



Hazard
 (Edition No. 69)
 Summer 2009
 Victorian Injury Surveillance
 Unit (VISU)

www.monash.edu.au/muarc/visu

Monash University
 Accident Research Centre



Unintentional dog bite injury in Victoria: 2005-7

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This edition provides a profile of unintentional ('accidental') dog bite injury in Victoria giving a picture of the size and nature of the problem overall and for adults and children separately.

Summary

- Over the 3-year period 2005-7, there were 3 deaths, 1,445 hospital admissions and 4,885 ED presentations (non-admissions) for unintentional dog bite injury in Victoria, an average of 1 death, 482 hospital admissions and 1,628 ED presentations per year.
 - Spring and summer were high risk seasons for dog bite injury
 - Males and females were equally represented in dog bite injury hospital admissions but males were over-represented in ED presentations, accounting for 54% of cases.
 - The peak 15-year age group for injury frequency was age group 0-14 years (35% of admissions and 26% of ED presentations) followed by age group 30-44 years (18% of admissions and 22% of ED presentations).
 - Two-year-olds are at highest risk of dog bite injury.
 - ED presentations data indicate that the home (the injured person's own home or another person's home) was the most common location of dog bite injury (57%), followed by the road/street (11%).
 - Open wounds accounted for 85% of hospital admissions and 94% of ED presentations. There were 36 recorded traumatic finger amputations.
 - Among both hospital admissions and ED presentations the upper extremity was the most commonly injured body region (47% of admissions and 52% of ED presentations, mostly hand/finger injuries), followed by the head/face/neck (38%, 21%) and the lower extremity (11%, 21%, mostly lower leg injuries).
 - 60% of admitted cases stayed in hospital less than 2 days, 35% had a length of stay of 2-7 days and 5% required a stay of more than 8 days.
 - The all-age dog bite injury hospitalisation rate (including same-day admissions) showed an increasing trend of 16% over the 9-year period January 1999 to December 2007, from 8.3 dog bite hospitalisations/100,000 population in 1999 to 9.5/100,000 in 2007.
- Dog bite injury among children and adults are reported separately in the body of this report. The findings indicate that children aged 0-14 years, especially very young

The analytical research underpinning this report was supported by the Bureau of Animal Welfare (BAW), a division of the Department of Primary Industries and the literature review by VISU's core grant from the Department of Human Services. We thank BAW for permission to publish part of a commissioned report to a broader audience.



children, should continue to be a prime target of dog bite prevention campaigns and that reducing dog bite in the domestic setting should remain a priority. While the ages at highest risk are found in children, about two-thirds of hospital-treated dog bite injuries occur in adults. Their risk awareness needs to be raised and their dog training, handling and interaction skills improved. Interventions to reduce the health and safety risk posed by uncontrolled dogs in public spaces (streets and parks) should be maintained.

1. Introduction

This report covers deaths and hospital-treated injury (admissions and ED presentations) that occurred in the three calendar years January 1, 2005 to December 31, 2007.

1.1 Aims

The aims of this study were:

- (1) To investigate the size and pattern of fatal and hospital-treated dog bite injury in Victoria over the 3-year period 2005-7
- (2) To estimate the trend in dog bite injury hospitalisations over the past decade
- (3) To suggest priority population groups and settings for prevention based on the findings of this descriptive study

1.2 Case selection

Unintentional dog bite injury cases for the study years were selected from three different datasets. A search was performed on the National Coroners Information System (NCIS) for deaths. Hospital admissions were extracted from the Victorian Admitted Episodes Dataset (VAED) and Emergency Department presentations (non-admissions) from the Victorian Emergency Minimum Dataset (VEMD).

No dog bite-related fatalities were found on the NCIS for the study years. However, one infant death due to dog bite was reported in the media in 2007 and two further dog-bite related deaths that occurred in hospital were recorded on the Victoria Admitted Episodes Dataset (VAED). These deaths are still being investigated by the Coroner.

Hospital admissions (excluding deaths) recorded on the Victorian Admitted Episodes Dataset (VAED) that attracted the ICD-10-AM Cause of injury code W54.0 Bitten by Dog were included.

Emergency Department (ED) presentations recorded on the Victorian Emergency Minimum Dataset (VEMD) that attracted the cause of injury code 21-Dog related AND the nature of main injury code 26-Bite (non-venomous OR 27-Bite (not further specified) were included. This search was supplemented by a text search of narrative data for cases containing the text terms 'dog' and 'bit'. These cases were checked and included if eligible. All deaths and hospital admissions recorded on the VEMD were excluded to avoid overcounting.

1.3 Estimating injury rates and trends

Rates can only be reliably calculated for hospital admissions because the VAED covers all public and private hospitals in Victoria, potentially capturing all hospitalisations. The VEMD does not capture all ED presentations as data collection is confined to the 38 public hospitals that provide a 24-hour emergency service and does not cover injury ED presentations to smaller public hospitals and private hospitals that offer ED services.

Rates of hospitalised dog bite injury were calculated per 100,000 population, using Victorian population data obtained from the Australian Bureau of Statistics.

2. Results

2.1 All dog bite injury

In Victoria, over the three-year study period 2005-7, there were three deaths, 1,445 hospital admissions and 4,885 ED presentations for dog bite, an average of one death, 482 hospital admissions and 1,628 ED presentations per year.

No dog bite fatalities for the study years were found in the National Coroners Information System (NCIS) but one infant dog bite death was reported in the media in 2007. Two deaths were recorded on the hospital admissions dataset (VAED) but were not found on the NCIS. One was an infant and the other a senior.

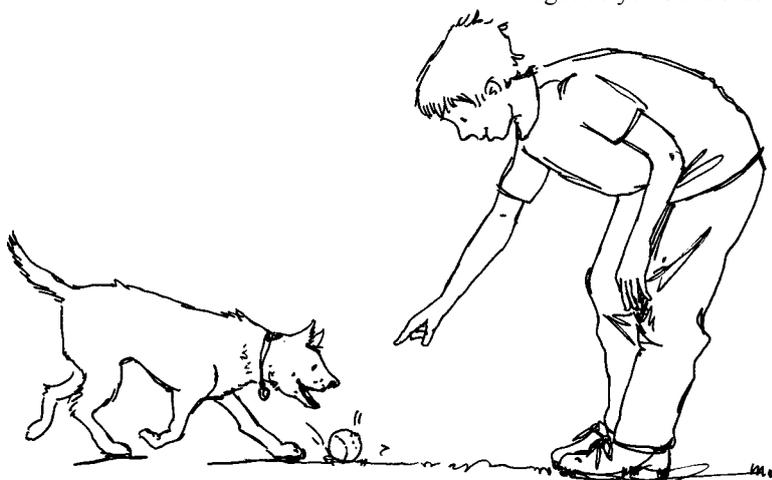
The pattern of hospital treated injury is summarised in Tables 1A & 1B

2.1.1 Seasonal distribution of dog bite injury cases

Dog bite injury hospital admissions were highest in spring (28%), followed by summer (26%), autumn (24%) then winter (22%). Dog bite ED presentations were highest in summer (31%), followed by spring (26%), autumn (22%) then winter (21%). (Figure 1)

2.1.2 Gender and age Hospital admissions

Overall, there was no gender imbalance among dog bite hospital admissions. However, among children aged 0-14 years males were more likely to be hospitalised for dog bite injury than females (ratio 1.2 males:1 female), whereas among seniors aged 75 years and older females were



VARIABLE	CHILDREN (0-14 years)				ADULTS (15 years and older)				ALL			
	Hospital Admissions (n=511)		ED Presentations (n=1,280)		Hospital Admissions (n=934)		ED Presentations (n=3,605)		Hospital Admissions (n=1,445)		ED Presentations (n=4,885)	
	N	%	N	%	N	%	N	%	N	%	N	%
Year												
2005	191	37	481	38	283	30	1 197	33	474	33	1 678	34
2006	171	34	405	32	308	33	1 159	32	479	33	1 564	32
2007	149	29	394	31	344	37	1 249	35	492	34	1 643	34
Gender												
Male	277	54	740	58	446	48	1 918	53	723	50	2 658	54
Female	234	46	540	42	489	52	1 687	47	722	50	2 227	46
Age group												
0-14 years	511	100	1 280	100					511	35	1 280	26
15-29 years					185	20	1 036	29	185	13	1 036	21
30-44 years					262	28	1 048	29	262	18	1 048	22
45-59 years					239	26	852	24	239	17	852	17
60-74 years					147	16	459	13	147	10	459	9
75+ years					101	11	210	6	101	7	210	4
Place (location)												
Home	141	28	877	69	135	14	1 887	52	276	19	2 764	57
Road/street/highway	8	2	68	5	28	3	484	13	36	3	552	11
Place of recreation	n/a	n/a	58	4	n/a	n/a	218	6	n/a	n/a	276	6
Other specified	15	2	113	9	50	6	418	12	65	4	531	11
Unspecified	347	68	162	13	722	77	596	17	1 068	74	758	16
Missing	-	-	2	<1	-	-	2	<1	-	-	4	<1

Source: VAED 2005-7 (hospital admissions); VEMD 2005-6 (hospital ED presentations, non-admissions)

more much more likely to be hospitalised for dog bite injury than males (ratio 1.8 females: 1 male). (Figure 2)

The peak 15-year age group for hospital admissions was children aged 0-14 (35% of admissions), followed by adults aged 30-44 years (18%). (Table 1 & Figure 2)

Age-specific dog bite injury rates (3-year average) were only estimated for hospitalisations because all Victorian hospitals (public and private) contribute

data to the VAED, so numerator data are close to complete.

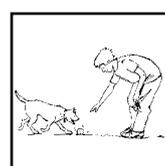
The highest risk group for hospitalisation for dog bite injury was age group 0-4 years, followed by age group 5-9 years (Figure 3). Among adults, admission rates were comparatively high in seniors aged 80-84 years and 85 years and older.

ED presentations

Among ED presentations for dog bite injury, males were over-represented

accounting for 54% of cases overall (ratio 1.2:1). They were over-represented in all 15-year age groups except for age groups 45-59 years and 75 years and older in which females accounted for 54% and 56% of cases, respectively (Figure 4).

As for hospitalisations, the peak 15-year age group for dog bite ED presentations was 0-14 years (26% of ED presentations) followed by age group 30-44 years (22% of ED presentations).



VARIABLE	CHILDREN (0-14 years)				ADULTS (15 years and older)				ALL			
	Hospital Admissions (n=511)		ED Presentations (n=1,280)		Hospital Admissions (n=934)		ED Presentations (n=3,605)		Hospital Admissions (n=1,445)		ED Presentations (n=4,842)	
Nature of injury												
Open wound	482	94	1187	93	749	80	3 382	94	1 231	85	4 569	94
Fracture	3	<1	1	<1	45	5	5	<1	48	3	6	<1
Superficial injury	5	1	62	5	14	2	143	4	19	1	207	4
Injury to muscle & tendon	5	1	-	-	34	4	4	<1	39	3	4	<1
Traumatic amputation	5	1	1	<1	29	3	1	<1	34	2	2	<1
Injury to nerve	3	<1	1	<1	17	2	-	-	20	1	1	<1
Other & unspecified injury	6	1	15	1	36	3	50	1	41	3	68	1
Missing	2	<1	13	1	11	1	15	<1	13	1	28	<1
Body region												
Head/face/neck	385	75	629	49	164	18	402	11	549	38	1 031	21
Trunk	8	2	26	2	5	<1	61	2	13	1	87	2
Upper extremity	82	16	380	30	592	63	2 156	60	674	47	2 536	52
Lower extremity	30	6	191	15	135	14	829	23	165	11	1 020	21
Other/unspecified	4	1	41	3	28	3	142	4	31	2	183	4
Missing	2	<1	13	1	11	1	15	<1	13	1	28	<1
Length of stay												
< 2 days	395	77	n/a	n/a	474	51	n/a	n/a	869	60	n/a	n/a
2-7 days	110	22	n/a	n/a	388	42	n/a	n/a	498	35	n/a	n/a
8-30 days	6	1	n/a	n/a	70	8	n/a	n/a	76	5	n/a	n/a
31+ days	-	-	n/a	n/a	3	<1	n/a	n/a	2	<1	n/a	n/a

Source: VAED 2005-7 (hospital admissions); VEMD 2005-6 (hospital ED presentations, non-admissions)

2.1.3 Place of occurrence (location)

Among hospitalisations, the place of occurrence (location) of injury was not specified for 74% of cases so data are unreliable. Of specified cases (n=377), 73% occurred in the home.

The location of the injury event was better specified in ED presentations data where 85% of cases attracted a specific location code. The home was the most common location of dog bite injury ED presentations (57%), followed by road/street/highway (11%) (Figure 5). The definition of a home

includes the patient's own home or another person's home including the house, garage, shed, garden and driveway.

2.1.4 Nature of injury and body region injured

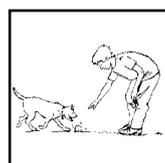
Open wounds accounted for 85% of hospital admissions, followed by fracture and injury to muscle and tendon (both 3%). Among ED presentations, open wounds accounted for 94% of injuries, followed by superficial injury (4%).

Among both hospital admissions and ED presentations the upper extremity was

the most commonly injured body region (47% of admissions and 52% of ED presentations), followed by the head/face/neck (38%, 21%) then the lower extremity (11%, 21%).

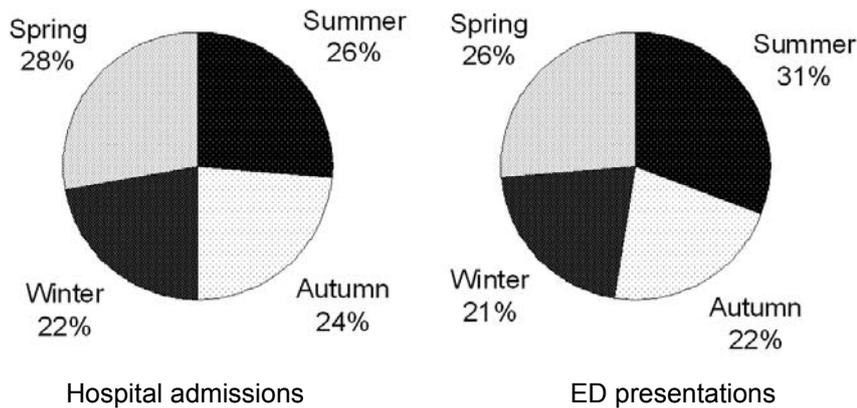
2.1.5 Length of stay (hospital admissions)

Length of stay of admissions is used as a proxy measure for severity. Sixty percent of admitted cases stayed in hospital less than 2 days, 35% had a length of stay of 2-7 days and 5% required a stay of more than 8 days. The average (mean) length



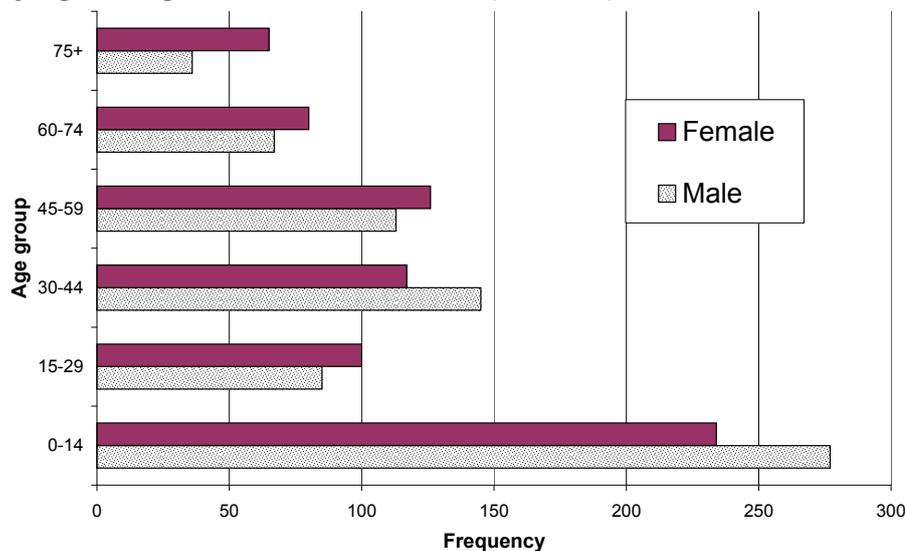
Seasonal distribution of hospital-treated dog bite injury cases, Victoria 2005-7

Figure 1



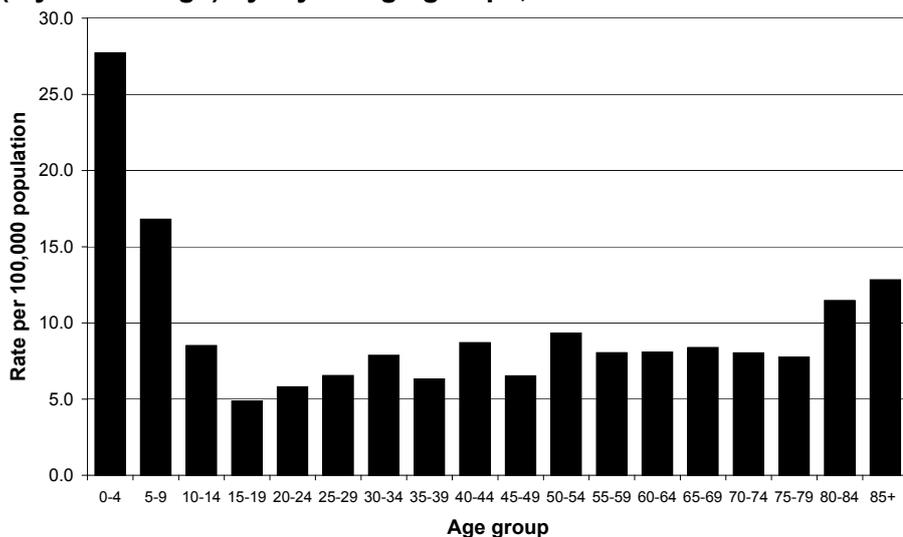
Frequency of dog bite injury hospital admissions by age and gender, Victoria 2005-7 (n=1,145)

Figure 2



Age-specific dog bite injury hospital admission rates (3-year average) by 5-year age groups, Victoria 2005-2007

Figure 3



of stay of all hospital admissions for dog bite was 2.2 days. This is much lower than the average length of stay for all other unintentional injury hospitalisations over the study years (5.2 days).

2.2 Child dog bite injury

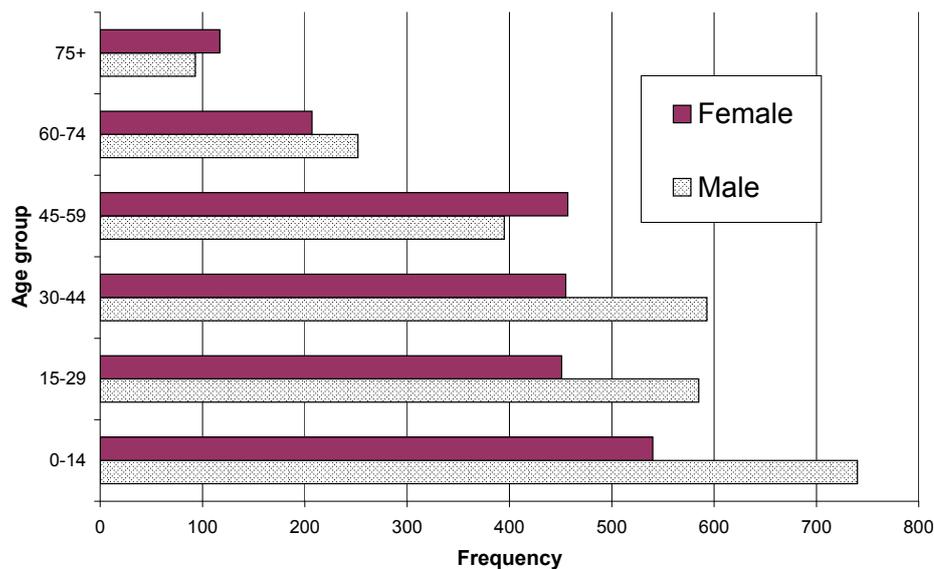
2.2.1 Summary

- Over the 3-year study period among children aged 0-14, there were 2 deaths and at least 511 hospital admissions and 1,280 ED presentations for dog bite injury, an average of 1 death, 170 hospital admissions and 427 ED presentations per year.
- Child dog bite hospital admissions and ED presentations both decreased by 22% over the 3-year period.
- Among both admissions and ED presentations summer was the peak season for hospital-treated dog bite cases (28% and 34% of cases respectively), followed by spring (27%, 26%).
- Males were over-represented in child dog bite injury hospital admissions (54%) and ED presentations (58%). Children aged 0-4 years were over-represented in both child dog bite admissions (51%) and ED presentations (40%).
- Among both admissions and presentations the peak age for dog bite injury was children aged 2 (17% and 11% respectively) followed by children aged 3 (12%, 10%), then children aged 1 (11%, 9%).
- Age-specific rates (3-year average) were only estimated for hospitalisations. Analysis of rate data confirmed that, among children, two year-olds were at highest risk of hospitalisation for dog bite injury (age specific rate: 46/100,000 population), followed by 3 year-olds (32/100,000), then 1 year-olds (30/100,000).
- ED presentations data indicated that more than two-thirds (69%) of dog bite injuries occur in the domestic environment - the child victim's own home or the home of a family member, friend or neighbour.
- Over 90% of all hospital-treated injuries (admissions and presentations) were open wounds.



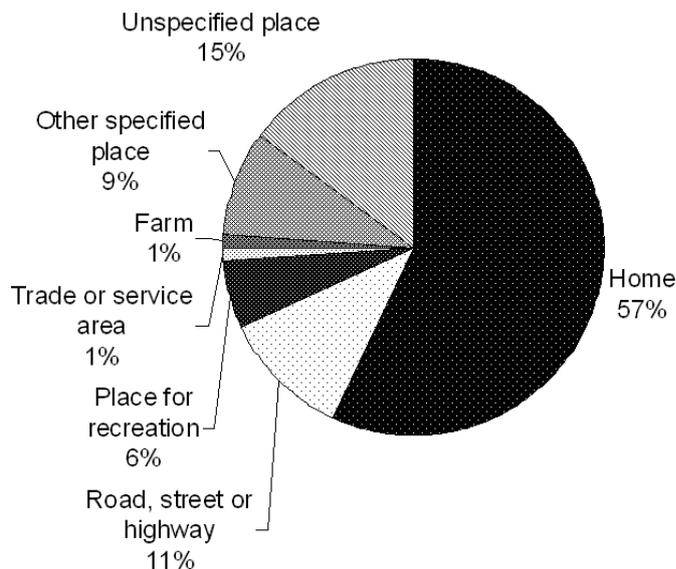
Dog bite ED presentations by age and gender, Victoria 2005-7 (n=4,885)

Figure 4



Place of occurrence (location) of dog bite injury ED presentations, Victoria 2005-7 (n=4,885)

Figure 5



- Three-quarters of dog bite-related hospitalisations and nearly half (49%) of dog bite ED presentations were for injuries to the head/face/neck, driven by the high proportion of head/face/neck injuries among 0-4 year olds (82% of admissions and 69% of ED presentations). Other major injury sites were the hand/finger and the lower leg.
- 77% of admitted cases stayed in hospital less than 2 days, 22% had a length of stay of 2-7 days and 1% required a

stay of more than 8 days. The average length of stay was 1.1 day, the same as the average length of stay for all child injury hospitalisations.

2.2.2 Frequency and pattern

Over the 3-year study period 2005-7 among children aged 0-14, there were two deaths and at least 511 hospital admissions and 1,280 ED presentations for dog bite injury, an average of 1 death, 170 hospital admissions and 427 ED presentations per

year. The pattern of child dog bite hospital-treated injury is summarised in Table 1.

The yearly distribution of injury cases by 5-year age group is shown in Table 2. Child dog bite hospital admissions and ED presentations both decreased by 22% over the 3-year period.

2.2.3 Seasonal distribution of cases

Among both admissions and ED presentations summer was the peak season for hospital-treated dog bite cases (28% and 34% of cases respectively), followed by spring (27%, 26%), then autumn (25%, 21%) and, lastly, winter (20%, 18%). (Figure 6)

2.2.4 Gender and age

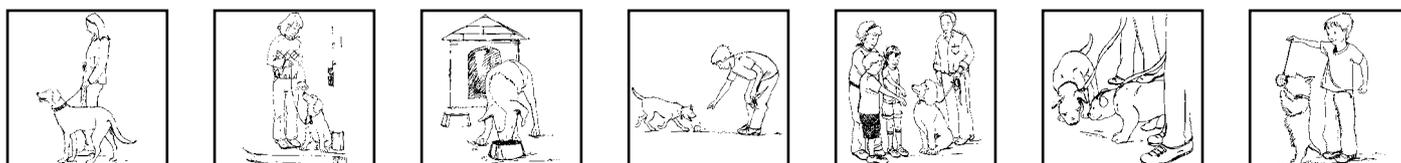
Figures 7 and 8 show the distribution of cases by age group and gender for hospital admissions and ED presentations, respectively.

Males were over-represented in child dog bite injury hospital admissions (54%) and ED presentations (58%). This pattern was consistent for hospital-treated injury across the three 5-year age groups except among admissions of 5-9 year olds where females accounted for 53% of dog bite admissions.

Children aged 0-4 years were over-represented in child dog bite admissions (51%) and ED presentations (40%). Among both admissions and ED presentations the peak age for dog bite injury was 2 years (17% and 11% respectively) followed by 3 years (12%, 10%), then 1 year (11%, 9%). From age 2, the number of cases generally decreased as age increased. (Figures 7 & 8)

The overall, male and female age-specific hospital admission rates are given in Table 3. Figure 9 graphs rates for each year of age, overall by age and gender.

Analysis of age-specific rate data showed that 2 year-olds were at highest risk of dog bite injury hospitalisation, followed by 3-year olds then 1 year-olds (Table 3 and Figure 9). When gender was factored into the analysis, 2 year-old males are at highest risk, followed by 2 year-old females, then 1

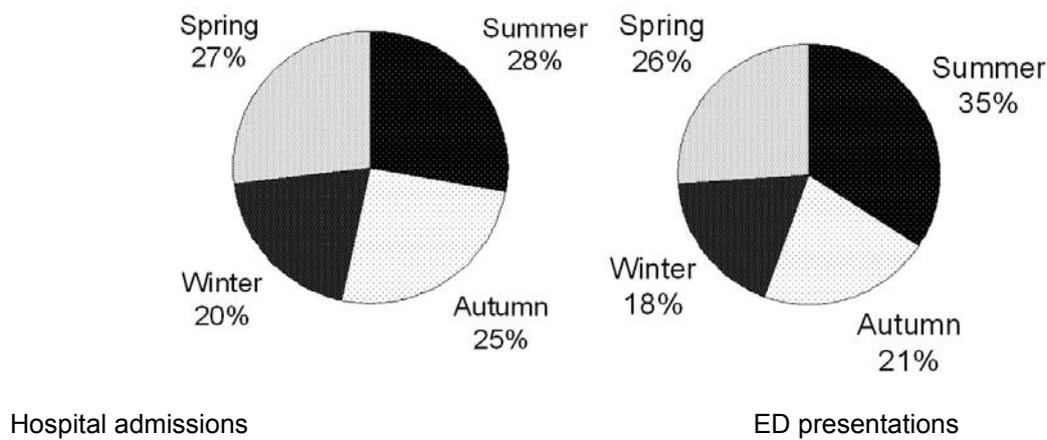


Yearly distribution of hospital-treated child dog bite injury by 5-year age group, Victoria 2005-7 Table 2

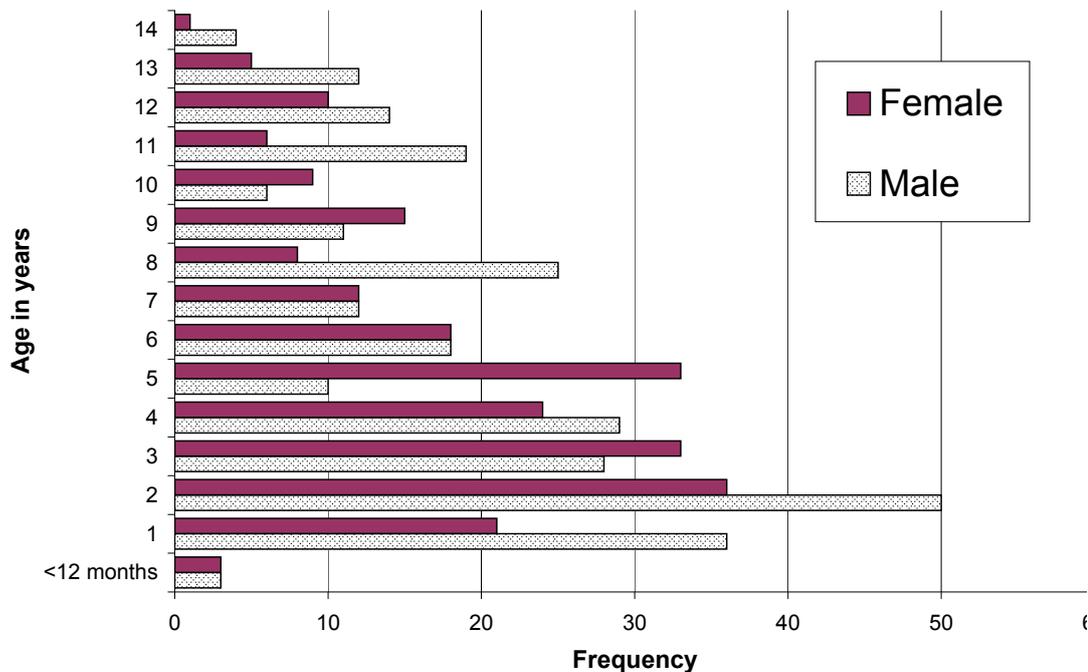
Year	2005		2006		2007		2005-7 ALL	
Age group	Hospital Admissions N (%)	ED Presentations N (%)	Hospital Admissions N (%)	ED Presentations N (%)	Hospital Admissions N (%)	ED Presentations N (%)	Hospital Admissions N (%)	ED Presentations N (%)
0-4	93 (49%)	182 (38%)	97 (57%)	167 (41%)	73 (49%)	167 (42%)	263 (51%)	516 (40%)
5-9	73 (38%)	168 (35%)	43 (25%)	127 (31%)	46 (32%)	123 (31%)	162 (32%)	418 (33%)
10-14	25 (13%)	131 (27%)	31 (18%)	111 (27%)	30 (20%)	104 (26%)	86 (17%)	346 (27%)
All	191(100%)	481 (100%)	171(100%)	405 (100%)	149(100%)	394 (100%)	511(100%)	1,280(100%)

Seasonal distribution of hospital-treated child dog bite injury cases, Victoria 2005-7

Figure 6

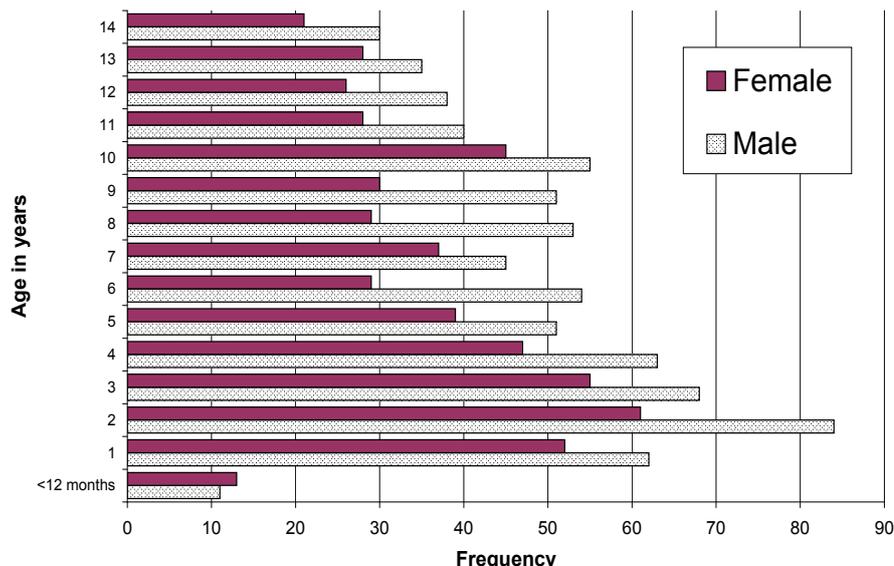


Distribution of child dog bite hospital admissions by age and gender, Victoria 2005-7 (n=511) Figure 7



Distribution of child dog bite ED presentations by age and gender, Victoria 2005-7 (n=1,280)

Figure 8



Age-specific child dog bite injury hospitalisation rates (3-year average) per 100,000 population, Victoria 2005-7

Table 3

Age (years)	Male Rate/100,000	Female Rate/100,000	All age Rate/100,000
<12 months	3.1	3.2	3.1
1	36.9	22.7	30.0
2	51.8	39.3	45.7
3	29.1	35.9	32.4
4	30.0	26.2	28.1
5	10.3	35.5	22.6
6	18.3	19.3	18.8
7	12.1	12.9	12.5
8	25.0	8.5	17.0
9	10.9	15.8	13.3
10	5.9	9.3	7.5
11	18.4	6.2	12.4
12	13.4	10.1	11.8
13	11.5	5.0	8.4
14	3.8	1.0	2.4

year-old males followed by 3 and 5 year-old females (Table 3 and Figure 9).

2.2.5 Place of occurrence (location)

Among hospitalisations, the place of occurrence (location) of injury was not specified for 68% of cases. Of specified cases (n=165), 86% occurred in the home

but this figure is probably unreliable. The location of the injury event was better specified in ED presentations data where 87% of child cases attracted a specific place of occurrence code. Just over two-thirds (68%) of dog bite injuries occurred in the home (Figure 10).

2.2.5 Relationship of bitten child to dog and circumstances of injury

Case narrative data recorded for ED presentations on the VEMD were analysed for information about the relationship of the child to the dog, circumstances surrounding the injury event and the breed of dog.

Admissions

Narrative data were available for 299 of the 511 admissions (59%) recorded on the VAED as only public hospitals with a 24-hour emergency service contribute data to the VEMD (38 hospitals) whereas all private and public hospitals contribute data to the VAED. Only 19% (n=56) of the 299 available narratives provided more information on the incident so these results should be interpreted with caution.

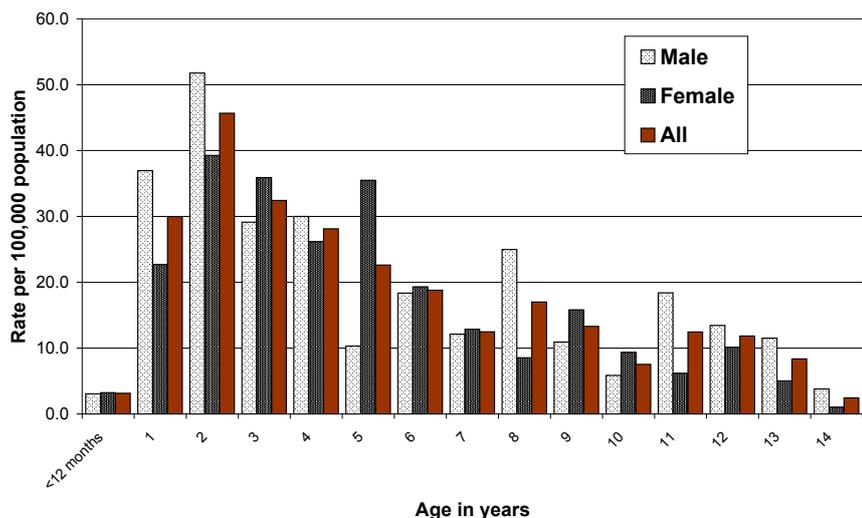
Nearly half of the dogs involved in cases with informative narratives were family pets (n=27). No further details were given of the incidents involving family pets in 20 narratives and the others described that the children were bitten when playing near (4), walking by (1), accidentally standing on (1) or playing with (1) the pet. Seven children were bitten by dogs owned by relatives (grandparent, uncle, aunt and an unnamed relative at a family party). Four of these children were bitten when they were playing near, playing with or ‘visiting’ the pet and there were no further details for the other three cases.

Five children were bitten by dogs owned by neighbours, two when walking by the neighbour’s house, one when putting his hand through the neighbour’s fence and there were no further details for the other two cases. Four were bitten by dogs belonging to friends when watching TV, playing near dog or walking in the street.

Seven were bitten by unknown/stray dogs when playing near the dog (4), playing with the dog (1), sitting near by (1) and riding a bike (1). The relationship between the child and the dog was not described in 6 of the 56 informative case narratives but the child was described as playing with (4), patting (1) or interfering with the dog when it was eating food (1).



Age- and gender- specific child dog bite injury hospitalisation rates (3 year average), Victoria 2005-7 (n=511) **Figure 9**

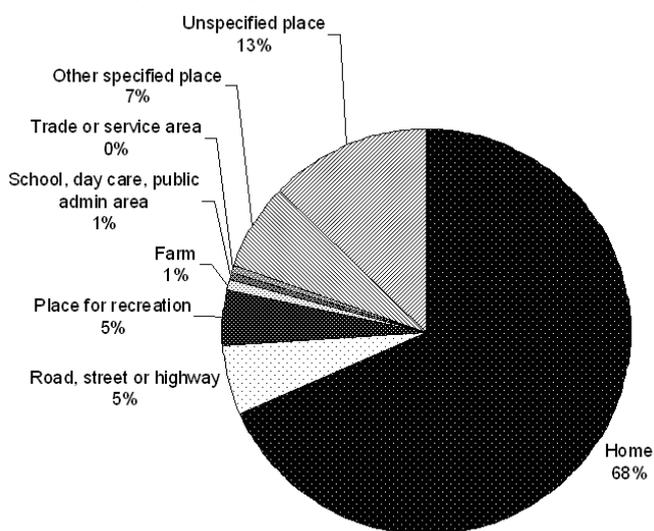


was resting when he/she was bitten and in another the dog attacked a baby.

Twenty-four children were bitten when visiting their own friends or a family friend. No further details were recorded in 12 cases. In the others, the child was reported as playing near the dog (3), playing with friend (1), playing a ball game (1), playing with dog (3) or patting the dog (1) when he/she was bitten and, in two cases, the dog jumped up and bit the child unexpectedly when the child appeared not to be interacting with the dog in any way.

Thirteen children were bitten by dogs belonging to relatives (grandparents, uncles and one unspecified 'relative'). No further details were given in 9 of these cases. In one case the child interfered with the dog when it was eating, in another the child was patting the dog and, in two cases, the bite appeared unprovoked with the dog described as 'attacking' a child (no other details) and biting the child when the mother was putting the child in a car seat.

Place of occurrence (location) of dog bite ED presentations (n=1,280) **Figure 10**



Dogs unknown to victim

Twenty-eight children were bitten by unknown or stray dogs. These incidents occurred when the child was: playing in a park (7); playing in their own garden or backyard (4); riding a bike on the street (3); walking to school (1); walking, no other detail (2); going about their own business in a public place i.e., a shopping centre, swimming pool and car park (3); or playing with or patting the dog (3). No further details were given in 4 case narratives.

Relationship to dog not described but additional information given

In 23 of the informative case narratives the relationship of the child to the dog was not described but there was some additional information on the circumstances of the bite. At the time of the incident the children were: playing with dog (6); playing, no further details (2); playing on the street, at a camp, in a park or on an oval (4); doing cartwheels (1); riding a bike (2); ferreting (1); walking (1); and stopping dogs fighting (2). Four children were bitten when overseas, three in Vietnam and one in Thailand, presenting to hospital for vaccination against rabies.

The dog breed was named in only 14 cases and included 16 dogs: Alaskan Malamute (1); Border Collie (1); Great Dane (1); Greyhound (4 dogs, in two incidents); Jack Russell (1); Kelpie cross (2); Maltese terrier (1); Pit Bull Terrier (2); Rottweiler (2); and sheepdog (1).

ED presentations (non-admissions)

Analysis of the case narratives for child dog bite ED presentations (non-admissions) revealed that only 196 of the 1,280 narratives (15%) included additional information.

Dogs known to victim

The family pet was involved in just over half of the 196 cases (n=101) with informative case narratives, 56 of which provided no further information on the circumstances. In the remaining cases (n=45) the child was bitten when playing with the dog (n=19), playing near the dog (14), riding a scooter near by (1), feeding dog (1), hugging dog (1), grooming dog (1), separating fighting dogs (1), picking up the dog after it was run over by a car (1), leaning over dog to help dog up (1), stepping on dog's tail (1), approaching dog when it had a bone (1) or pulling dog's ears (1). In one case the child



Dog breed

The dog breed was named in only 24 cases and included: American Bulldog (1); Beagle (2); Blue Heeler/Collie cross (1); Doberman (1); Fox Terrier (1); German Shepherd (1); Great Dane (1); Golden Retriever (2); Jack Russell (5); Pekinese (1); Pit Bull Terrier/cross (3); Rottweiler (3); Staffordshire Terrier (1); and Rhodesian Ridgeback (1).

Caution should be exercised when interpreting these results as the samples of informative narratives are small and may not be representative.

2.2.6 Nature of injury and body region injured

Over 90% of all hospital-treated injuries (admissions and presentations) were open wounds. Five hospital admissions involved traumatic amputation of fingers.

Three-quarters (75%) of dog bite hospital admissions and nearly half (49%) of dog bite ED presentations were for injuries to the head/face/neck, driven by the high proportion of head/face/neck injuries among 0-4 year olds (82% of admissions and 69% of ED presentations). The other major injury sites were the upper extremity (16% of admissions and 30% of ED presentations, mostly the hand/fingers) and the lower extremity (6% and 15%, mostly the lower leg).

2.2.7 Length of stay (hospital admissions)

Among admissions, length of stay may be used as a proxy measure for severity. Seventy-seven per cent of admitted cases stayed in hospital less than 2 days, 22% had a length of stay of 2-7 days and 1% required a stay of more than 8 days. The average (mean) length of stay was 1.1 days. This is same as the average length of stay for all other child injury hospitalisations and for all child unintentional injury hospitalisations. A proportion of children are re-admitted for plastic surgery but these additional hospitalisations cannot be tracked on our system.

2.3 Adult dog bite injury

2.3.1 Summary

- Over the three-year study period, among adults (aged 15 years and older), there was one death, 934 hospital admissions and 3,605 ED presentations for dog bite, an average of 311 hospital admissions and 1,202 ED presentations per year.
- Adult dog bite admissions and ED presentations increased between 2005 and 2007.
- Among hospital admissions, the peak season for dog bite injury was spring (28%) followed by summer (26%), whereas among ED presentations the peak season was summer (30%), followed by spring (26%).
- Females were over-represented in admissions (52%) but not in ED presentations (47%).
- Among both admissions and ED presentations, case counts were highest in age group 30-44 years, followed by age group 45-59 years for hospitalisations and age group 15-29 for ED presentations. Dog bite hospitalisations and ED presentations decreased as age increased from age 30-34 years.
- Age-specific rates (3-year average) for 15-year age groups (15-29 years, 30-44 etc) were only estimated for hospital admissions. The dog bite injury hospitalisation rates generally increased as age increased overall and in both sexes. Among adults, the highest risk group for adult dog bite injury hospitalisation was persons aged 75 years or older.
- Among ED presentations, the most common place of occurrence (location) of dog bite injury was the home (52%) followed by road/street/highway (13%) and place for recreation (6%).
- Open wounds accounted for 80% of adult dog bite injury hospital admissions and 94% of ED presentations.
- Among hospital admissions and ED presentations the upper extremity was the most commonly injured body region (63% of admissions and 60% of ED presentations, mostly the hand/fingers).
- Fifty-one per cent of admitted cases stayed in hospital less than 2 days,

42% had a length of stay of 2-7 days and 8% required a stay of more than 8 days. The average length of stay was 2.8 days. This is lower than the average length of stay for all other adult injury hospitalisations over the study years (5.3 days) and for all other unintentional injury hospitalisations (5.7 days).

2.3.2 Frequency

Over the three-year study period among adults (aged 15 years and older) there was one death, 934 hospital admissions and 3,605 ED presentations for dog bite, an average of 311 hospital admissions and 1,202 ED presentations per year. Adult dog bite admissions and ED presentations increased between 2005 and 2007.

The pattern of adult dog bite injury is summarised in Table 1.

2.3.3 Seasonal distribution of adult dog bite injury cases

Among hospital admissions, the peak season for dog bite injury cases was spring (28%), followed by summer (25%) whereas among ED presentations the peak season was summer (30%), then spring (26%). There was not much difference between the proportion of cases that occurred in autumn and winter (22-24% in each season) (Figure 11).

2.3.4 Gender and age

Figures 12 and 13 show the distribution of cases by 15-year age groups and gender for hospital admissions and ED presentations, respectively.

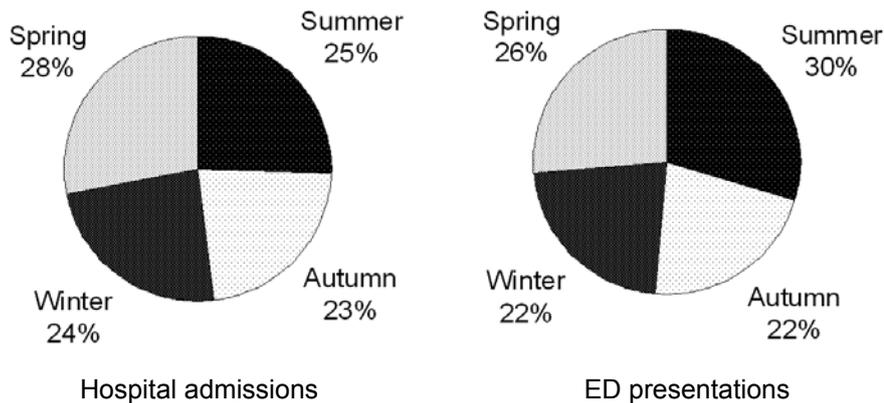
Females were over-represented in admissions (52%) but not in ED presentations (47%). Among both hospitalisations and ED presentations, case counts were highest in age group 30-44 years, followed by age group 45-59 years for hospitalisations and age group 15-29 for ED presentations. Dog bite hospitalisations and ED presentations decreased as age increased from age 30-34 years (Figures 12 & 13).

Age-specific rates (3-year average) were only estimated for hospital admissions. The dog bite injury hospitalisation rates generally increased as age increased, overall and in both sexes. Persons aged



Seasonal distribution of hospital-treated dog bite injury cases, Victoria 2005-7

Figure 11



75 years and older were the highest risk group for adult dog bite injury admissions (Figure 14).

2.3.5 Place of occurrence of injury (location)

Among hospitalisations, the location of injury was not specified for 76% of cases. Of specified cases (n=213), 63% occurred in the home. Among ED presentations data, 83% of cases attracted a specific location code. The most common location of injury was the home (52%) followed by road/street/highway (13%) and place for recreation (6%) (Figure 15).

2.3.6 Relationship of bitten adult to dog and circumstances of injury

Admissions

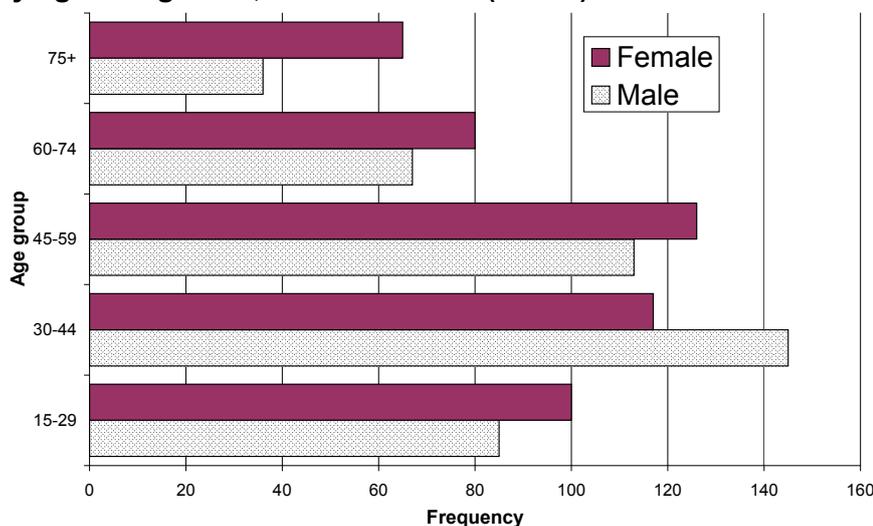
The VEMD contains narrative data for 370 (40%) of the 934 cases recorded on the VAED but only 68 narratives provided additional information on the relationship of the dog to the bitten adult and/or the circumstances of the injury.

Twenty seven of the adult hospitalisations were bitten by their own dog/s and in 11 of these cases no further detail was given of the circumstances. In the other 16 cases the owner was bitten in a wide variety of situations: breaking up fighting dogs (3); playing with dog (3); when outside socialising (1); feeding dog (1); rescuing dog/helping injured dog (3); removing object from dog's mouth (1); putting dog out for night (1); kissing sleeping dog when intoxicated (1); and in seemingly unprovoked attacks (2).

Twenty-one hospitalised adults were bitten by a dog or dogs belonging to a friend (4), the police force (3) or unknown/stray dogs (14) and in a further 13 cases more details were given of the circumstances of the dog bite incident but no information on the relationship of the dog to the injured person. The circumstances of these bite incidents were: separating fighting dogs (10); walking dog (1); out walking (5); in park and assailed by unknown dog (3); being subdued or pursued by police (3); playing with dog (2); 'bitten for no reason' (1); patting dog (1); entering locked compound and attacked by two dogs (1); checking

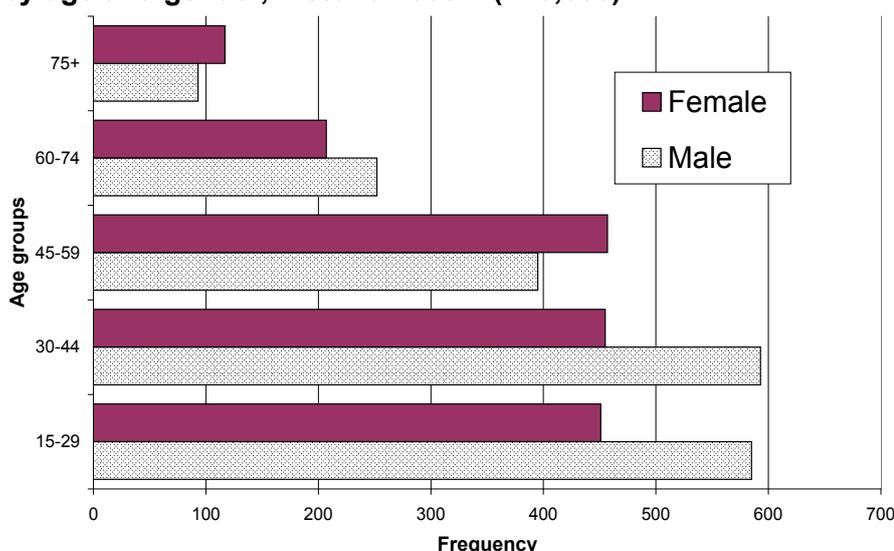
Distribution of adult dog bite hospital admissions by age and gender, Victoria 2005-7 (n=934)

Figure 12



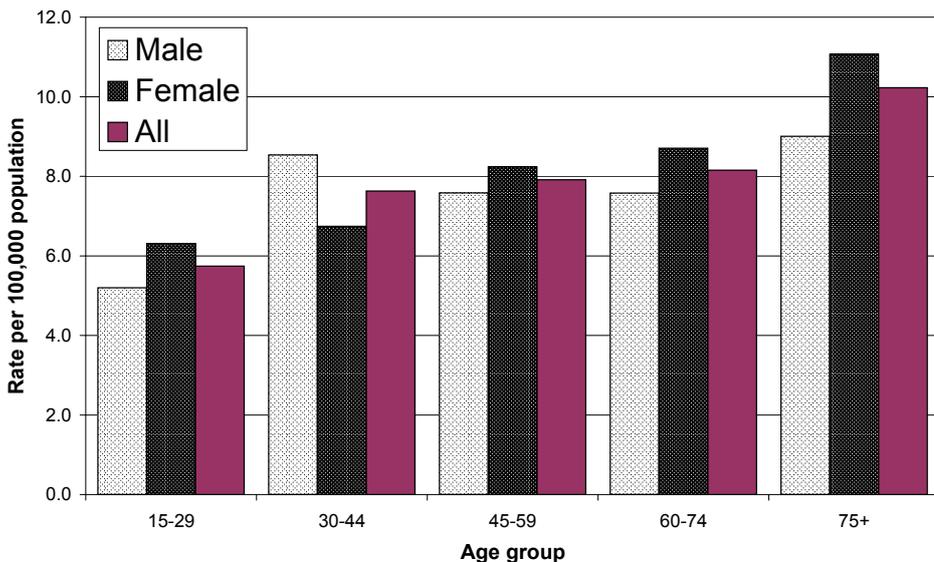
Distribution of adult dog bite ED presentations by age and gender, Victoria 2005-7 (n=3,605)

Figure 13



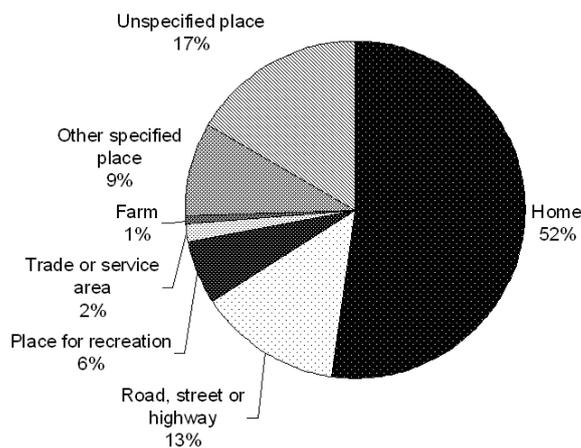
Adult dog bite hospital admission rates by age and gender, Victoria 2005-7 (n=934)

Figure 14



Place of occurrence (location) of adult dog bite ED presentations, Victoria 2005-7 (n=3,605)

Figure 15



circumstances of the dog bite. Among the remaining 176 cases, the major scenarios for dog bite injury were: separating fighting dogs (n=46) and playing with dog/s (n=46). Other bites occurred when the owner was: patting/cuddling/nursing dog (9); feeding dog (9); taking a bone or other object from the dog’s mouth (6); picking up injured pet (6); moving/handling dog (2); untangling dog from fence (1); putting dog to bed (2); cleaning/removing foreign body from eyes/ears (2); washing dog (1); taking dog to vet (2); attending old/sick dog (2); touching dog on tender spot (1); delivering/handling puppies – bitten by mother (3); chasing/trying to catch runaway dog (2); taking dog off lead (1); protecting dog from attack (1); stopping own dog attacking another animal (2); protecting child from dog (1); dog snapped/attacked/jumped up (4); giving attention to another dog (1); travelling in car with dog/removing dog from car (2); holding a bird (1); walking near dog (5); walking dog (4); standing/stepping on dog (4); punching dog (1); smacking dog (1); or at the barbeque/playing football/sitting/sleeping/relaxing/getting up (8).

In 11 cases (2%) the dog belonged to a relative (grandparent, mother-in-law, father, sister, nephew, son or daughter) and the person was bitten when walking near by dog (2), feeding dog (2), chastising dog (1), separating fighting dogs (1) or in the course of a visit when not interacting with dog (2). There were no further details in three case narratives.

In 52 cases (8%), the dog belonged to a friend; there were no further details about the injury event in 23 of these cases. Of the remainder (n= 29), the person was bitten when patting dog (6); playing with dog (5); separating fighting dogs (n=2); caring for/feeding dog (3); taking dog out of car (1); attending a party/visiting friend (11); or visiting friend’s factory (1).

In 31 cases (5%), the dog was owned by a neighbour; there was no further detail on the incident in 19 of these cases. In the other 12 cases, the person was bitten when: caring for/feeding dog (5); playing with dog (2); walking by dog (2); separating fighting dogs (1); entering neighbour’s house (1) and attending to dog after running over the dog (1).

dog when looking after neighbour’s dog (1); babysitting (1); riding bicycle (1) and no further detail (4).

Seven dog bite incidents leading to hospital admission occurred when the injured person was working as a vet/vet nurse (3), meter reader (1), dog breeder (1) or in an unspecified occupation (2).

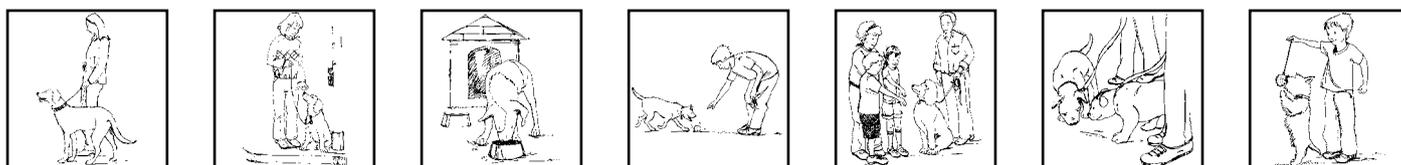
The breed of dog was named in only 6 case narratives: Alsatian cross (1, own dog); Pit Bull/Bull Terrier (3, ownership unidentified); Rottweiler (1, ownership unidentified); and Staffordshire terrier (1, own dog).

ED presentations (non admissions)

Narratives for all 3,605 dog bite cases presenting to ED were examined. Most narratives only confirmed that the cause of injury was dog bite and gave more information on the nature and site of injury. In all, 676 (19%) gave some additional information on dog ownership and/or some details on the circumstances of the dog bite injury event.

Dogs known to victim

Of the 676 cases with informative narratives, 266 (39%) were bitten by their own dog or the family pet. In 90 of these cases no further information was given about the



Dogs unknown to victim

In 147 cases (22%), the dog was unknown to the person who was bitten (described as an unknown, strange or stray dog); no further details were given of the bite incident in 15 of these cases. In the remaining 132 cases, persons were bitten when: walking/jogging/running (64); walking own dog (21); in a park (5); riding bike (5); playing golf/hockey (2); gardening (1); sliding down roof (1); outside a gym/hotel/shopping centre (3); walking into a scrap metal yard (1); breaking up dog fight (2); patting a strange dog (2); trying to catch dog (1); trying to help dog frightened by fireworks (1); assisting stricken dog NOD/helping dog NOD/helping dog off road/rescuing dog after it was struck by a car (13); protecting own cat from dog (1); protecting person being attacked by dog (3); or removing feral dog from own property (1). In another 5 cases the person presenting to ED was bitten by a dog when overseas (Bhutan, Philippines, Vietnam, Thailand and Laos).

There were 8 further cases (1%) where the injured person was bitten by a police dog when being apprehended.

There were 52 work-related dog bites (7%), with no further information given about the incident in 13 of these cases. The 39 other workplace dog bite incidents involved: policemen on duty (12); customs officer (1); security officer (1); vets/vet nurses (5); dog groomers (3); mail/pamphlet/newspaper/phone book/flower deliverers and couriers (6); census collector (1); health or welfare service deliverers - CATT team member attending psychiatric patient/home visitor/pathology/meals on wheels (4); pest controller (1); and a taxi driver who was assaulted and had a dog set on him (1). One worker was bitten by a guard dog at his workplace, another by a customer's dog and two in the grounds of their workplace by unknown dogs.

No information given on dog ownership

In 109 further cases (16%), no information was given about dog ownership but additional information was given on the circumstances of the dog bite incident. The person was bitten when: separating fighting

dogs (50); fighting with dog (3); arguing with dog owner (3); walking (7); riding bike (1); at beach (2); in park (2); protecting own dog (1); protecting another person from dog (4); chasing dog/blocking dog's exit/capturing dog (4); helping dog/assisting stricken dog/freeing dog from fence (7); calming dog (5); feeding dog (1); patting dog (5); playing with dog (5); play fighting near dog (1); kicking ball and accidentally kicked dog (1); squatting down (1); or the dog 'attacked' or jumped up and bit the person (2). In four cases, the person was bitten by a dog when overseas (in Vietnam, Thailand, China and Hong Kong).

Dog breed

The breed of dog was identified in only 44 cases, involving 46 dogs. Named dog breeds included: Alsatian (5, in four incidents); Blue Heeler/Blue Heeler Cross (4); Bull Mastiff (1); Bull Terrier (2); Cocker Spaniel (1); Collie cross (1); Dachshund/ 'sausage dog' (2); German Shepherd (5); Golden Retriever (1); Hungarian Puli (1); Husky (2); Jack Russell (3); Labrador (1); Mastiff (1); Maltese (1); Newfoundland (1); Pit Bull (5, in 4 incidents); American Pit Bull (1); Pomeranian (1); Red Heeler (1); Rottweiler (2); Spaniel NOD (1); Staffordshire Terrier (3).

Caution should be exercised when interpreting these results as the samples of informative narratives are small and may not be representative.

2.3.7 Nature of injury and body region injured

Open wounds accounted for 80% of adult dog bite injury hospital admissions. Fractures (5%), injury to muscle and tendon (4%) and traumatic amputation (3%) were the other noteworthy injury types among admissions. Among ED presentations open wounds accounted for 94% of cases and superficial injuries a further 4%.

Among both hospital admissions and ED presentations the upper extremity was the most commonly injured body region (accounting for 63% of admissions and 60% of ED presentations, mostly hand/finger injuries), followed by the head/face/neck (18%) and the lower extremity (15%, mostly lower leg injuries) for

admissions and the lower extremity (23%) then the head/face/neck (11%) for ED presentations.

2.3.8 Length of stay (hospital admissions)

Length of stay of admissions may be used as a proxy measure for severity. Fifty-one per cent of admitted cases stayed in hospital less than 2 days, 42% had a length of stay of 2-7 days and 8% required a stay of more than 8 days. The average (mean) length of stay was 2.8 days. This is lower than the average length of stay for all other adult injury hospitalisations over the study years (5.3 days) and for all other unintentional injury hospitalisations (5.7 days).

2.4 Trend in dog bite injury (1999-2007)

Rates can only be reliably calculated for hospital admissions because the VAED covers all public and private hospitals in Victoria, potentially capturing all hospitalisations. By contrast, the VEMD does not capture all ED presentations as data collection is confined to the 38 public hospitals that offer a 24-hour emergency service and does not cover smaller public and any private hospitals that provide ED services.

Figure 16 shows the trend in dog-bite hospitalisation rates per 100,000 population overall and by age group. Poisson regression modelling showed that the all-age dog bite injury hospitalisation rate (including same-day admissions) increased significantly over the 9-year period from 8.3 dog bite hospitalisations/100,000 population in 1999 to 9.5/100,000 in 2007, representing an estimated annual change of 1.7% (95% confidence interval 1.2% to 2.1%) and an overall increase of 16% (CI 11% to 21%) based on the trend line.

Statistically significant increasing trends were observed in age groups 10-14, 30-44 and 45-59 years. Decreasing trends were observed in dog bite admission rates in age groups 0-4, 5-9, 20-24 and 75+ years, but none of these decreases reached statistical significance.



3. Discussion

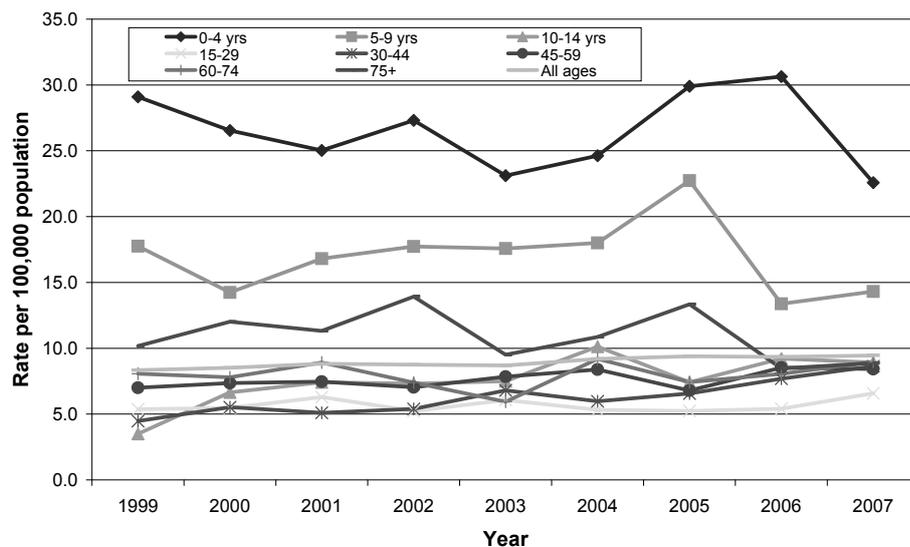
Over the three-year study period Jan 1, 2005 to December 31, 2007, three Victorians died and more than 6,330 were treated for dog bite injury in Victorian hospitals (at least 1,445 hospital admissions and 4,885 ED presentations). This gives an average of one death and at least 2,110 hospital-treated dog bite injury cases per year (or close to 6 per day). We have no Victorian data on the number of dog bite injuries treated by general practitioners.

Rates were only calculated for hospital admissions. Our study found that the all-ages dog bite hospitalisation rate in 2007 was 9.5 per 100,000 population, lower than the Australian rate of 11.3 per 100,000 based on hospital separations data for 2001-2003 (Kreisfeld & Harrison, 2005).

The significant upward trend in the all-ages dog bite hospitalisation rate from 1999 to 2007 is concerning. It was mainly due to increasing rates in older children (aged 10-14 years) and adults aged 30-59 years. By comparison, hospitalisation rates among children aged 0-9, young adults aged 20-24 and older seniors aged 75+ years

Trend in age-adjusted dog bite hospital admission rates per 100,000 population, overall and by age group, Victoria (January 1, 1999 to December 31, 2007)

Figure 16



Source: Victorian Admitted Episodes Dataset (VAED) 1999-2007

trended downward. The decrease in the incidence of dog bite hospitalisations in young children provides some ecological evidence that child dog bite prevention initiatives in Victoria are beginning to show a positive effect.

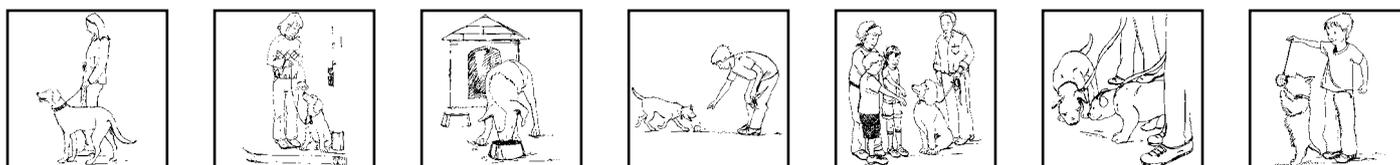
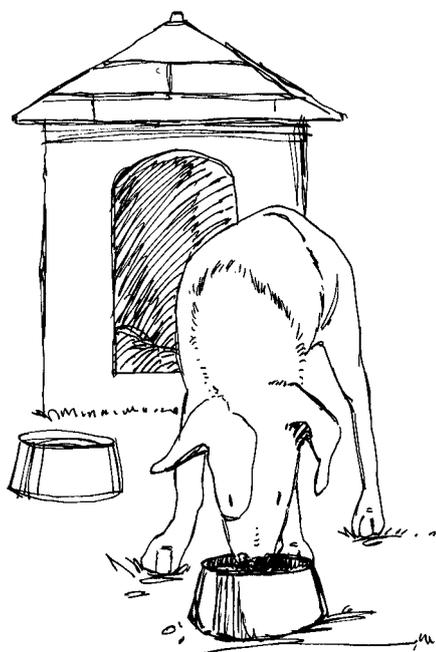
However, of all 15-year age groups (0-14, 15-29, 30-49 etc.) children aged 0-14 years remain over-represented in hospital-treated dog bite cases, accounting for 35% of all dog bite admissions and 26% of ED presentations. Children aged 0-4 years had the highest frequency of both admissions and ED presentations and the highest hospitalisation rate, so efforts to reduce injury should continue to focus on this age group as well as age group 5-9 years. Two-year-olds were the highest risk group for dog bite injury. Although 10-14 year olds experienced fewer hospital-treated dog bite injuries than their younger counterparts, the dog bite hospitalisation rate in this age group increased over the 9-year period 1997-2007, whereas in the younger age groups hospitalisation rates are decreasing.

Children were most commonly bitten on the head, face and neck, whereas adults were mostly bitten on the hand and fingers. The most frequently occurring injury among admissions and ED presentations was an

open wound. In total, there were 76 very serious injury cases that required hospital stays of 8 days or more and 36 cases involving finger amputation.

Most hospital-treated child dog bite injuries occur in the domestic environment. Our study indicated that children are most at risk of dog bite from their family pet but they were also bitten by dogs in the homes of relatives, friends and neighbours. Details on the circumstances of domestic dog bites were sparse but available evidence from case narratives on the ED dataset indicated that children were either directly interacting with the dog when they were bitten (playing with, patting, feeding or interfering with the dog in some way) or, less often, playing near the dog.

Obviously, current initiatives to educate children to adopt safe behaviours around dogs and the training of dogs to interact safely with children should continue. Children need to learn that they are at risk of dog bite from both familiar and strange dogs, their parents must be made aware that they need to closely supervise young children whenever they are interacting with dogs and dog owners need to train and socialise their dogs and actively supervise any interaction their dogs have with children.



Among adults, although hospitalisation rates for dog bite injury are highest in the very oldest age groups (persons aged 80-84 and 85+ years), case counts are comparatively small in these groups. If we want to reduce the number of serious adult dog bite injuries then prevention initiatives need to target all adult age groups, not just older seniors.

Case narratives recorded on the ED dataset indicated that adults are fairly equally at risk of being bitten by unknown dogs in a public space or the workplace and known dogs (their own or a dog belonging to a relative, friend or neighbour). Narratives also indicated that most bites to adults by unknown dogs occur in public spaces when adults are walking, jogging, running or undertaking leisure activities, indicating that uncontrolled dogs remain a public safety issue. With regard to incidents involving their own dogs, the three most common injury scenarios for adult injury appear to be: play sessions with pets that get out of control, separating fighting pets and incidents during 'normal' dog handling such as feeding, caring for pets and protecting them from harm.

Risk factors for dog bite

Overall and Love published a comprehensive literature review in 2001 covering published reports on dog bite from 1950 to 1999. In this section of the report we discuss the findings from this review and the results of good quality studies published since 1999. Our search revealed that only a few analytical studies designed to identify risk factors have been conducted in the field of dog bite injury. A small number of risk factors for dog bite—related to the injured person (the victim), the dog, the dog owner and the environment—have been identified from the research to date although the evidence is sometimes conflicting.

Risk factors related to the victim

Younger age

Similar to the present study, data from a number of studies of dog bites requiring medical attention indicate that children are at higher risk of dog bite injury than adults (Overall & Love, 2001- literature review). However, study results may be affected

by bias because medical attention may be sought more often for child than adult dog bite injuries and bites to the head (more common in children) appear to predispose the victim to receiving medical attention (Guy et al., 2001).

Notably, the second nationally representative U.S. Injury Control and Risk Survey (ICARIS-2) conducted by telephone during 2001-3 found that the difference between the incidence rate among children and adults for medically attended dog bites was small (3.2 per 1,000 versus 3.0 per 1,000) and had narrowed considerably since the initial ICARIS conducted in 1994 (6.4 vs. 2.0) (Gilchrist et al., 2008). The authors speculate that the success of child dog bite prevention programs may account for the near halving of the child dog bite incidence rate in the U.S. in the period between surveys. There are no comparable survey data for Victoria or Australia.

Male gender

The weight of current evidence generally supports the proposition that males are at higher risk of dog bite than females. All four analytic studies that reported on victim's gender and the risk of dog bite in the literature review by Overall & Love (2001) found that males had a significantly higher relative risk of dog bite than females in all age groups examined in each of the studies (Parish et al., 1955; Morton, 1973; Beck & Jones 1985; Sacks et al., 1996). Many of the 13 descriptive studies covered in the review also found significantly larger proportion of reported bite in males than females (Overall & Love, 2001). In addition, studies of fatal dog bite from Australia, Canada and United States consistently show that males are over-represented in dog bite deaths (MacBean et al., 2007; Raqhavan, 2008; Sacks et al., 1996).

Overall and Love (2001) conclude that the evidence they examined in their literature review clearly indicates that "some patterns of interaction (possibly including play) between dogs and humans are gender-biased and that some aspects of these interactions may be conducive to aggression."

However, two recent studies report no or only a weak association between gender and dog bite risk. The 2001-3 ICARIS found that there were no significant differences in bite rates by sex for either adults or children in the U.S. (Gilchrist et al., 2008). Similarly, the retrospective cohort study by Schuler et al. (2008) of dog bite incidents that occurred in Multnomah County, Oregon in the U.S. found a slightly higher bite rate in males than females but the difference was not statistically significant (77/100,000 vs. 73/100,000, P=0.4).

Belonging to a low income household

The association between household income level and dog bite risk has not been well studied and the results reported to date (from three studies conducted in the United States) are inconsistent.

An early descriptive study of 204 child dog bite incidents presenting to the emergency department of the Children's Hospital in Pittsburgh in 1997 found that children living in low income communities were over-represented in dog bite ED presentations (Bernardo et al., 2000). The authors also reported that persons residing in these same low income neighbourhoods were over-represented on the broader county-wide database of reported dog bite incidents kept by the Allegheny County Health Department (Bernardo et al., 2000).

The Multnomah County cohort study by Schuler et al (2008) indicated that low income is a possible risk factor for dog bite irrespective of the dog's breed or sex. The study found that dogs living in census blocks that had incomes less than the county median were 1.5 times more likely to be reported as a biting dog than reported as a non-biting dog (95%CI 1.3, 1.9; P<0.01). The authors speculate that dogs living in lower income neighbourhoods may not be given the level of training and supervision needed to minimise the risk of dog bite.

By contrast, the 2001-3 U.S. ICARIS found no relationship between household income and dog bite rates in adults (Gilchrist et al., 2008). The authors were unable to assess this characteristic in children because of small numbers.



Behavioural provocation by child victim

Although several study authors comment on the potential for young children's play behaviour to trigger aggressive reaction in dogs, surprisingly few descriptive studies report the circumstances of the child dog bite incident and no analytic study conducted to date has included this variable in the analysis.

Children who presented to The Children's Hospital of Philadelphia during 1989 for evaluation of dog bite injuries were prospectively studied by Avner and Baker (1991). The study showed that children aged 5 or younger were more likely to provoke animals prior to injury than were older children (69% vs 36%, $P < .001$). Schalamon et al. (2005) conducted a retrospective survey of medical charts of 341 Austrian children who sought medical attention for dog bite at a level 1 trauma hospital. The authors reported that 75% of the child victims were 'interfering' with the dog at the time of the incident. However, the definition of 'interfering' used in the study better fits the term 'interacting' as it appears to include playing near the dog and passing the dog when walking or cycling as well as feeding the dog, playing with the dog, cuddling the dog, disturbing the dog while eating, surprising the dog, pulling the dog's tail and interfering during a dog fight.

De Keuster et al. (2006) collected data on the characteristics of child dog bites prospectively over a period of 8.5 months in six hospital emergency departments in Belgium. Of the 100 victims included in the study 65 were bitten at home. According to the authors the bites in the home 'mostly occurred' when the child was interacting with the dog without adult supervision.

Reisner et al. (2007) characterised the behavioural circumstances of bites to children by conducting a retrospective case series examining the medical records of dogs presented by referral to a university veterinary hospital in Pennsylvania (U.S.) for aggression and which had bitten a child aged under 18. Two-thirds of the dogs had never previously bitten a child, although only 19% had never bitten any human. Anxiety screening tests revealed

abnormalities in 77% of the 103 dogs that had bitten a child, either anxiety/fear related to separation from owner or storm/noise related anxiety or both. The study found that children aged under 6 years (and children familiar with the dog) were more likely than older children to be bitten in relation to food guarding or other resource-related aggression or in a situation where they inadvertently stepped on or fell on a dog.

The authors of several reports speculate that children, especially young children, are more at risk of triggering fear-related aggressive behaviour in dogs with an anxiety disorder because of their high-pitched voices, sudden movements and inappropriate interactions (Reisner et al., 2007; Overall & Love, 2001).

Personality of owner

Only one study has investigated the influence of the personality of the owner on the expression of aggressive behaviour of their dogs. Podberscek & Serpell (1997) recruited 285 owners of pure bred English Cocker Spaniels, 128 owners of 153 dogs previously classified as being 'low' in terms of aggressiveness and 157 owners of 172 dogs classified as being 'high' in terms of aggressiveness. Owners were similar on a number of key demographic variables and dogs in both groups were similar in age, age when acquired and sex ratio. When results of the two groups of owners on the personality test were compared, it was found that owners of high aggression dogs were significantly more likely to be tense ($P < 0.001$), emotionally less stable ($P < 0.01$), shy ($P < 0.01$) and undisciplined ($P < 0.05$) than owners of low aggression dogs. Findings from this study require confirmation.

Risk factors related to the dog

Gender, neuter status and body weight

Reported associations between sex-neuter status, body weight and breed of dog and dog bites are inconclusive as study results are conflicting.

Three analytic studies have found that male dogs are over-represented among biting dogs, two of which reported that sexually

intact dogs were more likely to bite than neutered dogs. Gershman et al. (1994) conducted a matched case control study in Denver comprising 178 pairs of dogs. Cases were selected from dogs reported to Denver Animal Control in 1991 for a first bite episode involving a non-household member that resulted in the victim receiving medical attention. Compared to controls, biting dogs were more likely to be male (Odds Ratio (OR) 6.2, 95%CI 2.5-15.1) and unneutered (OR 2.6, 95%CI 1.1-6.3).

Stronger and similar findings were reported from the U.S. cohort study of 636 reported biting dogs among 47,526 dogs that were licensed in Multnomah County conducted by Shuler et al. (2008). The study found that, compared with spayed females, the risk ratio of dog bite was 18.6 (95%CI 13.9 -24.7) for sexually intact males, 10.5 (95%CI 7.4-14.8) for sexually intact females and 2.6 (95%CI 1.9-3.5) for neutered males (Shuler et al 2008). A smaller unmatched case control study of biting dogs and cats conducted in a veterinary teaching hospital in Philadelphia also found that the odds of biting was higher in male than female dogs (Drobatz & Smith, 2003).

By contrast, two analytic studies involving dogs seen by veterinarians in general practice found that either intact female dogs or female dogs (independent of their neuter status) were more likely to bite than their male counterparts. Messam et al. (2007) conducted a veterinary clinic-based retrospective cohort study of 'non-play' dog bites ($n=1,112$ cases) in two communities: San Francisco, U.S. and Kingston, Jamaica. The study found that, compared to spayed female dogs, all other categories of dogs had elevated risks of biting but the relative risk of biting was higher in intact females (RR 3.2) than intact males (RR 2.6).

Similar results for gender were reported from a Canadian case control study of the risk factors for dog bites to owners, based on a telephone survey of a random sample of 640 clients of veterinary clinics (Guy et al., 2001). Logistic regression modelling showed that female dogs were almost 3 times more likely to have bitten than male dogs (OR 2.98, 95%CI 0.89-0.93); biting by female dogs increased as body weight decreased (i.e. small female dogs formed



the riskiest group), an association not found in male dogs; and that neuter status was not an independent risk factor for biting (Guy et al., 2001).

These inconsistent findings may be due to the different populations of dogs studied (registered dogs versus dogs seen by veterinarians), case definitions of dog bite and reporting biases. Examples of possible reporting biases include: skewed reporting of male dog bites to authorities because aggressive biting behaviour in large male dogs may be perceived as more serious or frightening than similar behaviour in small female dogs; veterinarians may see fewer large biting dogs because their owners may be less likely to present them to a clinic; and large biting dogs may be more likely to be relinquished by their owners than small dogs leading to over-representation of small dogs in veterinarian-based study populations.

Breed

This is a controversial issue. Good quality research on the effect of breed on reported bite incidence is predicated on having reliable identification of dog breed by owners registering dogs and of the biting dogs by persons reporting bites, reliable estimates of the population size of all breeds in the source population and consistent reporting of dog bites.

These pre-conditions are rarely met. License records are often used to estimate breed populations but their reliability is dependent on the overall compliance level with dog licensing laws in the community under study and consistent compliance among owners of specific breeds. There is some evidence that biting dogs are less likely to be registered than non-biting dogs. Further, disproportionate media attention given to bites by specific breeds may also skew both breed identification and the reporting of bites to authorities. The classification of cross breed dogs on registers is also problematic; almost half the estimated 3.75 million dogs in Australia are crossbreeds (Australian Companion Animal Council Inc., undated)

Fatal dog bite

The largest study to date of breeds of dog involved in fatal attacks was conducted in the United States and collected data on dog bite related fatalities over the period 1979 to 1998 from a registry databank maintained by the Humane Society of the United States supplemented by media reports (Sacks et al., 2000). The study found that over this 20-year period at least 25 breeds of dog were involved in 238 human dog bite related fatalities in which breeds were known, involving 403 dogs. Pit bull-type dogs and Rottweilers were involved in more than half of these deaths. The authors concluded that, despite the unavailability of reliable breed-specific population data for the whole study period and other study limitations, the data indicated that there appears to be a breed specific problem with fatalities in the United States.

However, the authors were not in favour of breed specific restrictions or bans because of issues surrounding which breeds to regulate given the number of breeds involved in fatal attacks and the variation in involvement of breeds over time, the lack of an objective method of determining the breed of a particular dog, the possibility that people who want a dangerous dog would simply turn to another breed for the same qualities they sought in the original dog, and the lack of evidence on the effectiveness of existing breed-specific legislation in preventing fatal and non-fatal dog bite (Sacks et al., 2000).

Instead, Sacks and colleagues recommended a multifaceted approach involving the enactment of generic, non-breed specific, dangerous dog laws (that place the onus of responsibility for a dog's behaviour squarely on the owner), leash and fencing laws and their enforcement and education of dog owners, but noted that there was also a lack of evidence on the effectiveness of these measures. They recommended the formal evaluation of all dog bite preventive strategies and improved surveillance for fatal and non-fatal bites.

Non-fatal dog bite

Fatalities due to dog attacks are rare so non-fatal bites should also be considered when framing prevention policies. Only

a small number of studies of non-fatal dog bites have attempted to quantify the relative dangerousness of each breed using breed-specific population data. All studies have been too small to include less popular breeds in the analysis and have inherent limitations so caution should be exercised when interpreting results.

Two published Australian case series studies of hospital-treated dog bite injury have attempted to factor the prevalence of dog breed in the dog population into their investigation. The largest study involved 356 child and adult victims of dog attacks (defined as bites or acts of aggression causing injury) who presented to the emergency department of one Adelaide tertiary hospital between 1990 and 1993 (Thompson, 1997). Twenty two breeds (some aggregated) were involved in attacks. The study found that five breeds —Doberman, German Shepherd, Rottweiler, Bull Terrier and Blue/Red Heeler— were responsible for 73% of all hospital-treated attacks yet represented only 31% of the dog population in the hospital catchment area. Of these breeds, Dobermans and German Shepherds appeared to pose the highest risk of involvement in attacks.

Local dog breed information was derived from dog ownership data collected by the 1992 South Australian Health Omnibus Survey. However, only 43% of dog attack victims in the study identified the breed of dog that attacked them. The author commented that more dangerous dog breeds may exist but they did not feature



in the hospital case series because they comprised a small proportion of the dog population.

The other Australian study was conducted over 18 months in the emergency department of the Royal Children's Hospital in Adelaide. The study found that although many breeds of dog were involved in child dog bite incidents only German Shepherds were implicated more frequently than their prevalence in the community (Greenhalgh et al., 1991). At the time of this study German Shepherds were the most popular registered breed of dog in South Australia.

Two further case series of hospital-treated child dog bite cases, conducted in Belgium and Austria, report similar results. A retrospective survey of 341 child dog bite cases presenting to the Medical University of Graz, a level 1 trauma centre, reported that the bites from German Shepherds and Dobermans accounted for 37% of all dog bites recorded between 1994 and 2003, yet these two breeds comprised only 13% of the local registered dog population over this same period (Schalomon et al., 2006). Further, it was reported that the relative risk for a dog attack by a German shepherd or a Doberman was approximately five times higher than that for a Labrador/retriever or cross breed, statistic not reported. Due to small numbers, the analysis of breed data only included attacking dogs from the 18 most popular breeds on the local community dog register. The reliability of the register was not discussed.

A smaller prospective case series of 100 child dog bite cases treated in the six Belgian hospital emergency departments in 2001 also found that the German Shepherd was involved in a significantly greater frequency of bites than would be expected from their representation in the local dog population, based on dog registration data (Kahn et al., 2003; De Keuster et al., 2006). German Shepherds were involved in 52% of the bites, yet comprised 29% of local dog registrations (chi square, 11.5; $p < 0.001$). Rottweilers and Labradors were the other breeds frequently involved in dog bite cases, but the study found that the involvement of Rottweilers was not disproportionate

to their representation on the local dog register (28% of dogs and 20% of bites) and Labradors were under-represented in dog bite cases when their popularity was considered (38% of dogs and 17% of bites, chi square 9.3; $p = 0.002$). No information was given on the reliability of the national dog register on which breed population estimates were based.

Two case control studies have included breed of dog as a potential risk factor for biting behaviour. The first, a U.S. matched case control study of medically treated dog bites to non-household members included 178 pairs of dogs (Gersham et al. (1994). The study found that biting dogs were more likely to be German Shepherd [adjusted odds ratio (OR) 16.4 95% CI 3.8-71.4] or Chow Chow (OR 4.0, 95%CI 2.5-15.1). Non-biting dogs were more likely to be Golden Retrievers or Standard Poodles. Because of small numbers, the study was unable to assess in multivariate analysis whether other breeds were more likely to bite.

The second, the recently published case control study conducted in Multnomah County by Schuler et al (2008), compared the characteristic of dogs reported to authorities for biting in 2003 ($n = 636$) to those of all 47,850 dogs identified as residing in the county in the same year. The study used the 7 broad American Kennel Club (AKC) categories to classify all dogs in the study and found that terriers (including bull terriers), working breeds (such as Rottweilers and Dobermans), herding breeds (such as German Shepherds and Collies) and non-sporting breeds were two to approximately four times more likely to bite than sporting breeds such as Cocker Spaniels (risk ratio range 2.0-3.8, all statistically significant). Other breeds such as hounds, non-AKC breeds and toy dogs were found not to be statistically associated with biting.

The authors commented that the breeds found to pose higher biting risk have been bred to hunt and kill vermin, protect property and work livestock and may revert to type when uncontrolled. Also, because of their large size they are likely to inflict more damage when they bite, and

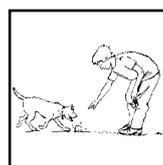
are therefore more likely to be reported to authorities.

Schuler and colleagues report that their study, like most other studies investigating the issue of breed, had inherent limitations. Dog bites were most probably under-reported and the dog register biased, breed assessment was subjective as identification relied on owners and reports from bitten persons, and breed-specific population estimates may have been inaccurate (an earlier county-wide survey had reported that less than half of owned dogs in the county were registered).

Finally, the recently reported retrospective cohort study of dog bites conducted in San Francisco and Kingston by Messam et al. (2008) found that German Shepherds (RR 2.27; CI 1.33-3.88) and Shih Tzus (RR 2.09 RR 1.22-3.59) were more than twice as likely to bite as other dog breeds.

Overall, the researchers involved in these studies tended to support the position that public policy and prevention efforts to reduce dog bite injury should not focus on breed restriction or bans but be based on the tenet that every breed poses a threat of dog bite and it is safest to conclude that any dog may bite (Sacks et al., 2000; Overall & Love, 2001; Kahn et al., 2003; De Keuster et al., 2006; Schalomon et al., 2006; Reisner et al., 2007).

However, there is also acceptance among these experts that innate tendencies dictated by breed and size may play a role in the potential of a dog to bite and the severity of a bite if it happens. They advise that owners of breeds identified as posing a higher risk of biting and/or possessing the physical attributes that indicate they may do more harm when they bite should be especially vigilant in ensuring that their dogs are well trained and socialised, and under their supervision and close control at all times when they are interacting with other dogs and humans, especially young children. Parents are advised to postpone buying a dog until their youngest child is 5 years of age, choose a breed that suits the family situation, train it well and to never leave a child alone with a dog.



Behavioural and environmental factors

Three analytical studies have established a small but diverse set of behavioural and environmental risk factors for dog bite. All results require confirmation from at least one, and preferably more, analytical studies that utilise the same definitions, methodology and dog population source.

The Canadian veterinarian clinic-based case control study of risk factors for dog bites to owners by Guy et al. (2001) compared 227 biting dogs (cases) to 126 non-biting dogs (controls). Multiple regression analysis found that the significant behavioural and environmental predictors for biting were: sleeping on someone's bed in the first two months of ownership (Odds Ratio 1.93; 95%CI 1.1-3.5); showing aggression over food in the first two months of ownership (OR 3.1; 95%CI 1.1-9.0); and having a high ranking for excitability in the first two months of ownership on a scale of 1-10 (OR 1.14; 95%CI 1.02-1.3). Living in a household with one or more teenagers doubled the odds of dog bite (OR 2.1; 95%CI 1.3, 3.4), partly confirming the results of an earlier small case control study that found that having more than one child in the home was positively associated with dog bites (Gershman et al., 1994).

The study also found several other strong associations between the dog's recent behaviour or lifestyle and biting including: being confined to a leash, yard or pen when outdoors ($P < 0.01$); spending less than 3 hours outdoors on an average weekday ($P = 0.004$); being allowed on furniture (OR 2.2; 95%CI 1.41-3.6); and playing tug of war (OR 1.7; 95%CI 1.1-2.7) (Guy et al., 2001).

The veterinarian clinic-based retrospective cohort study conducted later in two different cultures (San Francisco, U.S and Kingston, Jamaica) compared data for 161 biting dogs with 951 non-biters (Messam et al., 2008). This study identified two environmental risk factors but they were culturally specific. Allowing a dog to sleep in a family member's bedroom more than doubled the likelihood of biting in Kingston (RR 2.4; 95%CI 1.4-4.5) but not in San Francisco, while being able to leave the yard unaccompanied more than

tripled the likelihood for biting in San Francisco (RR 3.4; 95%CI 2.0-5.9) but not in Kingston. Unlike earlier case control studies, the presence of children (5-15 years) in the dog's household was only weakly associated with dog bites (RR 1.1; 95%CI 0.8-1.6).

All these findings on behavioural and environmental risk factors require confirmation in future case control or cohort studies conducted in comparable cultural settings as environmental risk factors appear to be culturally specific.

Health factors

There is also some evidence that health conditions in dogs such as presence of pain, endocrine and neurological conditions and skin disorders, diagnosed anxiety and taking certain medications (sedatives, tranquillisers and anaesthetic agents) predispose dogs to biting behaviour (Reinhard, 1978; Gershman et al., 1994; Guy et al., 2001; Reiser et al., 2007).

Prevention strategies and measures

Recommended general approach to prevention

The literature generally supports the proposition that a dog's propensity to bite is dependent on several interacting factors: heredity, early experience, late or inadequate socialisation and training, reproductive status, health (medical and behavioural), quality of ownership and supervision, the victim's age, size and behaviour and the absence of other people in the vicinity (Sacks et al., 2000; JAVMA, 2001; Raghaven, 2008).

Researchers and other experts therefore recommend the adoption of multifaceted preventive programs that include a mix of the following strategies to address proven and potential risk factors:

- Promotion of responsible dog ownership (including training, socialising and desexing of dogs)
- Education of owners and the public (especially children) about how to behave around dogs

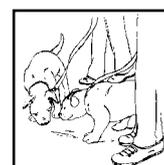
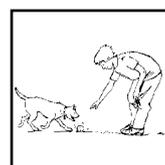
- Supportive animal control efforts (stray dog management, low cost neutering, licensing, dealing with irresponsible owners)
- Regulatory/legislative measures (e.g., targeting dogs of any breed that have exhibited harmful behaviour such as unprovoked attacks on a persons or animals, requiring insurance, placing primary responsibility for dog's behaviour on the owner).

(Gilchrist et al., 2008; AVMA 2001; ACAC, undated)

All of these strategies and measures, except compulsory insurance, are implemented in Victoria. The Victorian Domestic (Feral and Nuisance) Animals Act 1994, provides for cat and dog identification and enables Municipal councils to deal with feral, straying and nuisance populations. Later amendments included clear guidelines for the definition and control of dogs declared Dangerous, Menacing or Restricted Breeds.

The Act empowers Municipalities to declare a dog to be 'dangerous' if the animal has caused serious injury to a person or animal (Department of Primary Industries, 2005). Restricted breed legislation (in place in Victoria from 2 November 2005) makes it an offence to acquire the Dogo Argentino, Japanese Tosa, Fila Brasileiro, Perro de Presa Canario and American Pit Bull Terrier (Department of Primary Industries, 2005). Persons already owning any of these breeds of dogs at the time the legislation came into force (only the Pit Bull Terrier and Perro de Presa Canario were known to exist in Australia at that time) were required to declare their dog on registration. Owners of Restricted Breeds and Declared Dangerous Dogs must comply with desexing, enclosure, warning signs, microchipping, special collaring, restraint off premises, strict conditions of sale and other special conditions (Department of Primary Industries, 2005).

Our literature review found that only one of the recommended education, animal control and regulatory measures has been formally evaluated in a rigorous study. Chapman et al. (2000) conducted a randomised controlled trial of Delta



Dog Safe™, one of the four major public education programs implemented in Australia. The program was developed by the Delta Society Australia Ltd, a not-for-profit organisation, and is presented to junior primary schoolchildren by accredited volunteer dog handlers with teacher-led discussions and activities before and after the 30 minute education session. The handler and dog demonstrate appropriate behaviour and children practise petting the dog in the correct manner.

Seven to 10 days after participating in the program, children in the two intervention schools and the two control schools were allowed to play in the school yard unsupervised near a docile Labrador tethered 5 metres from its owner who was disguised as a tradesman. Videotape evidence showed that only 7% of the children who had received the education petted the dog compared with 79% of children in the control group.

Whether the behavioural effects of the program decay over time and whether, if widely implemented, the cumulative effect translates into an actual reduction of bites have not been investigated although almost 100% of schoolchildren in South Australia and Tasmania have now been exposed to the program. The NSW government has developed and is implementing a similar but more comprehensive child dog bite education program SPOT (Safe Pets out There), targeted specifically to junior primary school children that includes three modules: Kindness and Humanity, Safe Behaviour Around Dogs and Pet Care (http://www.spot.nsw.gov.au/spot_index.asp).

In Victoria, the state government's Responsible Pet Ownership Education Program for community and schools has been developed by the Bureau of Animal Welfare (BAW), a division within the Department of Primary Industries (DPI) (<http://www.pets.info.vic.gov.au/community/petshome.htm>). The program for primary schools includes a Teachers Kit, consisting of integrated units of work and extensive teacher reference and resource section, a video and big book, that was distributed free of charge to all Victorian Primary Schools late in the 2000

school year. Similar to the evaluated Delta DogSafe program, each primary school in Victoria is entitled to a free annual visit from a trained Pet Educator and their temperament-tested pet. Participation of schools is voluntary; over 1000 primary schools have been visited by one of the team of 65 BAW educators to date.

Another component of the BAW education program is the "We are Family" guide to nurturing the child/pet relationship. It aims to provide expectant and new parents with the knowledge, skills and strategies to ensure that their new child's experience with a pet is safe. This program has been implemented in childbirth education (antenatal) classes in Victorian hospitals either delivered directly by the BAW educators or by trained childbirth educators. It is yet to be evaluated for effectiveness.

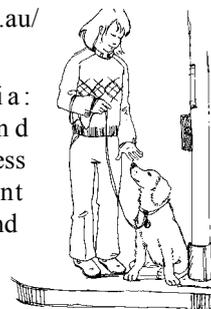
The DPI also provides research funding through the Domestic Animal Welfare Fund. MUARC is a current recipient of a research grant from this fund to conduct an in-depth study of the circumstances of child dog bite in Victoria, recruiting dog bite cases through 8 Victorian hospital emergency departments. Wherever possible, the parent, owner of the dog and injured child (if aged 7 or older) will be interviewed.

A number of other government and non-government agencies are involved in dog bite prevention in Victoria including:

- Petcare Information and Advisory Service: Community and school education programs to encourage the correct care of pets and promote socially responsible pet ownership including the production and wide dissemination of "How to care for..." literature, posters and videos, the Selectapet program and the development and promotion of the Australian Veterinary Association's primary school education program: AVA PetPEP and the development and sponsorship of the Dogs'n'Kids, a resource kit for health care professionals promoting responsible dog ownership and dog bite prevention. www.petnet.com.au
- Royal Children's Hospital Safety Centre: development and dissemination of the Dogs'n'Kids resource.

<http://www.rch.org.au/safetycentre/>

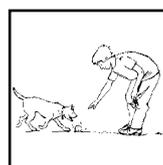
- RSPCA-Victoria: Advocacy and community awareness raising to prevent cruelty to animals and promote responsible pet ownership. <http://www.rspca.org.au/>
- Australian Veterinary Association (AVA): Advocacy, collaborator on the development of dog bite prevention programs and provider of AVA PetPEP, an education program that involves veterinarians and teachers working together to teach primary school students about responsible pet ownership and to enhance their overall understanding of animals. www.ava.com.au
- Delta Society Australia: Provider of the Canine Good Citizen™ education (owner and dog training and dog trainer) programs; the Delta Dog Safe project for 5-8 year olds, their parents and the community; and the Delta Pet Partners program. <http://www.deltasocietyaustralia.com.au/>
- Local government: Councils are responsible for the enforcement of the Domestic (Feral and Nuisance) Animals Act 1994, provide web-based educational material to dog owners and the public, and some councils (e.g. Cities of Melbourne, Dandenong and Moreland) offer discount vouchers to pensioners and/or health card holders for desexing of animals.



Specific recommendations arising from research studies

Dog owner education

- Education should be given the highest priority as most bites appear to be attributable to human misunderstanding of animal behaviour (De Keuster, 2006).
- Dog owners should be made aware that medical or painful conditions and medications to treat these conditions may increase the risk of aggression (Reisner et al., 2007; Guy et al., 2001).



- Aggression in a puppy should raise concern and consideration given to referral for behavioural evaluation of the dog (Reisner et al., 2007).
- Puppies should not be permitted to sleep on the owner's bed and efforts should be made to modify the behaviour of puppies that show aggression over food or toys in the first 2 months of ownership (Guy et al, 2001).
- Veterinarians should offer effective behavioural modification strategies to owners of dogs who find their puppy too excitable (Guy et al., 2001).
- Dog owners with teenage children should be made aware of the possibility that there may be some aspects of teenage behaviour that stimulate excitement and aggression in dogs and they should be counselled to monitor teenager-dog interactions or to select breeds with low reactivity (Guy et al., 2001).
- Children of any age should not be permitted near a dog whenever food (including human food) is present (Reisner, 2007).
- Neutering does not guarantee a reduction of aggression in dogs, but parents seeking a pet dog might be advised to seek a female (Reisner 2007).
- Education efforts should target dog owners through a variety of conduits such as pet stores, groomers, boarding facilities and other key stakeholders such as postal workers and animal control agencies (Shuler et al., 2008).
- Low-cost spay and neuter surgeries need to be easily accessible in the community (Shuler et al., 2008).
- Animal control agencies should be supported to maximise regulatory and educational activities (Shuler et al., 2008).
- Medical assistance to child dog bite victims should take into account the psychological effects of dog aggression and a psychological preventive intervention should be offered to all victims of dog bite (De Keuster et al., 2006).
- Evaluation of dog-bite awareness campaigns, educational interventions and other prevention and control strategies and measures should be implemented to determine their effectiveness in terms of reduction of bites (De Keuster et al., 2006; Gilchrist et al., 2008; Raghaven, 2008).

4. Conclusions

The results of our study indicate that young children (aged 0-9) and their parents should continue to be a prime target of dog bite awareness raising and education campaigns noting, however, that there is an increasing trend in the dog bite hospitalisation rate in 10-14 year olds. Our study also indicated that child (and adult) hospital-treated dog bite injuries mostly occur in the domestic setting, so initiatives to reduce dog bites to children in this setting should be given priority status. The victim's family pet is mostly involved.

While the ages at highest risk are found in children aged 0-9 years, about two-thirds of hospital-treated dog bite injuries occur in adults. Their risk awareness needs to be raised and their dog training, handling and interaction skills improved. Advice should also be given on ways to reduce the risk of injury when separating fighting dogs, a common scenario for adult dog bite injury. Interventions to reduce the health and safety risk posed by uncontrolled dogs in public spaces (streets and parks) should be maintained as should regulatory measures that support responsible dog ownership.

Dog bite prevention initiatives in Victoria are piecemeal with various agencies and interest groups involved in delivery and the area would benefit from a planned and co-ordinated approach to optimise dissemination, ensure systematic and sufficient penetration into the target groups and foster efficient allocation of scarce resources. All interventions to reduce dog bite injury should be formally evaluated as there is sparse evidence on the effectiveness of the regulatory and community dog bite prevention initiatives implemented to date.

Data on dog attacks collected by councils should be captured on a common report form, reporting should be co-ordinated by one agency and data should be collated, analysed and reviewed at least annually.

Surveillance, research and evaluation

- Dog bite cases and the circumstances of the bite should be routinely documented by health care personnel using validated assessment tools (Overall & Love, 2001).
- Data on the prevalence of dog breeds and ages, sex and reproductive status within these breeds should be routinely recorded (Overall & Love, 2001).
- Longitudinal studies should be undertaken to better understand which dogs bite and whom they bite to help determine whether dog bites are associated with a behavioural diagnosis of aggression and the extent to which certain human behaviours foster aggression (Overall & Love, 2001).
- Dog bite location patterns should be further explored by the collection of 'time of exposure' data (MacBean et al., 2007).
- Complete forensic investigations of fatal dog bites (involving the victim, the dog and the attack scene) should be undertaken to reconstruct the event, identify the attacker, exclude criminal intention, identify a pathological condition or provide another explanation. DNA testing by means of the cytochrome b gene can identify the species of dog involved. (De Munnynck & Van de Voorde, 2002).
- Multidisciplinary research should be undertaken to investigate the way children and dogs relate to each other in different life stages (De Keuster et al., 2006).

Other strategies/measures

- Additional efforts targeting adults and dog owners may be beneficial, given the ecological evidence from the U.S. national injury surveys that programs focussing on children are showing positive benefits (Gilchrist et al., 2009).
- The human and veterinary medical communities and animal control agencies need to work together to help foster healthy relationships between people and their pets, especially in low income neighbourhoods (Shuler et al., 2008).



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Data sources and case selection

Deaths

Source: National Coroners Information System (NCIS)

The NCIS was searched for dog bite related deaths but no (closed) cases were found. There were two unintentional dog bite deaths recorded on the Victorian Admitted Episodes Dataset and a media search found one other report of a fatality. These three cases are still under investigation by the Coroner.

Hospital admissions

Source: Victorian Admitted Episodes Dataset (VAED)

Hospital admissions for injury and poisoning that contain an external cause code are extracted from the VAED by the Victorian Department of Human Services (DHS) and supplied in unit record format to VISU every six months. The dataset covers admissions to all Victorian public and private hospitals.

From July 1998 cases recorded on the VAED are coded to ICD-10-AM, the WHO International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification. The external causes chapters of ICD-10-AM describe the causes of injury, poisoning and adverse events (complications of medical and surgical care). Adverse events and sequelae (late effects) of external causes of morbidity and mortality are usually not included in VISU reports.

Case selection (for this report):

- Admissions recorded on the VAED that occur between 1 Jan 2005 and 31 Dec 2007
- Unintentional injury cases with first external cause code W54.0 Bitten by Dog.
- Mode of admission has any value except those indicating that transfer from another hospital has occurred or that the record is a 'statistical separation'- a change of care type within a hospital. The aim of these omissions is to reduce over-counting of cases and to provide an estimated incidence of admission.
- Mode of separation has any value except that the person died while in hospital.

Emergency Department presentations (non admissions)

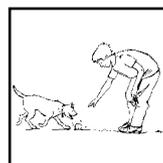
Source: Victorian Emergency Minimum Dataset (VEMD)

Emergency Department presentations for injury and poisoning are extracted from the VEMD by the Victorian Department of Human Services (DHS) and supplied quarterly in unit record format to VISU. Data are currently coded to the Victorian Emergency Minimum Dataset (VEMD) User Manual 10th Edition, July 2005. From January 2004, VEMD data are collected by all 38 Victorian public hospitals that provide a 24-hour ED service.

The VEMD contains both admitted and non-admitted cases. Presentations that are treated and discharged from the ED within 4 hours from the time patient management commences are classified as non-admissions and cases that are treated for 4 hours or more in the ED or a short stay ward attached to the ED or depart from the ED to an inpatient bed or are transferred to another hospital campus are classified as hospital admissions. Admissions for injury and poisoning recorded on the VEMD are not usually included in VISU injury surveillance reports if admissions are also being selected from the VAED because cases would then be over-counted.

Case selection (for this report)

- Hospital ED presentations (non-admissions) recorded on the VEMD occurring from 1 Jan 2005 to 31 Dec 2007 coded according to the Victorian Emergency Minimum Dataset (VEMD) User Manual 10th Edition, July 2005.
- Cases were selected if they attracted the Human Intent code 1 (Unintentional) AND the Injury Cause Code 21 (Dog Related) AND the Nature of Injury Code 26 (Bite, non-venomous) or 27 (Bite, not further specified). Case narratives of all remaining cases were searched using the terms 'dog' and 'bite' and were added to the dataset if found to be relevant.



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Acknowledgement

Ms Marde Hoy from the National Coroners Information System is acknowledged for providing deaths data extracted from the NCIS.

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General Acknowledgements

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



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

www.monash.edu.au/muarc/visu

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 Debbie Mourtzios

ISSN-1320-0593

*Printed by Work & Turner
Pty Ltd, Tullamarine*

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.

