Fatal work-related farm injuries in Canada, 1991–1995

Evidence

Études

William Pickett, PhD; Lisa Hartling, BScPT, MSc; Robert J. Brison, MD, MPH; Judith R. Guernsey, PhD; for the Canadian Agricultural Injury Surveillance Program*

Dr. Pickett, Ms. Hartling and Dr. Brison are with the Departments of Community Health and Epidemiology and of Emergency Medicine, Queen's University, Kingston, Ont. Dr. Guernsey is with the Department of Community Health and Epidemiology, Dalhousie University, Halifax, NS.

**Members of the Canadian Agricultural Injury Surveillance Program are listed at the end of the article.*

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Abstract

Background: Studies from other developed countries have shown that agriculture is among the most dangerous occupational sectors in terms of work-related deaths. The authors describe the occurrence of fatal work-related farm injuries in Canada and compare these rates with those in other Canadian industries.

Methods: The authors present a descriptive, epidemiological analysis of data from the recently established Canadian Agricultural Injury Surveillance Program. The study population comprised Canadians who died from work-related farm injuries between 1991 and 1995. Crude, age-standardized, age-specific and provincial rates of such injuries are presented, as are overall death rates in other Canadian industries. Other factors examined were the people involved, the mechanism of injury, and the place and time of injury.

Results: There were 503 deaths from work-related farm injuries during the study period, for an overall annual rate of 11.6 deaths per 100 000 farm population. Modest excesses in this rate were observed in Ontario, Quebec and the Atlantic provinces. High rates were observed among men of all ages and among elderly people. Among the cases that listed the person involved, farm owner-operators accounted for 60.2% of the people killed. There was no substantial increase or decrease in the annual number of deaths over the 5 years of study. The leading mechanisms of fatal injury included tractor rollovers, blind runovers (person not visible by driver), extra-rider runovers, and entanglements in machinery. Compared with other industries, agriculture appears to be the fourth most dangerous in Canada in terms of fatal injury, behind mining, logging and forestry, and construction.

Interpretation: Canada now has a national registry for the surveillance of fatal farm injuries. Farming clearly is among the most dangerous occupations in Canada in terms of fatal work-related injuries. Secondary analyses of data from this registry suggest priorities for prevention, continued surveillance and in-depth research.

Injuries are an important cause of death and disability among Canadians.[1–3] In the United States they place third behind cardiovascular disease and cancer as a cause of premature death[4] but contribute more in terms of person-years of life lost than these other 2 disease classes combined.[5] With respect to work-related injuries, studies from other developed countries (e.g., the United States,[6] Australia[7] and Finland[8]) have shown that agriculture is among the most dangerous occupational sectors. Although this belief is also widely held in Canada,[9] there have historically been limited data available to support this viewpoint.

The Canadian Agricultural Injury Surveillance Program (CAISP) was established in 1996 as a national initiative. Its mandate is to collect and interpret comprehensive information on Canadian agricultural injuries. Much of the focus of the first 2 years of CAISP was to develop a standard protocol for the identification and description of fatal farm injuries from each province. This has resulted in a national registry that should assist in the development of national priorities for health and safety programs, strategies for the targeting of these initiatives and a tool for program evaluation. Although initiatives for the surveillance of farm injuries existed previously in some provinces,[10–12] the CAISP initiative has improved upon these.

Reports of deaths are now collected, coded and disseminated in a standard manner. There are also advantages in pooling provincial data so that analyses can be based on a greater number of deaths.

Our objectives in performing this analysis were to describe the occurrence of fatal work-related farm injuries in Canada and to compare these rates with those in other Canadian industries.

Methods

We obtained data on fatal unintentional injuries that occurred during work-related activities associated with the operation of a farm, including deaths that occurred at off-farm work locations and those that involved motor vehicles used for farm work. We also included cases in which the person or people were killed by a third person performing farm work. We excluded all cases in which a relation to farm work was not obvious.

A formal data-collection protocol was developed. First, provincial agencies that were known sources of case reports were identified. A list of potentially eligible work-related deaths was compiled from each available source, and these lists were combined into provincial registries. Detailed case reports were sought for review and standardized data abstraction. Sources of information used during these abstractions were coroners' investigation reports, occupational safety and health agency investigation reports, and Royal Canadian Mounted Police and provincial police reports. Data were then sent to the national CAISP office for verification and analysis.

Data were analysed for characteristics of the victims (age, sex, relationship to farm owner-operator), location of injury (province), temporal patterns of injury (year, month, day of week), and the mechanism and circumstances of the injury. Crude and age-standardized rates of death per 100 000 farm population, frequencies and cross tabulations were calculated. All rates of death were calculated using farm-population denominator data from Statistics Canada's *Agricultural Profile of Canada*.[13] Age-standardization was direct,[14] with the entire 1991 Canadian agricultural census population[13] as the standard.

Two groups whose rates of fatal work-related injuries were most comparable with those in other Canadian industries were men 20 years and older, and men and women 20 years and older. The data on work-related deaths between 1993 and 1995 in the other industries, grouped by Standard Industrial Classification code, were obtained from the National Work Injury Statistics Program, which is run by the Association of Workers Compensation Boards of Canada.[15] Rates of death were generated for major industrial categories by dividing the number of deaths by the 1994 estimates of employment for each category provided by Statistics Canada.[16]

Results

A total of 503 fatal work-related farm injuries were identified during the study period. The overall annual rate was 11.6 per 100 000 farm population. Tractors accounted for 47.5% (n = 239) of the deaths, agricultural machinery other than tractors (more than 15 types) for 24.3% (n = 122) and causes not related to machinery for 28.4% (n = 143).

The distribution of deaths by province is provided in Table 1, with provincial distributions of the number of people recorded in the *Agricultural Profile of Canada*.[13]

Table 2 shows the frequency of work-related deaths, by age and sex, in the Canadian farm population, as well as the annual age-specific rates per 100 000 farm population. The male:female ratio of deaths varied by age group, with a low of 2.3:1 among children less than 5 years to a high of 88:1 among people 60–69 years of age. In general the male:female ratio increased with increasing age. The annual age-specific death rate was 7.8 per 100 000 farm population among children less than 5; it was slightly lower than that among older children and youths, and then became progressively higher with increasing age. The highest rates were observed among people 70 and older: 50.8 per 100 000 among those 70–79 and 65.1 per 100 000 among those 80 and older.

For 379 of the 503 deaths the relationship of the victim to a farm owner-operator was reported. In 228 (60.2%) of these cases, the victim was the owner-operator, in 57 (15.0%) it was a child of the owner-operator, in 44 (11.6%) a hired worker, in 31 (8.2%) a relative (e.g., brother or parent) and in 11 (2.9%) the owner-operator's spouse.

The annual number of deaths fluctuated by year, month and day of the week (Fig. 1), and there was no clear indication of an increase or decrease over time. Strong peaks in the occurrence of deaths were observed in the months of July through September, and early in the work week (Monday and Tuesday).

The circumstances surrounding the deaths are described in Table 3. Among children 14 years of age and younger, "blind" runovers (bystander was not in view of the machine operator) and extra-rider runovers (victim fell from machine and was then run over) were the most common circumstances. Among adults, rollovers of all types were most common.

Table 1: Fatal work-related farm injuries in Canada from 1991 to 1995, by province

Province	No. (and %) of deaths		Annual age-standardized rate of death per 100 000 farm population	Total farm population, no. (and %)*	
British Columbia	39	(7.8)	12.4	61 125	(7.0)
Alberta	66	(13.1)	7.5	177 175	(20.4)
Saskatchewan	80	(15.9)	9.7	159 725	(18.4)
Manitoba	48	(9.5)	12.1	79 605	(9.2)
Ontario	152	(30.2)	13.1	226 755	(26.1)
Quebec	90	(17.9)	15.7	128 375	(14.8)
Atlantic provinces	28	(5.6)	15.5	34 470	(4.0)
New Brunswick	10	(2.0)	–†	10 980	(1.3)
Nova Scotia	12	(2.4)	–†	12 770	(1.5)
Prince Edward Island	6	(1.2)	–†	8 675	(1.0)
Newfoundland and Labrador	0		0	2 045	(0.2)
Canada	503	(100.0)	11.6	867 230	(100.0)

*Source: *Agricultural Profile of Canada*.[13]
†Too few deaths to estimate rate.

The following annual rates (per 100 000) of work-related deaths were calculated for major, standard industrial categories in Canada for 1993–1995: mining 71.0, logging and forestry 62.0, construction 31.0, transportation 14.3, manufacturing 8.1, service industry 2.5, trade-commerce 2.2 and finance 0.9. Our analysis of the CAISP data suggests that the most comparable annual rate for agriculture during 1991-95 was between 14.9 per 100 000 and 25.6 per 100 000, which makes agriculture the fourth most dangerous industry in Canada in terms of fatal work-related injuries.

Interpretation

The rates of death from work-related farm injuries were relatively stable in Canada from 1991 to 1995; the number of people who died each year ranged from 91 to 116, and the overall annual rate of death was 11.6 per 100 000 farm population. To compare the rate of death in agriculture with those in other industries, we estimated the rate among people who would likely be farm workers. We believe that the true annual rate lies somewhere in the range of 14.9 to 25.6 deaths per 100 000. In other Canadian industries, work-related fatality rates range from 0.9 to 71.0 per 100 000 population. Based on these rates, agriculture ranks as the fourth most hazardous industry.

Rates of fatal farm injuries reported from other population-based studies ranged from 18.36 per 100 000 in the United States[17] and 19.4 per 100 000 in Australia[18] to 46 per 100 000 in the United States.[19] The differences are due in part to the different methods used to collect data and the different definitions of the population at risk. More recent reports have suggested that these numbers are declining, and the rates observed in our study may reflect the same trends observed in other countries, such as those reported by Myers and Hard.[20] Data from the US Bureau of Labor Statistics indicate, however, that the 1996 fatality rate among people employed in agricultural production and services was 19.2

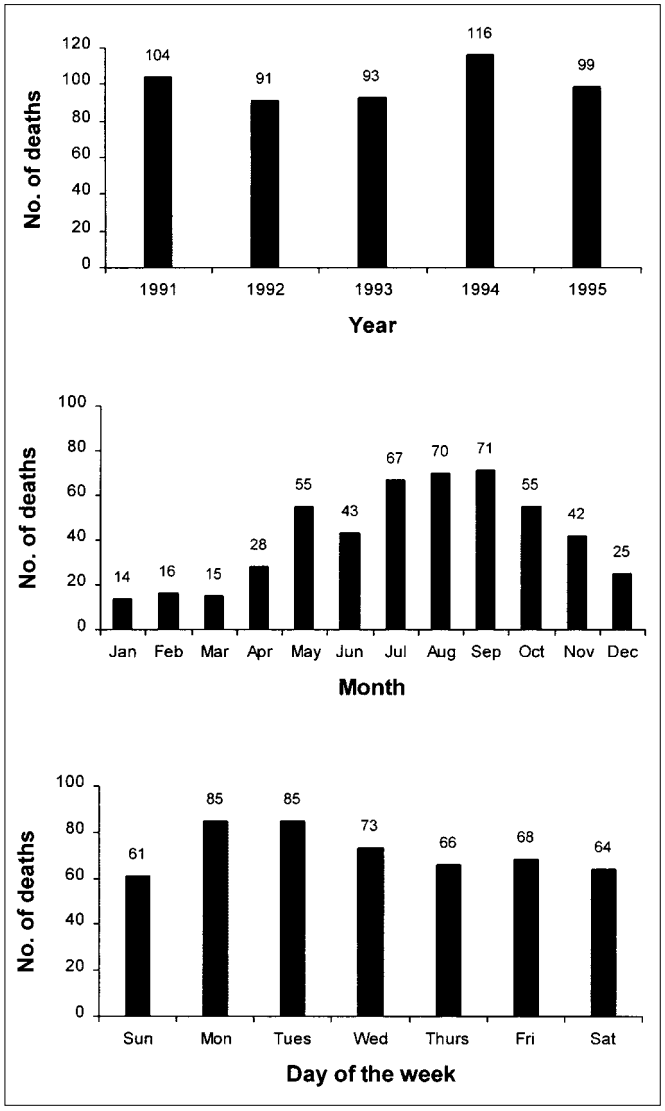

Fig. 1: Fatal work-related farm injuries in Canada from 1991 to 1995, by year, month and day of the week.

Table 2: Fatal work-related farm injuries, by sex and age group

Age group, yr	Sex; no. (and %) of deaths				Annual rate of death per 100 000	Total farm population, no. (and %)	
	Female	Male	Total				
< 5	7	16	23	(4.6)	7.8	59 155	(6.8)
5–9	4	13	17	(3.4)	4.6	74 210	(8.6)
10–14	2	8	10	(2.0)	2.5	81 180	(9.4)
15–19	3	21	24	(4.8)	6.1	78 405	(9.0)
20–29	2	41	43	(8.6)	8.9	96 650	(11.1)
30–39	8	56	64	(12.7)	10.1	127 020	(14.6)
40–49	8	62	70	(13.9)	10.9	128 995	(14.9)
50–59	7	61	68	(13.5)	12.4	109 975	(12.7)
60–69	1	88	89	(17.7)	23.2	76 610	(8.8)
70–79	2	69	71	(14.1)	50.8	27 955	(3.2)
≥ 80	1	22	23	(4.6)	65.1	7 065	(0.8)
All	45	457	502*	(100.0)	11.6	867 220	(100.0)

*Age unknown in 1 case.

per 100 000,[21] a rate that falls within the range estimated for agriculture in Canada based on our data.

The agricultural industry is struggling to find optimal yet acceptable approaches to intervention. Traditionally, farmers and their families value the ability to run farms in an independent manner,[23] preferring voluntary safety regulations and educational approaches to enforced legislation by government and outside agencies.[24] The result has been a widespread resistance to the implementation of agricultural health and safety regulations.[24] Although we believe that most farmers are aware of the importance of farm safety as a major public health issue, the work-related deaths chronicled in the CAISP registry suggest that this attitude is not always borne out in farm practice.

The people at highest risk of death from work-related farm injuries are men, especially those who are over the age of 60 and are owner-operators of farms. Case descriptions suggest that they often work in isolation, which leads to longer delays before they are discovered and transported to hospital and less opportunity for resuscitation and recovery.[27] Also, as farmers age, their ability to recover from a traumatic injury is reduced. In other industries, hired workers are more frequently injured, with little disruption to the overall operation. When a farm owner-operator is killed, the entire farm operation becomes vulnerable.

To the best of our knowledge, farm owner-operators have never been specifically targeted on a large scale for farm safety interventions in Canada, perhaps because they represent a group that is especially resistant to outside intervention. We have also long suspected that this group is at particular risk to the hazards of older machinery with fewer safety features, although this has not been proven through definitive, etiological study.[26]

The results we present should be viewed as a conservative appraisal of the true problem for several reasons. First, the rates for other industries are based on all deaths, both

Table 3: Fatal work-related farm injuries, by circumstance

Circumstance	Age group, yr; % of injuries ≤ 14 *n = 50*	15–59 *n = 269*	≥ 60 *n = 183*	Total no. (and %) of injuries
Entanglement in machinery	4.0	11.2	9.3	49 (9.8)
Rollover of farm vehicle				
Sideways, down a slope	2.0	8.6	13.1	48 (9.6)
Backwards	0.0	5.9	8.7	32 (6.4)
Other	4.0	5.6	5.5	27 (5.4)
Runover injury				
By unmanned machinery	2.0	3.7	6.6	23 (4.6)
Blind (person not in view of operator)	38.0	0.4	1.1	22 (4.4)
Extra rider on farm vehicle	26.0	1.9	0.5	19 (3.8)
Subsequent to jump-starting tractor	2.0	1.5	6.0	16 (3.2)
Striking or crushing injury				
Hit by falling material or rollback of large round hay bale	2.0	3.7	8.2	26 (5.2)
Hit by falling tree or tree limb while woodcutting	0.0	5.9	3.3	22 (4.4)
Knocked off or crushed by overhead object	2.0	3.0	4.9	18 (3.6)
Crushed in collapsed trench or ditch	0.0	3.3	0.0	9 (1.8)
Crushed by slipped jack or grain box	0.0	1.5	2.2	8 (1.6)
Crushed between tractor and other machine	0.0	1.1	0.0	3 (0.6)
Other trauma				
Motor vehicle crash	0.0	12.6	6.0	45 (9.0)
Animal trauma	6.0	3.0	7.1	24 (4.8)
Fall	0.0	3.3	4.9	18 (3.6)
Electrocution	0.0	5.6	0.5	16 (3.2)
Miscellaneous (involving towed machine or vehicle)	0.0	3.7	1.6	13 (2.6)
Miscellaneous equipment breakdown or malfunction	2.0	1.9	3.3	12 (2.4)
Fire, explosion, burns	0.0	3.0	1.6	11 (2.2)
Miscellaneous (blunt trauma)	4.0	2.2	1.1	10 (2.0)
Drowning	0.0	0.7	1.6	5 (1.0)
Other/unknown	6.0	6.7	2.7	26 (5.2)
Total	100.0	100.0	100.0	502 (100.0)

injury and non-injury related. The Association of Workers' Compensation Boards of Canada (AWCBC) estimates that about 6% of claims and 35% of deaths are non-injury related (Dilys Robertson, AWCBC: personal communication, 1998). Thus, the rates reported for other industries are likely inflated relative to the true rate of fatal injury. Second, the denominator data from Statistics Canada[13] includes all people who are members of a farm operator's household, living on a farm in a rural or urban area, many of whom are not actually working on farms; it excludes people not living on a farm (e.g., some hired workers). Comparisons of agricultural death rates generated by CAISP with rates from other occupations is also limited by differences in data sources and data-collection methods. CAISP relies on several agencies within each province to identify cases. Case identification is problematic in certain situations, including fatal injuries that occur while a person is undertaking farm work off the farm, and collisions involving farm vehicles or machinery on public roadways. Problems of differential underestimation and potential reporting bias of fatal occupational injuries in provincial workers' compensation files have been noted by Rossignol.[22] The degree of underestimation of work-related injuries in the CAISP registry is unknown. We acknowledge that our injury rates may be biased, and an assessment of this bias and improvement of our denominator data are recognized as a priority for the CAISP program.

In order to improve farm safety, injury prevention specialists need to focus on high-risk populations and on specific hazards posed by agricultural vehicles and machinery. Table 4 highlights important patterns of fatal work-related farm injuries in Canada and provides general recommendations for prevention.

The CAISP surveillance system can be used to describe patterns of injury occurring in the Canadian farm population, estimate the scope of the problem, monitor important trends and generate ideas for more in-depth research. Additional observation (e.g., case–control studies) and intervention research is required to establish the etiology of important farm injury patterns, estimate the risks attributable to various hazards, exposures and behaviours, test the effectiveness of various interventions, and assess the economic impact of these injuries.

Table 4: Recommendations for the prevention of fatal work-related farm injuries

Finding	Recommendation
People aged 60 and over had a rate of death 4 times that of the remaining farm population	Effective safety initiatives aimed at older farm operators are clearly needed
Among cases that listed the person involved, farm owner-operators accounted for 60% of the people killed	Farm owner-operators must be targetted in farm injury prevention programs
Children under 15 years of age accounted for 10% of the people killed	Comprehensive farm safety programs aimed at children are needed
Tractors were involved in 48% of the deaths	Farm safety specialists should continue to make farm tractor safety a major priority
Entanglement in machinery was the most common circumstance leading to death, accounting for 10% of cases	Manufacturers and farm safety specialists should increase their efforts to promote and enforce the safe-guarding of all farm vehicles and machinery

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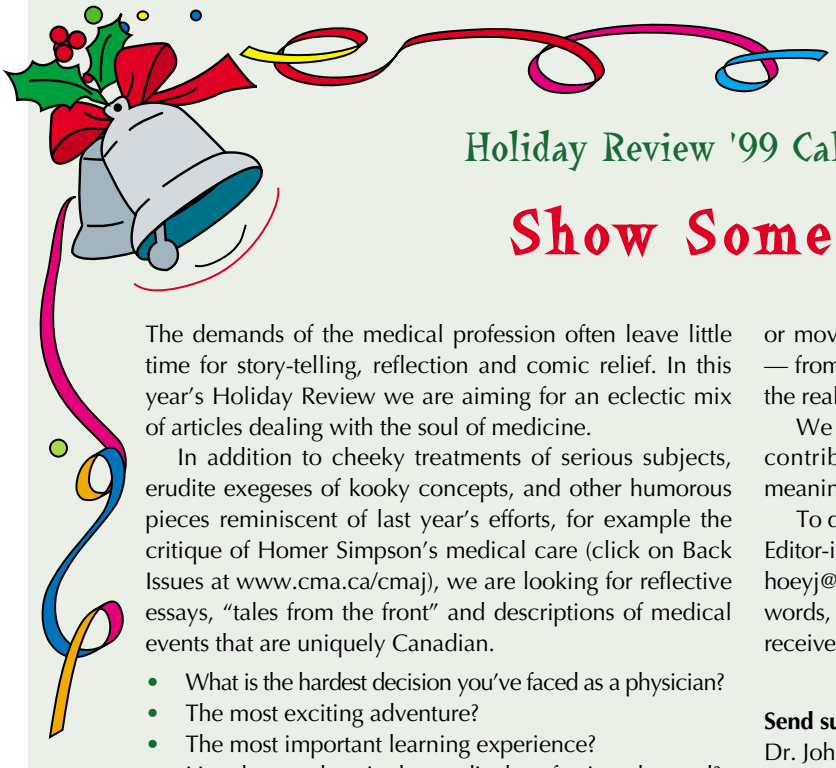
Reprint requests to: *Dr. William Pickett, Canadian Agricultural Injury Surveillance Program, Department of Emergency Medicine, Queen's University, 76 Stuart St., Kingston ON K7L 2V7; fax 613 548-1374; pickettw@post.queensu.ca*

Members of the Canadian Agricultural Injury Surveillance Program: *Dr. Helen Ward, Respiratory Division, Department of Medicine, University of British Columbia, Vancouver; Solomon Kyeremanteng, Farm Safety Program, Alberta Agriculture Food and Rural Development, Edmonton; Dr. Donald Voaklander, Injury Prevention Centre, University of Alberta, Edmonton; Louise Hagel, Centre for Agricultural Medicine, University of Saskatchewan, Saskatoon; Dr. Ted Redekop, Norma Alberg and Glen Blahey, Manitoba Department of Labour, Occupational Health Branch, Winnipeg; Dr. Robert Brison, Lisa Hartling and Dr. William Pickett, Queen's University, Kingston, Ont.; Dr. Yue Chen, Faculty of Medicine, University of Ottawa; Dr. Louise Paré and Dr. Benoit Gingras, Direction de la santé publique Chaudière-Appalaches, Montmagny, Que.; B. Christopher Balram and Elizabeth Bastin, Provincial Epidemiology Service, New Brunswick Department of Health and Community Services, Fredericton; Crystal McDonald, Prince Edward Island Federation of Agriculture, Charlottetown; Dr. Lamont Sweet, Prince Edward Island Department of Health and Social Services, Charlottetown; Dr. Judith R. Guernsey, Dalhousie University, Halifax; George Mackenzie, Nova Scotia Department of Agriculture, Truro, NS; Yvonne Rideout, Newfoundland and Labrador Federation of Agriculture, St. John's; and Dr. Tye Arbuckle and Jocelyn Rouleau, Laboratory Centre for Disease Control, Health Canada, Ottawa.*



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The demands of the medical profession often leave little time for story-telling, reflection and comic relief. In this year's Holiday Review we are aiming for an eclectic mix of articles dealing with the soul of medicine.

In addition to cheeky treatments of serious subjects, erudite exegeses of kooky concepts, and other humorous pieces reminiscent of last year's efforts, for example the critique of Homer Simpson's medical care (click on Back Issues at www.cma.ca/cmaj), we are looking for reflective essays, "tales from the front" and descriptions of medical events that are uniquely Canadian.

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To discuss an idea for the Holiday Review issue, contact Editor-in-Chief Dr. John Hoey, tel 800 663-7336 x2118; hoeyj@cma.ca. Articles should be no more than 1200 words, preferably accompanied by illustrations. Entries received by Oct. 1, 1999, are more likely to be published.

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