Australian Government
Australian Institute of Health and Welfare

# Contact with animals

**Web report** | Last updated: **13 Mar 2024** | Topic: Injury | Media release

## About

Human-animal interactions provide benefits to human health and wellbeing but can also result in injuries. This report describes patterns and trends in hospitalised injury cases due to contact with animals between July 2012 and June 2022 across Australia. It describes who is commonly injured and the types of animals causing the injuries.

**Cat. no:** INJCAT 237

### Findings from this report:

- Common pets caused most injuries overall, with crude rates per 100,000 persons of 47.5 in 2021-22, from 18.9 in 2012-13
- The highest rate of injury was among 45–64 year-olds, 110 cases per 100,000
- Australians are 6.6 times as likely to be hospitalised due to injury involving non-venomous compared to venomous animals
- The commonest injuries were open wounds and fractures. The commonest body parts injured were upper limbs (nearly half)

# Monitoring animal related injuries

There is a mounting body of evidence about the benefits to human health and wellbeing provided by animal interactions, however these interactions can also cause injuries (Steele, Ma et al. 2007, Centers for Disease Control and Prevention (CDC) and National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) 2021). Human encounters with domestic and wild animals are likely to become increasingly common throughout the world, particularly as ecosystems change (Myers, Gaffikin et al. 2013), pet ownership increases (Ozanne-Smith, Ashby et al. 2001) and humans encroach on animal habitat (Thirgood, Woodroffe et al. 2005).

Mechanisms and patterns of injuries vary by the type of animal involved (Norwood, McAuley et al. 2000). Specific industries such as the agricultural sector (Peachey and Lower 2023, Safe Work Australia 2023) and subpopulations including children (Rhea, Weber et al. 2014) are at increased risk of serious injury from contact with animals. Australians can also be exposed to a risk of animal-associated injury during international travel (Gautret, Schwartz et al. 2007). Australia is also home to some of the most venomous animals in the world and ongoing public health surveillance of envenomation informs work preventing deaths from these injuries (Welton, Williams et al. 2017, Australian Venomous Injury Project 2023).

## What this report describes

This report focuses exclusively on describing injuries caused by contact with animals. Some external causes of injury encompass animals and plants or humans, without further differentiation in hospitalisation records; these are excluded from the bulk of this report to focus on cases where only contact with animals is identified as the external cause of an injury. Zoonotic diseases are out of scope for this report.

This report explores injuries that resulted in hospitalisation. It excludes deaths caused by such injuries because numbers were too small for meaningful inferences to be made. Emergency department (ED) presentations were assessed but the number of cases where an external cause code was recorded (enabling the cause of injury to be ascertained) were too low to enable further analysis.

Trends in injuries over a ten-year period from July 2012 to June 2022 are described. Monitoring these trends informs discussions about evolving human-animal encounters, injury prevention and management.

The technical notes section of this report outlines how cases of injury are ascertained. Definitions, methodology and data limitations that should be considered when reading this report.

**This report aims to:**

Describe ED presentations and hospitalisations that occur across Australia due to injuries caused by contact with animals during 2021-22, specifically:

- How many injury cases are hospitalised or present to ED?
- Who is injured?
- What animals cause these injuries?
- What types of injuries are commonly sustained?
- Where do these injuries commonly occur?
- How severe these injuries are and how are they managed in hospitals?

We also describe any changes in observable trends of these injury presentations and hospitalisations over the past 10 years

## Related AIHW reports

Previous AIHW reporting related to this topic includes:

- Venomous bites and stings 2017–18 (3,500 hospitalisations)
- Dog-related injuries (4,000 hospitalisations for 2013–14)
- Horse-related injury in Australia (3,100 hospitalisations for 1996–97 with the majority being 'horse rider' injuries).

Injury in Australia includes a category called Contact with living things which covers injury hospitalisations (and a handful of deaths) caused by contact with animals, plants and humans. Contact with non-venomous animals was the top cause (60%) of hospitalisations due to contact with living things in 2021–22 and contact with venomous animals caused a further 7% of these hospitalisations.

## What this report does not describe

- A person may be injured multiple times, and this report does not present information about the number of people injured. In addition, one person may be hospitalised a number of times related to the same index injury case. We instead present information about the number of cases of injury.
- This report only reflects injuries where external causes are coded, the injury is identifiable as due to contact with animals and the case presents to Australian hospitals or EDs. It therefore underestimates the total impact of injuries due to contact with animals as it does not count injuries where health care is not sought from a hospital or emergency department.
- This report does not cover zoonotic infections, it focuses on primary diagnoses of injury.
- The report does not describe breeds of pets causing injuries.
- Minor injuries (e.g. scratches and stings) are likely under-reported, with injury hospitalisations or ED presentations likely biased towards injuries perceived as severe enough to require health care intervention. By the same logic, injuries caused by venomous animals are likely to be perceived as more serious and hence over-represented in this report.
- A smaller number of severe injuries that result in death may not include a stay in hospital but are captured in mortality data. These are not outlined in this report.
- Over time, minor changes have been made to the method for counting cases of injury, therefore data presented in previous AIHW reports may not match the data presented in this report.
- ICD-10-AM codes including injuries due to combined plants and animals, or combined humans and animals are excluded from this report due to inability to ascertain what type of animate mechanical forces are involved.
- The COVID-19 pandemic and the resulting Australian Government closure of the international border from 20 March 2020 caused significant disruptions to the usual Australian population trends. This report uses Australian Estimated Resident Populations (ERP) that reflect these disruptions.
- COVID-19 related disruptions in usual population trends may complicate interpretation of statistics calculated from these ERPs. For example, rates and proportions may be greater than in previous years due to decreases in the denominator (population size) of some sub-populations.
- Australian injury surveillance systems have a major focus on the external causes of injuries, which is especially important from a prevention perspective. When this information is not collected it obstructs direct comparisons between the causes of injury across hospitalisations, deaths, and ED presentation data.

### References


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# Emergency Department presentations

An American study of ED presentations over 2010-2014 described approximately 6.5 million ED presentations resulting from animal-related injuries. Of these, approximately 2 out of 5 were for bites from non-venomous arthropods (such as mosquitos, fleas and ticks), just over a quarter were dog bites and just over 1 in 9 were from venomous reptiles. Approximately 3% of presentations were subsequently admitted as in-patients, and the number of deaths was extremely small. The study concluded that animal related injuries as a mechanism warrant further public health prevention efforts (Forrester, Forrester et al. 2018)

In Australia, the recording of external cause information is not as complete in the National Non-admitted Patient Emergency Department Care Database (NNAPEDCD) as the National Hospital Morbidity Database (NHMD).

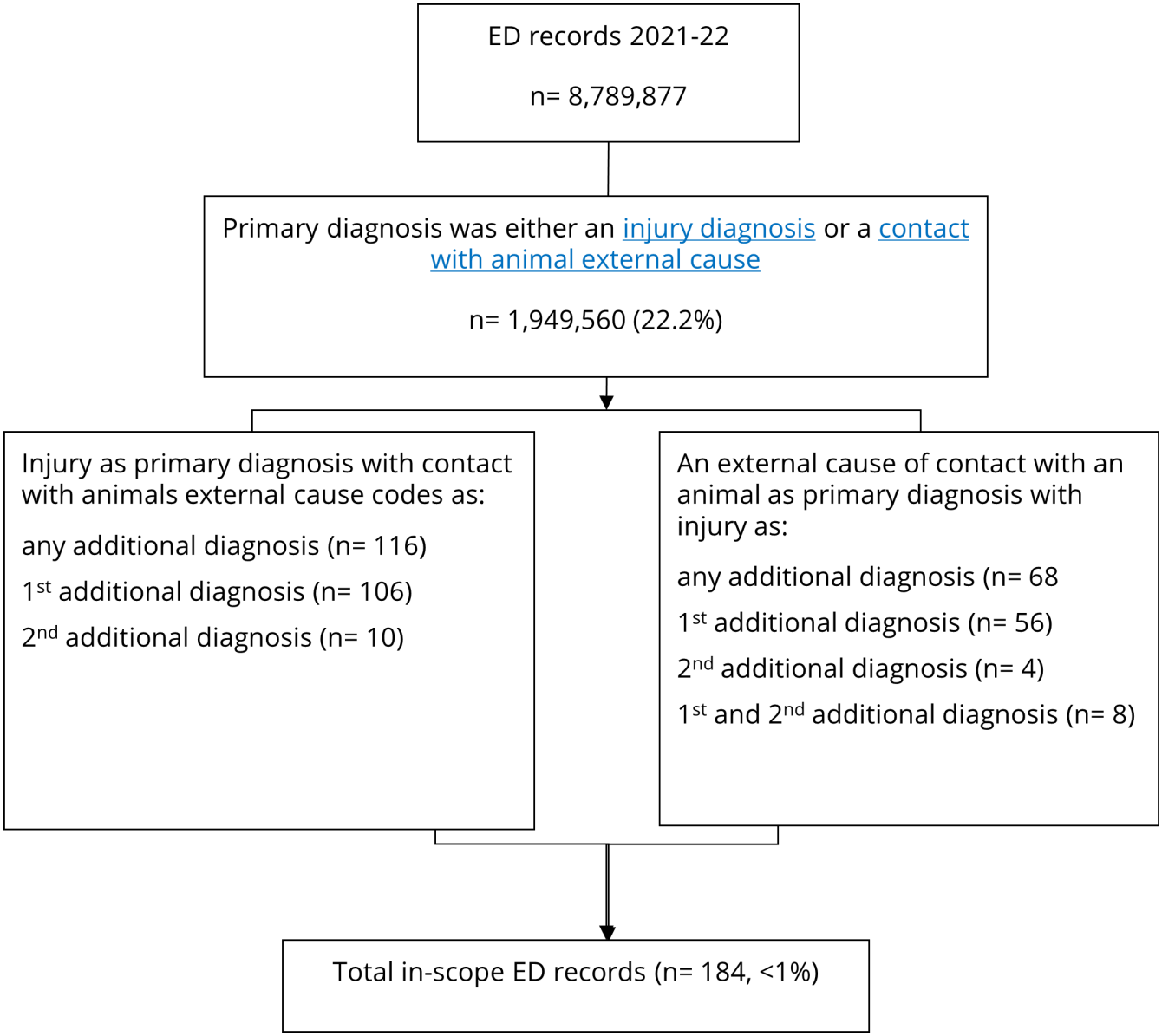
This analysis quantified the number of ED records in 2021-22 where the following could be ascertained:

- An injury diagnosis in any available primary or additional diagnosis variable AND
- An external cause code related to contact with animals in any primary or additional diagnosis variable

The technical notes section of this report details inclusion criteria and definitions used throughout this report.

The sum of cases identified by the above two criteria constituted 184 ED records in 2021-22. We therefore do not describe ED data further in this report, as the under-recording or unavailability of external cause related information in the ED dataset and resultant small case counts render the data unreliable for injury surveillance (Figure 1).

**Figure 1: Contact with Animals 2021-22 ED data inclusion flow diagram**

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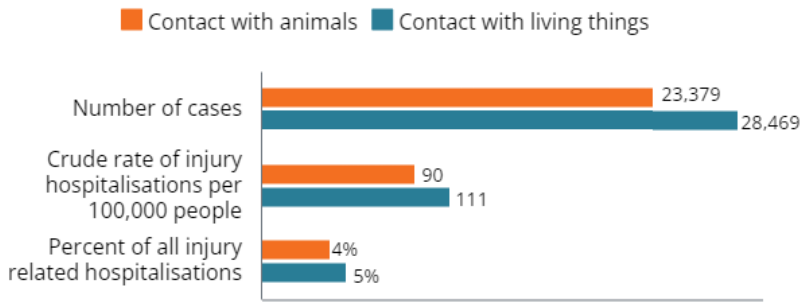
# Hospitalisations

In 2021-22, a total of 23,379 hospitalised cases had a primary diagnosis of an injury recorded alongside an external cause indicating contact with an animal. Contact with animals therefore represented approximately 8 out of 10 hospitalised injuries due to contact with living things, making it the 7th most frequent cause of injury hospitalisations in 2021-22.

3,226 cases were identified where the external cause of injury was a transport accident involving the rider or occupant of an animal drawn vehicle: these represent about 14% of total animal-related injury hospitalisations.

**Figure 2 Comparing injury hospitalisations due to contact with animals versus those due to contact with living things, 2021-22**




Notes: Contact with animals is a subset of Contact with living things, which includes animals, people and plants as external causes of injury. See technical notes and Injury in Australia for ICD10-AM codes included in both categories.

A further 73 hospitalised cases of injury were identified in 2021-22 where contact with animals was an external cause recorded alongside an additional diagnosis (not a principal diagnosis) of injury. 61 of these cases had a principal diagnosis of unspecified anaphylaxis or anaphylactic shock (T78.2), with 25 of these cases being due to bee allergies (Y37.61). These 73 cases where injury was an additional diagnosis have been excluded from the rest of this report.

**1,019 injury hospitalisation cases were excluded from this report because the external cause of injury may have included people or plants.**

In 448 (44%) of these excluded cases the external cause of injury was contact with living things;

- 238 cases of *Exposure to other and unspecified animate mechanical forces (W64)*
- 170 cases of *Contact with other specified venomous marine animals and plants (X26.8).*

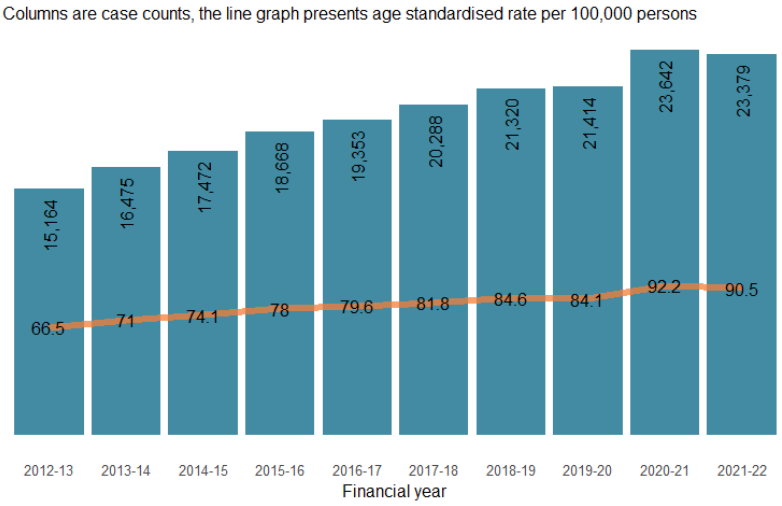
In 571 (56%) of these excluded cases the external cause of injury was a transport accident that may have involved an animal or pedestrian;

- 282 cases of *Motorcycle rider injured in collision with pedestrian or animal (V20)*
- 142 cases of *Pedal cyclist injured in collision with pedestrian or animal (V10)*
- 136 cases of *Car occupant injured in collision with pedestrian or animal (V40).*

## Trends

Between July 2012 and June 2022, the number, proportion and age standardised rate of hospitalised injuries due to contact with animals all gradually increased (Figure 3).

**Figure 3: Trends in hospitalised injury by financial year, 2012-22**




Source: National Hospital Morbidity Database

For more information please refer to supplementary data table 1.

Hospitalisations increased notably in 2020-21 with 2,228, or 10%,more hospitalisations than 2019-20. This may be attributable to increased exposure to animals secondary to increases in pet ownership during COVID-19 (Animal Medicines Australia and Newgate Research 2021).

The age standardised rate (ASR) accounts for population increases and different age distributions over the decade. The age standardised rate of hospitalisation for these injuries (per 100,000 people) gradually increased from about 66 in 2012-13 to 90 in 2021-22, peaking at about 92 in 2020-21.

## References

AIHW (2023). Injury in Australia. Canberra, Australian Institute of Health and Welfare

Animal Medicines Australia and Newgate Research (2021). Pets and the Pandemic: A social research snapshot of pets and people in the COVID-19 era: 1-35.

# Who is injured?

In 2021-22, females constituted 54% of injury cases hospitalised due to contact with animals. Nearly 3 out of 5 cases were adults aged between 25 and 64 years, and under 13% were children aged under 15 years. The highest crude rate was among females aged 15-24 at 123 per 100,000 (Table 1).

Table 1: Number and crude rate (per 100,000 persons) of injury hospitalisations due to contact with animals by sex and age Australia, 2021–22

| Age group [b] | Cases: Male | Cases: Female | Cases: Persons [e] | Crude rate[a] Male | Crude rate[a] Female | Crude rate[a] Persons |
|---|---|---|---|---|---|---|
| **0–4** | 568 | 425 | **993** | 73 | 58 | **66** |
| **5–14** | 1,062 | 1,116 | **2,178** | 64 | 71 | **67** |
| **15–24** | 1,250 | 1,864 | **3,115** | 77 | 123 | **99** |
| **25–44** | 3,122 | 3,696 | **6,818** | 86 | 101 | **94** |
| **45–64** | 3,052 | 3,840 | **6,892** | 99 | 120 | **110** |
| **65+** | 1,676 | 1,707 | **3,383** | 82 | 73 | **77** |
| **Total** | **10,730** | **12,648** | **23,379** | **83.6** | **97.1** | **90.4** |

Notes:

(a) Crude rate is per 100,000 persons

(b) Records where age is missing are excluded from this table

(c) Records where remoteness is missing are excluded from this table

(d) Remoteness is based on the remoteness of usual place of residence for the patient

(e) Persons include records where sex is missing, intersex or indeterminate. Therefore, sum of male and female components may not equal the persons count.

(f) Total is the grand total. This includes records where age or remoteness are missing. Therefore, the sum of the age group components or sum of the remoteness components may not equal the total.

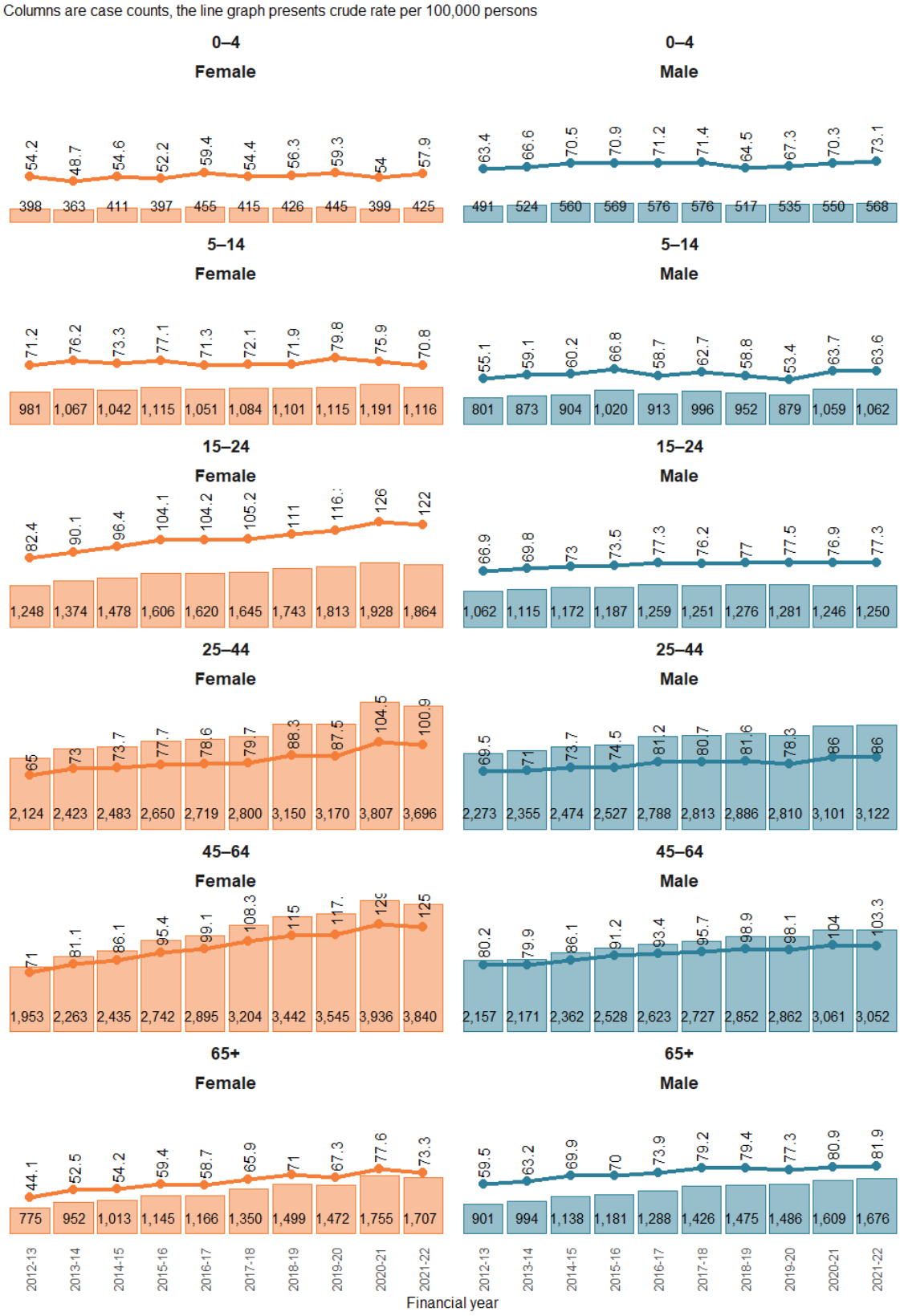
Source: National Hospital Morbidity Database

Over the 10 years described in this report, the largest increases in numbers of injury hospitalisations occurred for cases aged 15+, with generally more females than males hospitalised. The gender gap was widest for 15–64-year-olds and narrowest for people aged 65+. The largest increase in numbers of hospitalisations occurred between 2019-20 and 2020-21 (Figure 4, Figure 3).

Crude rates of injury hospitalisation generally increased over the decade for most age groups. The gender gap was widest for 15–24-year-olds and widening over time, with females (122.7 per 100,000) in this age group hospitalised at nearly 1 and a half times the rate of corresponding males (77.3 per 100,000) by 2021-22. At the extremes of age (0-4 and 65+ year olds) the gender preponderance was flipped, with a higher rate of hospitalisation among males (Figure 4).

Injury hospitalisations by categories of animals are described further in the 'Type of animals' section of this report.

**Figure 4: Increases in numbers and crude rates of injury hospitalisations related to contact with animals varied by age group and gender across Australia, 2012-22**




Source: National Hospital Morbidity Database

For more information please refer to supplementary data table 2.

### Children

In 2021-22, about 900 0–4-year-olds were hospitalised with injuries caused by contact with animals, a rate of 65.7 per 100,000. This was the lowest rate of hospitalisation for any age group.

- Boys had higher rates of hospitalisation than girls (73 and 58 per 100,000 respectively).
- Most children were injured by contact with pets (63.6% or 41.8 per 100,000 cases), followed by wildlife (28.4% or 18.7 per 100,000 cases).
- Head and neck injuries were more common in 0–4-year-olds than other age groups; over half of 0–4-year-olds sustained a head and neck injury and about two thirds of these head and neck injuries involved open wounds (Figure 21).

Crude rates of injury were similar for 0-4- and 5–14-year-olds across the decade (Figure 4). More males aged 0-4 and more females aged 5-14 were hospitalised.

### People who work with animals

While we are unable to drill down to specific occupation, 2021-22 hospitalisation data indicated 2,978 injuries occurred while working. Of the almost half of cases that had a place of occurrence recorded:

- over half occurred in homes (866 cases) of which,
  - 81 occurred while working for an income
  - 785 occurred while engaged in other types of work.
- 208 cases (13%) occurred on commercial, industrial or construction sites
- 169 cases (10%) occurred in sports or athletic arenas.

Of the 1,699 cases injured whilst working for an income, a third (572 cases) were among people working in the agriculture, forestry or fishing sectors.

### Injury hospitalisations by type of animal and work, 2021-22

**Common pets** were associated with 823 hospitalised injuries

- 294 (36%) cases engaged in caring, gardening, or other household work
- 217 (26%) engaged in specified work for income
- 187 (23%) engaged in health services

**Livestock** were associated with 1,038 hospitalised injuries

- 434 (42%) cases from the agriculture, forestry and fishing industries
- 271 (26%) engaged in specified work for income
- 222 (21%) engaged in caring, gardening, or other household work

**Wildlife** were associated with 1,011 hospitalised injuries

- 721 (71%) cases engaged in caring, gardening, or other household work
- 88 (9%) engaged in specified work for income
- 84 (8%) from the agriculture, forestry and fishing industries

**Marine animals** were associated with 33 hospitalised injuries, with 18 (55%) of these from the agriculture, forestry and fishing industries

For 73 hospitalised injuries the type of animal was unspecified

- 34 (47%) were engaged in caring, gardening, or other household work
- 24 (33%) were from the agriculture, forestry and fishing industries

For 2,978 injury hospitalisations both an animal and occupation were recorded.

- 1,279 (43%) were engaged in caring, gardening, or other household work
- 1,699 (57%) were working for an income
- 572 (19%) were from the agriculture, forestry and fishing industries

# Where are people injured?

The distribution of different animals and therefore injury patterns vary by place of occurrence. More bee-related anaphylaxes are reported in South Australia, more snake bites in Queensland and jack jumper ant anaphylaxes in Tasmania (Australian Venomous Injury Project 2023). Venomous animal injuries vary significantly by remoteness regions across states and territories, indicating the need for localised prevention approaches (Welton, Williams et al. 2017). Across Australia, people are about 6.6 times as likely to be hospitalised due to injury involving a non-venomous animal as they were from a venomous animal, however states and territories varied widely, with this risk being 14.4 times in the ACT and 3.4 times in SA.

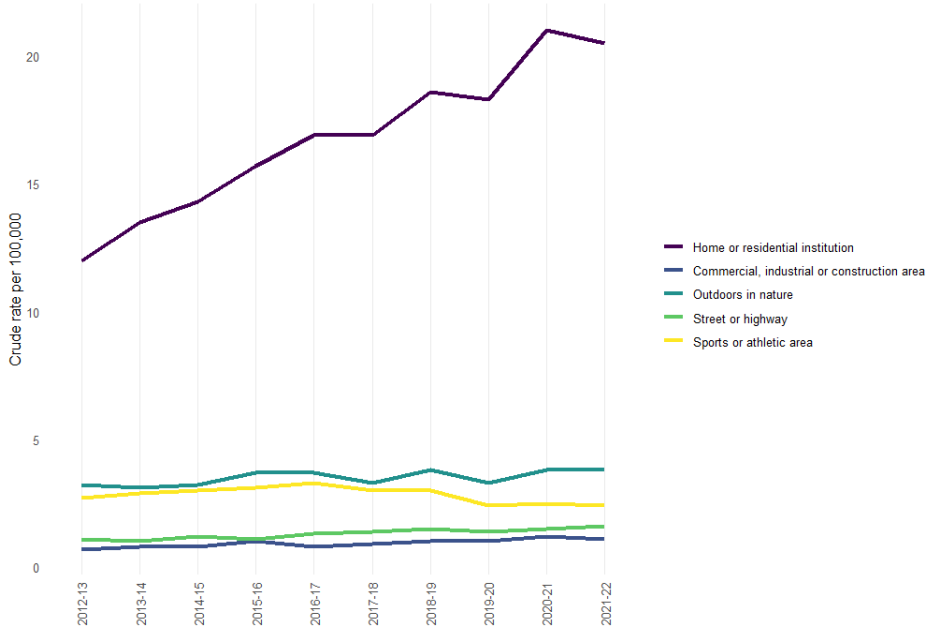
## Place of occurrence

Across the decade of data analysed in this report;

- place of occurrence of injury most frequently went unrecorded
- the number of hospitalisations generally increased by year across place categories (Figure 5).

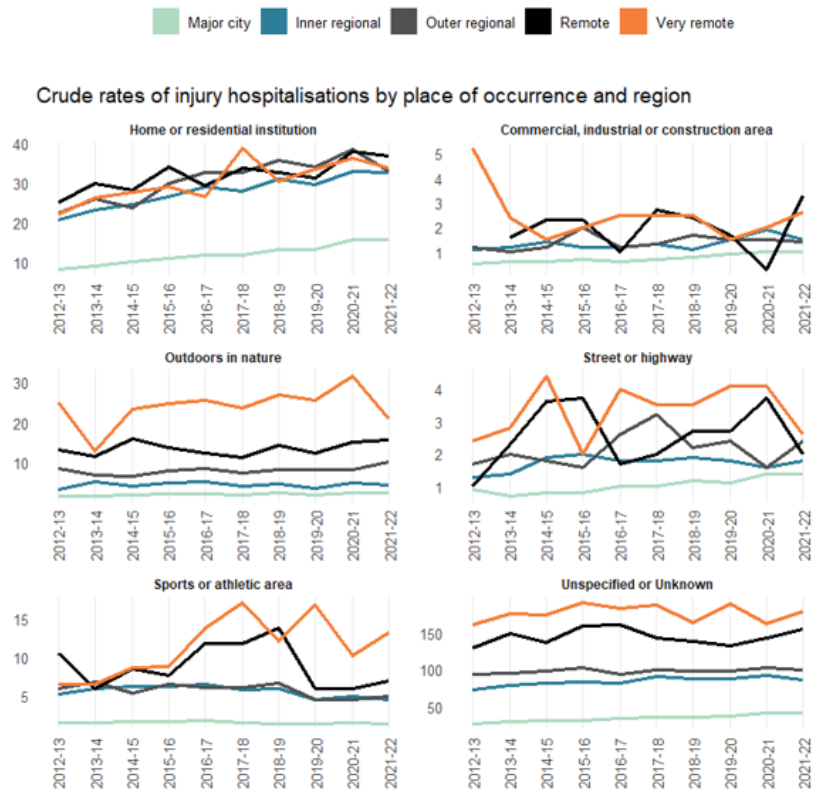
Of named places of occurrence of injury, the highest numbers and rates of hospitalisation occurred in homes, followed by outdoors or in nature (including natural bodies of water, bushland, deserts and other countryside). Rates varied by region within each place of occurrence, generally increasing as population size decreased with remoteness. For injuries that occurred in homes or residential institutions, similar rates were observed for all regions apart from major cities, where they were lower. Comparatively, rates of unspecified injuries, or those occurring outdoors or in nature increased clearly with remoteness, being highest in very remote regions. Rates of injuries occurring in sports or athletic areas were similar for major cities and regional areas and notably higher in remote and very remote regions (Figure 5).

**Figure 5.1: Injury hospitalisations by place of occurrence and remoteness, 2012-22**




Source: National Hospital Morbidity Database

**Figure 5.2: Injury hospitalisations by place of occurrence and remoteness, 2012-22**




Source: National Hospital Morbidity Database

## Region

Trends over the decade indicate that most of the growth in **numbers** of these hospitalised injuries is from major cities, with relatively static case counts in other regions (Figure 5, Table 2). This held true regardless of place of occurrence, except for sports or athletic areas, where the numbers of these hospitalised injuries decreased overall from 2019-20.

Over the past decade there has been a generally increasing trend in **rates** of these injuries within each region, with these rates also increasing with remoteness. Increased rates in remoter regions may reflect higher proportions of residents working in agriculture or other industries where one is more likely to be outdoors or around animals.

Table 2: Number (crude rate per 100,000) of injury hospitalisations by region and financial year, 2012-22

| Year | Major cities | Inner regional | Outer regional | Remote | Very remote |
|---|---|---|---|---|---|
| **2012-13** | 6,712 (41.2) | 4,472 (108.5) | 2,741 (137.3) | 560 (183.1) | 489 (229.8) |
| **2013-14** | 7,366 (44.4) | 4,937 (118.4) | 2,853 (141.9) | 621 (203.6) | 487 (230.8) |
| **2014-15** | 8,076 (47.8) | 5,213 (123.8) | 2,855 (141.4) | 613 (203.1) | 507 (245.1) |
| **2015-16** | 8,615 (50) | 5,496 (129.3) | 3,133 (154.7) | 670 (224.9) | 540 (265.8) |
| **2016-17** | 9,331 (53.1) | 5,571 (129.5) | 3,049 (149.9) | 660 (223.2) | 533 (265.5) |
| **2017-18** | 9,766 (54.6) | 5,908 (135.5) | 3,184 (155.7) | 622 (210.3) | 566 (284.5) |
| **2018-19** | 10,583 (58.2) | 6,110 (138.2) | 3,238 (157.6) | 628 (212) | 502 (254) |
| **2019-20** | 10,892 (59) | 5,999 (133.9) | 3,168 (153.3) | 568 (190.9) | 552 (280.7) |
| **2020-21** | 12,476 (67.2) | 6,501 (143.3) | 3,357 (161.6) | 644 (215.2) | 504 (257.3) |
| **2021-22** | 12,542 (67.2) | 6,234 (135.7) | 3,265 (156.1) | 690 (229.4) | 507 (258.8) |

Source: National Hospital Morbidity Database

## State and territory

The largest number of cases during 2021-22 were from Queensland, which also reported the highest number of injury hospitalisations due to contact with venomous animals (Table 3).

**Table 3: Number of injury hospitalisation cases due to contact with animals, by state and territory and venomous type, 2021-22**

| States & Territories | Venomous | Non-venomous | Total contact with animals[(a)] |
|---|---|---|---|
| **NSW** | 624 | 4,916 | 5,753 |
| **Vic** | 564 | 4,593 | 5,364 |
| **Qld** | 892 | 5,003 | 6,805 |
| **WA** | 338 | 1,842 | 2,347 |
| **SA** | 312 | 1,038 | 1,415 |
| **Tas** | 76 | 339 | 434 |
| **ACT** | 37 | 540 | 581 |
| **NT** | 38 | 476 | 583 |
| **Australia** | **2,887** | **18,825** | **23,379** |

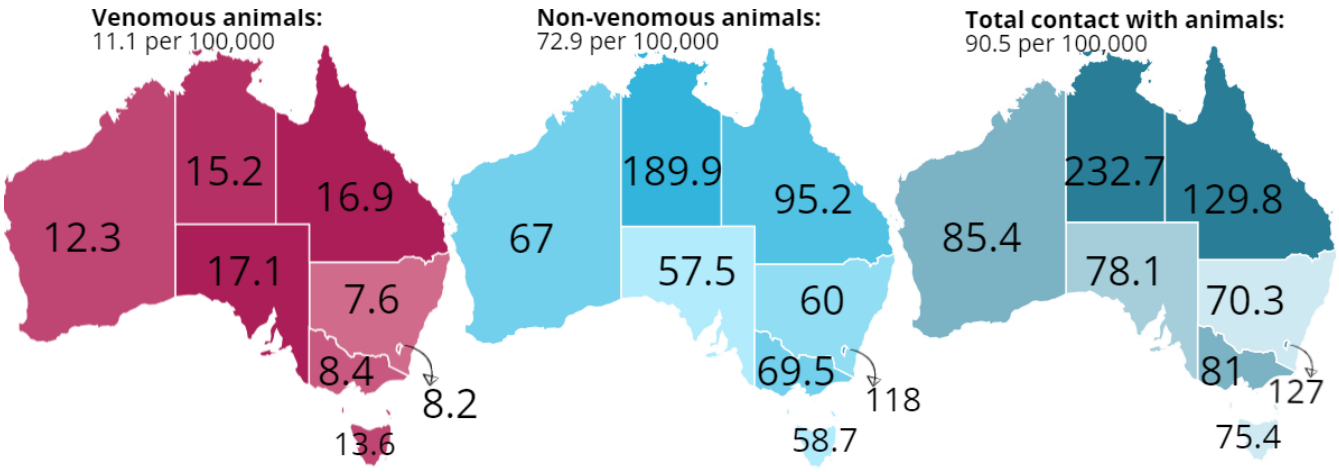
Notes:

(a) 'Total contact with animals' includes records where venomousness of animal could not be determined.

Source: National Hospital Morbidity Database

Age standardised rates (ASRs) per 100,000 present a population level risk of injury hospitalisation adjusted for different age distributions across states and territories. ASRs indicate that people from the NT (232.7), Queensland (129.8) and the ACT (127) are most likely to be hospitalised due to any animal-related injuries, and those from SA (17.1), Queensland (16.9), and the NT (15.2) for venomous animal-related injuries (Figure 6).

**Figure 6: Age standardised rate of injury hospitalisations due to contact with animals, by state and territory, 2021-22**




Source: National Hospital Morbidity Database

Across Australia, people are about 6.6 times as likely to be hospitalised due to injury involving a non-venomous animal (72.9 per 100,000) as they were from a venomous animal (11.1 per 100,000), however states and territories varied widely, with this risk ranging from 14.4 times in the ACT to 3.4 times in SA (Figure 6).

## References


Australian Venomous Injury Project. (2023). "Australian Venomous Injury Project - external site opens in new window." Accessed 30/10/23, 2023.

Welton, R. E., D. J. Williams and D. Liew (2017). "Injury trends from envenoming in Australia, 2000–2013." Internal Medicine Journal 47(2): 170-176.

# Types of animals

Of hospitalised injury cases due to contact with animals, 53% were due to common pets (cats and dogs), 21% due to livestock, 22% to wildlife and under 3% due to marine animals (Figure 7). Over 80% of injuries were caused by non-venomous animals (Table 3). In about 2% of cases the type of animal associated with the injury was not specified.

**Total contact with animals**

- 23,379 cases
- 100% of total contact with animals
- 4.3% of total injuries in Australia
- 90.4 cases per 100,000 people

**Bitten or struck by dog**

- 9,542 cases or 36.9 per 100,000 persons
- 40% of total contact with animals
- 1.8% of total injury hospitalisations

**Bitten or struck by other mammals**

- 4,924 cases or 19 per 100,000 persons
- 21.1% of total contact with animals
- 0.9% of total injury hospitalisations

**Animal-rider or occupant of animal-drawn vehicle injured in transport**

- 3,226 cases or 12.5 per 100,000 persons
- 13.8% of total contact with animals
- 0.6% of total injury hospitalisations

**Bitten or crushed by other reptiles**

- 1,829 cases or 7.1 per 100,000 persons
- 7.8% of total contact with animals
- Under 1% of total injury hospitalisations

**Contact with allergens, allergy to animals**

- 1,176 cases or 4.5 per 100,000 persons
- 5% of total contact with animals
- Under 1% of total injury hospitalisations

**Bitten or stung by nonvenomous insect and other nonvenomous arthropods**

- 544 cases or 2.1 per 100,000 persons
- 2.3% of total contact with animals
- Under 1% of total injury hospitalisations

**Contact with venomous snakes and lizards**

- 539 cases or 2.1 per 100,000 persons
- 2.3% of total contact with animals
- Under 1% of total injury hospitalisations

**Contact with spiders**

- 474 cases or 1.8 per 100,000 people
- 2% of total contact with animals
- Under 1% of total injury hospitalisations

**Contact with venomous marine animals**

- 302 cases or 1.2 per 100,00 persons
- 1.3% of total contact with animals
- Under 1% of total injury hospitalisations

**Contact with other venomous arthropods**

- 280 cases or 1.1 per 100,000 persons
- 1.2% of total contact with animals
- Under 1% of total injury hospitalisations

**Contact with marine animal**

- 223 cases or 1.1 per 100,000 persons
- 1.2% of total contact with animals
- Under 1% of total injury hospitalisations

**Contact with hornets, wasps and bees**

- 201 cases or 0.8 per 100,000 persons
- Under 1% each of total contact with animals and total injury hospitalisations

**Contact with birds**

- 52 cases or 0.2 per 100,000 persons
- Under 1% each of total contact with animals and total injury hospitalisations

**Bitten or struck by crocodile or alligator**

- 26 cases or 0.1 per 100,000 persons
- Under 1% each of total contact with animals and total injury hospitalisations

**Bitten by rat**

- 22 cases or under 1 per 100,000 persons
- Under 1% each of total contact with animals and total injury hospitalisations

**Contact with other specified venomous animals**

- 11 cases or under 1 per 100,000 persons
- Under 1% each of total contact with animals and total injury hospitalisations

**Contact with centipedes and venomous tropical millipedes**

- 5 cases

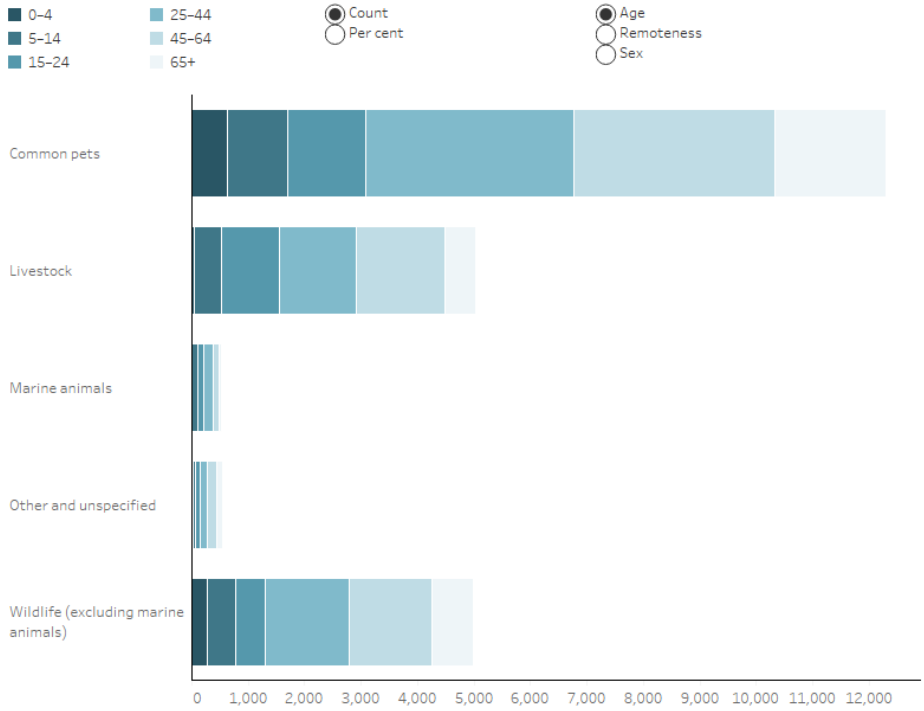
**Contact with scorpions**

- 3 cases

The number and percent of cases by animal type varied by gender, with more females being injured by common pets and livestock. More adults were injured across animal types than were children, and the majority were from major cities of inner regional areas (Figure 7).

**Figure 7: Number and percent of injury hospitalisations by type of animal, sex, age group and remoteness, 2021-22**

Interactive bar graphs displaying number and percent of injury hospitalisations by age, remoteness and sex.




Source:
AIHW National Hospital Morbidity Database (NHMD).
https://www.aihw.gov.au/about-our-data/our-data-collections/national-hospitals-data-collection

Rates of injury hospitalisation varied by the type of animal involved, with females having higher rates of injury from domestic animals and males more commonly injured by wildlife or marine animals. 45–64-year-olds had the highest rates overall apart from livestock and marine animal related injury hospitalisations, where rates were higher for 15–24-year-olds. Rates of injury hospitalisations increased with remoteness for all animal types except pets, where they peaked in remote regions as opposed to very remote regions (Table 4.1-4.3).

Table 4.1: Crude rate (per 100,000 persons) of injury hospitalisations due to contact with animals by animal category and sex, Australia, 2021–22

| Sex | Common pets | Livestock | Wildlife (excluding marine animals) | Marine animals | Other and unspecified | Total |
|---|---|---|---|---|---|---|
| **Male** | 42.4 | 12.6 | 23.6 | 2.8 | 2.2 | **83.6** |
| **Female** | 52.6 | 26.3 | 15 | 1.3 | 2 | **97.1** |
| **Persons** | 47.5 | 19.5 | 19.3 | 2 | 2.1 | **90.4** |

Source: National Hospital Morbidity Database (NHMD)

Table 4.2: Crude rate (per 100,000 persons) of injury hospitalisations due to contact with animals by animal category and age group, Australia, 2021–22

| Age group | Common pets | Livestock | Wildlife (excluding marine animals) | Marine animals | Other and unspecified | Total |
|---|---|---|---|---|---|---|
| **0–4** | 41.8 | 3 | 18.7 | 0.5 | 1.7 | **65.7** |
| **5–14** | 33 | 14.8 | 15.1 | 3 | 1.2 | **67.1** |
| **15–24** | 43.9 | 32.3 | 16.8 | 3.4 | 2.8 | **99.3** |
| **25–44** | 50.4 | 18.9 | 20.4 | 2.2 | 1.7 | **93.5** |
| **45–64** | 56.8 | 24.9 | 23.4 | 1.9 | 2.6 | **109.6** |
| **65+** | 44.8 | 12.5 | 16.6 | 0.9 | 2.6 | **77.3** |

Source: National Hospital Morbidity Database (NHMD)

Table 4.3: Crude rate (per 100,000 persons) of injury hospitalisations due to contact with animals by animal category and region, Australia, 2021–22

| Region | Common pets | Livestock | Wildlife (excluding marine animals) | Marine animals | Other and unspecified | Total |
|---|---|---|---|---|---|---|
| **Major city** | 44.7 | 8.3 | 11.6 | 1.3 | 1.3 | **67.2** |
| **Inner regional** | 53.8 | 44.7 | 31.3 | 1.8 | 4.1 | **135.7** |
| **Outer regional** | 50.5 | 48.1 | 47.6 | 5.7 | 4.1 | **156.1** |
| **Remote** | 71.1 | 73.8 | 65.8 | 14.3 | 4.3 | **229.4** |
| **Very remote** | 64.8 | 91.9 | 80.6 | 13.8 | 7.7 | **258.8** |

Source: National Hospital Morbidity Database (NHMD)

### Figure 8: Activity and place of injury by animal type, 2021-22

Interactive heatmap displaying the number of injury hospitalisations by animal type, activity at time of injury and place of occurrence. Most injuries occur in homes.

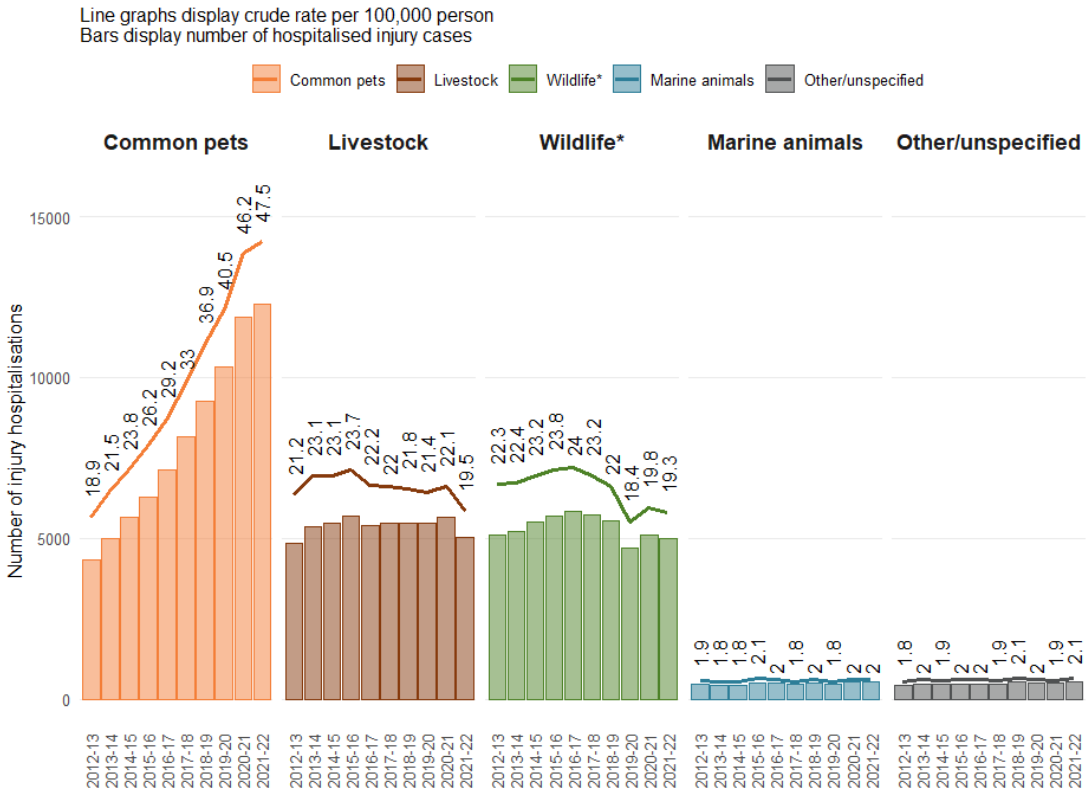

| Type | Place | Nonvenomous | | | | | Venomous | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Common pets | Livestock | Marine animals | Other and unspecified | Wildlife (excluding marine animals) | Marine animals | Other and unspecified | Wildlife (excluding marine animals) |
| Activity at time of injury | Leisure activity, not elsewhere classified | 587 | 89 | 19 | 24 | 43 | 39 | 0 | 72 |
| | Other specified activity | 865 | 88 | 8 | 16 | 16 | 4 | 0 | 84 |
| | Sport, exercise or recreational activities | 190 | 2,104 | 80 | 75 | 28 | 118 | 0 | 47 |
| | While engaged in other types of work | 294 | 222 | 6 | 25 | 83 | 2 | 1 | 278 |
| | While resting, sleeping, eating or engaging in other vital activities | 103 | 5 | 3 | 5 | 15 | 0 | 0 | 48 |
| | While working for income | 529 | 816 | 20 | 36 | 58 | 5 | 0 | 128 |
| Place of occurrence | Commercial, industrial or construction area | 174 | 32 | 4 | 4 | 11 | 1 | 0 | 39 |
| | Health service facility area | 89 | 3 | 0 | 1 | 3 | 0 | 0 | 13 |
| | Home or residential institution | 3,144 | 294 | 2 | 81 | 221 | 0 | 8 | 788 |
| | In nature | 95 | 105 | 137 | 23 | 51 | 233 | 1 | 123 |
| | Other specified area | 469 | 142 | 12 | 30 | 37 | 11 | 1 | 84 |
| | School | 7 | 7 | 0 | 3 | 13 | 0 | 0 | 25 |
| | Sports or athletic area | 12 | 540 | 0 | 37 | 4 | 1 | 0 | 25 |
| | Street or highway | 292 | 27 | 0 | 9 | 8 | 0 | 0 | 46 |

Source:
AIHW National Hospital Morbidity Database (NHMD).
https://www.aihw.gov.au/about-our-data/our-data-collections/national-hospitals-data-collection

## Trends

Over the past decade, the biggest increase in hospitalised injuries was observed where common pets were involved, with crude rates per 100,000 persons rising by about 2.5 times, from 18.9 in 2012-13 to 47.5 in 2021-22. The numbers and rates of hospitalised injuries due to common pets have been higher than those caused by the next closest category (livestock) since 2014-15. Injury hospitalisations associated with all other animal types decreased or remained static during the decade (Figure 9).

**Figure 9: Number and crude rate (per 100,000 persons) of injury hospitalisations by animal type, 2012-22**




Source: National Hospital Morbidity Database

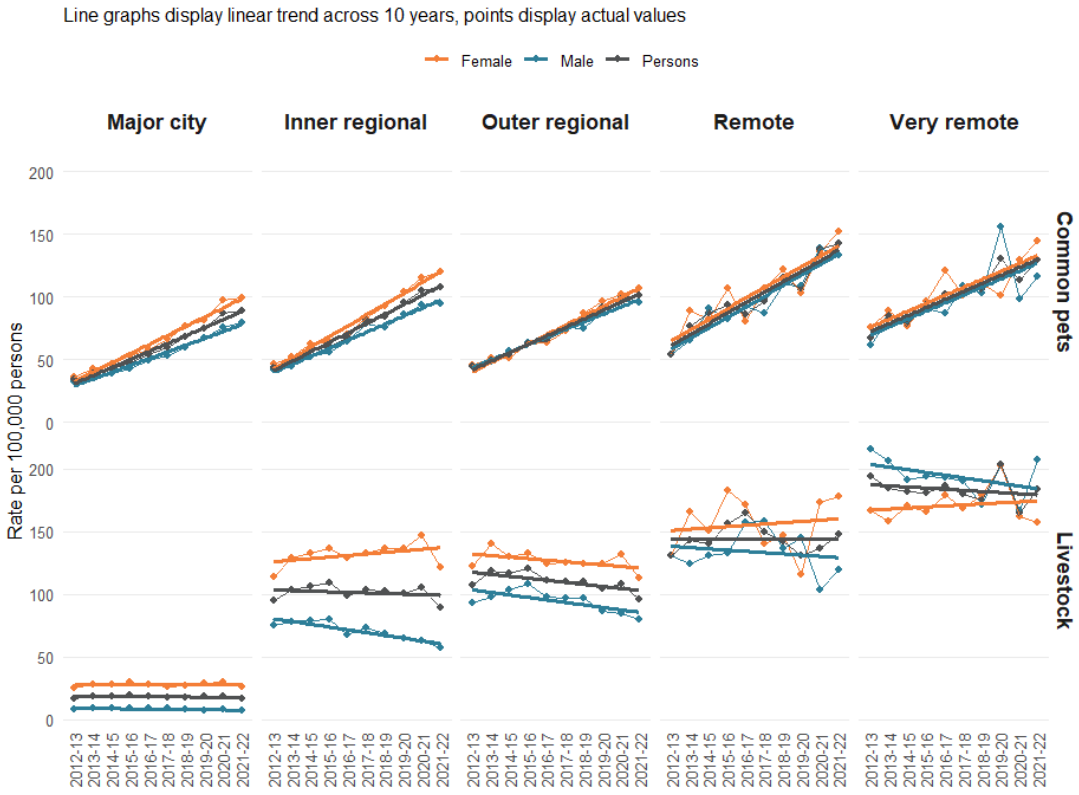
# Types of animals

This report counts cats and dogs as common pets. Over two thirds of Australian households are estimated to own a pet, so unsurprisingly common domestic pets constitute the largest proportion of animals involved in injury hospitalisations. The following groups have increased exposure to common pets (Animal Medicines Australia and Newgate Research 2022):

- women (nearly 2 in 3 pet owners are women)
- families with children (three quarters of those with children aged above 5 years and 4 out of 5 with children aged 12-17 years have pets)
- 18-24 years old (7 out of 10 have pets)
- 40-54 years old (two thirds have pets).

Two thirds of pet-related injury hospitalisations occurred from major cities (Figure 10). The rate of pet related injuries has increased over the past decade across all regions.

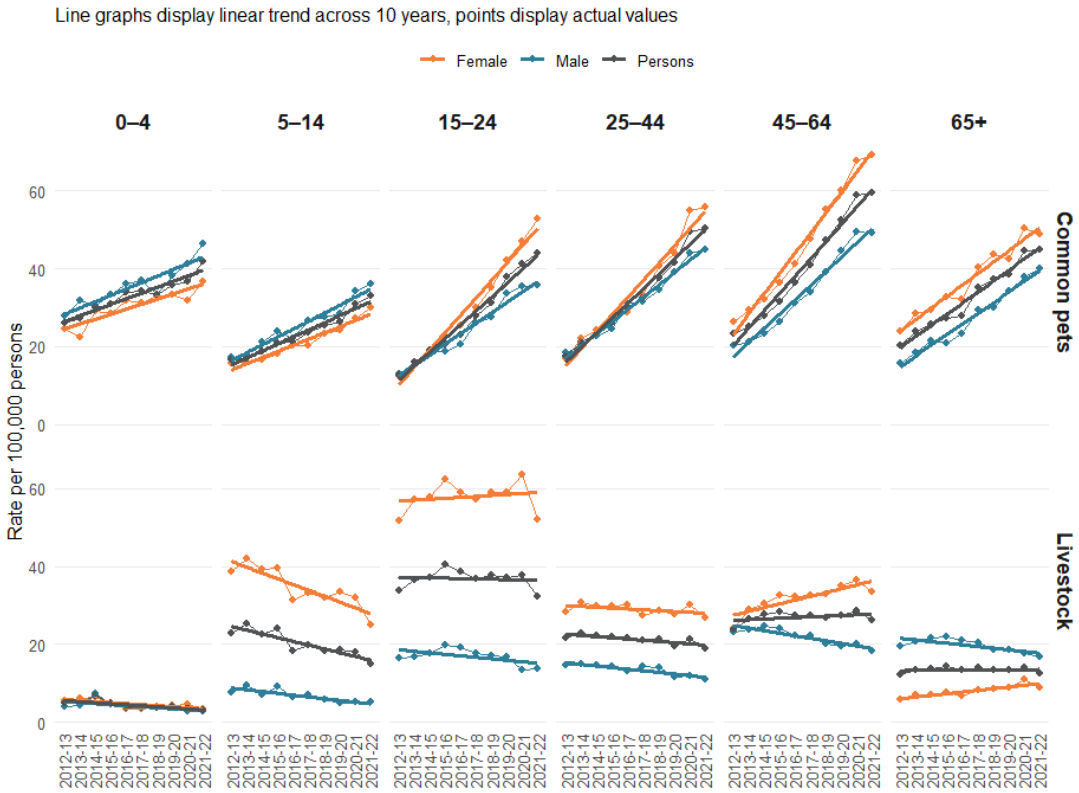
**Figure 10: Trends in crude rates of injury hospitalisations related to domestic animals by region, Australia, 2012-22**




Source: National Hospital Morbidity Database

Over half of injury hospitalisations during 2021-22 where pets were involved occurred in females (Figure 11). The age groups most frequently hospitalised were 25–64-year-olds. 0–4-year-olds hospitalised for injuries from contact with animals were most likely to have been injured by a pet, with rates of injury from common pets in this age group increasing over the decade.

**Figure 11: Trends in rates of injury hospitalisations related to domestic animals by age group, Australia, 2012-22**




Source: National Hospital Morbidity Database

## Dogs

Approximately 40% of Australian households have a dog, equating to about 5.1 million dogs (Animal Medicines Australia and Newgate Research 2022). While being bitten or struck by a dog was the most common cause of hospitalisation due to contact with animals, these injuries represented under 2% of all Australian injury hospitalisations during 2021-22. Adults aged 25-44 and 45-64 made up the majority of injury hospitalisations due to being bitten or struck by a dog (29% and 28% respectively). While only 6% of injury hospitalisations due to contact with a dog were for children aged 0-4, over half (61%) of all injury hospitalisations due to contact with animals for this age group were due to being bitten or struck by a dog.

**Figure 12: Summary statistics about 9,542 injury hospitalisations related to dogs during 2021-22**

There were 37 cases per 100,000 people in Australia, 4 in 5 injuries were open wound (7,681 cases)

1 in 4 injuries (2,384 cases) occurred in homes

Where activity was recorded, leisure contributed to about 2 in 5 injuries (551 cases)

Nearly half (4,323 cases) injured their wrist or hand.

Nearly 1 in 5 (1,987 cases) sustained a head and neck injury

Place and activity detail were often unrecorded:

- place of occurrence in 6,221 cases
- activity in 8,156 cases

For more information please refer to supplementary data tables 4 and 5.

## Trends

As expected with increased exposure to pets, numbers and rates of injury hospitalisations due to contact with dogs increased since 2012-13. Age and sex differences are outlined in Figure 13, with the highest rates in males being aged under 5 and in females aged 45-64. Across sexes and years, 0–4-year-olds were at relatively higher risk of these injuries as compared to other children or most adults.

**Figure 13: Heatmap of crude rates per 100,000 persons of injury hospitalisations due to contact with dogs by age and sex, Australia, 2012-22**

| Year | Sex | 0–4 | 5–14 | 15–24 | 25–44 | 45–64 | 65+ | Total |
|---|---|---|---|---|---|---|---|---|
| 2012–13 | Male | 27.6 | 17 | 12 | 16.2 | 16.1 | 12 | 15.9 |
| 2013–14 | | 31 | 17.3 | 14.8 | 17.4 | 16.2 | 14.6 | 17.3 |
| 2014–15 | | 30.2 | 20.8 | 17.7 | 19.8 | 18.5 | 18.2 | 19.8 |
| 2015–16 | | 32.6 | 22.7 | 17.8 | 21.9 | 20 | 16.7 | 21 |
| 2016–17 | | 35.3 | 21.3 | 19.3 | 27.5 | 25.1 | 18.1 | 24.2 |
| 2017–18 | | 36 | 26.1 | 23.9 | 27.7 | 27.5 | 23.9 | 26.9 |
| 2018–19 | | 32.6 | 26.7 | 25 | 30.3 | 32 | 23.6 | 28.7 |
| 2019–20 | | 36.7 | 27 | 31.3 | 34.6 | 35.6 | 26.7 | 32.3 |
| 2020–21 | | 40.2 | 32.6 | 32.6 | 37.5 | 38.6 | 28.7 | 35.3 |
| 2021-22 | | 44.8 | 34.6 | 32.5 | 38.5 | 39.3 | 30.9 | 36.6 |
| 2012–13 | Female | 22.7 | 14.8 | 9.4 | 12.1 | 17.8 | 16.3 | 14.8 |
| 2013–14 | | 21.6 | 14.7 | 12.6 | 14.8 | 19.4 | 19.4 | 16.8 |
| 2014–15 | | 28 | 15.6 | 13.8 | 16.5 | 21.8 | 18.7 | 18.4 |
| 2015–16 | | 27.3 | 17.2 | 16.6 | 19.8 | 24.8 | 22.7 | 21.3 |
| 2016–17 | | 31.3 | 18.9 | 19.6 | 21.3 | 26.9 | 22 | 22.9 |
| 2017–18 | | 29.5 | 18.7 | 23.5 | 23.8 | 32.1 | 26.8 | 26 |
| 2018–19 | | 31.7 | 22 | 27.5 | 29.4 | 36.6 | 28.9 | 30.1 |
| 2019–20 | | 31.5 | 21.5 | 31.4 | 30.1 | 38.4 | 26.6 | 30.7 |
| 2020–21 | | 30.8 | 24 | 37 | 37.7 | 41.7 | 31.4 | 35.4 |
| 2021-22 | | 34.6 | 27.2 | 38.2 | 38.1 | 45.8 | 31.1 | 37.2 |
| 2012–13 | Persons | 25.2 | 15.9 | 10.7 | 14.2 | 16.9 | 14.3 | 15.4 |
| 2013–14 | | 26.4 | 16 | 13.7 | 16.1 | 17.8 | 17.2 | 17 |
| 2014–15 | | 29.2 | 18.3 | 15.8 | 18.2 | 20.2 | 18.4 | 19.1 |
| 2015–16 | | 30.1 | 20 | 17.2 | 20.9 | 22.5 | 19.9 | 21.1 |
| 2016–17 | | 33.4 | 20.1 | 19.5 | 24.4 | 26 | 20.1 | 23.5 |
| 2017–18 | | 32.8 | 22.5 | 23.7 | 25.8 | 29.8 | 25.4 | 26.5 |
| 2018–19 | | 32.1 | 24.4 | 26.2 | 29.8 | 34.3 | 26.4 | 29.4 |
| 2019–20 | | 34.2 | 24.3 | 31.3 | 32.3 | 37 | 26.6 | 31.5 |
| 2020–21 | | 35.7 | 28.4 | 34.8 | 37.6 | 40.2 | 30.1 | 35.4 |
| 2021-22 | | 39.8 | 31 | 35.3 | 38.3 | 42.6 | 31 | 36.9 |

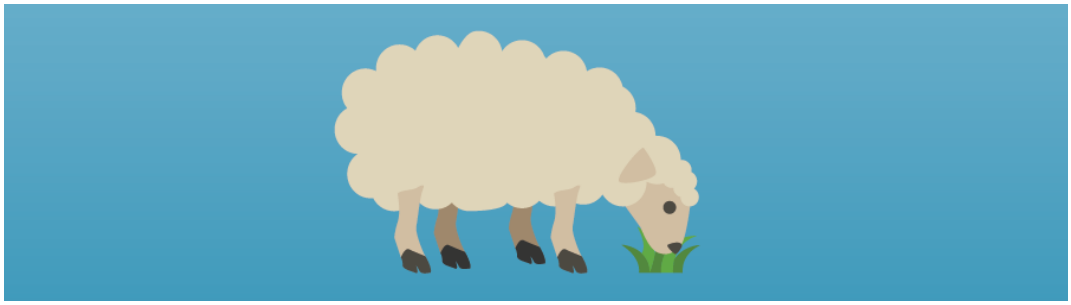
Source: National Hospital Morbidity Database

## References

Animal Medicines Australia and Newgate Research (2022). Pets in Australia: A national survey of pets and people**:** 1-50

# Types of animals

**Figure 14: Summary statistics about 5,032 injury hospitalisations related to livestock during 2021-22**



In 2021-22, 5,032 hospitalised injuries (22% or 19.5 per 100,000) were due to livestock.

Females were injured over twice as often as males (26 and 13 per 100,000, respectively)

15–24-year-olds had the highest rates of injury at 32.3 per 100,000

Engaged in sport, exercise or recreational activity (2,104 or about 2 in 3 cases)

2,053 (41%) lived in inner regional areas

1,117 (22%) were hospitalised after being bitten or struck by a horse, 639 (13%) by cows and 153 (3%) by sheep

Livestock related injuries increased with remoteness and remained relatively stable or decreased slightly over the decade, with the lowest rates of livestock related injuries occurring in major cities (Figure 10). Over the decade, livestock injuries among children have decreased while among adults they have remained generally stable (Figure 11). Most injuries occurred during sporting activity or while working (Figure 8).

# Types of animals

## Wildlife

In 2021-22, wildlife (excluding marine animals) caused 4,980 injury hospitalisations (21%or 19.3 per 100,000)

2,394 (48%) were related to reptiles, 539 (11%) being venomous snakes or lizards

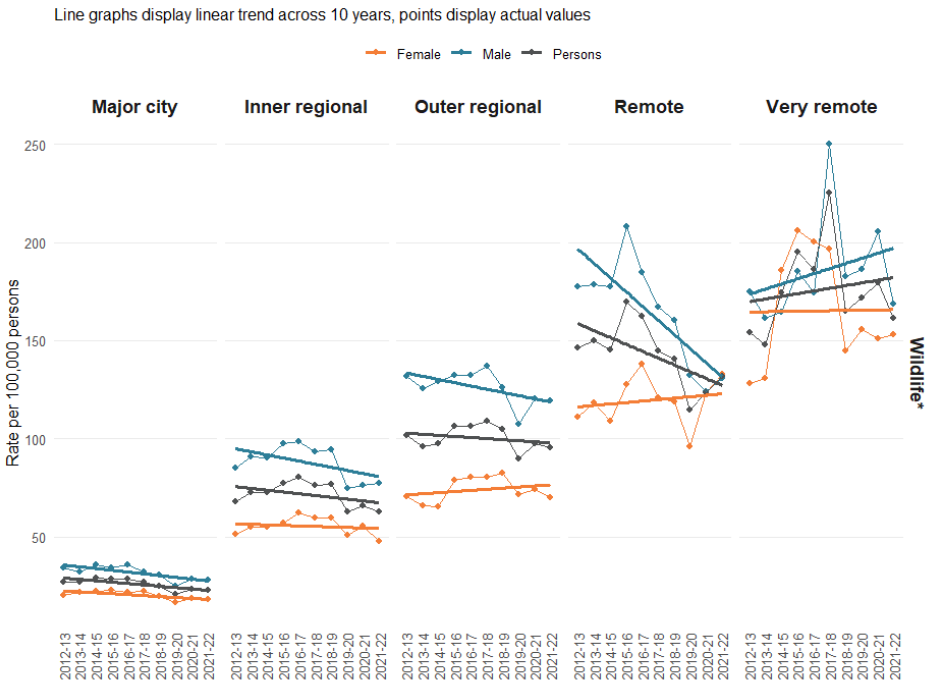
Insects and arthropods were associated with 1,504 (30%), including 474 (10%) from spiders

Males were injured more than females (24 and 15 per 100,000 respectively)

Homes were the most frequently recorded place of injury (1,009 cases, 20%)

Wildlife-related injury hospitalisations have been decreasing since 2012 across all ages, and sexes and regions (Figure 15). Rates of these injuries are highest among males and in very remote regions (Table 4). Injuries frequently occur at home and during work activity (Figure 8). For more information, please refer to supplementary data table 3.

**Figure 15: Crude rates of injury hospitalisations related to wildlife, by region, Australia, 2012-22**




Notes:

* Excluding marine animals, including venomous wildlife

For each region, crude rates along the y-axis are calculated using the total estimated regional population as denominators.

Source: National Hospital Morbidity Database

## Venomous animals

In 2021-22 venomous animals contributed to less than 1% of all cause injury hospitalisations across Australia. The number of injury hospitalisations due to venomous animals decreased to 2,867 in 2021-22 from 3,520 in 2017-18. Published research indicated 39,619 hospitalised injuries due to venomous animals over the 11 years between August 2001 and May 2013, an average of about 3,600 cases a year (Welton, Williams et al. 2017).

In 2021-22, the crude rate of injury hospitalisations due to venomous animals was 11.1 per 100,000, as compared to 72.8 per 100,000 for non-venomous animals. In 2017-18 this rate was 14.2 per 100,000 people (AIHW 2021). For more information, please refer to supplementary data tables 6 and 7.

**Figure 16: The top 5 ranked causes of the 2,867 injury hospitalisations caused by venomous animals, 2021-22**

Bee allergies caused 1,072 cases (4.1 per 100,00 or 37%). A further 201 cases were hospitalised due to contact with hornets, wasps or bees.

Venomous snakes and lizards caused 539 hospitalisations (201 per 100,000 or 19%). Brown snakes were most commonly identified (200 cases) while the snake was unspecified in 190 cases.

Spiders caused 455 injury hospitalisations (1.8 per 100,00 or 16%). Most were unspecified (277 cases), followed by redbacks (111 cases) and funnel web spiders (39 cases).

280 injury hospitalisations (1.1 per 10,000 or 10%) were due to venomous arthropods, the majority being ticks (116 cases) and venomous ants (84 cases).

121 hospitalisations were due to contact with jellyfish (0.5 per 100,000 or 4%) of which 91 were due to irukandji.

Of the 2,867 injuries from venomous animals, more than 60% of hospitalised cases were males (1,782 cases, 13.9 per 100,000). Most cases were adults with the highest rate being 14.4 per 100,000 among 45–64-year-olds. For more information, please refer to supplementary data table 6.

More than 50% of incidents (1,468 cases) did not have place of occurrence specified, but where it was, most venomous injuries occurred in homes (796 cases or 27%, of which 788 cases were caused by wildlife). Likewise, most incidents did not have a specific activity noted (2,041 cases or 71%) but where it was, work was the most frequent activity being undertaken during these incidents (414 cases or 14%). In two thirds of these cases (281 cases) the affected person was engaged in work that may not be associated with an income (for example, caring roles at home) (Figure 8). For more information, please refer to supplementary data table 8.

## Trends

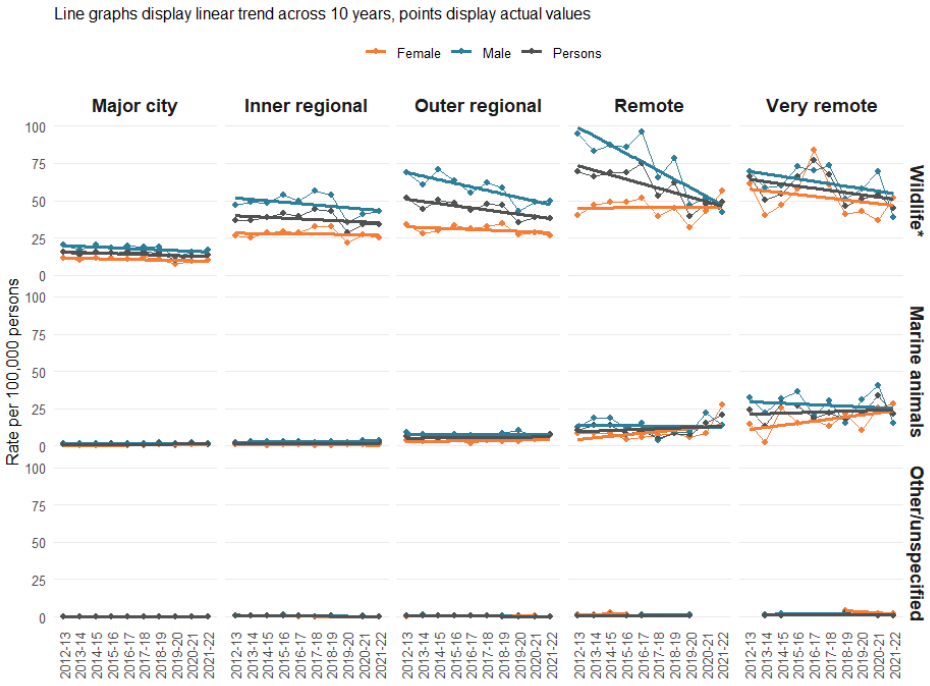
Injury hospitalisations associated with all venomous animals have remained relatively stable across Australia since 2012-13. 45–64-year-olds remain the most likely age group to be hospitalised for these injuries (Figure 17). Rates of hospitalisation increased with remoteness (Figure 18). Those associated with venomous wildlife have decreased across all age groups and regions (Figure 18). For more information, please refer to supplementary data table 2.

### Figure 17: Heatmap of crude rate (per 100,000) of injury hospitalisations due to contact with venomous animals by age, Australia, 2012–13 to 2021–22

| | Crude rate (per 100,000 persons) | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | 0–4 | 5–14 | 15–24 | 25–44 | 45–64 | 65+ | Total |
| 2012–13 | 8.1 | 11.4 | 13.8 | 14.7 | 15 | 10.8 | **13.3** |
| 2013–14 | 7.8 | 10 | 11.2 | 13.8 | 14 | 9.8 | **12.1** |
| 2014–15 | 6.6 | 11.4 | 11.9 | 14 | 16.1 | 12.5 | **13.2** |
| 2015–16 | 7.7 | 11.3 | 11.9 | 13.7 | 16.5 | 11.9 | **13.2** |
| 2016–17 | 7.7 | 10.4 | 11.4 | 13 | 16.1 | 11.9 | **12.7** |
| 2017–18 | 9.5 | 10.3 | 10.7 | 13.2 | 17.2 | 12.3 | **13.1** |
| 2018–19 | 7.7 | 9.5 | 11.3 | 13.1 | 16.6 | 13.4 | **13** |
| 2019–20 | 6.9 | 6.3 | 8 | 9.7 | 11.3 | 8.6 | **9.1** |
| 2020–21 | 6.1 | 8.2 | 8.7 | 11.9 | 14.3 | 10.1 | **11** |
| 2021-22 | 5.6 | 8.7 | 9.9 | 11.6 | 14.2 | 10.2 | **11.1** |

Source: National Hospital Morbidity Database

### Figure 18: Venomous animal related rates of injury hospitalisations, by region and venomous animal type, Australia, 2012-22




Notes:

* Excluding marine animals. Wildlife here represents only venomous wildlife.

For each region, crude rates along the y-axis are calculated using the total estimated regional population as denominators.

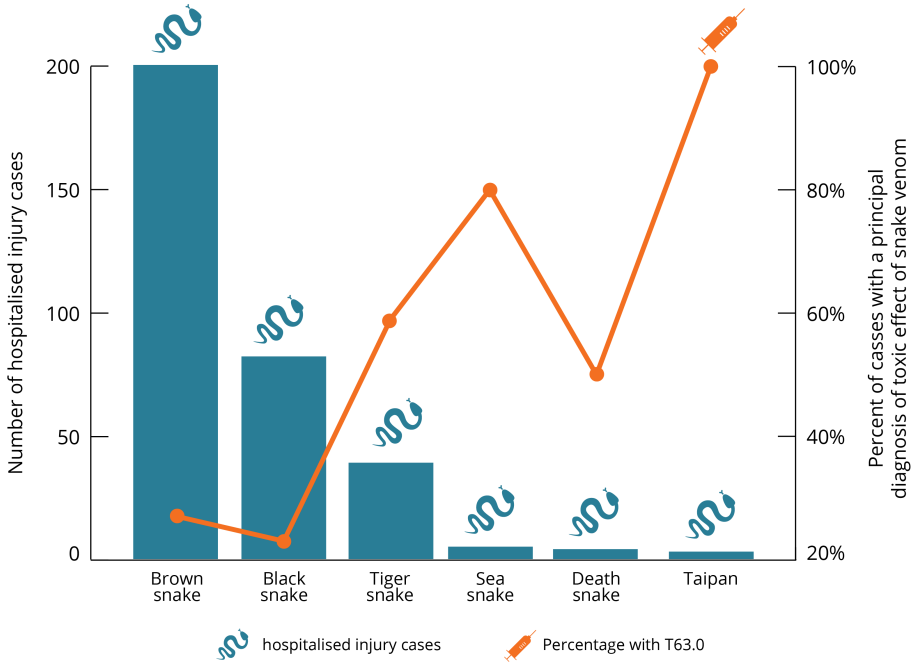
Source: National Hospital Morbidity Database

Envenomation is described further under Types of injuries and Envenomation and antivenom.

### Snakes

Snake bite envenomation (where exposure to a poison or toxin is from an animal's bite) is uncommon (Braitberg, Nimorakiotakis et al. 2021), with a total of 535 hospitalisations during 2021-22 of which 165 had a primary diagnosis of toxic effect of snake venom (T63.0) recorded. The relationship between cases, species and whether toxic effects of venom occur is complex, with the commonest species causing the most injuries having the lowest recorded proportions of hospitalisation due to toxic effects of venom (Figure 19).

**Figure 19: Snake bite injury hospitalisations by species and whether a principal diagnosis of toxic effect of venom (T63.0) was recorded, 2021-22**




Source: National Hospital Morbidity Database

For more information, please refer to supplementary data table 7.

Data from the Australian Snakebite Project 2005-2015 - external site opens in new window indicates nearly half of snake bites occurred when people were unknowingly active around a snake with a further 15% occurring when people attempt to catch or kill snakes (Johnston, Ryan et al. 2017).

### References

AIHW (2021). Venomous bites and stings 2017–18. AIHW. Canberra, Australian Institute of Health and Welfare

Braitberg, G., V. Nimorakiotakis, C. Y. L. Yap, V. Mukaro, R. Welton, A. Parker, J. Knott and D. Story (2021). "The Snake Study: Survey of National Attitudes and Knowledge in Envenomation." Toxins (Basel) 13(7).

Johnston, C. I., N. M. Ryan, C. B. Page, N. A. Buckley, S. G. Brown, M. A. O'Leary and G. K. Isbister (2017). 'The Australian Snakebite Project, 2005–2015 (ASP-20).' Medical Journal of Australia 207(3): 119-125.

Welton, R. E., D. J. Williams and D. Liew (2017). 'Injury trends from envenoming in Australia, 2000–2013.' Internal Medicine Journal 47(2): 170-176.

# Types of animals

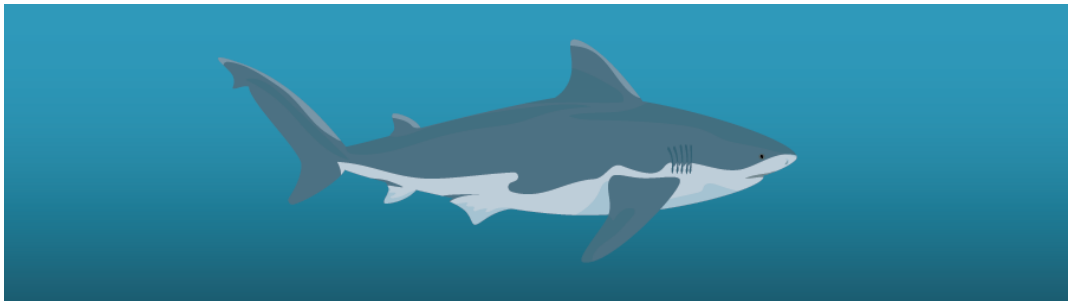
Injuries from marine animals have been described as seasonal but rarely serious, most frequently occurring in summer during leisure activities (Taylor, Ashby et al. 2002). During 2021-22, 525 cases were hospitalised due to contact with marine animals (in 302 of these cases or 58%, the animals were venomous), a crude rate of 2.2 per 100,000 people. 69% of these cases were male and 30% aged 24-44 years. For more information, please refer to supplementary data table 2.

## Sharks

Increases in shark attacks reflect increased human population access to coastlines, including in previously isolated areas (West 2011), but relative to the human population the number of shark attacks remains extremely low (International Shark Attack File and Gavin Naylor 2022). Australia has the second highest number of recorded shark bites globally, with an average of 22 bites a year from 2010-22 (Riley, Meagher et al. 2022).

Between 2000 and 2022, 466 shark attacks occurred across Australian waters, with 372 of these happening in coastal areas.

**Figure 20: Shark attacks on humans across Australia between 2000 and 2022**



Boarding, swimming and spearfishing were the three most common activities undertaken during attacks (42%,12% and 9% respectively)

Most attacks occurred in coastal areas along Australia's east and south-eastern seaboard, which is where the largest populations live

Tiger, bull and white sharks were the most frequently identified species

38% of all tiger shark bites result in fatality, followed by 32% of all bull shark and 25% of all white shark bites

12% of attacks were preceded by people enticing, touching or hurting sharks

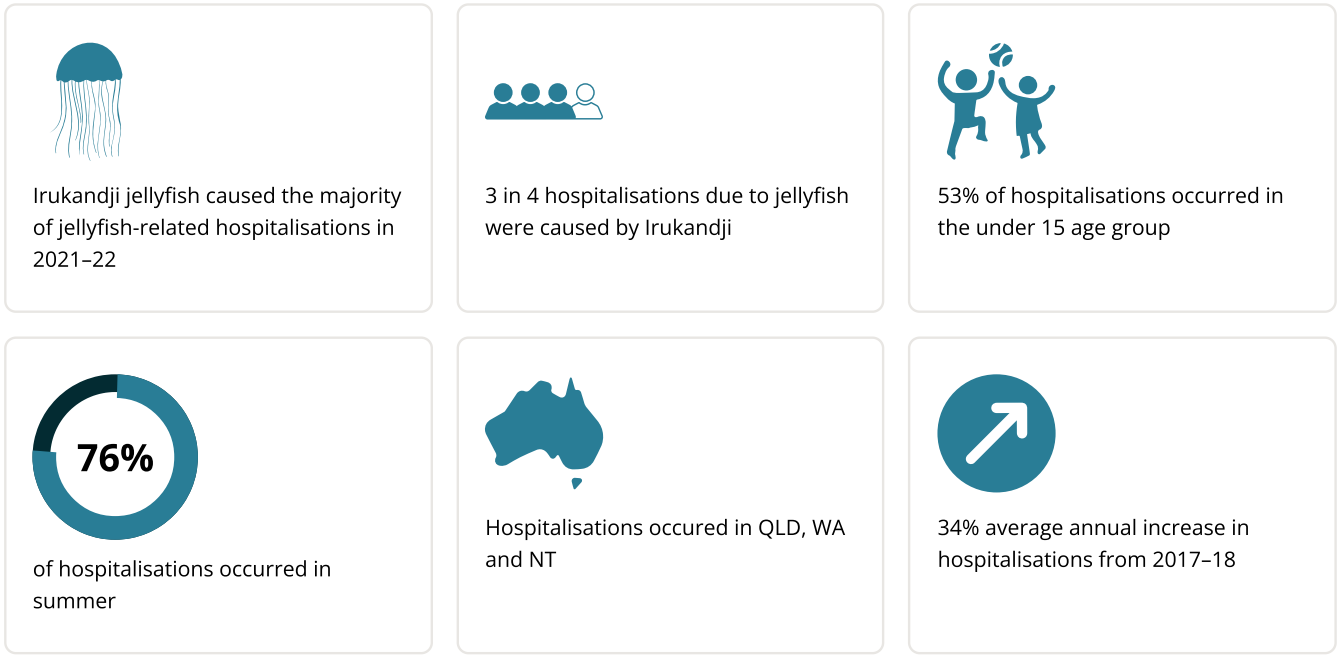
Source: The Australian Shark-Incident Database for quantifying temporal and spatial patterns of shark-human conflict - external site opens in new window (Riley, Meagher et al. 2022)

Relatively few injuries result in death. Of 1,196 attacks recorded in the Australian Shark-Incident Database, 250 (21%) resulted in fatalities and 723(60%) in non-fatal injuries. The highest proportion of fatalities were recorded for bites involving the torso (Riley, Meagher et al. 2022).

## Jellyfish

Irukandji jellyfish stings can cause a syndrome involving intense pain, and in severe cases, death. Research indicates a lengthening Irukandji season in northern Queensland (Carrette and Seymour 2013). 91 hospitalisations during 2021-22 were due to Irukandji (0.4 per 100,000 persons) and there has been a 34% average annual increase in these hospitalisations since 2017-18 (Figure 16, Figure 21).

**Figure 21: 2021-22 summary of Irukandji related hospitalisations**




Source: National Hospital Morbidity Database

For more information, please refer to supplementary data table 2.

### References

Carrette, T. J. and J. J. Seymour (2013). 'Long-term analysis of Irukandji stings in Far North Queensland.' Diving and hyperbaric medicine 43(1): 9-15.

International Shark Attack File and Gavin Naylor (2022). The ISAF 2022 shark attack report. International Shark Attack File: Yearly Worldwide Shark Attack Summary. Florida Museum of Natural History. Florida, University of Florida.

Meagher, P., C. Bradshaw, C. Huveneers, V. Peddemors and D. Slip (2022). Australian Shark Incident Database. Taronga Conservation Society Australia, Flinders University and New South Wales Department of Primary Industries.

Riley, M., P. Meagher, C. Huveneers, J. Leto, V. M. Peddemors, D. Slip, J. West and C. J. A. Bradshaw (2022). 'The Australian Shark-Incident Database for quantifying temporal and spatial patterns of shark-human conflict.' Scientific Data 9(1): 378.

Taylor, D. M., K. Ashby and K. D. Winkel (2002). 'An Analysis of Marine Animal Injuries Presenting to Emergency Departments in Victoria, Australia.' Wilderness & Environmental Medicine 13(2): 106-112.

West, J. G. (2011). 'Changing patterns of shark attacks in Australian waters.' Marine and Freshwater Research 62: 744-754.

# Types of injuries

The most frequent type of injuries caused by contact with animals were open wounds (13,419 cases, 57%) followed by fractures, toxic effects and superficial and soft tissue injuries. The body parts most commonly injured were the upper limbs (nearly half of these injuries) and head and neck (Figure 22).

No observable differences were noted by sex, however, by age group:

- nearly 3 out of 5 open wounds were in people aged 25-64 (7,806 cases,58%)
- of the 6,019 open wounds to the wrist or hand (45%), about a third were in each age group 25-44 and 45-64 years
- children presented with the highest proportions of open wounds to the head and neck. The highest proportion of open wounds to the head and neck was among 5–14-year-olds (593 cases, 29%) with 0-4-year-olds being second highest (482 cases, 23%)

Fractures were most frequently upper limb in people aged under 25, and the trunk in people aged 25 and over. For more information, please refer to supplementary data table 9.

### Figure 22: Type and body part of injury by age and sex, 2021-22

An interactive heatmap displaying the number and percent of injury hospitalisations by type and body part of injury. Body part injured can be further displayed by age and sex.

(●) Type ( ) Age ( ) Sex  (●) Cases ( ) Per cent  0 — 4,000

| Body part | Fracture | Open wound | Poisoning or toxic effect | Soft-tissue injury | Superficial injury | Total |
|---|---|---|---|---|---|---|
| Ankle and foot | 92 | 1,511 | 0 | 43 | 126 | 1,824 |
| Head and neck | 263 | 2,064 | 0 | 81 | 157 | 3,385 |
| Hip and lower limb (excluding ankle and foot) | 742 | 1,891 | 0 | 202 | 360 | 3,347 |
| Injuries not described in terms of body location | 0 | 0 | 2,293 | 0 | 0 | 2,311 |
| Other, multiple and incompletely specified body regions | 0 | 4 | 0 | 0 | 1 | 5 |
| Shoulder and upper limb (excluding wrist and hand) | 885 | 1,786 | 0 | 237 | 134 | 3,177 |
| Trunk (thorax, abdomen, lower back, lumbar spine & pelvis) | 896 | 144 | 0 | 54 | 215 | 1,809 |
| Wrist and hand | 569 | 6,019 | 0 | 446 | 189 | 7,521 |
| Total | 3,447 | 13,419 | 2,293 | 1,063 | 1,182 | 23,379 |

Notes:
1. Only the top 5 injury types are presented in this table.
2. Injuries to 'Other, multiple and incompletely specified body regions' have been removed from this table due to counts <5.
Source:
AIHW National Hospital Morbidity Database (NHMD).
https://www.aihw.gov.au/about-our-data/our-data-collections/national-hospitals-data-collection

## Head and neck injuries

In 2021-22 there were 3,385 cases of head and neck injuries, about 14% of injury hospitalisations due to contact with animals. 57% of these cases were females, 16% were aged 0-4 and 23% 5-14 years old.

While 68% of these head and neck injury cases were hospitalised with open wounds, soft tissue or superficial injuries, about 14% (485 cases) suffered intracranial injuries, which can have severe and long-lasting consequences. Nearly three quarters were female and about 1 in 4 intracranial injury cases were aged in each age group of 15-24, 25-44 and 45-64 years.

Ten-year trends indicate increasing head and neck injuries, with children under 5 years of age continuing to be at higher risk of injuries to the head and neck than any other age group (Figure 23).

**Figure 23: Heatmap of crude rate per 100,000 persons of head and neck injury hospitalisations due to contact with animals by age, Australia, 2012-22**

| Year | 0–4 | 5–14 | 15–24 | 25–44 | 45–64 | 65+ | Total |
|---|---|---|---|---|---|---|---|
| 2012–13 | 27.2 | 18 | 13.2 | 7.5 | 7 | 4.1 | 10.3 |
| 2013–14 | 26.9 | 19 | 15 | 8 | 7.5 | 5.1 | 11 |
| 2014–15 | 32.2 | 18.1 | 15.6 | 8.5 | 7.8 | 4.5 | 11.4 |
| 2015–16 | 29.4 | 20.4 | 18.1 | 8.5 | 8.7 | 4.5 | 12 |
| 2016–17 | 34.7 | 19.8 | 17.7 | 9.3 | 8.2 | 5.2 | 12.5 |
| 2017–18 | 33.5 | 21.1 | 17.8 | 8.9 | 8.6 | 4.7 | 12.4 |
| 2018–19 | 31.9 | 20.9 | 17.2 | 10.8 | 7.9 | 5.2 | 12.6 |
| 2019–20 | 34.1 | 20.2 | 19 | 9.8 | 8.8 | 4.1 | 12.6 |
| 2020–21 | 34.2 | 24.5 | 19.9 | 10.7 | 9.7 | 4.3 | 13.6 |
| 2021-22 | 36.7 | 24.4 | 17.9 | 10.1 | 9.1 | 4 | 13.1 |

Source: National Hospital Morbidity Database

## Allergies

In 2021-22 there were 1,176 injury hospitalisations due to contact with animal allergens, a crude rate of 4.6 per 100,000 persons (Table 5). Males were nearly twice as likely to be hospitalised as females for this reason (5.9 and 3.2 per 100,000 comparatively). In general, the rate of hospitalisation increased with increasing age, with rates being the most similar by sex for the 15-24 age group. In all other age groups, male crude rates were at least 1.7 times that of females. Bees were the main named animal these allergies were associated with (1,072 cases or 91%, a crude rate of 4.1 cases per 100,000 people) and almost all cases were emergency admissions.

Table 7.1: Number and crude rate (per 100,000 persons) of injury hospitalisations due to contact with animal allergens by sex and age, Australia, 2021–22

| Age group | Cases: Male | Cases: Female | Cases: Persons | Crude Rate: Male | Crude Rate: Female | Crude Rate: Persons |
|---|---|---|---|---|---|---|
| **0–4** | 26 | 5 | 31 | 3.3 | 0.7 | 2.1 |
| **5–14** | 72 | 37 | 109 | 4.3 | 2.3 | 3.4 |
| **15–24** | 49 | 50 | 99 | 3 | 3.3 | 3.2 |
| **25–44** | 211 | 128 | 339 | 5.8 | 3.5 | 4.6 |
| **45–64** | 277 | 129 | 406 | 9 | 4 | 6.5 |
| **65+** | 122 | 70 | 192 | 6 | 3 | 4.4 |
| **Total** | 757 | 419 | 1,176 | 5.9 | 3.2 | 4.5 |

Source: National Hospital Morbidity Database

Table 7.2: Number and crude rate (per 100,000 persons) of injury hospitalisations due to contact with animal allergens by region, Australia, 2021–22

| Remoteness | Cases: Male | Cases: Female | Cases: Persons | Crude Rate: Male | Crude Rate: Female | Crude Rate: Persons |
|---|---|---|---|---|---|---|
| **Major city** | 401 | 240 | 641 | 4.3 | 2.5 | 3.4 |
| **Inner regional** | 230 | 133 | 363 | 10.1 | 5.7 | 7.9 |
| **Outer regional** | 106 | 30 | 136 | 10 | 2.9 | 6.5 |
| **Remote** | 16 | 14 | 30 | 10.2 | 9.7 | 10 |
| **Very remote** | 2 | 1 | 3 | 1.9 | 1.1 | 1.5 |
| **Total** | 757 | 419 | 1,176 | 5.9 | 3.2 | 4.5 |

Source: National Hospital Morbidity Database

For more information, please refer to supplementary data table 10.

## Poisoning toxic effects and envenomation

Poisoning is when exposure to a toxic substance (through any route, such as absorption or ingestion) adversely affects health. Envenomation is when the exposure to a poison or toxin is from an animal's bite or sting.

Of the 2,867 injury hospitalisations due to venomous animals in 2021-22, there were 2,293 cases hospitalised with poisoning or toxic effects (including envenomation), representing about 10% of all injury hospitalisations due to contact with animals. This is down from 3,520 cases of venomous bites and stings reported in 2017-18 (AIHW 2021), and about 3,100 cases per year between 2001 and 2013 (Welton, Williams et al. 2017). Just over 75% of cases with contact with venomous animals experienced a poisonous or toxic effect, making it the most common type of injury from contact with venomous animals. The next commonest type of injury was open wounds (about 20% of cases).

These injuries were not described in terms of body location. 3 in 5 (1,403) cases were male and a third (727 cases) aged 45-64 years, similar to previously published patterns (Australian Venomous Injury Project 2023). About 10% were aged 5-14 or 15-24 years and 3% were under 5 years old (Figure 22).

Table 8: Number of injury hospitalisations with a principal diagnosis of toxic effect of contact with venomous animals, 2021-22

| Principal diagnosis (ICD10-AM code) | A: Contact with animals * (% of column A total) | B: Other external cause ** | Details of Other external cause (B) | Total (A+B) |
|---|---|---|---|---|
| Venom of other arthropods (T63.4) | 1,595 (70%) | 28 | 27 cases due to allergies (Y37.8 or Y37.9) | 1,623 |
| Venom of spider (T63.3) | 341 (15%) | 0 | | 341 |
| Snake venom (T63.0) | 167 (7%) | 1 | Immunoglobulin (biological substances causing adverse effects) (Y59.3) | 168 |
| Toxic effect of contact with fish or other marine animals (T63.5 or T63.66) | 167 (7%) | 40 | 40 cases due to contact with venomous marine animals and plants (X26.8 or X26.9) | 207 |
| Toxic effect of contact with other or unspecified venomous animals, other reptiles or scorpions (T63.8, T63.1,T63.2 or T63.9) | 22 (1%) | 12 | 11 cases due to contact with unspecified venomous animal or plant (X29) | 34 |
| **Total** | **2,292 (100%)** | **81** | | **2,373** |

Notes:

* Where the external cause of injury was recorded as contact with animals, and therefore included in the scope of this report as described in the Technical notes.

** Where the external cause of injury was not recorded as contact with animals, and therefore these cases are excluded from the scope of this report as described in the Technical notes.

Source: National Hospital Morbidity Database

Insects, snakes and spiders caused most cases (Figure 16, Table 8), congruent with previously published data (Welton, Williams et al. 2017). Hospitalisations due to the toxic effects of marine animal stings were minimal in 2021-22 (121 cases affected by jellyfish), likely reflecting both the impacts of preventive messaging on this topic and the COVID-19 pandemic (Australian Venomous Injury Project 2023). Where other external causes were recorded, the majority of these cases were excluded from the scope of this report as they may have been caused by plants or animals (51 cases, Table 8). The use of antivenom in envenomation cases is discussed in the section of this report on envenomation and antivenom.

## Superficial and soft-tissue injuries

In 2021-22 superficial and soft-tissue injuries contributed about 10% or 2,245 cases. The majority were upper (1,006 cases) or lower limb (731 cases) injuries. There were also 238 superficial or soft tissue injuries of the head and neck recorded. These injuries followed the overall pattern of increasing with age and peaking in adulthood, with a roughly even spread by sex (Figure 20).

### References

AIHW (2021). Venomous bites and stings 2017–18. AIHW. Canberra, Australian Institute of Health and Welfare

Australian Venomous Injury Project. (2023). 'Australian Venomous Injury Project - external site opens in new window.' Retrieved 30/10/23, 2023.

Welton, R. E., D. J. Williams and D. Liew (2017). 'Injury trends from envenoming in Australia, 2000–2013.' Internal Medicine Journal 47(2): 170-176.

# Severity and management

The severity of a hospitalisation may be indicated by the urgency of admission, average length of stay, time in intensive care units (ICU) or on continuous ventilatory support (CVS) and the mode of separation from hospital, including death in hospital. Table 9 describes selected severity metrics by type of animal in 2021-22.

- Over 85% of these injury cases were admitted as emergencies, rising to 97% for venomous animal related injuries. This is expected as bites by venomous animals (especially snakes) are considered potential medical emergencies requiring high priority assessment even in people who appear well (Isbister, Brown et al. 2013).
- 60-67% of hospitalisations related to contact with animals were overnight stays. In hospitalisations due to venomous animals the reverse was true with just under half of cases being overnight stays (if asymptomatic after 12 hours, cases may be discharged (Isbister, Brown et al. 2013)). The average length of stay overall was 2 days, with a shorter average of 1.5 days for injuries caused by venomous animals (Table 10). Injuries caused by contact with animals therefore spent less time overall (and by extension used less hospital resources) than most other external causes of injury, with the average length of stay across all injury hospitalisations being 4.7 days (Injury in Australia, Data table A13).
- About 7% of cases overall were transferred to a second acute-care hospital (for venomous animals this was lower at 4% of cases). Regardless of venomousness, 2% of cases left hospital against medical advice or discharged themselves.
- 152 cases, about 1%,regardless of venomousness, spent time in ICU and 44 received continuous ventilatory support (CVS); for injuries overall about 2% spent time in ICU (Injury in Australia, Data table A14).
- Overall, 6 of the 23,379 cases hospitalised due to injuries caused by contact with animals during 2021-22 died in hospital, underlining the rarity of fatalities from injuries caused by animals as compared to other causes of injury (Injury in Australia, Data table A15).

This report does not describe deaths, however research indicates relatively high proportions of fatalities related to allergies caused by insect bites and stings as compared to snake bites. This may indicate complacency about insect bites compared to snakes, with people underestimating the severity of anaphylactic reactions that may result (Welton, Williams et al. 2017).

Table 9: Severity of hospitalisation by type of animal, 2021-22

| Type of animal | Emergency admissions | Same day hospitalisation | Transferred to another acute hospital | Left/discharged against medical advice | Time in ICU | Average length of stay |
|---|---|---|---|---|---|---|
| **Venomous animals#** | 97% | 54% | 4% | 2% | 1.4% | 1.5 days |
| **Common pets** | 84% | 33% | 7% | 2% | 0.2% | 2.1 days |
| **Livestock** | 87% | 35% | 9% | 1% | 1.6% | 1.1 days |
| **Wildlife*** | 97% | 48% | 6% | 3% | 0.8% | 1.4 days |
| **Marine animals** | 86% | 44% | 6% | 2% | 1.1% | 1.8 days |
| **Other/unspecified** | 91% | 41% | 7% | 1% | 0.5% | 16.2 days |
| **Total** | 88% | 37% | 7% | 2% | 0.7% | 2 days |

Notes:

# venomous animals may be included in other categories listed below, such as wildlife

* Wildlife excluding marine animals

Source: National Hospital Morbidity Database

## By type of animal

Most venomous animals and insects are also categorised as wildlife, and the highest proportions of emergency admissions were for wildlife or venomous animal related injuries (Table 9). Injuries related to domestic animals (pets and livestock) were more likely to have overnight hospital stays, and pet related injuries had the highest average length of stay in hospital of cases with a specified animal type. Livestock injury cases were most likely to be transferred to other hospitals and wildlife injury cases to leave hospitals against medical advice, although proportions for these measures were low (under 10% of cases) across animal types.

## Hospital management

Procedures undertaken during hospitalisation can provide further indication of both the severity of an injury and the resourcing required to treat it. Table 10 details the top 10 most frequent procedures recorded against cases hospitalised due to injuries caused by contact with animals. Allied health interventions, particularly pharmacy and physiotherapy, were frequently provided. For nonvenomous animals, surgical debridement and wound repair were frequent procedures, aligning with the fact that most injuries were open wounds or superficial or soft tissue injuries.

Table 10: Top 10 procedures undertaken in hospital, by venomous and nonvenomous animals, 2021-22

| Procedure | cases | per cent (%) |
|---|---|---|
| **Venomous animal** | **1,123** | **100** |
| Allied health intervention, pharmacy | 163 | 14.5 |
| General anaesthesia, ASA 10,20 or 29 | 101 | 8.9 |
| Intravenous administration of pharmacological agent, antidote | 92 | 8.2 |
| Allied health intervention, physiotherapy | 85 | 7.6 |
| Debridement of skin and subcutaneous tissue, not elsewhere classified | 76 | 6.8 |
| Debridement of soft tissue | 55 | 4.9 |
| Incision and drainage of abscess of skin and subcutaneous tissue | 53 | 4.7 |
| Allied health intervention, social work | 42 | 3.7 |
| **Nonvenomous animal** | **40,753** | **100** |
| General anaesthesia, ASA 20,10,29 or 19 | 6,750 | 16.6 |
| Debridement of skin and subcutaneous tissue, not elsewhere classified | 5,560 | 13.6 |
| Allied health intervention, physiotherapy | 3,033 | 7.4 |
| Debridement of soft tissue | 2,646 | 6.5 |
| Allied health intervention, pharmacy | 2,330 | 5.7 |
| Repair of wound of skin and subcutaneous tissue of other site, superficial | 2,266 | 5.6 |
| Allied health intervention, occupational therapy | 1,663 | 4.1 |

Notes: Cases caused by animals that could not be categorised by venomousness are excluded from counts presented in this table. Multiple procedures may be provided to a single case, and counts will not sum to the total number of cases presented in other tables in this report.

Source: National Hospital Morbidity Database

## Envenomation and antivenom

Antivenom, also called antivenin, is a treatment that neutralises the venom of a particular animal or insect. Most bites do not result in significant envenomation and do not require antivenom, which is administered as soon as possible after identifying symptoms such as collapse, bleeding problems and muscle or nerve impairment (Isbister, Brown et al. 2013).

In hospitalised injury cases caused by venomous animals during 2021-22, 8.4% of cases had administration of a pharmacological antidote recorded. Antivenom administration in snakebite cases differed by snake species, with the highest proportion of administration occurring where snakes were unidentified (Table 11).

Table 11: Diagnosis and treatment for injury hospitalisations due to contact with snakes by type of snake, Australia, 2021-22

| Type of snake | Cases (A) | T63.0# (B) | Antivenom administered ( C) | % of all cases with antivenom administered (C/A) | % of cases with T63.0# and antivenom administered (C/B) |
|---|---|---|---|---|---|
| **Brown snake** | 200 | 54 | 26 | 13.0% | 48.1% |
| **Taipan** | 3 | 3 | 1 | 33.3% | 33.3% |
| **Death adder** | 4 | 2 | 0 | 0.0% | 0.0% |
| **Black snake** | 82 | 19 | 4 | 4.9% | 21.1% |
| **Tiger snake** | 39 | 23 | 13 | 33.3% | 56.5% |
| **Sea snake** | 5 | 4 | 0 | 0.0% | 0.0% |
| **Other specified venomous snake** | 12 | 2 | 1 | 8.3% | 50.0% |
| **Unspecified venomous snake** | 190 | 58 | 41 | 21.6% | 70.7% |

| | | | | | |
|---|---|---|---|---|---|
| **Total** | **535** | **165** | **86** | **16.1%** | **52.1%** |

Notes:

# T63.0 refers to a principal diagnosis of toxic effects of snake venom

Source: National Hospital Morbidity Database

## References

AIHW (2023). Injury in Australia. Canberra, Australian Institute of Health and Welfare

Isbister, G. K., S. G. A. Brown, C. B. Page, D. L. McCoubrie, S. L. Greene and N. A. Buckley (2013). 'Snakebite in Australia: a practical approach to diagnosis and treatment.' Medical Journal of Australia 199(11): 763-768.

# Technical notes

## Data sources

### Hospitalisations

Hospitalisations data are sourced from the Australian Institute of Health and Welfare's (AIHW) National Hospital Morbidity Database (NHMD). The NHMD is a compilation of episode-level records from admitted patient morbidity data collection systems (APC NMDS) in Australian public and private hospitals. It includes episodes of care for admitted patients in all public and private acute and psychiatric hospitals, free standing day hospital facilities and alcohol and drug treatment centres in Australia. Hospitals operated by the Australian Defence Force, corrections authorities and in Australia's offshore territories may also be included. Hospitals specialising in dental, ophthalmic aids and other specialised acute medical or surgical care are included. Data quality statements for the NHMD are available on the AIHW MyHospitals website. For more information about data contained in the NHMD refer to the AIHW MyHospitals technical notes.

### Emergency Department presentations

Emergency department data are sourced from the National Non-admitted Patient Emergency Department Care Database (NNAPEDCD). Data quality statements for this dataset are available on the AIHW MyHospitals website. For the 2021–22 NAPEDC NMDS/NBEDS, diagnosis information was reported using the ED ICD-10-AM version 11 shortlist that can be found on the website of the Independent Hospital Pricing Authority - external site opens in new window.

For more information about data contained in the NNAPEDCD refer to the MyHospitals technical notes for recent years.

### Population data

Population data are used for demographic analyses and as the denominator in calculating rates. All population level calculations are based on the estimated resident population (ERP) calculated as at the midpoint of each financial year. For example, for the reporting period 2021–22, the denominator population is the June 2021 ERP + the June 2022 ERP, divided by 2. This is used as the denominator for age-specific/crude and age-standardised rates.

The ERP as at 30 June 2001 is used as the standardising population throughout the report (ABS 2003).

All population data are sourced from the Australian Bureau of Statistics (ABS) as follows:

- General populations are from National, state and territory population - external site opens in new window (Australian Bureau of Statistics 2023, March)
- Remoteness populations (available on request from ABS)
- Socio-Economic Indexes For Areas (SEIFA) Index of Relative Socio-Economic Disadvantage (IRSD) quintile populations are from AIHW analysis of Census of Population and Housing: Socio-Economic Indexes for Areas (ABS 2018) and Regional Population by age and sex (Australian Bureau of Statistics 2022).

## What is counted in this report?

Cases of injury are included in numerators or counts in this report where injury case identification criteria are fulfilled and an external cause of contact with animals can be ascertained.

### Timeframe

The 2021-22 financial year except for trends over time, which are described by financial year between 2012-13 and 2021-22.

### Injury case identification

A diagnosis of injury is defined as ICD-10-AM codes in the range S00–T75 or T79, using 'Chapter 19 Injury, poisoning and certain other consequences of external causes'. A primary diagnosis of injury is when one of the specified codes is the first diagnosis code reported, while an additional diagnosis of injury is when one of the specified codes is reported but not as the first diagnosis.

A person may have more than one incident of injury resulting in hospitalisation in a financial year and each case of hospitalisation will be counted separately in this report. This is because we are counting incidents of injury resulting in hospitalisation, rather than the number of people who were hospitalised, in a given financial year. If a single incident led to an admission in more than one hospital, the incident has only been counted once. Therefore, counts of injury cases will be lower than the count of hospital records indicating injuries.

### Inclusion criteria

- Records with the maximal snapshot id in any database where the date of separation falls within the timeframe defined in the report.
- NHMD records with a principal diagnosis in the ICD-10-AM range S00–T75 or T79, using 'Chapter 19 Injury, poisoning and certain other consequences of external causes'.
- NHMD records with a separation date between 1 July 2012 to 30 June 2022

### Exclusion criteria

- Records were excluded where the AIHW 'standard analysis' flag was absent, i.e. care type was newborn with unqualified days only (7.3), organ procurement - posthumous (9), or hospital boarder (10).
- Injuries due to Complications of surgical and medical care (T80 – T88) and Sequelae of injuries, of poisoning and of other consequences of external causes (T90 – T98) are excluded.

### Estimating index cases, not counting separations

Each record in the NHMD refers to a single episode of care in a hospital. Some injury incidents result in more than one episode of care and, therefore, more than one record.

To minimise the impact of overcounting where a person experienced multiple episodes of care relating to the same condition, the following criteria are applied to estimate incidents:

- Excludes records where admission mode is transfer from another hospital (1)
- Excludes records where admission mode is statistical admission (2) and care type is not acute (1, 7.1, 7.2)
- Excluding records where care involving use of rehabilitation procedures (Z50) appears as an additional diagnosis and care type is not acute (1, 7.1, 7.2)

## Injury classifications from ICD-10-AM

Diagnosis, intervention, and external cause data in the NHMD for 2021–22 was reported to using classifications from the 11th edition of the International statistical classification of diseases and related health problems, 10th revision, Australian modification (ICD-10-AM) (ACCD 2019a).

In tables and figures, information on diagnoses, external causes, and interventions are presented using the codes and abbreviated descriptions of the ICD-10-AM and the 11th edition of the Australian classification of health interventions (ACHI). Full descriptions of the categories are available in ICD-10-AM/ACHI publications (ACCD 2019a, ACCD 2019b, ACCD 2019c).

Where data are presented in a time series incorporating previous reporting periods, these have been coded according to the following editions of ICD-10-AM:

- 7th edition for 2011–12 and 2012–13 hospital data
- 8th edition for 2013–14 and 2014–15 hospital data
- 9th edition for 2015–16 and 2016–17 hospital data
- 10th edition for 2017–18 and 2018–19 hospital data
- 11th edition for 2019–20, 2020-21 and 2021–22 hospital data

## Categorising external causes of injury

The NHMD is structured so that the first listed external cause for a record relates to the first listed injury diagnosis (principal diagnosis). While multiple external causes may be recorded for a separation, we report only one cause for each injury, referred to as 'nominal external cause' in these notes. The following steps are followed to determine the nominal external cause for each injury hospitalisation:

1. The first reported external cause is taken to be the nominal external cause
2. If the nominal external cause, as determined by step 1, is U90.0 (Staphylococcus aureus) or a supplementary factor (Y90–Y98), then the second reported code is taken to be the nominal external cause
3. If the nominal external cause, after steps 1 and 2, relates to complications of medical and surgical care (Y40–Y84), sequelae of external causes of morbidity and mortality (Y85–Y89), or a supplementary factor code (Y90–Y98), then the record is excluded.

The categorisation of external causes using ICD-10-AM codes are detailed in Appendix tables to technical notes for Injury in Australia.

### Identifying contact with animals as the external cause of injury

ICD10-AM codes indicating where a nominal external cause of injury is due to contact with animals are listed in Table 13.

Table 13: ICD10-AM codes identifying contact with animals as external cause of hospitalisation

| | | |
|---|---|---|
| W53 Bitten by rat | W55 Bitten or struck by other mammals | W57 Bitten or stung by nonvenomous insect and other nonvenomous arthropods |
| W54 Bitten or struck by dog | W56 Contact with marine animal | W58 Bitten or struck by crocodile or alligator |
| W59 Bitten or crushed by other reptiles | W61 Contact with bird | X20–25, X27 Contact with venomous animals |
| Y37.6 Allergy to animals | X26.0 Contact with Jellyfish | X26.1 Contact with stinging fish |
| X26.2 Contact with venomous octopus | X26.3 Contact with stingray | V80.00-V80.99 Animal-rider or occupant of animal-drawn vehicle injured in transport accident |

ICD10-AM codes where the external cause may include, but is not specifically limited to, contact with an animal are included in Table 11. These cases are excluded from the main body of analysis. Injury in Australia includes these in counts of 'Contact with living things'.

Table 14: ICD10-AM codes identifying mixed external causes of hospitalisation

| | | |
|---|---|---|
| X26.8 Contact with other specified venomous marine animals and plants | X29 Contact with unspecified venomous animal or plant | W64 Exposure to other and unspecified animate mechanical forces |

ICD10-AM codes where the external cause of injury is transport related and may involve an animal are outlined in Table 12. In these cases, injuries are sustained during collision with pedestrians or animals. Injuries sustained in collisions with animal-drawn vehicles are excluded as we are unable to ascertain from ICD10-AM codes whether the animal or the vehicle was involved in the collision. These cases are **excluded** from the main body of analysis.

Table 15: ICD10-AM transport related external cause codes identifying mixed causes of hospitalisation

| | | |
|---|---|---|
| V20 Motorcycle rider injured in collision with pedestrian or animal | V30 Occupant of three-wheeled motor vehicle injured in collision with pedestrian or animal | V40 Car occupant injured in collision with pedestrian or animal |
| V50 Occupant of pick-up truck or van injured in collision with pedestrian or animal | V60 Occupant of heavy transport vehicle injured in collision with pedestrian or animal | V70 Bus occupant injured in collision with pedestrian or animal |

## Definitions

If not otherwise indicated, data elements were defined according to their definitions in the AIHW's Metadata Online Registry (METEOR) - external site opens in new window and summarised in the Glossary.

Data element definitions for the NHMD and NNAPEDCD are available online on the METEOR - external site opens in new window website.

The terms 'injury hospitalisation', 'hospitalised injury' and 'hospitalised case' in this report refer to incidents where a person was admitted to hospital with injury as the main reason. If a single incident led to an admission in more than one hospital, the incident has only been counted once.

### Categorising animals by type

Categories in Table 16 and Table 17 are not mutually exclusive.

Table 16: ICD10-AM codes categorising external causes of injury into types of animals

| Category | ICD10-AM codes |
|---|---|

| | |
|---|---|
| **Common pets** | W54.0 Bitten by dog<br>W54.8 Other contact with dog: Struck by dog<br>W55.1 Bitten or struck by cat: Scratched by cat<br>Y37.63 Allergy to cats<br>Y37.64 Allergy to dogs |
| **Livestock** | W55.0 Bitten or struck by horse<br>W55.2 Bitten or struck by cattle, including where bitten or struck by:<br>• buffalo<br>• bull<br>• bullock<br>• cow<br>W55.3 Bitten or struck by sheep |
| **Wildlife (excluding marine animals)** | W57 Bitten or stung by nonvenomous insect and other nonvenomous arthropods<br>W58 Bitten or struck by crocodile or alligator<br>W59.0 Bitten or crushed by nonvenomous snake<br>W59.1 Bitten or crushed by snake, unknown whether venomous or nonvenomous, Bitten or crushed by snake NOS<br>W59.8 Bitten or crushed by other specified reptile, Bitten or crushed by nonvenomous lizard<br>W61.0 Contact with magpie<br>X20 Contact with venomous snakes and lizards<br>X21 Contact with spiders<br>X22 Contact with scorpions<br>X23 Contact with hornets, wasps and bees<br>X24 Contact with centipedes and venomous millipedes (tropical)<br>X25 Contact with other venomous arthropods<br>X27.0 Contact with platypus<br>Y37.61 Allergy to bees<br>Y37.62 Allergy to birds |
| **Marine animals** | W56.0 Contact with shark<br>W56.8 Contact with other specified marine animal<br>W56.9 Contact with unspecified marine animal<br>X20.05 Contact with sea-snake<br>X26.0 Contact with jellyfish<br>X26.1 Contact with stinging fish<br>X26.2 Contact with venomous octopus<br>X26.3 Contact with stingray |

| | |
|---|---|
| **Other and unspecified** | W53 Bitten by rat<br>W55.8 Bitten or struck by other specified mammal<br>W55.9 Bitten or struck by unspecified mammal<br>W61.8 Contact with other specified bird<br>W61.9 Contact with unspecified bird<br>X27.8 Contact with other and unspecified venomous animals<br>Y37.60 Allergy to animal, unspecified<br>Y37.69 Allergy to other animal<br>V80.00-V80.99 Animal-rider or occupant of animal-drawn vehicle injured in transport accident |

### Categorising animals by whether venomous or not

Animals have been categorised in Table 17 where codes specifically identify their venomous status. Codes including unspecified animals are excluded from this categorisation. Summing venomous and non-venomous categories will therefore not equal total contact with animals counts.

Table 17: ICD10-AM codes categorising contact with venomous animals

| | |
|---|---|
| **Venomous animals** | X20 Contact with venomous snakes and lizards. Includes brown snakes (X20.00), taipans (X20.01), death adders (X20.02), black snakes (X20.03), tiger snakes (X20.04), sea-snakes(X20.05), other or unspecified snakes (X20.08 & X20.09) and venomous lizards (X20.1)<br>X21 Contact with spiders. Includes funnel webs (X21.0), red backs (X21.1), necrotising spiders including white-tails (X21.2), other specified or unspecified spiders (X21.8 & X21.9).<br>X22 Contact with scorpions<br>X23 Contact with hornets, wasps and bees.<br>X24 Contact with centipedes and venomous millipedes (tropical)<br>X25 Contact with other venomous arthropods. Includes venomous ants (X25.0), ticks (X25.1), caterpillars (X25.2) other and unspecified arthropods (X25.8 & X25.9)<br>X26.0 Contact with jellyfish. Includes box (X26.00), Irukandji (X26.01), bluebottles (X26.02), other specified and unspecified jellyfish (X26.08 & X26.09)<br>X26.1 Contact with stinging fish<br>X26.2 Contact with venomous octopus<br>X26.3 Contact with stingray<br>X27.0 Contact with platypus<br>X27.8 Contact with other and unspecified venomous animals<br>Y37.61 Allergy to bees |

| | |
|---|---|
| **Non-venomous animals** | W53 Bitten by rat<br>W54.0 Bitten by dog<br>W54.8 Other contact with dog: Struck by dog<br>W55.0 Bitten or struck by horse<br>W55.1 Bitten or struck by cat: Scratched by cat<br>W55.2 Bitten or struck by cattle<br>W55.3 Bitten or struck by sheep<br>W55.8 Bitten or struck by other specified mammal<br>W56.0 Contact with shark<br>W56.8 Contact with other specified marine animal<br>W56.9 Contact with unspecified marine animal<br>W57 Bitten or stung by nonvenomous insect and other nonvenomous arthropods<br>W58 Bitten or struck by crocodile or alligator<br>W59.0 Bitten or crushed by nonvenomous snake<br>W59.8 Bitten or crushed by other specified reptile, Bitten or crushed by nonvenomous lizard<br>W61.0 Contact with magpie<br>W61.8 Contact with other specified bird<br>Y37.62 Allergy to birds<br>Y37.63 Allergy to cats<br>Y37.64 Allergy to dogs |

### Identifying cases where antivenom was administered

There are a series of five monovalent antivenoms for use in the treatment of Australian land snake bites, a sea snake antivenom and various exotic antivenoms used to treat bites from non-Australian venomous snakes (e.g. kept in zoos). A polyvalent antivenom is also available combining all five monovalent antivenoms where the species of snake is not identified. Antivenoms are also available for stonefish, paralysis tick, red back spider and funnel web spider.

Patients may receive multiple ampoules of antivenom. Such patients may have these ampoules given as single boluses or the contents of two ampoules combined.

Administration of antivenom is assigned a code from block [1920] Administration of pharmacotherapy with an extension of -04. These include:

- 96196-04 Intra-arterial administration of pharmacological agent, antidote
- 96197-04 Intramuscular administration of pharmacological agent, antidote
- 96198-04 Intrathecal administration of pharmacological agent, antidote
- 96199-04 Intravenous administration of pharmacological agent, antidote
- 96200-04 Subcutaneous administration of pharmacological agent, antidote
- 96201-04 Intracavitary administration of pharmacological agent, antidote
- 96202-04 Enteral administration of pharmacological agent, antidote
- 96203-04 Oral administration of pharmacological agent, antidote
- 96205-04 Other administration of pharmacological agent, antidote
- 96206-04 Unspecified administration of pharmacological agent, antidote
- 96209-04 Loading of drug delivery device, antidote

### Categorising type and site of injury

Type of injury includes, for example, fractures and poisoning. Site of injury includes, for example, head and neck or wrist and hand.

To categorise injuries by type and body part injured, Injury in Australia's principal diagnosis matrix has been applied (as outlined in the Appendix tables to technical notes for Injury in Australia). Body part and injury type are derived from the principal diagnosis of the case. The sum of injuries by body part may not equal the total number of hospitalised injury cases because some injuries are not described in terms of body region.

### Demographics

Table 18: Defining common demographic categories

| Characteristic | Notes |
|---|---|
| **Sex** | The NHMD reports sex as male or female. Persons totals include records where sex is not defined and may therefore not equal male + female counts. |
| **Age and age-group** | The patient's age is calculated at the date of admission. In tables by age group and sex, separations for which age and/or sex were not reported are included in the totals.<br>Age is presented categorised into life-stage age groups namely 0-4,5-14,15-24,25-44,45-64 and 65+ years. |
| **Remoteness** | SA1 or SA2 area of usual residence as supplied in the NHMD is mapped to the ABS's ASGS Remoteness structure 2016 [1] and categorised into the following remoteness regions; major cities, inner regional, outer regional, remote and very remote. Due to small counts, remote and very remote regions have been aggregated in this report to reduce the need for data suppression. |

## Analysis

The Australian ERP as at 30 June 2001 is used as the standardising population throughout the report. Age-standardisation of rates enables valid comparison across years and/or jurisdictions without being affected by differences in age distributions.

Population-based rates of injury tend to have similar values from one year to the next. Exceptions to this can occur (for example, due to a mass-casualty disaster), but are unusual in Australian injury data. Some year-on-year variation and short-run fluctuations are to be expected, so small changes in a rate over a short period do not provide a firm basis for asserting that a trend is present.

All rate calculations utilise a denominator based on the estimated resident population (ERP) calculated as at the midpoint of each financial year. For example, for the reporting period 2021–22, the denominator population is the June 2021 ERP + the June 2022 ERP, divided by 2. This is used as the denominator for age-specific/crude and age-standardised rates. Rates are calculated for each financial year unless otherwise noted.

Table 19

| Measure | Numerator | Denominator | Calculation |
|---|---|---|---|
| Population (used for rates) | June 21 population + June 2022 population | 2 | Numerator ÷ Denominator |
| Crude or age-specific rate of hospitalisation | Number of cases of injury hospitalisation per defined category (e.g. age group) | Estimated Australian population as at mid-point of financial year | (Numerator ÷ Denominator) x 100,000 |
| Age-standardised rate (ASR).<br>Age-standardised rates were derived using 5-year age groups up to 85+.<br>Age-standardised rates for First Nation populations were derived using 5-year age groups up to 65+. | Expected events per age group in standard population= crude rate of hospitalisation x standard population (for each corresponding age group) | | The direct method of standardisation is used.<br>(Sum of numerators across all age groups ÷ total standard population) x 100,000 |
| Average length of stay | Number of patient bed days | Number of cases | Numerator ÷ Denominator, as days, rounded to 1 decimal place |

| | | | |
|---|---|---|---|
| Change in rates | | | Estimated trends in age-standardised rates were reported as average annual percentage changes. |

Note that 'average length of stay', as presented in this report, does not include some patient days potentially attributable to injury. It does not include days for most aspects of injury rehabilitation, which cannot be reliably assigned without information enabling identification of all admitted episodes associated with an injury case.

Due to rounding, percentages in tables may not add up to 100.0.

### Remoteness

Remoteness is based off the patient's usual place of residence. Remoteness areas in Australia are comprised of 5 groups (Major Cities, Inner Regional, Outer Regional, Remote, and Very Remote) categorised by the Accessibility/Remoteness Index of Australia Plus (ARIA+). These ARIA+ values are derived using the Statistical Area Level 1 (SA1) from the Australian Statistical Geography Standard (ASGS) 2016.

Table 20

| Remoteness area | Average ARIA+ range for SA1 |
|---|---|
| Major Cities of Australia | 0 to 0.2 |
| Inner Regional Australia | Greater than 0.2 and less than or equal to 2.4 |
| Outer Regional Australia | Greater than 2.4 and less than or equal to 5.92 |
| Remote Australia | Greater than 5.92 and less than or equal to 10.53 |
| Very Remote Australia | Greater than 10.53 |

### Presentation of data

Counts are presented as whole numbers.

Crude/age-specific rates and age-standardised rates are calculated per 100,000 population and are rounded to 1 decimal place.

Proportions (%) and ALOS are also rounded to 1 decimal place.

### Data suppression and confidentiality

Aggregated injury hospitalisations data are usually presented in tables, graphs, or maps. To maintain attribute disclosure and minimise risk of potentially re-identifying a person, data suppression rules have been applied.

Sometimes consequential suppression is also applied to prevent the primary suppressed cell from being calculated. This is often done by suppressing table cells in the same row or column or suppressing the table totals.

#### Counts (hospitalisations)

- Counts less than 5 are suppressed and consequential suppression is applied unless that count applies to a whole of population level, in which case it may be published unsuppressed if there is not further ability to disaggregate by population groups.
- When data is disaggregated by geography location, counts for areas where the population is less than 1,000 are suppressed.

#### Crude rates

- Crude rates with counts (numerator for calculation) less than 10 are suppressed.
- If the corresponding counts measure is suppressed, the crude rate has been suppressed.
- When data is disaggregated by geography location, counts for areas where the population is less than 1,000 are suppressed.

#### Age-standardised rates

- Age-standardised rates with counts (numerator for calculation) less than 20 are suppressed
- If the corresponding counts measure is suppressed, the age-standardised rate has been suppressed.
- When data is disaggregated by geography location, counts for areas where the population is less than 30 are suppressed.

## Notes on data

1. Over time, minor changes have been made to the method for counting cases of injury, therefore data presented in previous AIHW reports may not match the data presented in this report.
2. Only a small proportion of all incidents of injury result in admission to a hospital. For each admission, many more people with injuries are treated in an emergency department but not admitted, or visit a general practitioner, physiotherapist or Urgent Care/Walk-in Clinic rather than a hospital. A larger number of minor injuries do not receive any medical treatment. A smaller number of severe injuries that quickly result in death do not include a stay in hospital but are captured in mortality data.
3. This report only reflects injuries where external causes are coded and the injury is identifiable as due to contact with animals. It only counts injuries that present to Australian hospitals or EDs. This report therefore underestimates the total burden of injuries due to contact with animals as it does not count injuries where health care is not sought from a hospital or emergency department.
4. Minor injuries (e.g. scratches and stings) are likely underrepresented in this report as injury hospitalisations or ED presentations are likely biased towards injuries perceived as severe enough to require health care intervention. By the same logic, injuries caused by venomous animals are likely to be over-represented in this report.
5. ICD10-AM codes including injuries due to plants and animals or humans and animals are excluded from this report due to inability to ascertain what type of animate mechanical forces are involved.
6. The NHMD does not provide unique identifiers and this report is unable to present information about the number of people injured. We instead present information about the number of cases of injury.
7. The COVID-19 pandemic and the resulting Australian Government closure of the international border from 20 March 2020, caused significant disruptions to the usual Australian population trends. This report uses Australian Estimated Resident Population (ERP) estimates that reflect these disruptions.
   In the year July 2020 to June 2021, the overall population growth was much smaller than the years prior and in particular, there was a relatively large decline in the population of Victoria. ABS reporting indicates these were primarily due to net-negative international migration (National, state and territory population, June 2021 | Australian Bureau of Statistics (abs.gov.au) - external site opens in new window).
   Please be aware that this change in the usual population trends may complicate your interpretation of statistics calculated from these ERPs. For example, rates and proportions may be greater than in previous years due to decreases in the denominator (population size) of some sub-populations.
8. Overall, the quality of the data in the NNAPEDCD is sufficient to be published in this report. However, limitations of the data as listed in the NNAPEDCD technical notes should be taken into consideration when ED data are interpreted.
9. The recording of external cause information is not as complete in the NNAPEDCD as the NHMD. A short list of ICD10 codes are used and the proportion of missing data is higher than the NHMD. This analysis quantifies the number of NNAPEDCD records in the latest financial year of the timeframe of interest, where the following can be ascertained:
   - An injury diagnosis in any available primary or additional diagnosis variable AND
   - An external cause code related to contact with animals in any primary or additional diagnosis variable
     Where the sum of cases identified by the above two criteria constituted 5% or less of all ED records in the latest financial year of the timeframe of interest, ED data was not described further. This is due to unreliability of data for injury surveillance due to under-recording or unavailability of external cause related information in the ED dataset.
10. The emergency department admission policy was changed for New South Wales (NSW) hospitals in 2017–18 and detailed in the NHMD technical notes. For NSW, the effect was a significant decrease (3.7%) in all public hospital admissions in 2017–18 compared to 2016–17. The impact of the change was felt disproportionately among hospitalisations for injury and poisoning. Due to the size of the contribution of NSW data to the national total, there is a break in series in Australian data from before and after 2017–18.

## Glossary

Injury topic glossary

# Notes

## Data quality statement

- AIHW National Hospital Morbidity Database (NHMD)
- AIHW National Non-admitted Patient Emergency Department Care Database (NNAPEDCD)

Australian Government
Australian Institute of Health and Welfare

# Data

## Data tables: Injury hospitalisations due to contact with animals in Australia, 2021–22

**Data**
XLSX 166Kb