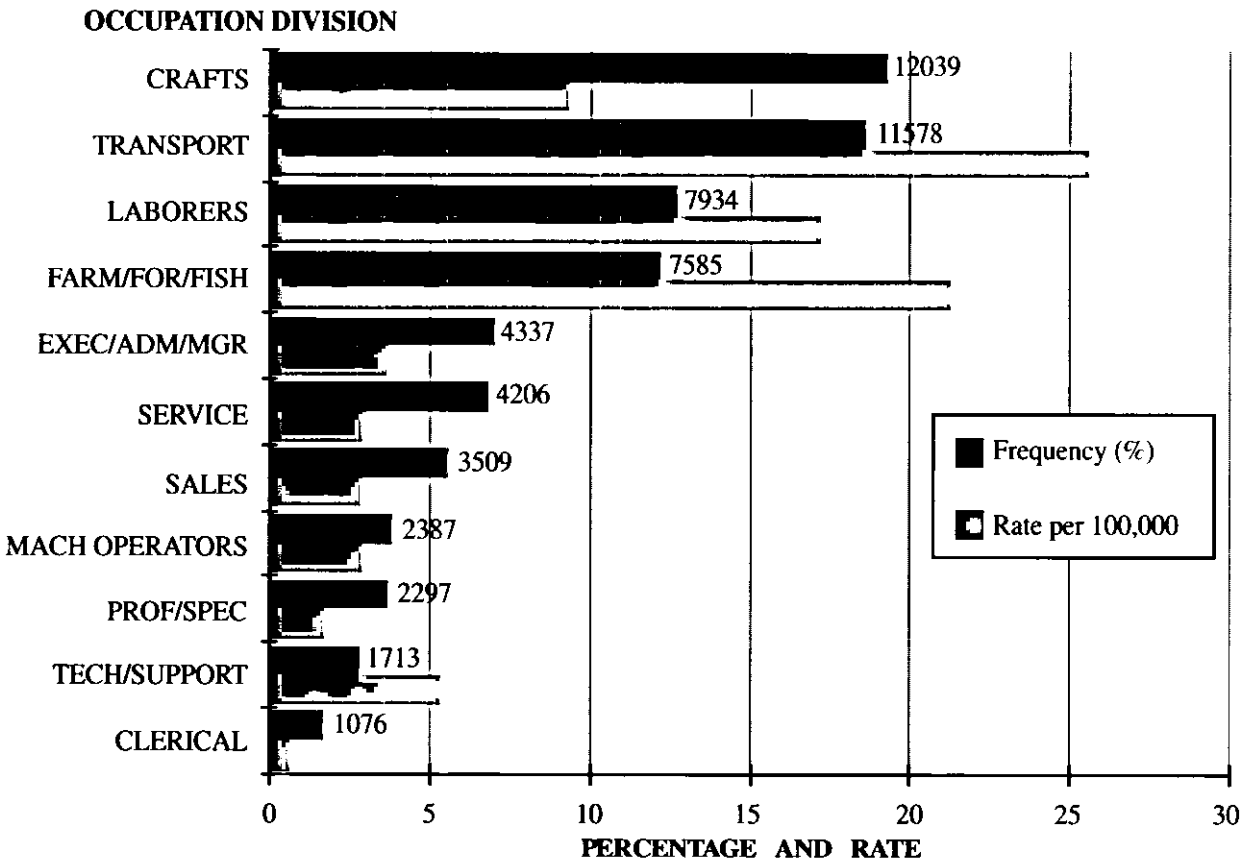

Figure US-20. *Distribution and Average Annual Rate of Traumatic Occupational Fatalities by Occupation Division, US, 1980-1989.*

Table US-4. Average Annual Rate (per 100,000 workers) of Traumatic Occupational Fatalities by Cause of Death and Occupation Division, US, 1980-1989.*

CAUSE OF DEATH	EXEC/ADM/ MGR	PROF/SPEC	TECH/ SUPPORT	SALES	CLERICAL	SERVICE	FARM/FOR/ FISH	CRAFTS	MACH OPERATORS	TRANSPORT	LABORERS
Motor Vehicle (E810-E829,E846-E849)	0.63	0.36	0.59	0.59	0.18	0.60	2.71	1.08	0.27	14.16	2.82
Machine (E919)	0.33	0.10	0.19	0.10	0.04	0.14	7.18	1.18	0.56	2.92	2.72
Homicide (E960-E969)†	0.90	0.26	0.12	1.36	0.18	0.97	0.49	0.42	0.20	1.50	1.48
Fall (E880-E888)	0.32	0.14	0.19	0.10	0.05	0.26	1.00	1.98	0.35	0.66	2.16
Electrocution (E925)	0.18	0.07	0.20	0.04	0.01	0.09	1.19	1.53	0.22	0.84	1.54
Struck by Falling Object (E916)	0.17	0.04	0.07	0.05	0.01	0.06	3.19	0.79	0.24	0.97	1.57
Air Transport (E840-E845)	0.23	0.24	3.26	0.09	0.02	0.09	0.17	0.13	0.03	0.16	0.10
Suicide (E950-E959)	0.24	0.13	0.10	0.23	0.04	0.16	0.42	0.21	0.06	0.27	0.25
Explosion (E923,E921)	0.10	0.04	0.14	0.03	0.01	0.05	0.18	0.40	0.27	0.44	0.54
Other	0.08	0.04	0.08	0.05	0.02	0.12	0.43	0.24	0.13	0.41	0.45
Flying Object/Caught In (E917-E918)	0.06	0.02	0.02	0.02	0.01	0.04	0.65	0.29	0.14	0.49	0.66
Nature/Environment (E900-E909,E928)	0.05	0.04	0.05	0.03	0.02	0.04	1.10	0.22	0.09	0.41	0.52
Suffocation (E911-E913)	0.06	0.02	0.04	0.02	0.003	0.03	0.36	0.17	0.07	0.26	0.88
Water Transport (E830-E838)	0.02	0.05	0.07	0.01	0.002	0.03	1.16	0.07	0.04	0.78	0.25
Fire (E890-E899)	0.07	0.02	0.04	0.04	0.01	0.11	0.21	0.21	0.12	0.23	0.34
Poisoning (E850-E858,E860-E869)	0.06	0.04	0.08	0.03	0.01	0.05	0.23	0.20	0.07	0.25	0.30
Drowning (E910)	0.03	0.05	0.05	0.01	0.01	0.06	0.48	0.09	0.04	0.20	0.37
Rail Transport (E800-E807)	0.02	0.03	0.01	--	0.003	0.02	0.02	0.04	0.02	0.46	0.16
Unknown/Undet (E980-E989,BLANK)	0.03	0.01	0.03	0.02	0.01	0.03	0.11	0.05	0.01	0.15	0.12
TOTAL	**3.59**	**1.70**	**5.33**	**2.81**	**0.62**	**2.94**	**21.28**	**9.30**	**2.94**	**25.58**	**17.22**

*Unclassified occupations were not included in calculating overall rates.

†Homicide data for New York, Oklahoma, Louisiana, and Nebraska were not available for earlier years.

--Rates were not calculated for cells with <3 cases due to instability of rates based on small numbers.

Shading denotes the leading causes of death in each occupation group.

the second highest fatality rate for professional specialties was homicide.

Machine-related incidents were the leading cause of work-related death in the farmers/foresters/fishers occupation division, with a rate of 7.2 per 100,000 workers, followed by struck by falling object incidents and motor vehicle incidents. Machine-related incidents were also the leading cause of death for the machine operators division with a rate of 0.6 per 100,000 workers, followed by falls, motor vehicle incidents, and explosions.

Homicide incidents accounted for the highest fatality rate per 100,000 workers in the occupation divisions sales (1.4), service (1.0), and executives/administrators/managers (0.9). Motor vehicle incidents accounted for the second highest fatality rate in these occupation divisions, and fall incidents accounted for the third or fourth highest fatality rate. Homicides and motor vehicle incidents each accounted for a rate of 0.2 per 100,000 workers in the clerical workers division.

In the occupation division precision production/craft/repair, fall incidents accounted for the highest fatality rate (2.0); this was followed by electrocutions, machine-related, and motor vehicle-related incidents. In the occupation division technicians/related support, air transport incidents accounted for the highest fatality rate (3.3), followed by motor vehicle-related incidents, electrocutions, machine-related incidents, and falls.

Age group-specific rates by occupation division for 1983 through 1989 are shown in **Table US-5**. Workers 65 years of age or older had the highest rates of occupational injury death in every occupation division. Note the extraordinary rates for workers 65 years of age and older working as farmers/foresters/

Table US-5. *Average Annual Rate (per 100,000 workers) of Traumatic Occupational Fatalities by Occupation Division and Age Group, US, 1983-1989.*

	AGE GROUP (IN YEARS)						
OCCUPATION DIVISION	**16-19**	**20-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65+**
EXEC/ADM/MGR	4.0	2.6	2.6	2.5	3.5	5.3	10.0
PROF/SPEC	2.4	1.7	1.3	1.2	1.5	2.4	5.5
TECH/SUPPORT	3.7	3.6	4.2	6.0	5.9	6.5	10.3
SALES	0.5	1.6	2.1	2.5	3.0	4.1	7.6
CLERICAL	0.3	0.5	0.6	0.5	0.5	0.9	1.8
SERVICE	0.4	2.1	3.3	3.4	3.0	3.4	4.3
FARM/FOR/FISH	5.8	16.2	17.9	19.6	22.1	25.4	49.1
CRAFTS	6.1	8.1	7.7	7.9	8.2	10.9	22.7
MACH OPERATORS	2.1	2.5	2.5	2.5	2.7	3.4	7.8
TRANSPORT	11.9	19.5	23.4	24.1	25.7	30.3	40.6
LABORERS	6.2	13.7	18.5	19.6	21.4	24.0	28.4

fishers, transportation/material movers, laborers, and in precision production/craft/repair occupations.

The rate of occupational injury deaths for each occupation division by year is shown in **Figure US-21**. While more dispersed than the distribution of fatality rates by industry divisions, three occupational groups—transportation/material movers, farmers/foresters/fishers, and laborers—have consistently higher rates than other occupation divisions.

Distribution and Fatality Rates by State

The greatest number of fatal occupational injuries occurred in Texas (6,664), California (6,623), Florida (3,681), Illinois (2,853) and Pennsylvania (2,564) (**Table US-6**). The lowest number of work-related deaths occurred in Rhode Island (125), Vermont (135), Delaware (146), New Hampshire (181) and the District of Columbia (191).

The states with the highest occupational injury fatality rates for the private sector were Alaska (34.8), Wyoming (29.0), Montana (20.9), Idaho (16.7), and West Virginia (15.7) (**Figure US-22**). The lowest occupational injury fatality rates were reported in Connecticut (1.8), Massachusetts (2.3), and New York (2.6).

The average annual years of potential life lost (YPLL) and YPLL rate for each state are presented in **Table US-7**. The overall YPLL rate for the U.S. civilian workforce was 175.6 years per 100,000 workers. Alaska had the highest private sector YPLL rate (1013.8 years per 100,000 workers) and Connecticut had the lowest (43.1 years per 100,000 workers).

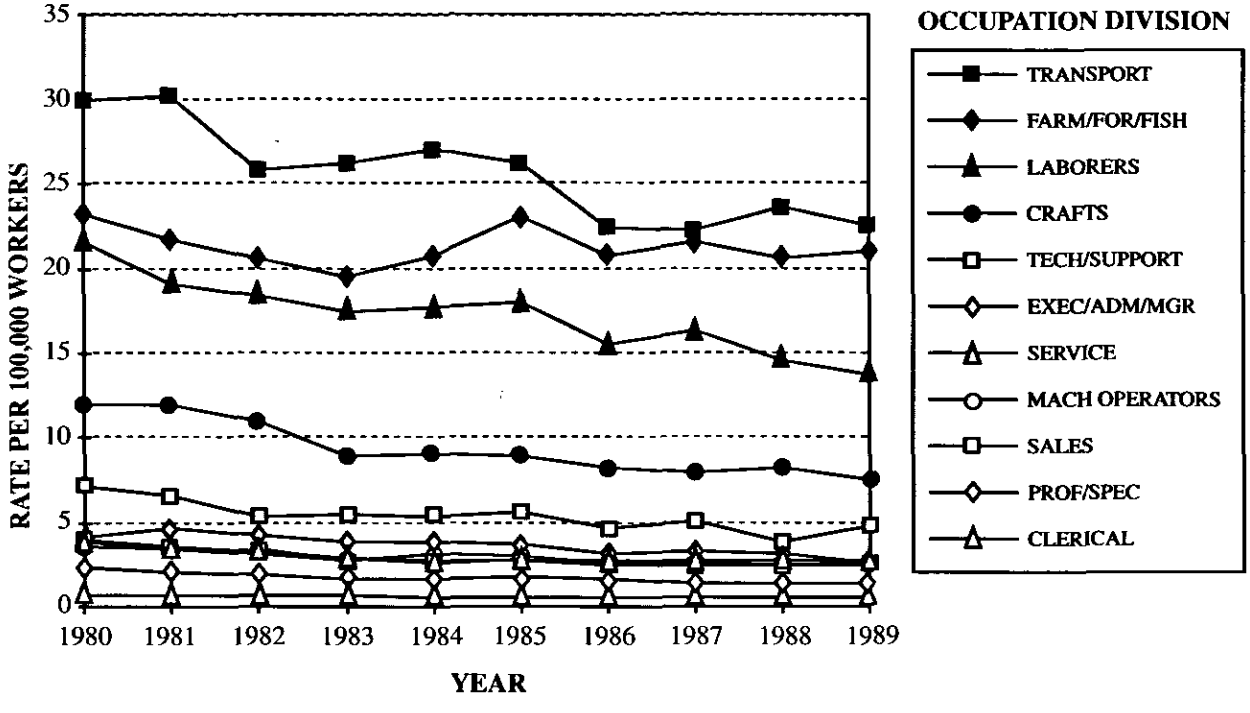

Figure US-21. *Rate of Traumatic Occupational Fatalities by Occupation Division and Year, US, 1980-1989.*

Table US-6. Distribution and Average Annual Rate (per 100,000 workers) of Traumatic Occupational Fatalities by State of Death, US, 1980-1989.

STATE	DEATHS	RATE
ALABAMA	1,143	9.2
ALASKA	561	34.8
ARIZONA	398	3.7
ARKANSAS	874	12.0
CALIFORNIA	6,623	6.3
COLORADO	1,110	8.9
CONNECTICUT	255	1.8
DELAWARE	146	5.6
DIST COLUMBIA	191	4.5
FLORIDA	3,681	9.1
GEORGIA	2,176	9.6
HAWAII	235	6.1
IDAHO	520	16.7
ILLINOIS	2,853	6.3
INDIANA	1,509	7.4
IOWA	962	9.0
KANSAS	784	8.6
KENTUCKY	1,392	11.6
LOUISIANA	1,438	11.0
MAINE	302	7.6
MARYLAND	862	5.3
MASSACHUSETTS	645	2.3
MICHIGAN	1,627	5.1
MINNESOTA	719	4.1
MISSISSIPPI	1,064	14.5
MISSOURI	1,052	5.3
MONTANA	525	20.9
NEBRASKA	653	10.9
NEVADA	504	10.8
NEW HAMPSHIRE	181	4.4
NEW JERSEY	1,009	3.3
NEW MEXICO	498	11.8
NEW YORK	1,783	2.6
NORTH CAROLINA	1,749	7.0
NORTH DAKOTA	304	13.5
OHIO	1,841	4.6
OKLAHOMA	894	8.6
OREGON	1,050	10.9
PENNSYLVANIA	2,564	5.9
RHODE ISLAND	125	3.3
SOUTH CAROLINA	784	6.8
SOUTH DAKOTA	331	14.2
TENNESSEE	1,392	7.8
TEXAS	6,664	11.3
UTAH	647	12.3
VERMONT	135	6.7
VIRGINIA	1,942	9.4
WASHINGTON	1,212	7.5
WEST VIRGINIA	770	15.7
WISCONSIN	1,156	6.2
WYOMING	454	29.0
TOTAL (CIVILIAN)	**62,289**	**7.0**

DISCUSSION

NTOF data for the decade, 1980 through 1989, provide valuable information for identifying specific worker groups at high-risk of traumatic occupational fatalities. Prevention efforts and resources should be targeted on specific, high-risk groups based on gender, age, race, industry, or occupation. Information on the leading causes of traumatic occupational fatalities and on the geographic and demographic distribution of these deaths facilitates the identification of risk factors for workplace injury deaths. Trends of fatal injuries over time, particularly within employment sectors and states, are useful in setting research and prevention priorities, for generating hypotheses for further research, and for monitoring progress. The rate of occupational injury deaths as well as the absolute number of events are important in the interpretation of these surveillance data; the rates depict the risk faced by workers and the numbers indicate