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Dog-related injuries

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Key findings

- Approximately 6,553 people were hospitalised as a result of dog-related injury during the three-year period 2000–01 to 2002–03, equating to an age-adjusted rate of 11.3 cases per 100,000 population. Death as the result of dog-related injuries are very rare.
- Young children and elderly people are most vulnerable to injuries from dog attacks. However, the pattern of injury differs for these two age groups.
- The highest rates of dog-related injury were in the youngest age group (0–9 years). These children were almost exclusively injured as the result of being bitten. While young children are also knocked over by dogs, they seldom sustain serious injuries in this way. Because of their small stature, they are most prone to sustaining injuries to the head, particularly open wounds. The mean length of stay in hospital for this age group is short.
- Rates of dog-related injury among older children and adults under 75 years of age were lower. These injuries are mainly bites, especially to the hand and forearm.
- Nearly half of elderly people hospitalised due to dogs had been struck, not bitten. In such circumstances fractures are comparatively common. The length of stay in hospital is also substantially longer for elderly people, particularly if they are struck by a dog.
- Rates of hospitalisation due to dogs appear to rise with the remoteness of place of residence. This is more marked for adults than children.
- In summary, dog attacks result in more than 2,000 hospital admissions per year in Australia. Rates and severity are greatest for children (most attacks are bites to the head) and older adults (falls due to dogs can result in serious injury, such as fractures of the hip). While most injuries were due to bites (89% in 2002–03) the remainder were due to being struck by a dog.

Hospitalisations, Australia, 2000–01 to 2002–03

About 6,553 people were hospitalised as a result of dog-related injury during the three year period 2000–01 to 2002–03. This equated to an age-adjusted rate of 11.3 cases per 100,000 population per year. Placed within the context of some other groups of injury admitted to hospital, the rate of dog-related injury compares with that of 546.4 per 100,000 for transport-related injury and 39.8 per 100,000 for unintentional poisoning by pharmaceutical agents during the period 2001–02.

Age and sex

The age-adjusted rate for dog-related injury for males was 12.1 per 100,000 population and that for females was 10.4 per 100,000.

Rates were highest among young children, particularly those aged under 5 years, and among those aged 80 years and over. Age-specific rates were generally similar for males and females, although rates were higher for young adult males than for young adult females (Figure 1).

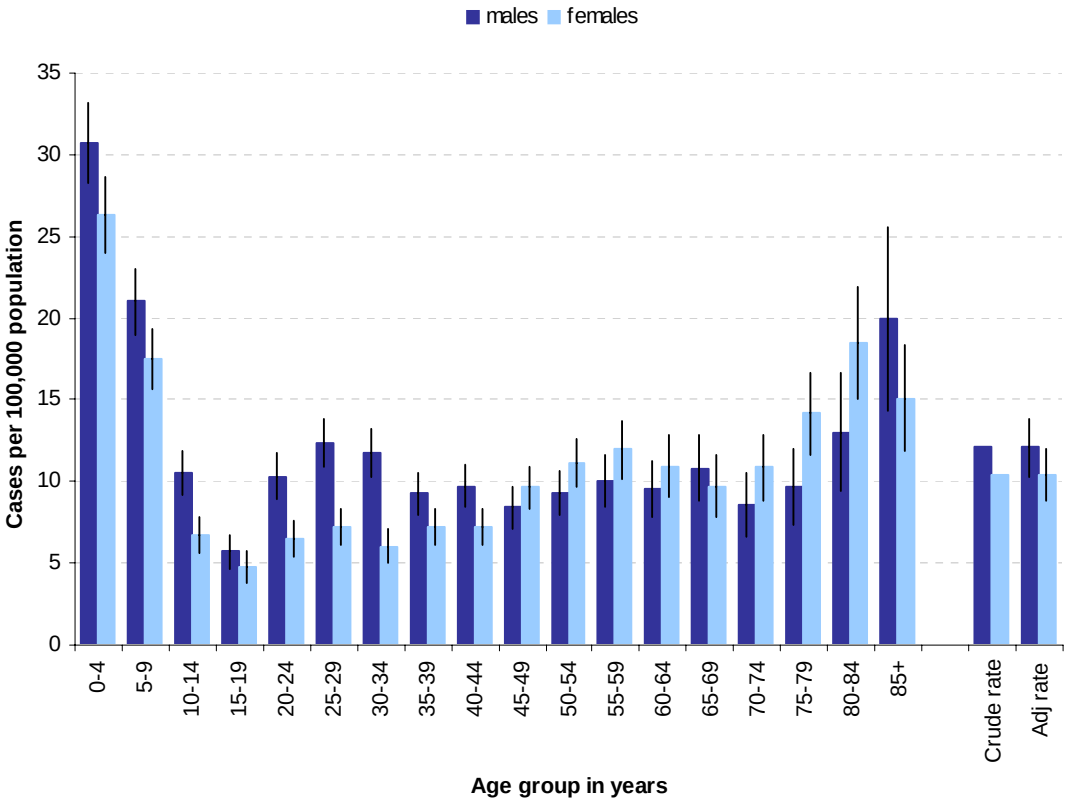

Figure 1: Dog-related hospitalisations by age and sex

Principal body region injured

Overall, the most commonly injured body parts were the head (3.7 cases per 100,000 population) and the shoulder and upper limb (3.6 per 100,000). The pattern of injury locations varies with age.

Due to their small stature, the highest proportion of injuries to children involved the head. Common sites of injury among adults were the wrist and hand, and forearm and elbow, possibly associated with defensive manoeuvres when faced with assault by a dog. The proportion of injuries to the knee and lower leg also rose with age, accounting for close to a quarter of the injuries sustained by those aged 75 years and over (Table 1).

Table 1: Principal body region injured by age group

	Age group in years		
	0–9	10–74	75 and over
Principal body part injured	**Column %**	**Column %**	**Column %**
Head	76.4	17.2	1.2
Neck	0.7	0.4	0.4
Thorax	0.3	0.2	1.0
Abdomen, lower back, lumbar spine and pelvis	1.5	1.0	1.7
Shoulder and upper arm	1.9	1.9	2.1
Elbow and forearm	1.9	8.2	8.1
Wrist and hand	5.6	31.4	21.3
Hip and thigh	1.9	2.2	5.8
Knee and lower leg	3.5	12.8	23.3
Ankle and foot	0.9	2.8	2.9
Multiple body regions	0.1	0.4	0.4
Injuries not classifiable to body part	1.0	4.1	2.7
Principal diagnosis not an injury	4.4	17.3	29.1
Total	**100.0**	**100.0**	**100.0**

Differences in patterns of injury are most evident when comparing young children and the elderly. Children aged 0–4 years had a high rate of injuries to the head (23.3 cases per 100,000 population) and a comparatively low rate of injuries to the hip and lower limb (0.8 per 100,000). Among those aged 75 years and over, this pattern was reversed with a rate of only 0.2 per 100,000 for injuries to the head compared with 4.6 per 100,000 for injuries to the hip and lower limb (Figure 2). A notable proportion of the cases categorised as 'other injuries not specified by body region' are cases of cellulitis*.

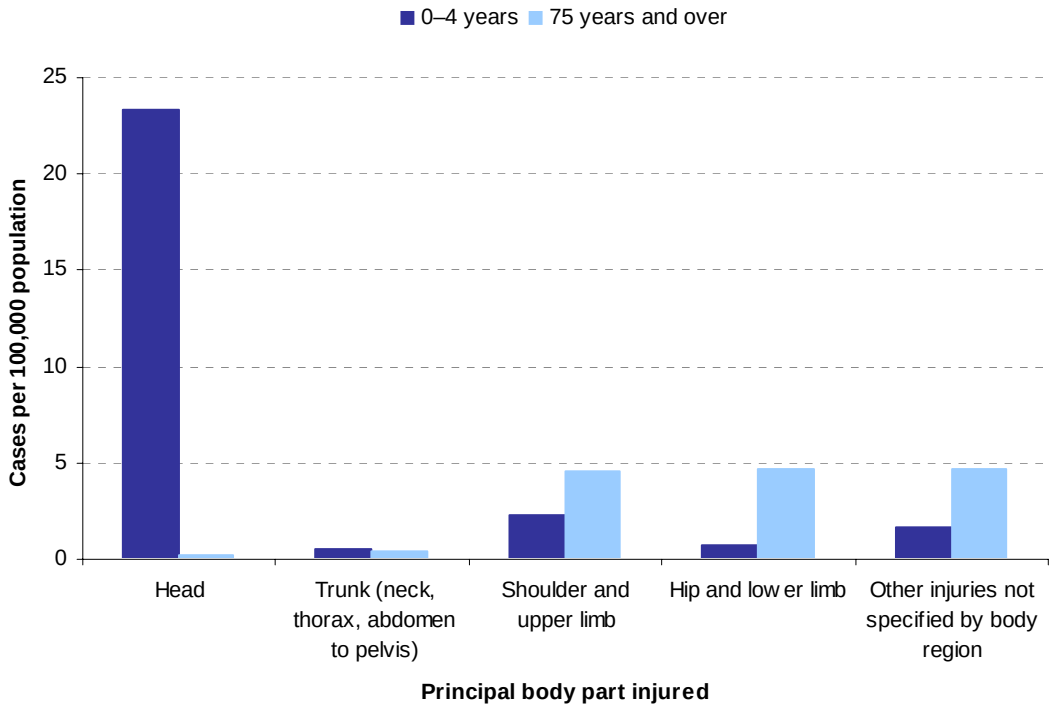

Figure 2: Comparison between principal body region injured by selected age groups

* Cellulitis refers to inflammation of the skin, usually due to infection by bacteria. In dog-related cases, cellulitis probably arises from a contaminated bite wound.

Nature of injury

In 5,603 of the total of 6,553 cases of dog-related hospitalisation, the principal diagnosis was an injury (i.e. a code from Chapter XIX of ICD-10-AM). The ten most common types of injury diagnosis are shown in Table 3, along with the other common diagnosis, cellulitis.

By far the most common type of diagnosis was an open wound (67.9%), followed by cellulitis (8.4%) and fractures (7.0%). The proportion of open wounds fell with age while the proportion of cellulitis and fractures rose (Table 2).

Open wounds, the most frequent diagnosis, most commonly affected the head, followed by the shoulder and upper limb. Fractures, a common outcome of dog attacks among older people, affected the wrist and hand (44%), knee and lower leg (18%), elbow and forearm (12%) and hip and thigh (10%). Open wounds were the most common injury sustained by young children. Among the elderly, less than half of the injuries were open wounds, with fractures and cellulitis being the next most common. 41% of fractures in this age group were of the hip and thigh.

Table 2: Nature of injury by age group

	Age group in years		
	0–9	10–74	75 and over
Principal diagnosis	Column %	Column %	Column %
Open wound	88.5	60.8	48.6
Cellulitis	2.8	10.7	9.9
Fracture	1.7	8.6	14.0
Superficial injury	0.7	1.1	1.7
Traumatic amputation	0.6	3.0	1.2
Injury to muscle and tendon	0.4	2.8	0.6
Injury to nerves	0.4	1.2	0.2
Internal injury	0.2	0.3	0.2
Dislocations, sprains and strains	0.1	0.5	0.8
Injury to blood vessels	0.1	0.4	0.2
Crushing injury	0.0	0.0	0.0
Other principal diagnoses	4.5	10.5	22.5
Total	**100.0**	**100.0**	**100.0**

Length of stay in hospital

Overall, the mean length of stay (LOS) for cases of dog-related injury was 2.75 days. The mean number of days varied by age group, with the period of stay increasing with age (Figure 3).

The longest length of stay was 211 days. The average time spent in hospital was notably longer for one type of injury condition—fractures of the femur entailed a mean LOS of 9 days.

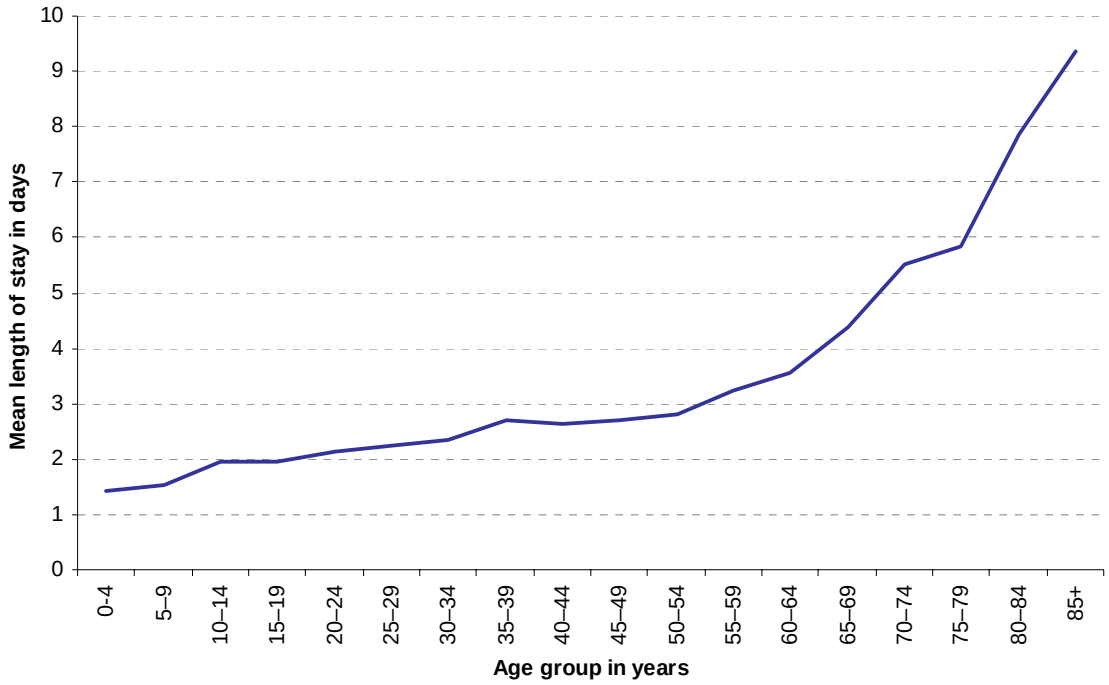

Figure 3: Mean length of stay by age group, dog-related hospitalisations, Australia 2000–01 to 2002–03

Bitten by dog *versus* being struck by dog

Introduction of a new version of the ICD-10-AM classification in July 2002 enables the separation of dog-related cases due to bites from those due to being struck by a dog. (The latter category normally describes a case in which a person has been pushed to the ground by a dog.)

Of 2,198 cases of dog-related hospitalisation during 2002–03, 1,963 (89.3%) injuries had resulted from being bitten by a dog, and 234 (10.6%) from being struck by a dog. Information about the nature of the event was not provided for one case.

For children and teenagers, the frequency of being bitten by a dog was much higher than being struck by a dog. Among those aged 80 years and over, frequencies were similar for both types of scenario (Figure 4).

Analysis of 2002–03 data also showed a different pattern with respect to the mean number of days spent in hospital dependent on whether the person was bitten by a dog or struck by a dog. Although there was no difference in the mean LOS between young children between these two scenarios, and little difference for the age group encompassing older children and adults in their middle years, the mean LOS for cases of people aged 75 years and over who had been struck by a dog was twice that of those who had been bitten (Table 3).

Patterns of injury differed according to the nature of the encounter with a dog. Open wounds were the most frequent outcome of a dog bite. In half of the cases where the person was struck by the animal, a fracture was the principal diagnosis (Table 4).

The relative proportions of dog bites to being struck by a dog were similar for people living in major cities and regional areas. The proportion of dog bites was slightly higher for remote areas (Table 5).

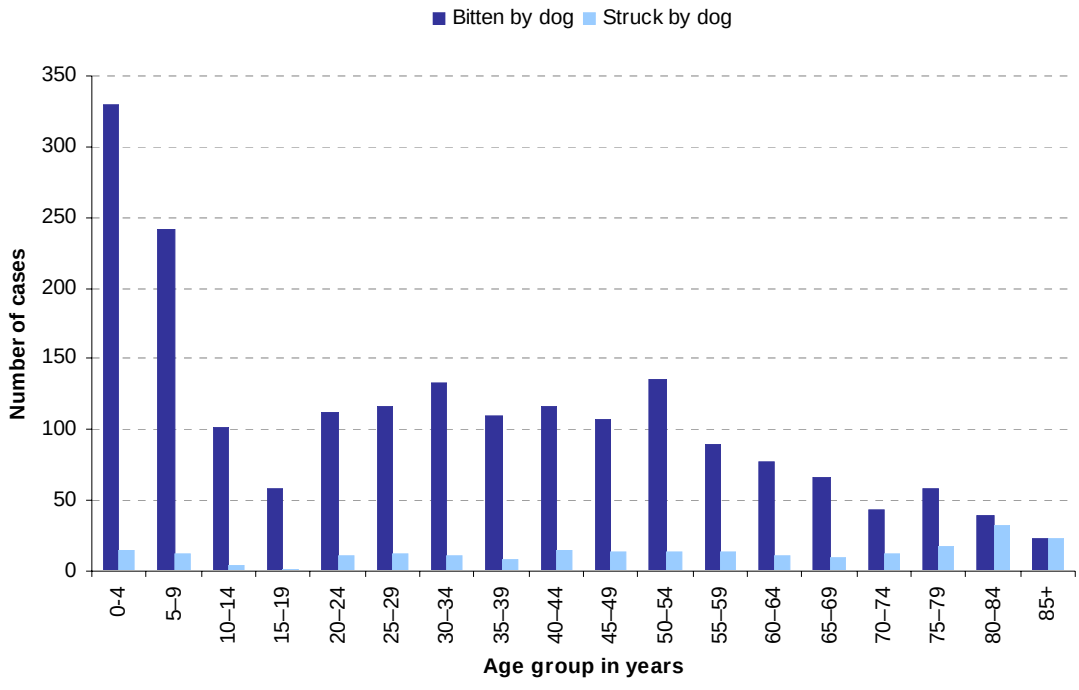

Figure 4: Relative frequency of dog bites compared with being struck by a dog, by age group

Table 3: Mean length of stay by age and nature of incident

	Mean length of stay in days		
Nature of incident	**0–9**	**10–74**	**75 years and over**
Struck by dog	1	4	12
Bitten by dog	1	3	6

Table 4: Nature of injury by nature of incident (i.e. bitten by dog or struck by dog)

	Bitten by dog		Struck by dog	
Nature of injury	**Number**	**Percentage**	**Number**	**Percentage**
Open wound	1,436	73.2	33	14.1
Cellulitis	153	7.8	6	2.6
Fracture	74	3.8	117	50.0
Traumatic amputation	47	2.4	1	0.4
Injury to muscle and tendon	43	2.2	1	0.4
Injury to nerves	22	1.1	1	0.4
Superficial injury	12	0.6	10	4.3
Injury to blood vessels	5	0.3	0	0.0
Dislocations, sprains and strains	2	0.1	7	3.0
Internal injury	0	0.0	4	1.7
Crushing injury	0	0.0	0	0.0
Other principal diagnoses	169	8.6	54	23.1

Table 5: Nature of incident by remoteness area of residence

	Bitten by dog		Struck by dog		Total	
Remoteness area	**Count**	**Row %**	**Count**	**Row %**	**Count**	**Row %**
Major city	1,098	89.3	130	10.6	1,229[(a)]	100.0
Regional area	720	87.8	100	12.2	820	100.0
Remote and very remote areas	130	97.0	4	3.0	134	100.0
Migratory or unknown	15	100.0	0	0.0	15	100.0
Total	**1,963**	**89.3**	**234**	**10.6**	**2,198**	**100.0**

(a) Information about the nature of the event was not provided for one case

States and territories

Although the Northern Territory appears to have had much higher rates of dog-related injuries than the other states and territories, the very wide confidence intervals indicate that caution should be exercised in interpreting those rates. None of the states and territories had a rate that differed significantly from that for Australia as a whole (Figure 5).

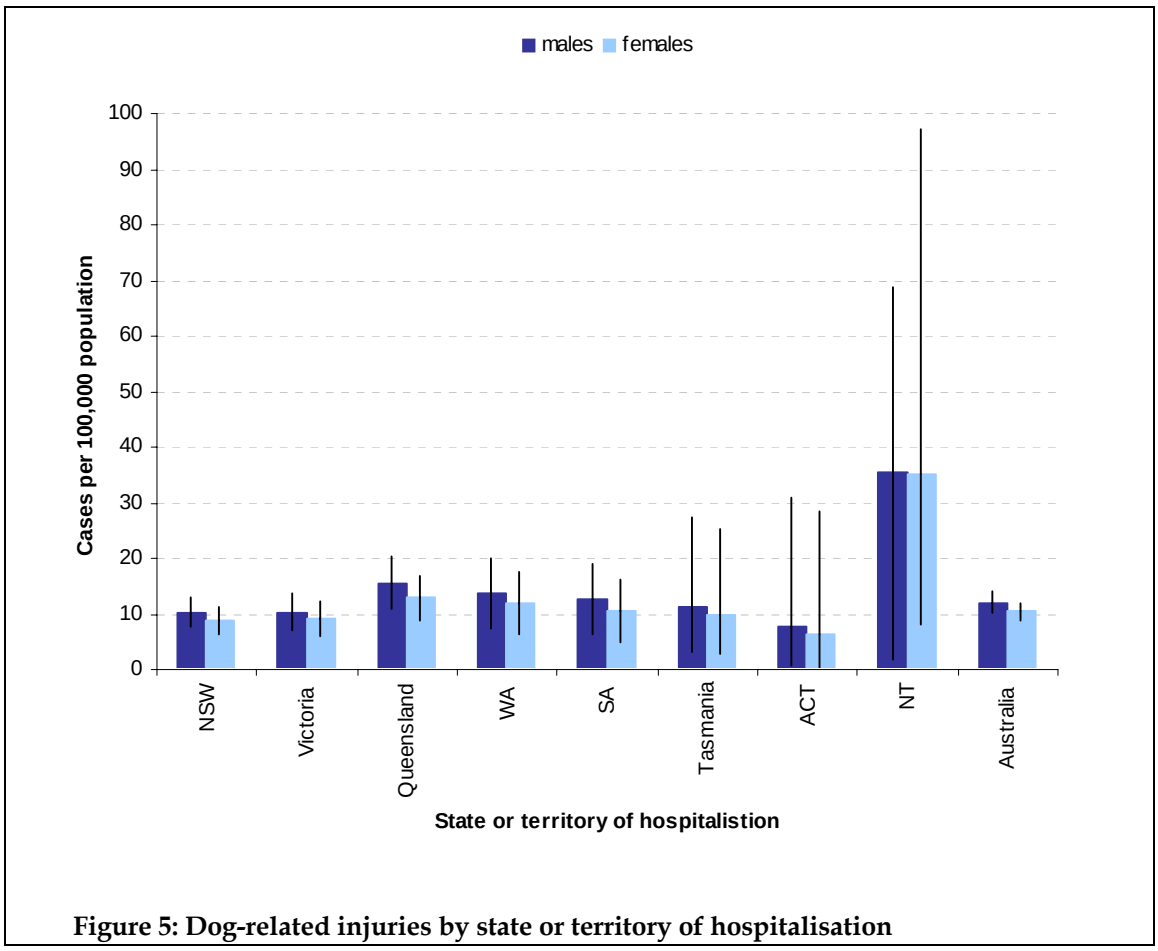

Figure 5: Dog-related injuries by state or territory of hospitalisation

Place of occurrence

For those cases where place of occurrence was specified, most occurred at home (1,649, 25.2%). The next most common place was a street or highway (203, 3.1%). Place of occurrence was not available for 4,542 (69.3%) cases (Table 6).

Table 6: Place where incident occurred

Place where incident occurred	Number of cases	Percentage
Home	1,649	25.2
Street and highway	203	3.1
Health service area	31	0.5
Trade and service area	31	0.5
Farm	26	0.4
Industrial and construction area	24	0.4
Residential institution	18	0.3
Sports and athletics area	16	0.2
Other specified institution and public administrative area	7	0.1
School	6	0.1
Other and unspecified	4,542	69.3
Total	**6,553**	**100.0**

Remoteness

The rate of cases rose with the remoteness of the location of the person's usual residence. Hospitalisation rates were more than three times as great for residents of very remote areas as they were for people who live in cities (major cities: males 10.3 per 100,000 population and females 9.3 per 100,000; very remote areas: males 33.8 per 100,000 and females 37.3 per 100,000). Small case counts for remote areas are reflected in wide confidence intervals (Figure 6).

The ratio of males to females was fairly similar between the various remoteness zones.

There were some differences according to remoteness in the principal body parts injured. In particular, the proportion of injuries to the head, wrist and hand were higher in major cities and regional areas than they were in remote areas. This pattern was reversed for some other categories: the proportion of injuries to the knee and lower leg, and to the ankle and foot were higher in remote areas (Table 8).

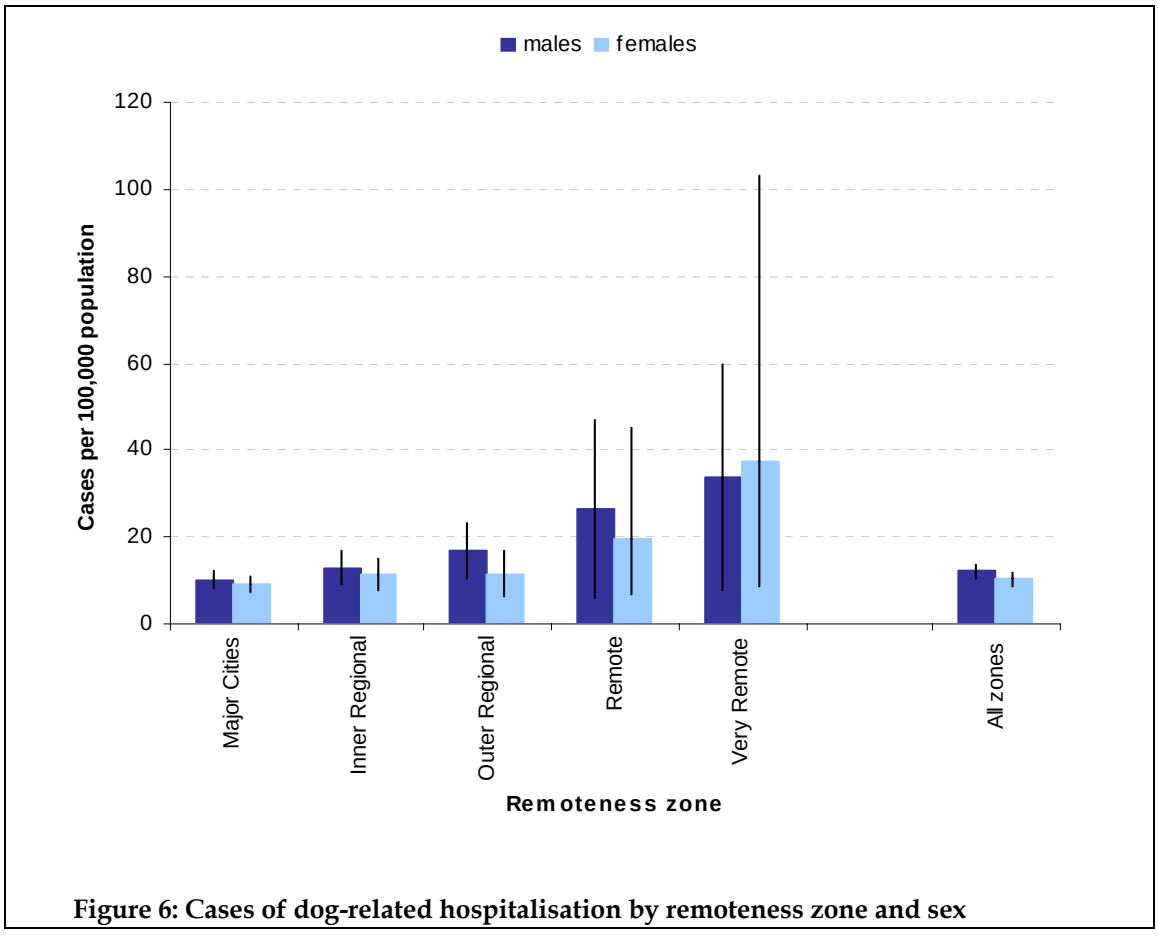

Figure 6: Cases of dog-related hospitalisation by remoteness zone and sex

Rates did not differ greatly by remoteness zone for the 0–9 year age group. The pattern was quite different at older ages where rates rose with the level of remoteness. For example, in the 0–9 year age group, the 'very remote' rate was 1.4 times that of the 'major city' rate. In the 10 years and over age group, the 'very remote' rate was 4.6 times higher than the 'major city' rate.

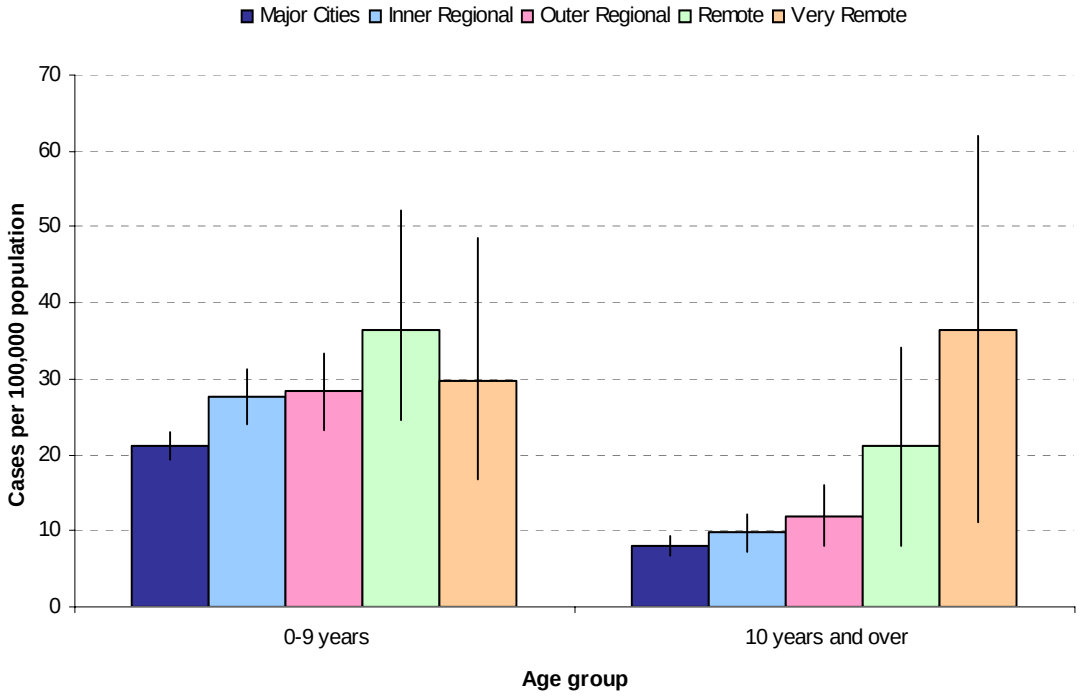

Figure 7: Cases of dog-related hospitalisation by selected age groups and remoteness zones

Table 7: Body part injured by remoteness of usual residence

	Major cities	Regional areas	Remote and very remote areas
Principal body part injured	**Column %**	**Column %**	**Column %**
Head	34.8	33.0	17.3
Wrist and hand	26.0	21.0	12.9
Knee and lower leg	9.0	12.9	16.4
Elbow and forearm	7.0	5.7	4.7
Hip and thigh	2.0	2.4	5.2
Shoulder and upper arm	2.0	1.7	3.3
Ankle and foot	1.6	2.4	7.3
Abdomen, lower back, lumbar spine and pelvis	1.3	1.0	1.4
Neck	0.5	0.5	0.0
Multiple body regions	0.3	0.3	0.2
Thorax	0.3	0.3	0.9
Injuries not classifiable to body part	15.3	18.9	30.4

Table 8: Nature of injury by remoteness of usual residence

Nature of injury	Major cities	Regional areas	Remote and very remote areas
	Column %	Column %	Column %
Open wound	68.7	67.1	64.4
Cellulitis	7.5	9.1	11.2
Fracture	7.2	7.5	3.5
Traumatic amputation	2.4	2.1	1.4
Injury to muscle and tendon	2.2	1.7	1.4
Superficial injury	1.2	0.6	2.3
Injury to nerves	1.2	0.5	0.5
Dislocations, sprains and strains	0.5	0.5	0.0
Injury to blood vessels	0.4	0.2	0.2
Internal injury	0.2	0.3	0.2
Crushing injury	0.0	0.0	0.0
Other or unspecified principal diagnoses	8.5	10.6	14.8

Deaths, Australia 1997–2003

Death resulting from dog-related injury is a rare event. During the seven year period 1997–2003, 11 deaths were registered as being due to this cause. The majority of these cases were males. The deaths were fairly evenly distributed between young children (0–9 years), older children and adults (10–74 years) and the elderly (75 years and over).

Other studies

Several papers dealing with the epidemiology of dog-related injury were identified. These were from Australia, New Zealand, Canada and the United States. Findings from these studies provide a basis for comparison of results presented in this Briefing. They also provide information on some aspects of dog-related injury that cannot be studied using Australian hospital admissions data. Some of the information contained in these studies provides a valuable supplement to the data presented earlier in this report. In particular, details about the circumstances in which the injuries occurred and the breed of dog involved.

A New Zealand study by Marsh et al. identified a total of 3,119 dog-related hospitalisations and one fatality for the period 1989–2001. 94 of the hospitalisations were the result of having been struck by a dog. The remainder (n=3,025) of the hospital cases involved dog bites. Of the dog bite cases, where location was specified (42% of cases) 30% of people were bitten at home, 6% on a street or highway, and 1% on a farm.

Ghandi *et al*. reviewed all paediatric patients admitted (n=67 to the Philadelphia Children's Hospital between January 1986 and June 1998 as the result of a dog bite. Their review showed that, in 91% of cases, the child had been attacked by a dog they were familiar with. The study also examined the circumstances surrounding the incidents: 55% involved an unprovoked attack; in 18% of cases the child had provoked the dog; 46% involved a family dog; 7% a friend's dog; and in 9% of cases, the dog was a stray or was unknown to the child. The breeds most commonly implicated in the attacks were Pit bulls (25%), Golden Retrievers (12%), Labrador Retrievers (12%), Chow Chows (10%), German Shepherds (10%), Rottweilers (10%), and Doberman Pinschers (<5%) (Ghandi R 1999). Breed-specific rates were not calculated.

Part of an Australian study undertaken by Thompson of the South Australian Health Commission (SAHC) analysed emergency department surveillance data for a major public hospital for the period January 1990 to July 1993. A total of 356 dog attacks were identified. Three-quarters of hospital treated attacks were caused by 5 of 160 available breeds. The breeds of dog recorded for these cases were as follows: German Shepherds (25.3%); Bull Terriers (13.6%); Blue or Red Heelers (13.6%); Dobermans (11.7%); and Rottweilers (9.1%). More than half of the cases occurred in a street or public place by loose, uncontrolled dogs. Data collected through the Adelaide 1992 Omnibus Survey, which obtained information from interviews with 3,093 randomly selected people, provided information about the dog population. For the purposes of the study, a representation ratio was calculated for the breeds that were involved in attacks by dividing the percentage of attacks per breed by the percentage of the total dog population represented by the same breed. Thompson concluded that the relative risk of attack by a German Shepherd was 5 times greater than a Collie. The relative risk of being attacked by a Doberman was even higher (Thompson, 1997).

Some earlier work undertaken at the SAHC, used surveillance data collected from three Adelaide public hospitals to identify the breeds involved in dog attacks. In 75% of a total of 4,500 cases, the attacks had occurred to family members or friends of the dog owner and, thus, there was a fair degree of confidence in most cases that the breed of

dog had been correctly identified. An estimate of the dog population was derived from a sample of 18,000 dogs registered with local government authorities. Six breeds, which accounted for 21.5% of the dog population, were involved in close to three-quarters of all identified attacks: Bull Terriers (13.4% of attacks, 2.5% of dog population); German Shepherds (33.6% of attacks, 8.0% of dog population); Dobermans (8.0% of attacks, 2.0% of dog population); Rottweilers (7.8% of attacks, 3.0% of dog population); Blue Heelers (7.1% of attacks, 3.0% of dog population); and Collies (3.7% of attacks, 3.0% of dog population) (South Australian Health Commission 1990).

Calkins *et al.* identified 39 children admitted to a regional paediatric trauma centre in the United States with a dog bite injury over the period 1994-1999. The mean age of the children was 5.4 years (range 0.8–17 years). Review of the cases showed that 50% had occurred in the patient's own home. The remainder involved a relative or neighbour's dog that had previous encountered the child without exhibiting any violence. The most frequently identified breeds of dog involved were Rottweilers (n=3); Akitas (n=2); and Labradors (n=2).

A report by Ashby, using Victorian emergency department data, found that the majority (64% of 1,144 cases) of dog attacks occurred outdoors at a private home (either the victim's or someone else's). 13% of cases occurred indoors in a private home, and 19% on roads, footpaths or playgrounds. Place of occurrence was not specified in 14% of cases.

Brogan *et al*. retrospectively reviewed the charts of 40 children who were admitted to three hospitals in the United States. All of these children had sustained severe dog bites; three had subsequently died. 43 dogs were involved in the 40 attacks on the children. The most common breeds were the German Shepherd and German Shepherd Cross (n=15, 31%) and Rottweilers (n=7, 16%). The majority of the dogs involved belonged to either a neighbour (n=21, 49%) or a household member (n=13, 30%). Twelve (30%) of the attacks occurred in a house, 8 (20%) in the child's or a neighbour's yard, 6 (15%) in the 'neighbourhood' , and 2 (5%) in the street (Brogan T 1995).

A 1997 article contained in the Centers for Disease Control's *Mortality and Morbidity Weekly Report (MMWR)* detailed the findings of an analysis of 1995–1996 deaths data. During that two-year period, at least 25 people died as the result of dog attacks in the United States. 80% of these were children. 23 of the 25 deaths had sufficient information to classify the circumstances of the incidents. Seven (30%) involved an unrestrained dog off the owner's property, 5 (22%) involved a restrained dog on the owner's property, and in 11 cases (48%) the dog involved was unrestrained on the owner's property. Of the total number of 25 deaths, 9 (36%) involved one dog, 9 (36%) involved two dogs, 2 (8%) involved three dogs, and 5 (20%) involved between 6 and 11 dogs. The three most commonly reported breeds were Rottweilers (n=10); Pit Bulls (n=3) and German Shepherds (n=2) (Centers for Disease Control 1997). A more recent edition of the *MMWR* contained an article on non-fatal hospital treatments resulting from dog bites. The report estimates that, in 2001, 368,245 people were treated in US hospital emergency departments for non-fatal dog bites. The data source was the National Electronic Injury Surveillance System—All Injury Program (NEISS-AIP). Among the findings detailed in the report was the fact that, across all ages, approximately 16,526 (4.5%) of dog-bites were work-related. For people aged ≤16 years, approximately 1,476 (7.9%) were work-related (Centers for Disease Control 2003).

Data from the emergency department of British Colombia's Children's Hospital in Canada provides information about dog-bite injury for the year 2002. A total of 68 records were identified. Data analysis showed that 22 (32%) of the cases occurred in the victim's own home; and n=18 (26%) incidents occurred in another house. Eight (12%)

dog attacks took place in a public park. The most frequently specified activities at the time of the attack were 'playing' (n=24, 35%) and 'Walking/running/crawling (n=11, 16%). The activity was not specified in 21% of cases (Canadian Hospitals Injury Reporting and Prevention Program 2002).

It is important to note that, with the exception of the studies undertaken at the South Australian Health Commission, information about breeds of dog implicated in attacks has not been assessed in relation to estimates of the size of the dog population and the distribution of breeds within that population.

Discussion

Around 6,553 people were hospitalised as a result of dog-related injury during the three-year period 2000–01 to 2002–03, equating to an age-adjusted rate of 11.3 cases per 100,000 population. Deaths as the result of dog-related injuries are rare.

Young children and elderly people are most likely to be injured as the result of dog attacks. However, these two groups have very different patterns of injury.

The highest rates of dog-related injury were in the youngest age group (0–9 years). The majority of these injuries are due to bites. While it is likely that young children are also knocked over by dogs, unlike elderly people, they are probably robust enough to withstand this. Because of their small stature, young children are particularly prone to sustaining injuries to the head, usually open wounds. The mean length of stay in hospital that results from their encounter with the dog is short.

There is a fairly constant rate of dog-related injury among older children and adults under 75 years of age. The injuries sustained by this group are mainly bites, especially to the hand and forearm.

Many elderly people are injured when they fall as the result of being struck by a dog. Fractures in these circumstances are comparatively common among the elderly. 50% of these fractures affected the hip and thigh, a serious injury, especially for older people. Elderly people had a substantially long mean length of stay in hospital than did other age groups.

The rates of hospitalisation due to dogs appear to rise with the remoteness of the person's usual place of residence. This tendency is more marked for adults than for children.

It is important to note that this report focuses on hospital data which comprises cases at the more serious end of the injury spectrum. Many more cases of less serious dog-related injury occur where treatment is administered by a general practitioner or in a hospital emergency department or where treatment is not sought.

A recent change to ICD-10-AM allows a distinction to be drawn between the majority of dog-related cases—those due to bites—and an important minority that occur when a person is struck by a dog. Young children and the elderly are susceptible to being knocked over by dogs, but the latter group is much more likely to be injured seriously in this way. Bones tend to become more brittle with age, so a fall by an older person is more likely to result in a fracture than a fall by a young person.

Hospital records do not provide information on the type of dog involved in an attack. The feasibility of doing so in the future could be explored. Such information would, however, be of limited value unless reliable information could also be obtained on the representation of particular breeds within the dog population in areas in which the human injuries occur. In addition, hospital data do not currently include information of the circumstances of a dog attack (e.g. whether the person was known to the dog, or whether the dog was provoked). Such information could aid understanding of the epidemiology of dog-related injuries.

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Data issues

Age adjustment

Most all-ages rates have been adjusted for age to overcome the effect of differences in the proportions of people of different ages (and different injury risks) in the populations that are compared. Direct standardisation was employed, taking the Australian population in 2001 as the standard. Changes in age composition are small within narrow age bands (e.g. 65–69 years) and adjustment has not been applied to five year age groups. Where crude rates are reported, this is noted.

Confidence intervals

Hospital separations

Nearly all injury/poisoning separations are thought to be included in the data reported, representing minimal risk of sampling error. Data are reported here for the three-year period commencing 1 July 2000 and ending 30 June 2003. Data are reported in terms of financial year of separation, although they could equally be reported in terms of years starting on any other date, in which case rates would differ slightly. Confidence intervals for rates provided in this report indicate the size of such differences (95%; based on Poisson distribution).

Data quality

Deaths

The reliability of information about cause of death depends on the reliability of ICD codes provided by the ABS. This depends largely on the adequacy of the information provided to the ABS through Registrars of Births, Deaths and Marriages, and originating from coroners and medical practitioners. Little published information is available on the quality of the data resulting from this process, particularly as it applies to injury deaths. Centralisation of mortality coding in the Brisbane office of the ABS since the mid 1990s has reduced the potential for variation due to local differences in coding practice. However, factors affecting information recording, provision, or coding could affect data in different ways for different jurisdictions, periods or population groups. Hence, apparent differences should be interpreted with caution.

Hospitalisations

This report uses data collected from state and territory hospitals. After coding and collection from the states and territories, the data is further processed by the AIHW and NISU. The geographical spread of the data and the large number of people involved in its processing increases the risk of inconsistencies across time and place in the data. Variations in reporting and coding continue to exist across jurisdictions, although standard classifications and formal coding guidelines have been in place for some years.

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