

HAZARD

Hazard
(Edition No. 68)
Spring 2008
Victorian Injury Surveillance
Unit (VISU)

www.monash.edu.au/muarc/visu

Monash University
Accident Research Centre



Preventing unintentional farm injury

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This edition provides a profile of unintentional farm injury in Victoria (deaths, hospital admissions and ED presentations) over the period 2004-6. Separate analyses of injury data were conducted to investigate the pattern of all farm injury, farm work-related injury and farm injury among vulnerable groups – children and young people aged 0-19 years and seniors aged 65 years and older.

Summary

Over the three-year study period 2004-6, there were 41 unintentional ('accidental') injury deaths on Victorian farms and at least a further 1,765 hospital admissions and 7,259 ED presentations (non-admissions) for farm injury, giving an average of 14 fatal and 3,008 hospital-treated farm injuries per year (588 admissions and 2,420 ED presentations). These figures include work- and recreation-injury that occurred on farms but not injury that occurred in the home (inside the farmhouse and its immediate surrounds).

Males were well over-represented accounting for 85% of deaths and 71% of hospital-treated injury cases. Fatalities and hospital admissions mostly occurred in adults aged 40 to 64 (39%), closely followed by adults aged 65 years and older for deaths (37%) but not for admissions where adults aged 20-39 ranked second on the basis of injury frequency (26%).

Transport was the major cause of farm injury accounting for 22 deaths, 623 hospital admissions and 2,314 ED presentations. Tractors, other agricultural vehicles, all-terrain vehicles and horses are classified as forms of transport in the ICD-10-AM coding system so are included in transport injury. It is usual in farm injury research to classify agricultural vehicles such as tractors as farm machinery.

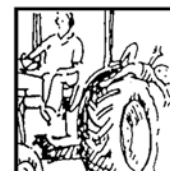
Transport deaths were due to persons on foot being runover by tractors (6) and a ute (1) and crashes involving tractors (7) a fertiliser spreader (1), all-terrain vehicles (3), air transport (3) and a motorcycle (1). Transport hospital admission and ED presentations were mostly related to motorcycle riding and horse riding.

The other major cause of deaths and hospital-treated injury was animal handling (mostly

involving cattle, horses, sheep and dogs). Falls and machinery (excluding agricultural vehicles) were major causes of admissions.

Separate analyses of data were conducted to investigate the pattern of farm work-related injury and farm injury among vulnerable groups – children and young people aged 0-19 years and seniors aged 65 years and older.

A literature review was also conducted to identify the risk factors for farm injury and evidence-based preventive measures. The recommended priorities for prevention for farm injury are: work and recreational motorcycle-related injury (falls, collisions and runovers); recreational horse riding and handling injuries (falls from the horse and kicks/strikes/bites); large animal handling injuries especially cattle; and agricultural machinery injury (including tractors and all-terrain vehicles).



1.0 All unintentional injury on farms

The first section of this report provides an overview of all unintentional ('accidental') deaths and hospital-treated injury to persons of all age groups that occurred on Victorian farms (including buildings and land under cultivation) over the 3-year study period (2004-6). Cases that occurred in the farmhouse, driveway, garage, garden and yard (including private swimming pool and tennis court) were not included as they are classified as home injuries. Three injury deaths that occurred in the garden of the farmhouse were included as they were related to tractor use.

Unintentional (accidental) injury deaths were extracted from the National Coroners Information System (NCIS) using the location code *Farm or other place of primary production and Home – Farmhouse*. After examination, it was decided to include the 3 deaths that attracted the farmhouse code as they were caused by tractor crashes or runovers in the garden or yard surrounding the farmhouse. Only 'closed' cases were included - there are two further 'open' cases of likely unintentional farm injury deaths recorded on the NCIS for the study years.

Unintentional (accidental) injury hospital admissions recorded on the Victorian Admitted Episodes Dataset (VAED) that attracted the ICD-10-AM place of occurrence (location) code Y92.7 *Farm* were included. This code covers injuries that occurred in all farm buildings and land but excludes injury cases that occurred in farm houses and the driveway, garage, garden and yard adjacent to the farmhouse including swimming pools in the house or garden — these are classified as home injuries. Cases were subsequently excluded if they attracted any of the *transport* cause of injury codes that indicate that the injury occurred in *traffic* as by definition these are road injuries as they occur on public highways or streets. Deaths were excluded to avoid double counting. Case counts are underestimates because only 60% of injury hospitalisations on the VAED attract a specific place of occurrence (location) code, but the farm location may be better reported than other locations.

Unintentional (accidental) injury ED presentations recorded on the Victorian Emergency Minimum Dataset (VEMD) that attracted the place code *F Farm* were included.

All deaths and hospital admissions recorded on the VEMD were excluded as it was presumed they were recorded on the NCIS and VAED respectively. Cases that occurred in farmhouses and their surrounds were excluded. The place of occurrence of injury is better specified on the VEMD (84%) than on the VAED.

Injury *rates and trends* were not estimated because there are no reliable annual data on the number of persons living and working on farms.

1.1 Case frequency

Over the three-year study period 2004-6, there were 41 injury deaths and at least a further 1,765 hospital admissions and 7,259 ED presentations (non-admissions) on Victorian farms. The annual average was 14 deaths and 3,008 hospital-treated farm injuries (588 admissions and 2,420 ED presentations).

The results of the analysis of data on all farm injury cases (deaths, hospital admissions and ED presentations) are summarised in Tables 1A & B. Table 1C contains vignettes of farm non-work related injury deaths derived from NCIS (Victorian coroners' data). Farm work-related vignettes are in Table 2C.

1.2 Gender and age

Males were well over-represented accounting for 85% of deaths and 71% of hospital-treated injury cases.

Age distribution is shown in Figure 1. Fatalities mostly occurred among adults aged 40 to 64 (39%), closely followed by adults aged 65 years and older (37%). Similarly, 40% of hospital admissions and 32% of ED presentations were aged 40-64 but the age pattern was otherwise different to that for deaths. Only 16% of farm injury hospital admissions and 6% of ED presentations were persons aged 65 years and older compared with 37% of deaths. By contrast, persons aged 20-39 were more highly represented in farm injury hospitalisations (26%) and ED presentations (36%) than in deaths (10%).

1.3 Activity when injured

A high proportion of farm injury deaths (56%) and hospital admissions (40%) occurred in

farm income-producing (paid) work activities. The pattern was different for ED presentations with 40% of injuries occurring while persons were engaged in leisure activities and 28% when working for income.

1.4 Body region injured and type of injury

Deaths were mainly caused by head injuries (34%) and injuries to multiple body regions (22%). Among both hospital admissions and ED presentations the upper extremity was the most commonly injured body region (33% of admissions and 41% of ED presentations), followed by the lower extremity (27%, 25%) and head/face/neck (20%, 15%).

Fractures (41%) and open wounds (14%) accounted for over half of hospital admissions, whereas open wounds and dislocations, sprains, strains (both 22%) were the most common injuries among ED presentations, followed by fractures (15%). Intracranial injuries accounted for 7% of admissions.

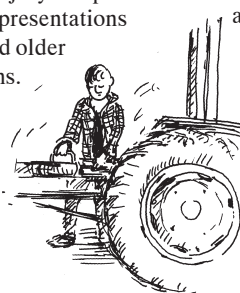
1.5 Injury severity

Length of stay data for hospital admissions is used as a proxy measure of severity. Fifty-four percent of admitted cases stayed in hospital less than 2 days, 38% had a length of stay of 2-7 days and 9% required a stay of more than 8 days. The average (mean) length of stay was 3.1 days. This is lower than the average length of stay for all other unintentional injury hospitalisations for the study years (5.2 days).

1.6 Causes of injury

The ranking of the major causes of farm injury, based on case frequency weighted by severity, is shown in Table 1D. Tractors and other special vehicles used in agriculture, all-terrain vehicles and horses being ridden are classified under the *transport cause of injury* code in the ICD-10 coding system used to classify the external cause of deaths on the NCIS and cause of hospital admissions on the VAED. An ICD-10 External Cause of Injury code was assigned to ED presentations.

Overall, transport was the major cause of farm injury accounting for over one-half of deaths, 35% of hospital admissions (more than half of which were motorcycle rider



injury cases) and 32% of ED presentations (mostly motorcycle rider and horse rider injury cases). The other major causes were (in rank order): natural/environmental/animals (mostly related to animal handling), falls, hit/struck/crush and cutting/piercing.

A high proportion of farm injury deaths (56%) and hospital admissions (40%) occurred in farm income-producing (paid) work activities. The pattern was different for ED presentations with 40% of injuries occurring while persons were engaged in leisure activities and 30% when working for income.

Deaths

The major mechanisms of farm transport deaths (n=22, 54% of farm deaths) were: persons on foot (farmers, farm workers and others) being struck/runover/crushed by tractors (n=7) and, in one case, a motor vehicle (ute); and vehicle crashes involving the operators of tractors (n= 6), a fertiliser spreader (n=1); all-terrain vehicles – quad bikes (n=3); a motorcycle (n=1) and air transport vehicles (n=3, a gyrocopter, hang glider and a parachute).

The other causes of death were: drowning (n= 5 in dams and waterholes and pool of water); hit/struck/crush injury (n=4, mostly by tree trunks/branches); animal handling (n=4, hit by cattle, charged by bull, trampled by horse and struck by unspecified animal); discharge of firearms during recreational activities (n=2); and single deaths due to electrocution, asphyxiation, a fall and burns from a flammable substance.

Vignettes providing short descriptions of each fatal incident are in Tables 1C and 2C.

Hospital admissions

About one-third of farm hospital admissions were transport-related [35%, mostly motorcycle riders (18% of admissions), horse riders (5%) and occupants of agricultural (3%) and all-terrain (2%) vehicles]. The other major causes of admissions were: natural/environmental/animals (18%, mostly struck by/kicked/bitten by mammals such as cattle, sheep, horses and dogs); falls (15%, evenly distributed across same level and different level falls); and hit/struck/crush and machinery (both 10%).

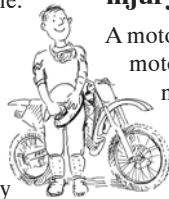
ED presentations

The pattern of causes for ED presentations was similar to admissions. Transport accounted for 32% of ED presentations

[mostly motorcycle riders (17% of transport ED presentations) and horse riders (8%)], followed by natural/environmental/animals (18%, mostly bitten/struck by mammals), then hit/struck/crush (13%), falls [12%, same level falls (9%), different level falls (3%)] and cutting and piercing (12%). Only 2% of ED presentations were machinery-related.

1.7 Major cause in detail

• Motorcycling-related farm injury



A motorcycle is defined as a two-wheeled motor vehicle. This definition includes mopeds, motor scooters and motorcycles fitted with a sidecar and excludes motor driven tricycles and all-terrain vehicles (quad bikes). There was one death, 324 hospital admissions and 1,218 ED presentations for motorcycle-related injury over the 3-year study period, 7% of hospital-treated farm injury over the period. Only 9% of hospital-treated injury cases occurred during paid farm work, most occurred during sport and leisure activities

The peak age groups for sport and leisure motorcycling admissions (n=285) and ED presentations (n=1,125) were 20-39 year olds (40% and 41% respectively) and 15-19 year-olds (20%, 22% respectively). The peak age groups for work-related admissions (n=39) and ED presentations (n=93) were 40-64 year olds (54% of motorcycling admissions and 31% of ED presentations) and 20-39 year olds (39% and 43%). Over 90% of work-related and 85% of sport and leisure-related motorcycle injury cases were male.

Ninety per cent of motorcycling injury cases were riders, and between 50% and 60% of injuries were caused by falls, the remainder mostly by collisions. Case narrative (descriptive) data for ED presentations were read but provided sparse additional information on the mechanisms and circumstances of the injury as most narratives gave information already known from coded data e.g. *fell off motorbike*.

The body region most commonly injured was the upper extremity (35-43% of admission and ED presentations among work and non-work cases) followed by the lower extremity (23-32%). Fracture was the most common injury type accounting for 34% of all motorcycling injury cases, followed by dislocation/sprain/strain (23%). Intracranial (brain injury) accounted for 5% of admissions

among work-related cases and 11% of admissions among non-work (sport and leisure) cases.

Among hospital admissions and ED presentations the upper extremity was the most common body region injured (43% and 35% of cases respectively), followed by the lower extremity (31%, 32%) then head/face/neck (22%, 8%). For both hospital admissions and ED presentations, the most common injury diagnosis was fracture (58% and 28% of injury cases respectively) followed by intracranial injury and open wounds for admissions (each 10%) and dislocation/sprain/strain (27%) and open wounds (14%) for ED presentations.

Length of stay was used as a proxy measure for severity. Half of the cases admitted to hospital had a length of stay of less than two days, 41% stayed in hospital 2-7 days, 9% were in hospital 8-30 days and one case was in hospital for 31 days or more.

• Animal-related farm injury (excluding horse riding)

The subset of animal-related farm injury cases included hospital admissions attracting the ICD-10-AM cause of injury codes W54 *Bitten/struck by dog* and W55 *Bitten/struck by other mammals*, X20-X27.8 *Contact with venomous animals (snakes, spider, bees etc)* and ED presentations attracting the VEMD cause codes 7 *Horse related*, 21 *Dog related* and 22 *Other animal related*. The 95 admissions and 562 ED presentations for injuries that occurred when the horse was being ridden (mainly due to falls) were excluded as these are classified as transport injuries.

There were 4 deaths and 1,599 hospital-treated animal-related injury cases over the 3-year study period (316 admissions and 1,283 ED presentations), an average of one death and 533 injury cases annually. Animal-related injury cases accounted for 18% of all hospital-treated farm injury cases over the study years.

Three of the 4 deaths, 146 admissions (48% of animal-related admissions) and 395 ED presentations (31% of animal-related ED presentations) were paid farm work-related.

Overall, males accounted for 73% of admissions and 56% of ED presentations. The male: female ratio was higher for work-related cases (3.5:1) than non-work-related cases where there was no gender imbalance.



Overall, persons in age group 40-64 years accounted for the highest proportion (40%) of hospital treated injury cases, followed by 20-39 year-olds (33%) and 65+ year-olds (10%). The age distribution was fairly similar for work and non-work cases except that there were no work-related cases among children (aged 0-14 years), whereas children formed 12% and 15% of non-work admissions and ED presentations respectively.

The four deaths involved a farmer/farm worker who was either struck by a cow, charged by a bull or trampled by a horse and one young female doing unpaid farm work who was killed when knocked over by an animal she was tending in a paddock. Among hospital admissions and ED presentations, mammals were also the most common class of animals involved, accounting for 69% of injuries. The kind of mammals involved in hospitalisations was only coded in the last 6 months of VAED data when coding improvements came into effect on July 1, 2006. Available coded data indicate that the mammals most frequently involved were cattle, horses, and sheep.

Analysis of case narratives recorded for ED presentations showed that cattle (predominantly cows but some steers and bulls) were most involved [20% of animal-related ED presentations, (n=320)] followed by horses (18%, n=290), sheep (5%, n=84) and dogs (3%, n=41). Both cattle (cow) and horse-related injuries were mostly from kicks (51% and 47% respectively) and hit/struck/crush incidents (36%, 18%). Stood on/trample injuries were much more common among horse- than cattle- related cases (18% vs. 2%). Thirty per cent of sheep-related cases were hit/struck injuries and 24% were cutting and piercing (needlestick) injuries that occurred during shearing and vaccination programs. Ninety per cent of dog-related injuries were bites. Other animals causing injury were included pigs, goats, cats, snakes, spiders, bees and ants.

Among all, work- and non-work- related hospital admissions, fracture was the most frequently occurring injury (30%), followed by open wounds (18%). Intracranial injuries accounted for 7% of all hospitalisations but were less prominent among work than non-work cases (5% versus 9%). Injuries were fairly evenly distributed across body regions for work-related admissions but among non-work admission injuries to the lower extremity (31%) and head/face/neck (26%) were more numerous than injuries to the trunk and upper extremity (both 16%).

All farm injury: Frequency, demographics, cause of injury and activity when injured

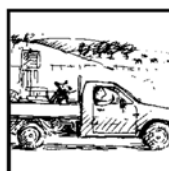
Table 1A

VARIABLE	DEATHS (n=41)		HOSPITAL ADMISSIONS (n=1,765)		ED PRESENTATIONS (n=7,259)	
	n	%	n	%	N	%
Year						
2004	21	51.2	578	32.7	2236	30.8
2005	4	9.8	632	35.8	2356	32.5
2006	16	39.0	555	31.4	2667	36.7
Age group						
0-14 years	4	9.8	184	10.4	1112	15.3
15-19 years	2	4.9	137	7.8	800	11.0
20-39 years	4	9.8	462	26.2	2580	35.5
40-64 years	16	39.0	704	39.9	2307	31.8
65+ years	15	36.6	278	15.8	460	6.3
Gender						
Male	35	85.4	1362	77.2	5080	70.0
Female	6	14.6	403	22.8	2135	29.4
Missing	-	-	-	-	44	0.6
Cause						
Transport	22	53.7	623	35.3	2314	31.9
- pedestrian/pedal cyclist	8	19.5	17	1.0	190	2.6
- motorcycle rider	1	2.5	324	18.4	1218	16.8
- car/truck occupant	-	-	66	3.7	168	2.3
- heavy transport occupant	-	-	5	0.3	-	-
- other land transport - animal rider	-	-	95	5.4	562	7.7
- other land transport - occupant of special agriculture vehicle	7	17.1	37	3.1	123	1.7
- other land transport - all-terrain vehicle	3	7.3	48	2.7	53	0.7
- other land transport - unspecified	-	-	5	0.3	-	-
- air transport	3	7.3	5	0.3	-	-
- other and unspecified	-	-	3	0.1	-	-
Drowning/near drowning	5	12.2	2	0.1	3	0.0
Poisoning	-	-	17	1.0	19	0.3
Falls	1	2.1	264	15.0	891	12.3
- same level slipping/tripping/stumbling	1	2.1	87	4.9	684	9.4
- other falls on same level	-	-	27	1.6	-	-
- different level stairs and steps	-	-	4	0.2	207	2.9
- different level ladder	-	-	32	1.8	-	-
- different level out of or through building	-	-	17	1.0	-	-
- different level tree	-	-	6	0.3	-	-
- other different level fall	-	-	55	3.1	-	-
- unspecified fall	-	-	28	1.6	-	-
- fracture unspecified	-	-	8	0.5	-	-
Fire/burns/scalds	1	2.4	25	1.4	120	1.7
Natural/environmental/animals	4	9.7	316	17.9	1283	17.7
- contact with venomous animals (snakes, spiders, bees etc) and plants	-	-	38	2.1	57	0.8
- exposure to excessive natural heat/cold	-	-	9	0.5	-	-
- bitten/struck by dog	-	-	7	0.4	41	0.6
- bitten/struck by other mammals	4	9.7	229	13.0	755	10.4
- other and unspecified nat/envIRON/animals	-	-	33	1.9	430	5.9
Choking/suffocate/strangulation	1	2.4	-	-	2	0.0
Hit/struck/crush	4	9.8	167	9.5	908	12.5
Cutting/piercing	-	-	88	5.0	883	12.2
Machinery	-	-	171	9.7	164	2.3
Explosions/firearms	2	4.9	4	.2	6	0.1
Other unintentional/unspecified	1	2.4	88	5.0	666	9.2
Activity						
Working for income	23	56.1	698	39.5	2025	27.9
Unpaid work	7	17.1	168	9.5	1015	14.0
Sport and recreation activity	6	14.6	128	7.3	118	1.6
Leisure	3	7.3	24	1.4	2935	40.4
Vital activities	-	-	5	0.3	137	1.9
Other specified	1	2.4	229	13.0	775	10.7
Unspecified	1	2.4	513	29.1	254	3.5

Source: NCIS 2004-6 (deaths); VAED 2004-6 (hospital admissions); VEMD 2004-6 (hospital ED presentations, non-admissions)

Among ED presentations, injury to nerves and spinal cord was the most common injury diagnosis (22%), followed by open wound (17%) and fracture (11%).

Fifty-six per cent of animal-related hospital admissions recorded a length of stay of <2 days, 39% stayed in hospital 2-7 days, 5% stayed 8-30 days and <1% stayed 31 days or more.



All farm injury: Body region injured, nature of injury and length of hospital stay

Table 1B

VARIABLE	DEATHS (n=41)		HOSPITAL ADMISSIONS (n=1,765)		ED PRESENTATIONS (n=7,259)	
	n	%	n	%	n	%
Body region						
Head/face/neck	14	34.1	355	20.1	1060	14.6
Trunk	6	14.6	241	13.7	529	7.3
Upper extremity	-	-	580	32.9	3008	41.4
Lower extremity	-	-	479	27.1	1843	25.4
Multiple body regions	9	22.0	1	.1	262	3.6
Body region not relevant	6	14.6	73	4.1	-	-
Unspecified body region	6	14.6	10	.6	132	1.8
No injury code	-	-	26	1.5	-	-
Nature of injury	N/A					
Fracture			720	40.8	1106	15.2
Open wound			246	13.9	1560	21.5
Intracranial injury			131	7.4	100	1.4
Dislocation, sprain & strain			102	5.8	1539	21.2
Superficial injury			87	4.9	750	10.3
Injury to muscle & tendon			67	3.8	384	5.3
Traumatic amputation			56	3.2	16	0.2
Toxic effects- substances, non-medicinal			48	2.7	183	2.5
Injury to internal organs			37	2.1	8	0.1
Burns			34	1.9	134	1.8
Injury to nerves & spinal cord			24	1.4	4	0.1
Crushing injury			15	0.8	212	2.9
Eye injury- excl foreign body			13	0.7	214	2.9
Injury to blood vessels			10	0.6	10	0.1
Other & unspecified injury			149	8.4	1034	14.2
Missing injury code			26	1.5	5	0.1
Length of stay (severity)	N/A				N/A	
< 2 days			951	53.9		
2-7 days			663	37.6		
8-30 days			132	7.5		
31+ days			19	1.1		

Source: NCIS 2004-6 (deaths); VAED 2004-6 (hospital admissions); VEMD 2004-6 (hospital ED presentations, non-admissions)

2. Farm work-related injury

The dataset was limited to farm injury cases that were classified as occurring when the person was working for an income and excluded cases occurring when the person was injured when engaged in other types of work such as domestic and learning/educational activities, sports and leisure and vital activities such as resting, eating and personal hygiene.

Case counts underestimate farm work-related hospitalisations because only 60% of injury hospitalisations on the database for the study years are specified for place of occurrence (home, farm etc.) and 43% are specified for activity at the time of injury (working for income, sports and leisure etc.) ED presentations are also underestimated, although the specificity of the location (84%) and activity (80%) coding is better on the ED presentations database than the admissions database.

2.1 Frequency

Over the 3-year period 2004-6, there were 23 deaths and at least 698 hospital admissions and 2,025 ED presentations that were farm work-related, an annual average of 8 deaths, 233 hospitalisations and 675 ED presentations (non-admissions). This represents over half (56%) of all injury deaths that occurred on farms, 40% of farm injury admissions and 28% of farm injury ED presentations.

The pattern of work-related farm injury is summarised in Tables 2A & B. Vignettes of the work-related fatalities are in Table 2C.

2.2 Gender and age

All but one of the farm work-related deaths (96%), 85% of hospitalisations and 83% of ED presentations were male.

Age distribution is shown in Figure 2. Close to half of all fatalities were aged 65 years or older (48%) compared with 16% of

hospitalisations and 6% of ED presentations. Hospitalisations were highest in age group 40-64 years (51%), followed by age group 20-39 years (29%). A small proportion of hospitalised cases were young people aged 15-19 years (4%) and there was only one recorded child work-related hospitalisation, in the 10-14 year age group. The average (mean) age of farm work-related injury hospitalisations was 47 years compared with 38 years for all other work-related hospitalisations recorded over the same period.

Eighty-seven per cent of ED presentations for farm work-related injury were adults aged 20-64 years.

2.3 Causes of injury

Ranking of the major causes of farm work-related farm injury based on case frequency data weighted by injury severity is shown in Table 2D. Overall, the major causes were (in rank order): transport (motorcycle riders, tractor/other agricultural vehicle operators and bystanders, ATV operators and horse riders), natural/environmental/animal (mostly animal handling), hit/struck/crush, falls and machinery.

Deaths (n=23)

The major cause of the work-related deaths was transport [n= 14 (61%), including pedestrian hit by tractors (n=6)/ute (n=1), tractor operator (n=4), fertiliser spreader operator (n=1) and ATV-quad bike driver (n=2)]. Other causes were natural/environmental/animals [n=3 (13%), struck by cow, charged by bull, trampled by horse), hit/struck/crush [n= 2 (8.7%), felled by tree/branch], drowning [n=1 (4.3%), pinned underwater by concrete cattle trough], electrocution [n=1 (4.3%), contact with electrical wiring when building a farm shed] and strangulation (n=1 (4.3%), entrapped in gate].

Hospital admissions (n=698)

The five major causes of work-related hospitalisations were:

- **Natural/environmental/animal-related causes (n=150, 22%):** Three-quarters of these hospitalisations were caused by being bitten or struck by a mammal (n=111) mainly cattle, horses and sheep, from the small amount of data on the specific animals involved (sub-codes were added to identify the animal from July 1 2006). The other major cause was contact with venomous animals and plants (n=20), mostly snake and spider bites.



Vignettes of non-work related farm injury deaths (n=23) Table 1C

Male, aged 0-14 Leisure activity	The deceased was a pre-school aged boy who fell into an irrigation dam while playing and <i>drowned</i> .
Male, aged 0-14 Leisure activity	The deceased was a pre-school aged boy who <i>drowned</i> after falling into a water hole while playing.
Male, aged 0-14 Activity unknown	The deceased, a schoolboy, died from <i>drowning</i> in a body of water on the farm.
Female, aged 0-14 Other work	The deceased, a young girl was helping with chores on the farm after school. While <i>tending to animals in a paddock, she was knocked over</i> and fell to the ground. She sustained fatal injuries to her head and neck and died.
Male, aged 15-19 Leisure activity	The deceased was a teenage boy who was rifle shooting on the family farm for fun. He sustained a <i>gunshot wound</i> to the head and died from his injuries.
Male, aged 20-39 Sporting activity	The deceased was a young man who <i>crashed</i> while riding a two-wheeled <i>motorbike</i> in a field. He received fatal fractures to his skull.
Male, aged 40-64 Sporting activity	The deceased, a middle-aged male, suffered a lethal gunshot wound to the head. He was <i>accidentally shot</i> while hunting foxes for sport on a remote part of a farm.
Male, aged 40-64 Sporting activity	The deceased was an older male who was <i>riding a quad bike</i> (all-terrain vehicle-ATV) for leisure. He <i>crashed</i> and asphyxiated due to the trauma sustained in the accident.
Male, aged 40-64 Other work - home maintenance	The deceased was a man undertaking domestic gardening. He <i>crashed the tractor</i> he was operating and died as a result of injuries sustained in the accident.
Female, aged 40-64 Other work - home maintenance	The deceased, a middle-aged housewife, was <i>struck by a tractor</i> while gardening.
Female, aged 20-39 Sporting activity	The deceased was a young woman who died in a <i>parachuting accident</i> after her parachute failed to slow her descent properly. She sustained multiple injuries after <i>impacting the ground</i> in a remote bush covered area.
Male, aged 40-64 Sporting activity	The deceased, a middle-aged <i>hang gliding</i> participant, died from multiple injuries after <i>crashing his hang glider</i> into the ground.
Male, aged 40-64 Sporting activity	The deceased was an older man who was killed after the <i>gyrocopter</i> he was operating <i>crashed</i> in a paddock. He sustained multiple injuries during the impact and later died.
Male, aged 40-64 Fire fighting	The deceased, a middle-aged man, died from <i>blunt head trauma</i> sustained while attempting to extinguish a horse float that had caught fire.
Male, aged 65+ Other work - home maintenance	The deceased was an elderly man who suffered severe <i>burns</i> after igniting a flammable substance while using gardening equipment. He later died from complications of his injuries.
Female, aged 65+, Other work	The deceased, an elderly woman, was collecting grass for her sheep when she fell into a septic tank and <i>drowned</i> .
Male, aged 65+, Other work - home maintenance	The deceased was an elderly male who was undertaking garden maintenance on his farm. He was <i>struck</i> on the head while felling a tree and died as a result of the injuries sustained.
Male, aged 65+ Other work - home maintenance	The deceased was an elderly male using a tractor to assist with household maintenance. He suffered multiple fatal injuries when the <i>tractor</i> he was driving <i>crashed</i> into the farmhouse.

Source: National Coroners Information System. Case studies published with the permission of the NCIS Unit

Rank order of causes of farm injury based on case frequency Table 1D

Rank*	Deaths (n=41)	Hospital admissions (n=1,765)	ED presentations (n=7,259)
1. Transport (motorcycle riders, horse riders, tractor/agricultural vehicle operators and bystanders (pedestrians), car/truck occupants and ATV riders)	22 (54%)	623 (35%)	2,314 (32%)
2. Natural/environmental/animals (mostly animal handling)	4 (10%)	316 (18%)	1,283 (18%)
3. Falls	1 (2%)	264 (15%)	891 (12%)
4. Hit/struck/crush	4 (10%)	167 (10%)	908 (13%)
5. Cutting/piercing	-	88 (5%)	883 (12%)

Note: *Weight is given to injury severity (frequency of deaths and hospital admissions) when deciding rank order

Distribution of all farm injury cases by age group

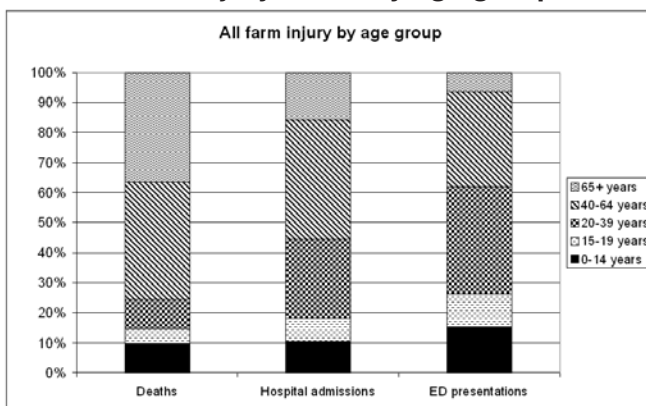


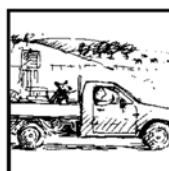
Figure 1

- **Contact with machinery (n=120, 17%):** Sixty-eight per cent of machinery-related hospitalisations were caused by agricultural machinery (n=81). Sub-codes were added to identify type of machinery from July 1 2006. Available data identify the involvement of harvesting machines, post-hole diggers and equipment towed by tractors (such as the grain auger and hay bailer). A further 27 cases involving agricultural machinery are included below under transport.
- **Falls (n=105, 15%):** Over half of the work-related hospitalisations were related to falls from height (n=54, 51%), 46% of which were ladder falls (n=25). Same-level falls accounted for 38% of hospitalisations (mostly trips, slips and stumbles) and the remaining 11% were coded to unspecified falls or fractures.
- **Transport (n=105, 15%):** Transport hospitalisations were mostly 'other land transport accidents' (n=53, 50%) that included animals being ridden (n=11), occupants of special agricultural machinery (n=27) and occupants of all-terrain vehicles (n=15). A further 37% of transport cases were motorcycle riders (n=39).
- **Hit/struck/crush (n=99, 14%):** These hospitalisations were mostly due to either entrapment incidents when a part of the injured person's body was caught, jammed or pinched between objects (n=41) or hit/struck/crush incidents by a thrown, projected or falling object (n=39)' other objects' (n=18).

ED presentations (n=2,025)

There was a different ranking of major causes among ED presentations compared with admissions. The five major causes were (in rank order): cutting/piercing (20%), natural/environmental/animals (20%), hit/struck/crush (18%), falls (11%) and transport (11%). Narrative data (25% sample) provide some more detail on the mechanism and circumstances of the injury incidents.

- **Cutting/piercing (n=401, 20%):** Only half of the random sample of narratives examined provided additional information - mainly the cutting implements/items involved with some very limited information on the circumstances of the injury. The most common implements mentioned were knives, secateurs and pruning shears. Other cutting instruments or items involved included: splinters and thorns, nails, wire, metal stakes, glass, plastic and



Farm work-related injury: frequency, demographics and cause of injury Table 2A

VARIABLE	DEATHS (n=23)		HOSPITAL ADMISSIONS (n=698)		ED PRESENTATIONS (n=2,025)	
	n	%	n	%	N	%
Year						
2004	15	68.2	238	34.1	651	32.1
2005	1	4.5	249	35.7	692	34.2
2006	7	27.7	211	30.2	682	33.7
Age group						
0-14 years	-	-	1	0.1	3	0.1
15-19 years	1	4.4	31	4.4	141	7.0
20-39 years	2	8.7	199	28.5	940	46.4
40-64 years	9	39.1	359	51.4	828	40.9
65+ years	11	47.8	108	15.5	113	5.6
Gender						
Male	22	95.7	596	85.4	1,686	83.3
Female	1	4.3	102	14.6	331	16.3
Missing	-	-	-	-	8	0.4
Cause						
Transport	14	60.9	105	15.0	216	10.7
- pedestrian/pedal cyclist	7	30.4	3	0.4	24	1.2
- motorcycle rider	-	-	39	5.6	87	4.3
- car/truck occupant	-	-	8	1.2	13	0.6
- heavy transport occupant	-	-	1	0.1	-	-
- other land transport - animal rider	-	-	11	1.6	27	1.3
- other land transport - occupant of special agriculture vehicle	5	21.7	27	3.9	50	2.5
- other land transport - occupant of all terrain vehicle	2	8.7	15	2.1	15	0.7
- air transport	-	-	1	0.1	-	-
- other and unspecified	-	-	-	-	-	-
Drowning/near drowning	1	4.3	-	-	-	-
Poisoning	-	-	10	1.4	10	0.5
Falls	1	4.3	105	15.0	227	11.2
- same level slipping/tripping/stumbling	1	4.3	34	4.9	-	8.8
- other falls on same level	-	-	6	0.8	179	-
- different level stairs and steps	-	-	-	-	-	2.4
- different level ladder	-	-	25	3.6	48	-
- different level out of or through building	-	-	4	0.6	-	-
- different level tree	-	-	5	0.7	-	-
- other different level fall	-	-	20	2.8	-	-
- unspecified fall	-	-	7	1.0	-	-
- fracture unspecified	-	-	4	0.6	-	-
Fire/burns/scalds	-	-	8	1.1	39	1.9
Natural/environmental/animals	3	13.0	150	21.5	396	19.6
- contact with venomous animals (snakes, spiders, bees etc) and plants	-	-	20	2.8	13	0.6
- exposure to excessive natural cold	-	-	4	0.6	1	0.0
- bitten/struck by dog	-	-	2	0.3	11	0.5
- bitten/struck by other mammals	3	-	111	15.9	248	12.2
- other and unspecified nat/environ/animals	-	-	13	1.9	123	6.1
Choking/suffocate	1	4.3	-	-	-	-
Hit/struck/crush	2	8.7	99	14.2	354	17.5
Cutting/piercing	-	-	55	7.9	401	19.8
Machinery	-	-	120	17.2	93	4.6
- contact with lifting & transmission device	-	-	11	1.6	-	-
- contact with agricultural machinery	-	-	81	11.6	-	-
- other and unspecified machinery	-	-	28	4.0	-	-
Explosions/firearms	-	-	1	0.1	-	-
Other unintentional	1	4.4	45	6.4	289	14.3

Source: NCIS 2004-6 (deaths); VAED 2004-6 (hospital admissions); VEMD 2004-6 (hospital ED presentations, non-admissions)

hand tools (stapling gun, shearing equipment including shearer's handpieces, band saw and grinder) and machinery (harvester, hay bailer). The few work tasks mentioned were pruning and picking

fruit, shearing, fencing and bailing hay. There were several needlestick injuries that occurred when the farmer or farm worker was vaccinating animals or injecting a carcass with fox bait.

- **Natural/environmental/animals (n=396, 20%):** About 80% of the random sample of narratives provided one extra piece of information, most commonly the animal involved. From this analysis it appears that the animals most involved were cattle (mostly cows but also bulls, steers and calves) and horses. Most cattle and horse injuries were from kicks. Other large animal-related injury mechanisms were: hits, butts, bites, being stood on or being crushed between the animal and a fence, gate, race or other structure. Other animals causing injury were sheep (ramming, charging and crushing injuries), dogs (bite injuries), goats (hit/ramming injuries), snakes (bites), spiders (bites) and bees/wasps (stings).
- **Hit/struck crush (n=354, 18%):** Two-thirds of the random sample of case narratives provided additional information, mainly indicating the mechanism i.e. whether a crush or a hit/struck injury. Injuries were mainly caused by blunt force when the injured person hit against, was struck by or dropped an object such as a gate, part of farm machinery, branch, flying object (hammer head, debris flung by slasher), crow bar, fan or fan housing or a pole/post/rail. Crushing injuries were less common and usually involved hand or finger entrapment with no further details provided.
- **Falls (n=227, 11%):** About 50% of the random sample of case narratives provided one piece of additional information about the fall. Same level falls were not well or consistently described but included falls due to rolled ankles, slips on hills and contaminated surfaces and trips over metal, pallets and other objects. Falls at height were down steps and ladders, into holes and pits and from a header.
- **Transport (n=216, 11%):** Seventy-five per cent of the random sample of narratives provided information on the vehicle involved. It is estimated that the most commonly involved vehicles were tractors, motorcycles and horses. There were a few forklift-related injuries.

Motorcycle injuries were mostly from falls when riding. The mechanisms of the tractor-related injuries were diverse and included being runover, falling from the tractor, impact injuries when jumping from the tractor, hitting against the tractor, and being caught between the tractor and a trailer. The main mechanisms of the horse-related injuries were falling off or being thrown off the horse



Farm work-related injury: Body region injured, nature of injury and length of hospital stay

Table 2B

VARIABLE	DEATHS (n=23)		HOSPITAL ADMISSIONS (n=698)		ED PRESENTATIONS (n=2,025)	
	n	%	n	%	N	%
Body region						
Head/face/neck	4	17.4	118	16.9	345	17
Trunk	5	21.7	99	14.2	144	7
Upper extremity	-	-	262	37.5	893	44
Lower extremity	1	4.3	163	23.4	413	20
Multiple body regions	2	8.7	-	-	46	2.3
Body region not relevant	4	17.4	39	5.6	128	6.3
Unspecified body region	7	30.4	4	0.6	56	2.8
No injury code	N/A		13	1.9	-	-
Nature of injury	N/A					
Fracture			234	33.5	180	8.9
Open wound			107	15.3	531	26.2
Intracranial injury			31	4.4	14	0.7
Dislocation, sprain & strain			45	6.4	386	19.1
Superficial injury			30	4.3	195	9.6
Injury to muscle & tendon			41	5.9	105	5.2
Traumatic amputation			33	4.7	8	0.4
Toxic effects- substances, nonmedicinal			28	4.0	56	2.8
Injury to internal organs			16	2.3	1	0.0
Burns			15	2.1	32	1.6
Injury to nerves & spinal cord			12	1.7	3	0.1
Crushing injury			8	1.1	79	3.9
Eye injury- excl foreign body			11	1.6	94	4.6
Injury to blood vessels			8	1.1	4	0.2
Other & unspecified injury			66	9.5	337	16.6
Missing injury code			13	1.9	0	0.0
Length of stay	N/A				N/A	
< 2 days			379	54.3		
2-7 days			267	38.3		
8-30 days			45	6.4		
31+ days			7	1.0		

Source: NCIS 2004-6 (deaths); VAED 2004-6 (hospital admissions); VEMD 2004-6 (hospital ED presentations, non-admissions)

2.4 Body region and nature of injury

The fatalities were mainly caused by traumatic head or trunk injuries or multiple injuries involving the head/trunk.

Among farm work-related hospital admissions and ED presentations, the upper extremity was the most commonly injured body region (38% of admissions and 44% of ED presentations), followed by the lower extremity (23%, 20%), head/face/neck (17%, 17%) and trunk (14%, 7%).

Among hospitalisations, fracture (n=234, 34%) and open wounds (n=107, 15%) were the most common diagnoses whereas for ED presentations the major injury types were open wounds (26%) and dislocation, sprain & strain (19%).

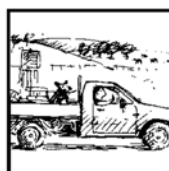
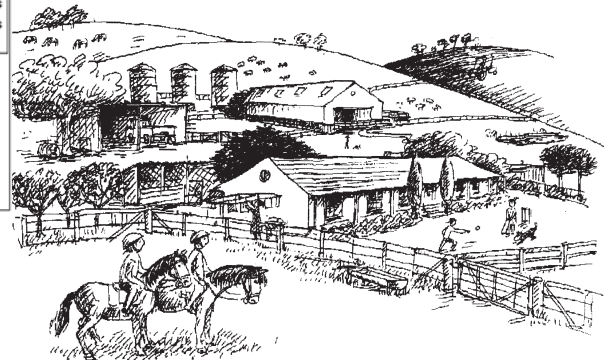
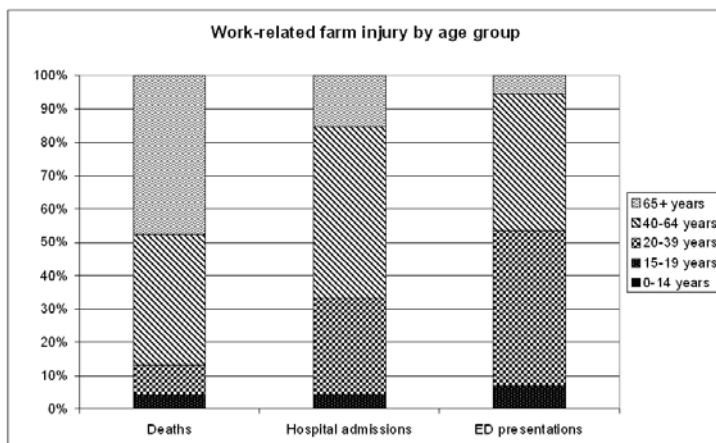
The most common specific injury diagnoses among hospitalisations were: fracture - upper extremity (14%), fracture - lower extremity (11%), open wound - upper extremity (7%), fracture – trunk (6%) and intracranial injury (4%).

2.5 Injury severity: Length of stay

The average length of stay for work-related hospital admissions was 3 days (range < 1 day to 113 days).

Distribution of farm work-related injury cases by age group

Figure 2



Vignettes of farm work-related deaths (n=23)

Table 2C

Male, aged 15-19, vehicle operation	The deceased, a teenage male working on a dairy farm, was <i>operating a tractor</i> with a stirrer attached. The tractor crashed into an effluent pond and the deceased drowned after being unable to get free of the vehicle.
Male, aged 20-39, construction	The deceased was a young male carpenter employed to construct a farm shed. He suffered a fatal heart attack after coming into contact with <i>live electrical wiring</i> during the construction.
Male, aged 20-39, dairy farming	The deceased, a young male dairy milker, died due to <i>strangulation</i> after becoming entrapped in a paddock gate.
Male, aged 40-64, woodcutting	The deceased was a middle-aged man employed to cut wood for sale. He was <i>struck on the head</i> by a branch he was splitting and died as a result of the trauma sustained.
Male, aged 40-64, vehicle operation	The deceased, an older male, <i>crashed while driving a fertilizer spreader</i> . He suffered fatal chest and abdominal injuries from being <i>crushed</i> between the vehicle and the ground.
Female, aged 40-64, cattle herding	The deceased was a middle-aged woman who was herding cattle on her farm. She was <i>struck in the chest by one of the animals</i> and received a lethal penetrating wound.
Male, aged 40-64, general farming	The deceased was a middle aged male farmer. He <i>drowned</i> after becoming pinned face down in a pool of water by a concrete cattle trough.
Male, aged 40-64, horse training	The deceased, an older male farrier, was <i>trampled by the horse</i> he was training. He received several severe blows to the chest that ruptured his heart.
Male, aged 40-64, tree felling	The deceased was an instructor at an agricultural training facility that was <i>struck while felling a tree</i> and died from massive head and chest injuries.
Male, aged 40-64, general farming/vehicular	The deceased was a middle aged farmer who was involved in a <i>vehicular impact as a pedestrian</i> . He received fatal chest and head injuries due to being crushed when hit by a tractor.
Female, aged 40-64, fire fighting	The deceased, a middle aged female volunteer firefighter, was <i>run over by a tractor</i> while attending to a fire on a farm.
Male, aged 40-64, general farming/vehicular	The deceased was an older male farmer who was <i>run over by a tractor</i> in a field while undertaking farming duties on foot.
Male, aged 65+, pig farming	The deceased, an elderly male pig farmer, <i>fell</i> over in a sty while tending to his pigs. He died from head injuries received from the impact with the floor.
Male, aged 65+, cattle herding	The deceased was an elderly man who received lethal chest injuries when <i>attacked by a bull</i> he was herding.
Male, aged 65+, general farming/vehicular	The deceased was an elderly farmer who was working on foot in a paddock. He was <i>hit by a ute</i> driven by a fellow farm worker and died of the injuries.
Male, aged 65+, vehicle operation	The deceased, an elderly man, was working on the farm when he fatally <i>crashed the ATV</i> quad bike he was riding at the time.
Male, aged 65+, vehicle operation	The deceased was an older farmer who sustained a lethal head injury when he was involved in a <i>collision while riding an ATV</i> quad bike.
Male, aged 65+, vehicle operation	The deceased, an elderly male, was <i>operating a tractor</i> on the farm. He was involved in a <i>collision</i> and received multiple fatal head injuries.
Male, aged 65+, general farming/vehicular	The deceased was an elderly farmer who was <i>hit by a tractor</i> travelling at speed while he was working on foot. The force of the impact crushed the farmer's pelvic area and resulted in multiple organ failures.
Male, aged 65+, general farming/vehicular	The deceased, a semi-retired farmer, was working adjacent to the farmhouse. <i>A tractor driven by another farm worker rolled over</i> and the farmer was caught underneath and crushed.
Male, aged 65+, general farming/vehicular	The deceased was an older man working on foot in a field. He was <i>struck by a tractor</i> driven by someone else, and died as a result of the injuries sustained.
Male, aged 65+, vehicle operation	The deceased, semi-retired, was <i>operating a tractor</i> on his farm when he became involved in an incident that resulted in him being <i>crushed between</i> the vehicle and a solid object.
Male, aged 65+, general farming/vehicular	The deceased was an elderly farmer who was <i>struck by equipment being towed behind a tractor</i> while he was working on foot in a crop field. His leg was partially severed resulting in a fatal loss of blood.

Source: National Coroners Information System. Case studies published with the permission of the NCIS Unit

Rank order of causes of work-related farm injury based on case frequency

Table 2D

Rank*	Deaths (n=23)	Hospital admissions (n=698)	ED Presentations (n=2,025)
1. Transport (mostly motorcycle riders, tractor/other agricultural vehicle operators and bystanders (pedestrians), ATV operators and horse riders)	14 (61%)	105 (15%)	216 (11%)
2. Natural/environmental/animal (mostly animal handling)	3 (13%)	150 (22%)	396 (20%)
3. Hit/struck/crush	2 (9%)	99 (14%)	354 (18%)
4. Falls	1(4%)	105 (15%)	227 (11%)
5. Machinery	-	120 (17%)	93 (5%)

Note: *Weight is given to injury severity (frequency of deaths and admissions) when deciding rank order

3. Farm injury in vulnerable population groups (1): Injury in children and young people (aged 0-19)

There were 6 deaths, 321 hospital admissions and 1,912 ED presentations for farm injury among children and young people aged 0-19 over the 3-year study period, an average of 2 deaths, 107 admissions and 637 ED presentations per year.

3.1 Deaths

Four of the 6 farm injury deaths of children and young people were children aged 0-14 (three males and one female) and two were young males aged 15-19 years. Three child fatalities were caused by drowning (in a dam, waterhole and 'body of water') and the other in an unspecified incident when the child was tending animals in a paddock. One young person was operating a tractor doing paid farm work when it crashed into an effluent pond and he was pinned by the vehicle and drowned and the other was killed in a shooting incident when rifle shooting for recreation. Vignettes are included in Table 1C and 2C.

3.2 Hospital-treated injury

The pattern of hospital-treated farm injury in children and young people (analysed separately) is summarised in tables 3A and B.

Among children aged 0-14 years there were 184 admissions and 1,112 ED presentations for farm injury over the 3-year study period. Among young people aged 16-19 there were 137 admissions and 800 ED presentations.

The data on activity when injured indicate that most of the child injuries on farms occurred when children were participating in sport, leisure and 'other specified' activities and very few were treated in hospital for injuries that occur when working for an income or doing unpaid work. However, these results should be treated as indicative as 50% of child farm injury hospitalisations and 37% of ED presentations are not coded for activity at the time of injury.

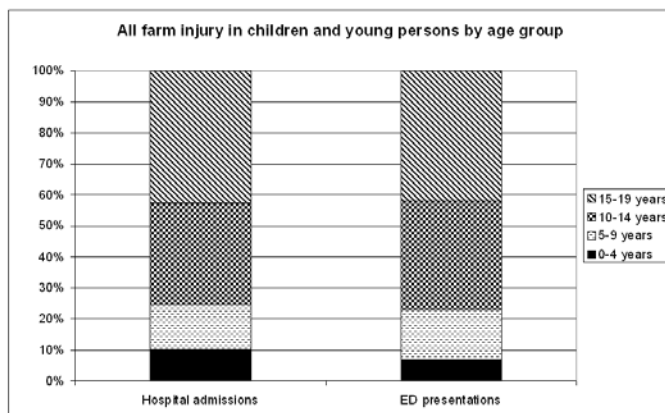


Farm injury among children and young people: Table 3A
Frequency, demographics, cause of injury and activities when injured

VARIABLE	CHILDREN (0-14 YEARS)				YOUNG PEOPLE (15-19 YEARS)			
	Hospital Admissions (n=184)		ED Presentations (1,112)		Hospital Admissions (n=137)		ED Presentations (n=800)	
	N	%	n	%	N	%	N	%
Year								
2004	63	34.2	330	29.7	42	30.7	257	32.1
2005	62	33.7	345	31.0	50	36.5	241	30.1
2006	59	32.1	437	39.3	45	32.8	302	37.8
Age group								
0-4 years	33	17.9	131	11.8	-	-	-	-
5-9 years	46	25.0	309	27.8	-	-	-	-
10-14 years	105	57.1	672	60.4	-	-	-	-
15-19 years	-	-	-	-	137	100.0	800	100.0
Gender								
Male	109	59.2	569	51.2	105	76.6	521	65.1
Female	75	40.8	539	48.5	32	23.4	268	33.5
Missing	-	-	4	0.4	-	-	11	1.4
Cause								
Transport	118	64.1	581	52.2	97	70.8	415	51.9
drowning/near drowning	2	1.1	3	0.3	-	-	-	-
Poisoning	4	2.2	-	-	-	-	-	-
Falls	20	10.9	199	17.9	9	6.6	78	9.8
Fires/burns/scalds	2	1.1	20	1.8	2	1.5	15	1.9
Natural/environmental/animals	19	10.3	134	12.1	4	2.9	105	13.1
Choking/suffocate	-	-	-	-	-	-	-	-
Hit/struck/crush	6	3.3	74	6.7	5	3.6	72	9.0
Cutting/piercing	5	2.7	61	5.5	5	3.6	67	8.4
Machinery	4	2.2	5	0.4	13	9.5	12	1.5
Explosions/firearms	-	-	-	-	-	-	-	-
Other unintentional	4	2.2	35	3.1	2	1.5	36	4.5
Activity								
Working for income	1	0.5	3	0.3	31	22.6	141	17.6
Unpaid work	3	1.6	26	2.3	5	3.6	58	7.3
Sport and recreation activity	34	18.5	40	3.6	24	17.5	16	2.0
Leisure	12	6.5	892	80.2	3	2.2	470	58.8
Vital activities	1	0.5	22	2.0	-	-	12	1.5
Other specified	41	22.3	91	8.2	24	17.5	74	9.3
Unspecified	92	50.0	38	3.4	50	36.5	29	3.6

Source: VAED 2004-6 (hospital admissions); VEMD 2004-6 (hospital ED presentations, non-admissions)

Distribution of hospital-treated farm injury cases in children and young people (aged 0-19 years) by age group **Figure 3**



The pattern is different for young people aged 15-19. In this age group, at least 23% of hospitalisations and 18% of ED presentations were for income-producing farm work-related injuries. Only a small proportion of injuries (4% of admissions and 7% of ED presentations) to 15-19 year olds occurred during unpaid work tasks. As for children, a substantial proportion of hospital admissions (20%) and ED presentations (60%) of young people occurred during sport and leisure activities undertaken on farms. Specific activities identified in hospital admissions and ED presentations data include trail and general horse riding, motorcycling, pedal cycling and driving motor vehicles (cars).

3.2.1 Gender and age

Males were over-represented in child farm injury admissions (59%) but less so in ED presentations (51%). The gender difference was more pronounced among young persons with males accounting for 77% of farm injury admissions and 65% of ED presentations.

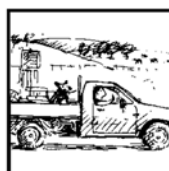
Figure 3 shows the distribution of hospital-treated injury cases by 5-year age group. The frequency of farm injury admissions and ED presentations increased as age increased, with 15-19 year olds accounting for 43% of child and youth farm injury hospital admissions and 42% of ED presentations.

3.2.2 Causes of injury

Ranking of the major causes of injury among children and young people based on case frequency data weighted by severity is summarised in Table 3C. Overall, the five major causes of injury among children and young people were: transport (mostly related to motorcycle riding and horse riding), natural/environmental/animals (mostly related to animal handling), falls, hit/struck/crushed and drowning (for fatalities only).

Children

Nearly two-thirds (64%) of the 184 child farm hospital admissions were transport-related, mostly motorcycle rider injuries (30% of all child farm hospitalisations) and 'other land transport' injuries that covers animal riding, occupant of agricultural vehicles and all-terrain/off-road vehicles (23%). The other major causes were falls (11%, mostly falls from height either from one level to another or falling out or through buildings) and natural/environmental/animal (10%, mostly bitten, struck or crushed by animal).



Farm injury among children and young people: Table 3B
Body region injured, nature of injury and length of hospital stay

VARIABLE	CHILDREN (0-14 YEARS)				ADOLESCENTS AND YOUNG ADULTS (15-19 YEARS)			
	Hospital Admissions (n=184)		ED Presentations (1,112)		Hospital Admissions (n=137)		ED Presentations (n=800)	
	N	%	n	%	N	%	n	%
Body region								
Head/face/neck	57	31.0	171	15.4	35	25.5	109	13.6
Trunk	19	10.3	44	4.0	12	8.8	52	6.5
Upper extremity	47	25.5	484	43.5	53	38.7	346	43.3
Lower extremity	49	26.6	292	26.3	33	24.1	223	27.9
Multiple body regions	1	0.5	41	3.7	-	-	34	4.3
Body region not relevant	10	5.4	61	5.5	2	1.5	26	3.3
Unspecified body region	-	-	19	1.7	-	-	10	1.3
No injury code	1	0.5	-	-	2	1.5	-	-
Injury								
Fracture	73	39.7	268	24.1	57	41.6	157	19.6
Open wound	33	17.9	203	18.3	20	14.6	137	17.1
Intracranial injury	29	15.8	45	4.0	18	13.1	17	2.1
Dislocation, sprain & strain	2	1.1	219	19.7	2	1.5	187	23.4
Superficial injury	4	2.2	119	10.7	8	5.8	88	11.0
Injury to muscle & tendon	3	1.6	41	3.7	3	2.2	48	6.0
Traumatic amputation	3	1.6	1	0.1	4	2.9	-	-
Toxic effects- substances, non-medical	5	2.7	25	2.2	1	0.7	19	2.4
Injury to internal organs	4	2.2	2	0.2	3	2.2	1	0.1
Fire/burns/scalds	4	2.2	33	3.0	4	2.9	20	2.5
Injury to nerves & spinal cord	3	1.6	1	0.1	1	0.7	-	-
Crushing injury	1	0.5	24	2.2	1	0.7	23	2.9
Eye injury- excl foreign body	-	-	5	0.4	-	-	10	1.3
Injury to blood vessels	-	-	-	-	-	-	-	-
Other & unspecified injury	19	10.3	34	3.1	13	9.5	39	4.9
Missing injury code	1	0.5	92	8.3	2	1.5	54	6.8
Length of stay								
< 2 days	128	69.6	-	-	83	60.6	-	-
2-7 days	51	27.7	-	-	48	35.0	-	-
8-30 days	4	2.2	-	-	5	3.6	-	-
31+ days	1	0.5	-	-	1	0.7	-	-

Source: VAED 2004-6 (hospital admissions); VEMD 2004-6 (hospital ED presentations, non-admissions)

Rank order of causes of farm injury in children and young people based on case frequency Table 3C

Rank*	Deaths (n=6)	Hospital admissions (n=321)	ED presentations (n=1,912)
1. Transport (mostly motorcycle and horse riders)	-	215 (67%)	996 (52%)
2. Natural/environmental/animal (mostly animal handling)	1 (17%)	23 (17%)	239 (13%)
3. Falls	-	29 (9%)	277 (14%)
4. Hit/struck/crush	-	11 (3%)	146 (8%)
5. Drowning	4 (66%)	2 (1%)	-

Note: *Weight is given to injury severity (frequency of deaths and admissions) when deciding rank order



Child farm injury ED presentations followed a similar causal pattern to admissions with transport-related injuries predominating (52%), followed by falls (18%) and natural/environmental/animals (12%).

Case narrative data provided some additional information on the mechanisms and circumstances of ED presentations; a 50% sample was analysed.

The vehicles most involved in child transport ED presentations were motorcycles and horses. Over half the motorcycle riding and most of the horse riding ED presentations were caused by falls from the bike or horse. Other mechanisms of motorcycling injury included crashing into fences (including barbed-wire and electric fences) and gates, driving into drains/ditches, being hit by tree branches, burns from the exhaust pipe and tip-overs. Other vehicles involved in a small number of transport injury incidents were bicycles, cars, tractors and ATVs. Very few narratives included information on the helmet wearing status of motorcycle and horse riders.

Child fall-related ED presentations were the result of children falling from height off a variety of objects including trees, fences, gates, moving trailers, the back of a ute, hay bales, a raft, and a swing and when rollerblading, playing soccer, bushwalking, running and jumping.

Young people

Most farm injury hospitalisations among young people were transport-related (71%), predominantly motorcycle riders (43% of all farm injury hospitalisations in 16-19 year-olds) and car occupants (6%). Machinery, most commonly agricultural machinery, was the other major cause of hospital admissions, accounting for 10% of hospitalisations.

As for hospital admissions, the major cause of ED presentations among young people was transport (52%). Other common causes were natural/environmental/animals (13%), falls (10%); hit/struck/crush (9%) and cutting/piercing (8%).

Fifty per cent of case narratives for ED presentations were analysed. The analysis revealed that transport ED presentations were mostly falls, collisions and other injuries from motorcycle riding (39% of transport ED presentations) and falls related to horse riding (29%).



Falls cases were not well described but reported incidents included falls/slips from the back of a ute, step ladder, roof, plank and a fall when paintballing.

3.2.3 Body region injured and site of injury

Children

Injuries among child hospitalisations were fairly evenly distributed across the head/face/neck (31%), lower extremity (27%) and upper extremity (26%). Fracture was the most common injury type accounting for 40% of child hospital admissions, followed by open wound (18%) and intracranial (brain) injury (16%). Thirty-four per cent of brain injuries occurred in the hospitalised motorcycle riders.

Young people

Among hospitalisations of young people, the upper extremity was most frequently injured body site (39%) followed by the head/face/neck (24%) and lower extremity (24%). As for children, fracture was the most common injury (42%), followed by open wounds (15%). Intracranial (brain) injury formed a sizeable proportion of hospitalised cases (13%), and, as for children, mostly occurred in motorcycle riders (50%).

3.2.4 Injury severity (length of stay)

Seventy per cent of child hospital admissions stayed in hospital less than two days compared with sixty-one per cent of admissions of young people aged 15-19. Compared with children, a higher proportion of young people had lengths of stay of 2 to 7

days (35% vs. 28%) and 8 or more days (4% vs. 3%).

The average length of stay in hospital for 15-19 year-olds was 2 days (range: 0-32 days) which was greater than the average LOS in children (1.7 days, range: 0-36 days).

4. Injury in vulnerable population groups (2): Injury to seniors aged 65 years and older

There were 15 injury deaths, 278 hospital admissions and 460 ED presentations among seniors aged 65 years and older on farms. Of these, 11 deaths (73 %) and at least 108 hospitalisations (39%) and 113 ED presentations (25%) occurred when the seniors were doing paid (income producing) farm work.

The pattern of farm injury in seniors is summarised in tables 4A & B.

Farm injury in seniors aged 65 years and older: Frequency, demographics, cause of injury and activity when injured **Table 4A**

VARIABLE	DEATHS (n=15)		HOSPITAL ADMISSIONS (n=278)		ED PRESENTATIONS (n=460)	
	N	%	N	%	N	%
Year						
2004	10	66.7	83	29.9	145	31.5
2005	1	6.7	108	38.8	153	33.3
2006	4	26.7	87	31.3	162	35.2
Gender						
Male	14	93.3	231	83.1	377	82.0
Female	1	6.7	47	16.9	79	17.2
Missing	-	-	-	-	4	0.9
Age group	N/A					
65-69 years			85	30.6	200	43.5
70-74 years			72	25.9	116	25.2
75-79 years			59	21.2	84	18.3
80-84 years			37	13.3	43	9.3
85+ years			25	9.0	17	3.7
Cause						
Transport	9	60.0	53	19.1	49	10.7
Drowning/near drowning	1	6.7	-	-	-	-
Poisoning	-	-	2	0.7	3	0.6
Falls	1	6.7	87	31.3	98	21.3
Fires/burns/scalds	1	6.7	5	1.8	5	1.1
Natural/environmental/animals	1	6.7	63	22.7	104	22.6
Choking/suffocate	-	-	-	-	-	-
Hit/struck/crush	2	13.3	31	11.2	75	16.3
Cutting/piercing	-	-	8	2.9	58	12.6
Machinery	-	-	17	6.1	12	2.6
Explosions/firearms	-	-	2	0.7	-	-
Other unintentional	-	-	10	3.6	56	12.2
Activity						
Working for income	11	73.3	108	38.8	113	24.6
Unpaid work	4	26.7	52	18.7	132	28.7
Sport and recreation activity	-	-	2	0.7	-	-
Leisure	-	-	1	0.4	100	21.7
Vital activities	-	-	2	0.7	16	3.5
Other specified	-	-	28	10.1	78	16.9
Unspecified	-	-	85	30.6	21	4.6

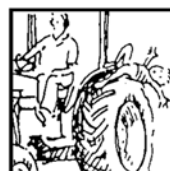
Source: NCIS 2004-6 (deaths); VAED 2004-6 (hospital admissions); VEMD 2004-6 (hospital ED presentations, non-admissions)

4.1 Deaths

Fourteen of the 15 fatalities were male. The major cause of fatalities was transport (n=9, 60%). Five transport-related deaths were caused when the vehicle (tractor or ATV) the senior was operating crashed. Four other transport deaths occurred when the senior was on foot doing paid work or home maintenance and was hit by a tractor (3 cases) or a utility vehicle (1 case). Other causes of single incidents were: a fall, animal handling (gored by bull), burns from igniting flammable liquid, hit/struck/crushed when tree felling and drowning after the victim fell into a septic tank

The body regions injured were the head (3 cases), chest (1) pelvis (1) and lower extremity (1) and by burns (1) and asphyxia due to drowning (1). In the remaining cases, multiple body regions were involved or the body region injured was not specified.

Vignettes of non-work related fatalities are in Table 1C and of work-related fatalities are in Table 2C.



Farm injury in seniors aged 65 years and older: Table 4B
Body region injured, nature of injury and length of hospital stay

VARIABLE	DEATHS (n=15)		HOSPITAL ADMISSIONS (n=278)		ED PRESENTATIONS (n=460)	
	N	%	N	%	N	%
Body region						
Head/face/neck	3	20.0	49	17.6	66	14.3
Trunk	2	13.3	55	19.8	37	8.0
Upper extremity	-	-	61	21.9	204	44.3
Lower extremity	1	6.7	97	34.9	105	22.8
Multiple body regions	1	6.7	0	0	16	3.5
Body region not relevant	2	13.3	9	3.2	23	5.0
Unspecified body region	6	40.0	2	0.7	9	2.0
No injury code	-	-	5	1.8	0	0
Injury	N/A					
Fracture			110	39.6	64	13.9
Open wound			40	14.4	141	30.7
Intracranial injury			19	6.8	1	0.2
Dislocation, sprain & strain			12	4.3	74	16.1
Superficial injury			24	8.6	51	11.1
Injury to muscle & tendon			9	3.2	21	4.6
Traumatic amputation			4	1.4	1	0.2
Toxic effects- substances nonmedicinal			6	2.2	12	2.6
Injury to internal organs			8	2.9	0	0.0
Burns			6	2.2	3	0.7
Injury to nerves & spinal cord			4	1.4	0	0.0
Crushing injury					17	3.7
Eye injury- excl foreign body			2	0.7	14	3.0
Injury to blood vessels			2	0.7	2	0.4
Other & unspecified injury			27	9.7	14	3.0
Missing injury code			5	1.8	45	9.8
Length of stay	N/A				N/A	
< 2 days			96	34.5		
2-7 days			117	42.1		
8-30 days			55	19.8		
31+ days			10	3.6		

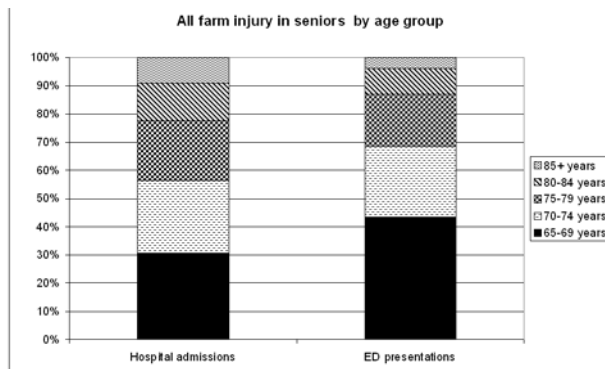
Source: NCIS 2004-6 (deaths); VAED 2004-6 (hospital admissions); VEMD 2004-6 (hospital ED presentations, non-admissions)

Rank order of causes of farm injury in seniors aged 65 years and older based on case frequency Table 4C

Rank*	Deaths (n=15)	Hospital admissions (n=278)	ED presentations (n=460)
1. Transport (mostly motorcycle and horse riders)	9 (60%)	53 (19%)	49 (11%)
2. Falls	1 (7%)	87 (31%)	98 (21%)
3. Natural/environmental/animals (mostly animal handling)	1 (7%)	63 (23%)	104 (23%)
4. Hit/crush/struck	2 (13%)	31 (11%)	75 (16%)

Note: *Weight is given to injury severity (frequency of deaths and admissions) when deciding rank order

Distribution of hospital treated farm injury cases in seniors aged 65 years and older by age group Figure 4



4.2 Hospital-treated injury

4.2.1 Gender and age

Males comprised 83% of the 278 hospital admissions and 82% of the 460 ED presentations.

Figure 4 shows the distribution of hospital-treated injury cases by age. Seniors aged 65-69 accounted for 31% of hospitalisations and the proportion decreased as age increased through to seniors aged 85+ who accounted for 9%. The pattern for ED presentations was similar with the number of presentations decreasing as age increases.

4.2.2 Causes of injury

Ranking of the major causes of injury among seniors aged 65 years and older based on case frequency data weighted by severity is summarised in Table 4D. Overall, the four major causes of injury were: transport (mostly related to motorcycle riding and horse riding), falls, natural/environmental/animal (mostly related to animal handling) and hit/struck/crushed.

Hospital admissions

The major cause of hospitalisations was falls [31%, mostly same level falls (55% of falls)], followed by natural/environmental causes [23%, mostly bitten/struck by animal (83%)] and transport [19%, mostly 'other land transport' (53%) and motorcycle rider (21%)].

ED presentations

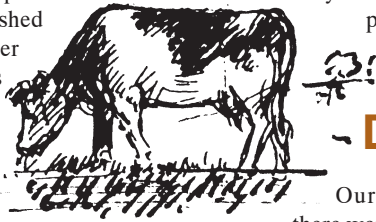
ED presentations were most commonly caused by natural/environmental/animals (23%), followed by falls (21%), hit/struck/crush (16%) and transport (11%).

Narratives provided some additional information on ED presentations but were of variable quality with about 25-50% (depending on cause) providing little or no extra information.

ED presentations for falls were caused by: slips on slopes, cow dung, muddy ground, grass and contaminants on the garage floor; trips over a variety of objects; and loss of balance occurred at height on ladders, steps and from ute and truck trays and at ground level while doing tasks such as fruit picking and gardening, cleaning out seeder and shearing.



Natural/environmental/animal injuries were mostly related to the injured person being hit, kicked, stood on, crushed or flicked by cows and, to a lesser extent, sheep. Other animals involved included dogs (bites), snakes (bites), spiders (stings) and wasps (stings). Single incidents involved a cat (bite), rooster (spur) and fox (bite).



and 23% were in hospital for 8 to more than 31 days compared with 3-7% of persons in other age groups.

Discussion

Our study showed that there were 41 injury deaths and at least 1,765 hospitalisations and 7,259 ED presentations for farm injuries in Victoria over the 3-year period 2004-6, giving an annual average of 14 deaths and at least 3,000 hospital-treated injuries. Over half the farm injury deaths, 40% of admissions and 28% of ED presentations were work-related.

Hit/struck/crush injuries were caused by finger/hand entrapment involving gates and impact with a variety of falling/dropped objects such as a metal bar, tree limb, chain, rock, bail of hay etc.

The vehicle was identified in 70% of the transport injury case narratives. Motorcycles were most commonly involved, followed by horses and tractors. Transport-related injuries usually occurred when the rider/operator fell from the vehicle. There were a few tractor rollover or rollover incidents.

4.2.3 Body region and type of injury

Among hospitalisations, the lower extremity was the most commonly injured body region (35%), followed by the upper extremity (22%), trunk (20%) and head/face/neck (18%). Fractures accounted for 40% of all hospitalisations, open wounds 14% and superficial injury 9%. Intracranial (brain) injury formed 7% of hospitalisations. The most common specific injury diagnoses were fracture-lower extremity (19%); fracture-trunk (9%); fracture-upper extremity and intracranial injury (both 7%).

The pattern was different for ED presentations where the upper extremity was the most commonly injured body region (44%), followed by the lower extremity (23%) and head/face/neck (14%).

4.2.4 Injury severity (length of stay)

Seniors injured on farms had a longer length of stay in hospital than their younger counterparts. Their average length of stay (LOS) was 6.4 days compared with 2.5 days in all other age groups injured on farms.

Just over one-third (35%) of hospitalised seniors had short stays (less than two days) compared to 53-69% of the younger age groups, 42% had a LOS of 2-7 days compared with 28-40% of their younger counterparts,

Males were over-represented accounting for 85% of farm injury deaths and 71% of hospital treated injury cases overall. The over-representation of males was even more evident among farm work-related injury cases where they accounted for 95% of deaths and over 80% of hospital-treated injuries. Among vulnerable population groups, males were well over-represented among injured seniors (aged 65 years and older) and young people (aged 16-19 years) but the gender difference narrowed for children where the male to female ratio was 59:41 for hospital admissions and 51:49 for ED presentations.

Overall, three-quarters of all farm injury deaths, over half of hospital admissions and 40% of ED presentations were in adults aged 40 years and older. Among work-related farm injury, this age-related pattern was even more evident. Rate data are not available so age-related risk comparisons cannot be made but, based on frequency data, seniors aged 65 years and older appear at excess risk of fatal injuries. They accounted for 37% of all farm injury deaths and 50% of farm work-related deaths. This age pattern has been noted previously in Australian and overseas studies of farm fatalities (Mitchell et al., 2002; Rissanen et al., 2003, Pickett et al., 1999).

Studies of the over-involvement of older drivers in motor vehicle crashes indicate that contributory factors may include a combination of age-related physical decline that makes older people more likely to be seriously injured on impact and reduced fitness for the task in hand (driving) due to functional decline in sensory and perceptual capacities, features of normal ageing, exacerbated by the onset of medical conditions (Langford & Oxley, 2006).

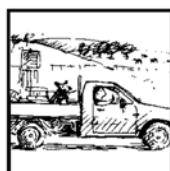
The major cause of fatal and serious farm injuries (hospitalisations) overall and for work-related injury was transport (mostly related to motorcycle riding, horse riding and the operation of agricultural vehicles), followed by hit/struck/crush and natural/environmental/animals (mostly kicked/struck/crushed by large animals mostly cows and horses). Machinery was a major cause of work-related hospitalisations. Falls were a prominent cause of injury among seniors and children. Five deaths (including three child deaths) were caused by drowning.

Fatal farm injuries were mostly due to head injuries and injuries to multiple body regions. Among hospitalisations, fracture and open wounds were the two most common injuries overall (41% and 14% respectively), in work-related injury cases (34%, 15%) and in all the vulnerable population groups studied – seniors, young people and children (40-41%, 14-18%). Intracranial injuries accounted for 7% of all farm injury hospitalisations mainly due to the high proportion of these injuries in children (16%) and young people (13%). The proportion of intracranial injuries was comparatively low in work-related hospitalisations (4%).

Risk factors

Our study was descriptive. As we did not recruit a comparison group of uninjured persons on farms, we could not definitively establish any risk factors for injury. We therefore conducted a literature review to identify what is known about farm injury risk factors. Due to time and budgetary constraints, we restricted our search to analytical studies (case control and cohort studies) recorded on the Medline database from 1990 – end July 2008. Also included were studies found in the reference lists of the eligible studies selected from Medline.

Using this method, we found 15 case control or cohort studies that identified a relatively small number of risk factors for adult farm injury. The studies were mostly conducted in the agricultural belt states and provinces of the United States and Canada and Northern European countries. Also included are the preliminary results from the only farm injury risk factor study conducted in Australia – the Farm Injury Risk among Men (FIRM) study by Lesley Day of MUARC and colleagues – as this study was of particular interest as it was conducted in Victoria. It has been submitted for publication.



The results of the 16 studies included in our review are summarised in a table (Table 5) in the electronic version of this *Hazard* that can be downloaded from the VISU website (www.monash.edu.au/muarc/visu).

Personal and health characteristics

Strong evidence

The strongest evidence, in terms of effect size and consistency of findings, was found for three personal and health characteristics: younger age, previous history of injury and medication use.

- **Younger age:** Farmers/farm workers in younger age groups (variously defined) were consistently reported to be at higher risk of non-fatal injury than their older counterparts, with most studies showing that risk was inversely related to age i.e., as age decreased the risk of injury increased (Sprince et al., 2003; Hwang et al., 2001; Lewis et al., 1998; Crawford et al., 1998; Zhou & Roseman 1994; Gerberich et al., 1993). In all but one of these studies the trend persisted after controlling for hours worked. Lewis et al. (1998) did not adjust for hours worked in their multivariate analysis. They found that the younger farmers in their study worked longer hours than their older counterparts and concluded that their finding of increased injury risk in younger farmers is probably explained by their greater exposure to workplace hazards.

The other study authors put forward several possible explanations for the higher risk status of younger farmers/farm workers including: inexperience, over-involvement in heavier and more hazardous tasks such as those related to machinery and animals and greater risk-taking behaviour. Two authors of case control studies suggested that their findings could be affected by bias with younger farmers over-represented in cases because they have better recall of all their injuries than older farmers (Sprince et al., 2003; Crawford et al., 1998).

It should be noted here that several descriptive studies of fatal farm injury in Australia and comparable countries have found that older farmers appear over-represented in farm fatalities (Day, 1999; Pickett et al., 1999; Mitchell et al., 2002; Rissanen et al., 2003).

- **Previous history of injury:** Farmers who report prior agricultural related injuries or an impairment that limits work such as a musculo-skeletal disorder have been consistently found to be at up to 2-fold increased risk of a subsequent injury (Voaklander et al., 2006; Suutarinen, 2004; Hwang et al., 2001; McGwin et al., 2000; Browning et al., 1998; Lewis et al., 1998; Zhou & Roseman, 1994; Elkington JM, 1990). Authors suggested that disabilities from previous injuries may impair mobility or the performance of tasks or that farmers experiencing prior injuries may work in more hazardous conditions, overwork, indulge in more risk-taking behaviour or be less safety conscious than their uninjured counterparts (Suutarinen, 2004; Hwang et al., 2001; McGwin et al., 2000; Browning et al., 1998; Lewis et al., 1998).

Increased risk of injury has also been consistently found among farmers who are hearing impaired perhaps due to their being less able to hear sounds that may warn of impending danger or because hearing asymmetry may cause misjudgement of direction, distance and movement leading to higher exposure to hazards (Hwang et al., 2001; Sprince et al., 2003; Choi et al., 2005).

- **Medication use:** Five studies report that the regular or recent use of any, prescription or specific medications (pain killers, NSAIDs, sedatives, heart or stomach medications or laxatives) results in a 1.5-9.4-fold increase in the odds/risk of injury (Elkington, 1990; Brison & Pickett, 2002; Pickett & Chapman 1996; Sprince et al., 2003; Voaklander et al., 2006). Authors suggest that medications may reduce alertness thereby increasing the risk of injury or the underlying condition/pain that is masked by the medication may impair ability to perform tasks. It is also suggested that recent cessation of medication may cause withdrawal symptoms distracting the worker's attention from the task in hand.

Conflicting evidence

The evidence was conflicting for two further risk factors:

- **Farm ownership status:** Three U.S. studies have found that being an owner/ operator increases the risk of farm injury with authors suggesting that owner operators may perform the more demanding and hazardous tasks themselves rather than

allocating them to their workers or may work longer hours or engage more frequently in risky practices due to economic stressors (Pratt et al., 1992; Zhou & Roseman, 1994; Hwang et al., 2001). By contrast, the Victorian FIRM study found that being an employee or contractor, compared with an owner/ manager, significantly increased the odds of injury (Day et al., unpublished). The authors of this study hypothesise that farm workers may be exposed to more hazardous work tasks than farm owners.

- **Hours worked:** Study findings are conflicting on the impact of working hours on injury risk with the weight of evidence indicating that working full-time (Bison & Pickett 1992) or long hours — more than 8 hours per day on average (Hwang et al., 2001), 30 hours or more per week (Elkington, 1990), 50 hours or more per week (Sprince et al. 2003) or more than 60 hours per week (Pratt et al., 1992)— is associated with injury, possibly due to greater exposure to farming hazards or to fatigue and stress caused by the long hours. However, two studies report that working part-time increased injury risk (McGwin et al., 2000; Zhou & Roseman, 1994).

Limited evidence

At this stage there is evidence from only one cohort or case control study to support an association between injury and higher education level (Sprince et al., 2003); non-attendance at agricultural courses (Day et al., unpublished); self-reported high neurotoxicity symptoms (Crawford et al., 1998); depressive symptoms (Park et al., 2001); having incontinence/urinary tract infection (Voaklander et al., 2006); and alcohol consumption (Zhou & Roseman (1994).

Farm characteristics

There is a reasonable level of evidence to indicate that exposure to animals or large livestock (cattle, hogs) on farms elevates the risk/odds of injury (Park et al., 2001; Sprince et al., 2003; Brison & Pickett, 2003; Browning et al., 1998).

There is no clear-cut evidence that any other farm characteristic increases or reduces injury risk on farms. Hwang et al (2001) found a weak but significant association between injury and high farm gross sales whereas the study by Day et al. (unpublished) found that working on farms with low annual farm income increased the odds of injury. Suutarinen (2004) reported that the odds of



injury increased with the number of farm machines but this finding requires corroboration.

Deficits in farm safety systems, measured by different indicators including the poor condition of farm machinery (McGwin et al., 2000), absence of roll-over protector structures on tractors (Day et al. unpublished), absence of personal protective equipment for chemical use (Day et al., unpublished) and hand or arm exposure to acids or alkalis (Lewis et al., 1998), have been shown to be associated with increased injury risk in a single analytical study and require confirmation. Day and colleagues found that working on farms where there had been a serious injury in the past three years was protective, perhaps indicating that safety practices and systems were improved by the negative experience of injury.

No studies have reported that farmers' or farm workers' attendance at farm safety courses has reduced injury risk on their farms. Day et al. found that not having attended a farm training course increased the odds of injury in farmers/farm workers. As farm training courses often include a safety component, the authors suggest that safety training is better applied by farmers and farm workers if it is delivered in the context of farm skills-based training rather than stand-alone farm safety sessions.

Preventing farm work injury: evidence-based prevention strategies and measures

As in other areas of injury prevention the interventions developed to prevent injury on farms fall into four broad categories:

- education often combined with incentives to engender behaviour change;
- engineering/technology solutions in the form of safety systems improvements, safer machinery and equipment and the use of protective devices;
- safety legislation/regulation and enforcement; and
- multifaceted interventions that combine two or more of these approaches.

A recently published Cochrane review summarised the current state of the research evidence on the effectiveness of field evaluations of farm injury prevention interventions targeting adults and children.

The Cochrane Review of interventions for preventing injuries in the agricultural industry adopted stringent study inclusion criteria, restricted to randomised controlled trials (RCTs), cluster randomised controlled trials (cRCTs), prospective cohort studies with a control group (PCSCs) and interrupted time series (ITs) (Rautiainen et al., 2008).

The review identified only eight eligible farm injury prevention studies (3 RCTs, 2cRCTs and 3 ITs) from a search of over 8,600 references. Two of these studies focussed on agricultural injury prevention in children and adolescents (Lee et al, 2004; Gadomski et al., 2006), the remainder dealt with agricultural injury prevention in adults (Rasmussen et al., 2003; Roberts et al., 2003; Sprinfeldt et al., 2003; Rautiainen et al., 2004; Rautiainen et al., 2005) including one that involved male reindeer herders (Pekkarinen et al., 1994).

Interventions included: educational programs aimed at behaviour change (5 studies); offering financial incentives to reduce farm injury insurance claims (1 study); and legislation and enforcement related to banning of a farm chemical and staged regulations that progressively required rollover protective structures (ROPS) on tractors (2 studies). The review authors found no evaluations that measured the effectiveness of engineering interventions such as automatic engine shut-off or alarms on tractors and other agricultural vehicles.

The review concluded that the five studies of educational interventions conducted in the U.S. (Lee et al., 2004; Rautiainen et al., 2004; Gadomski et al., 2006), Finland (Pekkarinen et al, 1994) and Denmark (Rasmussen et al., 2003) provided no evidence that stand-alone education programs (even when combined with incentives) decrease injury rates among agricultural workers (including children and adolescents).

The trialled multi-faceted educational interventions included: training and support of key farm safety partners (advisers) to train youth belonging to Future Farmers of America (FFA) chapters to become junior teachers, mentors and role models for young farm children (Lee et al., 2004); annual health screening of farmers by trained nurses including one-on-one health and safety counselling combined with annual on-farm safety review by trained peer farm safety consultant (Rautiainen et al., 2004); one farm visit by lay educator with farm background and supporting material

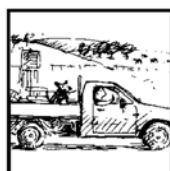
(Gadomski et al., 2006); occupational health personnel informed reindeer herders during medical examination about accident prevention (Pekkarinen et al., 1994); and safety consultation associated with checks on farms and a 1-day safety course for farmers delivered by an occupational health physician and psychologist (Rasmussen et al., 2003);

One of the Finnish studies offered insurance premium discounts to farmers as a stand-alone incentive to reduce injuries (Rautiainen et al., 2005). The intervention led to a 10% reduction in insurance claims for injury. However, the reviewers commented that the positive findings from this study required confirmation as some of the effect may have been because farmers under-reported their injuries to receive the discount. They recommended that the effectiveness of financial incentives should be better studied before widespread adoption.

The reviewers found that the effectiveness of safety legislation is not well studied. They accepted that the ban on Endosulfan pesticide in 1998 in Sri Lanka reported by Roberts et al. (2003) was associated with a reduction in fatal poisonings in the long term and recommended that this intervention should be considered for other countries. Swedish regulations that progressively expanded the mandatory use of Rollover Protectors (ROPS) on tractors were reported to be associated with a decrease in fatal injuries over the long term (Sprinfeldt et al., 1993 a, b, c & d) but the review authors expressed concern that the fatality and injury rates did not consistently decrease as the coverage of the ROPS fitting regulations expanded.

Conclusion

There are disappointingly few established risk factors for farm injury and proven prevention measures. Although farm safety education even with incentives has not been shown to reduce farm injury, education forms an important component of multifaceted injury prevention programs. However, the evidence suggests that education alone is insufficient to affect the adoption of safe behaviours and technologies. The recent Victorian case control study found that attending agricultural training courses was a protective factor for injury. This suggests that future effort in the area of farm safety training should be expended on integrating safety into all farm skills training courses rather than offering stand-alone safety training and education sessions.





The CowTime Dairy Design website (www.cowtime.com.au), funded by Dairy Australia, that provides low cost to elaborate plans for the re-design of milking sheds to increase the efficiency of milk harvesting systems, is the kind of initiative that should have safety spin-offs. Although injury reduction, due to improved animal behaviour, is mentioned as a benefit, the safety issue and benefits are not explicitly explored for each design, which is a missed opportunity for an integrated approach that seeks to improve efficiency and safety.

None of the new farming technologies has been evaluated for their injury prevention effects but innovations such as the Rotary Dairy, that minimise animal handling, should have a beneficial effect. Similarly, newer models of agricultural machinery such as headers, tractors, augers, and balers are much safer than older models (provided safety features are not modified) but the challenge remains to find low cost solutions for farmers who can't afford to replace/retrofit their large equipment.

Available evidence suggests that offering financial incentives (such as discounts on farm insurance premiums or 'sweeteners' to adopt safety measures enshrined in regulations) may encourage the adoption of safe practices and technologies but any such interventions should be trialled before widespread roll-out.

In view of the lack of strong evidence supporting the effectiveness of any of the farm injury interventions trialled to date, new initiatives should focus on novel approaches that target high frequency farm injuries making sure that preventive initiatives are subject to rigorous evaluation. Our study indicates that future farm injury prevention priorities should include: work and recreational motorcycling injury, recreational horse riding and horse handling injury, injury related to large animal handling particularly in the dairy industry, and agricultural machinery and all-terrain vehicle injury. It is beyond the scope of this study to canvass specific interventions but the reader is referred to the following special reports, mainly produced by the Australian Centre for Agricultural Health and

Safety (AgHealth) and Farmsafe Australia, that provide some guidance on the way forward.

Injury prevention resources

- **Prevention of work and recreational motorcycle-related injury (falls, collisions and runovers)**

Over the 3-year study period there was one death and more than 1,500 hospital-treated injuries due to motorcycle riding on farms, 90% of which were recreational. An earlier edition of *Hazard* (issue 64) published in 2006 compared the pattern of on- and off- road motorcycling injury in Victoria and canvassed injury risk factors and preventive measures (Cassell et al., 2006). Identified risk factors for motorcycle riding injury include: young age, low body weight, high engine capacity, lack of formal motorcycle training, lack of familiarity with the motorcycle being ridden, and non-use of a helmet.

The authors suggest a number of prevention strategies and measures that are relevant to off-road motorcycling on farm land including: age restrictions for riders, government support for skill development and risk awareness training courses and packages, a mentoring scheme for novice riders delivered through motorcycling organisations and clubs, promotion of the wearing of protective clothing including helmets and initiatives to encourage regular motorcycle maintenance.

<http://www.monash.edu.au/muarc/VISU/hazard/haz64.pdf>

- **Prevention of recreational horse riding and handling injury (falls from the horse and kicks, strikes and bites when handling horses)**

Over the 3-year study period there was one death, and at least 1,000 hospital-treated injuries related to horse riding and handling. Most horse riding and horse handling incidents were associated with recreational rather than work-related activities. A 1996 MUARC study of countermeasures to equestrian injury (Finch & Watt, 1996) remains the most comprehensive report on horse riding and handling injury prevention, although the

literature review is out-of-date. In a more recently published review McCrory and Turner (2005) comment that knowledge of the demographics or the efficacy of prevention measures in the field of equestrian injuries is sparse, especially for recreational riding, and that this lack of information remains a major impediment to effective prevention.

These two reports provide further information on horse-related injury patterns and outline prevention measures related to horse selection, horse handling, supervision and education of novice riders, protective equipment wear (helmets and vests) and the importance of using appropriate and well-maintained equipment riding equipment (e.g., tack or saddlery).

The MUARC report and associated fact sheet can be downloaded from the MUARC website:

<http://www.monash.edu.au/muarc/reports/muarc103.pdf>

<http://www.monash.edu.au/muarc/projects/horse.pdf>

The review by McCrory & Turner (2005) can be downloaded free from the Karger website:

<http://content.karger.com/produktedb/produkte.asp?doi=10.1159/000084280&typ=pdf>

An on-line search found only one resource covering work-related horse riding injury prevention. A bulletin issued by WorkSafe Northern Territory outlines safety guidelines for work-related riding in the rural industry. This provides direction regarding the selection of appropriate attire, the design and maintenance of equipment and the consideration of conditions. It also covers animal factors such as temperament, experience and capabilities.

<http://www.worksafe.nt.gov.au/corporate/bulletins/pdf/11-15/15.04.09.pdf>

- **Prevention of animal handling injury**

Over the three-year study period animal handling resulted in 4 deaths and more than 1,500 hospital-treated injuries excluding deaths and injuries that occurred when horses were being ridden. A substantial proportion of farm injuries related to the handling of large animals were work-related. The animals most associated with injury were cattle and horses and, to a lesser extent, sheep, dogs and pigs.



As in our study, the Farmsafe Australia's publication *Safe Cattle Handling- a Practical Guide* (Fragar & Temperly, 2005) notes that the most frequent life-threatening hazards from animal handling are associated with kicks and charges, while crushing against yard walls and fences is not uncommon. This guide outlines injury prevention tips for the design of yards and runs for safe handling, the maintenance of fences and gates, handler training and vigilance, cattle temperament factors and of risks specific to the handling of bulls.

Fragar LJ, Temperly J. *Safe Cattle Handling- a Practical Guide* available at: <http://www.aghealth.org.au/>

A second guide produced by WorkSafe Victoria—*Beef cattle handling: a practical safety guide, 1st Edition November 2006*—covers the same topics but provides more comprehensive coverage of safety measures related to cattle handling, the safe design and maintenance of cattle yards and the conduct of on-farm cattle sales. Both guides are focussed on the beef rather than the dairy industry and it would be useful to have a similar guide on dairy cow handling.

WorkSafe Victoria. *Beef cattle handling: a practical safety guide, 1st Edition November 2006* <http://www.worksafe.vic.gov.au/wps/wcm/resources/file/ebade8446d8cdb0/beef%20guide.pdf>

• **Prevention of agricultural machinery injury**

In our study injury cases related to agricultural and all-terrain vehicles attract the *transport* 'cause of injury' code not the *machinery* cause code as is the convention in most farm injury studies. Using the conventional classification, the farm machine most involved in injury deaths in the present study is the tractor.

Seven fatal incidents involved persons on foot being hit/runover by the tractor or, in one case, equipment being towed by the tractor and 6 more were tractor operators, four of whom died when the tractor crashed into a structure, one when the operator was crushed between a tractor and a structure and one when the tractor rolled over. In addition, over the study period two ATV riders and one farmer engaged in seed harvesting died when they crashed their vehicles. There were at least 150 additional hospital-treated tractor/other agricultural vehicle-related injuries and 100 ATV-related injuries that occurred during the operation of the vehicles. Other types of agricultural machinery involved in injury cases were not well identified.

Tractor injury prevention

Miller & Fragar (2006) of AgHealth conducted an intensive investigation of 215 Australian tractor fatal and non-fatal runover cases and extended their review to descriptive studies done in comparable overseas countries. They identified five key types of tractor related incidents and proposed several design improvements to tractors to reduce the incidence and severity of injury. These included the use of enclosed cabs, roll over protection systems and the fitment of seatbelts, audible warning systems for reversing, and the retrofitting of safety systems to older tractors.

<http://www.rirdc.gov.au/reports/HCC/06-033.pdf>

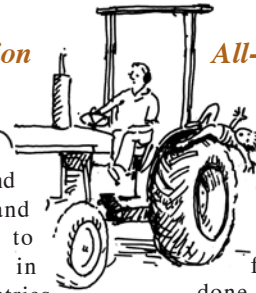
A tractor safety factsheet issued by AgHealth identifies several risk and protective factors for tractor rollover injury (such as the use of seatbelts, driver age and the carrying of passengers) and for tractor run-over injury (e.g. mounting a moving tractor, accessibility by children and the ability to start the tractor from the ground).

This sheet contains measures that can be taken to mitigate the identified risks.

Available via: <http://www.aghealth.org.au/>

The recently published Rural Industries Research and Development Corporation (RIRDC) report by Baker et al. (2008) *Making farm machinery safer* includes 23 recommendations that provide direction to the agricultural machinery and agricultural industries on safety design changes and machinery management issues based on evidence arising from an in-depth study of 85 machinery-related serious farm injury cases conducted in Victoria.

Cases were recruited from hospital emergency departments and, where the participant agreed, the study included an on-site examination of the machinery involved *viz*, powered hand tools, harvesting equipment, tillage equipment, augers, elevators, cherry picker, field bin, tractor-based lifting devices, stationary engine driven plant, PTO driven plant, fence post implements, tractor, wool press, irrigation machinery and earth moving equipment. <http://www.rirdc.gov.au/reports/HCC/07-190.pdf>



All-terrain vehicle (ATV) injury prevention

AgHealth recently published a briefing paper on ATV safety on Australian farms (Fragar & Pollock, 2007) which reports that ATVs are now in widespread use on Australian farms performing functions previously done by horses, tractors and 2-wheel motorcycles. Utilising available injury data, the authors identify a range of potential risk factors for ATV-related injury and a number of hazard elimination and reduction strategies including the substitution of more appropriate vehicles and machines if a review shows that the ATV is not suited to a particular work task, engineering and design solutions to reduce the risk of rollover or the operator being flung from the vehicle, helmet wearing and the revision of existing competency standards and training courses to encourage safe operation. <http://www.farmsafe.org.au/document.php?id=27>

A handbook for all-terrain vehicle usage on farms is also available from Worksafe Victoria. This handbook covers many aspects relevant to reducing ATV risk, such as the risk factors for injury, legal and licensing requirements, vehicle selection, farm communication and safety systems and tips for using, maintaining and storing an ATV.

http://www.worksafe.vic.gov.au/wps/wcm/resources/file/ebd6b3079c99ee0/ATV_handbook.pdf

• **Prevention of farm injury in children and young people**

In our study, drowning was the cause of most injury deaths among children and young people on farms and the recreational use of horses, motorcycles and ATVs were substantial contributors to child and youth injury.

A systematic review of interventions to prevent childhood farm injuries (Hartling et al. 2004) provides information on the effectiveness of child farm safety interventions evaluated to date. The authors conclude that there was some evidence that school-based participative farm safety education programs and safety camps showed positive results for short-term knowledge acquisition and that tractor training programs and community-based- and farm-based interventions showed mixed results. Their overall assessment was that there is little tangible evidence on which to make practical recommendations on interventions that are likely to reduce child farm injury rates, especially lethal injuries to young pre-school aged children.

<http://www.pediatrics.org/cgi/content/full/114/4/e483>



Priorities for child safety on farms developed by AgHealth and Farmsafe Australia, based on research of effective solutions, are:

- Have a securely fenced house yard (safe play area) for children to play, unless an adult can closely supervise them on the farm
- Ensure that children:
 - always wear seatbelts and restraints when in cars, utes and trucks;
 - don't ride on tractors, ATVs or in the back of utes; and
 - always wear helmets when riding bikes and horses



A safety checklist *Child safety on rural property* developed by Farmsafe Australia provides further information on child mortality and morbidity on Australian farms. It also provides guidance on the creation of a safe play area and other measures that should be taken to prevent drowning and injury related to farm motorcycles, horses, tractors and machinery, farm vehicles and other farm hazards. <http://www.farmsafe.org.au/document.php?id=64>

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BOX 1 Data extraction

All farm injury cases

Deaths

Unintentional (accidental) injury deaths were extracted from the National Coroners Information System (NCIS) using the location code *Farm or other place of primary production* and *Home – Farmhouse*. After examination, it was decided to include the 3 deaths that attracted the farmhouse code as they were caused by tractor crashes or runovers in the garden or yard surrounding the farmhouse. Only ‘closed’ cases were included.

Hospital admissions

Unintentional (accidental) hospital admissions recorded on the Victorian Admitted Episodes Dataset (VAED) that attracted the ICD-10-AM place of occurrence (location) code Y92.7 *Farm* were included. This code covers injuries that occurred in all farm buildings and land but excludes injury cases that occurred in farm houses and the driveway, garage, garden and yard adjacent to the farmhouse including private swimming pools and tennis courts — these are classified as home injuries. Cases that attracted any of the *transport* cause of injury codes that indicate that the injury occurred in *traffic* were excluded as by definition these are road injuries as they occur on public highways or streets. Deaths recorded on the VAED were excluded as it was presumed they were recorded on the NCIS.

ED presentations

Unintentional (accidental) ED presentations recorded on the Victorian Emergency Minimum Dataset (VEMD) that attracted the place code *Farm* were included. This code does not cover cases that occurred in farmhouses and their surrounds as they attract the place of occurrence code

Home

Deaths and hospital admissions recorded on the VEMD were excluded as it was presumed they were recorded on the NCIS and the VAED respectively. ED presentations were re-coded to ICD-10 AM broad cause of injury groups. Horse-related cases were re-coded to cause of injury code ‘transport’ if the person injured was riding the horse when injured. If the person was injured by contact with a horse (for example kicked/bitten/knocked) they were coded to the ‘natural/environmental/animals’ cause of injury code.

Work-related injury

Deaths (NCIS)

Work related cases were hand selected from the farm deaths dataset for analysis.

Hospital admissions

Farm injury cases coded to the ICD-10-AM activity code U73.0 *while working for income* were extracted from the farm hospital admissions dataset for analysis

ED presentations (excluding admissions)

Cases coded to activity=9 *working for income* were selected from the farm injury ED presentations dataset for analysis.

Vulnerable age groups

Cases in the specific age groups of interest were extracted for analysis separately (children aged 0-14, young persons aged 15-19 and seniors aged 65 and older).

Motorcycle-related injury

Deaths

Cases were hand selected from the farm deaths dataset

Hospital admissions

Cases coded to the ICD-10-AM external cause code V20-V29 *Motorcycle rider injured in transport accident* were selected

ED presentations (excluding admissions)

Cases were selected if the cause of injury was ‘motorcycle driver’ or ‘motorcycle passenger’ or information in the text narrative indicated the injured person was riding a motorcycle at the time of injury.

Animal-related injury

Deaths

Animal-related cases were hand selected from the farm deaths dataset excluding horse-riding cases.

Hospital admissions

Cases were selected if coded to the ICD-10-AM external cause codes: W53 Bitten by rat, W55 Bitten or struck by dog, W55 Bitten or struck by other mammals, W56 Contact with marine animals, W57 Bitten or stung by nonvenomous insect and other nonvenomous arthropods, W59 Bitten or crushed by other reptiles, W64 Exposure to other and unspecified animate mechanical forces, X20 Contact with venomous snakes and lizards, X21 Contact with spiders, X22 Contact with scorpions, X23 Contact with hornets, wasps and bees, X24 Contact with centipedes and venomous millipedes (tropical), X25 Contact with other venomous arthropods, X26.1-.3 Contact with venomous marine animals, X27 Contact with other specified marine animals, X29 Contact with unspecified venomous animals.

ED presentations (excluding admissions)

Cases were selected if information in the text narrative indicated the injury was animal-related. This involved a text search for the range of animals commonly found on farms such as horse, cow, cattle, sheep, pig, snake, bee etc. Horse-related cases that occurred during horse riding were excluded from the dataset.





COMMUNITY SAFETY MONTH

October



Community Safety Month 2008

This is the 12th year that community safety in Victoria will be celebrated with an exciting program of events and activities which remind us that we all have a role to play in keeping our communities safe.

Community Safety Month 2008 is a community based program initiated in 1996 by the Victorian Safe Communities Network (VSCN) and is currently coordinated by the Victoria Police **Safer Communities Unit Operations Coordination Department**, in partnership with the VSCN.

The aim of Community Safety Month is to call on community safety professionals to focus community attention on their year round efforts to address safety issues which concern local communities.

You can encourage schools, regional services, businesses, police and emergency services, road safety groups and health and welfare services to auspice safety events and activities in partnership with other organisations. For those with established partnerships, Community Safety Month provides an ideal opportunity to showcase existing safety programs and to develop new ones. Over 80% of activities are organised in partnership between organisations, groups or government agencies.

Participation in Community Safety Month demonstrates your commitment to maintaining Victoria as the safest state in Australia. By promoting safety and safe practices within your community, you will be contributing to increasing the confidence of Victorians about their safety.

In 2006, nearly 600 organisations were involved in organising over 1,000 safety related activities across Victoria.

Contacts

Community Safety Month Coordinator - Inspector Myles King

Phone: 9247 6925 or Email: Myles.King@police.vic.gov.au

Register your event on line www.communitysafetymonth

Victorian Safe Communities Network Inc. vscn.vscn@rch.org.au

Phone 9345 5193



BOX 2 Databases

The National Coroners Information System (NCIS)

Death data were extracted from the NCIS by NCIS staff. The NCIS is a national internet based data storage and retrieval system for Australian coronial cases. Details of the data collection system and data fields are available on the NCIS website. www.vifp.monash.edu.au/ncis/

The Victorian Admitted Episodes Dataset (VAED)

The VAED is a state-wide collection of data on all admissions to Victorian hospitals (both public and private) compiled by the Department of Human Services. The injury surveillance subset is supplied annually to VISU. Injury data are coded to the WHO International Classification of Diseases Version 10 with Australian Modifications (ICD10-AM) by trained hospital personnel utilising information recorded by medical and ancillary staff in patient records (paper-based and electronic).

When integrating the injury data onto the VEMD dataset held by VISU, cases readmitted to the same hospital within 30 days are excluded to minimise the possibility of double counting. Each record in the database represents an episode of care, and not necessarily one incident. A patient may be transferred within and between hospitals for various episodes of care and these transfers cannot be tracked so that they may be represented by more than one record. This double counting is estimated to account for 10% of cases on the database.

The VAED (Injury Surveillance) subset held by VISU contains in excess of 2 million records for the 20-year period 1987/88 to 2006/7.

The Victorian Emergency Minimum Dataset (VEMD)

The VEMD records details of injury cases treated at hospitals with 24-hour Emergency Department services in Victoria compiled by the Department of Human Services and supplied quarterly to VISU. Data are supplied to DHS from the participating hospitals. At the hospital level, injury surveillance data are entered onto an electronic database by Emergency Department medical staff or clerks at triage when the patient explains the reason for presentation or later based on the information on the presenting problem recorded electronically at triage or in the paper-based patient record. A small-scale validation study conducted by VISU showed that 80% of injury cases are captured on the VEMD but data quality varies by hospital and by individual staff member.

Both admitted and non-admitted cases are recorded on the dataset but only non-admissions were analysed for this report (admissions data for this report were extracted from the VAED). From 2004 onwards all 38 public hospitals in Victoria that provide a 24-hour emergency service contribute injury surveillance data to the VEMD. The total number of cases on the VISU-held VEMD dataset is in excess of 2 million records. In addition to the standard injury surveillance variables—age, sex, injury cause, location, activity, nature of main injury, body region injured, and human intent—the VEMD also contains a 'free text' description (narrative) that describes the injury event in more detail. The quality of narrative data varies between hospitals, ranging from poor to excellent.



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Acknowledgement

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Participating hospitals

From October 1995

Austin & Repatriation Medical Centre

Ballarat Base Hospital

The Bendigo Hospital Campus

Box Hill Hospital

Echuca Base Hospital

The Geelong Hospital

Goulburn Valley Base Hospital

Maroondah Hospital

Mildura Base Hospital

The Northern Hospital

Royal Children's Hospital

St Vincents Public Hospital

Wangaratta Base Hospital

Warrnambool & District Base Hospital

Western Hospital - Footscray

Western Hospital - Sunshine

Williamstown Hospital

Wimmera Base Hospital

From November 1995

Dandenong Hospital

From December 1995

Royal Victorian Eye & Ear Hospital

Frankston Hospital

From January 1996

Latrobe Regional Hospital

From July 1996

Alfred Hospital

Monash Medical Centre

From September 1996

Angliss Hospital

From January 1997

Royal Melbourne Hospital

From January 1999

Werribee Mercy Hospital

From December 2000

Rosebud Hospital

From January 2004

Bairnsdale Hospital

Central Gippsland Health Service (Sale)

Hamilton Base Hospital

Royal Women's Hospital

Sandringham & District Hospital

Swan Hill Hospital

West Gippsland Hospital (Warragul)

Wodonga Regional Health Group

From April 2005

Casey Hospital

How to access VISU

data:

VISU collects and analyses information on injury problems to underpin the development of prevention strategies and their implementation. VISU analyses are publicly available for teaching, research and prevention purposes. Requests for information should be directed to the VISU Co-ordinator or the Director by contacting them at the VISU office.

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All issues of *Hazard* and other information and publications of the Monash University Accident Research Centre can be found on our internet home page:

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A Victorian
Government
initiative



*VISU is a project of the Monash University Accident Research Centre,
funded by the Department of Human Services*



MONASH University
Accident Research Centre

*Hazard was produced by the Victorian Injury Surveillance Unit (VISU)
with layout assistance of Glenda Cairns, Monash University Accident Research Centre*

Illustrations by Jocelyn Bell

ISSN-1320-0593

Printed by Work & Turner Pty Ltd, Tullamarine

