A job to die for

Katherine Marshall

In 1992, Canadians were stunned when 26 miners were buried alive in the Westray Mine in Nova Scotia. Accidental death related to work happens to relatively few Canadians, but commands attention because it happens unexpectedly to otherwise healthy people. In addition to accidents, death can result from illness caused by exposure to environmental hazards in the workplace.

Work-related death also stands out because of its large financial and personal cost. Apart from its effect on family and friends, a death at work can reduce productivity because of temporary shutdowns, loss of morale and the training of replacement workers.

This article traces job-related deaths over three 6-year periods (1976 to 1981, 1982 to 1987 and 1988 to 1993), and examines differences in fatality counts and rates by industry, region, occupation, age, sex, and cause of death. It concludes with data on the financial cost associated with these deaths (see *Data sources and limitations* and *Definitions*).

Many deaths occur in manufacturing

From 1976 to 1993, almost 17,000 Canadians were fatally injured in the course of, or as a result of, their employment (Table 1)[1] – an average of more than two deaths a day. Four industries – manufacturing; construction; transportation and storage; and mining, quarrying and oil wells – accounted for 63% of all fatalities (over 10,000 deaths). In each of the three periods examined, the highest number of work-related deaths were traced to manufacturing (one in 6); but, as in many other industries, fatality counts have dropped over time.

From 1988 to 1993 (the most recent period examined), 863 people died while working in manufacturing or as a result of having once been employed there.

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Data sources and limitations

Fatality data are supplied to Human Resources Development Canada by provincial Workers' Compensation Boards and Commissions (WC); data on the number of paid workers (used in the calculation of rates) originate from Statistics Canada's Labour Force Survey (LFS). (Statistics Canada received detailed fatal work injury data from WC for 1993 and 1994.) Fatalities are reported for workers aged 14 and over, while paid worker data from the LFS cover only those persons aged 15 and over. This discrepancy is negligible as work-related fatalities among 14 year-olds are extremely rare.

The fatal work injury counts are a census of all reported* WC cases and are therefore not affected by sampling variability errors. However, the data concern only workers covered by WC, mainly paid workers. Since 1995, the Workers' Compensation Acts in Canada provide compulsory coverage for most workers in most industries, ranging from 70% to 100% depending on the jurisdiction (AWCBC, 1995). Persons most likely not covered by WC are the self-employed, unpaid family workers and workers in professional offices, although all may, and some do, apply for coverage. Therefore, WC fatality counts are in fact an under-representation of the total number of work fatalities in Canada. In particular, work deaths prior to 1995 may be seriously under-counted in the agriculture industry, where WC coverage has been traditionally excluded. However, the trend to expand compulsory coverage now includes workers in agriculture, who, since 1995, have had compulsory coverage in most jurisdictions.

Newfoundland and New Brunswick have not provided fatality reports since 1991, nor has Quebec since 1992. These missing counts are not likely to affect the results of this paper since the analysis centres on fatality rates, and adjustments were made to compensate for the excluded data; that is, when 1992 and 1993 national and regional fatality rates were calculated, paid worker counts for Newfoundland and New Brunswick were excluded from the denominator to match the missing counts in the numerator. (Similar exclusions were made in 1993 to adjust for missing Quebec data.)

The recording of fatalities is not uniform across Canada: Quebec reports by year of compensation; Ontario by year of death; and all other provinces by year of accident. Fatalities caused by exposure are the most likely to be affected by these variations, because some exposure deaths are gradual and will therefore have different accident and death dates. For example, if a person died of asbestos poisoning in 1992 but compensation was awarded in 1993, Ontario would report the fatality in 1992, Quebec in 1993 and the remaining provinces in the year (estimated) the poisoning began. However, the estimated number of exposure cases with dates that fall outside the study periods are sufficiently small as not to affect national results.

Finally, the data were aggregated over three 6-year periods (1976-1981, 1982-1987, 1988-1993) because of the limited number of observations available in any one year.

* Nationally, over 90% of reported cases are accepted for compensation by Workers' Compensation Boards and Commissions. The remaining cases may not be compensated for a number of reasons; for example, the job is not covered by the legislation, or the illness is not covered or deemed work-related.

Definitions

Work-related fatality: Any fatal injury, disease or illness resulting from a work-related incident that has been accepted for compensation by a Workers' Compensation Board or Commission. An accepted case means the death was connected with, or directly related to, the performance of the worker's current or past job.

A death may occur at a worker's usual place of work (for example, a mine) or anywhere else duties are performed (an outdoor hydro line for instance). The death may be instantaneous (caused by a fall, for example) or may happen much later (years after exposure to carcinogens at work).

Fatality rate: Although a fatality count is important, a more telling indicator of risk is the fatality rate, which expresses the number of work-related deaths per 100,000 paid workers. More specifically, the rate represents the number of people in a particular group (for example, an industry, occupation or age range) who died from a fatal injury, disease or illness resulting from their employment, in a specific period, divided by the sum of the annual average paid worker counts for that group during that period. (In some provinces, the year of accident or claim acceptance determines the time frame assigned. See *Data sources and limitations*.) As an example, the national fatality rate in the construction industry from 1988 to 1993 is calculated as follows:

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

where

N = the total number of work-related fatalities in construction from 1988 to 1993 (from WC Boards and Commissions)

W = the sum of the annual average counts of paid workers in construction from 1988 to 1993 (from the LFS).

The ratio is multiplied by 100,000, which allows the rate to be expressed in whole numbers, and thus represents the number of deaths per 100,000 paid workers.

An employment-based fatality rate, such as the one used in this paper, measures the fatality risk for those employed at the time the LFS was carried out. However, the annual average number of paid workers does not reflect the movement of workers in and out of the workforce, nor does it account for the volume of work performed (for example, part-time or part-year employment), which may differ for various groups. A number of factors may affect fatality rates: worker experience, number of hours worked, physical and other demands of the job, occupational environment, condition of equipment, human error, legislation, and presence and effectiveness of health and safety regulations.

Table 1
Fatalities and fatality rates by industry, 1976 to 1993

	Fatalities				Fatality rates *			
	1976-93	1976-81	1982-87	1988-93 **	1976-93	1976-81	1982-87	1988-93 **
All industries	**16,668**	**6,260**	**5,437**	**4,971**	**9**	**11**	**9**	**7**
Agriculture †	295	84	113	98	10	9	11	10
Fishing and trapping	363	120	128	115	145	182	155	113
Logging and forestry	1,022	405	338	279	90	97	89	82
Mining, quarrying and oil wells	2,228	836	748	644	70	79	69	63
Manufacturing	2,942	1,094	985	863	8	9	8	8
Construction	2,750	1,047	874	829	27	32	28	23
Transportation and storage	2,520	1,092	744	684	29	36	26	25
Communication and other utilities	343	128	112	103	5	6	5	4
Wholesale trade	891	317	339	235	10	11	11	7
Retail trade	395	158	127	110	2	2	2	1
Finance, insurance and real estate	132	47	41	44	1	1	1	1
Government services	986	356	360	270	7	8	7	5
Other services ††	1,404	448	408	548	2	3	2	2
Industry not stated	397	128	120	149	..	..	..	..

Sources: Workers' Compensation Boards and Commissions, and Labour Force Survey

* *Work-related deaths per 100,000 paid workers (see* Definitions*).*

** *Fatality counts are missing for Newfoundland and New Brunswick in 1992 and 1993, and for Quebec in 1993; paid worker counts for these provinces and years were excluded from the denominators in fatality-rate calculations.*

† *Agricultural workers have traditionally been excluded from Workers' Compensation coverage, so the fatality counts and rates shown are an under-representation (see* Data sources and limitations*).*

†† *Includes business services; educational services; health and social services; accommodation, food and beverage services; and other services, such as amusement and recreational services, personal and household services, and membership organizations.*

However, because of this industry's high number of paid workers,[2] its fatality rate was relatively low (8 per 100,000). In contrast, many other industries were responsible for fewer deaths but had much higher fatality rates, because of their relatively small workforces.

Although fatality rates have been falling ...

Over the 18 years covered by this study, there was a substantial reduction in the national fatality rate: from 11 per 100,000 paid workers in the 1976 to 1981 period, to 7 per 100,000 between 1988 and 1993 (Table 1). In industries with initially low fatality rates, figures remained relatively unchanged over the three periods; in industries with high rates between 1976 and 1981, death rates steadily decreased. For example, the fishing and trapping industry fatality rate improved from 182 in the first period to 113 in the last.

jobs in primary industries are still risky ...

But in spite of these gains, fatality rates remained high in most primary industries: fishing and trapping (as mentioned above); logging and forestry (82 per 100,000 paid workers between 1988 and 1993); and mining, quarrying and oil wells (63). The relatively low fatality counts and rates for agriculture are an under-representation because until recently this industry has been excluded from compulsory Workers' Compensation coverage (see *Data sources and limitations*). American and regional Canadian studies indicate that agricultural work is in fact riskier than average.[3]

Work in the primary industries usually requires physical exertion and dexterity; in addition, many employees must work outside in all kinds of weather, as well as in rugged terrain, on water or underground. To these difficulties are added the dangers of handling hazardous materials or heavy machinery. Such work inevitably places people at greater risk of injury or death.

while rates in most service industries have always been low

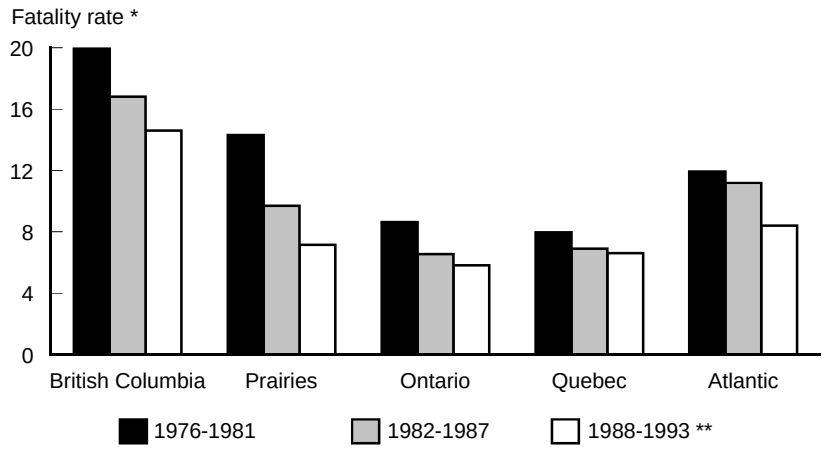
The safest industries are in the service sector.[4] With one exception, fatality rates were below 12 per 100,000 paid workers in all three periods studied. For example, in retail trade and in finance, insurance and real estate, the death rates were only one per 100,000 between 1988 and 1993. An exception was the transportation and storage industry, which registered a rate of 25 during this period; nevertheless, this figure was an improvement over death rates seen in earlier periods. Another study, which looked at absences from work due to illness or disability, also found that the service sector, particularly trade and the finance, insurance and real estate industries, had lower-than-average absence rates (Akyeampong, 1995).

Rates vary by region

The most recent six-year period (1988 to 1993) shows that British Columbia had the highest death rate at 15 per 100,000 paid workers, followed by the Atlantic provinces with 8, the Prairies and Quebec both with 7, and Ontario with 6. Although all regions saw a steady decline over the study's time frame, the Prairie provinces and British Columbia experienced the most dramatic improvements: from 14 to 7 deaths per 100,000, and from 20 to 15, respectively (Chart).

As previously noted, fatality rates vary by industry, which accounts in part for regional differences. In the 1988 to 1993 period, one in 7 paid workers in British Columbia, as well as in the Prairies and the Atlantic provinces, were employed in fishing and trapping;

Chart
Work-related fatality rates have been falling in all regions.



Sources: Workers' Compensation Boards and Commissions, and Labour Force Survey

* *Work-related deaths per 100,000 paid workers (see* Definitions*).*

** *Fatality counts are missing for Newfoundland and New Brunswick in 1992 and 1993, and for Quebec in 1993; paid worker counts for these provinces and years were excluded from the denominators in fatality-rate calculations.*

logging and forestry; mining, quarrying and oil wells; construction; and transportation and storage – the five most dangerous industries. In comparison, one in 10 employees in both Quebec and Ontario worked in these industries.

Workers in British Columbia were the most likely to be employed in high-risk industries (16% of all paid workers in this province). They also experienced higher-than-average fatality rates in most of them. For example, from 1988 to 1993 the province posted the highest fatality rates of all the regions involved in logging and forestry (131 per 100,000 paid workers, compared with a low of 28 in Ontario), construction (37 compared with 8 in Quebec), and transportation and storage (46 compared with 15 in the Atlantic provinces). British Columbia's rugged terrain probably makes logging, road construction and highway driving more dangerous than in other regions.

Occupations in mining are the most dangerous

In order to determine which occupations are the most dangerous it is important to focus on fatality rates, rather than counts. For example, between 1988 and 1993 a relatively low number of deaths (64) were associated with log hoisting, sorting and moving, but because relatively few people worked in this job, it had a high fatality rate of 116 per 100,000. Similarly, truck driving accounted for 10% (496) of all fatalities (4,971) in the 1988 to 1993 period, but had a death rate of only 38 per 100,000 paid workers, placing it eighth among the 10 occupations with the highest fatality rates (Table 2).

Two occupations had strikingly high fatality rates in this period: mining and quarrying (cutting, handling and loading) and construction (insulating) had rates of 281 and 246 per 100,000 paid workers, respectively.

Table 2
The 10 most dangerous jobs, 1988-1993

	Fatalities	Fatality rates *
All occupations	**4,971**	**7**
Top 10 occupations combined **	1,354	58
Mining and quarrying: cutting, handling, loading	212	281
Construction: insulating	65	246
Mining and quarrying: labouring	56	139
Air pilots, navigators and flight engineers	77	137
Timber cutting	108	123
Log hoisting, sorting and moving	64	116
Net, trap and line fishing	67	110
Truck drivers	496	38
Construction: labouring	122	35
Construction: pipefitting and plumbing	87	31

Sources: Workers' Compensation Boards and Commissions, and Labour Force Survey
* *Work-related deaths per 100,000 paid workers (see* Definitions*).*
** *Based on the 1980 Standard Occupational Classification, coded to the 4-digit level; each occupation listed had at least 50 deaths between 1988 and 1993.*

Fatality rate is highest for older men

Most workers whose deaths were registered in the 1988 to 1993 period were men (96%); this proportion varied little by age group. Presumably, more men than women die from job-related causes because of their over-representation in the higher-risk industries and occupations. Women are more likely to work in the "safer" service industries.

The largest number of work deaths (929) was among people aged 25 to 34, accounting for 19% of all deaths between 1988 and 1993. However, the fatality rate of this age group was low, hovering just above zero for women and reaching 8 per 100,000 paid workers for men (Table 3).

Among women, fatality rates remained below 5 per 100,000 regardless of age. The picture was quite different for men, however. Their rates initially rose slowly with age – from 6 per 100,000 for 15 to 24 year-olds, to 12 for 45 to 54 year-olds, and to 28 for 55 to 64 year-olds – then jumped to 203 per 100,000 for men aged 65 and over. The aging process, which reduces agility, stamina and overall health, is one factor that puts older men at greater risk of injury or death, particularly if workers are in the more physically demanding blue-collar jobs. In addition, many older people, who have long since retired, die from exposure to environmental hazards encountered earlier in their working lives.

Causes of death

One in five work-related fatalities accepted by Workers' Compensation Boards and Commissions for the 1988 to 1993 period were caused by exposure to harmful substances, including poisons, chemicals, allergens, carcinogens and radiation. Almost as many involved transportation vehicles, mostly trucks and cars (65%), but this category also covers aircraft and watercraft. Workers also died from being struck or caught by objects, and from falls, overexertion, fire and explosion, electrocution and violence[5] (Table 4).

The two leading causes of death affect certain age groups differ-

Table 3
Fatalities and fatality rates by age and sex, 1988-1993

	Fatalities *		Fatality rates **	
	Men	Women	Men	Women
Total	**4,788**	**181**	**13**	**1**
15-24 †	371	24	6	-
25-34	888	40	8	-
35-44	800	42	9	1
45-54	733	27	12	1
55-64	898	21	28	1
65+	887	11	203 ††	4
Age not stated	211	16	..	..

Sources: Workers' Compensation Boards and Commissions, and Labour Force Survey
* *Excludes two cases where sex was not reported.*
** *Work-related deaths per 100,000 paid workers (see* Definitions).
† *Fatalities are reported for workers 14 years and over.*
†† *This high rate reflects the large number of retirees who died from earlier exposure to harmful substances.*

ently. Exposure-related death, which can happen gradually, accounted for 55% of all work fatalities among persons aged 65 and over and 13% among persons under 65. In contrast, transportation accidents were the leading cause of death among those under 65 years (26%), but accounted for only 3% of deaths for persons 65 and over.

Fatality costs are deadly

The cost of a fatality, in terms of survivors' benefits, is huge. In 1993, $5.6 billion was awarded for 881,512 injury and fatality claims for all provinces combined. Although fatalities accounted for only 735 (or 0.1%) of these claims, they cost $361 million in benefits (6.4% of the total). As a result, the cost per fatality averaged $492,000; in comparison, the cost per injury averaged $6,000. Beyond the costs assumed by Workers' Compensation, there may have been increased insurance premiums for the employer as well as safety violation fines. Of course, the emotional cost to the victims' families and friends is incalculable.

Summary

From 1988 to 1993 the manufacturing industry experienced the highest number of work-related fatalities among paid workers (863); nevertheless, this industry had one of the lowest death rates (8 per 100,000). At 113 deaths per 100,000, the fishing and trapping industry was the most dangerous in which to be employed. In terms of specific high-risk occupations, miners who cut, handled and loaded material had the highest fatality rate (281 per 100,000). High-risk jobs tend to be held by men, who accounted for 96% of all work-related deaths.

Occupational deaths are tragic and expensive to compensate. The monitoring and surveillance of such fatalities can shed light on the effectiveness of safety policies and programs over time, and help pinpoint work environments that may require further preventive intervention. Certainly, it is encouraging that Canada's fatality rates have progressively improved since the mid-1970s.

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Table 4
Causes of work fatalities, 1988-1993

	Number	%
All fatalities	**4,971**	**100**
Exposure to harmful substance *	982	20
Involving transportation vehicle	933	19
Struck by object	891	18
Fall from elevation	425	9
Bodily exertion and heart attack	311	6
Caught in, on, between object(s)	255	5
Struck against	194	4
Fire and explosion	139	3
Contact with electric current	138	3
Violence	93	2
Fall from same level	78	2
Other **	532	11

Sources: Workers' Compensation Boards and Commissions
* *Half of all exposure-related deaths (497) happened to people aged 65 and over.*
** *Includes past injuries and cases not elsewhere classified.*

Notes

1 The figures in this study are for the provinces only. The Yukon and Northwest Territories are excluded because the Labour Force Survey does not provide their paid worker counts, which are required in the calculation of fatality rates.

2 Between 1988 and 1993, 17% of all paid workers were employed in manufacturing.

3 The 1993 Census of Fatal Occupational Injuries in the United States showed a fatality rate of 34 per 100,000 agricultural workers (Toscano and Windau, 1994), and a Canadian study of fatal farm injuries in Ontario yielded a rate of 56 per 100,000 farms from 1984 to 1992 (Brison and Pickett, 1995).

4 The service sector includes transportation and storage; communication and other utilities; wholesale trade; retail trade; finance, insurance and real estate; government services; and other services.

5 Canadian and American work-related fatality data follow similar patterns, with one exception. In Canada, violence in the workplace has remained stable and rare (2%); in the United States, violence (predominantly shootings) was the second leading cause of death at work in 1993 (following highway fatalities), accounting for 21% of work-related fatalities (Toscano and Windau, 1994).

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