



Australian Government

Australian Institute of  
Health and Welfare

Department of  
Health and Ageing



Flinders  
UNIVERSITY

Number 12, July 2008

# NISU Briefing

AIHW National Injury Surveillance Unit • Research Centre  
for Injury Studies • Flinders University • South Australia

## Hospitalised farm injury among children and young people, Australia 2000–01 to 2004–05

Renate Kreisfeld

July 2008

### Key findings

- During the reporting period an annual average of at least 785 children and young people aged 0–19 years were hospitalised. The age-adjusted rate of hospitalisation was 21.4 separations per 100,000 population for males and 7.5 per 100,000 for females.
- Injury rates on farms increased with age and male rates were higher than female rates in all age groups.
- Injury rates increased according to the remoteness of the person's residence.
- Motorcycles and horse riding were the most common mechanisms of hospitalised injury among 0–19 year olds.
- The mechanisms of injury differed markedly between farm and non-farm settings.
- For 0–4 year olds, falls and being bitten or struck by a mammal other than a dog were the most common causes of injury.
- From the age of 5, motorcycles and riding an animal or being an occupant of an animal-drawn vehicle were the most common mechanisms of injury.
- From the age of 5, in incidents involving a motorcycle, the injured person was most often the driver (5–9 years, 84%; 10–14 years, 96%; 15–19 years, 97%).
- Open wounds and fractures were the most common injury outcome in the 0–4 year age group. Fractures were the most frequent type of injury in the remaining age groups.
- The head was the most commonly injured body part among 0–4 and 5–9 year olds.
- Children in the 10–14 year age group most frequently sustained injuries to the shoulder and upper limb and the head.
- The shoulder and upper limb was the most frequently injured body part in the 15–19 year age group.
- The mean length of stay, across all age groups, was 2.8 days.
- Across all ages, the injury severity score assigned to 13.6% of cases suggested that the injuries sustained posed a significant threat to life.

## Introduction

Over the five-year period 2000–01 to 2004–05, a total of at least 3,926 children and young people were hospitalised as the result of injuries sustained on farms. This briefing focuses on these cases.

Life on a farm can present a range of hazards for children and young people: unfenced dams, ponds and rivers present a drowning risk, particularly for young children; children and young people can be seriously hurt through a fall from a horse or contact with a large farm animal; the range of vehicles in use on farms can also present dangers—off-road motorcycles, all-terrain vehicles (ATVs) and agricultural vehicles such as tractors. Even standard motor vehicles can pose greater risks to their occupants when used on unsealed and poorly maintained roads.

In reporting the injury experience of 0–19 year olds, cases of hospitalised injury for this age band have been divided into four sub-groups in order to describe the injury experience at different developmental stages.

## Case selection

This briefing uses data for hospital separations due to injury and poisoning that occurred in Australia during the period 2000–01 to 2004–05. National hospital separations data was provided by the Australian Institute of Health and Welfare (AIHW) National Hospital Morbidity Database (NHMD). A separation is defined as:

A formal, or statistical process, by which an episode of care for an admitted patient ceases (AIHW 2001).

Records in which the mode of admission was recorded as being by transfer from another acute-care hospital, were excluded from the selected subset on the grounds that such cases are likely to result in more than one separation record. It should be recognised that this method for avoiding multiple counting of cases is approximate. It should allow for cases involving transfer between or within hospitals. It cannot allow for re-admissions which meet the project's selection criteria. Cases transferred from another hospital are included in estimates of patient days.

The operational definition of injury used in this briefing specifies cases that have been designated Community Injury. These are cases where the principal diagnosis is a code in the range S00–T75 or T79. Community Injury excludes most cases of *complications of medical and surgical care* as well as *sequelae of injury*.

A subset of farm cases was created by selecting all cases that have attracted the ICD-10-AM place code Y92.7 *Farm*. This code takes in any farm buildings, cultivated land, or ranches devoted to the raising of livestock. Farm houses are excluded, as are home garages, gardens or yards, and private swimming pools or tennis courts. It should be borne in mind that the boundary between 'farm' and 'farmhouse' is not always precisely delineated. For example, a home garage may be used to store farm chemicals or to undertake tasks associated with work on the farm. In addition, some farm locations are not included within the scope of Y92.7. Farm dams, in particular, receive a separate place code within ICD-10-AM. These factors contribute to an underestimate in the number of farm cases.

The data reported in this briefing are expressed as annual average counts and rates over the five-year period 2000–01 to 2004–05. A reporting period of this duration was chosen because of the relatively small numbers of cases per year. Reporting data for a single year would produce many values based on small case numbers which are susceptible to chance variation and often cannot be reported because the case count for a table cell is less than 5, a limit used to help ensure that patient confidentiality is preserved.

This briefing includes all community injury cases at ages under 20 years in which the place of occurrence was recorded as being a farm. As shown in Table 1, in a substantial proportion of injury cases, the place of occurrence is not recorded. It is likely that at least some of the unspecified places were farms. Hence, results presented here are likely to be underestimates.

Selection of a suitable denominator for the purpose of calculating rates was problematic. An estimate based on 2001 Census data for the number of children under the age of 15 years and resident of farms was calculated from an ABS publication as being 135,439. This estimate was arrived from the publication as follows: There were 112,753 farming families in 2001. 57.2% of these families had children, and 'there was an average of 2.1 children aged less than 15 years living in farming families with children' (ABS 2003). In addition to this, an unknown number of children visit farms and thereby experience some level of exposure to the risks associated with such an environment. Because of the uncertainties about the numbers of children on farms, rates used in this report have been calculated using general population data.

**Table 1: Community injury hospital separations by place of occurrence, 0–19 years, Australia 2000–01 to 2004–05**

Place	Total frequency	Per cent
Home	102,110	23.1
Residential institution	1,074	0.2
School, other institution & public administration area	31,827	7.2
Sports and athletics area	40,646	9.2
Street and highway	36,437	8.2
Trade and service area	7,199	1.6
Industrial and construction area	3,272	0.7
Farm	3,926	0.9
Other specified place of occurrence	23,519	5.3
Unspecified place of occurrence	190,046	42.9
Place not reported/not applicable	2,881	0.7
<b>Total</b>	<b>442,937</b>	<b>100.0</b>

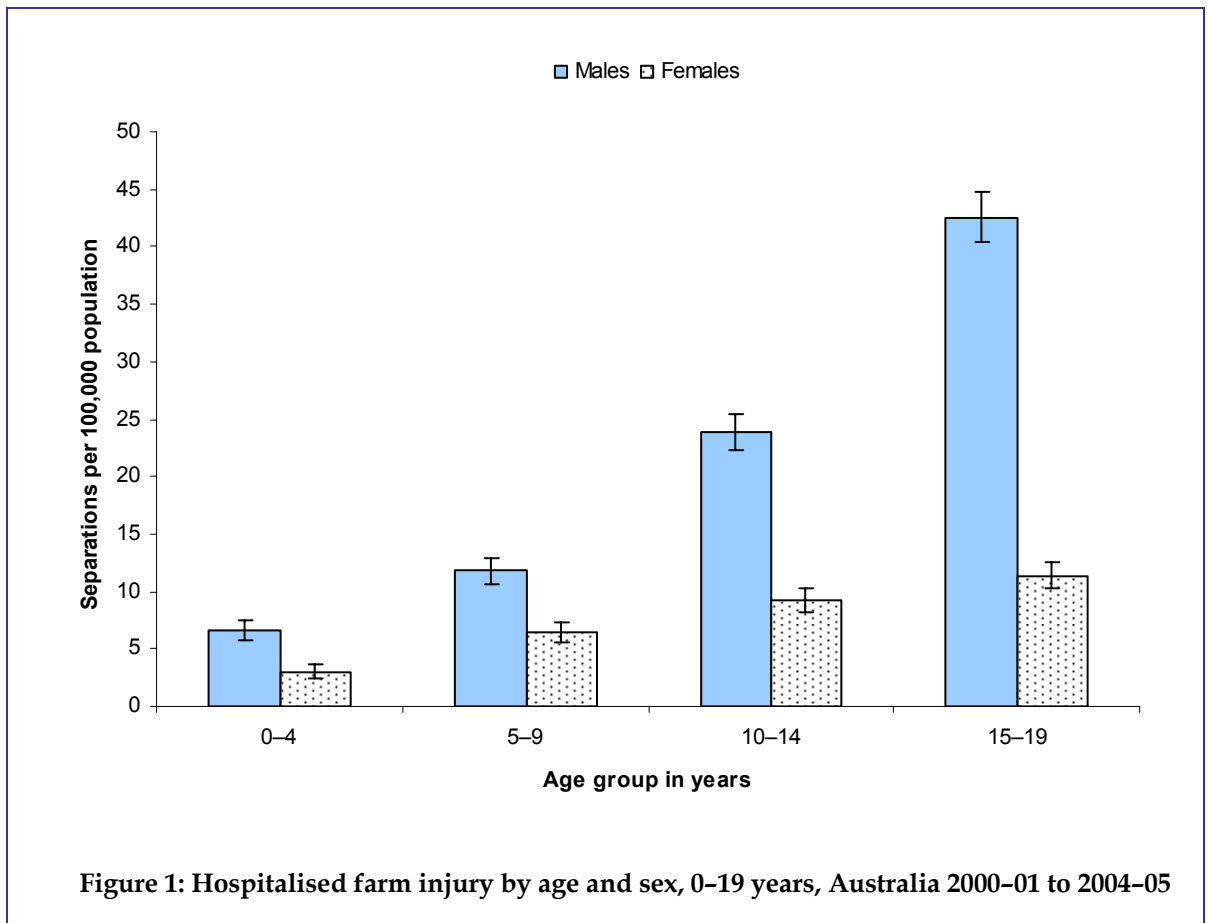
Note Place of occurrence was not specified in 43.6% of cases.

**Overview: 0–19 years**

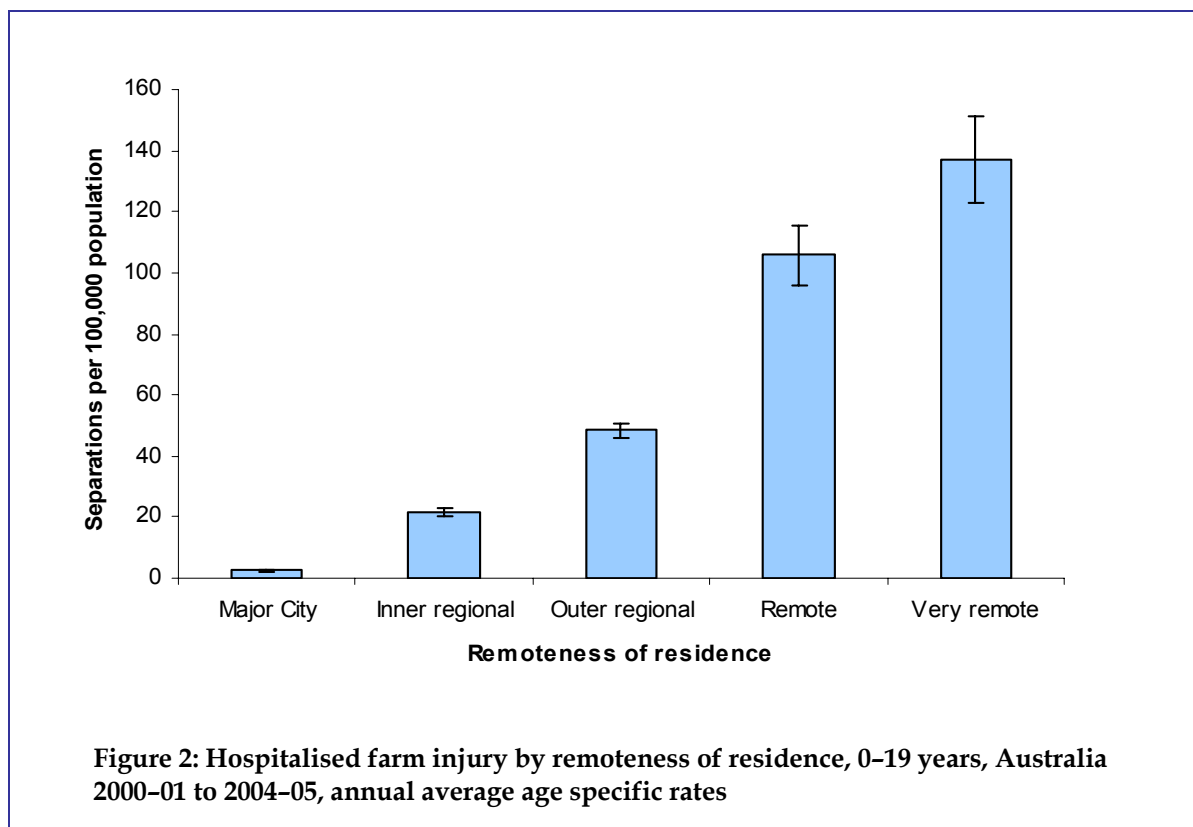
During the reporting period an annual average of at least 785 children and young people aged 0–19 years were hospitalised due to injuries sustained on farms. This accounted for 22% of all cases of farm injury hospitalisation during that interval.

For males, rates increased markedly from one age group to the next. Female rates also increased with age, but did so more gradually (Figure 1).

Hospitalised farm injury was more common among males than females across all age groups. This difference was most pronounced in the 15–19 year age group where the male to female rate ratio was 3.7 (Figure 1).



The rate of farm injury hospitalisations increased with the remoteness of the person's place of usual residence. Rates were highest in very remote regions (Figure 2).



The pattern of external causes of farm and non-farm injury differ considerably, reflecting differences between the environments and the range of activities undertaken. Table 2 compares patterns for the most common groups of external causes. It should be remembered that the statistical definition of the subset of cases designated 'farm' does not include farmhouses or the yards that immediately surround them (NCCCH 2004).

By far the most frequent mechanism of hospitalised farm injury in the 0-19 year age group was motorcycles, which accounted for 33.6% of hospitalised cases on farms compared with only 4.5% of non-farm cases. The next most frequent mechanism of injury on farms was riding an animal or being an occupant of an animal-drawn vehicle. This accounted for 14.0% of all farm injury hospital separations but only 0.9% of all separations due to injuries that occurred in other places (Table 2).

Unintentional falls were a common external cause of hospitalised injury in non-farm settings (36.0%), but were far less common on farms (6.3%). This would, in part, be due to a high proportion of falls occurring in the home (Table 2).

The frequency of intentional self-harm and assault was low on farms (excluding farm houses). The number of cases for each was under four.

On average, two young people died each year while in hospital during the study period because of injuries that occurred on a farm. (Note that this does not include deaths that occurred without admission to a hospital.)

The mean length of stay (MLOS) for farm injury hospitalisations was 2.8 days per incident case. This compared with non-farm related hospitalisations where the MLOS per incident case was 2.4 days. 31.7% of patients hospitalised for farm injury were discharged on the same day they entered hospital.

The two most common mechanisms of injury, motorcycles and animal riding, show distinct patterns of injury. The principal body regions injured in incidents involving a motorcycle were the hip and lower limb (30.8%); the shoulder and upper limb (29.2%) and the head (26.5%). The most common type of injury was a fracture (46.4%). For cases where the mechanism of injury was the riding of an animal, the head (38.5%) and the shoulder and upper limb (33.8%) were the most commonly injured body parts. As was the case for motorcycles, fractures were the most numerous type of injury (43.6%), followed by intracranial injury (21.4%).

**Table 2: Ten most frequent external causes of hospitalised farm injury, 0–19 years, Australia 2000–01 to 2004–05**

Selected external causes of injury	Farm n=3,926	Non-farm n=143,974	Farm : non-farm ratio
	Per cent	Per cent	
Motorcycle rider injured in transport accident	33.6	4.5	7.5
Animal or animal-drawn vehicle occupant injured in transport accident	14.0	0.9	15.6
Unintentional fall	6.3	36.0	0.2
Bitten or struck by other mammals (including horses but not dogs)	6.0	0.2	30.0
Car occupant injured in transport accident	4.5	12.4	0.4
Special all-terrain or off-road vehicle occupant injured in transport accident	3.8	0.2	19.0
Contact with agricultural machinery	3.4	0.0	..
Struck by, against or caught between objects	3.1	5.3	0.6
Contact with venomous animals and plants	2.3	0.8	2.9
Caught, crushed in or between objects	2.0	1.2	1.7
Other external causes of injury	20.8	38.5	..
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>..</b>

Cases of hospitalised community injury in the dataset used by NISU have been assigned an International Classification of Injury Severity Score (ICISS) (Stephenson et al. 2003). The ICISS score provides a measure of the person’s probability of survival to discharge. The scores range between 0 (100% probability of death) and 1 (100% probability of survival). (Cases with a score that is less than 0.941 are taken to have sustained injuries presenting a substantial threat to life.) Among 0–19 year olds, an annual average of 107 (13.6%) cases had an ICISS score that indicated that they were severe. The proportion of motorcycle cases with severe outcomes was slightly higher—16.4%.

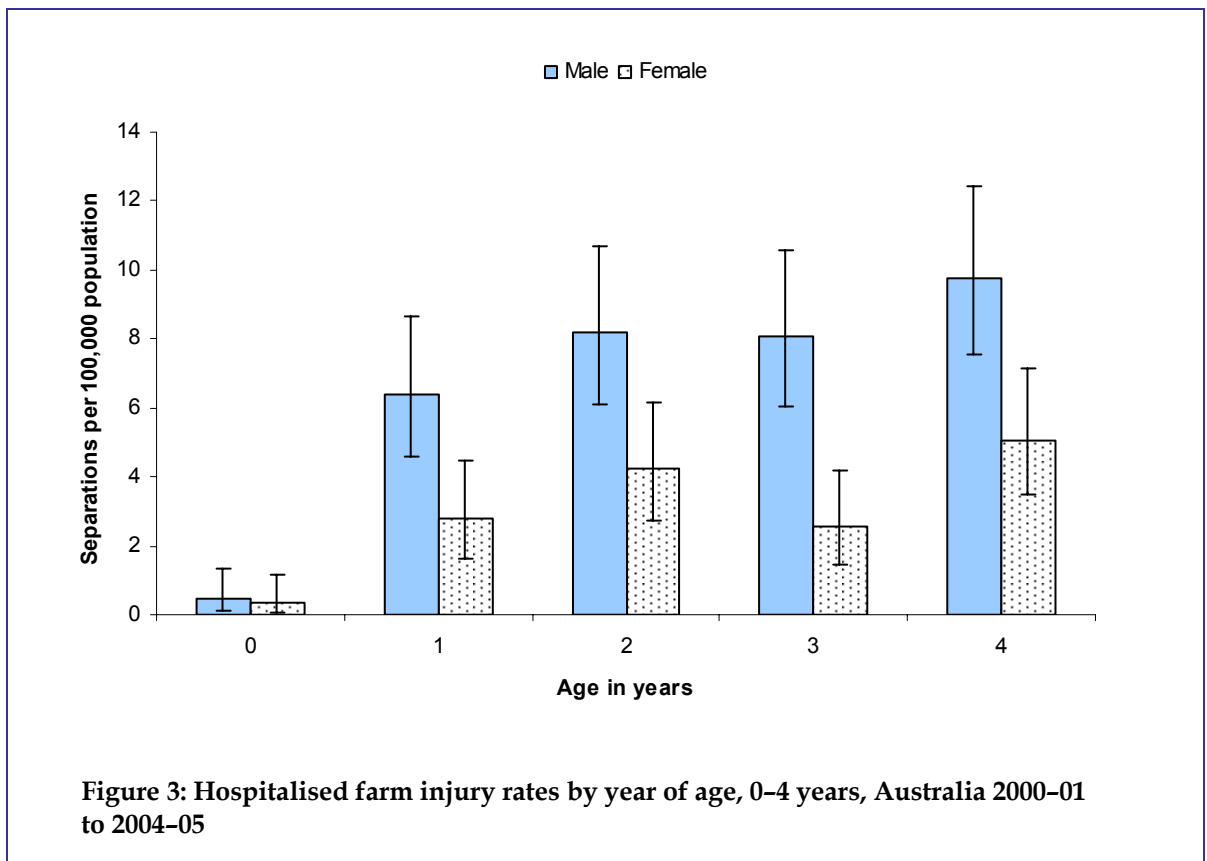
Across the age range 0–19, farm cases had a lower mean ICISS score than did non-farm cases (0.964 and 0.970 respectively), indicating that the injuries sustained in the former context presented a greater threat to life.

**0–4 years**

During the five-year reporting period, at least 308 children between the ages of 0–4 years were hospitalised due to injuries sustained on farms. This equates to an annual average of 62 children. The annual average age-specific rate was 6.6 separations per 100,000 population for males and 3.0 per 100,000 for females. Up to the age of 5 years, male children had higher rates of hospitalisation than did female children.

The annual average age-specific rate for children that were hospitalised under the age of 1 year was comparatively low (0.4 separations per 100,000 population), presumably reflecting their relative lack of mobility and a high level of supervision. After that age, rates increased markedly, particularly for males (Figure 3 and Table 3).

For the few cases for which this had been specified, the most common activity being engaged in at the time of injury was leisure. (Activity was not specified in 89% of cases.)



**Table 3: Average annual number of hospital separations due to farm injury by single year of age, 0–4 years, Australia 2000–01 to 2004–05**

Age	Annual average number of cases	Annual average age-specific rate
Under 1 year	1	0.4
1 year	12	4.6
2 years	16	6.2
3 years	14	5.4
4 years	19	7.5
<b>Total</b>	<b>62</b>	<b>4.8</b>

Falls were the most common cause of injury in this age group (15.9%), followed closely by being bitten or struck by a mammal (including horses but not dogs) (14.6%). In at least 58% of cases, the animal involved was a horse. Being bitten or struck by a dog was comparatively rare (1.9% of cases). Unintentional falls were much more common in non-farm areas where they accounted for 46.6% of cases in this age group (Table 4).

During the five-year study period there were 78 motorised and non-motorised vehicle related incidents. In three of these, a child in this age group was coded as having been the driver of a motorised vehicle.

**Table 4: Ten most frequent external causes of hospitalised farm injury, 0–4 years, Australia 2000–01 to 2004–05**

Major external cause of injury	Farm (n=308)	Non-farm (n=10,948)	Farm : non-farm ratio
	Per cent	Per cent	
Unintentional falls	15.9	46.6	0.3
Bitten or struck by a mammal (including horses but not dogs)	14.6	0.3	48.7
Struck by, against or caught between objects	6.2	5.5	1.1
Motorcycle rider injured in transport accident	4.9	0.3	16.3
Pedestrian injured in transport accident	4.2	5.3	0.8
Special agricultural vehicle occupant injured in transport accident	3.9	0.0	..
Contact with venomous animals and plants	3.9	1.0	3.9
Unintentional poisoning by other substances other than drugs	3.9	1.1	3.5
Contact with agricultural machinery	3.6	0.0	..
Accidental drowning and submersion	3.6	2.3	1.6
Other external causes	35.4	37.5	..
<b>Total</b>	<b>100.1*</b>	<b>99.9*</b>	<b>..</b>

\*Column does not add to 100% due to rounding of annual average case numbers.



Some mechanisms of injury, although not always the most frequent, are associated with comparatively severe outcomes. Those mechanisms with an ICISS score below 0.941, indicating that the injury resulted in a significant threat to life, are shown in Table 5.

**Table 5: Severe cases by mechanism involved , hospitalised farm injury, 0–4 years, Australia 2000–01 to 2004–05**

Major external cause of injury	Annual average number of cases	Mean ICISS score
Car occupant injured in transport accident	1.6	0.869
Accidental drowning and submersion	2.2	0.885
Pedestrian injured in transport accident	2.6	0.902
Bitten or struck by mammal (including horses but not dogs)	9.0	0.915
Struck by, against or caught between objects	3.8	0.920
Pick-up truck or van occupant injured in transport accident	1.0	0.928
Special agricultural vehicle occupant injured in transport accident	2.4	0.935
Contact with heat and hot substances	1.6	0.935

Where the injured body region was specified, the head was the most common site of injury (Table 6).

**Table 6: Body region injured, hospitalised farm injury, 0–4 years, Australia 2000–01 to 2004–05**

Body region injured	Annual average number of cases	Per cent
Head	24	39.6
Shoulder and upper limb	10	15.9
Hip and lower limb	9	15.3
Trunk (neck, thorax, abdomen, lower back, lumbar spine and pelvis)	7	11.7
Other injuries not specified by body region	11	17.5
<b>Total</b>	<b>62*</b>	<b>100.0</b>

\*Does not equal the sum of values in the column above due to rounding of annual average case numbers.

The most common type of injury in this age group was an open wound (26.3%) followed by fractures (17.9%) and superficial injuries (10.4%) (Table 7).

**Table 7: Ten most frequent types of hospitalised farm injury, 0–4 years, Australia 2000–01 to 2004–05**

<b>Nature of injury</b>	<b>Annual average number of cases</b>	<b>Per cent</b>
Open wound (excluding eye)	16	26.3
Fracture (excluding tooth)	11	17.9
Superficial injury (excluding eye)	6	10.4
Intracranial injury (including concussion)	5	8.4
Burn/corrosion (excluding eye)	4	6.2
Poison/toxic effect (excluding bite)	2	3.9
Drowning, immersion	2	3.6
Amputation (including partial)	2	3.2
Internal organ	2	2.9
Bite (including envenomation)	2	2.9
Other types of injury	9	14.3
<b>Total</b>	<b>62*</b>	<b>100.0</b>

\*Does not equal the sum of values in the column above due to rounding of annual average case numbers.

The MLOS in hospital in the 0–4 year age group was 2.9 days. Stays in hospital ranged from 1–88 days.

An annual average of 11 (17.9%) cases had received an ICISS score indicating that the injuries were severe.

In the majority of cases, the injured person's place of usual residence was in the remote or very remote zone (age specific rates 20.0 and 20.4 separations per 100,000 population, respectively).

### 5–9 years

During the reporting period, at least 614 children between the ages of 5–9 years were hospitalised due to injuries sustained on farms. This equates to an annual average of 123 children. The annual average age-specific rate for males was 11.8 separations per 100,000 population and 6.4 per 100,000 for females.

Male cases (n=81, 66.1%) outnumbered female cases (n=42, 33.9%) in this age group.

The most commonly identified activities at the time of injury were sports 18 (14.7%) and leisure 16 (13.2%). Activity was not specified in 68.4% of cases.

In around a quarter of cases the mechanism of injury was a motorcycle (n=34, 27.7%). The majority of these cases (77.6%) involved males. The second most common external cause of injury was associated with riding an animal or being in charge of an animal drawn vehicle (n=21, 16.9%). Around two-thirds of these cases involved females (Table 8).

**Table 8: Ten most frequent external causes of hospitalised farm injury, 5–9 years, Australia 2000–01 to 2004–05**

Major external cause of injury	Farm (n=614)	Non-farm (n=27,457)	Farm: non-farm ratio
	Per cent	Per cent	
Motorcycle rider injured in transport accident	27.7	1.4	19.8
Animal rider or occupant of animal-drawn vehicle injured in transport accident	16.9	0.6	28.2
Unintentional falls	11.2	60.4	0.2
Special all-terrain or off-road vehicle injured in transport accident	5.5	0.1	55.0
Special agricultural vehicle occupant injured in transport accident	3.4	0.0	..
Bitten or struck by a mammal (including horses but not dogs)	3.4	0.1	34.0
Struck by, against or caught between objects	2.9	5.0	0.6
Contact with agricultural machinery	2.6	0.0	..
Contact with venomous animals and plants	2.6	1.1	2.4
Car occupant injured in transport accident	2.4	5.2	0.5
Other external causes	21.2	26.0	..
<b>Total</b>	<b>99.8*</b>	<b>99.9*</b>	<b>..</b>

\*Does not equal the sum of values in the column above due to rounding of annual average case numbers.

Table 9 provides details of the mechanism of injury for those cases in this age group that sustained injuries which posed a serious threat to life.

**Table 9: Severe cases by mechanism involved, hospitalised farm injury, 5-9 years, Australia 2000-01 to 2004-05**

Major external cause of injury	Annual average number of cases	Mean ICISS score
Contact with lifting devices	0.2	0.650
Accidental drowning and submersion	0.4	0.899
Pedal cycle	2.6	0.910
Bitten or struck by mammal (including horses but not dogs)	4.2	0.938
Contact with agricultural machinery	3.2	0.940

During the five-year study period there were 398 motorised and non-motorised transport related incidents. In 170 (43%) of these cases the injured person was travelling on a motorcycle.

Table 10 presents data for selected motorised vehicle types according to whether the injured person was the driver or a passenger. (Cases where the person's position in the vehicle was unknown were excluded from the denominator used to calculate the percentages shown in the table.) In a high proportion of motorcycle cases (84%), the injured person was the driver of the vehicle. A substantial proportion of those injured in ATV accidents were also driving the vehicle (59%).

**Table 10: Selected motorised vehicle types by injured person's status as driver or passenger, hospitalised farm injuries, 5-9 years, Australia 2000-01 to 2004-05**

Vehicle type	Driver	Passenger	Total
Car occupant injured in transport accident	13%	88%	101%*
Motorcycle rider injured in transport accident	84%	16%	100%
Special all-terrain or off-road vehicle occupant injured in transport accident	59%	41%	100%
Special agricultural vehicle occupant injured in transport accident	14%	86%	100%
Three-wheeled motor vehicle occupant injured in transport accident	25%	75%	100%

\*Row does not add to 100% as the result of rounding.

The most commonly injured body regions in this age group were the head (n=38, 31.1%) and the shoulder and upper limb (n=38, 30.6%) (Table 11).

**Table 11: Principal body region injured, hospitalised farm injuries, 5–9 years, Australia 2000–01 to 2004–05**

Principal body region injured	Annual average number of cases	Per cent
Head	38	31.1
Shoulder and upper limb	38	30.6
Hip and lower limb	23	18.4
Trunk (neck, thorax, abdomen, lower back, lumbar spine and pelvis)	15	12.1
Other injuries not specified by body region	10	7.8
<b>Total</b>	<b>123*</b>	<b>100.0</b>

\*Does not equal the sum of values in the column above due to rounding of annual average case numbers.

The most common type of injury in the 5–9 year age group was fractures (n=49, 39.7%) (Table 12).

**Table 12: Ten most frequent types of hospitalised farm injury, 5–9 years, Australia 2000–01 to 2004–05**

Nature of principal injury	Annual average number of cases	Per cent
Fracture (excluding tooth)	49	39.7
Open wound (excluding eye)	21	17.1
Intracranial (including concussion)	16	13.4
Superficial (excluding eye)	8	6.5
Internal organ	3	2.8
Burn/corrosion (excluding eye)	3	2.8
Bite (including envenomation)	3	2.4
Muscle/tendon	2	1.3
Amputation (including partial)	2	1.3
Dislocation	1	0.8
Other types of injury	15	11.9
<b>Total</b>	<b>123</b>	<b>100.0</b>

The MLOS for this age group was 2.7 days. The length of stay ranged from 1–56 days. An annual average of 17 (14.0%) cases had received an ICISS score indicating that the injuries posed a significant threat to life.

### 10–14 years

There were at least 1,146 hospitalisations in this age group during the reporting period due to injury on a farm. This equates to an annual average of 229 cases. The annual average age-specific rate of hospitalisation for males was 23.9 separations per 100,000 population, and 9.2 per 100,000 for females.

Residents of the remote zone had the highest age-specific rate of hospitalisation in this age group (an annual average of 93.0 separations per 100,000 population). This was followed by residents of the very remote zone where the rate was 82.0 per 100,000.

The most frequent mechanisms of injury were motorcycles (n=96, 41.7%) and riding an animal or being in charge of an animal-drawn vehicle (n=36, 15.9%) (Table 13). Cases involving motorcycles were most frequently males (87.2%), whereas the majority of animal rider cases were female (72.0%). There was a high farm:non-farm ratio with respect to being bitten or struck by a mammal, including horses but not dogs.

**Table 13: Ten most frequent external causes of hospitalised farm injury, 10–14 years, Australia, 2000–01 to 2004–05**

Major external causes	Farm (n=1,146)	Non-farm (n=42,436)	Farm : non-farm ratio
	Per cent	Per cent	
Motorcycle rider injured in transport accident	41.7	4.2	9.9
Animal rider or occupant of an animal-drawn vehicle injured in transport accident	15.9	1.1	14.5
Unintentional fall	5.4	43.7	0.1
Special all-terrain or off-road vehicle occupant injured in transport accident	5.0	0.3	16.7
Car occupant injured in transport accident	4.7	4.4	1.1
Bitten or struck by other mammals (including horses but not dogs)	3.1	0.1	31.0
Contact with venomous animals and plants	2.6	1.0	2.6
Contact with agricultural machinery	2.4	0.0	..
Pedal cyclist injured in transport accident	1.7	10.1	0.2
Struck by, against or caught between objects	1.7	6.7	0.3
Other external causes of injury	15.8	28.4	..
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>..</b>

Table 14 provides details of the mechanism of injury for those cases in this age group that sustained injuries which posed a serious threat to life.

**Table 14: Severe cases by mechanism involved, hospitalised farm injury, 10–14 years, Australia 2000–01 to 2004–05**

Major external cause of injury	Annual average number of cases	Mean ICISS score
Unintentional poisoning by substances other than drugs	0.2	0.826
Unintentional injury from firearms	1.4	0.836
Pedestrian injured in transport accident	2.8	0.919
Exposure to smoke, fire and flames	3.6	0.925
Pick-up truck or van occupant injured in transport accident	2.4	0.928
Special agricultural vehicle occupant injured in transport accident	3.0	0.935

During the five-year study period there were 842 motorised and non-motorised transport related incidents, 478 (57%) of which involved a person travelling on a motorcycle.

Table 15 presents data for selected motorised vehicle types according to whether the injured person was the driver or a passenger. (Cases where the person's position in the vehicle was unknown were excluded from the denominator used to calculate the percentages shown in the table.) The vast majority of those injured in motorcycle and ATV cases were driving the vehicle at the time of being injured (96% and 86% respectively).

**Table 15: Selected motorised vehicle types by injured person's status as driver or passenger, hospitalised farm injury, 10–14 years, Australia 2000–01 to 2004–05**

Vehicle type	Driver	Passenger	Total
Car occupant injured in transport accident	41%	59%	100%
Motorcycle rider injured in transport accident	96%	4%	100%
Pick-up truck or van occupant injured in transport accident	40%	60%	100%
Special all-terrain or off-road vehicle occupant injured in transport accident	86%	14%	100%
Special agricultural vehicle occupant injured in transport accident	33%	67%	100%

The shoulder and upper limb was the most commonly injured body region (n=68, 29.8%). This was followed by the head (n=63, 27.6%) (Table 16).

**Table 16: Principal body region injured, hospitalised farm injury, 10–14 years, Australia 2000–01 to 2004–05**

Principal body region injured	Annual average number of cases	Per cent
Shoulder and upper limb	68	29.8
Head	63	27.6
Hip and lower limb	59	25.9
Trunk (neck, thorax, abdomen, lower back, lumbar spine and pelvis)	22	9.7
Other injuries not specified by body region	16	7.0
<b>Total</b>	<b>229*</b>	<b>100.0</b>

\*Does not equal the sum of values in the column above due to rounding of annual average case numbers.

Fractures were by far the most common type of hospitalised injury sustained in this age group (n=97, 42.1%) (Table 17).

**Table 17: Ten most frequent types of hospitalised farm injury, 10–14 years, Australia 2000–01 to 2004–05**

Nature of principal injury	Annual average number of cases	Per cent
Fracture (excluding tooth)	97	42.1
Open wound (excluding eye)	34	15.0
Intracranial (including concussion)	32	14.0
Superficial (excluding eye)	10	4.5
Internal organ	7	2.9
Burn/corrosion (excluding eye)	6	2.6
Bite (including envenomation)	6	2.6
Muscle/tendon	3	1.3
Dislocation	3	1.2
Sprain/strain	3	1.2
Other	29	12.5
<b>Total</b>	<b>230</b>	<b>99.9*</b>

\*Does not equal the sum of values in the column above due to rounding of annual average case numbers.

The mean length of stay in hospital for 10–14 year olds was 2.8 days. The period in hospital ranged between 1–87 days.

An annual average of 29 (12.7%) cases had received an ICISS score which indicated that the injuries sustained were severe.

Among the cases in this age group, where an activity code had been assigned, sports were the pursuit most commonly being engaged in at the time of injury (n=33, 14.2%). This was followed by leisure activities (n=26, 11.4%). In an annual average of 8 (3.4%) cases the person was recorded as working for income and in an annual average of 15 (6.5%) cases the person was engaged in other types of work on the farm. The type of activity was not specified in 64.4% of cases.



### 15–19 years

There were 1,858 hospitalisations in this age group during the reporting period. This equates to an annual average of at least 372 cases. The age-specific annual average rate for males was 42.6 separations per 100,000 population and that for females was 11.4 per 100,000 population.

The most frequent external causes of injury are shown in Table 18. The majority of cases involved a motorcycle (35.4%). The second most frequent group of hospitalisations involved the riding of animals or being an occupant of an animal-drawn vehicle (13.8%).

The vast majority of motorcycle riders were male (91%). Animal rider cases were more evenly distributed, with the majority being female (Males 45.7%; Females 54.3%).

**Table 18: Ten most frequent external causes of hospitalised farm injury, 15–19 years, Australia 2000–01 to 2004–05**

Major external causes of injury	Farm (n=1,858)	Non-farm (n=63,133)	Farm: non-farm ratio
	Annual average proportion	Annual average proportion	
Motorcycle rider injured in transport accident	35.4	6.8	5.2
Animal rider or occupant of an animal-drawn vehicle occupant injured in transport accident	13.8	1.0	13.8
Bitten or struck by other mammals (including horses but not dogs)	7.3	0.2	36.5
Car occupant injured in transport accident	5.3	21.2	0.3
Contact with agricultural machinery	4.1	0.0	..
Unintentional fall	3.7	18.3	0.2
Struck by, against or caught between objects	3.6	4.6	0.8
Special all-terrain or off-road vehicle occupant injured in transport accident	2.9	0.3	9.7
Caught, crushed in or between objects	2.6	0.7	3.7
Contact with knife, sword or dagger	2.1	1.0	2.1
Other external causes	19.2	45.9	..
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>..</b>

Annual rates of hospitalisation among 15–19 year olds rose markedly according to the remoteness of their place of residence. The age-specific rates for the zones with the highest rates, the remote and very remote zones, were 263.2 and 400.6 separations per 100,000 population, respectively.

Table 19 provides details of the mechanism of injury for those cases in this age group that sustained injuries which posed a serious threat to life.

**Table 19: Severe cases by mechanism involved, hospitalised farm injury, 15–19 years, Australia 2000–01 to 2004–05**

Major external cause of injury	Annual average number of cases	Mean ICISS score
Unintentional injury from firearms	1.6	0.861
Pick-up truck or van occupant injured in transport accident	3.6	0.881
Pedestrian injured in transport accident	2.0	0.912
Special agricultural vehicle occupant injured in transport accident	4.8	0.924
Exposure to smoke, fire and flames	3.4	0.929

Over the five-year period, there were 1,138 motorised and non-motorised transport related incidents. In 567 (58%) of these cases the injured person was travelling on a motorcycle.

Table 20 presents data for selected motorised vehicles according to whether the injured person was the driver or a passenger. (Cases where the person's position in the vehicle was unknown were excluded from the denominator used to calculate the percentages shown in the table.) In the vast majority of cases involving motorcycles, ATVs and three-wheeled motor vehicles, the injured person was the vehicle driver.

**Table 20: Selected motorised vehicle types by injured person's status as driver or passenger, hospitalised farm injury, 15–19 years, Australia 2000–01 to 2004–05**

Vehicle type	Driver	Passenger	Total
Car occupant injured in transport accident	66%	34%	100%
Motorcycle rider injured in transport accident	97%	3%	100%
Pick-up truck or van occupant injured in transport accident	46%	54%	100%
Special all-terrain or off-road vehicle occupant injured in transport accident	91%	9%	100%
Special agricultural vehicle occupant injured in transport accident	73%	27%	100%
Three-wheeled motor vehicle occupant injured in transport accident	83%	17%	100%

The shoulder and upper limb was the most frequently injured body region (n=114, 30.8%) (Table 21). The pattern of injured body regions differed for motorcyclists (Hip and lower limb n=42, 31.7%; Shoulder and upper limb n=41, 30.9%; Head n=31, 23.9%). For animal riders, the head was the most frequently injured part of the body (n=19, 36.7%).

**Table 21: Most frequently injured body regions, hospitalised farm injury, 15–19 years, Australia 2000–01 to 2004–05**

Principal body region injured	Annual average number of cases	Annual average proportion
Shoulder and upper limb	114	30.8
Hip and lower limb	90	24.3
Head	90	24.2
Trunk (neck, thorax, abdomen, lower back, lumbar spine and pelvis)	49	13.2
Other injuries not specified by body region	28	7.5
<b>Total</b>	<b>372*</b>	<b>100.0</b>

\*Does not equal the sum of values in the column above due to rounding of annual average case numbers.

The most common type of injury was a fracture (n=130, 35.0%), and open wounds and intracranial injuries were also fairly frequent (n=59, 15.8% and n=43, 11.6% respectively) (Table 22).

**Table 22: Ten most frequent types of hospitalised farm injury, 15–19 years, Australia 2000–01 to 2004–05**

Nature of principal injury	Annual average number of cases	Per cent
Fracture (excluding tooth)	130	35.0
Open wound (excluding eye)	59	15.8
Intracranial (including concussion)	43	11.6
Superficial (excluding eye)	25	6.6
Dislocation	12	3.2
Sprain/strain	11	2.9
Internal organ	9	2.4
Muscle/tendon	8	2.2
Amputation (including partial)	8	2.1
Bite (including envenomation)	7	1.8
Other external causes	61	16.4
<b>Total</b>	<b>372*</b>	<b>100.0</b>

\*Does not equal the sum of values in the column above due to rounding of annual average case numbers.

An annual average of 50 (13.5%) cases received an ICISS score indicating that the injuries posed a significant threat to life.

The mean length of stay in hospital in this age group was 2.8 days. Stays ranged from 1–180 days.

For those cases where activity was specified, an annual average of 136 (36.7%) cases occurred while working for income and an annual average of 17 (4.6%) occurred while engaged in other types of work. 29 (7.9%) cases of injury occurred while playing sport. The type of activity being undertaken was not specified in 44.3% of cases.

## Discussion

This investigation of five years of hospitalised farm injury events in children identified 3,926 cases during the five years to 30 June 2005. Most injuries occurred in young males aged 15–19 years. The most common mechanism of hospitalised injury on farms was found to be motorcycles (32.3% of farm injury compared with only 2.4% of non-farm injury). Even at young ages these vehicles were found to be a frequent cause of injury (e.g. they are the source of over a quarter of the hospitalisations in the 5–9 year age group). The next most common mechanism of hospitalised farm injury in children was horse riding which accounted for 13.5% of cases.

Rates of child injury on farms reported throughout the briefing are based on general population denominators. As mentioned earlier, the lack of data on the number of children on farms, and periods they spend there, and the things that they do, prevented us from reporting rates in terms of exposure to hazards. In addition to the estimate of 134,729 based on 2001 Census data that was cited earlier in this briefing (ABS 2003), a survey of 859 farmers by Fragar et al. found that 56% of respondents had children under the age of 15 resident on their farms and 26% indicated that children visited their farm at least once each year (Fragar et al. 2005).

## Emergency department presentations

Several studies have been published in recent years on the number of farm-related injuries presenting to emergency departments. In 2006, the Queensland Injury Surveillance Unit (QISU) published a study examining emergency department presentations for rural/farm injury in Queensland. Over an 8 year period (1998–2005) 1,417 cases of farm injury to children under the age of 15 were identified (these included cases that occurred in a farmhouse). 24% (n=346) of these cases involved a child between the ages of 0–4 years. The QISU study found that, in 25% of cases, the external cause of injury was a horse and in 13% a motorcycle (Shepherd et al. 2006).

An earlier report on farm injury in Victoria, by the Monash University Accident Research Unit (MUARC) looked at emergency department presentations during the period 1989–1997 and found 238 cases of children under the age of 15 (Day et al. 1997). MUARC found that 27.3% of cases were horse related and 20.6% involved a motorcycle.

## Children and work related injuries

The QISU study referred to above identified eight children who were injured while undertaking paid work, and a further 96 while carrying out unpaid work (Shepherd et al. 2006). The current study identified 736 cases over the five year period where an activity code indicating that a child was working for income was present and 171 cases where the child was engaged in other types of work. While the bulk of cases of working for income were confined to 15–19 year olds, a total of 54 cases occurred in children up to and including 14 years of age. These figures are likely to be an underestimate of actual incidence for a number of reasons, including the absence of information about activity at time of injury for a high proportion of cases.

## Horse and other animal related injuries

Aside from motorcycle related injuries, horse and other animal related injuries were the next most prevalent injury type for all but the youngest age group examined in the present study. Similarly, in both the emergency department studies identified above, horses were also the cause of a significant number of presentations. The QISU emergency department study found that a kick from a horse was the cause of injury for 60 children and that for around half of these children the kick impacted on the head or

face. The MUARC emergency department study found the 0–4 year age group was over-represented among injuries associated with other animals.

A study by Williams and Ashby in 1995 focused on the issue of horse related injuries and 1,330 cases were identified in the Victorian Injury Surveillance System (VISS). (At that time, VISS did not contain records of all emergency department presentations in Victoria but can be said to have reasonable coverage of major hospitals.) This subset of cases included all horse related cases irrespective of where they had occurred. The study found that the age groups with the greatest case numbers of injury were 10–14 year olds and 15–19 year olds. While the report does not specify whether these child horse related injuries occurred on farms, it does indicate that only 49% of rural child riders were wearing a helmet at the time of the injury (Williams & Ashby 1995).

A retrospective study of admissions to the Westmead Children's Hospital in Sydney over a 12 year period to December 1999 found that, of 97 children with horse-related injuries (26 cases occurred on a farm), 38% were wearing a helmet and 33% were not. There was no documentation for 29% of the cases (Holland et al. 2001).

From the survey of farmers conducted by Fragar et al. (2005) it was clear that most respondents believed that horses posed a low risk to children.

### Motorcycle injuries

The results of the present study and the emergency department studies from Victoria and New South Wales, referred to above, demonstrate that motorcycle related injuries are by far the most common form of serious injury to children on farms. In addition to these studies, a 2001 survey of 1,382 randomly selected farmers in Victoria shows the exposure to risk of a crash on a motorcycle or all terrain vehicle (ATV) to be fairly high, with motorcycles present on 70% of the farms surveyed. The survey found that 14% of the total riding population was less than 15 years of age, and 71% of these reported riding ATVs. Less than 1% of the ATVs identified had an engine capacity less than 90 cc, which means that most young riders were using adult-sized vehicles (Day et al. 2006).

In addition, apparently low rates of helmet wearing increase the potential for injury in the case of an accident. A survey of motorcycle riders published in 2000 found that only 33.3% of those in the 0–14 age group and 16.3% of those aged 15–19 years reported that they always wore a helmet when riding on farms (Schalk & Fragar 2000).

### Preventing farm injury

A characteristic of life on a farm is the frequent absence of a clear demarcation between home and work (Farmsafe Australia Inc.). Often, there are no physical barriers between farmhouse and farm (e.g. at least 40% of farms in Queensland with children under 5 do not have a secure fenced area for play) (Ferguson 2000).

From an early age, many farm children are exposed to the hazards associated with farm work (farm machinery, animals, transport, dams, etc), and the attention of busy parents is often diverted away from the supervision of children. In addition, as they grow older, children increasingly participate in jobs around the property. Sometimes these jobs may be beyond their cognitive and other abilities.

A broad range of prevention measures are suggested in the literature—too many to refer to in this report. Among the general recommendations is the importance of providing very young children with a safely fenced area to play away from the places where hazards are present (Shepherd et al. 2006). The need for providing child care options for farming families is also emphasised (Farmsafe Australia Inc. 1999). Regular inspections of the farm environment and work practices should be made in order to identify hazards (Shepherd et al. 2006).

With respect to the two most common causes of hospitalised injury on farms—motorcycles and horses—several measures are proposed in published literature. It is widely recommended that helmet wearing be promoted for both motorcycle and horse riders (Holland et al. 2001; Day et al. 1997; Farmsafe Australia Inc. 2004), and perhaps be made mandatory (Shepherd et al. 2006). It has also been recommended that appropriate training should be given to both groups (Schalk & Fragar 2000; Finch & Watt 1996). In addition, conditions should be imposed on children using motorcycles and ATVs (e.g. a maximum riding speed, no children under the age of 16 to use an adult ATV; no passengers on an ATV) (Shepherd et al. 2006). Various measures could also minimise the risk of injury to horse riders (e.g. the selection of an appropriate horse to match the rider's ability (Williams & Ashby 1995); always avoiding the back legs of horses) (Day et al. 1997).

Farmsafe Australia, a partnership of industry and government agencies, produced a framework for a national strategy in 1999 to provide guidance in the prevention of farm injury. The document was developed through extensive consultation drawing on differing expertise from a range of sectors. The first phase of implementation began in 2002 and phase 2 is due to end in August 2007 (Farmsafe Australia Inc.).

## Conclusion

Injury prevention programs for children and young people on farms should focus on activities that most often result in serious injury, in particular motorbike riding and horse riding. In addition, thought must also be given to the wellbeing of children visiting farms who may not be familiar with such an environment and hence be at even greater risk from some hazards.

## Resources

A wide range of publications relating to farm injury and its prevention are available at the Farmsafe website: <[www.farmsafe.org.au](http://www.farmsafe.org.au)>. Several publications are also available at the website for the Rural Industries Research and Development Corporation: <[www.rirdc.gov.au](http://www.rirdc.gov.au)>.

## Data issues

### Data source

The data on hospital separations were provided by the Australian Institute of Health and Welfare (AIHW), from the National Hospital Morbidity Database (NHMD).

### Confidence intervals

Nearly all injury/poisoning cases are thought to be included in the data reported, representing minimal risk of sampling error. Data are based on the financial year of separation, but choice of this time period is arbitrary. Use of calendar year would result in different rates, particularly where case numbers are small. Confidence intervals (95%; based on a Poisson distribution) were calculated using a method elsewhere described (Anderson & Rosenberg 1998). Asymmetrical confidence intervals were calculated for case numbers up to 100. Symmetrical intervals, based on a normal approximation, were calculated where case numbers exceed 100.

### ICISS survival probability score

The ICISS method involves calculating a Survival Risk Ratio (SRR), i.e. the probability of survival, for each individual injury diagnosis code as the ratio of the number of patients with that injury code who have not died to the total number of patients diagnosed with that code. Thus, a given SRR represents the likelihood that a patient will survive a particular injury. Each patient's ICISS score (survival probability) is then the product of the probabilities of surviving each of their injuries individually. This may be

a single SRR, as in the case of a patient with a single injury, or it may be multiple SRRs, as in the case of a patient with multiple injuries (Stephenson et al. 2003).

## References

- ABS (Australian Bureau of Statistics) 2003. Australian social trends. Family and community—Living arrangements: Farming families. ABS cat. no. 4102.0. Canberra: ABS.
- AIHW (Australian Institute of Health and Welfare) 2001. National Health Data Dictionary. Cat. no. HWI30. Canberra: AIHW.
- Anderson R & Rosenberg H 1998. Age standardisation of death rates: implementation of the year 2000 standard. National Vital Statistics Report 47 (3):117.
- Day L, Ashby K & Stathakis V 1997. Unintentional farm injury. Hazard 33:1–13.
- Day L, Stathakis V & O'Hare M 2006. Motorcycle deployment and rider characteristics on Victorian farms. Australian Journal of Rural Health 14:190–5.
- Farmsafe Australia Inc. 1999. Child safety on farms: a framework for a national strategy. Moree, New South Wales: Farmsafe Australia.
- Farmsafe Australia Inc. 2004. Child safety on farms: a guidance note. Moree, New South Wales: Farmsafe Australia.
- Ferguson K 2000. Farm safety survey final report. Brisbane: Department of Employment, Training and Industrial Relations, Queensland Government.
- Finch C & Watt G 1996. Locking the stable door: preventing equestrian injuries. Report no. 103. Melbourne: Monash University Accident Research Unit.
- Fragar L, Stiller L & Thomas P 2005. Child injury on Australian farms: the facts. Rural Industries Research and Development Corporation and Australian Centre for Agriculture Health and Safety.
- Holland A, Roy G, Goh V, Ross F, Keneally J & Cass D 2001. Horse-related injuries in children. Medical Journal of Australia 175.
- NCCH (National Centre for Classification in Health) 2004. The International Statistical Classification of Diseases and Related Health Problems, tenth revision, Australian Modification. 4th Edition. Sydney: NCCH.
- Schalk T & Fragar L 2000. Injury associated with farm motorcycles on farms in Australia. Australian Centre for Agricultural Health and Safety, University of Sydney.
- Shepherd M, Barker R, Scott D & Hockey R 2006. Rural/farm injury in Queensland. Injury Bulletin 92. Queensland Injury Surveillance Unit.
- Stephenson S, Henley G, Harrison J & Langley J 2003. Diagnosis-based injury severity scaling. AIHW cat. no. INJCAT 59. Adelaide: AIHW.
- Williams F & Ashby K 1995. Horse related injuries. Hazard 23:1–13.

**Correspondence regarding this report can be addressed to the AIHW National Injury Surveillance Unit at Flinders University, GPO Box 2100, Bedford Park, South Australia 5042, Tel: 08 8201 7602, Fax: 08 8374 0702, E-mail: [nisu@flinders.edu.au](mailto:nisu@flinders.edu.au)**

ISSN 1833-024X  
INJCAT 106