

Fatal Occupational Injury Rates: Quebec, 1981 through 1988

ABSTRACT

Objectives. The purpose of the study was to estimate the death rates from occupational injuries in the province of Quebec for the period 1981 through 1988.

Methods. Worker's compensation files were used to ascertain numbers of deaths, which were used as the numerators in figuring the rates (it was estimated that these files reported 83% of the true number of deaths among men). Annual average estimates of the labor force were used as denominators.

Results. From 1981 through 1988, compensation was awarded for 1227 fatal work injuries. Among men (96% of the victims), rates declined from 1981 to 1988 (from 12.7 to 8.1 per 100 000); women's rates were stable (≤ 1.0 per 100 000). Compared with men, women had excess mortality from violent acts. Motor vehicle crashes accounted for 36% of all fatal injuries in 1984 and 1985 and declined thereafter. Fatal injury rates in forestry and mining rose to a 1987 maximum of 67.6 per 100 000. The construction sector had the largest number of deaths, despite a decline in rates from 1981 to 1988 (from 27.8 to 15.9 per 100 000).

Conclusions. Except for construction and agriculture, reported fatal occupational injury rates in Quebec were similar to those in the United States. Motor vehicle crashes, falls, violent acts, and farming-related injuries were the most frequent causes of death. (*Am J Public Health.* 1993;83:1563-1566)

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Introduction

Comparison of fatal occupational injury rates is difficult, largely because of differences in definitions and methods for estimating the numerators and denominators of these rates. The discrepancies between some of the rates reported for the United States suggest that case ascertainment remains an important limitation in our understanding of fatal occupational injuries. The National Safety Council, the Bureau of Labor Statistics, Bell et al., and Baker et al. reported, respectively, annual crude rates of 13, 7, and 9.1 (1980) and 7 (1978) per 100 000.¹⁻⁴

The objective of this study was to estimate the death rates from occupational injuries in the Province of Quebec for the period 1981 through 1988 by sex, age, and industrial sector.

Methods

Numerators

In Quebec, any person who hires another to do a job for a salary or other form of benefit must register with the Quebec Worker's Compensation Board to insure the employee in case of occupational injury or disease. Most employees in Quebec, with the exception of employees under federal administration, military personnel, and most of the self-employed, are covered under this scheme. For use as the numerator of death rates in this study, we counted all cases in which compensation was paid to the relatives of a worker, aged 15 years or older, who died from unintentional or intentional injuries (except suicide) sustained while working or at the work site from January 1, 1981, through December 31, 1988.

Reporting to the Quebec Worker's Compensation Board protects the em-

ployer against lawsuits in the compensation system. Fatal injuries were determined by the Board to be occupational if the victim was pursuing a gainful activity at the time of the event or the injuries were inflicted on the employer's premises (including parking lots). Deaths from occupational diseases and exertional heart attacks, which are sometimes coded as occupational injuries by the Board, were excluded from this study.

Denominators

The annual average labor force estimates of Statistics Canada for Quebec, 1981 through 1988, were used as denominators.⁵ These averages were based on monthly interview surveys of families randomly selected to be representative of the population of Quebec (response rates over 95%). Excluded from these estimates were persons younger than 15 years of age, full-time military personnel, most inhabitants of Indian reserves, and institutionalized persons. Statistics Canada provided estimates of the sampling error in the form of standard deviations for the number of employed persons by age, sex, and industrial sector. In this study, we used data on industrial sector only for 1984 and following years, because the classification system used before 1984 was not compatible with the current one.

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TABLE 1—Compensated Fatal Occupational Injury Rates for Men, by Age, Quebec, 1981 through 1988

Age Category	Compensation Coverage, % ^b	Average Annual Rate per 100 000	n	95% Confidence Interval ^a
<20 y	81	6.6	52	4.9, 8.8
20–24 y	82	8.3	131	7.0, 9.9
25–34 y	93	8.7	329	7.8, 9.7
35–44 y	91	8.7	274	7.7, 9.8
45–54 y	78	10.0	221	8.7, 11.5
55+ y	66	11.4	173	8.9, 14.6
Total		9.1	1180	8.4, 9.8

Note. In calculating these rates, the numerator was taken from Quebec Worker's Compensation Board figures; the denominator was from Statistics Canada annual averages of the employed population.

^aConfidence intervals are based on the Poisson distribution and take into account the sampling error for the denominators.

^bCompensation coverages reported elsewhere.⁸

TABLE 2—Compensated Fatal Occupational Injury Rates for Men, by Industrial Sector, Quebec, 1984 through 1988

Sector (Compensation Coverage) ^a	Rate per 100 000 (n)				
	1984	1985	1986	1987	1988
Primary ^b (92%)	17.4 (8)	29.3 (12)	50.0 (20)	67.6 (25)	52.8 (19)
Construction (90%)	27.8 (30)	21.5 (23)	17.9 (22)	13.4 (19)	15.9 (25)
Transportation, communication, and utilities ^c (77%)	12.5 (20)	13.5 (23)	13.6 (22)	14.5 (25)	13.1 (23)
Public administration ^d (96%)	16.0 (20)	15.0 (18)	15.7 (19)	12.2 (16)	7.7 (9)
Agriculture (46%)	9.4 (5)	5.0 (3)	10.9 (6)	13.2 (7)	6.3 (3)
Wholesale and retail (86%)	5.3 (15)	5.5 (16)	5.8 (18)	6.3 (19)	5.3 (16)
Manufacturing (95%)	4.0 (16)	5.2 (20)	3.6 (14)	3.3 (13)	5.1 (22)
Finance, insurance (undetermined)	9.5 (6)	3.1 (2)	7.8 (5)	0.0 (0)	0.0 (0)
Services (98%)	2.5 (9)	4.2 (16)	2.4 (9)	4.8 (18)	5.3 (21)
Missing	1	1	3	1	1

Note. In calculating these rates, the numerator was taken from Quebec Worker's Compensation Board figures; the denominator was taken from Statistics Canada annual averages of the employed population.

The Canadian classification of industrial sectors based on the 1981 revision was first used in 1984.

^aCompensation coverages reported elsewhere.⁸

^bPrimary sector other than agriculture: fishing, forestry, and mining.

^cUtilities include gas and electricity.

^dProvincial and municipal, including protection and police services.

among men (96% of the total) declined from 1981 (12.7 per 100 000; 95% confidence interval [CI] = 11.1, 14.6) to 1984 (8.2 per 100 000; 95% CI = 6.9, 9.8) and remained stable thereafter. Because compensated cases represented roughly 83% of the true number of deaths among men, the rates would actually be closer to 15.3 (1981) and 9.9 (1984) per 100 000.⁸ Among women, rates ranged from 0.2 to 0.8 per 100 000; 53% of the fatal injuries were related to motor vehicle crashes. Although they represented only 4% (n = 47) of all fatal injuries, women were victims of 14% of the fatal violent acts that occurred during the period studied.

Motor vehicle crashes accounted for 25% (n = 54) of all occupational injury deaths in 1981, increasing to 36% in 1984 (n = 49) and 1985 (n = 52) and dropping thereafter to a low of 21% (n = 30) in 1988. Two causes of fatal injuries showed regular increases in proportion between 1981 and 1988: falls to a lower level (an increase from 8% to 15%) and electrocutions (an increase from 4% to 6%) (chi-square; p < 0.01).

Fatal occupational injury rates increased with age, reaching 11.4 per 100 000 in the group aged 55 years and older (Table 1). The lower compensation coverage in that age group (66%) would bring the rate to 17.3 per 100 000. It was also these workers who showed the most dramatic drop (53%) in rates between 1981 (15.6 per 100 000) and 1988 (7.4 per 100 000). Fatal injuries in the older age group were associated in higher proportions with "being struck by" objects (27%) and with falls (17%). The 35-through 44-year-olds had the highest proportion of motor vehicle crash-related fatalities (38%). In terms of years of productive life lost, the 25- through 34-year-old age group came first, with a total of 11 337, followed by the 35- through 44-year-old group (6847) and the group aged 20 through 24 years (5481).

The only industrial sector that showed a regular increase in fatal injury rates, and also the one with the highest rates, was the primary sector (fishing, mining, and forestry) (Table 2). The rates in this sector peaked in 1987 at 67.6 per 100 000, nearly a fourfold increase over 1984 rates. This increase was explained by an increase in fatal injuries in the forestry industry, in which the number of deaths rose from 8 in 1984 to 25 in 1987 and 19 in 1988.

The construction sector, on the other hand, showed a steady 43% decrease between the years 1984 and 1988. It had the

Statistical Analysis

Death rates were computed for each year from 1981 through 1988 by age and sex, and from 1984 through 1988 by industrial sector. Age and sex standardization of the rates was performed with the 1981 population structure as the reference.⁶ The adjusted rates were almost identical to the crude rates; therefore, the unadjusted rates are presented throughout this report. Years of potential life lost were computed for each death by calculating the difference between the age at death and 65.⁷

Measure of Error

Confidence intervals (95%) were computed for each rate, based on the Poisson distribution and taking into account the sampling error of the denominator pro-

vided by Statistics Canada.⁵ To account in part for the exclusion of the self-employed from the compensation system data (numerator), compensation coverages had been previously calculated by age, sex, and industrial sector from a combination of compensation files and coroner's death certificates for the years 1987 and 1988.⁸ It was estimated that the compensation coverage of fatal occupational injuries was 83% for men and 100% for women. Compensation coverages are reported throughout this paper for greater accuracy in interpreting the rates.

Results

From 1981 through 1988, the Board compensated 1227 fatal injuries. Rates

highest number of deaths (119, or 18% of the total from 1984 through 1988) and the largest proportions of deaths from falls (30%) and electrocutions (10%). Transportation, communications, and public utilities were second for number of deaths (113 deaths, or 17% of the total from 1984 through 1988), almost half of which (46%) were related to motor vehicle crashes. Considering the low compensation coverage in this sector (77%), this sector would account for the largest number of deaths, and rates would be closer to 16.2 (1984) and 18.8 (1987) per 100 000.

Agricultural death rates were low, but because of the low compensation coverage (46%), the true rates would be twice those shown in Table 2.

Discussion

Information on cases of occupational fatal injuries is often incomplete in the United States, where differences of up to 300% have been found in rates reported by different sources of information.⁹ Death certificates have been the information source of choice because more deaths could be identified from death certificates than from surveys or inspection reports.¹⁰ The Quebec Worker's Compensation Board information system on fatal occupational injuries was found to provide more accurate information than death certificates in Quebec except for older workers and those in transportation and agriculture, where compensation coverages were found to be low.⁸

The specification of sex when reporting fatal occupational injury rates is a point that deserves special attention. Because men accounted for 96% of all fatal injuries but for only 60% of the work force in Quebec, the rates for both sexes combined underestimate the real situation for men almost by half. For example, our men's rate for the year 1988 was 8.1 per 100 000, but the rate for both sexes combined was only 4.8 per 100 000. The National Safety Council's work-related accidental death rates did not mention sex, so it is assumed that both sexes were combined in the Council's estimations by year and industry.¹ For any comparison with these rates to be fair, one must multiply the denominator of the rate by the proportion of men in the working population. If the proportion of men in the US work force is 60%, as it is in Quebec, the 1988 death rate for men in the United States would be not 9 per 100 000, the rate reported by the National Security Council, but 15 per 100 000, which is al-

most twice as high as the rate of 8.1 we found for men in Quebec.

In two different studies, homicides accounted for 53%¹¹ and 39%³ of women's fatal occupational injuries. These proportions are difficult to compare with ours (17%) because our data included only 47 deaths among women. Nevertheless, there is enough consistency to justify specific prevention programs aimed at protecting women who are in direct contact with the public.

In the 8 years prior to 1981, a 35% decrease in death rates from occupational injuries was reported for Quebec.¹² The secular downward evolution could be partially explained by the gradual introduction of safer working conditions and practices. However, this pattern was not sustained through the 1980s with rates that remained stable after 1983. After 1983, for instance, the 50% reduction in fatal injury rates in the construction sector was counterbalanced by a threefold increase in the primary sector. The large contribution of forestry to this increase was similar to what was reported in British Columbia.¹³

The rising proportion of motor vehicle crashes as occupational fatalities is a concern that Baker et al.⁴ pointed out more than 10 years ago when they urged the need for preventive measures addressed to professional drivers. Little has been achieved in Quebec to improve the situation. The rate of truck crashes (of trucks weighing more than 4.5 metric tons) causing any type of injuries increased from 18.0 per 1000 vehicles in 1982 to 22.8 in 1986, and for each death of a truck occupant, 4.6 additional deaths occurred among nonoccupants.¹⁴ The increasing weight and length and number of trailers pulled have been implicated as factors influencing crash involvement.¹⁵ Three sectors accounted for 62% of all fatal motor vehicle crashes: transportation, wholesale and retail, and services. Energetic action must be taken to address this No. 1 occupational cause of death.

Another important finding was the higher fatal injury rates among workers aged 55 and older. The pattern was more pronounced than that reported by Baker et al.⁴ Falls caused more deaths among these workers than in any other age group, and the proportion of deaths due to falls increased between the years 1981 and 1988. Factors that influence older persons' stability and balance, including antihypertensive and antihypoglycemic drugs, could be of importance in the workplace. Such a hypothesis deserves further attention.

Between 1981 and 1988, 19 fatal injuries were compensated in the farming sector. The compensation coverage rate of only 15% would bring the actual number of deaths to around 146, second only to motor transport operation (for which there were 202 compensated, or 264 estimated, deaths). Our rates for agriculture cannot be compared directly with those reported in the United States, where fishing and forestry are included in the agricultural sector. In addition, gross errors in estimating the number of deaths in agriculture have been reported.^{16,17}

In Quebec, as in the United States, half of the fatal injuries in farming were related to farm tractors.^{4,15} Goodman et al. estimated the annual tractor-related fatality rate for males to be 23.6 per 100 000 male farm residents in the state of Georgia for the years 1971 through 1981.¹⁸ This figure is almost as high as our highest estimation of the death rate in the agricultural sector (28.7 per 100 000). The application of rollover protection structures in farm tractors has been examined by Kelsey et al.¹⁹ and Karlson et al.²⁰ This hazard has remained largely unrecognized in Quebec because of an insufficiency of data outside the compensation statistics. The public health authorities must be alerted to the seriousness of the situation so that they can formulate new priorities for the agricultural sector. □

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