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Horse-related injury in Australia

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Introduction

Horse riding is a popular sport and recreational activity in Australia. In the Equestrian Federation of Australia, with a membership of 13,800 equestrians, 28,500 horses are registered to compete in events sponsored by its 500 affiliated clubs. An additional 60,000 equestrians are members of Pony clubs and about 5,000 horse riders actively compete in rodeos (personal communication, Denzil O'Brien, The Equestrian Federation of Australia, February 2000).

Deaths and injury from horse-related activities have been well documented in Australia and overseas (Pounder 1984), (Bixby-Hammett & Brooks 1990), (Ingemarson et al. 1989), and (Paix 1999), but studies using national population figures to calculate mortality and morbidity rates for horse-related injury in Australia and overseas are few. Estimates of injury rates based on exposure (riding hours or horse riding participation) among all classes of horse riders combined are generally of the order of one injury per 1000 riding hours. This rate suggests horse riding is more dangerous than motorcycle riding and automobile racing (Gierup et al. 1976); (Firth 1985); (Nelson et al. 1994); and (Paix 1999). The danger from horse riding is compounded by the interaction of two species, human and horse, which may result in unpredictable events.

Although in population terms, the frequency of death and injury is low, the severity of horse related injuries is high, particularly in children and young adults (based on estimated numbers of annual sports injuries and hospitalisations) (Silver and Lloyd Parry 1991). Horse riders were recognised in the Commonwealth Department of Human Service and Health's Injury Prevention and Control Implementation Strategy as one of four priority population groups to be targeted in order to reduce severe injuries in sport and recreational activities (Nutbeam et al. 1993).

This document reports deaths and injuries associated with riding animals or from animal-drawn vehicle accidents and reviews their magnitude in Australia. In this report, it is assumed that deaths and injuries of "riders" were horse-related as it is assumed that deaths and injuries from riding animals other than horses would be rare. Australian Bureau of Statistics (ABS) mortality unit record data collection, 1979–98, and hospital separation unit record data collection, 1996–97 provided by the Australian Institute of Health and Welfare (AIHW) were used in this review. Reference is also made to other data sources and overseas horse-related injury studies.

Deaths and hospital separations for horse-related injury were selected from the 9th International Classification of Diseases (ICD-9) animal-related injury external cause code categories E810.5 to E825.5 (motor vehicle traffic accident) and E826.2 to E829.2 and E826.3 to E829.3 (other road vehicle accident) where fourth-digit subdivisions refer to rider of animal or occupant of animal-drawn vehicle. It is assumed that horses are the animal most likely to be associated with these external cause category subdivisions. Although subdivisions of E-code category 906 ('other injury caused by animals') contain external causes ('fallen on by horse or animal not being ridden'; 'run over by animal, not being ridden'; 'stepped on by animal, not being ridden'; and to a lesser extent, 'animal bite') which are known to cause injury and death in horse riders or handlers, they cannot be used to select deaths and hospital separations attributed specifically to horses. These subdivisions do not distinguish between horses and other animals and will not be used in this review. Data issues, with a summary table of horse-related E-codes (Table A) are discussed in the section "Data Issues".

Mortality data

Between 1979–98, there were an estimated 20 horse-related deaths per annum in Australia. The external cause of the 410 deaths during this 20-year period are summarised in Table 1. Eight per cent of the deaths (n=33) were caused by motor vehicle traffic accidents involving a collision with horse riders or horse-drawn vehicles, or during animal-drawn vehicle accidents. Ninety-two per cent of the deaths (n=377) occurred during horse riding accidents, with 54 per cent (n=224) of the deaths in males. For all external cause categories, males accounted for about 60 per cent of the deaths (n=248).

No deaths were registered to other codes in the range E810 to E825 where the fourth digit is '5' ('rider of animal; occupant of animal-drawn vehicle'), nor to other codes in the range E826 to E829 where the fourth digit is '2' ('rider of animal') or '3' ('occupant of animal-drawn vehicle').

Table 1: External cause of estimated horse-related deaths, Australia 1979–98.

External cause	Males		Females		Persons	
	Counts	%	Counts	%	Counts	%
Motor vehicle traffic accident involving collision with animal rider or animal-drawn vehicle (E813.5)	7	1.7	6	1.5	13	3.2
Motor vehicle traffic accident involving collision with pedestrian and animal-drawn vehicle (E814.5)	1	0.2	0	0.0	1	0.2
Animal-drawn vehicle accident (E827.3)	16	3.9	3	0.7	19	4.6
Accident involving animal being ridden (E828.2)	224	54.6	153	37.3	377	92.0
All horse-related external causes	248	60.5	162	39.5	410	100.0

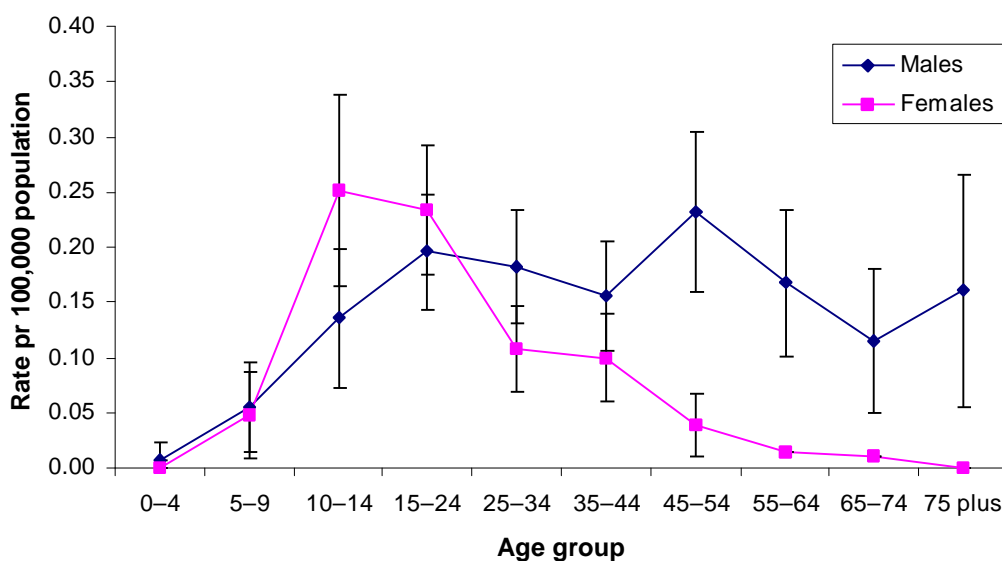
Although 20 deaths per year in Australia are few in number and yields a mean annual rate of 0.13 deaths per 100,000 population, the rate in terms of horse riding participants is of the order of 7.8 horse-related deaths per 100,000 participants per year (based on 257.5 thousand horse riding participants reported for the year 1997 (Australian Bureau of Statistics (1999))). Because of small numbers of horse-related deaths each year, rates are quite variable over the 20-year period. When rates are calculated for the 10-year periods 1979–88 and 1989–98, there is a decline in the horse-related death rate from 0.17 deaths per 100,000 population in 1979–88 to 0.08 deaths per 100,000 population in 1989–98.

In Table 2, each E-code category of horse-related injury deaths for the 20-year period reviewed, are presented for age-specific groups. Riders, particularly in age groups 15 to 24 years of age and 35 to 54 years of age, appear to be of greatest risk of lethal horse-related injury and account for 54 per cent (n=221) of the deaths. Examination of these cases indicated that for age-group 15 to 24 years, 54 per cent of the deaths in this age group (n=61) were females and for age group 35 to 54 years, 71 per cent (n=76) were males (possibly reflecting more professional (work-related) horse riding activity in older males than females, hence more risk of lethal injuries) (Pounder 1984).

In Figure 1, age-specific rates of injury deaths from horse-related injury are presented for both sexes. Because of the low number of reported deaths and data variability in each age group, 20-year population averages were used in rate calculations. It is evident from the 95% confidence intervals, based on the Poisson distribution, that for age groups 0 to 44 years of age, there is statistically no significant difference between horse-related death rates in males and females. At age 45 years and above, the death rates in males are significantly higher than females. This is in agreement with Australian and overseas reports on lethal horse-related injuries.

Table 2: Estimated horse-related injury deaths by age group and external cause category, Australia 1979–98 (counts and percentages)

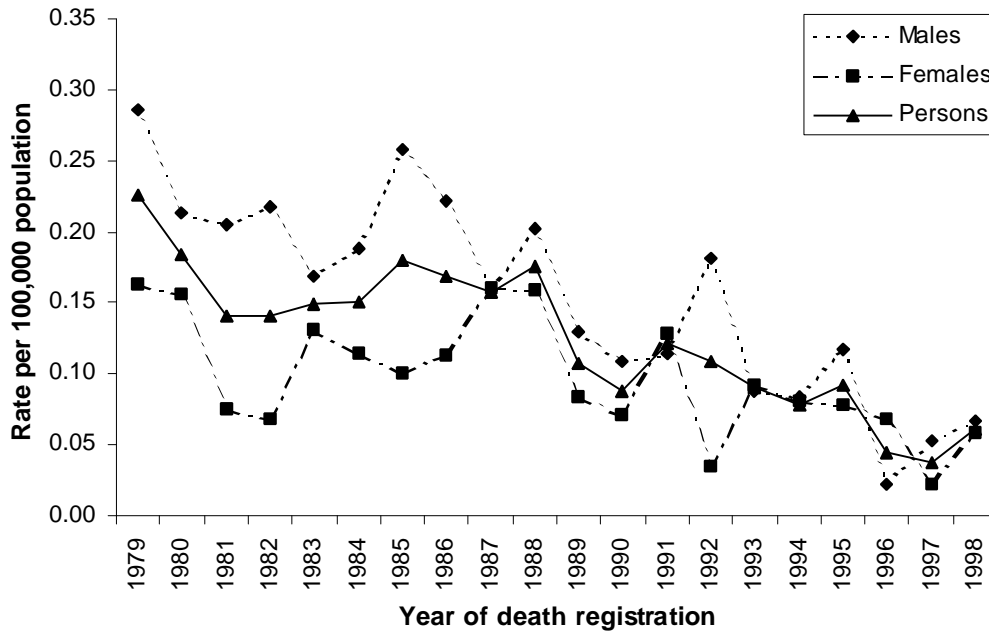
Age group	External cause category									
	Motor vehicle traffic accident involving collision with animal rider or animal-drawn vehicle		Motor vehicle traffic accident involving collision with pedestrian and animal-drawn vehicle		Animal-drawn vehicle accident		Accident involving animal being ridden		All horse-related causes	
	Count	%	Count	%	Count	%	Count	%	Count	%
0 to 4	0	0.0	0	0.0	1	5.3	0	0.0	1	0.2
5 to 9	0	0.0	0	0.0	1	5.3	12	3.2	13	3.2
10 to 14	2	15.4	0	0.0	0	0.0	48	12.7	50	12.2
15 to 24	2	15.4	0	0.0	2	10.5	110	29.2	114	27.8
25 to 34	4	30.8	0	0.0	2	10.5	71	18.8	77	18.8
35 to 44	1	7.7	0	0.0	1	5.3	59	15.6	61	14.9
45 to 54	2	15.4	1	100.0	3	15.8	40	10.6	46	11.2
55 to 64	2	15.4	0	0.0	4	21.1	20	5.3	26	6.3
65 to 74	0	0.0	0	0.0	2	10.5	11	2.9	13	3.2
75 plus	0	0.0	0	0.0	3	15.8	6	1.6	9	2.2
All ages	13	100.0	1	100.0	19	100.0	377	100.0	410	100.0



Note: Error bars indicate 95% confidence intervals for crude rates. Rates are based on 20-year population averages.

Figure 1: Age-specific estimated death rates from horse-related injury by sex, Australia 1979–98.

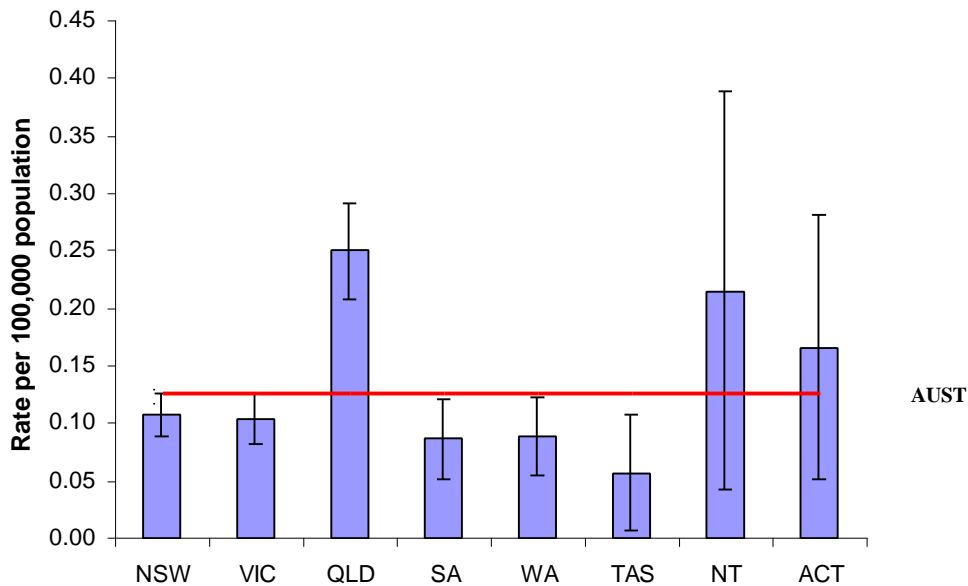
Age-adjusted death rates from horse-related injuries by sex during the period 1979 to 1998 are presented in Figure 2. Because of small numbers of horse-related deaths reported annually and their variability in number each year, 20-year population averages were used to calculate crude rates and to reduce the variability in age-adjusted rates. Interpretation of these data must be made with caution, due to this variability over the 20-year time period. An examination of age-adjusted death rates appears to indicate a decline in horse-related injury death rate in both sexes over the 20-year period.



Note: Age-adjusted rates based on E-code categories E813.5, E814.5, E827.3, and E828.2.

Figure 2: Age-adjusted rates of estimated injury deaths from horse-related injury by sex, Australia 1979–1998.

Crude rates of horse-related deaths by state and territory of death registration are presented in Figure 3. It is evident from the 95% confidence intervals, based on the Poisson distribution, that Queensland and Tasmania have horse-related death rates that are statistically different from the national rate of 0.13 deaths per 100,000 population. In Queensland, the rate of 0.25 horse-related deaths per 100,000 population, is significantly higher than the national rate and rates in all other states, but not significantly higher than the rates in Northern Territory or the Australian Capital Territory. In Tasmania, the rate of 0.06 horse-related deaths per 100,000 population is significantly lower than the national rate and the rate in Queensland, but not rates of any other state or territory.



Note: Error bars indicate 95% confidence intervals for crude rates. Rates are based on 20-year population averages.

Figure 3: Crude rate of estimated horse-related deaths by state and territory of death registration, Australia 1979–98.

Hospital separations data

In 1996–97, there were 644,407 hospital separations of people in Australia and 0.5 per cent (n=3,539) were estimated to be due to horse-related injury. Hospital separations can include multiple admissions for some patients, particularly when they are transferred to other acute care hospitals or from one ward to another. To offset the effect of multiple admissions and to have a dataset of acute admissions for horse-related hospitalisations, a selection method for estimating new incident cases was used and is described in the section “Data Issues”. Using this selection method, estimated incident cases of horse-related injury hospitalisations during 1996–97 were 3,124 cases.

Estimated incident cases and their horse-related external causes are presented in Table 3. Most cases were riders of horses involved in a riding accident. These cases were admitted at a rate of 16.2 estimated incident cases of horse-related injury per 100,000 population and accounted for 96 percent of the cases (n=2,989). Horse-rider injuries from motor vehicle accidents and non-motor road-vehicle accidents were few (135 cases), with injuries due to animal-drawn vehicles and their occupants predominating in this group (53%, n=72 cases).

Table 3: Estimated incident cases of horse-related injury by external cause of injury, Australia 1996–97.

External cause of injury	Count	Rate
Motor vehicle traffic accidents involving rider of animal, or occupant of animal-drawn vehicle (E810-825/.5)	34	0.2
Other road vehicle accident involving rider of animal, or occupant of animal-drawn vehicle (E826-827/.2,.3)	101	0.6
Ridden animal accident, animal rider injured ('horse rider')	2989	16.2
All horse-related injuries	3124	17.0

In Figure 4, age-specific rates of estimated incident cases of horse-related injury are presented for both sexes. It is evident that horse-related injuries are common in children and young adults of both sexes. Estimated incident case numbers are 1.4 times higher for females than for males (n=1,809 vs 1,315). From 5–34 years of age, female rates were significantly higher than male rates, with a maximum rate of 73.5 estimated incident cases of horse-related injury per 100,000 population occurring at 10–14 years of age. At ages greater than 34 years, female rates declined and were significantly lower statistically than male rates at 55 to 74 years of age. This pattern may reflect the shift in the horse riding population from young amateur female riders to older male professionals.

The predominance of young amateur female horse riders with their high exposure to the hazards associated with horse riding may account for the high injury rates in this group rather than the risk factors of female gender and youth (Buckley, Chalmers et al. 1993).

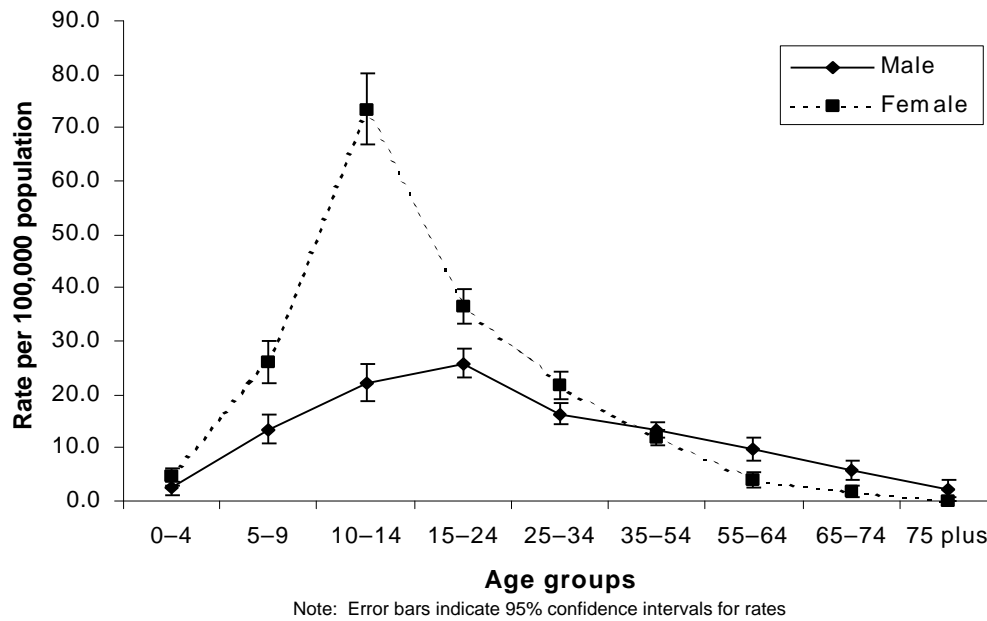


Figure 4: Age-specific rates of estimated incident cases of horse-related injury by sex, Australia 1996-97.

Crude rates of estimated incident cases of horse-related injury by state and territory of residence are presented in Figure 5. It is evident from the 95% confidence intervals, based on the Poisson distribution, that Queensland, with a rate of 29.4 estimated incident cases per 100,000 population, is significantly higher statistically than the national rate of 16.8 estimated incident cases per 100,000 population and higher than the rate in all states and the Australian Capital Territory. Rates in Victoria, South Australia, and the Australian Capital Territory (11.3, 11.4, and 5.8 estimated incident cases per 100,000 population, respectively) were significantly lower statistically than the national rate and the rate in New South Wales, Queensland, and Western Australia. The pattern of horse-related injury (highest rates in Queensland and lower rates in Victoria and South Australia) is similar to the death rate for these states (see Figure 3).

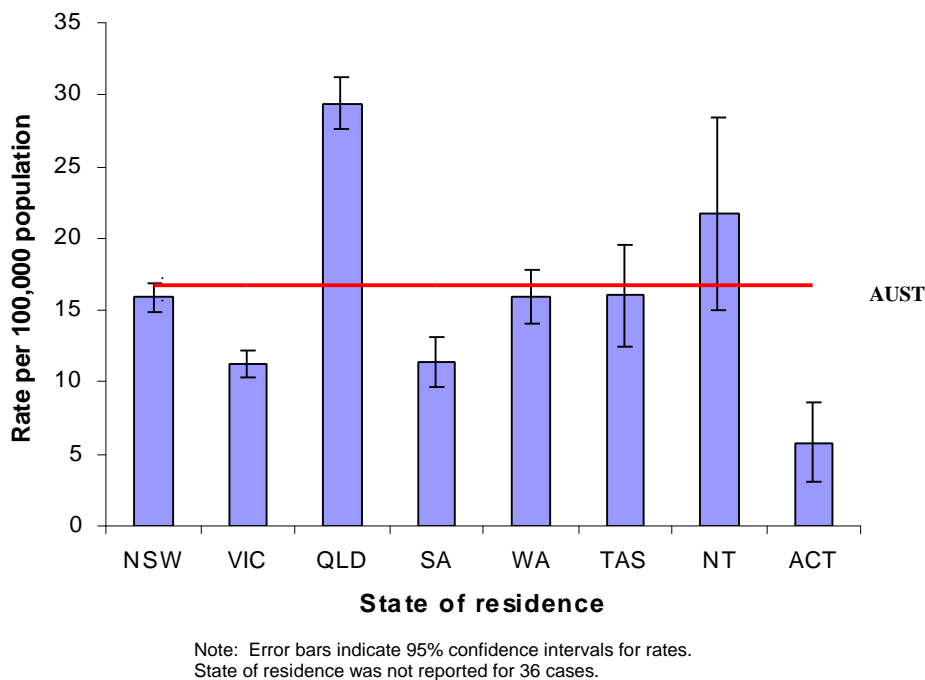


Figure 5: Crude rate of estimated incident cases of horse-related injury by state and territory of residence, Australia 1996-97.

Estimated incident cases of horse-related injury by state of residence and regional distribution are presented in Table 4. Incident cases of horse-related injuries are distributed widely in Australia. Over one-third of the cases occurred in capital cities and suburbs, with the highest number in New South Wales (13.3%, n=403 cases). Queensland and New South Wales had 67 per cent (n=1023) of the rural cases, possibly as a result of riding and handling of horses recreationally and on farms and stations. Many equestrian sporting events are also held in rural areas. Queensland, with the highest rate of estimated incident cases of horse-related injury, had 70 per cent of its cases from remote regions of the state. Given the severe nature of many horse-related injuries, retrieval of injured riders would be of a particular concern in these remote regions.

Table 4: Estimated incident cases of horse-related injury by state and territories of residence and rural and remote area (RRMA) regions, Australia 1996–97 (counts and table percentages).

State of residence	Capital cities and suburbs		Rural centres		Rural area		Remote centres		Remote area		All RRMA regions	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
NSW	403	13.3	176	5.8	367	12.1	0	0.0	28	0.9	974	32.1
VIC	235	7.7	85	2.8	178	5.9	0	0.0	2	0.1	500	16.5
QLD	229	7.5	160	5.3	320	10.5	97	3.2	180	5.9	986	32.4
SA	75	2.5	13	0.4	74	2.4	0	0.0	6	0.2	168	5.5
WA	127	4.2	30	1.0	67	2.2	20	0.7	36	1.2	280	9.2
TAS	24	0.8	13	0.4	36	1.2	0	0.0	3	0.1	76	2.5
NT	7	0.2	0	0.0	5	0.2	12	0.4	13	0.4	37	1.2
ACT	15	0.5	0	0.0	3	0.1	0	0.0	0	0.0	18	0.6
AUST	1115	36.7	477	15.7	1050	34.6	129	4.2	268	8.8	3039	100.0

State of residence and RRMA regions were not reported for 85 cases

In the following discussion of horse-related injuries, incident cases will be restricted to external cause category E828.2 ('ridden animal accident, animal rider injured'). This category represents 96 per cent (n=2989) of estimated incident cases of horse-related injury, is more uniform and representative of the horse rider population, and will be referred to as 'horse rider' incident cases.

During 1996–97, the four most common injuries, representing 78 per cent of all the injuries reported in horse rider incident cases as principal diagnosis, are summarised by major body region in Table 5 (also see Appendix 1, Table A1.1). Fifty-nine per cent of the injuries reported were in females, with injury to the upper body region (head and upper limbs) occurring most often in both sexes. This pattern of injury is consistent with injuries from falling or being thrown by a horse (Danielsson and Westlin 1973), (Grossman, Kulund et al. 1978), and (Masters 1991). Overall, the most common injury reported was musculoskeletal, usually either a fracture, dislocation or sprain (55%, n=1634).

The most serious injury reported in both male and female cases was neurological, primarily intracranial injury which occurred in 20.4 per cent (n=609) of the incident cases. Loss of consciousness or concussion was not reported as principal diagnosis in this dataset; these clinical symptoms were reported, however, as additional diagnoses in 2.2 per cent of the cases (n=69). Brief loss of consciousness was reported in 57 per cent of these cases (n=39) and concussion in the remaining cases.

Rates of injury for the four most common injuries in each body region indicate that injury to the head and upper body was high, with the rate of intracranial injury and the rate of fracture of radius and ulna highest in females. Overall, these rates in both sexes were higher than rates for any other injury.

Based on the ABS survey of participation in sport and physical activities in 1997, males participated in horse-riding 1.8 times that of women (Australian Bureau of Statistics 1999), but the pattern of injury remained the same for both sexes, with estimated annual rates of hospitalised intracranial injury of 297.4 per 100,000 male participants and 212.7 per 100,000 female participants.

Table 5: Estimated incident cases of horse rider injury by principal diagnosis of body part injured, and sex, Australia 1996–97 (case counts and crude rates).

Principal diagnosis	Males			Females			Persons		
	Count	Rates		Count	Rates		Count	Rates	
		Pop ^{†*}	Part ^{†**}		Pop ^{†*}	Part ^{†**}		Pop ^{†*}	Part ^{†**}
All head, spinal column, nerve, and spinal cord injuries									
Intracranial injury excluding skull fracture	215	2.3	297.4	394	4.3	212.7	609	3.3	236.5
Fracture of vertebral column without mention of spinal cord	37	0.4	51.2	92	1.0	49.7	129	0.7	50.1
Fracture of the skull	35	0.4	48.4	43	0.5	23.2	78	0.4	30.3
Open wound of head and face	25	0.3	34.6	19	0.2	10.3	44	0.2	17.1
Shoulder and upper limb									
Fracture of radius and ulna	227	2.5	314.0	339	3.7	183.0	566	3.1	219.8
Fracture of humerus	44	0.5	60.9	162	1.7	87.5	206	1.1	80.0
Fracture of hand bones	27	0.3	37.3	25	0.3	13.5	52	0.3	20.2
Dislocation of shoulder	40	0.4	55.3	8	0.1	4.3	48	0.3	18.6
Trunk									
Fracture of rib(s), sternum, larynx, and trachea	65	0.7	89.9	43	0.5	23.2	108	0.6	41.9
Fracture of clavicle	30	0.3	41.5	36	0.4	19.4	66	0.4	25.6
Injury to other and unspecified internal organs	22	0.2	30.4	32	0.3	17.3	54	0.3	21.0
Traumatic pneumothorax and haemothorax	14	0.2	19.4	18	0.2	9.7	32	0.2	12.4
Pelvis and lower limbs									
Fracture of ankle	71	0.8	98.2	80	0.9	43.2	151	0.8	58.6
Fracture of tibia and fibula	46	0.5	63.6	38	0.4	20.5	84	0.5	32.6
Fracture of pelvis	26	0.3	36.0	31	0.3	16.7	57	0.3	22.1
Fracture of one or more ankle, foot bones or other fractures	17	0.2	23.5	28	0.3	15.1	45	0.2	17.5
Other injuries	285	3.1	394.2	375	4.1	202.5	660	3.6	256.3
All injuries	1226	13.4	1695.7	1763	19.0	951.9	2989	16.2	1160.8

*Crude rate per 100,000 population (National population figures, Australia 1996–97)

** Crude rate per 100,000 horse riding participants (National horse riding participants, Australia 1997, ABS Cat No 4177.0)

Rates of estimated incident cases of horse rider injury for three of the most common injuries in upper and lower body regions diagnosed in injured male and female horse riders are presented by age and sex in Figure 6. It is evident that male and female horse riders aged 10 to 14 years are at a high risk of injury from riding horses at this age, with rates (per 100,000 population) of upper and lower limb fractures and intracranial injuries in females significantly higher statistically in this age group than rates (per 100,000 population) in males of the same age (fracture radius ulna: 26.0 ± 4.0 CI* vs 8.3 ± 2.2 CI; fracture of ankle: 3.4 ± 1.4 CI vs 0.7 ± 0.7 CI; and intracranial injury: 16.1 ± 3.1 CI vs 4.8 ± 1.7 CI, respectively). This pattern of injury may be consistent with falling or being thrown from a horse, which is common in young amateur riders (Masters 1991). With increasing age, there was a decrease in rates for all injuries in females, with female intracranial rates remaining significantly higher statistically than male rates at ages 15 to 34 years of age. At ages 35 to

* Confidence interval of 95%, based on Poisson distribution of estimate new incident cases

64 years, male rates were generally higher than female rates of the same age, possibly due to more older male professional riders, but the rates were not significantly different statistically.

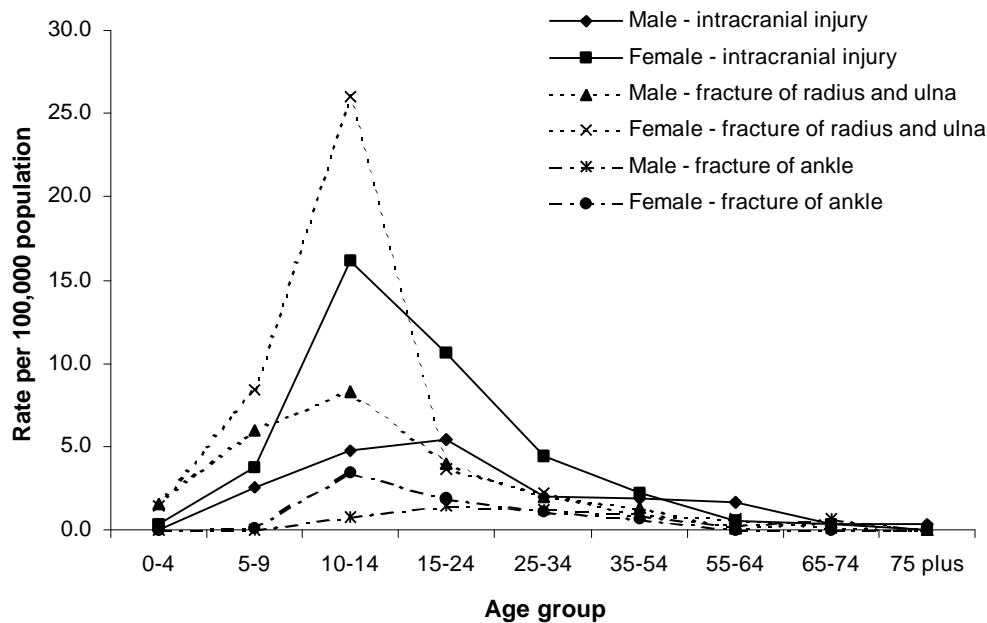


Figure 6: Principal diagnoses of estimated incident cases of horse rider injury by age and sex, Australia 1996–97, crude rates.

Length of stay

The calculation of length of stay is based on the time that injured horse riders (n=2,989) spent in hospital during their treatment and any complications associated with their injuries. This period of treatment is based on time of admission to time of discharge to previous home, or when death occurred on ward. Length of stay for treatment of horse-related injuries is calculated by dividing the number of bed-days occupied by all horse rider injury cases (irrespective of Mode of Separation) by the number of estimated incident cases. Based on this method, the average length of stay (ALOS) for horse rider injuries was 3 days.

The twelve most common horse rider injuries are listed with estimated incident cases, total bed days and average length of stay, in Table 6 and a tabulation of all injuries is presented in Appendix 1, Table A1.2. Intracranial injury, the most common injury sustained by riders, accounted for a total of 1,344 bed days, with an average length of stay of 2 days. Although intracranial injury is generally regarded as serious, for 94 per cent of the cases the average length of stay was two days (probably for observation). Only six per cent of the cases reported having an ALOS greater than three days, reflecting a more serious head injury. The maximum ALOS reported for intracranial injury was 78 days, with six cases requiring more than three weeks of treatment. Pelvic, vertebral column, and skull fractures had ALOS of more than a week. The highest ALOS (30 days) was for treatment of fracture of vertebral column with spinal cord injury (Table A2.2).

Table 6: Estimated incident cases of horse rider injury by principal diagnosis and average length of stay (ALOS), Australia 1996–97.

Principal diagnosis	Estimated incident cases	LOS (days) for all horse-related separations	Average LOS
Intracranial injury, excluding skull fracture	609	1344	2
Fracture of radius and ulna	566	683	1
Fracture of humerus	206	435	2
Certain traumatic complications and unspecified injuries	161	271	2
Contusion with intact skin surface	154	347	2
Fracture of ankle	151	693	5
Fracture of vertebral column without mention of spinal cord	129	1006	8
Fracture of rib(s), sternum, larynx, and trachea	108	497	5
Fracture of tibia and fibula	84	525	6
Fracture of the skull	78	604	8
Fracture of clavicle	66	144	2
Fracture of pelvis	57	869	15
All injuries	2989	9587	3

Discussion

Horse-riding and handling horses is a common activity, with over 250,000 Australians actively engaged in sport and recreational horse riding in 1997 (Australian Bureau of Statistics 1999). This report describes injury related to horses, considering cases resulting in death or admission to a hospital. These sources do not describe the whole picture, as they do not include non-hospitalised morbidity. Furthermore, some types of injury such as bites, and from handling horses, are not identifiable as horse-related.

The epidemiology of horse-related injuries has been well described in numerous studies, primarily overseas (Edixhoven, Sinha et al. 1980), (Berhang and Winslett 1983), and (Bixby-Hammett and Brooks 1990). A majority of these were prospective or retrospective studies of cases presenting to regional emergency departments or admitted to hospitals rather than national population studies (Buckley, Chalmers et al. 1993), (Hobbs, Yealy et al. 1994), (Chitnavis, Gibbons et al. 1996), and (Campbell-Hewson and Robinson 1999). These and other horse-related injury studies have been summarised in detailed reviews of local and international literature (Masters 1991) and (Watt and Finch 1996).

Pounder (1984), extrapolating from South Australian horse riding deaths and population in South Australia at the time of his survey, estimated the national death rate to be one death per million population, per year. In 1998 population terms, this would be equivalent to 19 deaths from horse riding activities, similar to the figure (20 deaths per year) calculated from national mortality unit record data.

Buckley et al. (1993) using New Zealand Accident Compensation Corporation (ACC) figures from a 1983–84 survey of participation in sporting activities, estimated that 5 deaths per 100,000 population per year occurred in horse riders falling from horses. This rate is probably an underestimation of the death rate in New Zealand as falling from horses represents about 85 per cent of horse-related accidents (Barber 1973). In the United States, using medical examiner and national population figures, horse-related deaths were estimated to be 219 deaths per year (Bixby-Hammett 1987).

The major cause of death reported in Australia and overseas is head injury, accounting for: 77.8 per cent (n=14) in Australia (Pounder 1984); 61.1 per cent (n=33) in New Zealand (Buckley et al. 1993); and 60.5 per cent (n=124) in the United States (Bixby-Hammett and Brooks 1990). According to these studies, young females and older males are particularly at risk of sustaining fatal head injuries, with most of these deaths occurring in young, female, amateur riders who fall off their horses, followed by male professional riders aged 30 to 50 years. Head injury was prominent among the hospitalised ages reported in this report.

A limitation of present mortality and hospital morbidity data collections is that they provide very little detail concerning the circumstances and mechanisms of occurrence of injury. For example, these sources provide no information about the type of riding, the experience of the rider, nor whether a helmet was in use. As noted above, some types of horse-related injuries are not identified as such. Because injuries from kicking, biting, or being crushed (typical injuries from handling horses) cannot be attributed to horses and, therefore were excluded, horse-related injuries reported for the period 1996–97 were based on national estimates of horse rider injuries in Australia.

The 10th revision of the International Classification of Diseases (ICD-10), recently introduced for coding deaths and hospital morbidity cases in Australia, should result in some improvement in potential to identify and characterise horse-related cases. The ICD-10 external cause code V80 ('animal rider or occupant of animal drawn vehicle injured in transport accident') is superior to the current ICD-9 E-code categories for animal related injury used in this report. For example, V80.0 describes the mechanism of injury (fall or being thrown from), important in understanding the injury event and for planning interventions to reduce injury. In addition, the ICD-10 supplementing classification of activity at the time of injury has potential to enable better identification of cases associated with sport and recreation (though the activity classification is not presently applied to deaths).

Most studies of horse-related deaths in Australia and overseas have used surveys, State Coronial records or National Medical Examiner records (in the USA) to obtain more detailed information on the medical cause and circumstances that led to the death. The value of coroner records and the benefits of improving their utility for purposes including injury prevention research has been recognised in Australia. In 1997, the National Coronial Information System (NCIS) was established by a consortium called the Monash University Centre for Coronial Information (MUCCI). When fully operational, the NCIS will hold information on all deaths referred to a Coroner in Australia.

The draft NCIS Data Dictionary, published in February 2000, specifies data standards for the NCIS Core Data Items. A review of the Data Dictionary indicated that horse-related deaths in Australia will be readily identifiable and national statistics on horse-related deaths, including details on the injury event and cause of death, will be eventually available for research purposes.

The following Core Data Items would be particularly useful for identifying horse-related deaths:

- Description of circumstances of death,
- Activity,
- Sport or active recreation,
- Mechanism of injury,
- Mode of transport,
- Counterpart,
- Object or substance producing injury, and
- Pathological cause of death.

In addition, the ability to conduct text string searches on coroners' findings and circumstances of death will provide further information on the mechanism and factors that contributed to the horse-related injury and medical cause of death—invaluable in the development and evaluation of injury prevention programs.

The lack of national statistics on horse-related injury is acknowledged in the literature. Many studies use localised population centres especially associated with emergency departments, and investigate horse-related injuries using retrospective or prospective casenote reviews. Although these studies describe horse-related injuries epidemiologically, they are limited by information available in the casenotes, particularly the nature and circumstances of the injury event. Detailed information on the mechanism and factors that contributed to the injury event is fundamental in the development of prevention programs.

Data issues

Data sources

Deaths data are from the Australian Bureau of Statistics (ABS) mortality unit record data collection, 1979–98. Hospital separations data are from hospital separations unit record data collection, 1996–97 and are provided by the AIHW. Population data were obtained from the ABS and are based on ABS estimates of resident population as at 30 June 1998. Estimated number of horse riders engaged in sport and recreational activities during 1997 were obtained from the ABS (Australian Bureau of Statistics 1999).

Case definition

Death data

The cause of each death registered in Australia is classified by the ABS according to the International Classification of Diseases (ICD). The 9th revision (ICD9) has been used for death registrations beginning in 1979. All deaths given an ICD9 “External Cause” code by the ABS are included in the mortality dataset.

Data are presented according to the year in which deaths were registered. For deaths occurring in the latter part of the calendar year, registration may not occur until the following year. For the year 1998, seven per cent of the death registrations in the 1998 mortality dataset included deaths that occurred in previous years.

State-specific data are presented on the basis of the state or territory in which death was registered. This is normally the one in which death occurred.

Hospital separations data

Unit record hospital separations data relating to injury and poisoning were obtained from the Australian Institute of Health and Welfare (AIHW). Selection criteria for these cases were as follows:

1. An ICD9-CM External cause E-code in the external cause field; and
2. An ICD9-CM Principal Diagnosis code in the range 800.00–999.99 (Chapter 17 ‘Injury and Poisoning’).

Selection of horse-related hospital separations

Horse-related hospital separations were obtained from the hospital separations 1996–97 dataset as specified above by selecting cases where the main E-code had one of the values in Table A.

Table A: Horse-related external cause codes (E-code)

External cause of injury	E-code
Motor vehicle traffic accidents	810-825/.5*
Other road vehicle accidents	826-829/.2, .3**

*Fourth-digit subdivision: rider of animal; occupant of animal-drawn vehicle

** Fourth-digit subdivision: rider of animal (.2); occupant of animal-drawn vehicle (.3)

Estimation of incident cases

The main matter of interest for this report is the incidence of horse-related injury resulting in death or admission to a hospital. The hospital data count episodes of inpatient care. Some injuries result in more than one episode of care at one or more hospitals. One aid to identifying cases likely to have resulted in more than one episode is the data item ‘Mode of Separation’. For present purposes, cases discharged to another acute hospital, and ‘statistical’ discharges have been omitted from estimates of incident case numbers. The bed-days occupied by these cases have been included in estimates of the burden of injury.

Incident cases were estimated by excluding unit records that had the following modes of separation:

1. Discharge/transfer to an(other) hospital
2. Statistical discharge – type change
3. Statistical discharge from leave

Age adjustment

Some all-ages rates have been standardised to overcome the effect of differences in the proportions of people of different ages (and different injury risks) in the populations that are compared. Direct standardisation was employed, taking the Australian population in 1991 as the standard.

Time series

Mortality time trends have been presented for the period 1979 to 1998. This is the period during which Australian deaths data have been classified according to the 9th revision of the International Classification of Diseases (ICD9).

Appendix 1

Table A1.1: Estimated incident cases of horse rider injury by principal diagnosis, external cause of injury, and sex, Australia 1996–97 (counts and table percentages).

Principal diagnosis	Males		Females		Persons	
	Count	%	Count	%	Count	%
Intracranial injury excluding skull fracture	215	7.2	394	13.2	609	20.4
Fracture of radius and ulna	227	7.6	339	11.3	566	18.9
Fracture of humerus	44	1.5	162	5.4	206	6.9
Certain traumatic complications and unspecified injuries	54	1.8	107	3.6	161	5.4
Contusion with intact skin surface	58	1.9	96	3.2	154	5.2
Fracture of ankle	71	2.4	80	2.7	151	5.1
Fracture of vertebral column without mention of spinal cord	37	1.2	92	3.1	129	4.3
Fracture of rib(s), sternum, larynx, and trachea	65	2.2	43	1.4	108	3.6
Fracture of tibia and fibula	46	1.5	38	1.3	84	2.8
Fracture of the skull	35	1.2	43	1.4	78	2.6
Fracture of clavicle	30	1.0	36	1.2	66	2.2
Fracture of pelvis	26	0.9	31	1.0	57	1.9
Injury to other and unspecified internal organs	22	0.7	32	1.1	54	1.8
Fracture of hand bones	27	0.9	25	0.8	52	1.7
Dislocation of shoulder	40	1.3	8	0.3	48	1.6
Fracture of one or more ankle, foot bones or other fractures	17	0.6	28	0.9	45	1.5
Open wound of head and face	25	0.8	19	0.6	44	1.5
Dislocation of elbow	14	0.5	18	0.6	32	1.1
Traumatic pneumothorax and haemothorax	14	0.5	18	0.6	32	1.1
Sprains and strains of other and unspecified parts of back	5	0.2	26	0.9	31	1.0
Superficial injury	10	0.3	18	0.6	28	0.9
Fracture of carpal bone(s)	16	0.5	9	0.3	25	0.8
Fracture other/unspecified parts of femur	13	0.4	11	0.4	24	0.8
Fracture neck of femur	14	0.5	8	0.3	22	0.7
Sprains and strains of knee and leg	12	0.4	9	0.3	21	0.7
Other, multiple, and ill-defined dislocations	12	0.4	3	0.1	15	0.5
Open wound of upper limb	7	0.2	8	0.3	15	0.5
Dislocation of knee	10	0.3	4	0.1	14	0.5
Open wound of lower limb	9	0.3	4	0.1	13	0.4

Continued

Table A1.1 (continued): Estimated incident cases of horse rider injury by principal diagnosis, external cause of injury, and sex, Australia 1996–97 (counts and table percentages).

Principal diagnosis	Males		Females		Persons	
	Count	%	Count	%	Count	%
Injury to nerves and spinal cord	4	0.1	8	0.3	12	0.4
Fracture of scapula	3	0.1	7	0.2	10	0.3
Injury to heart and lung	8	0.3	1	0.0	9	0.3
Fracture of patella	6	0.2	2	0.1	8	0.3
Sprains & strains of shoulder and upper arm	7	0.2	1	0.0	8	0.3
Dislocation of hip	0	0.0	6	0.2	6	0.2
Fracture of vertebral column with mention of spinal cord injury	2	0.1	3	0.1	5	0.2
Sprains and strains of ankle and foot	3	0.1	2	0.1	5	0.2
Sprains and strains of hip and thigh	2	0.1	2	0.1	4	0.1
Sprains and strains of sacroiliac region	1	0.0	3	0.1	4	0.1
Other and ill-defined sprains and strains	1	0.0	3	0.1	4	0.1
Crushing injury	0	0.0	4	0.1	4	0.1
Dislocation of finger	2	0.1	1	0.0	3	0.1
Sprains and strains of wrist and hand	2	0.1	1	0.0	3	0.1
Open wound of buttock	0	0.0	3	0.1	3	0.1
Dislocation of wrist	1	0.0	1	0.0	2	0.1
Dislocation of ankle	1	0.0	1	0.0	2	0.1
Open wound of neck	1	0.0	1	0.0	2	0.1
Open wound of genital region	1	0.0	1	0.0	2	0.1
Injury to blood vessels	1	0.0	1	0.0	2	0.1
Complications of surgical and medical care not elsewhere classified	1	0.0	1	0.0	2	0.1
Dislocation of foot	1	0.0	0	0.0	1	0.0
Sprains and strains of elbow and forearm	1	0.0	0	0.0	1	0.0
Open wound of chest (wall)	1	0.0	0	0.0	1	0.0
Open wound of back	1	0.0	0	0.0	1	0.0
Open wound of other and unspecified sites, except limbs	0	0.0	1	0.0	1	0.0
All injuries	1226	41.0	1763	59.0	2989	100.0

Table A1.2: Estimated incident cases of horse rider injury by principal diagnosis and average length of stay (ALOS), Australia 1996–97.

Principal diagnosis	Estimated incident cases	LOS (days) for all horse-related separations	Average LOS (days)
Intracranial injury excluding skull fracture	609	1344	2
Fracture of radius and ulna	566	683	1
Fracture of humerus	206	435	2
Certain traumatic complications and unspecified injuries	161	271	2
Contusion with intact skin surface	154	347	2
Fracture of ankle	151	693	5
Fracture of vertebral column without mention of spinal cord	129	1006	8
Fracture of rib(s), sternum, larynx, and trachea	108	497	5
Fracture of tibia and fibula	84	525	6
Fracture of the skull	78	604	8
Fracture of clavicle	66	144	2
Fracture of pelvis	57	869	15
Injury to other and unspecified internal organs	54	398	7
Fracture of hand bones	52	49	1
Dislocation of shoulder	48	46	1
Fracture of one or more ankle, foot bones or other fractures	45	103	2
Open wound of head and face	44	42	1
Traumatic pneumothorax and haemothorax	32	165	5
Dislocation of elbow	32	25	1
Sprains and strains of other and unspecified parts of back	31	58	2
Superficial injury	28	50	2
Fracture of carpal bone(s)	25	27	1
Fracture other/unspecified parts of femur	24	292	12
Fracture neck of femur	22	246	11
Sprains and strains of knee and leg	21	29	1
Other, multiple, and ill-defined dislocations	15	91	6
Open wound of upper limb	15	21	1
Dislocation of knee	14	32	2
Open wound of lower limb	13	21	2
Injury to nerves and spinal cord	12	33	3
Fracture of scapula	10	20	2
Injury to heart and lung	9	30	3
Fracture of patella	8	32	4
Sprains & strains of shoulder and upper arm	8	20	3
Dislocation of hip	6	54	9
Fracture of vertebral column with mention of spinal cord injury	5	148	30

Continued

Table A1.2 (continued): Estimated incident cases of horse rider injury by principal diagnosis and average length of stay (ALOS), Australia 1996–97.

Principal diagnosis	Estimated incident cases	LOS (days) for all fall-related separations	Average LOS (days)
Sprains and strains of ankle and foot	5	15	3
Other and ill-defined sprains and strains	4	13	3
Sprains and strains of sacroiliac region	4	9	2
Sprains and strains of hip and thigh	4	8	2
Crushing injury	4	8	2
Open wound of buttock	3	7	2
Dislocation of finger	3	3	1
Sprains and strains of wrist and hand	3	1	0
Dislocation of ankle	2	23	12
Injury to blood vessels	2	23	12
Open wound of genital region	2	8	4
Dislocation of wrist	2	4	2
Complications of surgical and medical care not elsewhere classified	2	3	2
Open wound of neck	2	2	1
Open wound of back	1	5	5
Sprains and strains of elbow and forearm	1	3	3
Open wound of chest (wall)	1	1	1
Open wound of other and unspecified sites, except limbs	1	1	1
Dislocation of foot	1	0	0
All injuries	2989	9587	3

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