Occupational Injury Deaths among Females
The US Experience for the Decade 1980 to 1989

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ABSTRACT

From 1980 through 1989, females accounted for 44% of the total employed population. Thus, occupational safety and health issues specific to the experience of women merit consideration. Research has demonstrated that the occupational fatality experience of females is not adequately described by the group of all workers. The leading cause of death for all workers is motor vehicle incidents, while the leading cause of occupational injury death of females is homicide. The National Institute for Occupational Safety and Health (NIOSH) has compiled a decade of data on the fatal occupational injury experience of US workers, providing a sufficient number of female cases to allow separate analyses. Over the decade, 3821 females died as a result of injuries sustained at work, with an average annual fatality rate of 0.82/100,000 female workers. Among industries, retail trade and services accounted for nearly half of all occupational injury deaths to females. The detailed occupations with the highest rates of work-related injury death were airplane pilots and navigators, drivers of heavy trucks, construction laborers, and police and detectives. Information on the causes of work-related injury death by occupation is fundamental to the prevention of these deaths. The causes of death in the highest-risk occupations included aircraft crashes, motor vehicle collisions, pedestrians struck by motor vehicles, and homicides by firearms. These data provide a foundation for the prevention of occupational injury deaths among females in the United States. Ann Epidemiol 1994;4:146–151.

KEY WORDS: Trauma, females, wounds and injuries, occupational.

INTRODUCTION

Female participation in the labor force increased over two and one-half times in the 25-year period from 1964 to 1989. In service-producing industries alone, female employment almost tripled in that same 25-year period (1). From 1980 through 1989, females accounted for 44% of the total employed population (2). Thus, occupational safety and health issues specific to the experience of women merit consideration.

Previous studies of occupational injury deaths excluded females from analysis or reported so few that gender-specific analyses were not possible (3–7). Research also demonstrated that the occupational fatality experience of females is not adequately described by examining only the total population of workers (i.e., males and females combined). For example, the leading cause of death for all workers is motor vehicle incidents, while the leading cause of occupational injury death for females is homicide (18). The National Institute for Occupational Safety and Health (NIOSH) has compiled a decade of data on the fatal occupational injury experience of US workers, providing a sufficient number of female cases to allow the description of the distribution of female occupational injury deaths by year of occurrence, age group, cause of death, industry division, and detailed occupation.

METHODS

Cases in this analysis were taken from the National Traumatic Occupational Fatalities (NTOF) surveillance system maintained by NIOSH. The NTOF system is a death certificate–based census of occupational injury deaths to workers aged 16 years or older. Data are collected from the 52 vital records units in the 50 states, New York City, and the District of Columbia. This system provides for complete coverage of all workers in the United States without regard to size of establishment, kind of work being performed, or coverage by compensation systems. The "Injury at Work?" item from the death certificate is used to identify cases submitted by the states to NIOSH. During the period analyzed here, there was no standardized definition of an injury at work in use by medical examiners and coroners; therefore, the response to this item on the certificate was open to interpretation by individual certifiers. Operational guidelines for the determination of work injuries were developed in 1991 and have been disseminated to all vital registrars for distribution to medical examiners and coroners. This

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change should improve death certificate surveillance of deaths from work-related injuries. A complete discussion of the methods and limitations of the NTOF system is available elsewhere (7). The analysis presented here includes all females aged 16 years and older in the US civilian work force. For the period 1980 through 1984, data on homicides 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.

Employment information was coded from industry and occupation narratives taken from the death certificate, using software developed by the NIOSH Division of Safety Research. The program effectively codes narrative descriptions into broad occupational categories according to the 1980 Bureau of the Census (BOC) classification system (8) and by industry divisions according to the *Standard Industrial Classification Manual, 1987* (9). Cases also were manually assigned detailed occupation codes according to the BOC classification system. Codes for cause of death were assigned based on the International Classification of Diseases, ninth revision (ICD-9) supplementary chapter for the classification of external causes of injury and poisoning (10).

Rates were calculated using annual average employment data published by the Bureau of Labor Statistics from the Current Population Survey (2). These data are based on monthly surveys taken from a sample of households selected to represent the civilian noninstitutional population.

Rates by year, for age groups, and by industry division were calculated for the 10-year period of 1980 to 1989. Rates for detailed occupation categories were calculated only for the 7-year period of 1983 to 1989, because changes in the BOC classification system implemented in 1983 rendered data for previous years inconsistent with data for subsequent years. The female workers killed during the period of the study were employed in more than 250 detailed occupations; therefore, average annual rates are presented only for those occupations that had rates more than two times the average annual rate (i.e., a minimum of 1.64 deaths/100,000 female workers).

RESULTS

Over the decade, 3821 females died as a result of injuries sustained at work. This represents 6% of all deaths captured in the NTOF surveillance system for the 10-year period. The average annual fatality rate was 0.82/100,000 female workers. Figure 1 shows the rate of occupational injury deaths to females by year. The annual fatality rate per 100,000 female workers decreased 31% over the period, from 1.08 in 1980 to 0.74 in 1989.

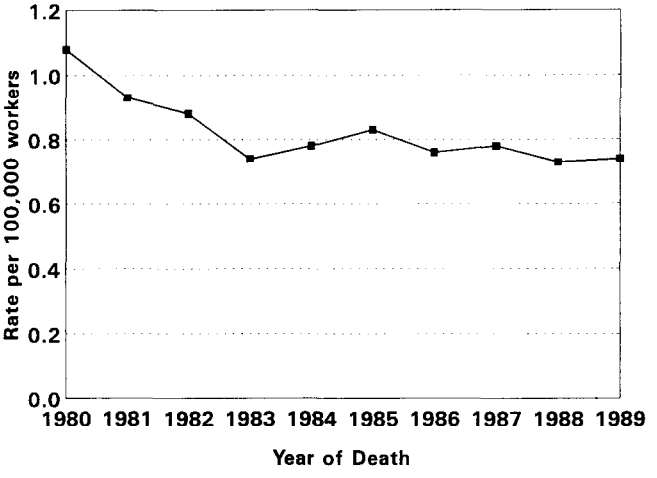


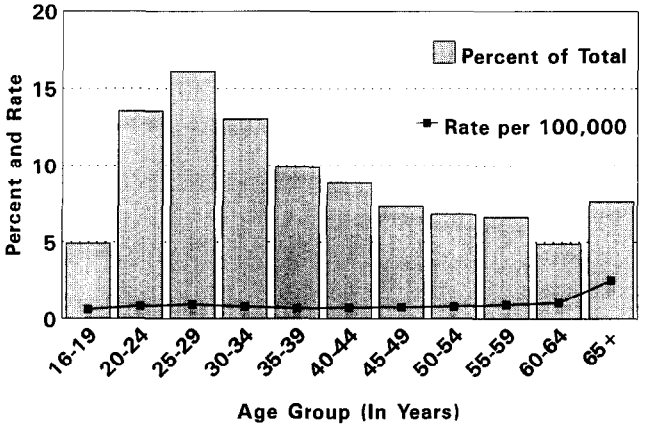
FIGURE 1. Rate of female occupational injury deaths by year, United States, 1980 to 1989.

Female workers aged 25 to 29 years accounted for the largest number of deaths, at 617, whereas the highest average annual rate occurred among female workers aged 65 years and older (2.5/100,000) (Figure 2).

Homicides were the leading cause of death to females, accounting for 40% of the total (Figure 3). Motor vehicle incidents were the second leading cause, accounting for 15% of the total.

Among industries, retail trade and services accounted for nearly half of all occupational injury deaths to females. The highest rates per 100,000 female workers occurred in construction (1.82), transportation/communication/public utilities (1.81), mining (1.67), and agriculture/forestry/fishing (1.62) (Table 1). The 613 cases for which industry division is listed as "not classified" included a number of cases for which "housewife" or "student" was listed on the death certificate as the "usual" industry.

FIGURE 2. Distribution and rate of female occupational injury deaths by age group, United States, 1980 to 1989.



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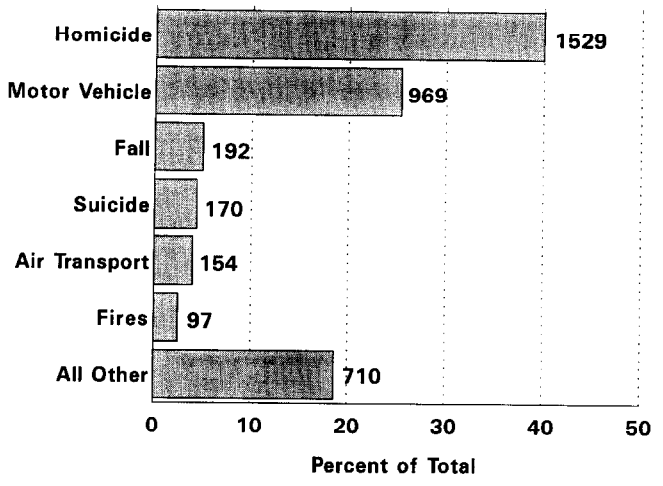

FIGURE 3. Distribution of female occupational injury deaths by cause of death, United States, 1980 to 1989.

Occupations with the Highest Rates

The detailed occupations with the highest rates of work-related injury death were airplane pilots and navigators, with 93.33/100,000 female workers, followed by heavy-truck drivers (30.71), construction laborers (23.97), and police and detectives (11.24) (Table 2). These four occupational categories, with rates more than ten times the average annual rate, were examined in greater detail.

Airplane pilots and navigators. There were 14 deaths of female airplane pilots or navigators. All were employed in the transportation/communication/public utilities industry. Females aged 40 to 44 years accounted for the largest percentage of deaths (29%), followed, by those aged 45 to 49 years (21%) and those 25 to 29 years (21%). All 14 died as a result of an air transport crash; for 50% of those, the death certificate specified that the worker was a crew member of a commercial aircraft killed in an unspecified accident. These 14 deaths occurred in separate incidents.

Drivers of heavy trucks. There were 86 deaths of female drivers of heavy trucks. Eighty-four percent were employed in the transportation/communication/public utilities industry. Females 30 to 34 years old accounted for the largest percentage of deaths, at 24%, and those 25 to 29 years old accounted for another 21%. Eighty-seven percent died as a result of a motor vehicle crash; 32% of these were the result of a collision with another motor vehicle, while 27% were the result of loss of control.

Construction laborers. There were 35 deaths of female construction laborers. Ninety-four percent were employed in the construction industry. Females aged 25 to 29 years accounted for the largest percentage of deaths (20%), followed by those aged 20 to 24 years (17%) and those aged 35 to 39 years (17%). Sixty-six percent of these females died as the result of a motor vehicle–related incident; 74% of these occurred when the worker was a pedestrian.

Police and detectives. There were 28 deaths of policewomen or female detectives. All were employed in public administration. Forty-three percent of the females were aged 25 to 29 years, and another 25% were aged 30 to 34 years. Forty-three percent of these females died as a result of motor vehicle–related incidents; in 50% of these cases the worker was a pedestrian and another 42% involved collisions with other motor vehicles. Thirty-nine percent of the policewomen or female detectives were killed as the result of homicide, 91% of which were caused by a firearm.

Occupations with the Largest Number of Fatalities

To understand adequately occupational injury deaths to females, occupations that accounted for the largest numbers of fatalities also must be examined (Table 3). Three occupations—managers not elsewhere classified (includes managers of restaurants and service establishments), sales supervisors and proprietors, and sales workers in other commodities (includes sales of food, liquor, gas, and jewelry)—accounted for 18% of the female fatalities from 1983 to 1989. These three occupations were examined in more detail.

Managers not elsewhere classified. There were 199 deaths of females working in the category managers not elsewhere classified. Forty-four percent were employed in

TABLE 1. Distribution and rate of female occupational injury deaths by industry division, United States, 1980 to 1989

Industry division	Frequency	Percentage	Rate/100,000 workers
Retail trade	934	24.4	1.01
Service	902	23.6	0.45
Manufacturing	384	10.0	0.57
Transportation/communication/public utilities	353	9.2	1.81
Finance/insurance/real estate	177	4.6	0.43
Public administration	153	4.0	0.75
Agriculture/forestry/fishing	112	2.9	1.62
Construction	106	2.8	1.82
Wholesale trade	63	1.6	0.53
Mining	24	0.6	1.67
Not classified	613	16.0	
Total	3821	100.0	0.82

TABLE 2. Detailed occupations with high rates of female occupational injury deaths, United States, 1983 to 1989

Detailed occupation	Frequency	Rate/100,000 workers
Airplane pilot/navigator	14	93.33
Truck driver, heavy	86	30.71
Construction laborer	35	23.97
Police/detective	28	11.24
Taxicab driver	12	8.11
Public transport attendant	23	5.64
Stock handler/bagger	76	5.72
News vendor	15	5.56
Mail carrier, Post Office	22	5.30
Nonconstruction laborer	74	4.87
Truck driver, light	18	4.39
Hotel clerk	11	2.73
Guards and police, excluding public service	16	2.56
Sales supervisor/proprietor	151	1.99
Bus driver	26	1.85
Bartender	20	1.77
Dressmaker	13	1.71

retail trade and another 30% were employed in the services industry. Workers aged 25 to 29 years and 45 to 49 years each accounted for 15% of the deaths; those aged 35 to 39 years added another 13%. Sixty-three percent of these female managers were victims of homicide; 56% of these involved a firearm, and 23% involved cutting or piercing instruments.

Sales supervisors and proprietors. There were 151 deaths of females working as sales supervisors or proprietors. Eighty-nine percent were employed in retail trade. Workers aged 65 years and older accounted for the largest percentage of deaths (17%), followed by female workers aged 55 to 59 years (14%), 40 to 44 years (13%), and 30 to 34 years (11%). Seventy-three percent of these women were victims of homicide; 66% of these specified the involvement of a firearm, and another 23% involved cutting or piercing instruments.

Sales workers, other commodities. There were 124 deaths of females working as sales workers in other commodities. Eighty-two percent were employed in retail trade.

TABLE 3. Detailed occupations with high numbers of female occupational injury deaths, United States, 1983 to 1989

Detailed occupation	Frequency
Managers not elsewhere classified	199
Sales supervisor/proprietor	151
Sales workers, other commodities	124
Secretary	88
Truck driver, heavy	86
Stock handler/bagger	76
Nonconstruction laborer	74
Registered nurse	69
Waitress	65
Cashier	57

Workers aged 25 to 29 years accounted for the largest percentage of deaths (19%), followed by female workers aged 20 to 24 years (17%) and those 30 to 34 years old (15%). Seventy-four percent of these women were victims of homicide; 67% of these specified the involvement of a firearm, and another 18% involved cutting or piercing instruments.

DISCUSSION

The results of this analysis are consistent with previous study findings that female workers comprise from 6 to 8% of all occupational injury deaths (11–15).

Rates of occupational injury death among females decreased over the decade of 1980 through 1989. Further research will be required to elucidate the factors contributing to this decline. The relative contributions of economic conditions, changes in the industrial mix of the United States, the distribution of the work force, changes in working practices and environments, and declines in particular causes of death should be examined.

Consistent with previous findings on occupational injury death among both males and females combined (7), for the group of all females, workers aged 20 to 34 years accounted for the greatest number of deaths, but the highest rate per 100,000 female workers occurred among those aged 65 years and older. Several factors may contribute to increased rates among workers aged 65 years and older; these include decreased ability to survive injury and the perception that they may be "softer" targets with regard to incidents involving intentional injury (16). Additionally, 59% of female workers 65 years and older work part-time compared to 23% of females 20 to 64 years old (2). Older workers, particularly part-time workers, may be under-enumerated in employment data, which may result in artificially high fatality rates.

Homicide has been identified as the leading cause of occupational injury death for females in the United States overall (17) and in state-specific studies from North Carolina, California, and Texas (11, 12, 18). However, a study of occupational injury deaths in Colorado from 1982 to 1987 (14) found that motor vehicle traffic and other transport incidents were the leading causes of occupational injury deaths to females in that state. Further investigation of geographic variations in the leading causes of occupational injury death is needed to determine the role of various factors, such as the distribution of the work force by gender, in these variations.

The rate of occupational injury deaths as well as the absolute number of events are important in the interpretation of these data; the rates depict the risk faced by female workers, and the numbers indicate the magnitude of the problem or the number of lives that could be saved if these injuries were prevented.

The industries with the highest rates per 100,000 female

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workers were construction, transportation/communication/public utilities, mining, and agriculture/forestry/fishing. These are the same four highest-risk industries identified by the NTOF surveillance system for males and females combined, despite the fact that females comprise only 6% of the total number of deaths (19). In 1989, females represented a relatively small proportion of the total employment in construction (9%), transportation/communication/public utilities (28%), mining (16%), and agriculture/forestry/fishing (21%) (2). Thus, although these are male-dominated industries, females in these industries are at higher risk, as are their male counterparts, when compared to workers in other industries.

Detailed occupations with the highest fatality rates per 100,000 female workers were airplane pilots and navigators, drivers of heavy trucks, construction laborers, and police and detectives. As with the highest-risk industries, employment in these highest-risk occupations is primarily male. In 1989, females represented a small proportion of the employment in these occupations: airplane pilots and navigators, 4%; drivers of heavy trucks, 2%; construction laborers, 3%; and police and detectives, 10% (2). Although the number of female deaths in these occupations is relatively small, the risk is high.

Among industry divisions, the greatest percentage of deaths occurred in retail trade (24%) and services (24%). Three occupations accounted for 18% of the occupational injury deaths among females: managers not elsewhere classified, sales supervisors and proprietors, and sales workers in other commodities.

Information on the causes of work-related injury death by occupation is fundamental to the prevention of these deaths. The causes of death in the highest-risk occupations included aircraft crashes, motor vehicle collisions, pedestrians struck by motor vehicles, and homicides by firearms. In the three occupations with the largest numbers of deaths, homicides accounted for between 63 and 74% of the total deaths, and firearms were implicated in 56 to 67% of these homicides. Occupations in which homicide played a major role were sales and service-oriented.

Hypotheses regarding increased homicide risk have been discussed previously (16, 17). Homicide is the leading cause of occupational injury death for females due to the preponderance of homicides in particular industries and occupations where other hazards may be less prominent and where females are more likely to be employed. It should be noted that while the proportion of females killed as a result of homicide is greater than the proportion of males, the rate of work-related homicide is three times lower for females compared to males (19).

Motor vehicle–related incidents were the second leading cause of occupational injury among females. Appropriate design of intervention strategies requires information on the role of the worker in the incident. For example, whether the worker was a driver or an occupant in a motor vehicle collision or loss of control incident, or was a pedestrian struck by a motor vehicle. Occupant-restraint systems and airbags could play a role in reducing motor vehicle crashes that involve collisions or loss of control. Motor vehicle pedestrian deaths require different intervention strategies. Construction and work zones should be evaluated to identify risk factors for pedestrian injury.

Other areas where research is needed include elucidation of the actual circumstances surrounding fatal occupational injury events. For homicides, death certificate data do not contain information on the relationship of the victim to the offender, the involvement of a concurrent crime such as robbery, or other situational factors.

The prevention of occupational injury deaths requires research to identify populations at increased risk and to design, implement, and evaluate intervention strategies. The data presented here provide a foundation for the prevention of occupational injury deaths among females in the United States. Women comprise over 40% of the US work force; provision of safe and healthful working environments for all US workers requires the analysis of occupational safety issues specific to females in the workplace.

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