Fatal Occupational Injuries of Women, Texas 1975–84

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Abstract: A review of Texas death certificates for 1975–84 identified 348 cases of fatal occupational injuries of civilian females. Homicides accounted for 53 per cent and motor vehicle-related injuries accounted for 26 per cent of the deaths. Injuries from firearms caused 70 per cent of the homicides. One hundred thirty-three deaths occurred to women employed in the retail trade industry; of these, 77 per cent resulted from homicide. Women workers in gasoline service stations, food-bakery-and-dairy stores, and eating-and-drinking places had especially high risks of homicide. Texas female heavy-truck drivers had the highest fatal-injury rate, with motor-vehicle-related injuries causing 89 per cent of their deaths. These results indicate that effective strategies to prevent fatal occupational injuries of Texas women will need to address the problems of workplace violence and the hazards posed by motor vehicles. (*Am J Public Health* 1987; 77:1524–1527.)

Introduction

Each year an estimated 10,000 American workers die of work-related injuries.[1] Recent studies in Maryland[2] and Texas[3] have described the epidemiology of fatal occupational injuries, but the small number of fatally injured women identified in these studies precluded meaningful epidemiologic descriptions of their injuries. Yet in 1980, women comprised 43% of the American workforce; they were more likely than men to work in certain industries and occupations (retail trade, personal services, and professional and related services) and less likely than men to work in others (agriculture, mining, construction, and transportation).[4] The risks men and women workers face, therefore, can be expected to differ.

Using death certificates and medical examiners' records as the sources of data, we conducted a study to describe the epidemiology of fatal occupational injuries of Texas women. This report describes the causes of work-related injuries and the occupations and industries that present the highest risk of such injuries. In addition, for the deaths that were homicides, the report describes the circumstances under which the injuries occurred.

Methods

Texas death certificates for 1975 through 1984 were reviewed. A case was defined as the death of a female, 16 years of age or older, who was injured and died in Texas, whose death certificate had a positive response to "injury at work?", whose underlying cause of death was coded to an "external cause" according to the International Classification of Diseases (ICD Codes E800–E989, 8th[5] and 9th[6] revisions), and who died in the period 1975 through 1984. Deaths were included regardless of the states of residence listed on the death certificates, and regardless of the intervals from injury to death. Deaths of housewives, students, military personnel, and suicide victims were excluded. In Texas, medical examiners or coroners complete the injury-at-work and cause-of-death portions of death certificates of all persons who died from injuries.

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Editor's Note: See also related paper, Am J Public Health 1987; 77(10): 1290–1293.

Texas death certificate information on usual occupation and kind of business or industry was coded to the 1980 census occupation and industry classification system.[7] The coding system has been described previously.[8] Occupation-specific, industry-specific, and age-specific fatal injury rates were determined using Bureau of the Census 1980 estimates of the employed civilian labor force in Texas for females 16 years of age or older.[9] The rates are average annual rates for 1975 through 1984. For all rate ratios, 95 per cent confidence intervals were determined.[10]

Medical examiners' records were reviewed for the women identified in the death certificate review who had died in 1975 through 1984 in five urban counties: Harris, Dallas, Tarrant, Bexar, or Travis Counties. These counties contain the cities of Houston, Dallas, Fort Worth, San Antonio, and Austin, respectively. Data obtained from these records included blood and cerebrospinal-fluid alcohol levels for deaths in which the interval from injury to death was ≤ 4 hours; and for deaths that were homicides, the activity in which the person was engaged when she was injured, the relationship between the offender and victim, whether the homicide had occurred during a robbery, and the type of weapon used. To use medical examiners' data to verify whether a fatal injury had occurred in a workplace, a workplace was defined as any location where a person was at work, either employed by others or self-employed.

Years of potential life lost was defined as the number of years of potential life lost by each death occurring before a predetermined end point, set at age 65 years.[11]

Results

The review of death certificates identified 348 women who met the case definition. Of these, 335 women (96 per cent) were Texas residents. The median age of the women at death was 37 years, with a range of 17 to 92 years. This resulted in the premature loss (death before age 65) of 9,078 potential years of life.

Homicide was the leading cause of death (185 women, 53 per cent of the total), followed by injuries from motor vehicles (90, 26 per cent), falls (17, 5 per cent), fires and flames (15, 4 per cent), machinery or tools (12, 3 per cent), explosions (7, 2 per cent), and other causes (22, 6 per cent).

Injuries from firearms caused 129 (70 per cent) of the homicides. The remaining homicides were caused by injuries from cutting or piercing instruments (32 women, 17 per cent), strangulation (11, 6 per cent), drowning (2, 1 per cent), and other means (11, 6 per cent).

The overall fatal occupational injury rate was 1.3/100,000 female workers/year. The workplace homicide rate was

TABLE 1—Leading Causes and Rates of Fatal Injuries for Major Industries and Subindustries, Females, 16 Years Old or Older, Texas, 1975–84

Industry or Type of Business*	No. Fatal Injuries	1980 Texas Population at Risk	Fatal Injury Rate/ 100,000/Year	Leading Cause of Fatal Injury: External Cause of Death	Leading Cause of Fatal Injury: No. deaths	Workplace Homicide Rate/ 100,000/Year
Construction	14	47,952	2.9	Motor vehicle incidents	9	NA**
Retail trade	133	535,727	2.5	Homicides	103	1.9
Gasoline service stations	14	9,748	14.4	Homicides	13	13.3
Food, bakery, and dairy stores	34	78,718	4.3	Homicides	28	3.6
Eating and drinking places	46	148,912	3.1	Homicides	39	2.6
Transportation, communications, and other public utilities	30	120,328	2.5	Motor vehicle incidents	21	NA
Trucking service and warehousing	12	16,588	7.2	Motor vehicle incidents	9	NA
Personal services	26	156,663	1.7	Homicides	18	1.1
Private households	10	53,208	1.9	Homicides	4	0.8
Manufacturing	36	334,686	1.1	Motor vehicle incidents	9	NA
Business and repair services	10	96,004	1.0	Homicides	4	0.4
Finance, insurance and real estate	20	227,406	0.9	Homicides	15	0.7
Real estate, including real estate-insurance law offices	10	53,342	1.9	Homicides	9	1.7
Professional and related services	30	797,588	0.4	Homicides	14	0.2
All industries	348	2,606,295	1.3	Homicides	185	0.7

*Only major industries and subindustries with 10 or more deaths are included. Only subindustries with above-average risk are included. Industry was not codable for 25 cases.
**NA: not applicable.

0.7/100,000 female workers/year. Of the eight major industries with 10 or more deaths (Table 1), five had homicide as their leading cause of fatal injury. The retail trade industry had the highest workplace homicide rate, 1.9/100,000 female workers/year. Three retail trade subindustries had especially high workplace homicide rates: gasoline service stations (13.3 workplace homicides/100,000 female workers/year), food-bakery-and-dairy stores (3.6/100,000 female workers/year), and eating-and-drinking places (2.6/100,000 female workers/year).

Of the occupations, female drivers of heavy trucks had the highest fatal occupational injury rate (54.9 fatal injuries/100,000 female workers/year) (Table 2), with motor-vehicle incidents accounting for 89 per cent of their fatal injuries. Three occupations had markedly elevated workplace homicide rates: stock handlers and baggers (19.7 workplace homicides/100,000 female workers/year), food counter and fountain workers (15.4/100,000 female workers/year), and supervisors and proprietors in sales occupations (6.1/100,000 female workers/year).

All of the 16 murdered stock handlers and baggers were grocery clerks. Of the 22 murdered supervisors and proprietors (sales occupations), five worked in food-bakery-and-dairy stores and five in gasoline service stations. Fourteen of the 25 murdered managers and administrators worked in eating-and-drinking places.

Of the 90 motor vehicle-related fatalities, 32 (36 per cent) occurred to occupants of automobiles (unless otherwise stated on the death certificate, a worker was assumed to be an occupant of the vehicle described). Sixteen (18 per cent) additional women were pedestrians; 11 (12 per cent) were occupants of trucks; one (1 per cent) fell from a truck; and another (1 per cent) died when the school bus that she was driving crashed. In 29 women's deaths (32 per cent) the types of motor vehicles involved were not described.

An approximate interval from injury to death could be determined for 341 women. Two hundred eighty-four (83 per cent) of these women died within 24 hours of the time of injury.

In 134 homicides, the work shift in which the injury occurred could be determined. Fifty-one (38 per cent) occurred between 8 am and 4 pm, and 64 (48 per cent) occurred between 4 pm and midnight. Of the 83 motor vehicle-related injuries for which the work shift could be determined, 42 (51 per cent) occurred between 8 am and 4 pm, and 23 (28 per cent) occurred between 4 pm and midnight. The injury

TABLE 2—Leading Causes and Rates of Fatal Injuries for the Occupations with Above-average Risk, Females, 16 Years Old or Older, Texas, 1975–84

Occupation	No. Fatal Injuries	1980 Texas Population at Risk	Fatal Injury Rate/ 100,000/Year	Leading Cause of Fatal Injury: External Cause of Death	Leading Cause of Fatal Injury: No. Deaths	Workplace Homicide Rate/ 100,000/Year
Heavy-truck drivers	19	3.458	54.9	Motor vehicle incidents	17	NA**
Stock handlers and baggers	18	8,135	22.1	Homicides	16	19.7
Food counter and fountain workers	13	8,421	15.4	Homicides	13	15.4
Supervisors and proprietors, sales	31	35,820	8.7	Homicides	22	6.1
Laborers, except construction	10	12,619	7.9	Homicides	3	2.4
Managers and administrators	33	84,432	3.9	Homicides	25	3.0
Sales workers, other commodities	11	73,800	1.5	Homicides	8	1.1
All occupations	348	2,606,295	1.3	Homicides	185	0.7

*Only occupations with 10 or more deaths are included. Occuption was not codable for nine cases.
**NA: not applicable.

TABLE 3—Rates of Fatal Occupational Injuries, by Industry and Age, Females, 16 Years Old and Older, Texas, 1975–84

Age Group (years)	No. Fatal Injuries	1980 Texas Population at Risk	Fatal Injury Rate/ 100,000/Year
Retail trade industry			
16–19	7	98,756	0.7
20–44	78	293,247	2.7
45–64	37	124,299	3.0
≥65	11	19,425	5.7
All ages	133	535,727	2.5
Non-retail trade industry			
16–19	7	109,809	0.6
20–44	129	1,392,896	0.9
45–64	63	507,822	1.2
≥65	16	60,041	2.7
All ages	215	2,070,568	1.0

occurred Monday through Friday in 144 (80 per cent) of 179 homicides for whom such a determination could be made and in 73 (81 per cent) of 90 motor vehicle-related injuries. Thirty-six (40 per cent) motor vehicle-related injuries occurred June through August. No seasonal pattern was apparent for homicides.

After stratifying data by employment in retail trade (Table 3), we found a trend toward higher rates of fatal injuries with increasing age. Workplace homicides accounted for 12 (44 per cent) of the 27 deaths of women ≥65 years old; this older age group had a workplace homicide rate 2.2 (95 per cent confidence interval [CI]: 1.2–3.9) times higher than that of women <65 years old (1.5 vs 0.7 workplace homicides/100,000 female workers/year). In retail trade, women ≥65 years old had a workplace homicide rate 1.9 (CI: 0.9–4.1) times higher than that of women <65 years old (3.6 vs 1.9 workplace homicides/100,000 female workers/year).

Minimal differences were found in the rates by race and by Spanish origin for all fatal occupational injuries, those injuries due to homicide, and those from motor vehicles. The workplace homicide rate for women in Standard Metropolitan Statistical Areas (SMSAs) differed minimally from the rate for women outside of SMSAs.

For the deaths that occurred in Harris, Dallas, Tarrant, Bexar, or Travis Counties and that met the case definition, medical examiners' records were available for review for 86 of the 89 homicides and 49 of the 59 other deaths. For the homicides, a review of these records indicated that 85 (99 per cent) injuries had occurred in the workplace and that one (1 per cent) injury had not. For the other deaths, the review indicated that 40 (82 per cent) injuries had occurred in the workplace; for five (10 per cent) deaths, insufficient information was available to make such a determination; and for four (8 per cent) deaths, the review indicated the injury had not occurred in the workplace. Only fatal injuries that were confirmed as having occurred in the workplace were included in the analyses that follow.

Of the 85 confirmed workplace homicides, 40 (47 per cent) occurred during robberies, six (7 per cent) during arguments between victims and customers, 18 (21 per cent) under other known circumstances, and 21 (25 per cent) under unknown circumstances. The offenders were either of unknown relationships or strangers to the victims in 60 (71 per cent) homicides; spouses or other intimate acquaintances in 14 (16 per cent) homicides; customers in seven (8 per cent) homicides; and co-workers in four (5 per cent) homicides.

Injuries from firearms caused 69 (81 per cent) of the confirmed workplace homicides. For 41 firearm-related deaths, the type of weapon used could be determined; injuries from handguns caused 38 (93 per cent) of these homicides, and injuries from shotguns caused three (7 per cent) of them.

For the 98 confirmed fatal occupational injuries in which the interval from injury to death was ≤4 hours, blood or cerebrospinal fluid levels were available for 75 of the 76 workplace homicides and 20 of the 22 other deaths. Of the homicide victims, seven (9 per cent) had blood or cerebrospinal fluid alcohol levels between 0.01 and 0.09 g/dl, and four (5 per cent) had levels ≥0.10 g/dl; the latter four women worked in eating-and-drinking places. Of the women whose deaths were not homicides, two (10 per cent) had blood or cerebrospinal fluid alcohol levels between 0.01 and 0.09 g/dl.

Discussion

Deaths of civilian females were included in this study only when the question "injury at work?" was answered "yes" on the death certificate. Because of this restriction and because persons who completed death certificates might not have been aware that injuries occurred at work, the study probably underestimates the number of fatal occupational injuries of Texas women. A review of Wisconsin death certificates and workers' compensation records found that death certificates identified 76 per cent of the fatal occupational injury cases.[12] Using several sources, including death certificates, Baker, *et al,* reviewed occupational injury deaths in Maryland[2]; except for medical examiners' records, no source identified more than 67 per cent of the cases. The sensitivity of death certificates might vary with the nature of the fatal occupational injury. In the Wisconsin study, for example, death certificates identified 61 per cent of the motor vehicle-related deaths but 85 per cent of other occupational injury-related deaths.

Studies of the data on occupation and industry listed on death certificates have shown the accuracy of the industry data to be 67–70 per cent and of the occupation data to be 64–68 per cent.[13,14] The accuracy of such data on women was lower than that on men; these differences occurred because women who had worked outside the home were at times misclassified on their death certificates as housewives. If women listed on the death certificates as housewives are excluded, the differences in the accuracy of the data on men and women are eliminated. Because the deaths in the present study were due to factors in the workplace and the interval from injury to death was less than 24 hours in 83 per cent of

cases, the accuracy of the non-housewife occupation and industry data might be especially high.

Homicide accounted for more than half the fatal occupational injuries of Texas women identified in this study. Nationwide, homicide claims the lives of an estimated 800 to 1,400 workers each year and, among Texas males, it ranks as the third leading cause of fatal occupational injuries.[3,15] The use of firearms in 70 per cent of the homicides in this study reflects the importance of these weapons in homicide in general and highlights the toll that firearms are taking on Americans, including American workers.[16,17]

Women 65 years old or older had the highest workplace homicide rate, 2.2 times the rate for women under age 65. This higher rate of workplace homicide for older women workers is probably not due to under-enumeration in the census of employed women ≥65 years old. The 1980 census estimate for employed Texas women ≥65 years old was based on a survey of 19 per cent of all housing units, with 95 per cent of the data obtained by a mailout/mailback procedure.[18] An estimate from the 1980 Current Population Surveys, based on monthly interviews with persons from approximately 60,000 households nationwide, was 6 per cent lower than the census estimate.* A possible explanation for the older women's increased risk of workplace homicide is that perpetrators of violent crimes might have viewed them as being especially vulnerable targets. In addition, older women might have been less likely than younger women to survive their injuries.

Texas women have a lower workplace homicide rate than Texas men (0.7/100,000 female workers/year vs 2.1/100,000 male workers/year).[8] Workplace homicide rates are lower for women than men in food-bakery-and-dairy stores (3.6/100,000 female workers/year vs 11.9/100,000 male workers/year) and eating-and-drinking places (2.6/100,000 female workers/year vs 7.0/100,000 male workers/year), but are similar for women and men in gasoline service stations (13.3/100,000 female workers/year vs 14.2/100,000 male workers/year). The disparities noted might result in part from larger proportions of male workers being employed in neighborhoods, during workshifts, or in types of stores (convenience stores vs supermarkets) that have higher workplace homicide rates.

This study indicates the current high risk to persons whose work involves the exchange of money in public, unsecured places. Efficient prevention of workplace homicides requires that research and intervention be targeted to these high-risk settings. A study in convenience stores has demonstrated that the number of robberies can be reduced by making the cash register area more visible from the street; keeping as little money as possible in the cash register and making that fact known; the use of a drop safe into which, at night, all bills of value greater than $1 are placed; greeting each person who comes into the store; and keeping the store clean.[19] Because many workplace homicides occur during robberies, a reduction in the number of workplace homicides might accompany effective programs of robbery deterrence.

The importance of motor vehicles as a cause of fatal occupational injuries is confirmed by this study. The prominent role that heavy trucks have in causing fatal occupational injuries[2,3] is reflected in the present study by the high rate of fatal injuries of Texas women who are heavy-truck drivers. The large number of American workers killed in motor vehicles[3,15] suggests the need for means to ensure the use of seat belts in company-owned vehicles. Regulations requiring workers who drive to use seat belts might be considered analogous to existing regulations requiring workers in other high-risk settings to use designated safety devices.

In summary, this study indicates that most fatal occupational injuries of Texas women are homicides or motor vehicle-related. In particular, gasoline service stations, food-bakery-and-dairy stores, eating-and-drinking places, and heavy trucks appear to pose the greatest threat of fatal injury to women workers. Effective strategies to prevent these deaths need to address the problems of workplace violence and the hazards posed by motor vehicles.

*US Department of Labor, Bureau of Labor Statistics, Unpublished data.

ACKNOWLEDGMENTS

We wish to thank Charles E. Alexander, MD, DrPH, for guidance and support; Leland N. Carmichael, William E. Barrington, MPH, and William D. Carroll, MPH, for providing vital statistics services; Angela Caban for assistance in data gathering and entry; Mary Jo Preece for assistance in data coding; the staffs of the medical examiners' offices of Bexar, Dallas, Harris, Tarrant, and Travis Counties for assistance in reviewing records; and the staffs of the Texas Department of Health and the Centers for Disease Control who read and commented on the manuscript.

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