

Agriculture-related injuries in the parkland region of Manitoba

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OBJECTIVE To review a series of farm injuries in the parkland region of Manitoba, compare the collected data to similar studies, and provide a baseline for deriving effective preventive measures for the local community.

DESIGN Retrospective case study involving review of hospital charts.

SETTING The population studied was derived from the catchment area for Dauphin General Hospital, a referral centre servicing an agricultural region of 57 000 people.

PATIENTS Seventy-two patients were admitted to hospital between January 1981 and December 1991 after being injured by agricultural machines, farm animals, herbicides or other chemicals, and fertilizers. Four fatalities were identified through a review of local medical examiner records, for a total of 76 cases.

MAIN OUTCOME MEASURES The following data were abstracted for each case: sex, age, time and date of injury, cause, type of injury, and body part involved.

RESULTS Most cases involved men, between the ages of 20 and 69, during the afternoon and early evening with a seasonal peak in late summer. More than 60% of injuries were caused by agricultural machinery, followed by animal-related injuries (25%). Grain augers were the most common type of machine causing injury (35%). All patients younger than 9 years were female, and 75% of their injuries involved farm animals. A decreasing annual frequency of farm injuries was noted over the 11-year period. Fewer accidents involving farm machinery appear most responsible for this trend.

CONCLUSIONS Many agriculture-related injuries occur in the parkland region of Manitoba. The type and pattern of injuries observed resembles those documented in other studies. With effective education and preventive measures, most injuries and fatalities could be prevented. Physicians are obliged to encourage and support educational programs in their communities and to review safety practices with patients.

OBJECTIF Analyser une série de blessures reliées à la ferme survenues dans une région agricole du Manitoba, comparer les données recueillies à celles publiées dans des études semblables et fournir des données de base pour élaborer des mesures préventives efficaces pour cette communauté locale.

CONCEPTION Étude rétrospective de cas impliquant une revue des dossiers hospitaliers.

CONTEXTE La population étudiée provenait de la région desservie par l'Hôpital général Dauphin, un centre de référence qui dessert une région agricole de 57 000 habitants.

PATIENTS Entre janvier 1981 et décembre 1991, 72 patients furent hospitalisés suite à des blessures causées par la machinerie agricole, les animaux de ferme, les herbicides ou autres produits chimiques et les fertilisants. Une revue des dossiers du coroner local a permis d'identifier quatre décès, pour un total de 76 cas.

PRINCIPALES MESURES DES RÉSULTATS Pour chaque cas, nous avons recueilli les données suivantes: sexe, âge, heure et date de la blessure, la cause, le type de blessure et la partie du corps impliquée.

RÉSULTATS La plupart des victimes étaient des hommes âgés de 20 à 69 ans, et les accidents sont survenus en après-midi et tôt en soirée avec un pic saisonnier vers la fin de l'été. Plus de 60% des blessures furent causées par la machinerie agricole, suivies par les blessures reliées aux animaux (25%). La tarière à décharger le grain fut le type de machinerie le plus fréquemment impliqué dans les blessures (35%). Tous les patients de moins de 9 ans étaient de sexe féminin et 75% de leurs blessures impliquaient les animaux de ferme. Au cours de cette période de 11 ans, on a noté une diminution annuelle de la fréquence des blessures de ferme. La réduction des accidents attribuables à la machinerie de ferme semble l'élément le plus responsable de cette tendance à la baisse.

CONCLUSIONS Cette région agricole du Manitoba est victime de nombreux accidents de ferme. Le type et le modèle des blessures observées sont semblables à ceux observés dans les autres études. On pourrait prévenir la plupart des blessures et des décès si on appliquait des mesures préventives et un programme d'éducation efficace. Les médecins sont contraints d'encourager et de soutenir les programmes éducatifs dans leur communauté et de réviser les pratiques sécuritaires avec leurs patients.

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FARMING CONSISTENTLY RANKS as one of the most dangerous occupations in North America.¹⁻⁵ According to US statistics, agriculture has a mortality rate of 52/100 000 workers each year, a figure higher than other occupations, such as mining and construction.⁶ Comparable data are not available for Canada; however, Robertson⁷ estimates that some 100 to 200 Canadians die annually from farm-related injuries. Statistics compiled by the Manitoba Department of Labour (Workplace Safety and Health) reveal 43 Manitobans died from farming accidents between 1985 and 1991.⁸ Fortunately, the number of fatalities nation-wide appears to be decreasing.⁹

Several features unique to farming help explain the increased risk to agricultural workers. The work is seasonal and highly dependent on weather conditions. Attempts to accomplish large amounts of work in a limited time lead to haste, fatigue, and stress, all of which increase accident risk.^{1,4,10} By its very design and purpose, farm machinery is dangerous, and the slightest error can lead to serious injury. Economic pressures compound the problem when workers are forced to use methods and equipment that cost less but are unsafe (*Figure 1*).^{1,11,12}

Farmers often work alone, and it sometimes is hours before an injured worker is discovered. Delayed medical response and excessive transport time in rural areas contribute to increased morbidity and mortality.¹³ More than 50% of children involved in fatal farm injuries die without ever reaching a hospital or receiving medical attention.¹⁴ Unlike other industries, children of any age can work on the family farm, which is exempt from child labour laws. Several studies have examined the unique situation of farm children, which exposes them to great risk of injury.¹⁵⁻¹⁹ Sadly, nearly 300 children and adolescents die each year in the United States from farm injuries and 23 500 suffer non-fatal trauma.¹⁴

The need for preventive measures to control injury and death in the agricultural workplace is obvious. Implicit in any prevention strategy, however, is the need for accurate knowledge of the problem so that risks can be identified and avoided.^{20,21} Unfortunately we lack published epidemiological studies on farm injuries, particularly those assessing potential risk factors.^{2,4,16} Because Canadian farmers and their families are not generally covered by workers' compensation legislation, there is no administrative or legal need to collect information on injuries. Official

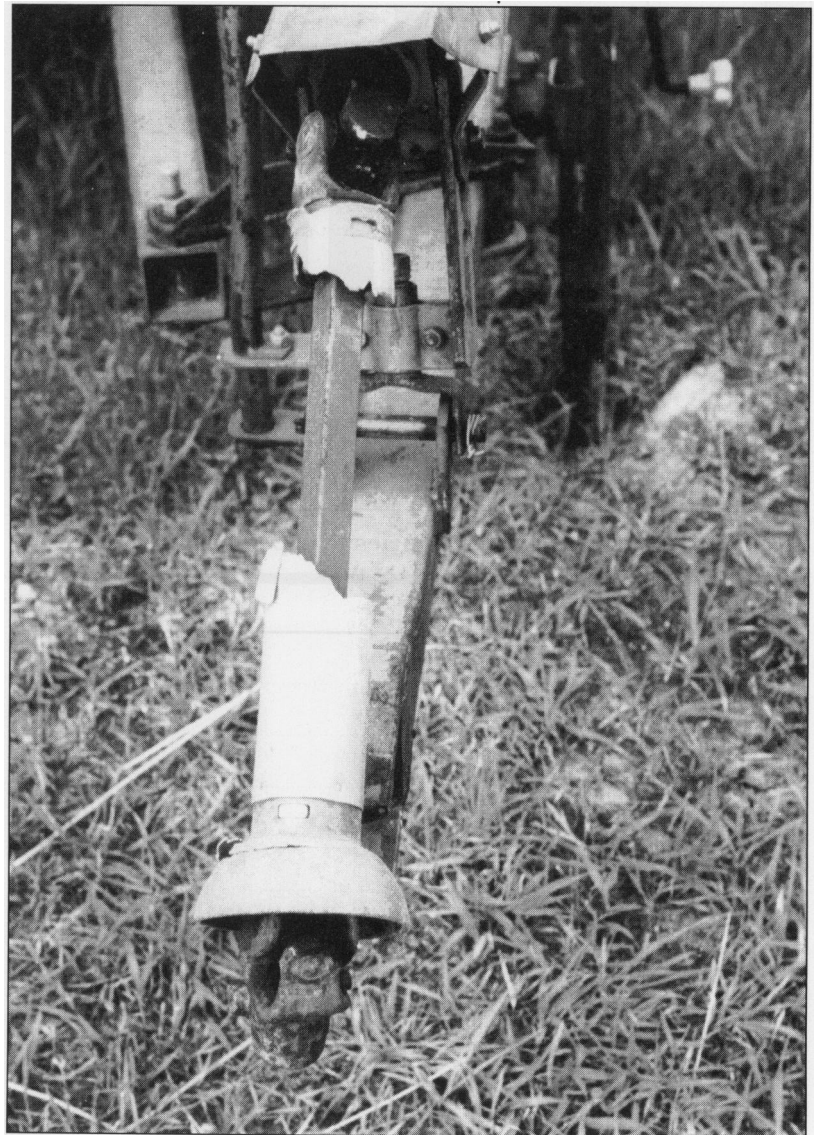


Figure 1. Economic pressures delay repairs: A damaged shield increases the chance of entanglement on the rotating drive shaft of an implement.

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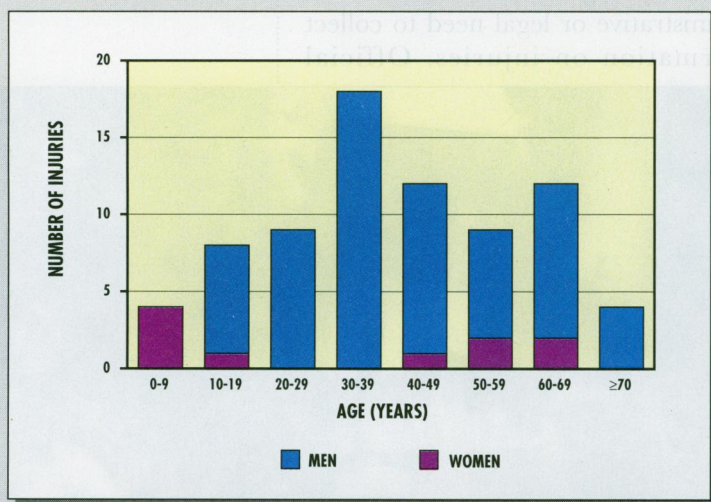
estimates are, therefore, often inaccurate, and many perceive them as being too conservative.^{2,16,22}

Part of the problem is the absence of a nation-wide surveillance program for agricultural injuries and illness.^{5,23,24} Recently a program was successfully implemented in North Dakota, and valuable epidemiological data were obtained.¹² It is hoped the information

will guide strategies for education and intervention.

The purpose of the current study was to review a series of farm injuries in the parkland region of Manitoba, compare the collected data to similar studies, and provide a baseline for deriving effective preventive measures for the local community.

Figure 2. Who gets injured?



METHODS

The population studied lived in the catchment area for Dauphin General Hospital, a 125-bed facility centrally located in the parkland region of Manitoba. Based predominantly on agriculture, the area comprises the town of Dauphin and surrounding farms and communities, with a total population of approximately 57 000. Dauphin General Hospital has two general surgeons on staff and, as a regional referral centre, receives most severe trauma cases occurring in the area.

Cases occurring between January 1981 and December 1991 were identified from hospital discharge records as codes of the International Classification of Disease: specifically, those admitted subsequent to injury from agricultural machines (E919), farm animals (E906), herbicides and other chemicals (E863), and fertilizers (E866.5). Injuries resulting in death without hospital admission were included through review of all local medical examiner cases during the 11-year study period. The following data were abstracted for each case: sex, age, time and date of injury, cause, type of injury, and body part involved.

Table 1. Distribution of farm injuries by type of injury

INJURY	%	N
Fracture	31.6	24
Amputation	14.5	11
Crush	13.1	10
Laceration	13.1	10
Other*	7.9	6
Contusion	5.3	4
Multiple	5.3	4
Sprain	5.3	4
Avulsion	2.6	2
Dislocation	1.3	1
TOTAL	100	76

* Other includes asphyxiation (2), burn (1), gunshot, (1), and high-pressure injection (1).

RESULTS

During the 11-year period ending December 1991, 72 patients were admitted to Dauphin General Hospital as a result of agriculture-related injuries. Four fatalities occurred before admission for a total of 76 cases. There

were 66 male (87%) and 10 female (13%) patients in the study with an age distribution of 2.5 to 86 years (mean of 40.8 years). The age group with the most reported injuries was between 30 and 39 years and accounted for almost 24% of the total number of injuries (Figure 2). All patients younger than 9 years were female, and 75% of their injuries involved farm animals.

Fractures accounted for 32% of all injuries, followed by amputations (14%), crush injuries (13%), and lacerations (13%) (Table 1). Upper extremities were most often involved (43%) followed by lower extremities (25%), multiple (13%), thorax (8%), head (7%), and abdomen (4%). The mechanism of injury (Table 2) was machinery (63%), animal (25%), fall (7%), and other (7%).

Decreasing frequency of farm injuries became apparent over the 11-year study (Figure 3). Fewer accidents involving machinery appear most responsible for this trend. Within the first 5 years of the study (1981 to 1985), 88% of power take-off (PTO), 80% of V-belt, 77% of auger, and 75% of tractor injuries had occurred.

Clear seasonal variation was observed, with 86% of injuries occurring during the summer and fall (Figure 4A). Power take-off injuries were most prevalent in the late fall and winter. The average time of injury was 15:30, with 41% of cases occurring between 16:00 and 19:00 (Figure 4B).

Four fatalities occurred during the study period. Two involved exposure to gases from liquid manure, one a gunshot wound, and one crush injuries to the chest and abdomen by a tractor and implement (Table 3).

DISCUSSION

The study data suggest that farm workers in the parkland region are exposed to great risk of personal injury in the workplace. Because the study represents only cases requiring admission to hospital or resulting in fatality, the data

could greatly underestimate the incidence of farm injuries in the area. Recent studies suggest that only 50% of persons sustaining agriculture-related injuries come to hospital-based emergency departments; of these, only 25% require subsequent admission.^{12,16,20}

Many of the data concerning injured patients are similar to those

Table 2. What causes farm injuries?

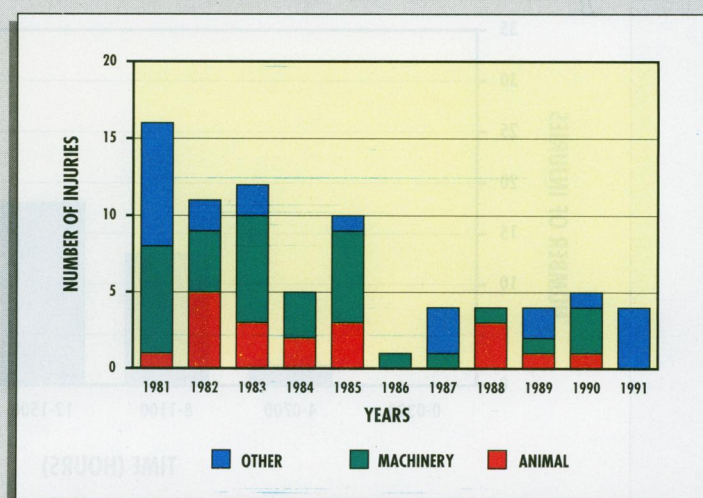
CAUSE	%	N
Animal	25.0	19
Auger	17.1	13
Other*	14.5	11
Power takeoff	10.5	8
Tractor	10.5	8
Power tool†	7.8	6
V-belt	6.6	5
Chemical‡	4.0	3
Fall	4.0	3
TOTAL	100	76

* Other includes discer (1), stone picker (1), fence post driver (1), sweather (1), forklift (1), hitch (1), granary door (1), gunshot (1), hydraulic press (1), grain dust (1), and "farm equipment" (1).

† Power tool includes grinder (2), chain saw (2), calf puller (1), and lawn mower (1).

‡ Chemical includes liquid gases (2) and anhydrous ammonia (1).

Figure 3. Annual rates of causes of farm injuries



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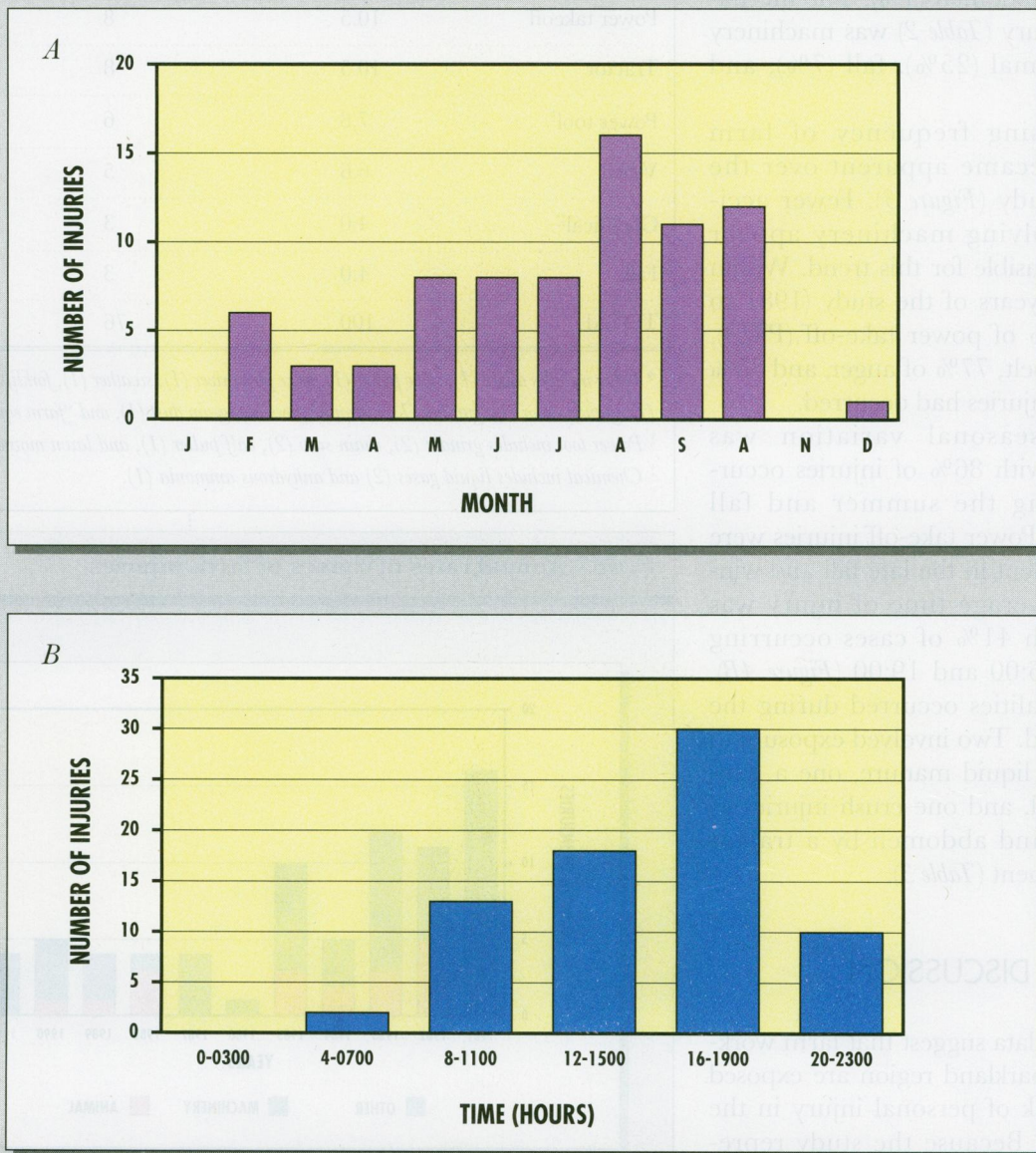
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reported in other studies. Most cases involved men between the ages of 20 and 69 during the afternoon and early evening, with a seasonal peak in late summer.^{3,8,12,16} The preponderance of injuries involving the upper extremities (fractures, amputation, lacerations) has also been previously reported.^{2,3,12,15}

As a group, agricultural machinery accidents were the most common cause of injury.^{2,8,12,16} Differences were noted when comparing types of machinery involved.^{10,12,18} Augers

rather than tractors were most often responsible for machinery-related injuries. This is unsurprising, as a local study revealed that grain augers are the most common piece of farm equipment to have the safety shields removed (*Figure 5*).¹¹ Reasons for removal include increasing maneuverability and capacity to haul more grain. Because provincial figures do not classify injury by machine type, comparisons with other regions could not be made. A previous study,

Figure 4. When do farm injuries occur? A) Monthly rates, B) time of day



however, revealed that augers are the main cause of traumatic amputation in children in Manitoba.²⁵ This was not demonstrated in the present study, as no children were involved in auger accidents.

As described in the literature, most power take-off injuries were incurred in the fall and winter months.^{10,13,26,27} During these times of year, farmers wear heavier, bulkier clothing, which is more readily entangled in machinery. Shields are provided by the manufacturer but are often inadequate, damaged, or discarded (*Figure 6*). Unfortunately, the condition of these devices at the time of accident was rarely recorded in the hospital chart.

However, horses and cattle, rather than any single type of agricultural machinery, were the leading cause of injury.^{12,13} Of the 10 injuries to female patients in the study, eight were caused by farm animals, as were three of the four injuries to children younger than 9 years of age. These findings could relate to increased exposure to risk among female subjects and a lack of respect and caution among young children.²⁸ Conclusions cannot be drawn about children, however, given the small number of cases. An emphasis on ranching in the area could explain the frequency of animal-related injuries.

The annual frequency of farming accidents decreased over the 11-year study period. While livestock injuries remained relatively constant through time, the trend is associated with fewer injuries involving machinery. Possible explanations include improvement in safety shields, increased precautions by operators, decreased exposure to risk, or a combination of all three.

Of the four deaths during the study period, none resulted from tractor rollovers, the most common cause of agriculture-related fatalities.³⁻⁵ Two individuals were severely injured however, when their tractors unequipped with rollover protection structures (ROPS) overturned. The effectiveness of ROPS has been well documented in Sweden, where their use is now

mandatory and fatalities from tractor rollovers have been virtually eliminated.²² North American manufacturers are beginning to produce tractors with this safety feature, although older models remain unequipped.

Two of the deaths could have been prevented with proper education. Fatalities from acute exposure to toxic gases emanating from liquid manure

Table 3. Agriculture-related fatalities from 1981 to 1991:

All who died during the study period were men.

DATE	AGE	INJURY	MECHANISM
08/81	49	Spinal cord transection	Shot while examining crops
08/83	61	Crush injury to chest and abdomen	Run over by discer
07/87	36	Inhalation of toxic gases	Fell into liquid manure storage tank
07/87	37	Inhalation of toxic gases	Attempted rescue of colleague in manure storage tank



Figure 5. Safety screens are often removed from grain augers, increasing the risk that a limb will become caught in the mechanism.

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have been well documented.^{22,29,30} Hydrogen sulfide is the main toxic substance involved, and at lethal levels the characteristic "rotten egg" smell is lost as the sense of smell becomes paralyzed. Thus, there could be no warning of exposure until it is too late. Agitation of the manure during draining of the holding tanks appears to be important

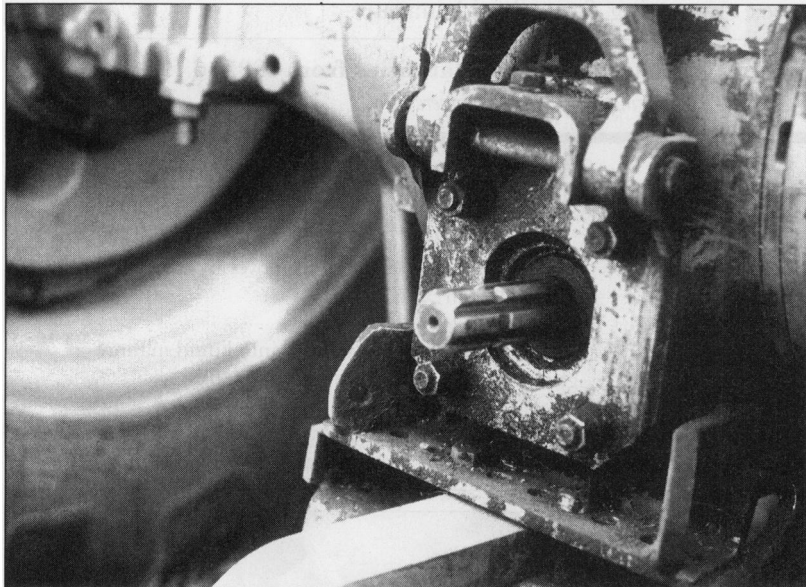


Figure 6. A power take-off shaft dangerously exposed after removal of the safety shield

for hydrogen sulfide to reach toxic levels. Sadly, as seen in this study and reported elsewhere, a double fatality occurs when a worker attempting to rescue a stricken colleague also succumbs to the toxic gases.

CONCLUSION

This study reveals that many agriculture-related injuries are occurring in the parkland region of Manitoba. The type and pattern of injuries observed resembles those documented in other studies. With effective education and preventive measures, most of these injuries and fatalities could be prevented. Recently, communities are becoming involved with programs that promote farm safety education (Farm Safety 4 Just Kids, Manitoba Hydro Farm Safety Days, 4-H Farm Safety

Programs) and prevention in the form of day-care facilities for rural children during peak farming seasons (Rural Child Care Safety Registry of the Manitoba Women's Institute).

Concurrently, physicians must be aware of the potential health hazards of farming and cognizant that the entire family is at risk. We are obliged to encourage and support educational programs in our communities and individually review safety practices with our patients. Specifically, check whether safety guards are in place, precautions are taken around livestock, tractors are equipped with ROPS, children have been formally exposed to a farm safety program, and children are adequately supervised during the peak seasons of farming. ■

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Acetaminophen is an analgesic and antipyretic.

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ADVERSE EFFECTS:

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PRECAUTIONS AND TREATMENT OF OVERDOSE:

Resuscitation and supportive care must proceed as for any other potentially serious overdose. In acute overdose, serum levels of acetaminophen are meaningful in predicting those patients likely to develop serious hepatic toxicity. They must be drawn between 4 and 24 hours post overdose and the values plotted on the Matthew-Rumack Nomogram. N-acetylcysteine (N.A.C.) is a highly effective antidote for acetaminophen poisoning. Do not delay administration of N.A.C. either by parenteral or oral routes if the ingested dose is likely to be toxic (> 150 mg/kg ingested) or if serum levels are in the toxic range on the Nomogram. N.A.C. must be administered prior to the 24th hour post overdose to be protective. Further details on therapy of acetaminophen overdose are available by calling your regional Poison Control Centre.

DOSAGE:

Adults: 650 to 1000 mg every 4 to 6 hours, not to exceed 4000 mg in 24 hours.

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TYLENOL* Gelcaps 500 mg: Each solid caplet-shaped tablet, coated with red gelatin on one end and yellow on the other, printed "TYLENOL/500" on each gelatin coated end, contains: 500 mg acetaminophen. Available in bottles of 24† and 50 gelcaps.

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