

The incidence of public sector hospitalisations due to dog bites in Australia 2001–2013

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Dog bites have long been identified as a potential source of serious injury to humans,¹ and injuries due to dog bites are a largely unrecognised and growing public health problem. The public health implications of dog bites are substantial, and verifying the extent of the problem is important.² The serious health-related consequences of injuries sustained due to dog bites include open wounds, cellulitis, and fractures leading to temporary or permanent disability, mental trauma, anxiety and premature mortality. The economic consequences include use of medical resources, lost productivity of victims and their carers, and time and effort expended by the wide range of personnel involved in apprehending and dealing with the offending animal including court cases involving the victim, the victim's family and the owner of the offending dog. The social consequences include inter-personal disputes and community conflict.

There is limited, incomplete and fragmented information on dog bites in Australia due to the lack of a comprehensive reporting system.^{3,4} The National Coronial Information System⁵ produced a fact sheet on animal-related deaths of humans in Australia between July 2000 and November 2010. It highlighted that, on average, 1–2 persons died due to dog bites each year. The Australian Companion Animal Council Inc. has estimated that more than 100,000 persons in Australia are attacked by dogs each year,

Abstract

Objective: To estimate the incidence of dog bite-related injuries requiring public sector hospitalisation in Australia during the period 2001–13.

Methods: Summary data on public sector hospitalisations due to dog bite-related injuries with an ICD 10-AM W54.0 coding were sourced from the Australian Institute of Health and Welfare for the study period 2001–2013.

Results: In Australia, on average, 2,061 persons were hospitalised each year for treatment for dog bite injuries at an annual rate of 12.39 (95%CI 12.25–12.53) per 100,000 during 2001–13. The highest annual rates of 25.95 (95%CI 25.16–26.72) and 18.42 (95%CI 17.75–19.07) per 100,000 were for age groups 0–4 and 5–9 years respectively. Rates of recorded events increased over the study period and reached 16.15 (95%CI 15.78–16.52) per 100,000 during 2011–13.

Conclusion: Dog bites are a largely unrecognised and growing public health problem in Australia.

Implications for public health: There is an increasing public sector burden of hospitalisations for injuries from dog bites in Australia.

Key words: Public health, dog bites, dog bite injury, hospitalisations from dog bites, dog bite incidence in Australia

with an estimated 12,000–14,000 individuals requiring treatment for dog bite injuries, and around 10% of those being hospitalised each year.³ This may be an underestimate of the rates of hospitalisation because, in the only national compilation of data that was published in 2005,⁶ an average of 2,184 persons each year were found to require hospitalisation during 2001–03. The authors of the national report used the ICD-10-AM W54 code to estimate the incidence of injuries due to dog bites. That code included other injuries due to being struck by dogs (injuries from falls due to being knocked over by dogs). In 2002–03, ICD-10-AM w54 was

sub-classified into ICD-10-AM W54.0 to record dog bite injuries, and ICD-10-AM W54.8 to record injuries due to being struck by dogs respectively. To date, this has not been succeeded by another national report that has reported the incidence of hospitalisations due to injuries from dog bites using the revised ICD-10AM W54.0 code.

A position paper by the Royal Australasian College of Surgeons in 2012⁷ on dog bites in Australia recommended updating the current data and investing in further research on the epidemiology of dog-related injury including dog bites. To address this paucity of recent data, this study investigated the incidence,

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and trends in incidence, of hospitalisation due to dog bites in Australia during the period 2001–13.

Method

Data Sources

Summary data on hospitalisations due to dog bite-related injuries with an ICD-10-AM (WHO International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification) code w54.0 (external cause of injury code) for public hospitals in each Australian state or territory during 2001–13 were sourced from the Australian Institute of Health and Welfare. The data were provided in biennial (July 2001–June 2003, July 2003–June 2005.... July 2011–June 2013) and sex-specific totals for age-groups 0–4, 5–9, 10–14, 15–24, 25–34, 35–44, 45–54, 55–64, 65–74 and 75+ years. Data for Tasmania, ACT and Northern Territory were combined due to small cell counts in some age and sex categories.

Additional data from injury surveillance units and health department registries of each state and territory of Australia were used for state-based analyses. Mid-year estimates of the population of Australia in five year age groups and sex-specific categories were sourced from the Australian Bureau of Statistics online resources.⁸

The study was approved by the Tasmanian Health and Medical Human Research Ethics Committee (HREC no H0013594).

Data analysis

The population estimates were aggregated to match the year, age and jurisdictional groupings in which AIHW hospitalisation data were provided for each sex. Estimates of incidence density were calculated by dividing the number of hospitalisations due to dog

bite-related injuries of persons of each sex in each year/age/jurisdictional grouping by the sex-specific population estimate for that grouping. Ninety-five per cent confidence intervals for the incidence density were based on a normal approximation with the standard error of the logarithm of the incidence density estimated as the square root of the inverse of the number of cases. Trends in sex-specific incidence density were estimated by Poisson regression of the mean number of hospitalisations in each age/jurisdictional grouping of the midpoint of each year grouping and binary (0/1) terms for each age and jurisdictional grouping other than the reference category, and with the logarithm of the sex-specific population of the age/jurisdictional grouping entered as an offset. Quadratic terms in the mid-point of each year groupings were included to capture non-linearities.

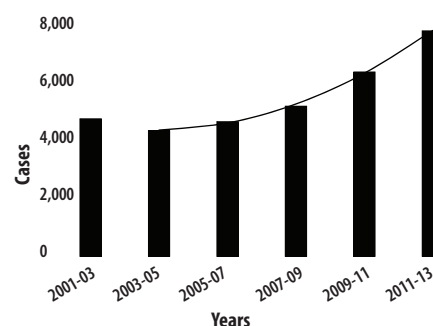
Results

During the 12-year study period, 31,218 persons (17,049 males and 14,169 females) were hospitalised for treatment for dog bite injuries, at an average annual rate of 2601 per year and 12.39 (95%CI 12.25–12.53) per 100,000 person years.

Age-and sex-specific incidence density

The highest rates of hospitalisations due to injuries from dog bites were 25.95 (95%CI 25.17–26.73) recorded for 0–4 year olds, followed by 18.41 (95%CI 17.75–19.07) for 5–9 year olds. The lowest rates were 7.99 (95%CI 7.69–8.29) per 100,000 for 15–24 year olds. Rates for persons aged 45+ years were generally stable at 12.11 (95%CI 11.89–12.33) per 100,000. Table 1 presents age- and sex-specific estimates of incidence density for the study period 2001–13. In each age category

Figure 1: Biennial incidence density of hospitalisation due to injuries from dog-bites in Australia, 2001–13.



prior to 45–54 years, the number of cases among males exceeded the number among females, and male rates for hospitalisations due to injuries from dog bites were higher than female rates. This male: female disparity was not continued at older ages.

Rates were generally similar among adults commencing with 25–34 year olds, but the numbers of cases peaked for 25–34, 35–44 and 45–54 year olds and were similar to the number of cases among 0–4 year olds.

Biennial incidence and incidence density

The biennial estimates of incidence and incidence density of hospitalisation due to injuries from dog bites in Australia during 2001–03 were 11.50 (95%CI 11.16–11.84) per 100,000 males and females combined. Rates increased from 10.28 (95%CI 9.96–10.59) per 100,000 during 2003–05, the low point of the period, to 13.63 (95%CI 13.29–13.98) per 100,000 during 2011–13 for both sexes combined. Rates rose progressively after 2001–03, with a more substantial increase after 2009. The increase in rates after 2001–03 is closely approximated by a quadratic trend on the logarithmic scale (Figure 1).

State and territory incidence density

Of all Australian states and territories, the lowest rates of 11.64 (95%CI 11.31–11.97) per 100,000 and 9.57 (95%CI 9.27–9.87) per 100,000 respectively for males and females were recorded in NSW, followed by 11.68 (95%CI 10.99–12.37) and 10.21 (95%CI 9.57–10.85) per 100,000 respectively for males and females in SA. The highest rates of 22.2 (21.04–23.36) per 100,000 and 18.20 (17.15–19.25) per 100,000 for males and females respectively were recorded for TAS/ACT/NT. These analyses were solely based on AIHW data. The highest rates of 44.64 (41.66, 47.61) were recorded for Northern Territory, followed

Table 1: Age group and sex-specific rates of hospitalisations for dog-bite injuries.

Age group	Males		Females	
	Cases	Incidence density (95%CI)	Cases	ID (95%CI)
00-04 years	2,356	28.13 (26.99–29.26)	1,879	23.65 (22.58–4.72)
05-09 years	1,617	19.44 (18.50–20.39)	1,368	17.33 (16.41–18.25)
10-14 years	1,022	12.03 (11.29–12.76)	607	7.53 (6.93–8.12)
15-24 years	1,608	9.04 (8.60–9.48)	1,170	6.89 (6.49–7.28)
25-34 years	2,534	14.07 (13.53–14.62)	1,489	8.32 (7.90–8.74)
35-44 years	2,319	12.69 (12.18–13.22)	1,705	9.21 (8.77–9.64)
45-54 years	2,128	12.44 (11.91–12.97)	2,115	12.18 (11.67–12.71)
55-64 years	1,627	11.87 (11.29–12.44)	1,694	12.35 (11.77–12.94)
65-74 years	1,004	11.43 (10.73–12.14)	1,030	11.27 (10.58–11.96)
75+ years	834	13.12 (12.23–14.01)	1,112	12.17 (11.45–12.88)
All ages	17,049	13.61 (13.41–13.82)	14,169	11.19 (11.00–11.37)

by 18.75 (95%CI 17.22–20.27) for the ACT and 12.82 (95%CI 11.76–3.87) for Tasmania. For this analysis, data from injury surveillance units and data registries of individual states and territories have been used.

National age-specific trends in incidence density

Figure 2 presents trends in age-specific incidence density for 2001–13. The incidence density for persons aged 0–4 years or 5–9 years remained roughly stable, but a steady increase in rates was observed for all other age groups after 2003. In sex specific analysis of persons aged 10+ years, the downturn in 2003–05 was more pronounced for males than females (data not shown).

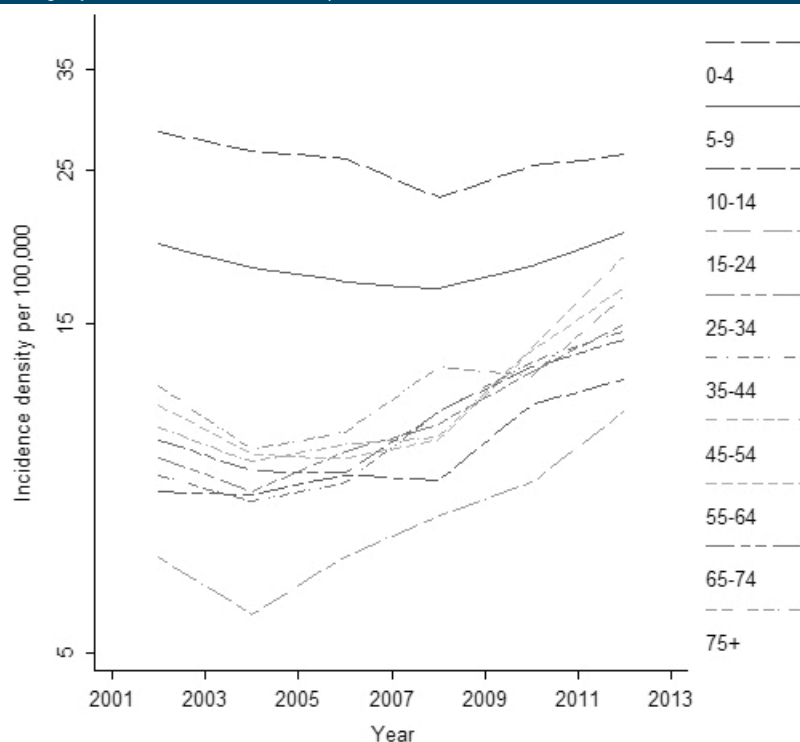
Discussion

This study has identified a number of patterns in the statistical data for dog bite injuries in contemporary Australia. On average each year between 2001 and 2013, 2601 persons required hospitalisation for dog bite injuries in Australia at an annual rate of 12.39 per 100,000. The highest incidence density was for infants and children aged 0–4 years and the next highest was for 5–9 year olds. Rates for males were higher than those for females for all age groups prior to 45–54 years. Since 2003, there has been a 57% increase in rates that reached 16.15 per 100,000 per year in 2011–13. Of all states and territories, the highest rates were recorded in the Northern Territory. While one would expect growth in the Australian population (now more than 24 million) over time to give a steady rise in the head count of injured people, the concerning aspect is the rising incidence density.

The high incidence and incidence density for 0–4 and 5–9 year olds are consistent with findings of previous national⁶ and jurisdictional reports.^{1,9–11} Children are considered to be at a greater risk of dog bites due to their inexperienced handling of animals,¹² their innate curiosity,^{12–14} and their inability to defend themselves against an animal attack¹⁵ due to their small stature.⁶

The excess of male cases in each age category of persons younger than 45 years is consistent with findings from international studies,^{12–16} that have reported higher rates of hospitalisation due to dog bites among males. This has been attributed to the greater prevalence of ownership of dogs by men (particularly younger men), the inclination of males to be daring and aggressive with dogs,

Figure 2: Age-specific trends in incidence density, 2001–13.



a predisposition of men to be occupied in professions such as post-carriers, utility meter readers and door-to-door sales persons that have a greater exposure to dog bites.¹⁵

There are some differences between the estimates of incidence for 2001–03 provided in the national report⁶ and our estimates. Most notably, the national report provided estimates for 75+ year-olds during 2001–03 were about 20% higher than our own. About half the cases in that age category during that period were due to being struck by dogs.⁶ The differences in rates between the national report and our data may be due to the use of WHO ICD classification code ICD-10-AM W54 prior to July 2002. The coding transition from ICD-10-AM W54 to ICD-10-AM W54.0 resulted in restriction to dog bites as the primary cause of injury requiring hospitalisation, and exclusion of injuries from being struck by dogs. This change is likely to be responsible also for the lower incidence density we have reported for 2003–05 than for 2001–03. The more pronounced downturn in rates for males than females between 2001–03 and 2003–05 would be explained if males are more often struck by dogs than females.

The longer-term trends in dog bite injuries and their underlying driving factors are worthy of comment. The initial decline was followed by a steady increase of 5.9% on average over the remainder of the study period. This pattern was mirrored by increases

in age-specific rates for each age category of persons aged 15 years and older, but was not replicated for 0–14 year olds. The stability in rates of young children relative to those of older individuals may be due to the introduction of successful national and jurisdictional dog bite prevention initiatives¹⁰ such as Delta Dog safe™, the AVA Pets and People Education Program and SPOT (Safe pets out there) amongst others.¹⁷ These programs have generally targeted junior and primary school children.

The increases occurred despite the introduction of the Domestic Animal Act, the Animal Welfare Act and the Animal Management Act in individual states and territories between 1985 and 2008, and of breed-specific legislation in some states and territories between 2004 and 2009. The Acts provided guidelines for responsible ownership/registration of dogs and prescribed penalties for dog-related offenses. Breed-specific legislation identified particular breeds of dogs as being dangerous, and placed restrictions on breeding, handling and ownership of breeds of dogs¹⁸ that could cause serious injury.

The increasing rates were not isolated to specific states. In general, the overall trends were replicated in each state and territory during the study period. The nature of the data for TAS/ACT/NT supplied by AIHW did not permit rates for the Northern Territory,

ACT and Tasmania to be calculated separately. For this purpose, data sourced from data registries and injury surveillance units were used. The results showed that the Northern Territory – the jurisdiction with the highest proportion of households exposed to stray dogs¹⁹ had the highest rates. The next highest rates were recorded in the ACT, followed by Queensland. The lowest rates were for NSW. There is very limited information available on rates of dog ownerships in each state and territory²⁰ with which to investigate whether the jurisdictional differences in rates can be attributed to jurisdictional differences in dog-ownership.

Several factors may have contributed to the overall increase in rates during the study period. First, there has been an increase in the number of households with dogs. It is estimated that about 39% of Australian households now own a dog.²⁰ The Australian Bureau of Statistics online resources indicate that married couples with dependants were most likely to have pets, with 49% of those households owning a dog.¹⁹ This heightened exposure to dogs as a result of increase in households with dogs may have contributed to the increase in rates over time. Also, an increased awareness of the infectious ramifications of dog bites,²¹ and increasing use of surgical procedures to repair damage due to dog bites,²² may have contributed to more individuals being treated in Australian hospitals than in previous years.

This study adds considerably to what is known regarding the public health problem of dog bite injuries in Australia. It is the first national study to report the incidence of hospitalisation for injuries due to dog bites for an extended period with complete coverage of all public hospitals in Australian states and territories. The previous national study covered only a three-year period. Because the present study is based on the revised ICD-10-AM W54.0 classification (July 2002), it is able to distinguish between injuries from being struck by dogs and injuries due to dog bites. Furthermore, the restriction to injuries sufficiently serious to require hospitalisation provides a strong focus on important and significant injuries and ensures that the data were based on a distinct criterion (hospitalisation).

Some limitations of this study must be acknowledged. There was no coverage of dog bites not treated in public hospitals. An unknown proportion of dog bites resulting in injuries would have been treated in general

medical practice, community health centres, and in private hospitals. Our estimates therefore under-state the extent of the problem. The trend data would be unreliable if there has been a systematic shift to or from treatment in general practice or private hospitals during the study period. During 2000–01 to 2009–10, presentations to public hospital emergency departments increased by 1.8% per year.²³ A Commonwealth Government funding initiative was introduced after 2011 to increase the number of short-stay units to accommodate these increasing presentations at the public hospital emergency departments.^{24,25} Because this increase in numbers of short-stay units occurred during the later stages of our study period, it could not be responsible for the earlier increases. Furthermore, without comprehensive data on dog registrations across Australia, it is not possible to track precisely trends in the rate of increase in dog ownerships or the increase in ownership of specific breeds of dogs. This study provides aggregate level data on the incidence of hospitalisation due to injuries from dog bites in Australia for an extended period, thereby addressing the critical lack of information on this public health problem. Finally, it was not possible to provide sex-specific estimates for Tas./ACT/NT due to the aggregated nature of the data supplied by the AIHW.

In conclusion, there is an increasing public sector burden of hospitalisations for injuries from dog bites in Australia. This study showed that persons aged 0–4 and 5–9 years had the highest rates of hospitalisation. Prevention initiatives targeting children may have warded off the increases in rates experienced by those aged 15 years or greater, which occurred despite breed-specific legislation in Australia to regulate breeding and ownership of dangerous dogs. Uniform and more complete surveillance of injuries and hospitalisations due to dog bites and dog ownership would provide evidence for the development of improved public policy in respect of dog bites.

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