Agriculture is one of the most hazardous industries with its high rates of fatal work-related injuries. In Canada, the overall rate of farm-related fatalities has been previously reported at 14.8 per 100,000 farm population in persons over the age of 20 years, and this is almost 3 times greater than the fatality rate for workers in all other industries. The economic burden caused by injury in Canada is estimated to be $11 billion, including direct and indirect costs.

Studies show that people living in rural areas experience higher rates of fatal injuries than do their urban counterparts. Agriculture was found to be the third most hazardous industry in Canada with respect to rates of fatal injury, and adults aged 60 years and older were over-represented in these fatal injuries.

Saskatchewan is one of Canada’s most intensive agricultural provinces. In Saskatchewan, there are 50,598 farm enterprises with 123,385 household residents, representing 12.6% of the total population of the province. Farming is seasonal and an entire year’s income depends upon getting the crop harvested, except for those with dairy, poultry or hogs. Many farms are family operations and children are expected to contribute to the running of the farm. Seniors over the age of 65 in Saskatchewan comprise 22% of the population of towns and villages versus 15% in cities. Saskatchewan reports the highest male and female potential years of life lost due to unintentional injury in Canada.

In this study, we examined the burden and trends in injury mortality rates in the farm population in the province of Saskatchewan over a 14-year period. We also examined circumstances surrounding fatality events.

**METHODS**

We used farm fatality data for the province of Saskatchewan from January 1990 to December 2004 available from the Saskatchewan collaborators of the Canadian Agricultural Injury Surveillance Program (CAISP). Under Section 13 of The Coroners Act, the Coroner conducts investigation into all sudden, unexpected and unnatural deaths occurring in the province of Saskatchewan. Fatality data were identified from the existing mortality databases of the Chief.
Figure 1. Age-standardized fatality rates over time

Coroner’s Office, Ministry of Justice and the Occupational Health and Safety Division, Ministry of Advanced Education, Employment and Labour. Deidentified data were abstracted from the records using a standardized abstraction form. A fatal agricultural injury was defined as any unintentional injury resulting in death that occurred during an activity related to the function of a farm, including children and other bystanders who sustained fatal injury due to exposure to farm-work hazards during the study period. The study protocol was approved by the Biomedical Research Ethics Board at the University of Saskatchewan.

Surveillance information available included date of injury, sex and age of the victim, location on the farm, nature of injury, body part affected, agent causing injury, and an electronic text of circumstances leading to the event. Descriptive statistics were used to summarize the data. We used denominator data provided by the Canada Population Census and the Census of Agriculture 1991, 1996, and 2001 to calculate incidence rates for the study period 1990-94, 1995-99, and 2000-04. The farm population is the number of persons living in the households of farm operators. Canadian farm population is computed by combining the Population Census with the Agriculture Census. We also calculated age-specific and age-adjusted rates using the entire 1996 Canadian farm population as the standard. To estimate population numbers for intermediate years, we assumed that the population of each gender had changed in a linear pattern between census years.

We used a Poisson regression model to test for evidence of a trend in fatality incidence rates as a function of calendar year. The GENMOD procedure with a Poisson distribution was used to evaluate trends over time (using SAS release 9.1). We used the following regression model: \( \log (\lambda_{\text{year}}) = \beta_0 + \beta_1 \times \text{Year} \). Here the natural log transformation ensures that the model-based predictions of rates are constrained to be greater than or equal to zero. We estimated the percent change in injury rate by exponentiation of the coefficients from the fitted model. In our study, a 0.05 alpha level was used for statistical significance.

RESULTS

There were 251 work-related farm fatalities from 1990 to 2004 in Saskatchewan. Of these, 232 (92%) were males with a mean age of 49 years (SD=22). The overall fatality rate was 11.9 (95% CI, 2.0-30.1) per 100,000. The overall age-adjusted work-related fatality rate was 32.1 (95% CI, 19.6-44.6) per 100,000 among males and 3.2 (95% CI, 1.3-5.1) per 100,000 among females.

Figure 1 shows farm fatality rate by gender and by year, 1990 through 2004. Throughout the study period, farm fatality rates for males were consistently higher. Age-adjusted rate increased from 29.3 (95% CI, 6.9-59.3) per 100,000 in 1990-1994 to 37.1 per 100,000 in 2000-2004 in males. Trend analysis of the fatality rate in
Higher fatality rates were observed in study subjects under 15 years and in those 60 years old and older (Table 1, Figure 2). Table 2 shows the most common circumstances of farm fatality among various age groups. The most common mechanism of injury was being run over by farm machinery or vehicles, accounting for 60.7% of deaths among those <15 years of age. Most often the machinery involved was being operated by a member of the farm family. A total of 122 deaths occurred among people age 15 to 59 years. Rollover of farm machinery was the leading cause of death, with 53% of fatalities having occurred when the machine was being operated on an incline or on rough ground, 18% when the operator lost control during transport of the equipment on roadways and 17% when the load was being shifted. The second leading cause of death was being struck or pinned by a farm machine or vehicle. In half of these cases, the injury event occurred due to failed or improper blocking while the victim was working beneath the machine. Entanglement in farm machinery was the third leading cause of death in this age category. The farm work being performed at the time of the injury event included grinding feed (35.7%), operating an auger (28.6%) and clearing the plugged intake of a baler (14.3%). Motor vehicle-related fatalities were due to collisions of farm equipment with vehicles or other road traffic. Contributing factors included poor visibility, poor lighting on farm machinery, excessive speed and loss of control. The running over of an operator who had dismounted the farm machine occurred most often when the operator attempted to jumpstart (bypass start) a tractor or when the unmanned machine slipped into gear. Electrocutions occurred most frequently when a farm machine came into contact with a high voltage overhead power line, and poisoning occurred during operations involving the handling of liquid manure.

There were 98 work-related fatalities among persons 60 years old and over. In these cases, the main mechanisms of injury were being run over by an unmanned machine or the operator or passenger falling from a moving machine and being subsequently run over. The second leading cause of death was being struck by an object, primarily large round bales. This was followed by events where the victim was pinned or crushed by machinery while repairing or inspecting beneath a raised machine. Fatalities involving being struck or crushed by animals occurred most often while the victim was performing routine chores in a feedlot or corral.

Table 3 shows causative agent, location of injury, place of death and relationship with the victim of farm fatality, Saskatchewan, 1990-2004.
this study concurs with similar findings in Canada, other developed and developing countries.6,17,18 Huston et al.19 examined farm fatalities in Saskatchewan between 1955 and 1967 (total n=247) and noted that people aged 60 years and over accounted for 22.7% of all farm fatalities compared to 40.2% of fatalities in our study. Children contributed to 11.1% of fatalities in this study compared to 27.9% in the previous study by Huston et al. Adults contributed to almost half of fatalities then (49.4%) and now (48.6%). This demands high vigilance on the part of adults to prevent a high proportion of runover injuries in children and the elderly population. These are avoidable deaths. Long-term intervention will be needed to change this behaviour.20,21 Rollover played a key role in fatal injuries among adults in particular as well as among children and old people. Studies show that the majority of tractors operate without rollover protective structures (ROPS) in the farm despite their proven effectiveness in reducing fatalities from tractor overturns by more than 80%.22,23

The CAISP data form describing the circumstances surrounding the injury event was helpful in determining different types of hazards in the workplace for children, adults, and the elderly population. To reduce farm fatalities, the training needs to be customized for specific age groups.

LIMITATIONS

Strengths of our study include our use of population-based data to determine trends in injury rate over a period of fifteen years. There are a number of limitations in this study. The study does not capture all the dimensions of injury burden. Burden also includes economic costs, lost productivity, potential years of life lost, and mental stress to the family. There were small numbers of fatalities in females and in some age categories for males, therefore rates need to be interpreted with caution. The use of the Canadian census and Agricultural census may not account accurately for people living on but not actually working on farms (for example, working in nearby towns) or conversely who work on but do not live on farms (for example, daily wage earners). We used a regression method to estimate farm populations for the denominator data between census years assuming a linear reduction of population between the census years of 1991, 1996 and 2001.

CONCLUSION

Farming remains a dangerous occupation in Saskatchewan and there is a clear need to initiate evidence-based prevention and intervention programs to reduce the rising fatality rates, especially among young children and the elderly.

REFERENCES


Received: April 4, 2010
Accepted: August 20, 2010

RÉSUMÉ


Méthode : Nos données sur les accidents agricoles mortels survenus en Saskatchewan, au Canada, entre janvier 1990 et décembre 2004 sont tirées du Programme canadien de surveillance des blessures en milieu agricole (PCSBMA).

Résultats : On a enregistré 251 accidents agricoles mortels entre 1990 et 2004 en Saskatchewan. La majorité (92 %) des accidents mortels liés au travail sont survenus chez des hommes. Le taux global d’accidents mortels était de 11,9 (IC de 95 %, 2,0-30,1) p. 100 000. Le taux global d’accidents mortels par habitant était de 3,1 (IC de 95 %, 1,3-5,1) p. 100 000 chez les femmes. Le taux ajusté selon l’âge était de 32,1 (IC de 95 %, 19,6-44,6) p. 100 000 chez les hommes et de 3,2 (IC de 95 %, 1,3-5,1) p. 100 000 chez les femmes. Le taux ajusté selon l’âge a augmenté, passant de 29,3 (IC de 95 %, 6,9-59,3) p. 100 000 en 1990-1994 à 37,1 p. 100 000 entre 2000 et 2004 chez les hommes. L’analyse des tendances des taux d’accidents mortels, tous cas confondus, fait état d’une augmentation annuelle moyenne de 3,8 %, et cette hausse est significative (p<0,05). Les blessures de tiers et les écrasements ont contribué à la proportion élevée d’accidents mortels chez les enfants (32,1 %) et les personnes âgées (26,7 %).

Conclusion : Le fardeau des accidents mortels est considérable, et l’on observe un mouvement de hausse significatif dans les taux de blessures sur les 15 années de l’étude. Une stricte vigilance est de mise de la part des adultes pour prévenir une grande proportion des blessures liées aux écrasements chez les enfants et les personnes âgées.

Mots clés : accidents; surveillance; accidents agricoles mortels; agriculture; Saskatchewan