INJURY RESEARCH & STATISTICS

Australian Government
Australian Institute of Health and Welfare

Hospitalised sports injury, Australia 2002–03

FLINDERS UNIVERSITY
ADELAIDE AUSTRALIA

Louise Flood, James E Harrison

Hospitalised sports injury, Australia 2002–03

The Australian Institute of Health and Welfare is Australia's national health and welfare statistics and information agency. The Institute's mission is *better health and wellbeing for Australians through better health and welfare statistics and information*.

Please note that as with all statistical reports there is the potential for minor revisions of data in *Hospitalised sports injury, Australia 2002–03* over its life. Please refer to the online version at <www.nisu.flinders.edu.au>.

Injury Research and Statistics Series
Number 27

Hospitalised sports injury, Australia 2002–03

Louise Flood
and
James E Harrison

2006

Australian Institute of Health and Welfare
Canberra

AIHW cat. no. INJCAT 79

This publication is part of the Australian Institute of Health and Welfare's Injury Research and Statistics Series. A complete list of the Institute's publications is available from Business Promotion and Media, Australian Institute of Health and Welfare, GPO Box 570, Canberra ACT 2601, or via the Institute's web site (http://www.aihw.gov.au). Electronic copies of publications in this series can be downloaded from the Research Centre for Injury Studies web site (http://www.nisu.flinders.edu.au)

ISSN 1444-3791
ISBN 1 74024 549 0

Suggested citation

Flood L and Harrison JE 2006 Hospitalised sports injury, Australia 2002–03 Injury Research and Statistics Series Number 27. (AIHW cat no. INJCAT 79) Adelaide: AIHW

Any enquiries about or comments on this publication should be directed to:

James Harrison
Research Centre for Injury Studies
Flinders University of South Australia
GPO Box 2100,
Adelaide 5001, South Australia

Phone: (08) 8201 7602
email: James.Harrison@flinders.edu.au

Published by Australian Institute of Health and Welfare

Printed by Snap Printing

Proofreading and Layout by Stacey Avefua

Contents

Abbreviations used

ABS	Australian Bureau of Statistics
ACL	Anterior cruciate ligament (of the knee)
AIHW	Australian Institute of Health and Welfare
ICD–10–AM	International Classification of Diseases, 10th Revision, Australian Modification
MCL	Medical collateral ligament (of the knee)
NA	Not applicable
NCIS	National Coroners Information System
USA	United States of America
VAED	Victorian Admitted Episodes Dataset
VEMD	Victorian Emergency Minimum Dataset
VIMD	Victorian Inpatient Minimum Dataset
VISS	Victorian Injury Surveillance System

List of tables

List of figures

Executive summary

This report describes and characterises hospitalisation in Australia due to injury sustained during sport and recreational activities.

Exercise is important in promoting health and preventing premature death. However, it is not uncommon for exercise participants to be injured. Most injuries are not severe with Finch et al. finding that in the Latrobe Valley there was 1 sport and exercise related hospitalisation for every 10 emergency admissions and 12 general practice consultations (Finch et al. 1999a). Hospitalised injuries tend to be more severe and costly than other injuries (Watson & Ozanne-Smith 1997). Hence, while hospitalised sports injuries are small as a proportion of all sport injuries they warrant attention.

On 1 July 2002 the 3rd edition of the Australian Modification of the International Classification of Diseases, 10th revision, (ICD-10-AM) was introduced. This includes an expanded number of sports categories for coding of activity involved in at the time of injury. Hence, this report was able to be produced.

Findings

- There were 45,452 sports and recreation related hospitalisations in the 2002–2003 financial year in Australia. This was 0.7% of total hospitalisations.
- The greatest number of sports and recreation related hospitalisations was in the 0–14 year age group with 14,218 hospitalisations.
- 73.9% of sports and recreation related hospitalisations occurred in males but there were a greater number of females (15 years and over) participating in sports and recreation.
- Football had the highest number of hospitalisations with 12,600, with 3,944 of these due to Australian football and 3,270 due to soccer. There were 2,799 water sports and 2,725 sports and recreation cycling related hospitalisations. 14 sports and recreation groupings are reviewed in detail.
- Participation data was available in those 15 years and over. When this is used, wheeled motor sports had the highest rate of hospitalisation per 100,000 participants with 942.7, followed by roller sports with 738.6, Australian football with 734.3 and equestrian pursuits with 692.7. However, these rates cannot be used to compare the potential of danger of particular sports as the extent of participation per person is unknown. Also, participation data was not always comparable with the hospitalisation data available.
- Fracture was the most common principal diagnosis in those hospitalised for sports and recreation with 22,655 (52.8%) hospitalisations.
- The recently released National Injury Prevention and Safety Promotion Plan: 2004–2014 (National Public Health Partnership (NPHP) 2004) promotes safer environments and the encouragement of safer behaviour in the sporting arena. The data in this report can help with development of strategies to implement this.

1 Introduction

Exercise is important in minimising risk of conditions including cardiovascular disease, stroke, diabetes, cancer, hypertension, mental health disorders and premature death (Sacco et al. 1998; Blair et al. 1989; Stevenson et al. 2000; General 1999; Szabadi 1988; Siscovick et al. 1985). An Australian Bureau of Statistics (ABS) survey conducted in 2003 found that 82.5% of the adult population (15 years and over) had participated in exercise for recreation or sport in the previous 12 months (Australian Sports Commission 2003). A similar ABS survey conducted in April 2003 found that 62% of children 5–14 years had taken part in sport outside school hours in the previous 12 months (Australian Bureau of Statistics 2005).

It is not uncommon for those involved in sports to be injured. Injury can be a reason for dropping out of sport. In 1995–1996, 20.7% of males and 18.7% of females, dropped out of sport due to injury (Australian Bureau of Statistics 1997).

The majority of injuries are not severe (Lindsay et al. 2000; Office for Recreation and Sport 2000). A study of sport and exercise related injury in the Latrobe Valley found 1 hospital admission for every 10 emergency admissions and 12 general practice consultations (Finch et al. 1999a). Hospitalised injuries tend to be more severe and costly than other injuries (Watson & Ozanne-Smith 1997). Hence, while hospitalised sports injuries are small as a proportion of all sport injuries they warrant attention.

This report describes hospitalised sport injury July 2002–June 2003 in Australia. As such it focuses on the minority of sport related injury that is sufficiently serious to result in admission to hospital. We have examined this period because the 3rd edition of the Australian Modification of the International Classification of Diseases, 10th revision, (ICD-10-AM) introduced on 1 July 2002 includes a greatly expanded set of categories to code the types of sporting activities involved in at the time of injury.

Numbers of cases provide an indication of the extent, or burden, of hospitalised sports injury. Burden can be characterised further using measures such as duration in hospital. Population based rates enable burden to be compared between parts of the Australian population that differ in size, such as States and Territories, and age groups. Since most people in the population do not participate in each type of sport, population based injury rates do not provide a good indication of the risk of hospitalisation for participants in a sport, unlike rates based on numbers of participants. Two types of measures of participation are of particular relevance: numbers of participants and extent of participation (e.g. hours of involvement or matches played). Information available on cases and on the population is more extensive than the information available on participation. We have framed this report to make the most of the available participation data. The main source of participation data that we have used is Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003). A limitation of this for present purposes is that it does not provide estimates for children younger than 15 years of age. We do have limited data on participation in major sports for children from Year Book Australia. Culture and recreation. Children's participation in organised sport (Australian Bureau of Statistics 2005).

This report used data from the National Hospital Morbidity Database compiled by the Australian Institute of Health and Welfare (AIHW) for inpatient care in the financial year 2002–2003 in Australia, in particular, the subset of data with ICD-10AM codes for sports or leisure as an external cause of morbidity and mortality (U50–U72). The estimated number of participants was found in

the Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003). This report only includes persons 15 years and over, hence, participation rates used in the Tables and Figures are for those 15 years and over. Case numbers less than 4 are not shown in the Tables in order to maintain confidentiality.

The report begins with introductory chapters and a statistical overview of hospitalised injury due to all types of sport, and finishes with sections on data issues and conclusions.

The main part of the report comprises 14 chapters, each dealing with hospitalised injury occurring in a particular type of sport. These types of sport were selected largely on the basis of the number of hospitalised injuries and the chapters were ordered on the same basis. Most of the chapter titles refer to a group of specific sports with characteristics in common (e.g. football, wheeled motor sports). Where the available data allowed, the more specific sports within the scope of a chapter were distinguished in analysis. In each chapter, our statistical analysis of hospital data follows a summary of relevant findings of other research.

The recently released National Injury Prevention and Safety Promotion Plan: 2004–2014 (National Public Health Partnership (NPHP) 2004) promotes safer environments and the encouragement of safer behaviour in the sporting arena. The data in this report can help with development of strategies to implement this. The Department of Health and Ageing released a report in July 2003 entitled Sports Safety in Australia (Australian Government Department of Health and Ageing 2004) which identified the lack of sports injury surveillance data. This report goes some way towards correcting the deficiency.

2 Background

Most sporting injuries are not severe (Lindsay et al. 2000; Office for Recreation and Sport 2000). The National Health Survey undertaken by the ABS in 2001 surveyed approximately 26,900 persons about health status, services used and health risk factors (Australian Bureau of Statistics 2003). Injury is included in this survey. 12% of respondents reported sustaining an injury in the 4 weeks prior to the interview. 1.9% of the population reported having sustained an injury in the past 4 weeks as a result of organised sport, with 66.3% of these persons being male. Musculoskeletal injury and bruising was frequent. The legs and feet were the most commonly injured body parts. Only 10.0% of persons injured attended hospital (Australian Bureau of Statistics 2003) (Table 2.1).

Table 2.1: Recently injured in sport, selected items—2001

	Persons (%)
Sex:	
Males	66.3
Females	33.7
Type of damage:	
Dislocations, sprains, strains, torn muscles/ligaments	42.1
Bruising	40.0
Open wound	19.8
Body part injured:	
Legs/feet	61.1
Arms/wrists	17.0
Hands/fingers	14.5
Action taken:	
Cut down on usual activities	45.7
Visited doctor/other health professional	35.5
Attended hospital	10.0
Had time off work/study	16.0
Total recently injured while playing sport	100.0
Proportion of the population who injured themselves playing sport	1.9

Persons may have reported more than one type of event and therefore components may not add to totals.
Table taken from National Health Survey: Injuries, page 17 (Australian Bureau of Statistics 2003).

What follows is a brief overview of what is already known about hospitalised sport injury focusing particularly on Australia. An exhaustive literature search has not been done. Published articles have been found through a Medline search and electronic searching of major medical and sporting medical journal databases. To date, there are few published articles on population based hospitalised sports injury and even fewer articles from Australia. Literature relevant to particular types of sporting activity is summarised at the start of each chapter.

Dempsey et al. 2005 reviewed all sports and recreation related hospitalisations in Wisconsin, United States of America (USA), in 2000 using the Wisconsin Bureau of Health Information database of inpatient discharge data. They reviewed 1,714 cases, which was 3.5% of all un–intentional injury hospitalisations. Thus the sports and recreation related hospitalisation rate was 32.0 per 100,000 population. Sports and recreation related injury hospitalisation was most common in those 10–19 years (65 per 100,000 population) and least common in those 65 years and over (9 per 100,000 population). Males had a 4.2 times higher relative risk of sports and recreation related hospitalisation compared with females (Dempsey et al. 2005).

Hume et al. 1994 studied sports injuries in New Zealand. Rugby union and swimming had the highest number of fatalities with a fatal injury rate (for those 5 years and over) of 1.35 deaths and 0.25 deaths per 100,000 participants per year, respectively. Horse riding had a fatal injury rate of 0.64 deaths per 100,000 participants per year (for those 5 years and over). Rugby union, horse riding and snow skiing and tobogganing had the highest hospitalisation rates per 100,000 participants with 900.45, 607.84 and 447.86, respectively. Males were more frequently injured than females by 79:21 for deaths, 75:25 for hospitalisations and 73:27 for emergency department presentations. More than 25% of injuries and fatalities were in the 15–19 year age group (Hume & Marshall 1994).

Stevenson et al. 2000 performed a cohort study in Perth from May to September 1997 of non–elite Australian football, field hockey, basketball and netball players from a random sample of clubs. The 1,512 participants completed an initial self report questionnaire and were followed up by monthly telephone interviews. 701 participants sustained at least one injury over the period. Overall, per 1,000 hours of training or competition there were 16.7 injuries sustained. This rate was highest for Australian football (20.3 injuries per 1,000 participation hours), followed by field hockey and basketball (15.2 and 15.1 injuries per 1,000 participation hours, respectively) and lowest for netball (12.1 injuries per 1,000 participation hours). Males were significantly more likely to be injured than females ($p<0.001$). Injured participants were significantly older than non–injured participants ($p<0.01$). Muscle strain/tear, bruising and ligament strain/tear were the 3 most common injuries reported. Injuries were most likely to occur in the first 4 weeks of the season (Stevenson et al. 2000).

Hockey and Knowles 2000 reviewed sports injuries in Queensland using Queensland Injury Surveillance Unit data from emergency department presentations to 14 hospitals in Queensland during 1998–1999. There were 9,031 sports injury presentations which accounted for almost 10% of all injury related presentations. One third of sports injury presentations were in the 5–14 year age group. Greater than 70% occurred in the 5–24 year age group. There were 3 times as many sports injury presentations in males as females. Football codes accounted for more than 60% of presentations, with a breakdown of: football not specified (21%), rugby league (15%), soccer (14%), rugby union (5%) and touch football (3%). 9% of presentations were due to netball, 7% due to basketball, 6% due to cricket and 3% each due to hockey and martial arts (Hockey & Knowles 2000). 42.6% of presentations were sprain/strains and 22.9% were fractures. The hand and ankle were the most commonly injured body parts (15% each). In the majority (70%) of injuries, the patient felt that the mechanism was a low fall or striking/collision with another person (Hockey & Knowles 2000).

Cassell and Clapperton 2002 reviewed sports injuries in Victoria using the Victorian Admitted Episodes Dataset (VAED) from July 2000 to June 2001 and the Victorian Emergency Minimum Dataset (VEMD) from January 1999 to December 2001. There were 18,445 admissions identified from the VAED database and 59,382 emergency department presentations (but non admissions) identified from the VEMD database. The majority of presentations and admissions were males (78% and 74% respectively). 40% of emergency presentations involved the upper extremity, 30%

the lower extremity and 14% the head/eyes/face/neck. 31% of hospitalisations involved the upper extremity, 37% the lower extremity and 20% the head/eyes/face/neck. 31% of emergency presentations were sprains/strains and 29% were fractures or dislocations. Whereas, the majority of hospitalisations were due to fractures (56%) and only 18% of hospitalisations were due to sprains/strains. 39% of presentations were due to falls and 38% due to striking/collision with person/object. 27% of hospitalisations were due to hit/struck/crush and 26% were due to falls (Cassell & Clapperton 2002).

The most common sport and recreation activities resulting in an emergency department presentation was Australian football (22.0%), followed by cycling (14.7%), basketball (8.8%), soccer (6.4%), play equipment and netball (both 6.0%) and skateboarding/in-line skating (5.1%) (Cassell & Clapperton 2002).

Cassell and Clapperton also reviewed sports related deaths in Australia using the National Coroners Information System (NCIS) from July 2000 to June 2002. There were 105 sports related deaths during the 2 year period (except that Queensland data was only available for January 2001 to June 2002). There were 24 deaths related to swimming, 14 to motor cycling, 8 to scuba diving or snorkelling, 5 to surfing, 3 to other water based activities, 2 to boating and 2 to snowboarding. Several sports sustained a single death (Cassell & Clapperton 2002).

3 Sports related hospitalisations

There were 6,653,772 hospitalisations in Australia in 2002–2003. There were 725,632 (10.9%) hospitalisations with an external cause reported (injury or poisoning) and 45,452 sports and recreation related hospitalisations. 0.7% of total hospitalisations and 6.3% of hospitalisations with an external cause reported were sport and recreation related (Australian Institute of Health and Welfare 2004).

This report used data from the National Hospital Morbidity Database compiled by the AIHW for inpatient care in the financial year 2002–2003 in Australia. This report uses the subset of data with ICD-10-AM codes for sports or leisure as an external cause of morbidity and mortality (U50–U72).

Age

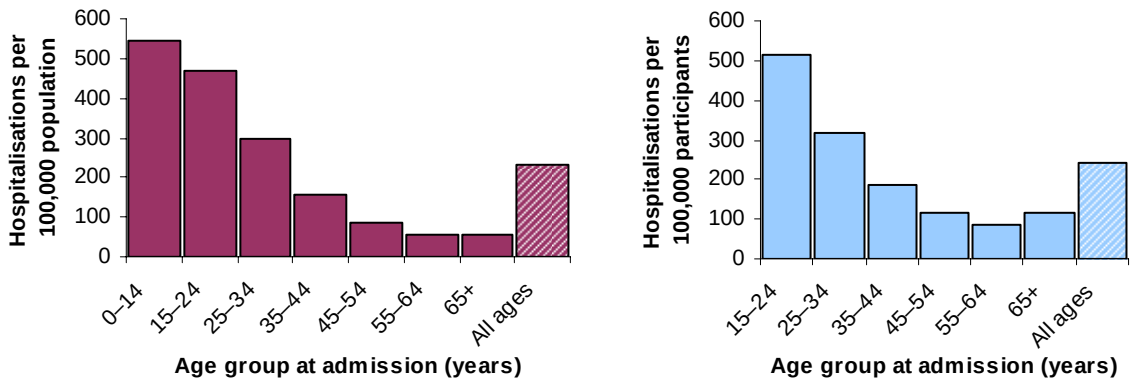
Table 3.1: Summary measures for sports and recreation related injury hospitalisations, by age group at admission, Australia, 2002–2003

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages
Cases	14,218	12,810	8,095	4,618	2,503	1,304	1,903	45,452[†]
Estimated number of participants ('000)[‡]	NA	2,480.3	2,554.8	2,449.8	2,164.3	1,534.6	1,666.9	12,850.7[§]
Rate/100,000 population	543.2	469.7	299.2	155.2	86.6	54.6	57.0	231.4[†]
Rate/100,000 participants[‡]	NA	516.5	316.9	188.5	115.6	85.0	114.2	243.1[†§]

[†] There was 1 case for which age data was not available, this case is included in the all ages category.
[‡] The estimated number of participants is found in Participation in Exercise Recreation and Sport Annual Report 2003. The rate per 100,000 participants is calculated from the estimated number of participants found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).
[§] The estimated number of participants and the rate per 100,000 participants for all ages does not include those under 15 years (n=14,218).

The greatest number of hospitalised injuries due to sports and recreation are in the 0–14 year age group. Those under 15 years had the highest rate of hospitalised injury per 100,000 population (543.2) (Table 3.1 and Figure 3.1). The Participation in Exercise Recreation and Sport Annual Report 2003 does not provide data for those less than 15 years of age. Hence, the rate of hospitalised sports injury per 100,000 participants, less than 15 years of age, is not shown in the Table 3.1 or Figure 3.1. The Australian Bureau of Statistics Year Book Australia, Culture and recreation, Children's participation in organised sport report (Australian Bureau of Statistics 2005) does provide participation data in those 5–14 years. There were an estimated 1,630,400 children, 5–14 years, who participated in organised sport in the 12 months to interview in April 2003 (Australian Bureau of Statistics 2005). This makes a rate of hospitalised injury per 100,000 participants of 791.5, for those 5–14 years.

The age group with the second largest number of hospitalised injuries due to sports and recreation was the 15–24 year age group. They had a rate of injury per 100,000 participants of 516.5. The older age groups have a lower rate of injury per population and per participant (Table 3.1 and Figure 3.1).



Note: The hospitalisation rate per 100,000 participants excludes 14,218 injuries in those less than 15 years.
For 1 case age data was not available, this is shown in the total but not elsewhere.

Figure 3.1: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to sport and recreation injury, by age group at admission, Australia, 2002–2003

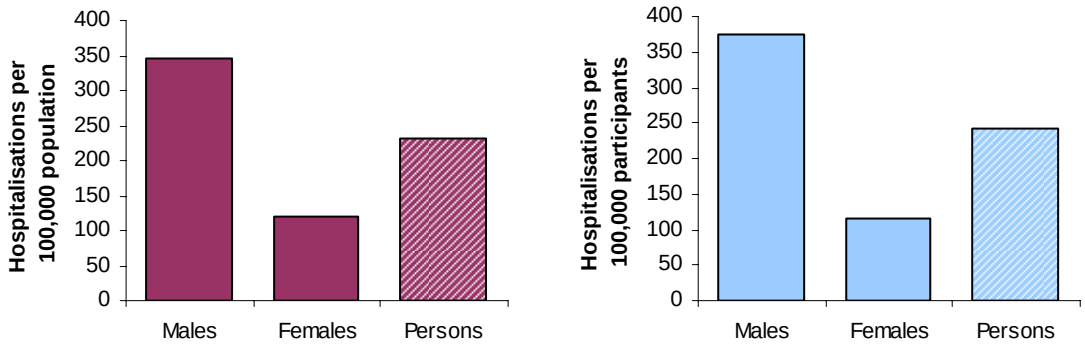
Sex

Table 3.2: Summary measures for sport and recreation related injury hospitalisations, by sex, Australia, 2002–2003

	Males	Females	Persons
Cases (%)	33,590 (73.9)	11,862 (26.1)	45,452 (100)
Estimated number of participants ('000)[†]	6,376.8	6,473.9	12,850.7
Rate/100,000 population	344.4	120.0	231.4
Rate/100,000 participants[†]	373.4	114.6	243.1

[†] The estimated number of participants and rate of injury per 100,000 participants excludes those less than 15 years (n=14,218).

There are a slightly greater total number of females participating in sports than males (6,473,900 versus 6,376,800). The male participation rate is marginally higher than that of females (82.6% versus 82.4%) (Australian Sports Commission 2003). However, the majority of hospitalised sporting injury occurs in males (73.9%). As a result the rate per 100,000 population is much higher in males than in females (344.4 versus 120.0) as is the rate per 100,000 participants (373.4 versus 114.6). This may be due to the differing types of sports participated in by males and females or different ways in which sports are played by males and females rather than males being more injury prone or more likely to be hospitalised (for a given injury) (Table 3.2 and Figure 3.2).



Note: The hospitalisation rate per 100,000 participants excludes cases of sports and recreation injury in those under 15 years (n=14,218).

Figure 3.2: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to sport and recreation injury, by sex, Australia, 2002–2003

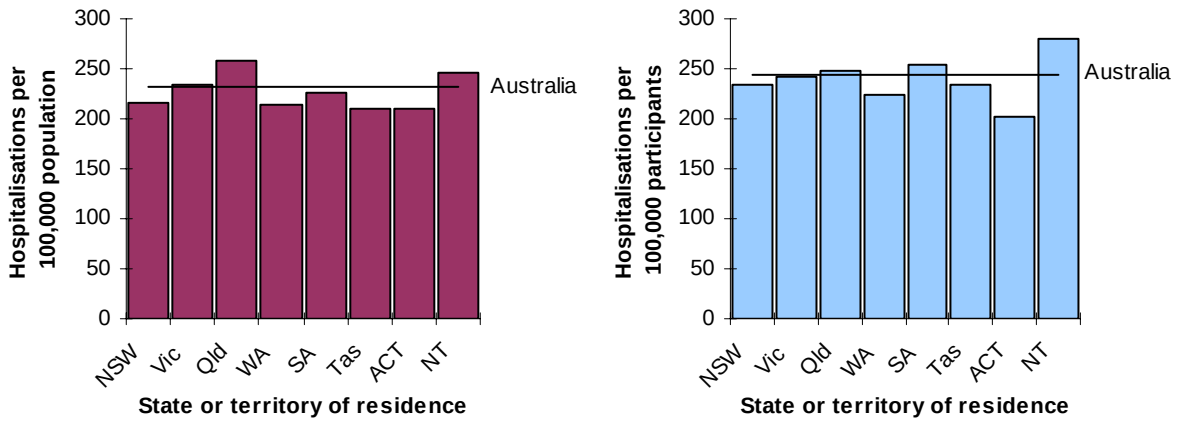
State or territory of residence and hospitalisation

Table 3.3: Summary measures for sports and recreation related injury hospitalisations, by state or territory of residence and hospitalisation, Australia, 2002–2003

	State or territory								
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
Cases by state or territory of residence	14,327	11,320	9,562	4,101	3,430	989	675	489	45,452[†]
Cases by state or territory of hospitalisation	14,251	11,312	9,881	4,139	3,472	997	870	530	45,452[†]
Estimated number of participants ('000) [‡]	4,255.0	3,317.8	2,353.4	1,297.2	992.9	298.7	218.6	117.2	12,850.7
Rate/100,000 population by state or territory of residence[†]	216.0	233.1	257.7	213.1	225.9	209.3	209.9	246.1	231.4
Rate/100,000 population by state or territory of hospitalisation	214.8	232.9	266.3	215.1	228.6	211.0	270.6	266.8	231.4
Rate/100,000 participants by state or territory of residence[†‡]	233.9	241.0	247.8	224.6	254.8	234.3	202.7	280.7	243.1
Rate/100,000 participants by state or territory of hospitalisation[‡]	233.3	240.9	260.6	227.8	258.9	237.0	268.1	308.0	243.1

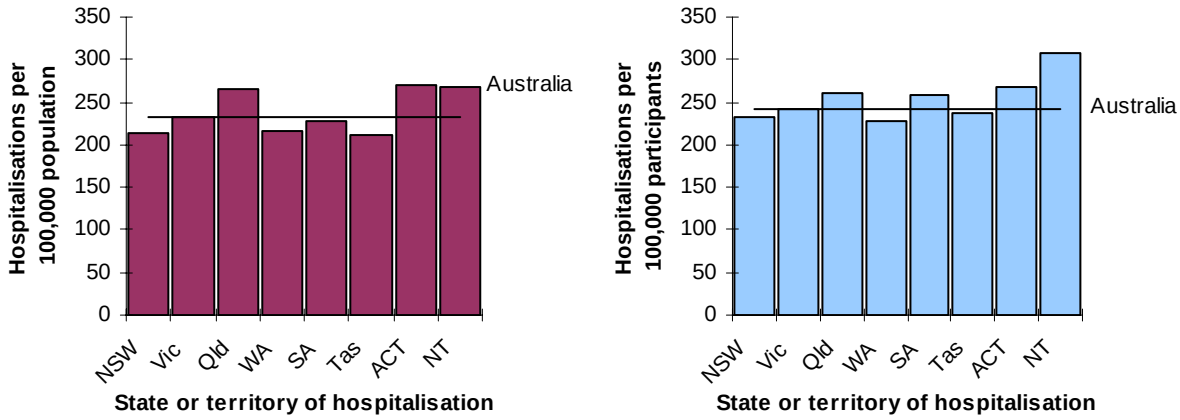
[†] There were 550 cases where state or territory of residence was not reported and 9 cases state or territory of residence was other territory, including 21 cases with unreported state or territory of residence in those under 15 years of age. These cases are included in the hospitalisation rate for Australia as a whole.

[‡] The estimated number of participants and hospitalisation rate per 100,000 participants excludes cases of sports and recreation injury in those under 15 years of age (n=14,218).



Note: The horizontal bar represents the sports and recreation related hospitalisation rate for Australia as a whole.
Excludes 550 cases where state or territory of residence was not reported and 9 cases where state or territory of residence was other territory, including 21 cases of unreported state or territory of residence in those under 15 years. These cases are included in the rate for Australia as a whole.
The hospitalisation rate per 100,000 participants excludes 14,218 cases of sports and recreation related injury in those under 15 years.

Figure 3.3: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to all sports and recreation injury, by state or territory of residence, Australia, 2002–2003



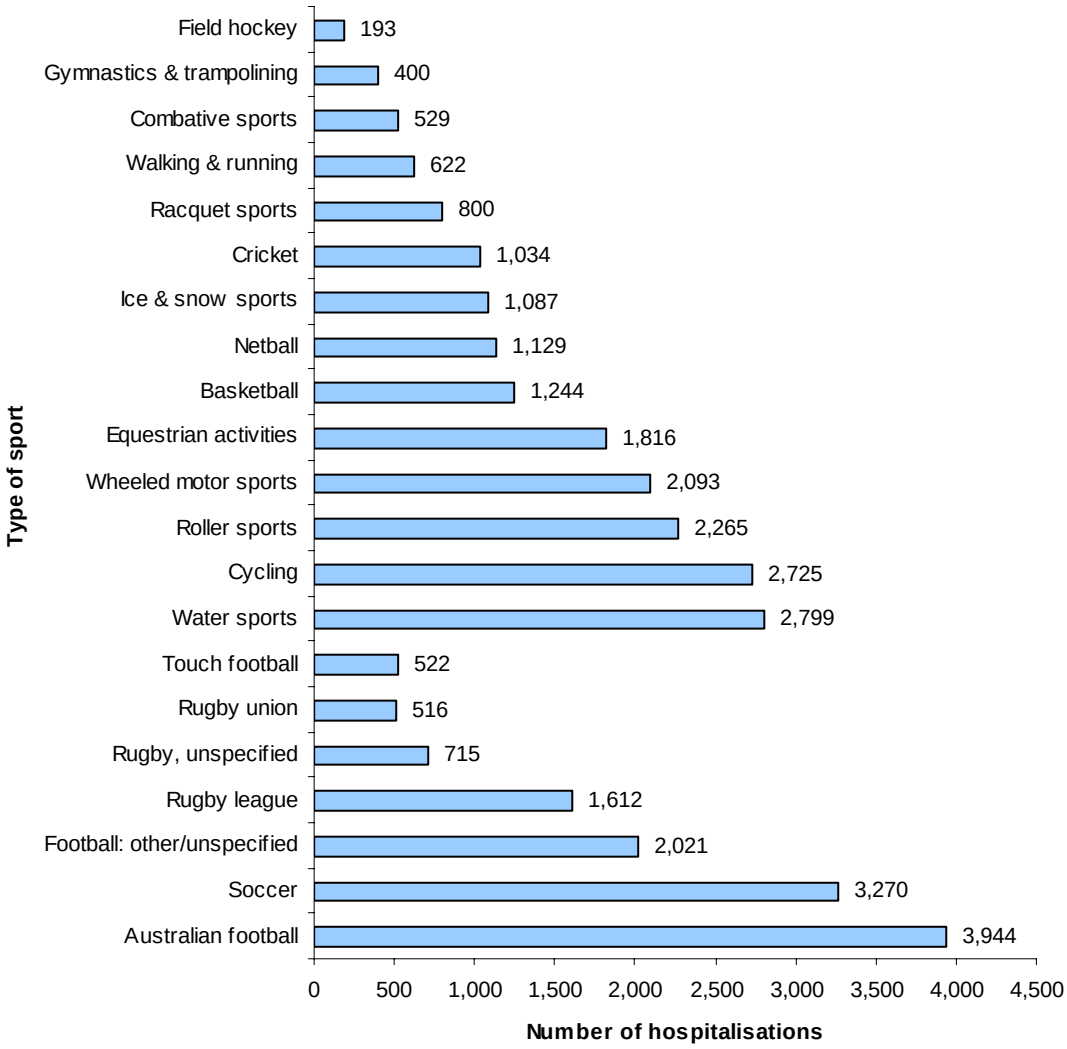
Note: The horizontal bar represents the sports and recreation related hospitalisation rate for Australia as a whole.
The hospitalisation rate per 100,000 participants excludes 14,218 cases of sports and recreation related injury in those under 15 years.

Figure 3.4: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to all sports and recreation injury, by state or territory of hospitalisation, Australia, 2002–2003

All the states and territories have similar rates with regard to sports and recreation related injury hospitalisations when all sports are considered together. Generally, there is also little difference whether rates are calculated using populations specified in terms of state or territory of residence, or in terms of place of hospitalisation is reviewed. Rates calculated using these two types of denominator show a noticeable though small difference for the Australian Capital Territory (ACT). This is likely because the ACT hospitals have a catchment area which includes some of surrounding New South Wales (NSW) (Figures 3.3 and 3.4).

Type of sport

Football was the most common sport or recreation in terms of hospitalisations with 12,600 admissions. There were 3,944 admissions due to Australian football, 3,270 due to soccer, 2,021 due to football other and unspecified, 1,612 due to rugby league, 715 due to rugby unspecified, 522 due to touch football and 516 due to rugby union. There were 2,799 water sport related hospitalisations, 2,725 sports and recreation related cycling hospitalisations, 2,265 hospitalisations due to roller sports, 2,093 hospitalisations due to wheeled motor sports and 1,816 hospitalisations due to equestrian activities. These and other sports are shown in the Figure 3.5. All of the sports in Figure 3.5 will be discussed in more detail in the chapters that follow.



Note: There were 14,116 cases due to other and unspecified sports.
There was a total of 45,452 sports related hospitalisations, Australia, in 2002–2003.

Figure 3.5: Hospitalisations due to sport and recreation, by type of sport, Australia, 2002–2003

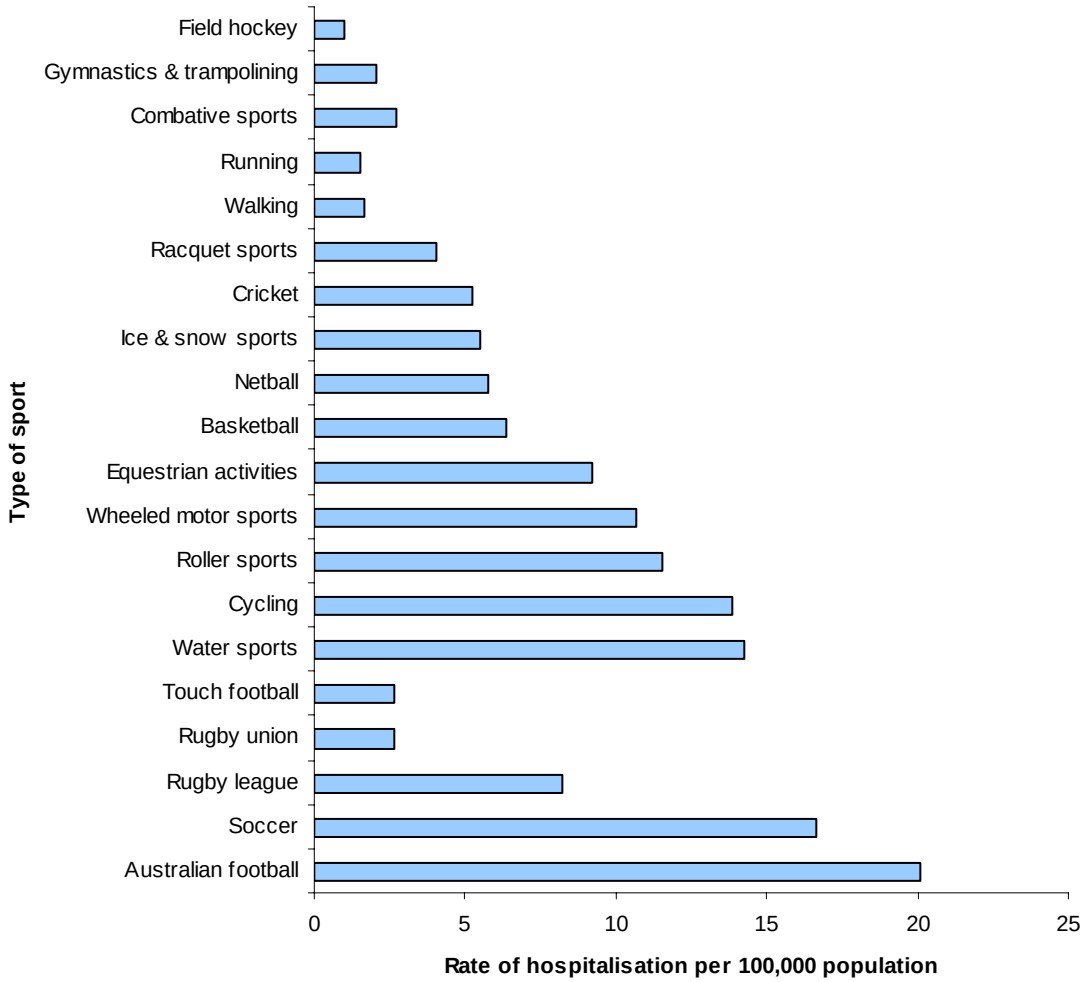
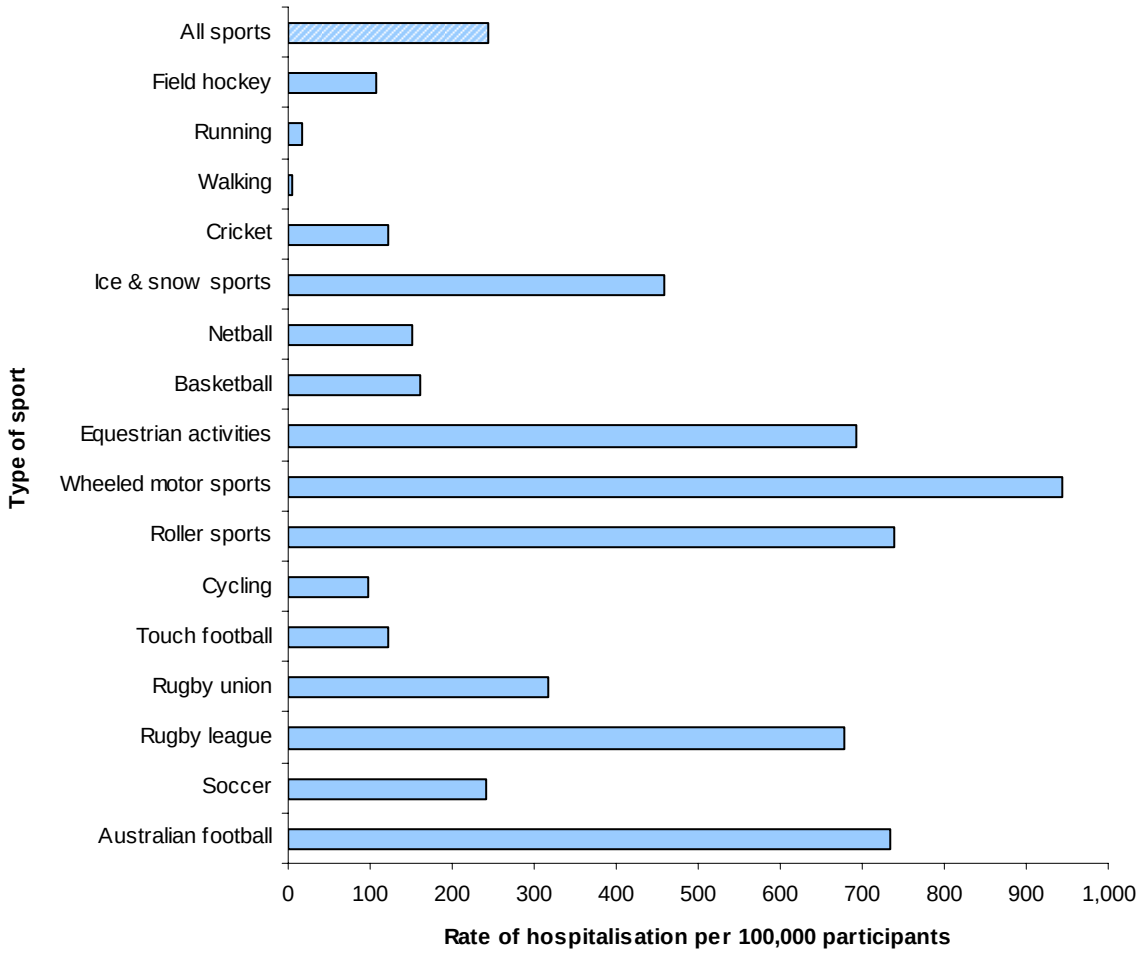


Figure 3.6: Hospitalisation rate per 100,000 population due to sport and recreation, Australia, 2002–2003

Australian football, soccer, water sports and cycling had the highest rates of hospitalisation per 100,000 population with 20.1, 16.6, 14.3 and 13.9, respectively. When participation data is considered (for persons 15 years and over), wheeled motor sports has the highest rate of hospitalisation per 100,000 participants with 942.7, followed by, roller sports with 738.6, Australian football with 734.3, equestrian pursuits with 692.7 and rugby league with 677.9. These rates cannot be used to compare the level of danger of particular sports as the frequency of participation of participants may differ with the various sports. Also, the participation data does not always compare with broad groupings of sports e.g. participation data is available for tennis, squash and racquetball, and badminton but not for racquet sports as a whole (Figures 3.6 and 3.7).



Note: Not all sports categories are shown due to inconsistencies between the sports categories and the participation data.
Excludes 14,218 cases in those less than 15 years.

Figure 3.7: Hospitalisation rate per 100,000 participants (15 years and over) due to sport and recreation, Australia, 2002–2003

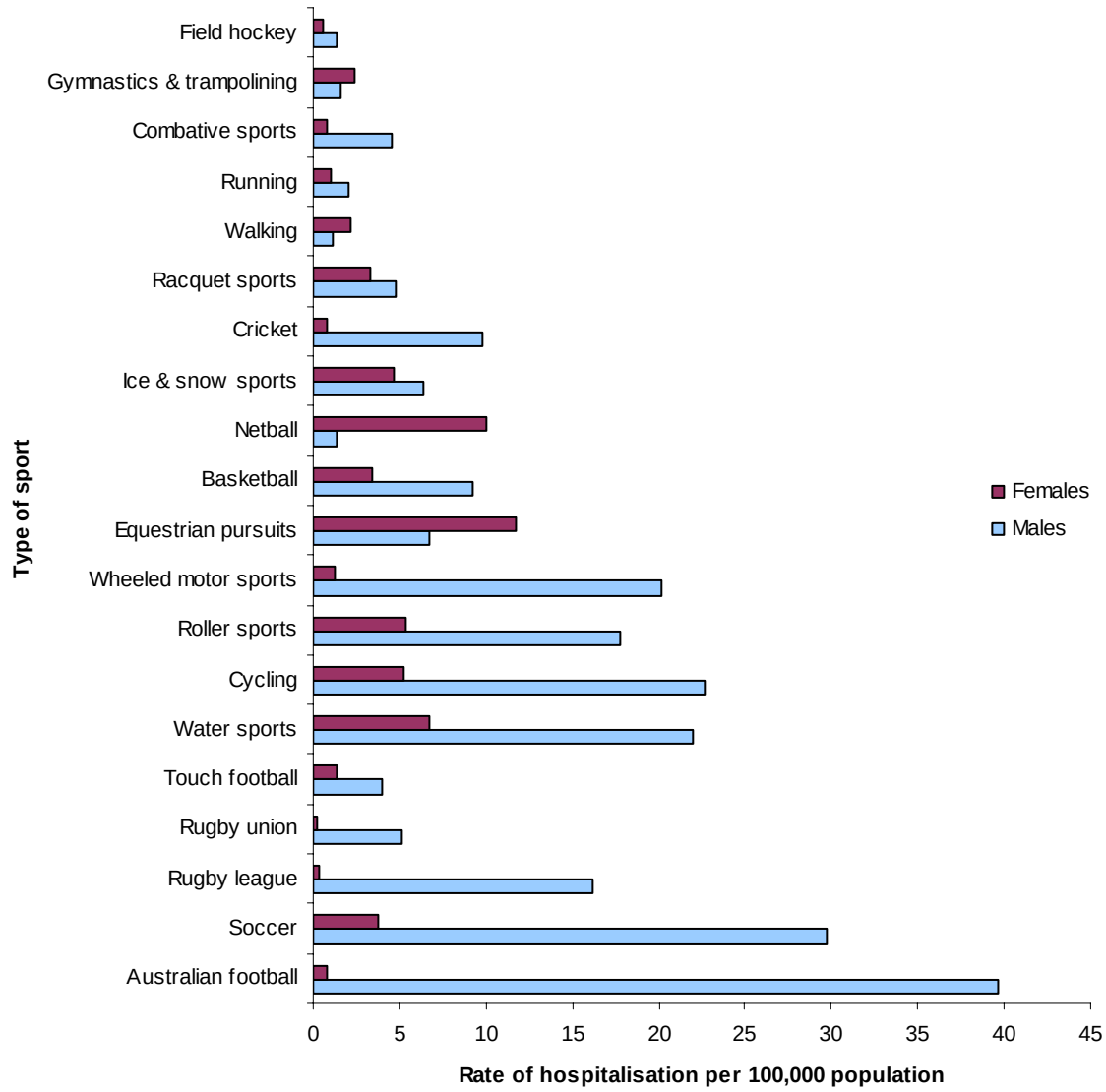
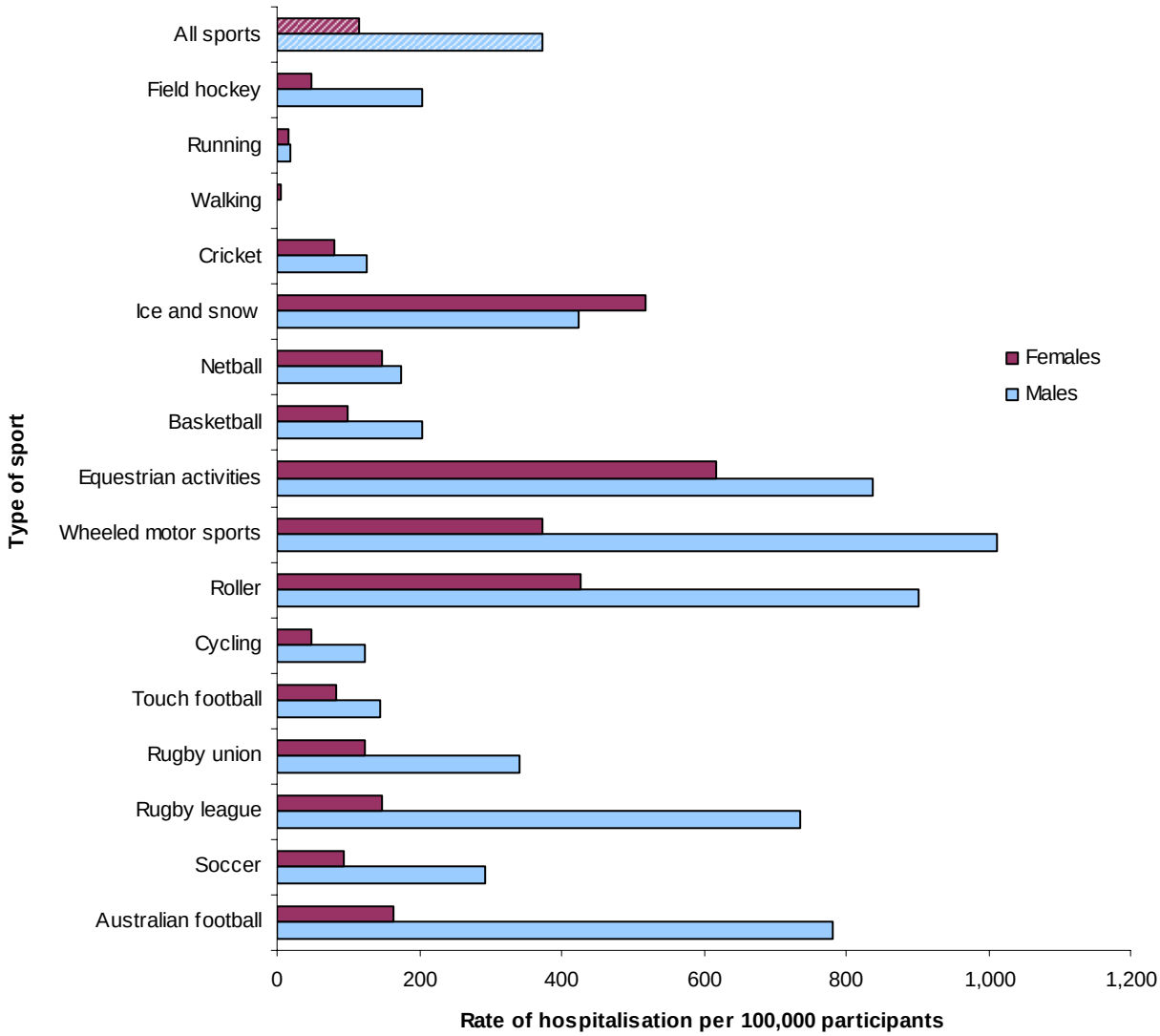


Figure 3.8: Hospitalisation rate per 100,000 population due to sport and recreation injury, by sex, Australia, 2002–2003

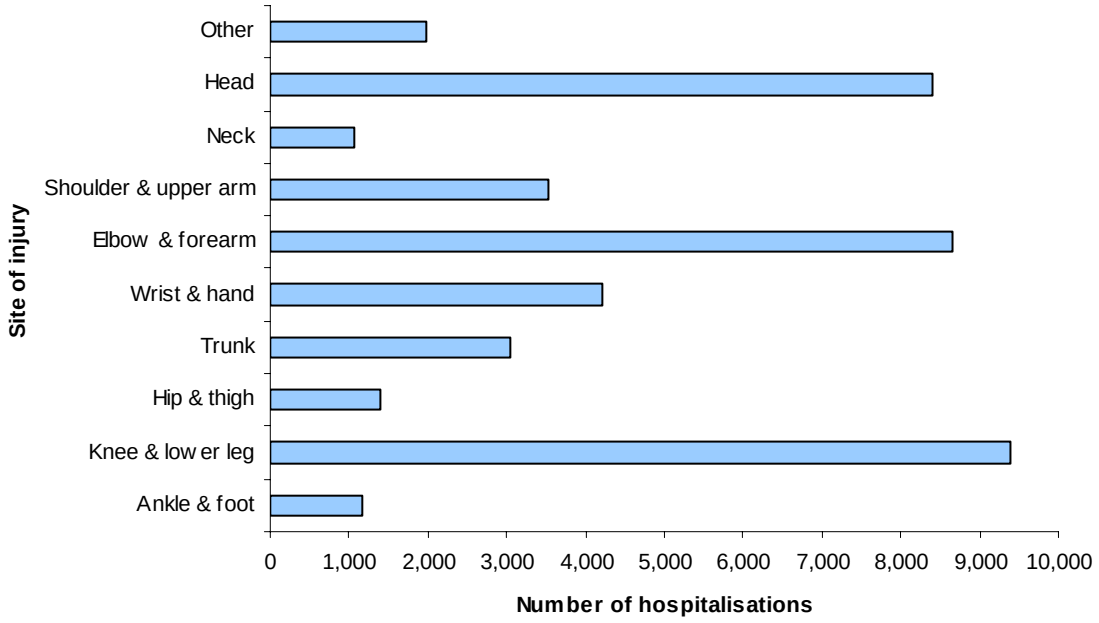
Males and females have a different profile in regards to the rate of hospitalisations for the various types of sports. The rate of hospitalisation per 100,000 population for males is highest for Australian football (39.7) and soccer (29.8), whereas for females is highest for equestrian activities (11.7) and netball (10.0). The rate of hospitalisation per 100,000 participants (15 years and over) for males is highest for wheeled motor sports (1,012.9), followed by roller sports (900.7) and equestrian pursuits (836.3) whereas for females the hospitalisation rate per 100,000 participants (15 years and over), is highest for equestrian pursuits (616.3) followed by ice and snow sports (519.4) (Figures 3.8 and 3.9).



Note: Not all sports categories are shown due to inconsistencies between the sports categories and the participation data.
Excludes 14,218 cases in those less than 15 years.

Figure 3.9 Hospitalisation rate per 100,000 participants (15 years and over) due to sport and recreation injury, by sex, Australia, 2002–2003

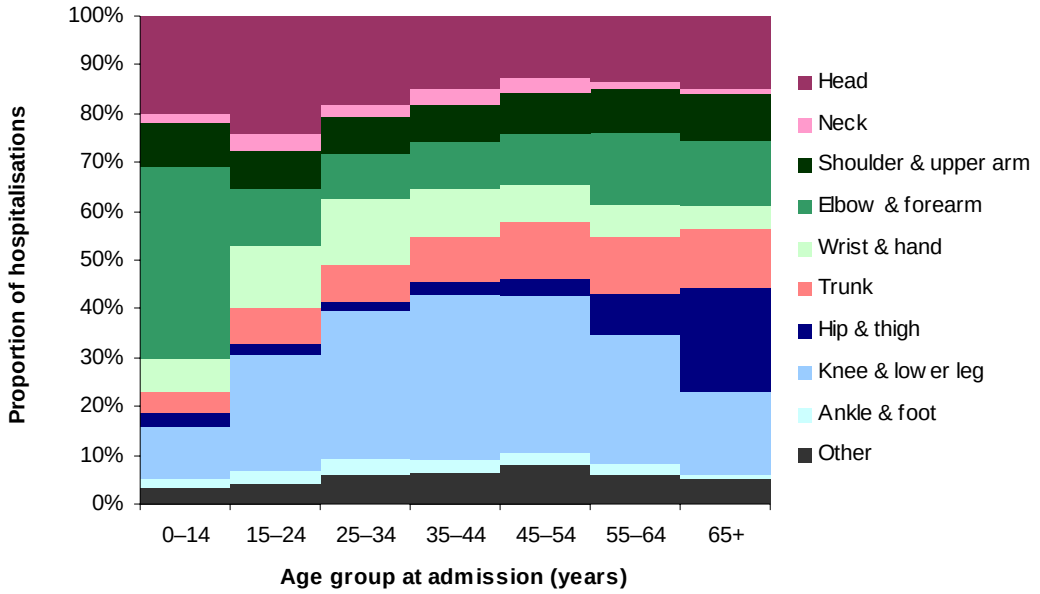
Body region



Note: Excludes 2,578 sport and recreation related cases that had ICD-10-AM codes for injury (U50–U72) but did not have a diagnosis in the injury range (S or T).

Figure 3.10: Hospitalisations due to sport and recreation injury, by principal body region injured, Australia, 2002–2003

For all sport and recreation related hospitalisations, 20.7% (n=9,395) involved the knee and lower leg as principal body region injured, 19.1% (n=8,664) involved the elbow and forearm as principal body region injured and 18.5% (n=8,390) involved the head as principal body region injured. The principal body region most commonly injured differed with the sport played. Elbow and forearm injury requiring hospitalisation was more common in the 0–14 year age group and knee and lower leg injury requiring hospitalisation was more common in the middle age groups (as a percentage of all injury in the age group) (Figures 3.10 and 3.11).

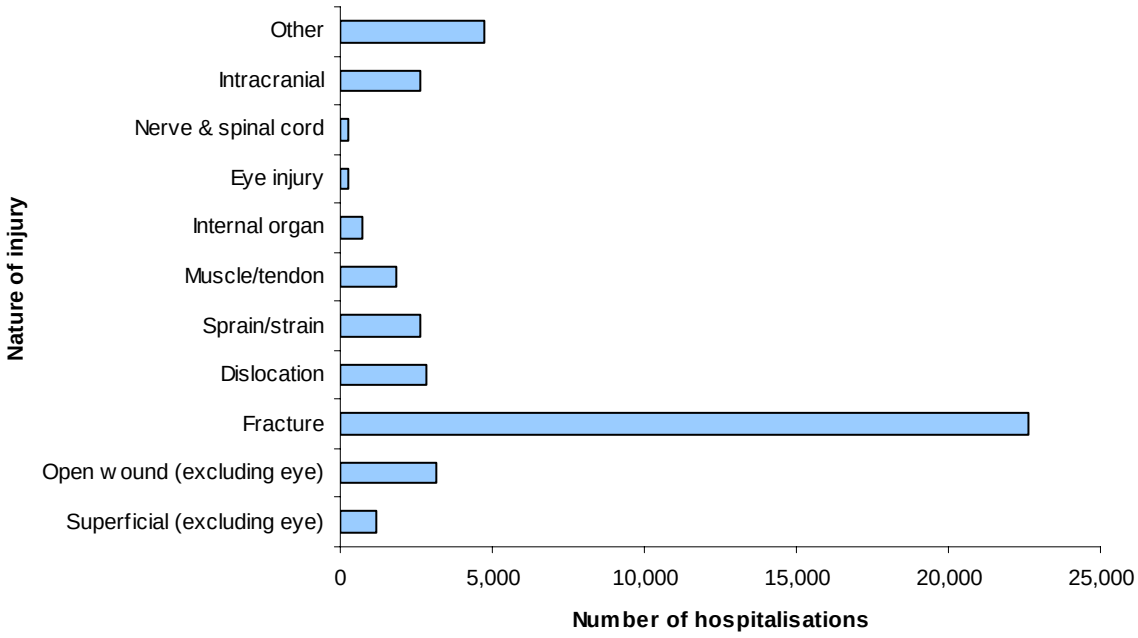


Note: Excludes 1 case with missing age data.
Excludes 2,578 sport and recreation cases that had ICD-10-AM codes for injury (U50–U72) but did not have a diagnosis in the injury range (S or T).

Figure 3.11: Hospitalisations due to sport and recreation injury, by age group at admission and principal body region injured, Australia, 2002–2003

Nature of injury

A fracture was the type of condition accounting for admission in the majority (52.8%) of injury in sport and recreation related hospitalisations. In 2001–2002, 36% of all injury hospitalisations had fracture as the principal diagnosis (Bradley & Harrison 2004). Cassell and Clapperton found that the majority of sports related hospitalisations were due to fractures (56%) (Cassell & Clapperton 2002) (Figure 3.12).



Note: Excludes 2,578 sport and recreation cases that had ICD-10-AM codes for injury (U50–U72) but did not have a diagnosis in the injury range (S or T).

Figure 3.12: Hospitalisations due to sport and recreation injury, by nature of injury, Australia, 2002–2003

5.8% (n= 2,578) of admissions that had a sport or leisure in the activity category (U50–72) did not have an external cause code (S or T). These have been excluded from analysis in the nature of injury section. These admissions did not have any particular common diagnosis.

Among all sports and recreation related hospitalisations in 2002–03, 65 ended with death of the person in hospital. Only a small number of deaths occurred in each sport, so for several reasons these have generally not been reported separately (except in cycling, wheeled motor sports and water sports). Firstly, as there are only small numbers, there is risk of breach of confidentiality. Secondly, small numbers are subject to misleading fluctuations. Thirdly, this report only includes hospitalised persons and not deaths of persons who died before arriving at hospital.

Mechanism of injury

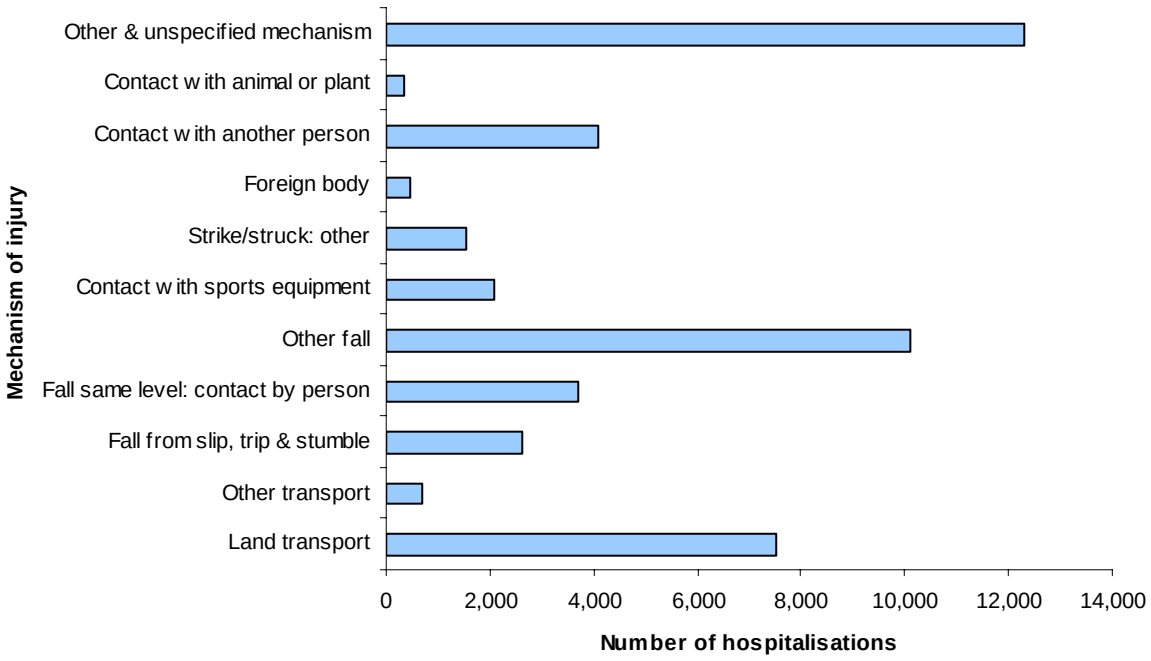


Figure: 3.13 Hospitalisations due to sports and recreation injury, by mechanism of injury, Australia, 2003–2003

Falls were the most common mechanism of injury and accounted for 36.0% (n=16,384) of cases. Nearly one quarter of these (n=3,685, 22.5%) were due to falls on the same level from contact by a person. Mechanism of injury varies with the sport involved, e.g. in cricket, 37.5% of hospitalised injury resulted from contact with the ball and in roller sports, 83.8% of hospitalised injury resulted from falls (Figure 3.13).

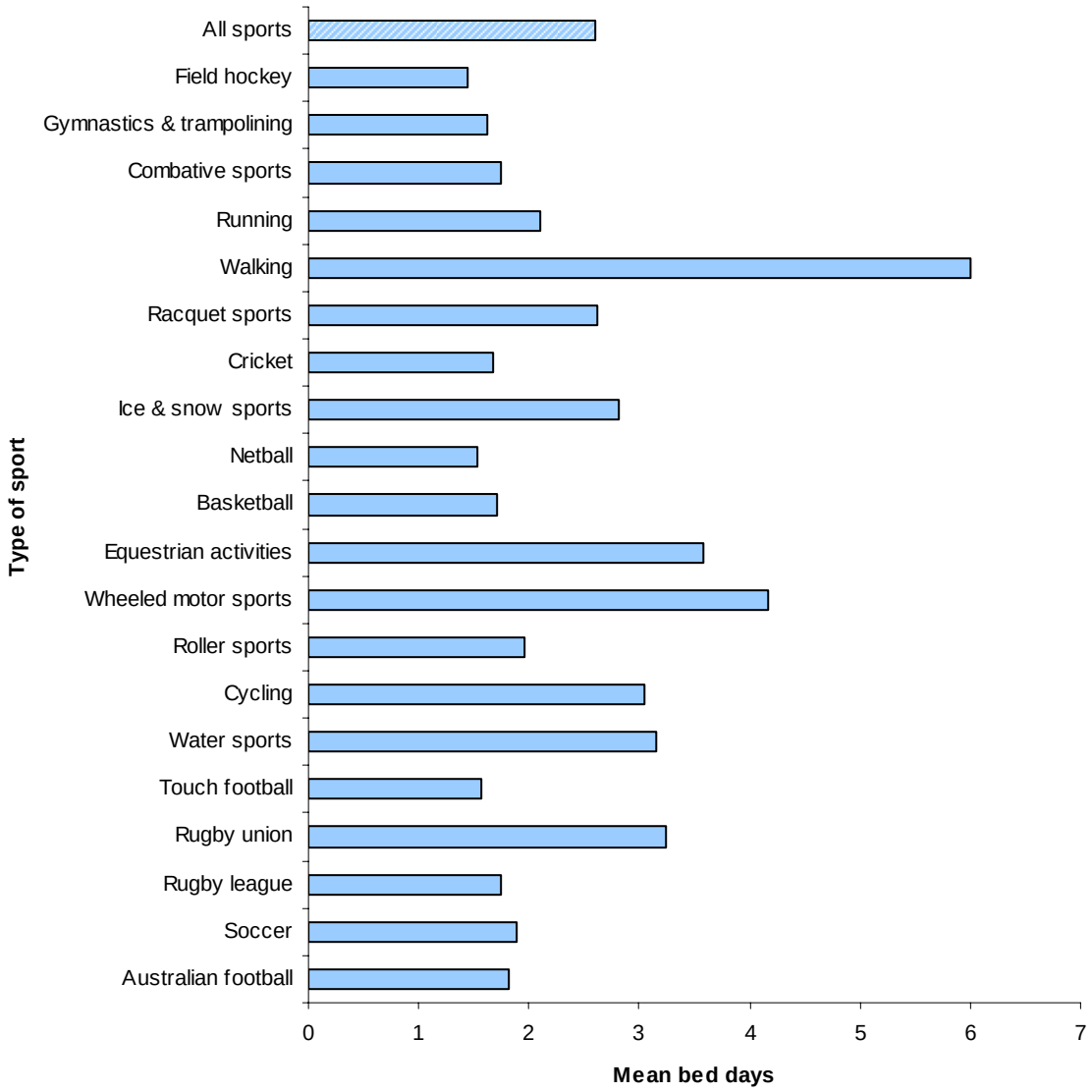
Length of stay

Table 3.4: Sports and recreation related hospitalisations by length of stay, Australia, 2002–2003

	Total bed days[†]	Cases[‡]	Mean bed days[††]
Australian football	7,169	3,944	1.8
Soccer	6,166	3,270	1.9
Rugby league	2,808	1,612	1.7
Rugby union	1,670	516	3.2
Touch football	815	522	1.6
Water sports	8,808	2,799	3.1
Cycling	8,302	2,725	3.0
Roller sports	4,424	2,265	2.0
Wheeled motor sports	8,714	2,093	4.2
Equestrian activities	6,505	1,816	3.6
Basketball	2,126	1,244	1.7
Netball	1,730	1,129	1.5
Ice & snow sports	3,055	1,087	2.8
Cricket	1,725	1,034	1.7
Racquet sports	2,096	800	2.6
Walking	1,932	322	6.0
Running	632	300	2.1
Combative sports	922	529	1.7
Gymnastics & trampolining	647	400	1.6
Field hockey	278	193	1.4
All sports[‡‡]	117,989	45,452	2.6

[†] This is total bed days, including inward transfers.
[‡] This excludes inward transfers.
[††] This is total bed days (including inward transfers) divided by cases (excluding inward transfers).
[‡‡] There were 16,852 cases due to other and unspecified sports.

Length of stay is an indication of severity of injury. Most sports had a similar profile with regard to length of stay. The mean number of bed days stayed was 2.6. Walking had the highest mean number of bed days with 6.0 (Table 3.4 and Figure 3.14).



Note: This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Figure 3.14: Hospitalisations due to sports and recreation injury, by mean bed days, Australia, 2002–2003

Place of occurrence

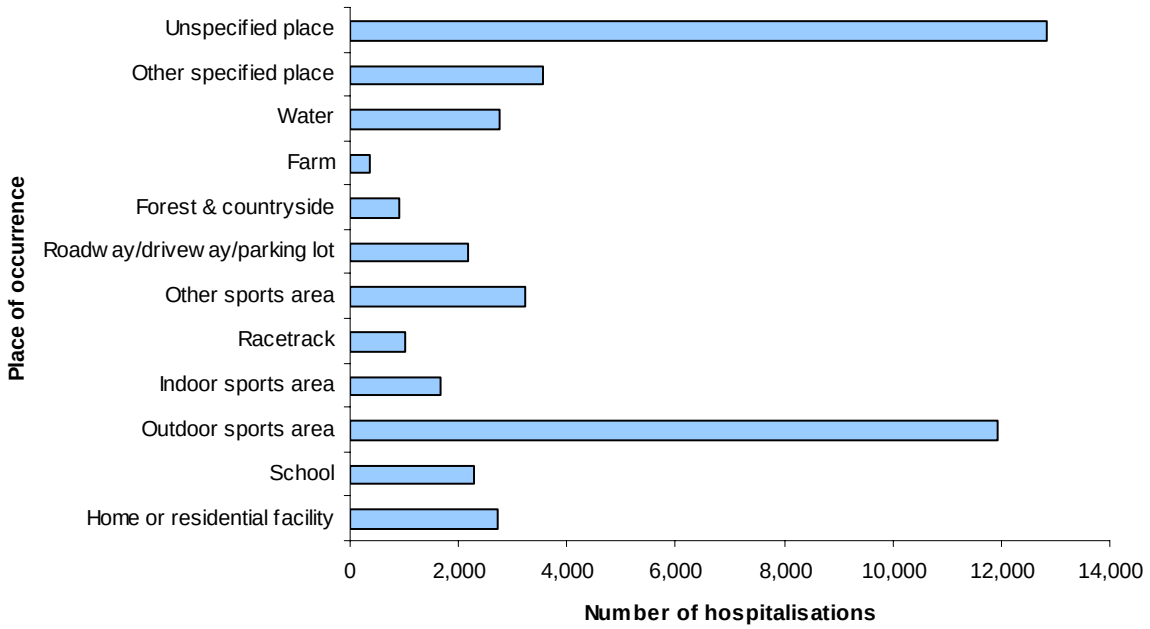


Figure 3.15: Hospitalisations due to sport and recreation injury, by place of occurrence, Australia, 2002–2003

26.3% (n=11,943) of sports and recreation related hospitalised injury occurred at an outdoor sports area. The location where a sports injury occurred varies depending on the sport, e.g. Australian football injuries usually occur at an outdoor sports area (78.6%) but cycling rarely does (0.9%). This is likely due to the different locations that sports are played (Figure 3.15).

Month of admission

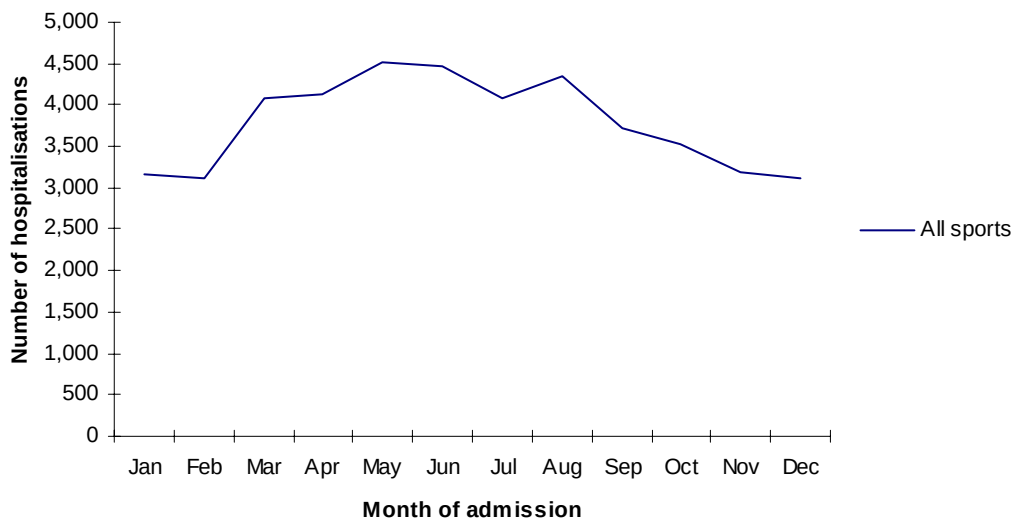


Figure 3.16: Hospitalisations due to sports and recreation injury, by month of admission, Australia, 2002–2003

When all sports are considered together, hospitalised sports injuries are relatively evenly spread across the year with a slight peak over the winter period. As would be expected winter sports, e.g. ice and snow sports, tend to have a peak incidence in winter and summer sports, e.g. cricket, tend to peak in summer (Figure 3.16).

Discussion

The greatest number of hospitalised injuries due to sports and recreation are in the 0–14 year age group (n=14,218), followed by the 15–24 year age group. The highest rate of hospitalisation per 100,000 participants (15 years and over) was in the 15–24 year age group with 516.5.

There are a greater total number of females participating in sports than males. The male participation rate is however, slightly higher than that of females (82.6% versus 82.4%) (Australian Sports Commission 2003). 73.9% of persons hospitalised as a result of sport are male. The rate of hospitalisation per 100,000 population is much higher in males than females (344.4 versus 120.0) as is the rate per 100,000 participants (373.4 versus 114.6). This may be due to the differing types of sports participated in or different ways in which sports are played by males and females rather than males being more injury prone or more likely to be hospitalised (for a given injury).

Football was the most common sport or recreation in terms of hospitalisations with 12,600 admissions. There were 3,944 admissions due to Australian football and 3,270 due to soccer. There were 2,799 water sport related hospitalisations, 2,725 sports and recreation related cycling hospitalisations, 2,265 hospitalisations due to roller sports, 2,093 hospitalisations due to wheeled motor sports and 1,816 hospitalisations due to equestrian activities.

Australian football, soccer, water sports and cycling had the highest rates of hospitalisation per 100,000 population with 20.1, 16.6, 14.3 and 13.9, respectively. When participation data is considered (for persons 15 years and over), wheeled motor sports has the highest rate of hospitalisation per 100,000 participants with 942.7, followed by, roller sports with 738.6, Australian football with 734.3, equestrian pursuits with 692.7 and rugby league with 677.9. These rates cannot be used to compare the level of danger of particular sports as the frequency of participation of participants may differ with the various sports. Also, the participation data does not always compare with broad groupings of sports e.g. participation data is available for tennis, squash and racquetball, and badminton but not for racquet sports as a whole.

Males and females have a different profile in regards to the rate of hospitalisations for the various types of sports. The rate of hospitalisation per 100,000 population for males is highest for Australian football (39.7) and soccer (29.8), whereas for females is highest for equestrian activities (11.7) and netball (10.0). The rate of hospitalisation per 100,000 participants (15 years and over) for males is highest for wheeled motor sports (1,012.9), followed by roller sports (836.3) and equestrian pursuits (900.7), whereas for females the hospitalisation rate per 100,000 participants (15 years and over), is highest for equestrian pursuits (616.3) followed by ice and snow sports (519.4).

20.7% (n=9,395) of all sport and recreation related hospitalisations, involved the knee and lower leg as the principal body region injured. In 52.8% (n=22,655) of hospitalisations, a fracture was the principal diagnosis. Falls were the most common mechanism of injury and accounted for 36.0% (n=16,384) of cases. There were 65 deaths in those hospitalised for sports and recreation related reasons.

4 Football

U50.00, U50.01, U50.02, U50.03, U50.04, U50.05, U50.08, U50.09

Several codes of football are played commonly in Australia. These include: soccer, Australian football, rugby league and rugby union. Participation shows strong regional differences for some codes with Australian football being predominately played in Victoria and SA and rugby being predominately played in NSW and Queensland. Football is mainly played in winter.

Soccer is the most widely played sport in the world (Murtaugh 2001; Kirkendall et al. 2001). For Australian adults (15 years and over) soccer was the fifth most popular organised physical activity in 2002 and sixth most popular in 2003 (Australian Sports Commission 2003). In 2003, 1.7% of adults (15 years and over) participated in indoor soccer (2.7% of males and 0.8% of females) and 4.3% of adults (15 years and over) participated in outdoor soccer (6.4% of males and 2.3% of females) (Australian Sports Commission 2003). The majority of soccer participants (15 years and over) were aged 15–24 years (6.3% participation rate for indoor soccer and 14.7% for outdoor soccer) (Australian Sports Commission 2003).

2.8% of Australians, 15 years and over (5.2% of males and 0.4% of females), participated in Australian football in 2003 (Australian Sports Commission 2003). The majority of participants (15 years and over) were aged 15–24 years (8.4% participation rate) followed by 25–34 years (4.1% participation rate) (Australian Sports Commission 2003). For those 15 years and over, SA had a participation rate of 5.5% and Victoria had a participation rate of 5.1% (Australian Sports Commission 2003).

1.1% of Australians, 15 years and over (2.0% of males), participated in rugby league and 0.8% of Australians (1.5% of males), participated in rugby union in 2003 (Australian Sports Commission 2003). The majority of participants (15 years and over) were aged 15–24 years (4.5% participation rate for rugby league and 3.1% for rugby union). NSW had a participation rate (15 years and over) of 1.6% for rugby league and 1.0% for rugby union (Australian Sports Commission 2003). Queensland had a participation rate (15 years and over) of 2.4% for rugby league and 1.4% for rugby union (Australian Sports Commission 2003).

In the 12 months prior to interview in April 2003, 13.4% of children, 5–14 years, (22.2% of males and 4.2% of females) had participated in organised soccer; 7.3% of children (13.6% of males and 0.7% of females) had participated in organised Australian football and 2.9% of children had participated in organised rugby league (Australian Bureau of Statistics 2005).

Hockey and Knowles 2000 collected data of emergency department presentations in Queensland related to sports injury in 1998–1999. 15.3% of such presentations were due to rugby league, 14.3% were due to soccer, 4.5% were due to rugby union, 3.7% were due to Australian football, 3.1% were due to touch football and 21.3% were due to football not specified (Hockey & Knowles 2000).

Hockey and Knowles 2000 found that for soccer, 36.6% of injury was due to falls; 36.4% due to striking or collision with another person; 15.5% due to striking or collision with an object (e.g. the ball or goal post) and 6.5% due to other specified cause. In Australian football, 31.5% of injury was due to falls; 49.6% due to striking or collision with another person; 8.5% due to striking or collision with an object and 5.4% due to other specified cause. In rugby league, 27.8% of injury was due to falls; 54.9% due to striking or collision with another person; 6.3% due to striking or collision with an object and 4.2% due to other specified cause. In rugby union, 26.7% of injury was due to falls; 57.8% due to striking or collision with another person; 3.8% due to striking or collision with an object and 4.4% due to other specified cause (Hockey & Knowles 2000).

In their review of emergency department presentations in Queensland, Hockey and Knowles 2000 found that in soccer the ankle was the most commonly injured body part (16.8%), followed by the lower arm (14.7%) and knee (12.1%). The head was injured in 5.7% of cases. In Australian football, the hand was the most commonly injured body part (15.0%), followed by the shoulder (14.6%) and the ankle (10.8%). The head was injured in 6.9% of cases. In rugby league, the shoulder was the most commonly injured body part (13.5%), followed by the hand (11.7%), the face (10.8%) and the knee (10.4%). The head was injured in 9.2% of cases. In rugby union, the face was the most commonly injured body part (13.7%), followed by the shoulder (12.4%) and the knee (11.4%). The head was injured in 8.6% of cases (Hockey & Knowles 2000).

In the study by Hockey and Knowles 2000 of emergency department presentations in Queensland, sprain/strain was the most common reason for presentation in football (46.0% for soccer, 31.2% for Australian football, 38.6% for rugby league and 35.6% for rugby union), followed by fracture (25.5% for soccer, 28.1% for Australian football, 23.0% for rugby league and 22.2% for rugby union). Intracranial injuries accounted for 5.1% of presentations in soccer, 6.9% in Australian football, 9.0% in rugby league and 7.9% in rugby union (Hockey & Knowles 2000).

Elias 2001 reviewed injuries presenting to the medical clinic at the USA Cup Soccer Tournament (which is the largest international soccer youth tournament) from 1988–1997. 5,911 patients were seen at the clinic. 65.5% of injury involved the lower limb, 13.6% involved the head/neck, 12.3% involved the upper limb and 8.6% involved the trunk. Over the 10 year period, there was a decline in the rate of lower extremity injuries and head/neck injuries (excluding concussions which remained relatively constant) (Elias 2001).

Indoor and outdoor soccer differ in that the playing field is generally smaller in indoor soccer and the ball stays in play longer because of deflections from the walls, resulting in a rapid game with the ball quickly changing direction (Putukian et al. 1996). Putukian et al. 1996 studied injuries resulting from the Soccer America Dawn to Dark Festival (indoor soccer). There were 4.44 injuries per 100 player hours (including all injuries which required time off from play or practice) and goalkeepers had 1.45 injuries per 100 player hours. 18.4% of injuries were severe, that is, requiring more than 1 month off practice or play. The majority of these were knee injuries i.e. anterior cruciate ligament (ACL), medial collateral ligament (MCL) and meniscal injuries. Ankle sprain was the most common injury (26.3%) followed by injury to the knee ligaments (18.4%). 71.4% of all injuries involved the lower limb, 15.8% involved the head/face and 13.2% involved the upper limb. 5.3% of injuries were concussion. 7.9% of injuries were fractures (5.3% head/face and 2.6% upper limb). Putukian et al. 1996 concluded that, indoor and outdoor soccer had similar patterns of injury (Putukian et al. 1996).

Junge et al. 2004 studied amateur male soccer and rugby union players 10–14 years for 1 season. On average, there were 1.8 injuries per player in that season for soccer and 2.8 for rugby union. In soccer, the ankle was the most commonly injured body part (17.2%), followed by the thigh (17.0%), lower leg (16.1%) and knee (15.0%). The head was injured in 4.2% of cases and the neck in 0.8% of cases. In rugby union, the shoulder was the most commonly injured body part (19.1%), followed by the upper extremity (13.2%), the knee (11.5%) and the head and the lower leg (both 9.1%). The neck was injured in 6.8% of cases. There were significantly more head, neck, shoulder and upper extremity injuries per 1,000 hours of exposure in rugby union compared with soccer ($p<0.001$). Junge et al. 2004 found significantly more concussion and dislocations ($p<0.05$) and fractures ($p<0.01$) per 1,000 hours of exposure in rugby union compared with soccer. Strain was the most common type of injury (31.8% for soccer and 36.2% for rugby union). Fractures comprised 1.2% of injuries in soccer and 4.1% of injuries in rugby union. Concussion comprised 1.2% of injuries in soccer and 2.9% of injuries in rugby union (Junge et al. 2004).

Characteristics of playing surface can affect injury risk. Orchard et al. 1999 found that low rainfall the year prior and high evaporation the month prior to an Australian football match results in an elevated risk of ACL injury (Orchard et al. 1999). However, Seward et al. 2004 suggests that grass type and thatch depth, may be of more importance than ground hardness in ACL injury risk in Australian football players (Seward et al. 2004).

Serious head and cervical injury or even death can result from football. The issue of cervical injury is particularly of concern in rugby. Rotem et al. looked at severe cervical spinal cord injury from rugby league and union in NSW from 1984–1996. They reviewed all cases admitted to the spinal units at Royal North Shore Hospital and Prince Henry Hospital but excluded cases which had been transferred from outside NSW and as such their study included more than 95% of all spinal injuries in NSW. They found 59 cervical cord injuries due to rugby league, 56 due to rugby union, 1 due to touch football and 1 'backyard' rugby player. Spinal injuries are most commonly due to tackles in rugby league and scrum–like play in rugby union (Rotem et al. 1998). Players with long thin necks are excluded from participating in the front row of scrums as they are more susceptible to spinal injury (Haylen 2004). However, a player is more likely to sustain a serious spinal injury crossing the road or driving to or from the sports field than from actually playing rugby union (Milburn 1993).

McCory et al. 2000 reviewed fatalities from brain injury in footballers in Victoria (1968–1999). They found 25 deaths (22 Australian football players and 3 rugby union players) of which 9 were due to brain injury (all Australian football players). In brain injury related fatalities, the majority (n=8) died of intracranial haemorrhage. Three of these deaths were from vertebral artery injury causing traumatic subarachnoid haemorrhage. Five deaths were due to congenital cardiac disease, 5 due to ischaemic cardiac disease and 3 due to commotio cordis (sudden death from low–energy trauma to the chest, presumably due to be arrhythmia) (McCrory et al. 2000).

4–20% of all injuries in soccer are head injuries. There is a higher frequency of concussion in more advanced play (Kirkendall et al. 2001). It has been suggested that multiple concussive or sub concussive blows to the head may cause cumulative brain injury and that this is possible in soccer. Soccer is unique because the unprotected head is used to direct and advance the ball. A soccer ball can travel greater than 100 km/hr when kicked, however, most opportunities for heading occur at ball speeds less than 65 km/hr. Prior to the 1970s, a leather soccer ball was used and this could absorb a large amount of water thus increasing the force of impact. Current balls are resistant to water absorption (Kirkendall et al. 2001). The player's head can impact the ball, an opponent, the goal post or the ground. Heading a modern ball does not produce sufficient G forces to sustain a concussion. However, impact with another player's head does and wearing a soft helmet does not decrease these forces sufficiently to stop concussion (McCrory 2003).

Two Norwegian studies assessed retired and current players for signs of head injury. Players identified as 'headers' had significantly higher frequency of cerebral atrophy on CT scan. Neuropsychological testing was suggestive of organic brain damage in one third of players (Kirkendall et al. 2001). Matser et al. found that amateur soccer players had impairment in planning and memory function when compared with controls (Matser et al. 1999). Other studies have not replicated these findings (McCrory 2003).

Age

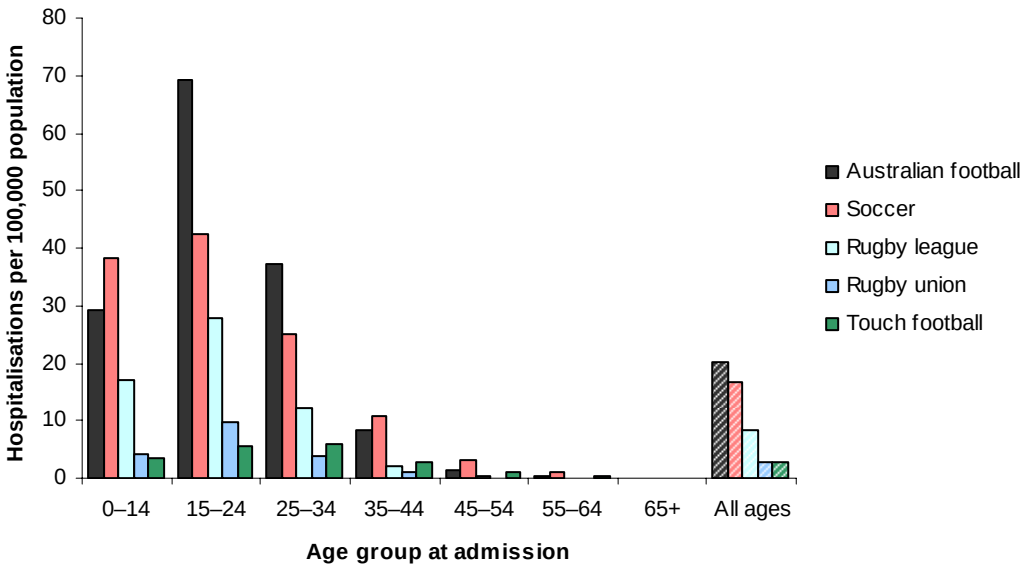
Football accounted for 27.7% (n=12,600) of sports related hospitalisations in 2002–2003. Australian football accounted for 31.3% (n=3,944) and soccer accounted for 26.0% (n=3,270) of football related admissions. Football is most commonly played by the younger age groups. Soccer is the most commonly played football code, however, Australian football accounted for more admissions. The majority (61.5%) of soccer players, Australian football players (52.8%), rugby league (72.4%) and rugby union (66.7%) over 14 years are in the 15–24 year age group. For those 14 years and over, touch football was also most commonly played in the 15–24 year age group, but was also commonly played by the 25–44 year age group (Australian Sports Commission 2003). As would be expected, the majority of football injuries occurred in the younger age groups. For all codes except touch football, the peak incidence of hospitalisation was in the 15–24 year age group, with 43.5% (n=5,756) of hospitalisations occurring in this age group (Table 4.1 and Figure 4.1).

Australian football had the highest rate of hospitalisation per 100,000 participants with 734.3. This was followed by rugby league with 677.9. Both these codes had a peak rate of hospitalisation per 100,000 participants in the 25–34 year age group with 1,071.4 for rugby league and 831.8 for Australian football (Table 4.1 and Figure 4.2).

Table 4.1: Summary measures for football related injury hospitalisations, by age group at admission, Australia, 2002–2003

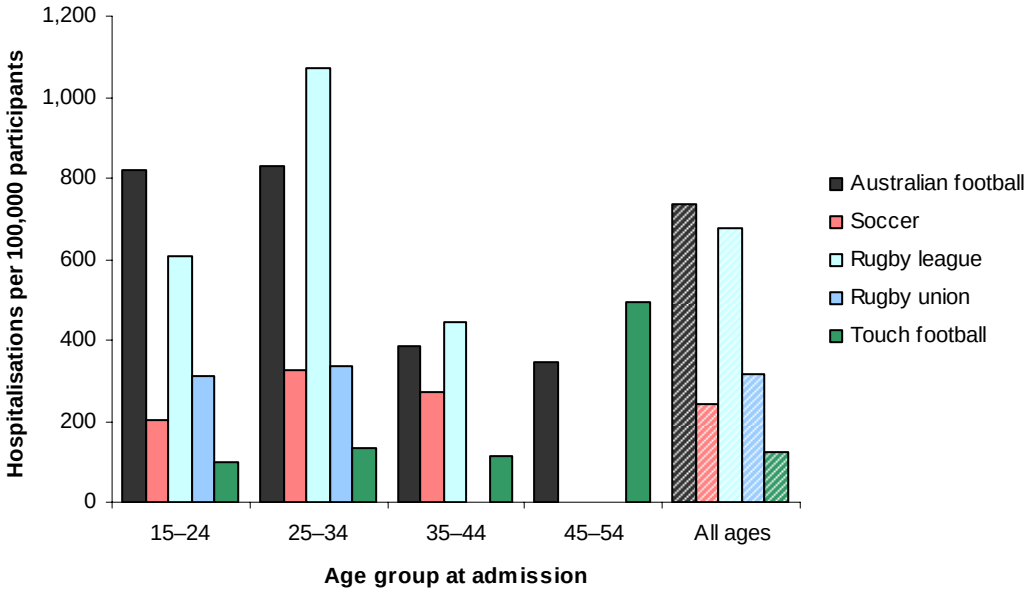
	Age group at admission (years)							
	0–14	**15–24**	**25–34**	**35–44**	**45–54**	**55–64**	**65+**	**All ages (%)**
Cases: Football	3,026	5,495	2,926	893	207	43	9	12,600[‡] (100)
Australian football	761	1,883	1,004	244	40	7	4	3,944[‡] (31.3)
Soccer	1,003	1,160	675	316	91	22	…	3,270 (26.0)
Rugby league	446	758	330	67	10	…	0	1,612 (12.8)
Rugby union	111	267	105	28	5	0	0	516 (4.1)
Rugby, unspecified	164	327	188	30	6	0	0	715 (5.7)
Touch football	90	153	159	80	34	5	…	522 (4.1)
Football: other	451	947	465	128	21	8	…	2,021 (16.0)
Estimated number of participants ('000)								
Australian football	NA	229.1	120.7	63.5	11.5[*]	5.7[**]	2.9[**]	433.5[†]
Soccer[††]	NA	575.9	205.8	115.9[*]	31.2[**]	0.3[**]	7.6[**]	936.7[†]
Rugby league	NA	124.5	30.8	15.1[*]	0[**]	1.5[**]	0[**]	172.0[†]
Rugby union	NA	85.2	31.1	5.7[**]	1.1[**]	4.6[**]	0[**]	127.8[†]
Touch football	NA	153.1	121.3	71.9	6.9[*]	3.2[**]	0[**]	356.3[†]
Rate/100,000 population								
Australian football	29.1	69.0	37.1	8.2	1.4	0.3	0.1	20.1
Soccer	38.3	42.5	24.9	10.6	3.1	0.9	0.1	16.6
Rugby league	17.0	27.8	12.2	2.3	0.3	0.0	0.0	8.2
Rugby union	4.2	9.8	3.9	0.9	0.2	0.0	0.0	2.6
Touch football	3.4	5.6	5.9	2.7	1.2	0.2	0.0	2.7
Rate/100,000 participants								
Australian football	NA	821.9	831.8	384.3	347.8	NA	NA	734.3[†]
Soccer[††]	NA	201.4	328.0	272.6	NA	NA	NA	242.0[†]
Rugby league	NA	608.8	1071.4	443.7	NA	NA	NA	677.9[†]
Rugby union	NA	313.4	337.6	NA	NA	NA	NA	316.9[†]
Touch football	NA	99.9	131.1	111.3	492.8	NA	NA	121.2[†]

Note: Case numbers when n<4 are not shown.
[†] The estimated number of participants and the rate of hospitalisation per 100,000 participants for all ages do not include those less than 15 years.
[‡] There was 1 case of Australian football with missing age data. This case is included in the all ages total.
[*] Estimate has a relative standard error of between 25% and 50% and should be used with caution.
[**] Estimate has a relative standard error of greater than 50% and is considered too unreliable for general use.
[††] For soccer, the estimated number of participants and the rate per 100,000 participants has been calculated from values for indoor and outdoor soccer found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).
The rate per 100,000 participants is not shown for those 55+ years for Australian football, those 45+ years for soccer and rugby league and those 35+ years for rugby union due to high uncertainty in participation data.
Cases of rugby unspecified (n=715) and other football (n=2,021) are not shown.



Note: Cases of rugby unspecified (n=715) and other football (n=2,021) are not shown.

Figure 4.1: Hospitalisation rate per 100,000 population, due to football injury, by age group at admission, Australia, 2002–2003



Note: The hospitalisation rate per 100,000 participants excludes 2,411 cases of Australian football, soccer, rugby league, rugby union and touch football in those less than 15 years.
The rates for those 55+ years for Australian and touch football, for those 45+ years for soccer and rugby league and 35+ years for rugby union are not shown due to high uncertainty in participation data.
For soccer, the estimated number of participants and the rate per 100,000 participants has been calculated from values for indoor and outdoor soccer found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).
Cases of rugby unspecified (n=715) and other football (n=2,021) are not shown.

Figure 4.2: Hospitalisation rate per 100,000 participants (15 years and over) due to football injury, by age group at admission, Australia, 2002–2003

Sex

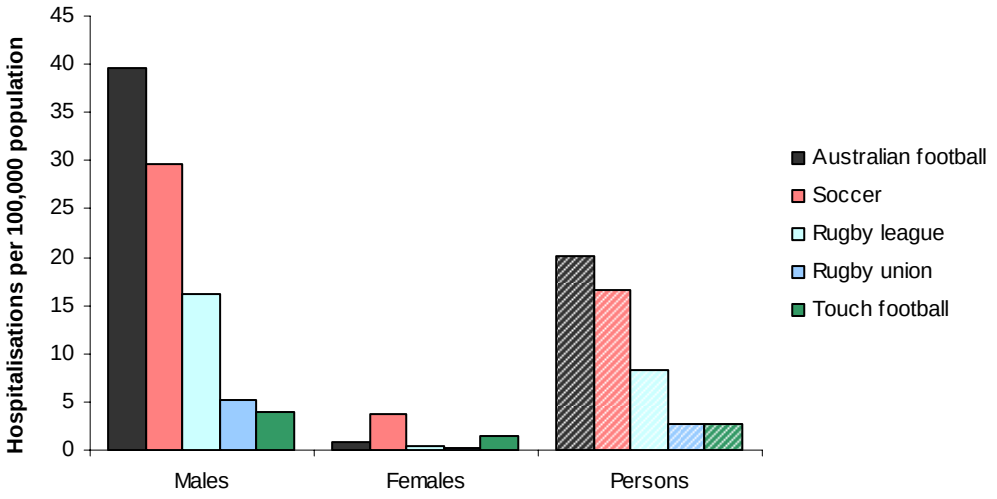
All football codes are played much more commonly by males than females. There was less disparity of males to female players for soccer (2.9:1) and touch football (1.7:1) than Australian football (12.4:1) (Australian Sports Commission 2003). The majority (94.3%) of hospitalisations were in males. The majority (51.4%, 368) of hospitalisations in females occurred in soccer. In males, hospitalisations were most common in Australian football (n=3,868, 32.5%) and soccer (n=2,902, 24.4%) (Table 4.2 and Figure 4.3).

Table 4.2: Summary measures for football injury hospitalisations, by sex, Australia, 2002–2003

	Males (%)	Females (%)	Persons (%)
Cases: Football	11,884 (100)	716 (100)	12,600 (100)
Australian football	3,868 (32.5)	76 (10.6)	3,944 (31.3)
Soccer	2,902 (24.4)	368 (51.4)	3,270 (26.0)
Rugby league	1,579 (13.3)	33 (4.6)	1,612 (12.8)
Rugby union	497 (4.2)	19 (2.7)	516 (4.1)
Rugby, unspecified	683 (5.7)	32 (4.5)	715 (5.7)
Touch football	387 (3.3)	135 (18.9)	522 (4.1)
Football: other	1,968 (16.6)	53 (7.4)	2,021 (16.0)
Estimated number of participants ('000) [†]			
Australian football	401.0	32.4	433.5
Soccer[‡]	699.0	237.6	936.7
Rugby league	155.5	16.4[*]	172.0
Rugby union	114.1	13.7[*]	127.8
Touch football	223.3	133	356.3
Rate/100,000 population			
Australian football	39.7	0.8	20.1
Soccer	29.8	3.7	16.6
Rugby league	16.2	0.3	8.2
Rugby union	5.1	0.2	2.6
Touch football	4.0	1.4	2.7
Rate/100,000 participants[†]			
Australian football	780.5	163.6	734.3
Soccer[‡]	292.0	95.1	242.0
Rugby league	734.4	146.3[*]	677.9
Rugby union	340.1	124.1[*]	316.9
Touch football	144.2	82.7	121.2

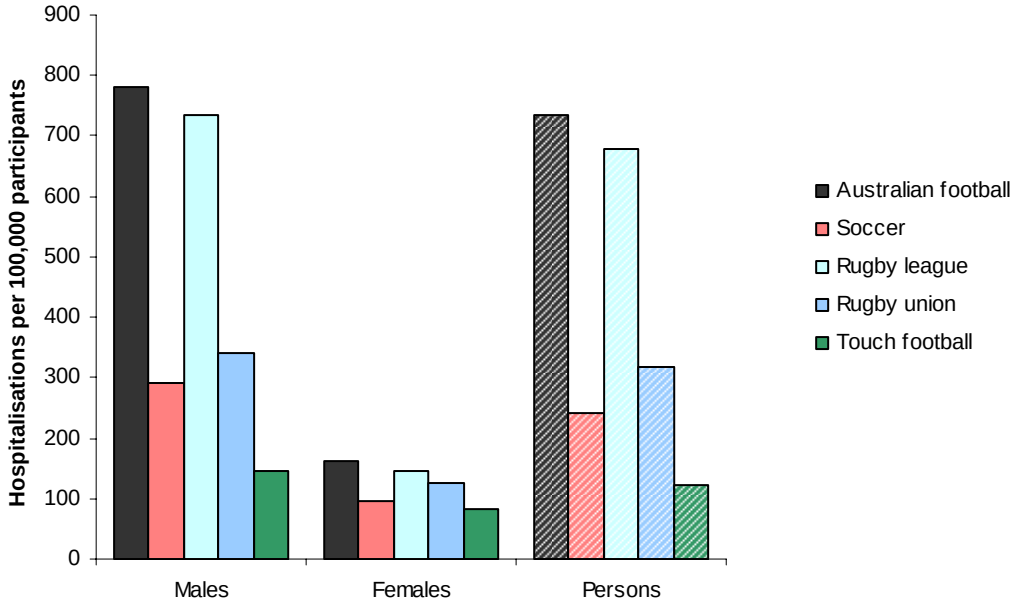
[*] Estimate has a relative standard error of between 25% and 50% and should be used with caution.
[†] The estimated number of participants and rate of hospitalisation per 100,000 participants excludes those less than 15 years (n=2,411).
[‡] For soccer, the estimated number of participants and the rate per 100,000 participants has been calculated from values for indoor and outdoor soccer found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).

Across all football codes the rate of hospitalisation per 100,000 participants was higher for males than females. For rugby league the rate of hospitalisation per 100,000 participants was 5.0 times higher in males than in females (734.4 versus 146.3). However, there is a relative standard error of between 25% and 50% for the value for females. For Australian football the rate of hospitalisation per 100,000 participants was 4.8 times higher in males than in females (780.5 versus 163.6) (Table 4.2 and Figure 4.4).



Note: Cases of rugby unspecified (n=715) and other football (n=2,021) are not shown.

Figure 4.3: Hospitalisation rate per 100,000 population, due to football injury, by sex, Australia, 2002–2003



Note: The hospitalisation rate per 100,000 participants excludes 2,411 cases of Australian football, soccer, rugby league, rugby union and touch football in those less than 15 years.
For soccer, the estimated number of participants and the rate per 100,000 participants has been calculated from values for indoor and outdoor soccer found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).
Cases of rugby unspecified (n=715) and other football (n=2,021) are not shown.

Figure 4.4: Hospitalisation rate per 100,000 participants (15 years and over) due to football injury, by sex, Australia, 2002–2003

State or territory of hospitalisation

Information on participation was not available for all states and territories for all football codes. The estimated number of participants was not available for rugby union, rugby league and touch football in Victoria, South Australia (SA) and Tasmania; was not available for rugby league in Western Australia (WA) and was not available for Australian football in Queensland.

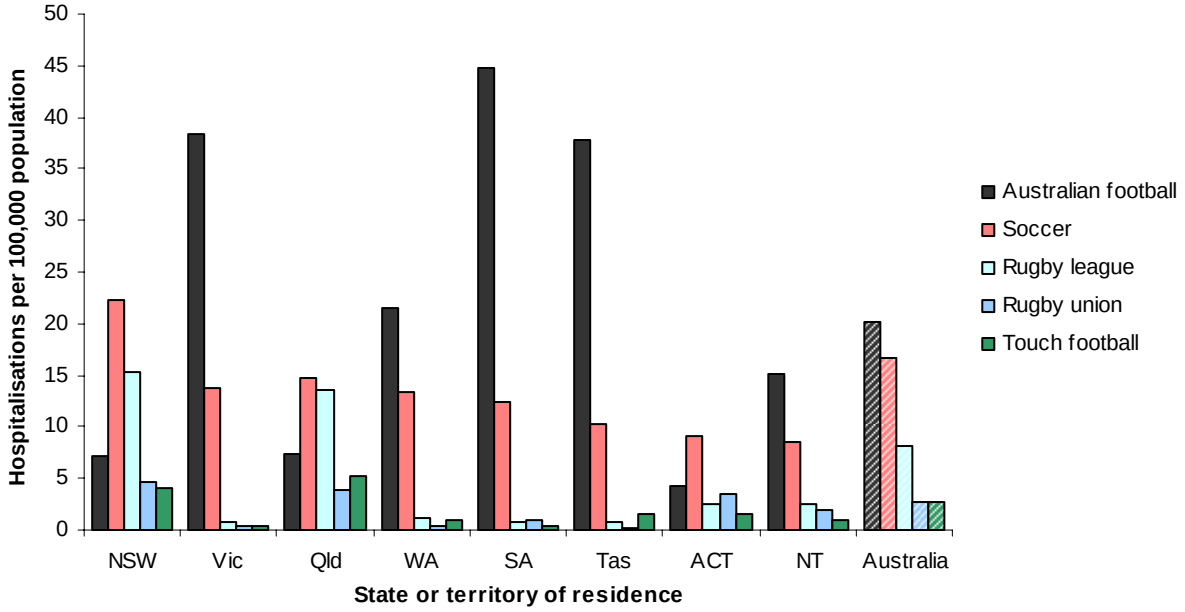
South Australia (SA) had the highest hospitalisation rate per 100,000 population for Australian football with 44.7. This was more than twice the Australian rate of 20.1 per 100,000 population (Figure 4.5). SA had the highest participation rate for Australian football (for those 15 years and over) with 5.5% followed by 5.1 for Victoria (Australian Sports Commission 2003). When hospitalisation rate per 100,000 participants (15 years and over) is reviewed Tasmania has the highest rate with 1,006.3, followed by SA with 853.9 (Figure 4.6).

New South Wales (NSW had the highest hospitalisation rate per 100,000 population for soccer with 22.2, this compares with the Australian rate of 16.6. Northern Territory (NT) had the lowest rate per 100,000 population with 8.6. (Figure 4.5) Australian Capital Territory (ACT) had the highest participation rates (for those 15 years and over) with 3.7% of the population participating in indoor soccer and 6.3% of the population participating in outdoor soccer (Australian Sports Commission 2003). NSW had the highest rate per 100,000 participants (15 years and over) with 289.9 which is 2.7 times higher than the rate in the ACT (105.7) (Figure 4.6).

Rugby league is predominately played in NSW and Queensland with 49.0% and 41.0% of the 172,000 players in Australia residing in NSW and Queensland, respectively (Australian Sports Commission 2003). As would be expected NSW and Queensland had the highest hospitalisation rate per 100,000 population with 15.2 and 13.7, respectively (Figure 4.5). However, the hospitalisation rate per 100,000 participants is much higher in NSW than Queensland (852.7 versus 521.2) (Figure 4.6).

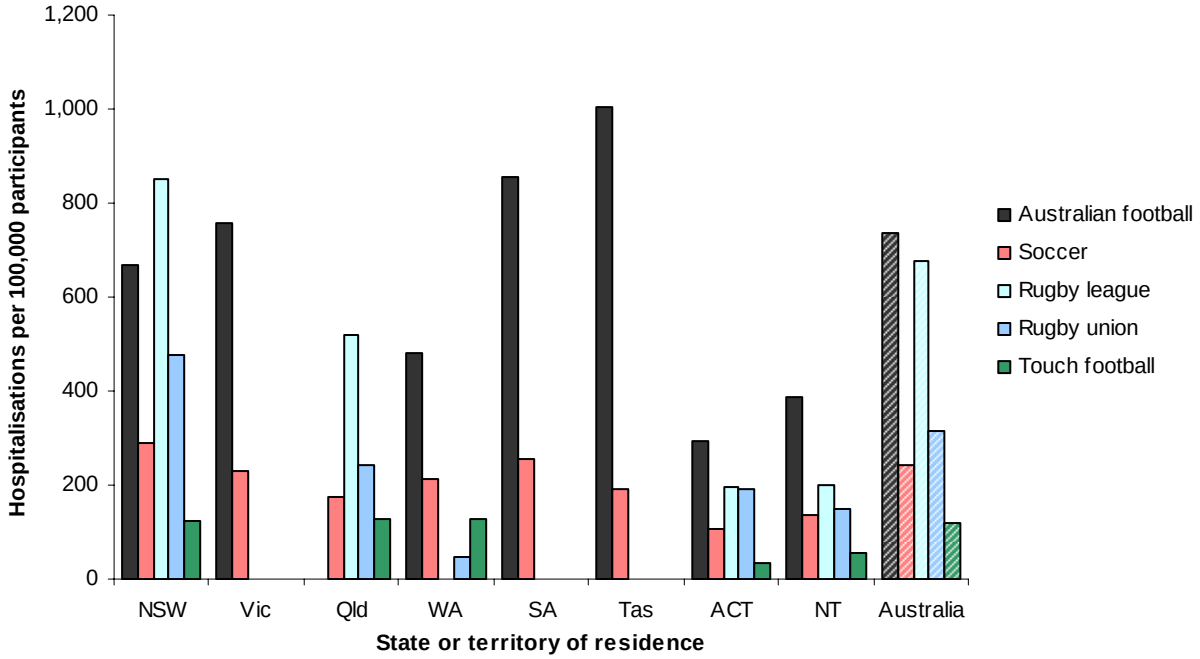
Rugby union is also predominately played in NSW and Queensland with 41.2% and 33.3% of the 127,800 players in Australia residing in NSW and Queensland, respectively (Australian Sports Commission 2003). The hospitalisation rate per 100,000 population was 4.6 for NSW and 4.0 for Queensland, compared with the Australian rate of 2.6 (Figure 4.5). As with rugby league the hospitalisation rate per 100,000 participants (15 years and over) is much higher in NSW than in Queensland (475.3 versus 242.4) (Figure 4.6).

Queensland had the highest hospitalisation rate per 100,000 population for touch football with 5.2 compared with the Australian rate of 2.7 (Figure 4.5). Queensland, WA and NSW all had similar hospitalisation rates per 100,000 participants (15 years and over) with 126.1, 125.9 and 121.6, respectively, and the Australian rate was 121.2. This is much lower than the hospitalisation rate per 100,000 participants for Australia as a whole for Australian football (734.3) and rugby league (677.9) (Figure 4.6).



Note: Cases of rugby unspecified (n=715) and other football (n=2,021) are not shown.
There were 65 cases of Australian football, soccer, rugby league, rugby union and touch football with unreported state or territory of residence and 3 with state or territory of residence as other territory. These cases have been included in the rate for Australia as a whole.

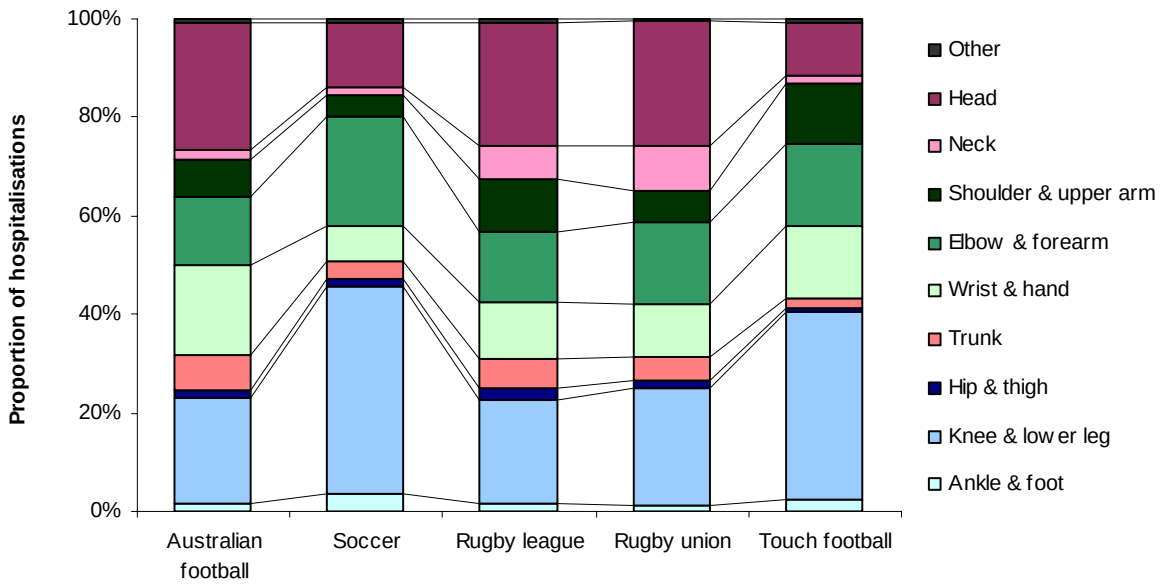
Figure 4.5: Hospitalisation rate per 100,000 population, by state or territory of residence, due to football injury, Australia, 2002–2003



Note: Cases of rugby unspecified (n=715) and other football (n=2,021) are not shown.
Hospitalisation rate per 100,000 participants excludes 761 cases of Australian football, 1,003 cases of soccer, 446 cases of rugby league, 111 cases of rugby union and 90 cases of touch football hospitalisation in those under 15 years.
Participation rates for football have been calculated from estimated number of participants found in Participation in Exercise Recreation and Sport Annual Report 2003. For soccer, the estimated number of participants and the rate per 100,000 participants has been calculated from values for indoor and outdoor soccer found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).
The estimated number of participants was not available for rugby union, rugby league and touch football in Victoria, SA and Tasmania; was not available for rugby league in Western Australia and was not available for Australian football in Queensland.
There were 65 cases of Australian football, soccer, rugby league, rugby union and touch football with unreported state or territory of residence and 3 with state or territory of residence as other territory. These cases have been included in the rate for Australia as a whole.

Figure 4.6: Hospitalisation rate per 100,000 participants (15 years and over) by state or territory of residence, due to football injury, Australia, 2002–2003

Body region

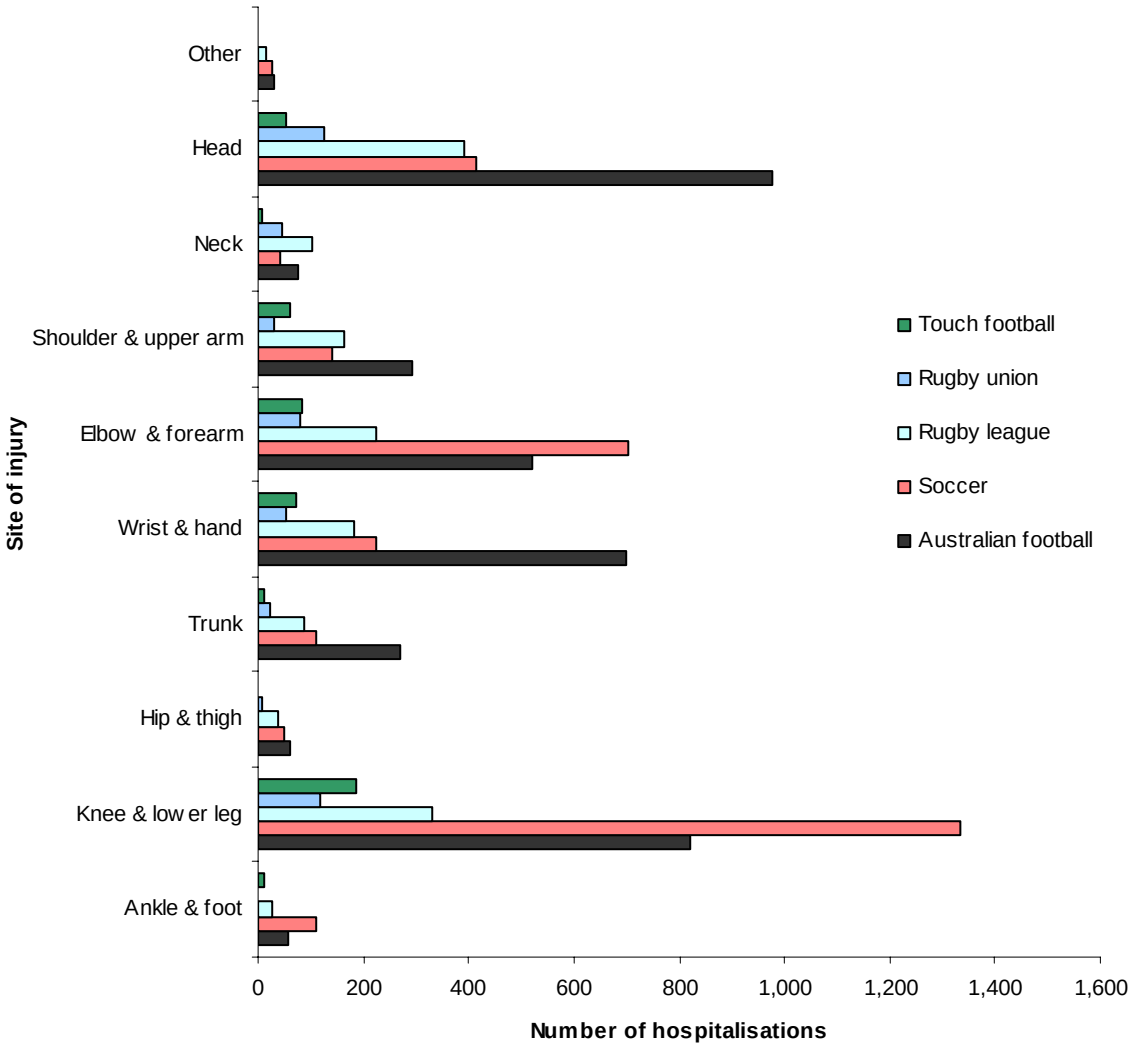


Note: Excludes 359 cases of Australian football, soccer, rugby league, rugby union and touch football that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.
Cases of rugby unspecified (n=715) and football, other and unspecified (n=2,021) are not shown.

Figure 4.7: Hospitalisations due to football injury, by principal body region injured, Australia, 2002–2003

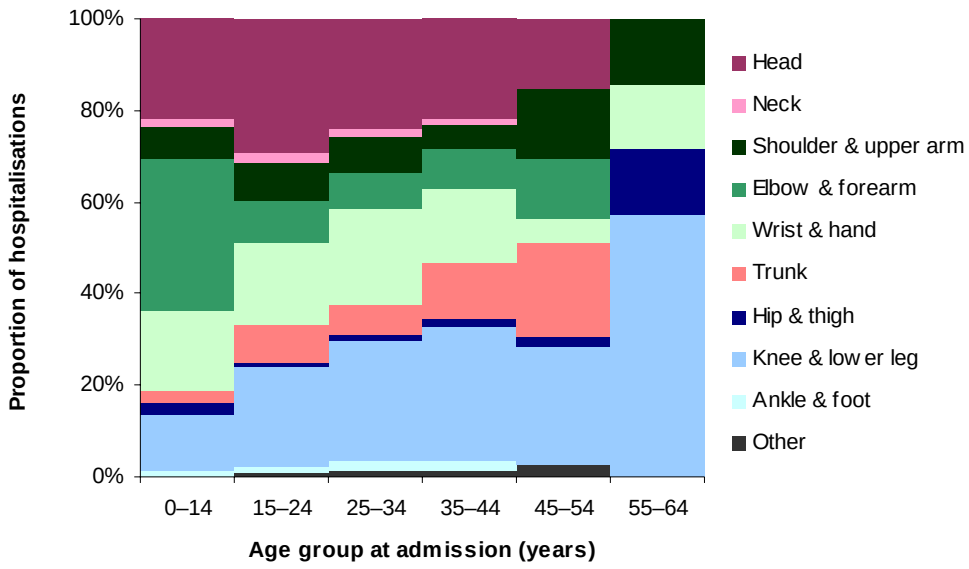
Head injuries were the most common reason for hospitalisation in Australian football (n=977, 24.8%), rugby league (n=393, 24.4%) and rugby union (n=124, 24.0%). Knee and lower leg injury were the most common reason for hospitalisation in soccer (n=1,334, 40.8%) and touch football (n=186, 35.6%). 6.5% of rugby league hospitalisations (n=104) and 8.7% of rugby union hospitalisations (n=45) were due to neck injury (Figure 4.7).

In terms of total numbers of hospitalisations the highest number was due to knee and lower leg injury in soccer (n=1,334), followed by head injury in Australian football (n=977), knee and lower leg injury in Australian football (n=822) and elbow and forearm injury in soccer (n=703) (Figure 4.8).



Note: Excludes 359 cases of Australian football, soccer, rugby league, rugby union and touch football that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.
Cases of rugby unspecified (n=715) and football, other and unspecified (n=2,021) are not shown.

Figure 4.8: Hospitalisations due to football, by principal body region injured, Australia, 2002–2003

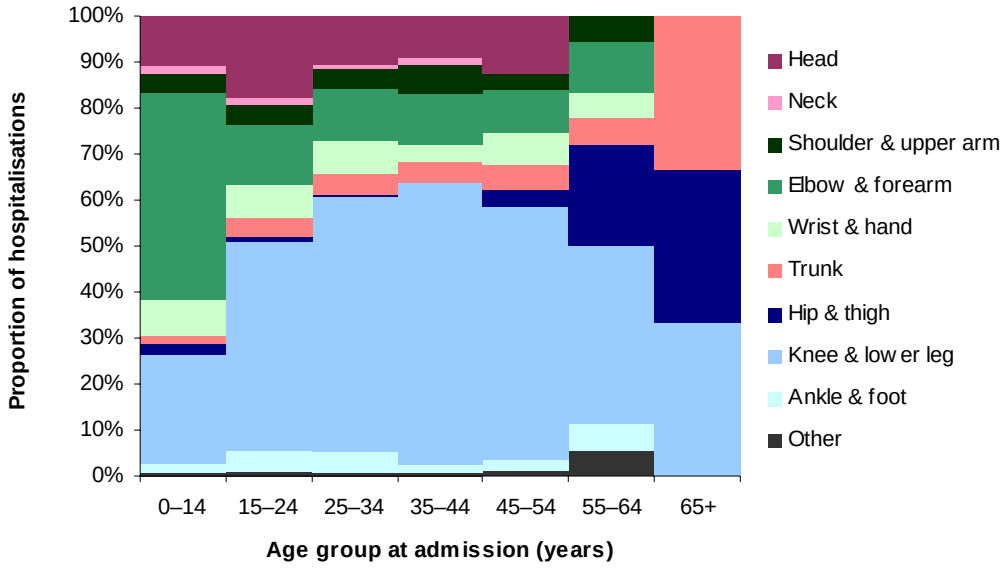


Note: Excludes 1 case with missing age data.
Values for those 65+ years are not shown due to low numbers.
Excludes 142 cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 4.9: Hospitalisations due to Australian football injury, by age group at admission and principal body region injured, Australia, 2002–2003

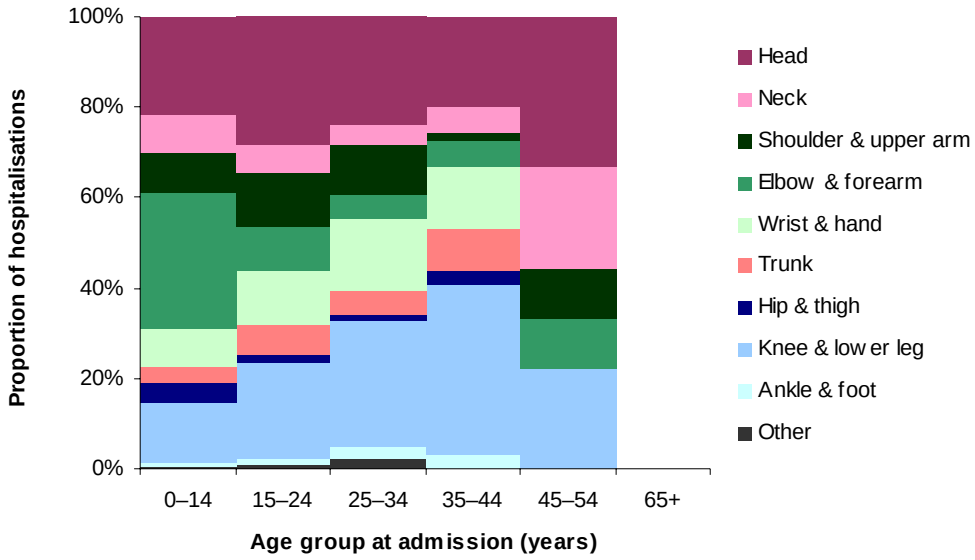
For Australian football head injury was most common in the 15–24 year age group with 28.0% of admissions in this age group due to head injury (n=528). Knee and lower leg injury as a percentage of admissions gradually increased to a peak in the 55–64 year age group (n=4, 57.1%). Upper limb injury as a percentage of admissions was highest in the 0–14 year age group (56.5%) with 249 elbow and forearm admissions, 131 wrist and hand admissions and 50 shoulder and upper arm admissions (Figure 4.9).

In soccer, elbow and forearm injury as the principal site injury peaked in the 0–14 year age group with 445 injuries (44.4%). The greatest number of soccer hospitalisations due to knee and lower leg injury occurred in the 15–24 year age group (n=502, 43.3%). However, as a percentage of total injuries for the age group, the peak for knee and lower leg injury was in the 35–44 year age group with 58.5% (n=185) (Figure 4.10).



Note: Excludes 114 cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

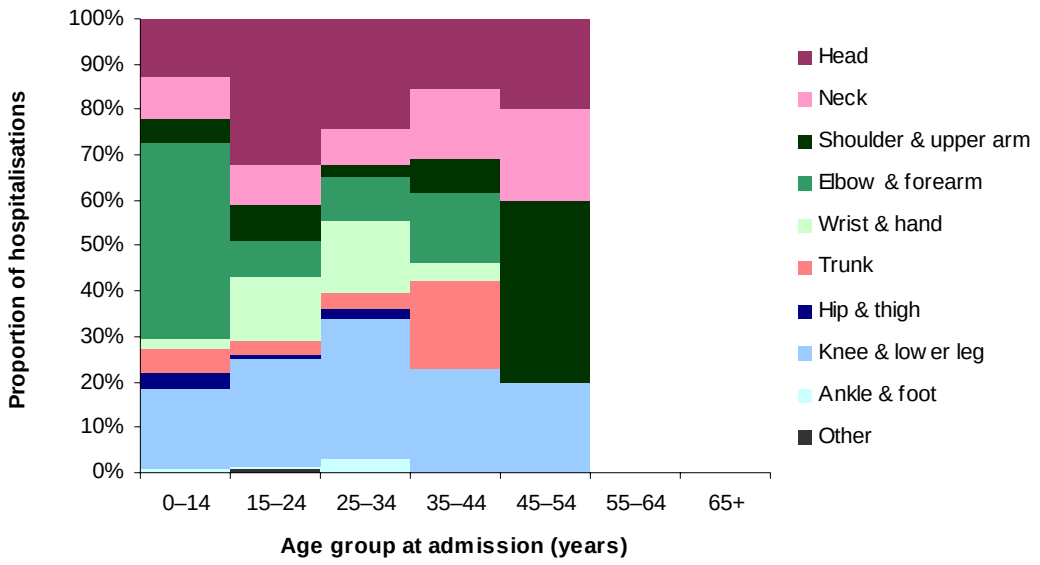
Figure 4.10: Hospitalisations due to soccer injury, by age group at admission and principal body region injured, Australia, 2002–2003



Note: Values for the 55–64 year age group are not shown due to low numbers.
There were no cases in the 65+ year age group.
Excludes 45 cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 4.11: Hospitalisations due to rugby league injury, by age group at admission and principal body region injured, Australia, 2002–2003

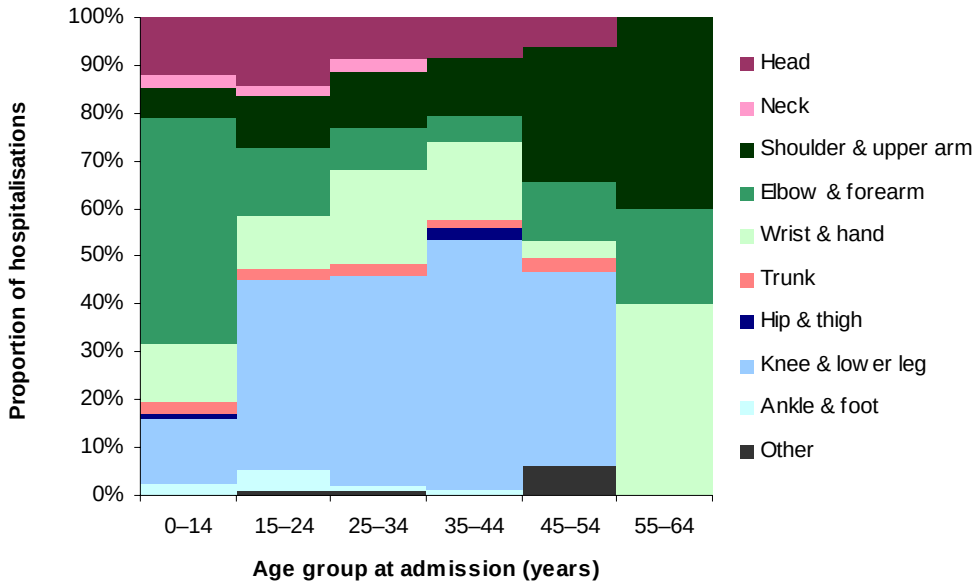
In rugby league, the peak number of hospitalisations for head injury is in the 15–24 year age group (n=208, 27.4%) however, the peak in terms of percentage of hospitalisations for the age group is in the 45–54 year age group (30%). The peak number and percentage of hospitalisations for elbow and forearm injury is in the 0–14 year age group (n=130, 29.1%) (Figure 4.11).



Note: There were no hospitalisations due to rugby union in those 55+ years.
Excludes 25 cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 4.12: Hospitalisations due to rugby union injury, by age group at admission and principal body region injured, Australia, 2002–2003

In rugby union, head injury related hospitalisations are most common in the 15–24 year age group with 80 hospitalisations (30.0%). Elbow and forearm injury related hospitalisations peak in the 0–14 year age group with 47 hospitalisations (42.3%) (Figure 4.12).

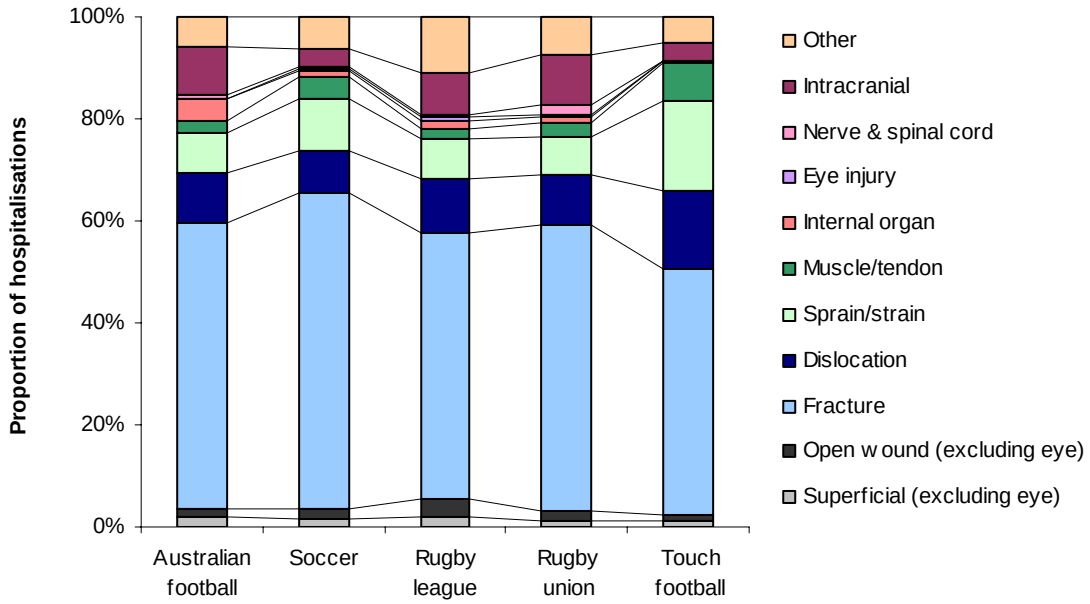


Note: Cases 65+ years are not shown due to small numbers n<4.
Excludes 33 cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 4.13: Hospitalisations due to touch football injury, by age group at admission and principal body region injured, Australia, 2002–2003

In touch football, elbow and forearm injury requiring hospitalisation was most common in the 0–14 year age group (n=39, 43.3%). Knee and lower leg injury requiring hospitalisation was highest in the 25–34 year age group (n=65) but reached a peak in terms of percentage of total hospitalisations for the age group in the 35–44 year age group (n=38, 47.5%) (Figure 4.13).

Nature of injury

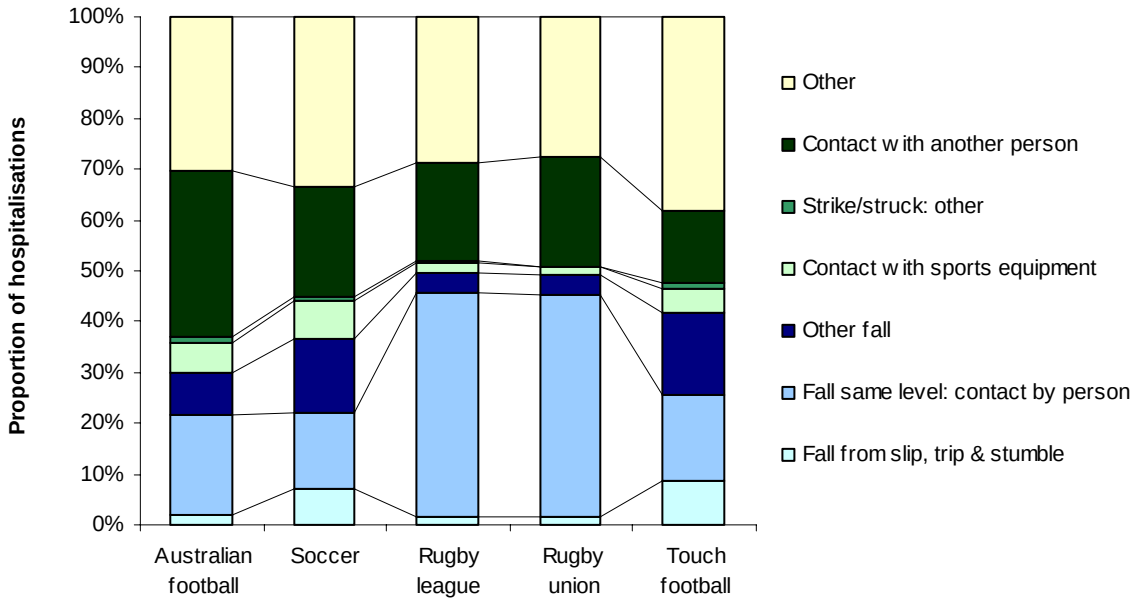


Note: Excludes 359 cases of Australian football, soccer, rugby league, rugby union and touch football that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.
Cases of rugby unspecified (n=715) and football, other and unspecified (n=2,021) are not shown.

Figure 4.14: Hospitalisations due to football injury, by nature of injury, Australia, 2002–2003

In all football codes, fractures were the most common principal diagnosis in those requiring hospitalisation. Fractures comprised 61.9% (n=1,954) of admissions in soccer, 56.2% (n=276) in rugby union, 56.0% (n=2,130) in Australian football, 51.9% (n=813) in rugby league and 48.5% (n=237) in touch football. 9.6% of admissions in rugby union (n=47), 9.5% of admissions in Australian football (n=360) and 8.1% of admissions in rugby league (n=127) were due to intracranial injury. Only 3.5% of admissions in soccer (n=111) and 3.7% of admissions in touch football (n=18) were due to intracranial injury (Figure 4.15). There were 21 admissions due to nerve and spinal cord injury in Australian football (0.6%), 11 (2.2%) in rugby union and 7 (0.4%) in rugby league (Figure 4.14).

Mechanism of injury

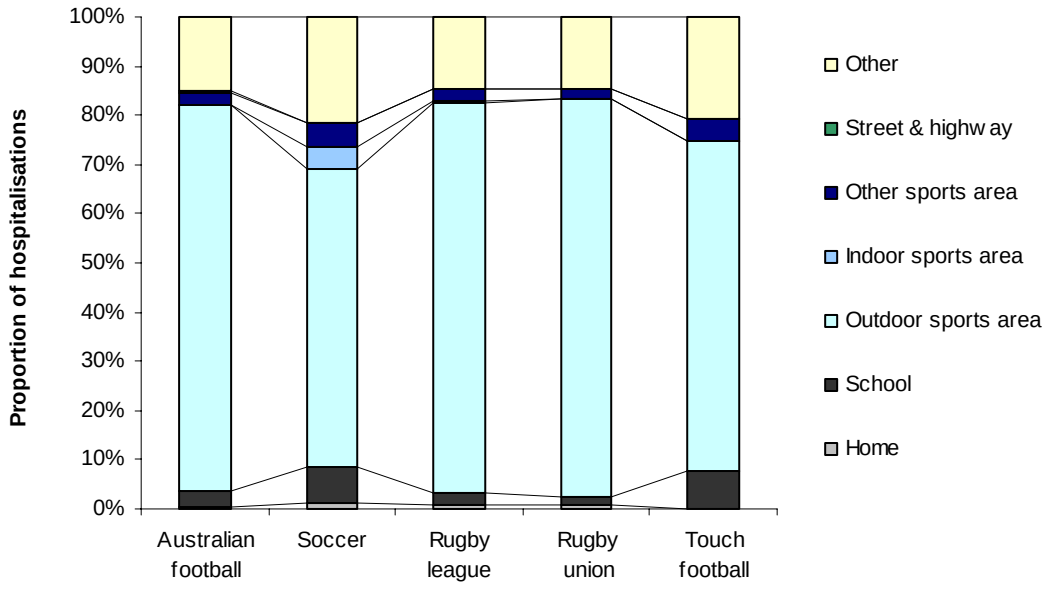


Note: Cases of rugby unspecified (n=715) and football other and unspecified (n=2,021) are not shown.

Figure 4.15: Hospitalisations due to football injury, by mechanism of injury, Australia, 2003–2003

Falls were the most common mechanism of injury in rugby league (n=801, 49.7%) and union (n=253, 49.0%) with the majority of these due to fall on the same level from contact by a person (n=712 and n=225 respectively). Contact with another person was the most common mechanism of injury resulting in hospitalisation for Australian football (n=1,303, 33.0%) and the most common single mechanism, after other and unspecified (n=1,093), in soccer (n=706, 21.6%) (Figure 4.15).

Place of occurrence



Cases of rugby unspecified (n=715) and football, other and unspecified (n=2,021) are not shown.

Figure 4.16: Hospitalisations due to football injury, by place of occurrence, Australia, 2002–2003

The majority of football related hospitalisations occurred at an outdoor sports area i.e. 80.6% (n=416) for rugby union, 79.4% (n=1,280) for rugby league, 78.6% (n=3,100) for Australian football, 67.0% (n=350) for touch football and 60.7% (n=1,985) for soccer (Figure 4.16).

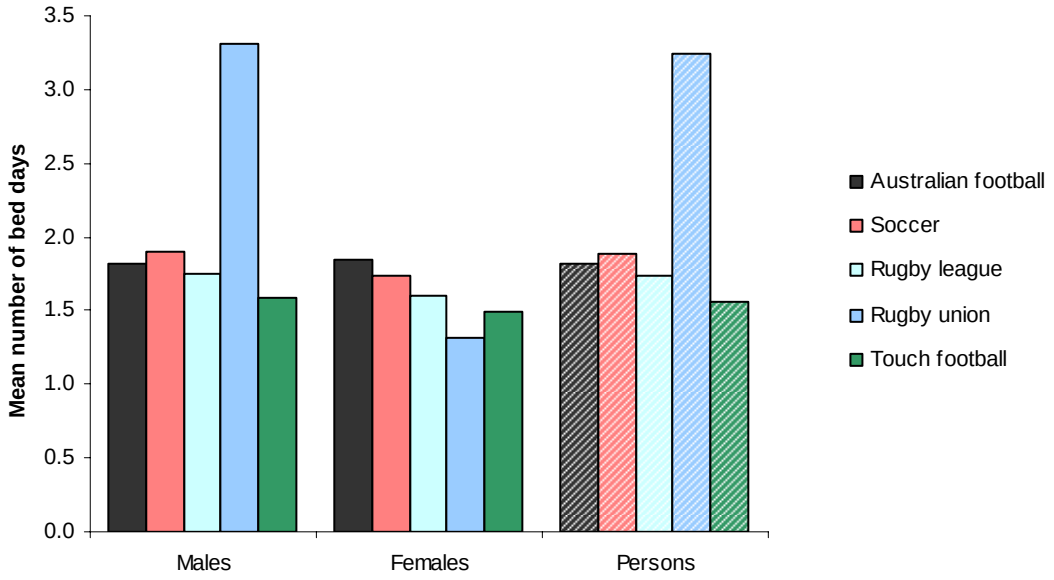
Length of stay

Table 4.3: Football related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]
Australian football	7,029	1.8	140	1.8	7,169	1.8
Soccer	5,525	1.9	641	1.7	6,166	1.9
Rugby league	2,755	1.7	53	1.6	2,808	1.7
Rugby union	1,645	3.3	25	1.3	1,670	3.2
Touch football	614	1.6	201	1.5	815	1.6
All sports	85,269	2.5	32,720	2.8	117,989	2.6

[†] This is total bed days, including inward transfers.
[††] This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

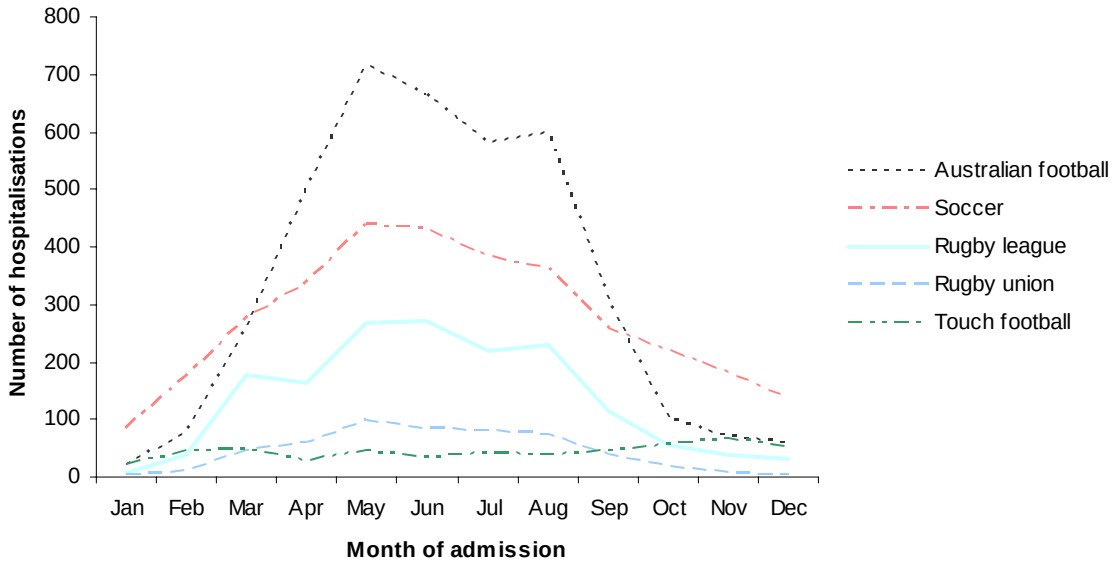
Rugby union had the highest mean number of bed days of the major football codes with 3.2. All other major codes were similar and had a lower mean number of bed days than all sports related hospitalisations (2.6) (Table 4.3 and Figure 4.17).



Note: Cases of rugby unspecified (n=715) and football, other and unspecified (n=2,021) are not shown.
This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Figure 4.17: Hospitalisations due to football, by mean number of bed days, Australia, 2002–2003

Month of admission



Note: Cases of rugby unspecified (n=715) and football unspecified (n=2,021) are not shown.

Figure 4.18: Hospitalisations due to football injury, by month of admission, Australia, 2002–2003

Australian football, soccer, rugby league and rugby union have the peak number of admissions over the colder months. This is particularly pronounced for Australian football. The peak number of admissions for Australian football occurs in May with 716 admissions (18.2%). For soccer the peak number of hospitalisations is in May with 437 hospitalisations (13.4%). The peak number of admissions is in June for rugby league (n=270, 16.7%) and in May for rugby union (n=96, 18.6%). Touch football hospitalisations are more evenly spread across the year with a peak of 67 (12.8%) in November and a trough of 21 (4.0%) in January (Figure 4.18).

Discussion

Football is a winter sport. In 2003, soccer was the sixth most popular sport (Australian Sports Commission 2003). Australian football and rugby show regional differences with Australian football being predominately played in Victoria and SA and rugby being predominately played in NSW and Queensland.

Football accounted for 27.7% (n=12,600) of all sports related hospitalisations, with Australian football accounting for 31.3% and soccer 26.0% of football related hospitalisations. For all codes the majority of hospitalisations occurred in the younger age groups and in males. Males also had much higher hospitalisation rates per 100,000 participants (for those 15 years and over) with a peak for Australian football of 780.5 which was 4.8 times higher than the rate for females (163.6).

Head injuries were the most common reason for hospitalisation in Australian football (n=977, 24.8%), rugby league (n=393, 24.4%) and rugby union (n=124, 24.0%). Knee and lower leg injury were the most common reason for hospitalisation in soccer (n=1,334, 40.8%) and touch football (n=186, 35.6%). Hockey and Knowles reviewed emergency department presentations in Queensland. The ankle was the most commonly injured body part (16.8%), followed by the lower arm (14.7%) and the knee (12.1%) (Hockey & Knowles 2000). This differs from the figures in this report, however, this study was of emergency presentations and not admissions.

In all football codes fractures were the most common principal diagnosis in those requiring hospitalisation. Fractures comprised 61.9% (n=1,954) of admissions in soccer, 56.2% (n=276) in rugby union, 56.0% (n=2,130) in Australian football, 51.9% (n=813) in rugby league and 48.5% (n=237) in touch football.

Contact with another person was the most common mechanism of injury resulting in hospitalisation for Australian football (n=1,303, 33.0%). Hockey and Knowles found that for Australian football, 31.5% of injury was due to falls and 49.6% due to striking or collision with another person (Hockey & Knowles 2000).

Falls were the most common mechanism of injury in soccer (n=1,200, 36.7%) rugby league (n=801, 49.7%), rugby union (n=253, 49.0%) and touch football (n=218, 41.8%). Hockey and Knowles found that in soccer, 36.6% of injury was due to falls; 36.4% due to striking or collision with another person and 15.5% due to striking or collision with an object. In rugby league, 27.8% of injury was due to falls and 54.9% due to striking or collision with another person. In rugby union, 26.7% of injury was due to falls and 57.8% due to striking or collision with another person (Hockey & Knowles 2000).

The majority of football related hospitalisations occurred at an outdoor sports area. The majority of football related admissions were over the winter months.

5 Water sports

U52, U53, U54

Water sports are popular in Australia. For those 15 years and over, swimming was the second most popular sport in 2002 and the third most popular sport in 2003 (Australian Sports Commission 2003). 15.3% of the Australian population (15 years and over) participated in swimming (13.4% of males and 17.1% of females). Participation is more evenly spread across the age groups compared with some sports. 16.7% of those 15–24 years participated in swimming, 19.5% of those 25–34 years, 18.1% of those 35–44 years, 15.9% of those 45–54 years, 11.4% of those 55–64 years and 7.3% of those 65 years and over (Australian Sports Commission 2003). Swimming is the most popular organised sport for children 5–14 years. 16.6% of children 5–14 years participated in swimming (15.7% of males and 17.5% of females) (Australian Bureau of Statistics 2005). There are many other water sports with some more popular in older age groups (e.g. aquarobics) and others more popular in younger age groups (e.g. surf sports) (Australian Sports Commission 2003) (Table 5.1).

Table 5.1: Proportion of the Australian population (15 years and over) participating in various water sports in 2003

Sport	% of total population participating	Age group most popular with (years)	% of most popular age group participating
Aquarobics	1.1	65+	1.7
Canoeing/kayaking	0.7	15–24	1.1
Fishing	2.6	55–64	3.3
Sailing	0.8	55–64*	0.9*
Scuba diving	0.2	35–44	1.1
Surf lifesaving	0.2	15–24	0.6*
Surf sports	2.4	15–24	3.9
Water polo	0.2	15–24	0.9*
Waterskiing/powerboating	1.1	25–34	2.3

From data in Participation in Exercise and Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).
* Estimate has a relative standard error of between 25% and 50% and should be used with caution.

Richardson 1999 reviewed injuries reported in 1997 to United States Swimming, which insures all swimming clubs in USA, with most participants aged between 8 and 18 years. There were 886 reported incidents with 78% of injuries being minor. 42% of injuries were sustained whilst in the water. 54% of injuries were sustained during competition. 32% of injuries involved the leg/foot, 18% the hand/arm and 17% the head/neck. The heel is not uncommonly injured whist doing a flip turn (Richardson 1999).

10% of admissions to spinal units in Australia are due to diving accidents (Blanksby et al. 1997). The cervical spine (especially C5 or C6) is the most common site of injury. Compression and wedge fractures are particularly common. The diver's head hitting the bottom is the most common reason for injury in swimming pools. Alcohol ingestion is involved in many cases (Blanksby et al. 1997).

Rubin 1999 reviewed competitive diving. No cervical fractures or dislocations have been reported in organised diving. Two fatal head injuries have been reported in competitive diving, both resulting from hitting the 10 metre platform. Strains and sprains of the spine and brachial plexus stretch injuries have been reported, as well as lumbar vertebral disc injury. Shoulder injuries are extremely common with 80% of the USA team having had shoulder injuries requiring at least 1 week off training. Shoulder instability and tendonitis are particularly prevalent. Forced dorsiflexion and repetitive impact can result in wrist injury. Most lower limb injuries are sustained during jumping. Perforation of the tympanic membrane and retinal detachment occasionally occur (Rubin 1999).

Edmonds and Walker 1999 reviewed snorkelling deaths in Australia, 1987–1996. There were 60 deaths, of which, 27 were from drowning, 18 were from cardiac events, 12 were from hypoxia and subsequent drowning and in 3 cases the cause was either uncommon or unknown. Most of the deaths from hypoxia were amongst spear fishers. It is common for spear fishers to increase their breath hold time by hyperventilating, however, this produces hypocapnoea without an increase in oxygen carrying capacity, with a resultant risk of hypoxia, particularly on ascent (Edmonds & Walker 1999). The snorkellers who died of cardiac events were significantly older and the snorkellers who died of hypoxia were significantly younger than the group as a whole. Almost half of the 27 who drowned were overseas tourists, of which at least 10 did not speak English. The snorkellers who died of hypoxia were all Australians. In ocean currents, flippers are required for propulsion, however, only 2 of the 18 who died of cardiac events and 16 of the 27 who drowned, were wearing flippers. Only 4 of the 60 snorkellers were buddy diving. Buddy diving is important for quick rescue attempts (Edmonds & Walker 1999).

Ashby and Cassell 2004 reviewed unintentional recreational boating related injuries in Victoria from July 2000 to June 2002. Data was collected using the Marine Incident Database, NCIS, VEMD and VAED. In Victoria, there were 517 emergency presentations, 205 hospitalisations and 18 deaths (all from drowning). More than three quarters of injuries and 94% of deaths were males, however, male participation rates are substantially higher. There were 75 boating related fatalities, in Australia, from July 2000 to June 2002. 37% occurred whilst fishing from a boat, 17% occurred whilst riding a personal watercraft or jetski, 9% occurred whilst canoeing or kayaking and 7% whilst sailing (Ashby & Cassell 2004). 56% of Victorian boating related drowning fatalities occurred after the boat capsized and in 28% of fatalities alcohol was involved. 72% of fatalities occurred during fishing and motorboat activity whereas almost half of non-fatal injuries were related to water skiing (24%) and personal watercraft or jetski riding (23%) (Ashby & Cassell 2004).

Lower limb injury was the most common reason for hospitalisation (29%); of these, the knee was involved in 24% of cases and the hip/thigh in 22% (Ashby & Cassell 2004). 26% of hospitalisations were due to head, eyes, face and neck injury (of which 59% were due to head injury). The trunk was involved in 19% of hospitalisations (41% spine/back and 36% abdomen/pelvis). The upper limb was involved in 19% of hospitalisations. Lower limb injury was the most common reason for emergency department presentation (32%) with 28% of these involving the knee, 27% the foot and 22% the ankle. The upper limb was involved in 24% of emergency department presentations with 35% of these involving the hand and 29% the shoulder. The head, eyes, face and neck was involved in 23% of emergency department presentations with 47% of these involving the head. The trunk was involved in 10% of emergency department presentations (Ashby & Cassell 2004).

Fractures were the most common reason for hospitalisation (43%) with 17% involving the spine, 12% the lower leg, and 10% each for the face, the hip/thigh and the forearm. 12% of hospitalisations were due to open wound, 9% due to near drowning, 9% due to intracranial injury and 6% due to dislocations. 23% of emergency department presentations were due to open wounds, 22% due to sprain/strain and 15% due to fractures (Ashby & Cassell 2004).

Hospitalisations tend to be longer for boating related injuries compared with other sport and recreation related activities (Ashby & Cassell 2004). 72% of admissions for sports related injuries are less than 2 days, compared with 49% for boating related activities. 41% of emergency presentations were due to falls and 32% due to collisions with objects and persons (Ashby & Cassell 2004).

Pikora 2005 reviewed boating related injuries and fatalities in Western Australia using hospital separation data and the Marine Indident Database. There were 99 boating related deaths in Western Australia from 1989–2002 (average 7 per year) with 94% being males. Between 1989 and 2003 there were 1,911 new boating related admissions in Western Australia with 80% being male. 29% of these were accidents whilst onboard (e.g. fall from ladder). 43% of deaths occurred in those 20–34 years and 58% of new hospitalisations occurred in those 15–39 years (Pikora 2005).

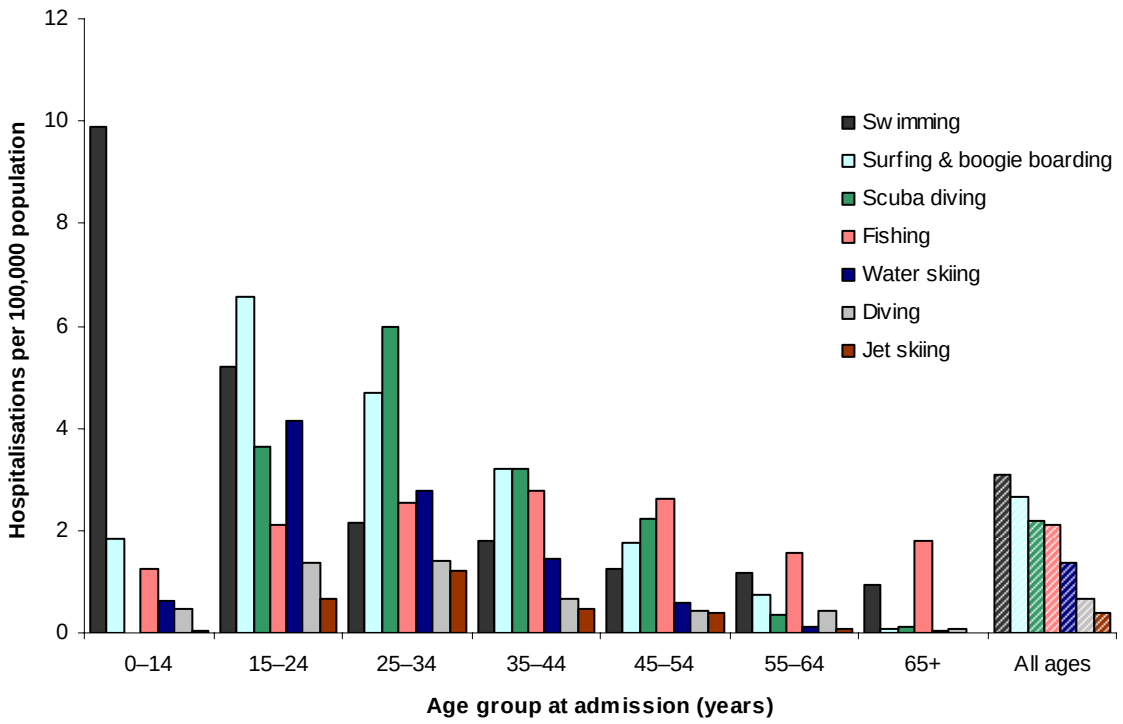
In this report, swimming does not include synchronised swimming.

Age

Table 5.2: Summary measures for water sport related injury hospitalisations, by age group at admission, Australia, 2002–2003

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages (%)
Proportion of hospitalised sports (%)	2.8	5.6	7.8	10.2	12.4	11.1	6.5	6.2
Cases: Water sports	400	715	635	471	310	145	123	2,799 (100)
Swimming	259	142	58	54	36	28	31	608 (21.7)
Surfing & boogie boarding	48	179	127	95	51	18	…	521 (18.6)
Scuba diving	0	99	162	95	64	8	4	432 (15.4)
Fishing	33	58	69	83	76	37	60	416 (14.9)
Water skiing	16	113	75	43	17	...	...	268 (9.6)
Diving	12	37	38	20	12	10	…	132 (4.7)
Jet skiing	…	18	33	14	11	…	0	79 (2.8)
Other water sports	31	69	73	67	43	39	21	343 (12.3)
Estimated number of participants ('000) [††]								
Swimming	NA	457.4	574.8	533.3	425.5	226.3	165.8	2,383.1
Scuba diving	NA	8.6[*]	25.7[*]	33.8	16.4[*]	6.0[**]	0.2[**]	90.7
Fishing	NA	19.3[*]	71	96.1	85.7	71.8	58.6	402.6
Rate/100,000 population: Water sports	15.3	26.2	23.5	15.8	10.7	6.1	3.7	14.3
Swimming	9.9	5.2	2.1	1.8	1.2	1.2	0.9	3.1
Surfing & boogie boarding	1.8	6.6	4.7	3.2	1.8	0.8	0.1	2.7
Scuba diving	0.0	3.6	6.0	3.2	2.2	0.3	0.1	2.2
Fishing	1.3	2.1	2.6	2.8	2.6	1.6	1.8	2.1
Water skiing	0.6	4.1	2.8	1.4	0.6	0.1	0.0	1.4
Diving	0.5	1.4	1.4	0.7	0.4	0.4	0.1	0.7
Jet skiing	0.0	0.7	1.2	0.5	0.4	0.1	0.0	0.4
Rate/100,000 participants								
Swimming	NA	31.0	10.1	10.1	8.5	12.4	18.7	14.6[†]
Scuba diving	NA	1,151.2[*]	630.4[*]	281.1	390.2[*]	NA[‡]	NA[‡]	476.3[†]
Fishing	NA	300.5[*]	97.2	86.4	88.7	51.5	102.4	95.1[†]

[†] The rate per 100,000 participants for all ages does not include those less than15 years (n=292 cases of swimming, scuba diving and fishing).
[††] Estimated number of participants does not include persons less than 15 years.
[*] Estimate has a relative standard error of between 25% and 50% and should be used with caution.
[**] Estimate has a relative standard error of greater than 50% and is considered too unreliable for general use.
[‡] The rate per 100,000 participants is not applicable for those 55+ years for scuba diving due to high uncertainty in participation data.
Case numbers when n<4 are not shown.



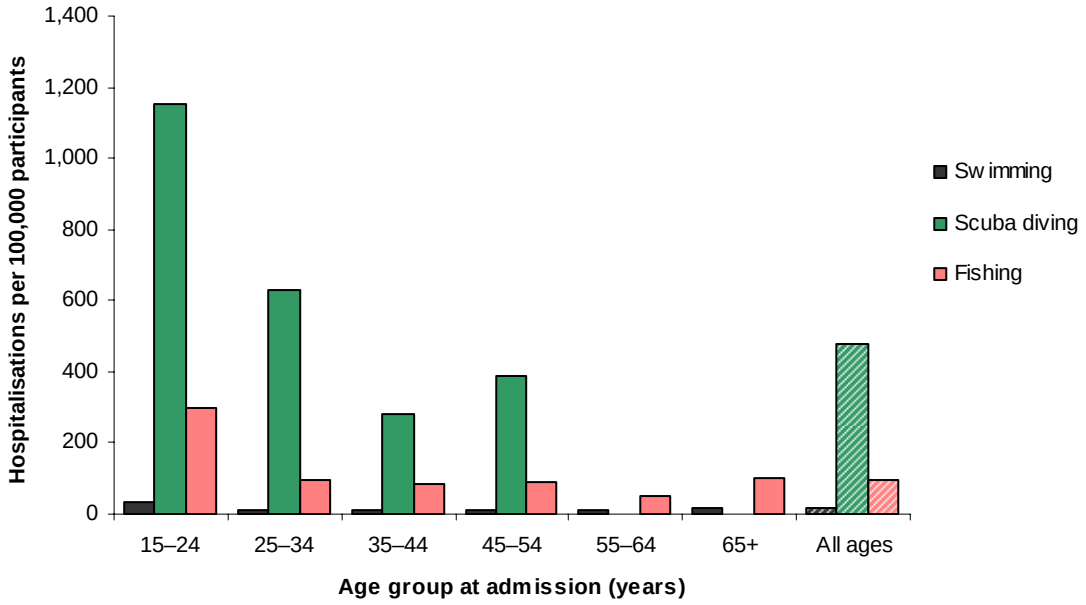
Note: 343 cases due to other water sports are not shown.

Figure 5.1: Hospitalisation rate per 100,000 population, due to water sport injury, by age group at admission, Australia, 2002–2003

The largest number of hospitalisations due to water sports occurred in the 15–24 year age group (n=715, 25.5%). In the 15–24 year age group, 25.0% of admissions (n=179) were due to surfing and boogie boarding and 19.9% of admissions (n=142) were due to swimming. Scuba diving hospitalisations were most common in the 25–34 year age group (n=162) and fishing hospitalisations were most common in the 35–44 year age group (n=83) (Table 5.2).

There were 15.3 hospitalisations per 100,000 persons 0–14 years due to water sports, with 9.9 hospitalisations per 100,000 due to swimming. In the 15–24 year age group there were 26.2 hospitalisations per 100,000 population due to water sports, with 6.6 hospitalisations per 100,000 population due to surfing and boogie boarding and 5.2 hospitalisations per 100,000 population due to swimming (Table 5.2 and Figure 5.1).

Hospitalisation rates per participants were only available for swimming, scuba diving and fishing due to differences in classification of water sports between ICD-10-AM and the Australian Sports Commission data (Australian Sports Commission 2003). Scuba diving had a hospitalisation rate per 100,000 participants (15 years and over) of 476.3 which was 32.6 times higher the rate for swimming and 5.0 times the rate for fishing. For all of these the rate was highest in the 15–24 year age group (Table 5.2 and Figure 5.2).



Note: The hospitalisation rate per 100,000 participants excludes 292 cases of swimming, scuba diving and fishing hospitalisations in persons less than 15 years.
The rates for those 55+ years for scuba diving are not shown due to high uncertainty in participation data.

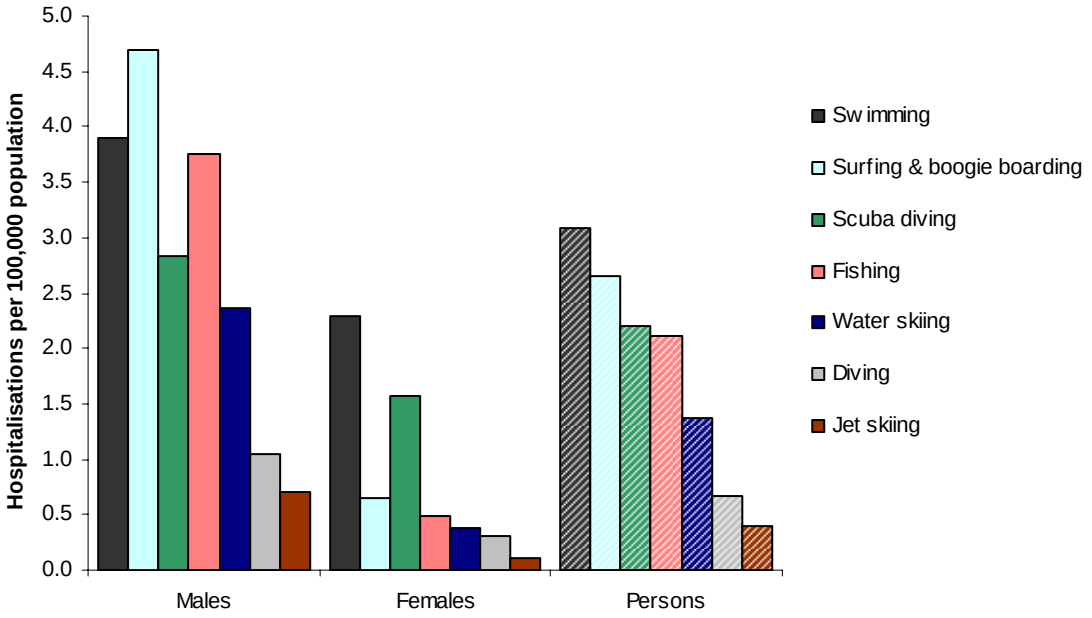
Figure 5.2: Hospitalisation rate per 100,000 participants (15 years and over) due to swimming, scuba diving and fishing, by age group at admission, Australia, 2002–2003

Sex

Table 5.3: Summary measures for water sport related injury hospitalisations, by sex, Australia, 2002–2003

	Males (%)	Females (%)	Persons (%)
Proportion of hospitalised sports (%)	6.4	5.6	6.2
Cases: Water sports	2,140 (100)	659 (100)	2,799 (100)
Swimming	381 (17.8)	227 (34.4)	608 (21.7)
Surfing & boogie boarding	457 (21.4)	64 (9.7)	521 (18.6)
Scuba diving	276 (12.9)	156 (23.7)	432 (15.4)
Fishing	367 (17.1)	49 (7.4)	416 (14.9)
Water skiing	231 (10.8)	37 (5.6)	268 (9.6)
Diving	102 (4.8)	30 (4.6)	132 (4.7)
Jet skiing	68 (3.2)	11 (1.7)	79 (2.8)
Other water sports	258 (12.1)	85 (12.9)	343 (12.3)
Estimated number of participants ('000)[†]			
Swimming	1,037.2	1,346.0	2,383.1
Scuba diving	69.2	21.5[*]	90.7
Fishing	336.2	66.4	402.6
Rate/100,000 population: Water sports	21.9	6.7	14.3
Swimming	3.91	2.30	3.1
Surfing & boogie boarding	4.69	0.65	2.7
Scuba diving	2.83	1.58	2.2
Fishing	3.76	0.50	2.1
Water skiing	2.37	0.37	1.4
Diving	1.05	0.30	0. 7
Jet skiing	0.70	0.11	0.4
Rate/100,000 participants[†]			
Swimming	23.0	8.2	14.6
Scuba diving	398.8	725.6[*]	476.3
Fishing	100.8	66.3	95.1

[*] Estimate has a relative standard error of between 25% and 50% and should be used with caution.
[†] The estimated number of participants and the rate of hospitalisation per 100,000 participants excludes those less than 15 years (n=292 cases of swimming, scuba diving and fishing).

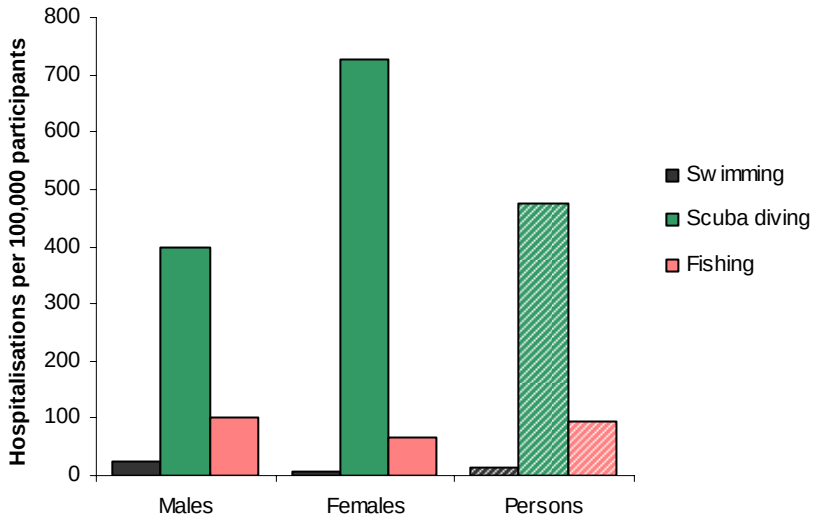


Note: Excludes 343 cases of other water related sports.

Figure 5.3: Hospitalisation rate per 100,000 population, due to water sports injury, by sex, Australia, 2002–2003

76.5% of water sport related hospitalisations occurred in males (n=2,140). In males, 21.4% of hospitalisations were due to surfing and boogie boarding (n=457) and 17.8% were due to swimming (n=381). In females, 34.4% of admissions were due to swimming (n=227), 23.7% were due to scuba diving (n=156) and 9.7% were due to surfing and boogie boarding (n=64) (Table 5.3).

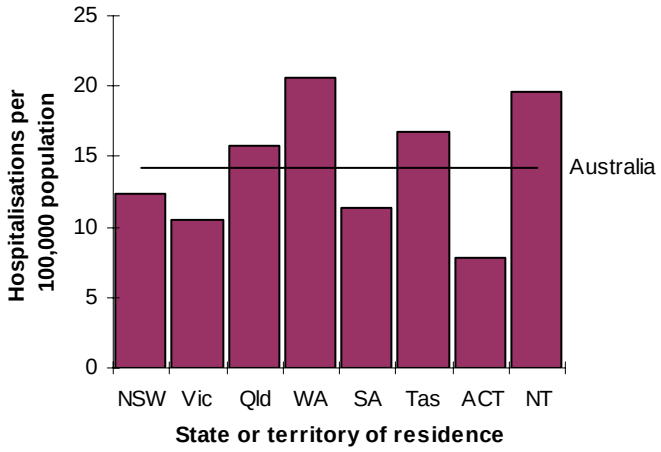
The rate of hospitalisation per 100,000 population for water sports was 21.9 in males and 6.7 in females. The rate of hospitalisation per 100,000 participants was 1.8 times higher in female scuba divers than male scuba divers (725.6 versus 398.8), however, the estimate for female scuba divers has a relative standard error of between 25% and 50%. Swimming and fishing both had a higher rate of hospitalisation in males than in females (Table 5.3 and Figure 5.4).



Note: The hospitalisation rate per 100,000 participants excludes 292 cases of swimming, scuba diving and fishing hospitalisations in those less than 15 years.
Estimate for female scuba diving related hospitalisations has a relative standard error of between 25% and 50% and should be used with caution.

Figure 5.4: Hospitalisation rate per 100,000 participants (15 years and over) due to water sports injury, by sex, Australia, 2002–2003

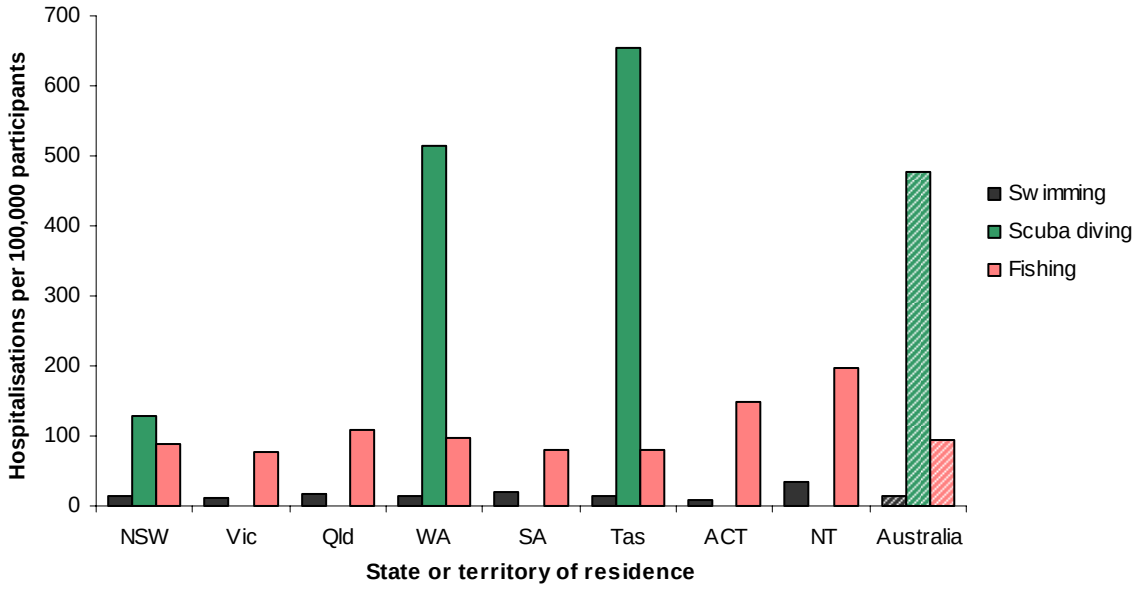
State or territory of residence



Note: The horizontal line represents the hospitalisation rate per 100,000 population due to water sports for Australia as a whole.
There were 176 cases of water sports hospitalisation with unreported state or territory of residence and 4 with state or territory of residence as other territory. These cases have been included in the rate for Australia as a whole.

Figure 5.5: Hospitalisation rate per 100,000 population, by state or territory of residence, due to water sports, Australia, 2002–2003

The highest number of hospitalisations per 100,000 population occurred in WA with 20.6 which compares with the Australian rate of 14.3. The ACT had the lowest number of water sports related hospitalisations with 7.8 hospitalisations per 100,000 population (Figure 5.5).

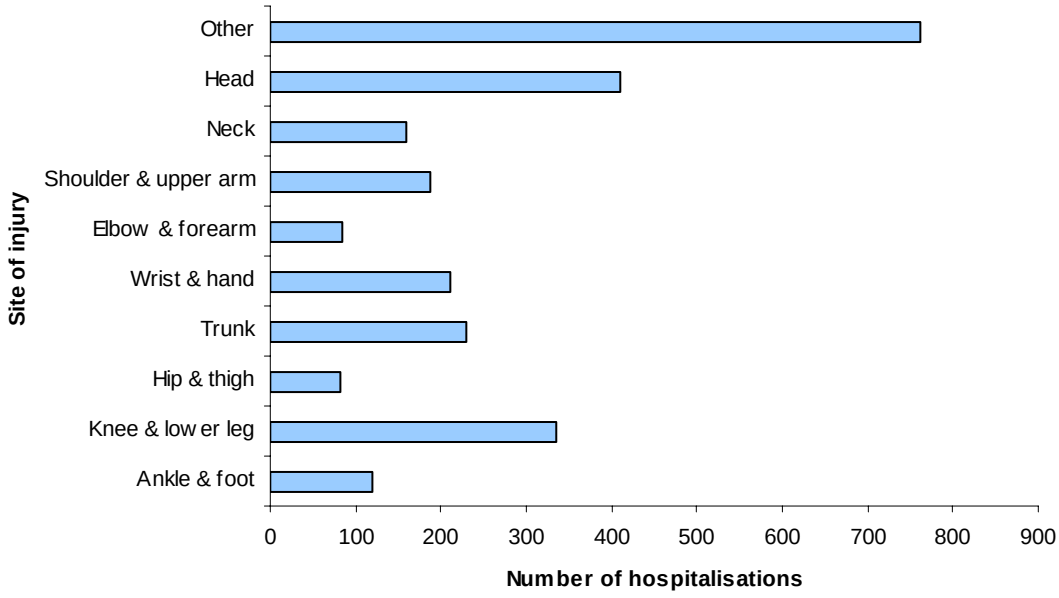


Note: The hospitalisation rate per 100,000 participants excludes 292 cases of swimming, scuba diving and fishing hospitalisations in those less than 15 years.
The estimated number of participants was only available for scuba diving in NSW, WA, Tasmania and for Australia as a whole.
There were 176 cases of water sports hospitalisation with unreported state or territory of residence and 4 with state or territory of residence as other territory. These cases have been included in the rate for Australia as a whole.

Figure 5.6: Hospitalisation rate per 100,000 participants (15 years and over) by state or territory of residence, due to swimming, scuba diving and fishing, Australia, 2002–2003

For swimming the highest hospitalisation rate per 100,000 participants (15 years and over) was in the NT with 33.7 compared with the Australian rate of 14.6. Scuba diving participation data was only available for NSW, WA, Tasmania and for Australia as a whole. Tasmania had the highest rate of hospitalisation per 100,000 participants (15 years and over) with 653.8 compared with the Australian rate of 476.3. NSW had the lowest rate with 127.6 hospitalisations per 100,000 participants, 15 years and over. For fishing, the NT had the highest rate of hospitalisation per 100,000 participants, 15 year and over, with 196.7 and Tasmania had the lowest rate with 80.9. The rate of hospitalisation per 100,000 participants (15 years and over) for fishing for Australia as a whole was 95.1 (Figure 5.6).

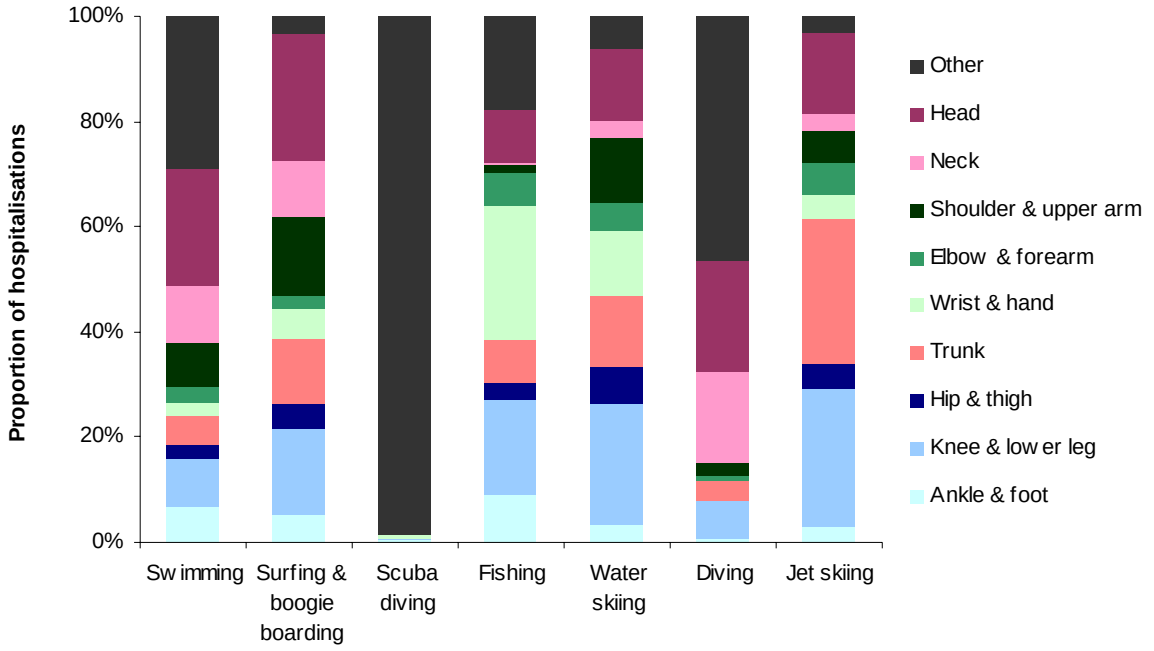
Body region



Note: Excludes 223 water sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 5.7: Hospitalisations due to water sports, Australia, 2002–2003, by principal body region injured

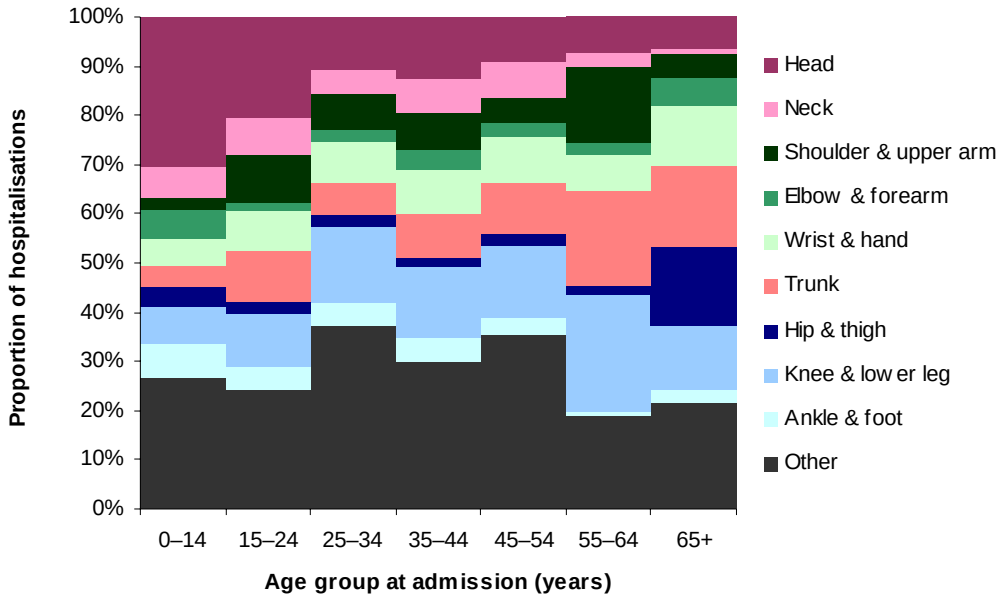
'Other' was the most common principal body region injured in those hospitalised for water sports (n=762, 27.2%), with this including hospitalisations for decompression sickness. Head injury was the next most common principal body region injured in those hospitalised for water sports (n=409, 14.6%) (Figure 5.7).



Note: Excludes 188 swimming, surfing and boogie boarding, scuba diving, fishing, water skiing, diving and jet skiing cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 5.8: Hospitalisations due to water sports, by principal body region injured, Australia, 2002–2003

Head injury was the second most common principal body region injured (after other) for swimming with 122 hospitalisations (20.1%) and for surfing and boogie boarding with 116 hospitalisations (22.3%). The wrist and hand was the most common principal body region involved in those with fishing related hospitalisations (n=97, 23.3%). The knee and lower leg was the most common principal body part involved in persons hospitalised for water skiing (n=57, 21.3%) and jet skiing (n=17, 21.5%). A large proportion (39.4%) of diving hospitalisations and almost all (96.3%) of scuba diving related hospitalisations were classified as other (which includes decompression sickness) (Figure 5.8).

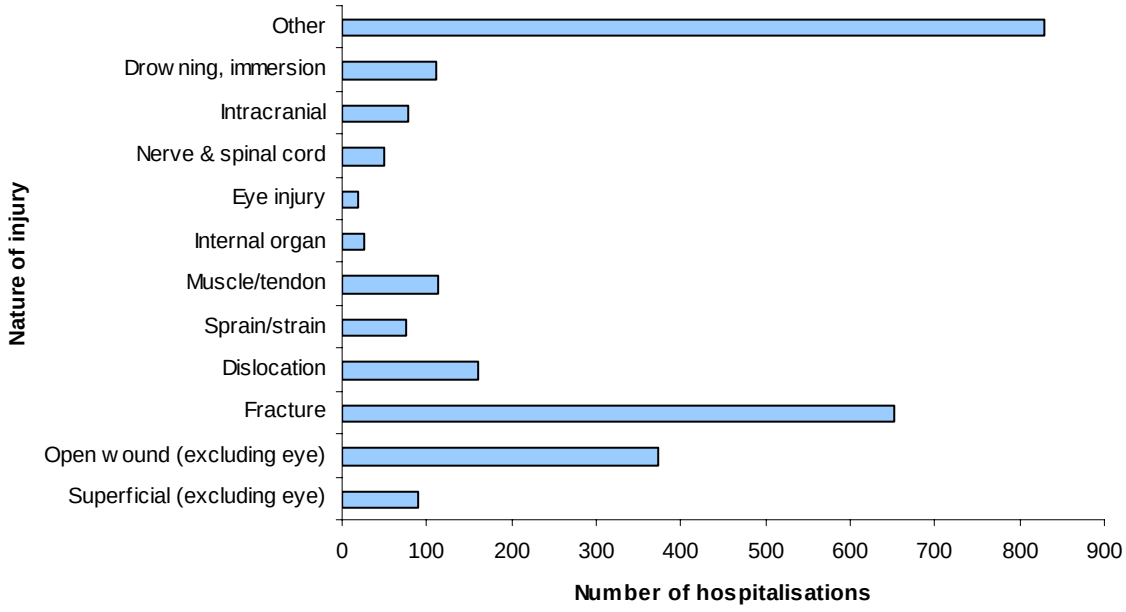


Note: Excludes 223 water sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 5.9: Hospitalisations due to water sports injury, Australia, 2002–2003, by age group at admission and principal body region injured

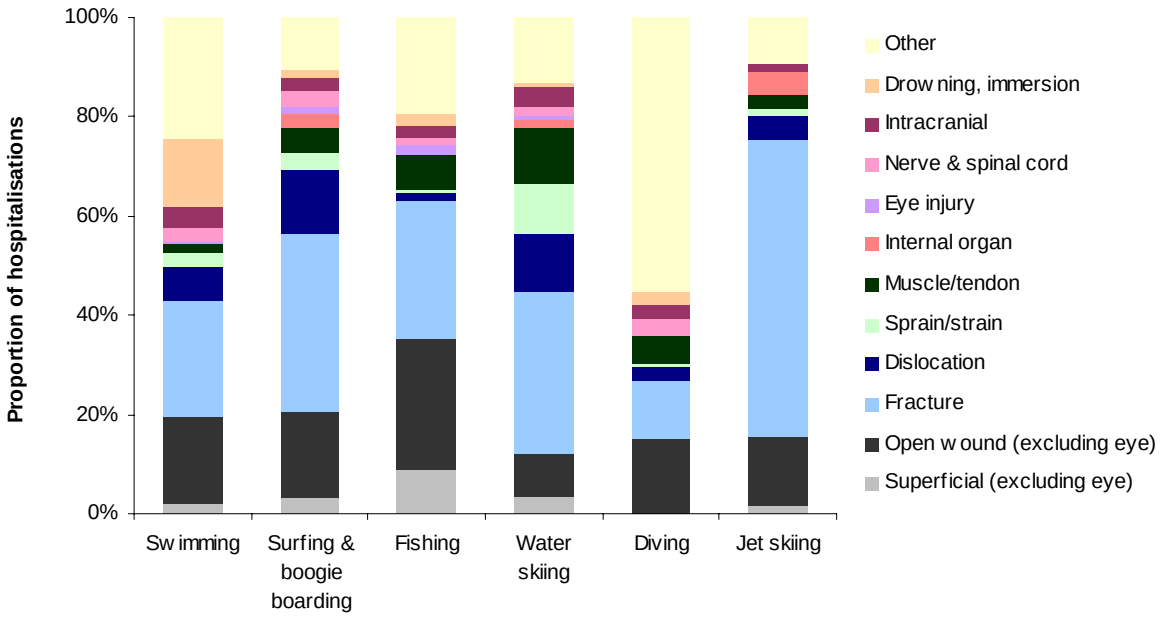
Head injury as principal diagnosis was most common in the younger age groups with 29.0% (n=116) of water sport related hospitalisations in 0–14 years and 18.9% (n=135) of water sport related hospitalisations in 15–24 year age group due to head injury. Hip and thigh injury as a principal diagnosis as a proportion of all injury for the age group peaked in the 65+ year age group with 13.8% (n=17) (Figure 5.9).

Nature of injury



Note: Excludes 223 water sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 5.10: Hospitalisations due to water sports, by nature of injury, Australia, 2002–2003



Note: Excludes 179 swimming, surfing and boogie boarding, fishing, water skiing, diving and jet skiing cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 5.11: Hospitalisations due to water sports, by nature of injury, Australia, 2002–2003

Fracture was the most common single type of principal diagnosis in those hospitalised for water sport related reasons (n=652, 25.3%). 60.0% (n=39) of jet skiing related hospitalisations had a fracture as the principal diagnosis. The largest total number of fracture admissions (as the principal diagnosis) was in surfing and boogie boarding with 174 (35.7% of surfing and boogie boarding admissions). There were 828 hospitalisations for other. 96.9% (n=410) of scuba diving related admissions and 55.4% (n=62) of diving related admissions were for other (Figures 5.10 and 5.11).

Mechanism of injury

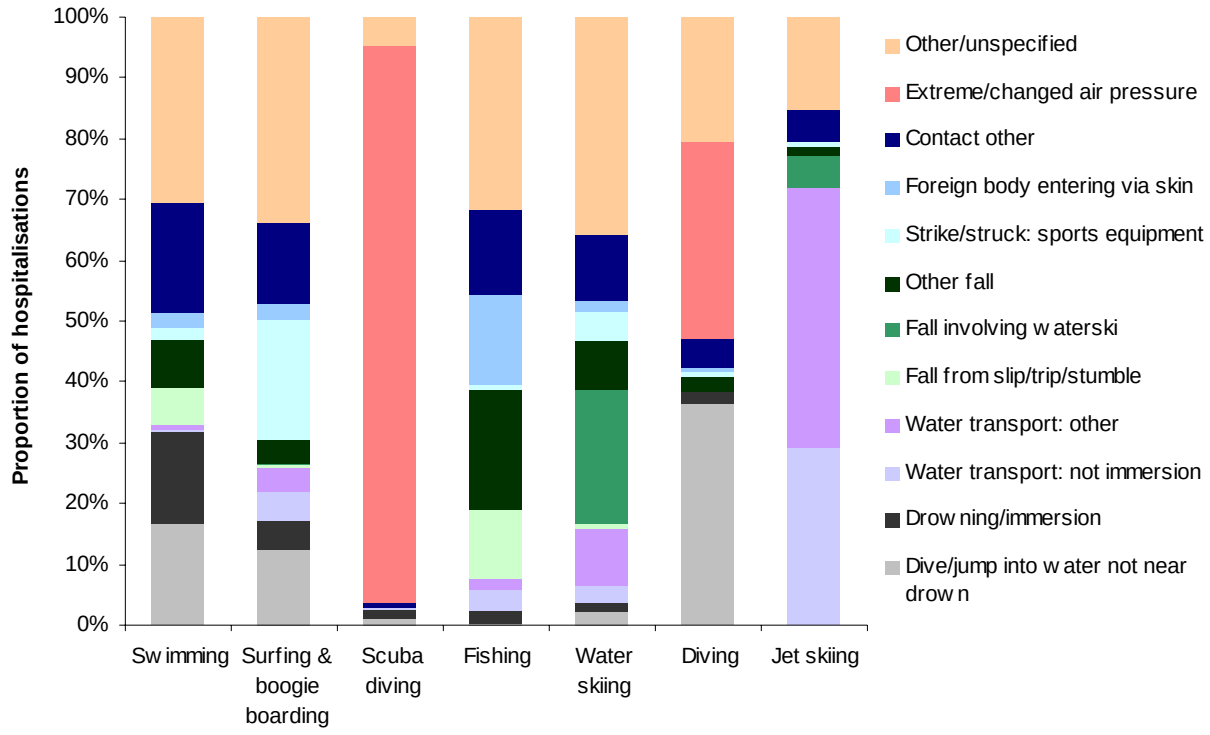


Figure 5.12: Hospitalisations due to water sports, by mechanism of injury, Australia, 2003–2003

'Contact: other' was the second most common mechanism of injury for swimming (n=108, 17.8%) and surfing and boogie boarding (n=104, 20.0%) after other/unspecified (n=187 and n=176 respectively). 91.9% (397) of scuba diving related hospitalisations had extreme/changed air pressure as the mechanism of injury. For jet skiing related admissions, 'water transport, not immersion' was the mechanism of injury in 23 cases (29.1%) and 'water transport, other' was the mechanism of injury in 34 cases (43.0%) (Figure 5.12).

Length of stay

Table 5.4: Water sport and all sport related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]
Water sports	7,094	3.3	1,714	2.6	8,808	3.1
All sports	85,269	2.5	32,720	2.8	117,989	2.6

[†] This is total bed days, including inward transfers.
[††] This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Water sports had a higher mean number of bed days (3.1) than all sport related hospitalisations (2.6) (Table 5.4).

Place of occurrence

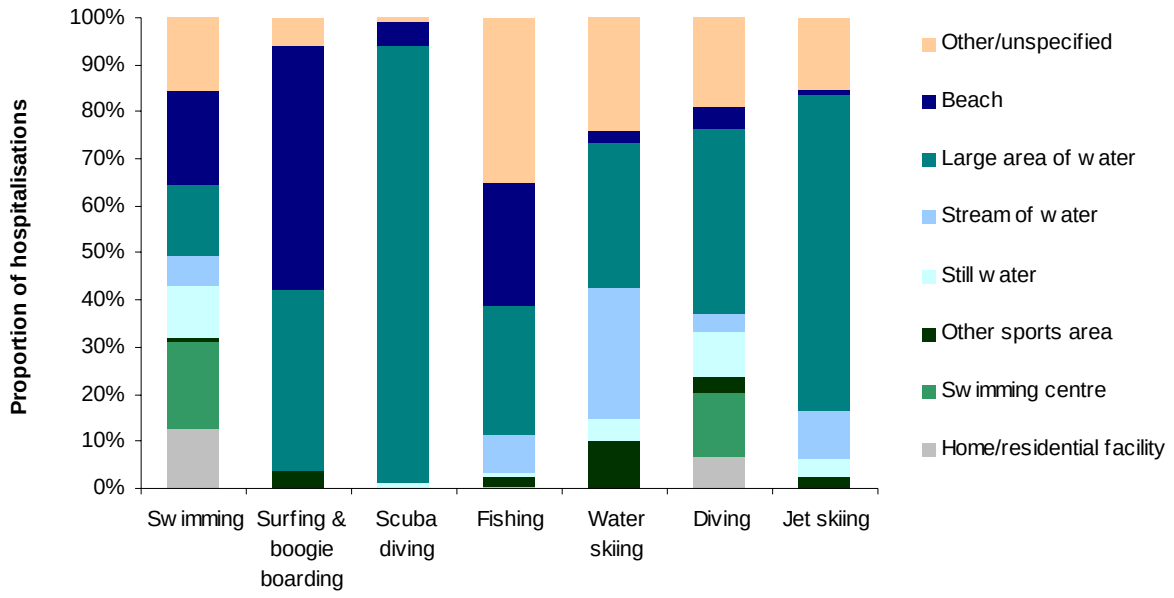


Figure 5.13: Hospitalisations due to water sports, by place of occurrence, Australia, 2002–2003

The incidents resulting in the majority of scuba diving (n=400, 92.6%) and jet skiing (n=53, 67.1%) related hospitalisations occurred at a large area of water. 31.0% (n=83) of water skiing related hospitalisations occurred at a large area of water and 27.6% (n=74) occurred at a stream of water. A beach was the most common place of occurrence in surfing and boogie boarding related hospitalisations (n=272, 52.2%), followed by a large area of water (n=199, 38.2%). For swimming related hospitalisations, a beach was the most common place of occurrence (n=122, 20.1%), followed by a swimming centre (n=113, 18.6%) and a large area of water (n=92, 15.1%). 12.5% (n=76) of swimming related admissions and 6.8% (n=9) of diving related admissions occurred at a home or residential facility (Figure 5.13).

Month of admission

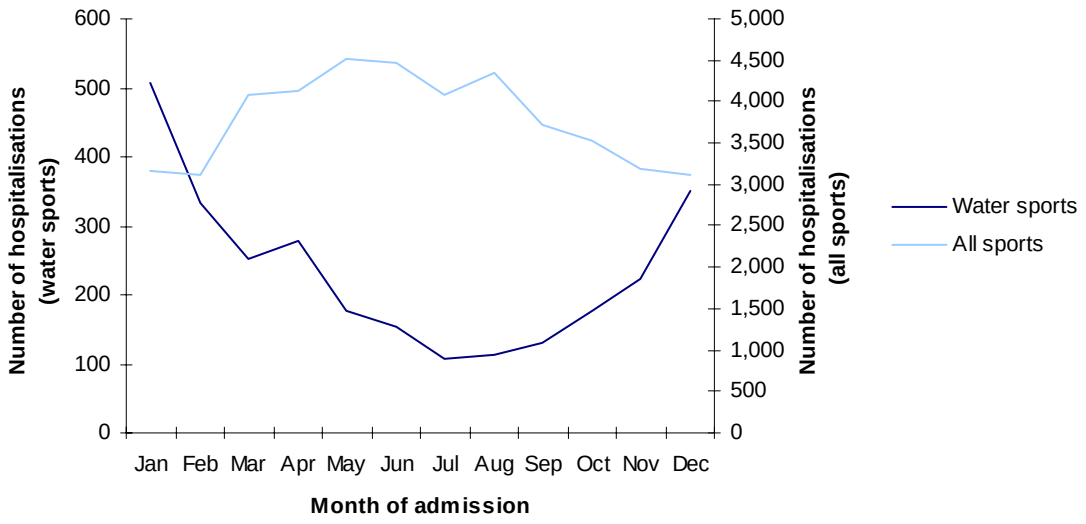


Figure 5.14: Hospitalisations due to water sports, by month of occurrence, Australia, 2002–2003

As would be expected, the peak number of water sports hospitalisations occurred in the warmer months, with 506 cases (18.1%) occurring in January (Figure 5.14).

Discussion

Water sports are very popular in Australia with swimming being the third most popular sport in 2003 (Australian Sports Commission 2003). The highest number of hospitalisations for water sports as a whole was in the 15–24 year age group (n=715, 25.5%), however, swimming hospitalisations peaked in the 0–14 year age group (n=259); scuba diving, jet skiing and diving peaked in the 25–34 year age group and fishing peaked in the 35–44 year age group.

76.5% of hospitalisations (n=2,140) occurred in males, with 88.2% (n=367) of fishing, 87.7% (n=457) of surfing and boogie boarding, 86.2% (n=231) of water skiing and 86.1% (n=68) of jet skiing hospitalisations occurring in males. Males had a higher rate of hospitalisation per 100,000 participants (15 years and over) than females, for swimming (23.0 versus 8.2) and fishing (100.8 versus 66.3) but a lower rate compared with females for scuba diving (398.8 versus 725.6). Ashby and Cassell found that more than three quarters of unintentional recreational boating related injuries in Victoria occurred in males (Ashby & Cassell 2004).

'Other' was the most common principal body region injured in those hospitalised for water sports (n=762, 27.2%), with this including such hospitalisations as decompression sickness. Head injury was the next most common principal body region injured in those hospitalised for water sports (n=409, 14.6%). Ashby and Cassell found that lower limb injury was the most common reason for admission in boating related incidents (Ashby & Cassell 2004). Richardson found that 32% of swimming related injuries involved the leg/foot (Richardson 1999).

Fracture was the most common single type of principal diagnosis in those hospitalised for water sport related reasons (n=652, 25.3%). There were 14 deaths in those hospitalised for water sports with 7 of these occurring in swimming. Five of the seven swimming deaths were due to drowning and immersion. However, these include only deaths occurring in those hospitalised and not deaths occurring before arrival at hospital.

The peak number of hospitalisations occurred in January with 506 cases (18.1%).

6 Cycling

U66.0

9.4% of the Australian population (15 years and over) participated in cycling in 2003, making it the fourth most popular sport (Australian Sports Commission 2003). 12.4% of males and 6.5% of females (15 years and over) participated (Australian Sports Commission 2003). Participation is more evenly spread across the age groups than in some sports. There was a 8.0% participation rate in those 15–24 years, 13.5% in those 25–34 years, 13.7% in those 35–44 years, 9.9% in those 45–54 years, 6.4% in those 55–64 years and 2.5% in those 65 years and older (Australian Sports Commission 2003).

Cycling differs from many sports in that it is difficult to determine whether cycling has been part of sport and recreation as such or been used as a mode of transport. This report includes all cycling that has been coded as U66.0 i.e. an external cause of morbidity and mortality occurring whilst engaged in sports or leisure.

Kronish and Pfieffer 2002 reviewed mountain biking injuries. The most common type of injuries were lacerations, contusions and abrasions. Fractures are the next most common injury. The upper limb was more commonly fractured than the lower limb. Fractures of the clavicle were the most common fracture. 3–13% of mountain biking injuries are concussions (Kronisch & Pfeiffer 2002).

Kronish et al. 1996 studied injuries at an off–road cycling race in 1994. Sixteen cyclists were injured out of 3,624 starts (injury rate 0.40%). The upper extremity was injured in 19 cyclists, the lower extremity in 12 cyclists, the face in 5 cyclists, the head/neck in 5 cyclists and the torso in 3 cyclists. Cyclists that went over the handlebars had more severe injuries than those who fell off to the side. Turning was a factor in 43.8% of injuries (Kronisch et al. 1996).

Chow et al. 1993 surveyed cyclists from two off–road cycling clubs in USA. 268 of the 459 surveys were returned. 84% of cyclists had experienced at least one injury. Only 4.4% had been admitted to hospital. The majority of injuries (almost 90%) involved the limbs. 36% of injured riders felt that excessive speed and 34.7% felt that unfamiliar terrain had contributed to their accident (Chow et al. 1993).

Jeys et al. 2001 reviewed all off–road mountain cycling injury referrals to the orthopaedic trauma team at the Royal Shrewsbury Hospital, England during the course of 1 year. Of the 84 patients, 83% were male. 13% of injuries were a fracture of the clavicle, 12% were other shoulder girdle injuries, 11% were distal radial fractures and 10% were soft tissue injury/laceration. 10% of injuries involved the head and neck. 20% of the injuries were serious including long bone fractures, spinal fracture, head injury and internal injury (Jeys et al. 2001).

Scott et al. 2005 reviewed bicycle related injury in Queensland presenting to Queensland Injury Surveillance Unit hospitals from 1998–2004. 3% of emergency department presentations were related to cycling. Those under 15 years accounted for 6% of emergency department presentations and for almost 75% of the total cycling presentations. Two thirds of patients were male. Hospitalisation was required in 15% of cycling emergency presentations. The majority (74%) of accidents did not involve another vehicle. The majority of injuries resulted from a fall (53%). 16% of accidents resulted from contact with an object (equally divided between moving and static). Fracture was the most common type of injury (25%), closely followed by open wound (24%) and superficial injury (19%). 7% of injuries were intracranial. The elbow, forearm, wrist or hand was involved in 30% of cases. The head, neck or face was involved in 23% of cases. The knee, lower leg, ankle or foot was involved in 22% of cases (Scott et al. 2005).

More than 90% of cycling deaths are due to collisions with motor vehicles (Thompson & Patterson 1998). Two thirds of hospitalisations and three quarters of cycling deaths are due to head injury. Facial injuries occur at a similar rate to head injuries (Thompson & Patterson 1998). It has been demonstrated that cycle helmets are effective in reducing head injuries (Thompson & Patterson 1998; Thompson et al. 1996b; Kronisch & Pfeiffer 2002; Scott et al. 2005). Thompson et al. also showed that helmets reduced the risk of serious injury to the upper and middle face (Thompson et al. 1996a). There is no evidence that they increase the risk of neck injuries (Thompson & Patterson 1998).

In the study by Scott et al. there were 56 internal abdominal injuries (<1% of total injuries), of which approximately 25% were handlebar related (Scott et al. 2005). 5% of total injuries were handlebar related (Scott et al. 2005). Acton et al. studied handlebar related abdominal injuries in children (Acton et al. 1994). Of the 83 children who presented with cycling related injuries to 5 Queensland hospitals during the study period, there were 10 major (life–threatening) and 31 minor abdominal injuries. The major injuries all occurred in those riding bicycles with unprotected handlebars (p=0.003). In 5 of those 10 with severe injuries the severity of the injury was not immediately apparent after injury (Acton et al. 1994).

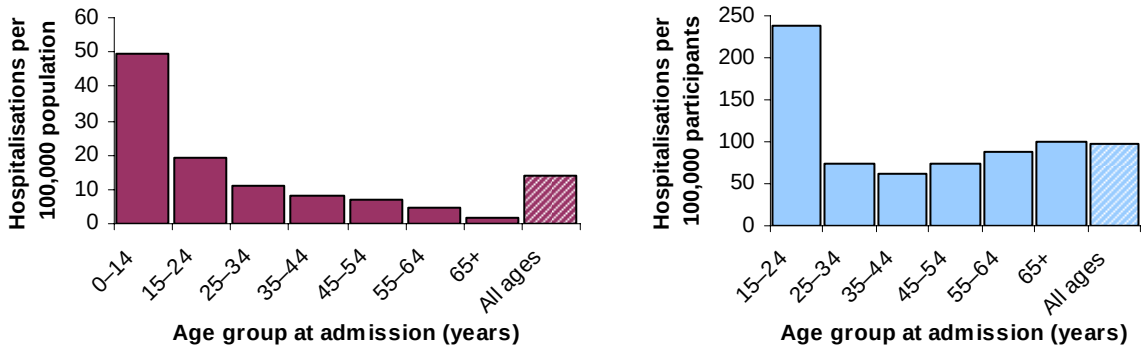
Age

Table 6.1: Summary measures for cycling related injury hospitalisations, by age group at admission, Australia, 2002–2003

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages (%)
Proportion of hospitalised sports (%)	9.1	4.0	3.7	5.4	7.8	8.5	2.9	6.0
Cases: Cycling	1,298	518	296	250	196	111	56	2,725 (100)
BMX	171	127	27	12	…	…	…	342 (12.6)
Mountain	27	37	56	31	12	4	0	167 (6.1)
Road	13	23	20	24	35	20	8	143 (5.2)
Track & velodrome	…	8	6	…	9	5	…	35 (1.3)
Other specified cycling	46	12	20	7	4	8	6	103 (3.8)
Cycling, unspecified	1,038	311	167	174	133	73	39	1,935 (71.0)
Estimated number of participants ('000)	NA	218.4	399.3	404.2	266.7	127	56.2	1,471.8[†]
Rate/100,000 population	49.6	19.0	10.9	8.4	6.8	4.7	1.7	13.9
Rate/100,000 participants	NA	237.2	74.1	61.9	73.5	87.4	99.6	97.0[‡]

[†] The estimated number of participants for all ages excludes those less than 15 years.
[‡] The rate of hospitalisation per 100,000 participants for all ages excludes the 1,298 cases in those 0–14 years.
Case numbers when n<4 are not shown.

47.6% of sports and leisure related cycling hospitalisations occurred in the 0–14 year age group (n=1,298) with the rate of hospitalisation per 100,000 population being 49.6. The rate per 100,000 participants was highest in the 15–24 year age group with 237.2 (but unavailable in the 0–14 year age group) (Table 6.1 and Figure 6.1).



Note: The hospitalisation rate per 100,000 participants excludes 1,298 cases in those less than 15 years.

Figure 6.1: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to cycling injury, by age group at admission, Australia, 2002–2003

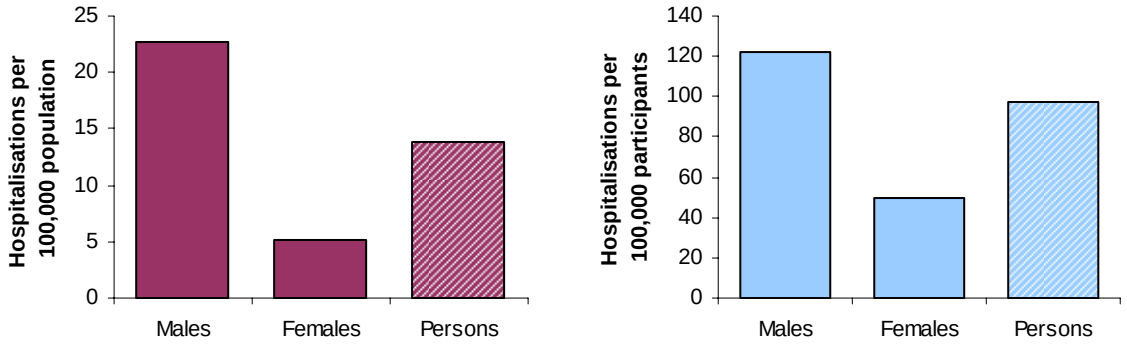
Sex

Table 6.2: Summary measures for cycling related injury hospitalisations, by sex, Australia, 2002–2003

	Males (%)	Females (%)	Persons (%)
Proportion of hospitalised sports (%)	3.3	2.1	6.0
Cases: Cycling	2,209 (100)	516 (100)	2,725 (100)
BMX	322 (14.6)	20 (3.9)	342 (12.6)
Mountain	150 (6.8)	17 (3.3)	167 (6.1)
Road	123 (5.6)	20 (3.9)	143 (5.2)
Track & velodrome	23 (1.0)	12 (2.3)	35 (1.3)
Other specified cycling	78 (3.5)	25 (4.8)	103 (3.8)
Cycling, unspecified	1,513 (68.5)	422 (81.8)	1,935 (71.0)
Estimated number of participants ('000)[†]	960.3	511.4	1,474.8
Rate/100,000 population	22.6	5.2	13.9
Rate/100,000 participants[†]	122.4	49.3	97.0

[†] The estimated number of participants and rate of injury per 100,000 participants excludes those less than 15 years (n=1,298).

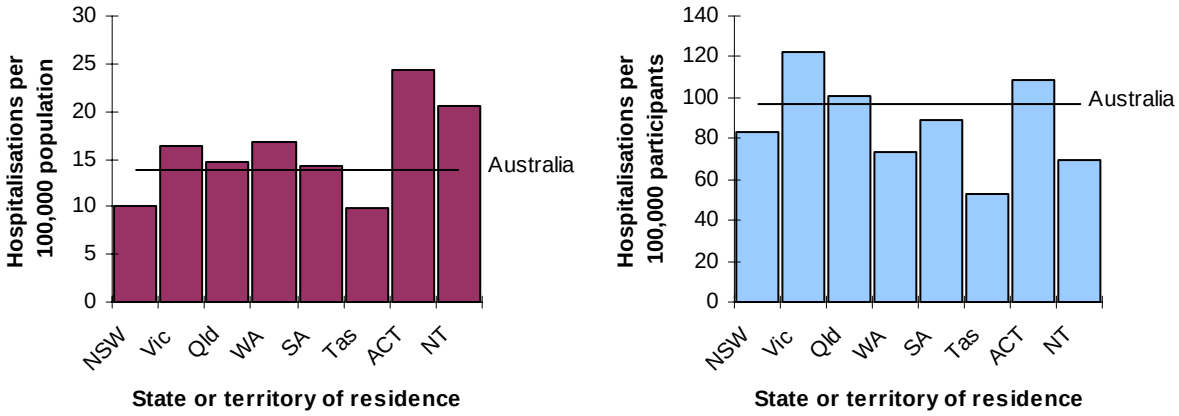
The majority (81.1%) of sports and leisure related cycling hospitalisations occurred in males (n=2,209). 12.4% of males and 6.5% of females participated in sports and leisure related cycling (Australian Sports Commission 2003). The rate per 100,000 participants was higher in males than females (122.4 versus 49.3) (Table 6.2 and Figure 6.2).



Note: Hospitalisation rate per participation excludes 1,298 cases of cycling injury in those under 15 years.

Figure 6.2: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to cycling injury, by sex, Australia, 2002–2003

State or territory of residence

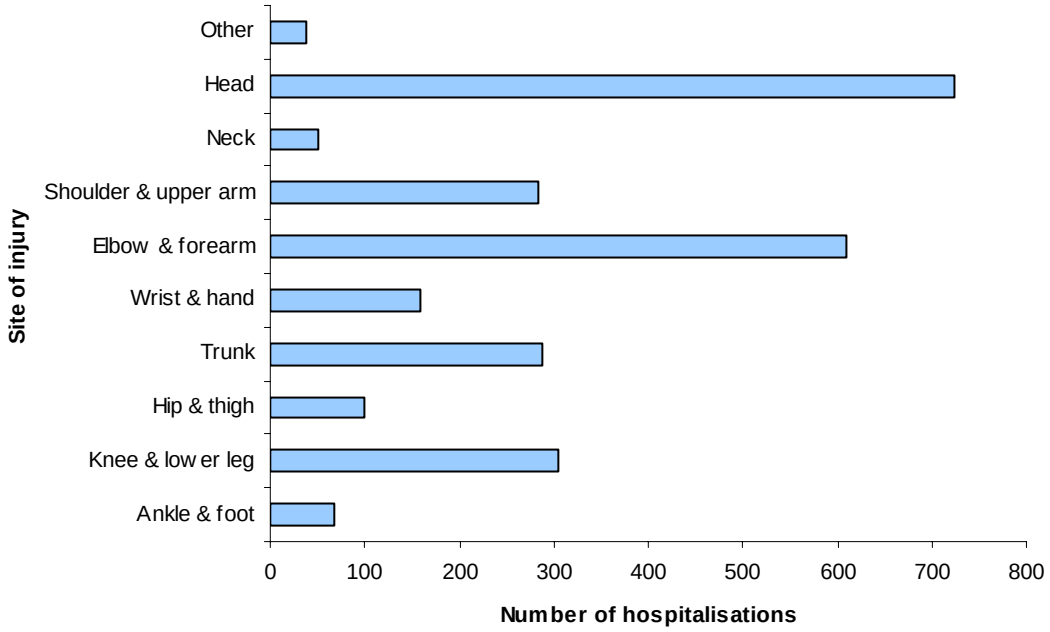


Note: Horizontal bar represents the hospitalisation rate for Australia as a whole.
Hospitalisation rate per 100,000 participants excludes 1,298 cases of cycling injury in those under 15 years.
There were 12 cases with unreported state or territory of residence including 2 in those less than 15 years.

Figure 6.3: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) by state or territory of residence, due to cycling injury, Australia, 2002–2003

ACT had the highest participation rate for cycling with 17.3% of the population participating and the NT was second with 16.3% of the population participating (Australian Sports Commission 2003). ACT had the highest rate of sports and leisure related cycling hospitalisation per 100,000 population with 24.3. Victoria had the highest rate of sports and leisure related cycling hospitalisation per 100,000 participants with 122.7 (Figure 6.3).

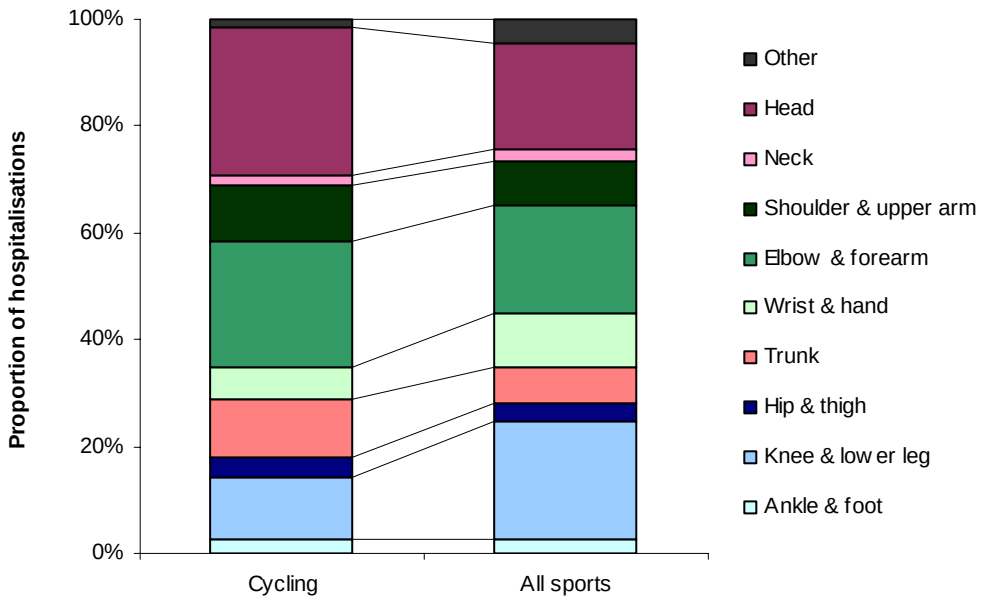
Body region



Note: Excludes 100 cycling cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

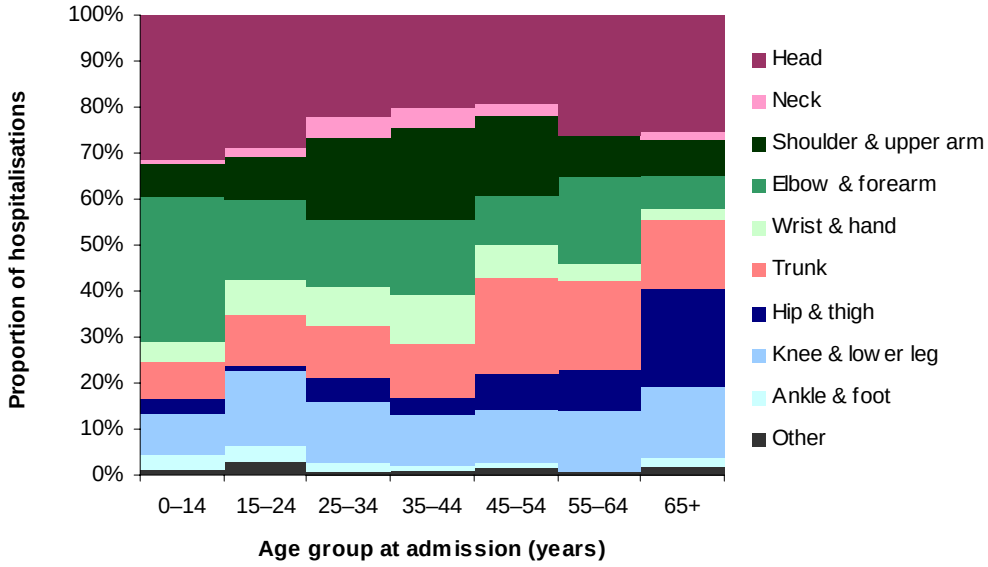
Figure 6.4: Hospitalisations due to cycling injury, by principal body region injured, Australia, 2002–2003

Head injury (n=723, 26.5%) is the most common principal body region injured in sports and recreation related cycling hospitalisations this compared with 18.5% of all sports related injury hospitalisations. Elbow and forearm injury comprised 22.4% of admissions (n=610) compared with 19.1% for all sports related injury hospitalisations (Figures 6.4 and 6.5).



Note: Excludes 100 cycling cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 6.5: Hospitalisations due to cycling and all sports, by principal body region injured, Australia, 2002–2003

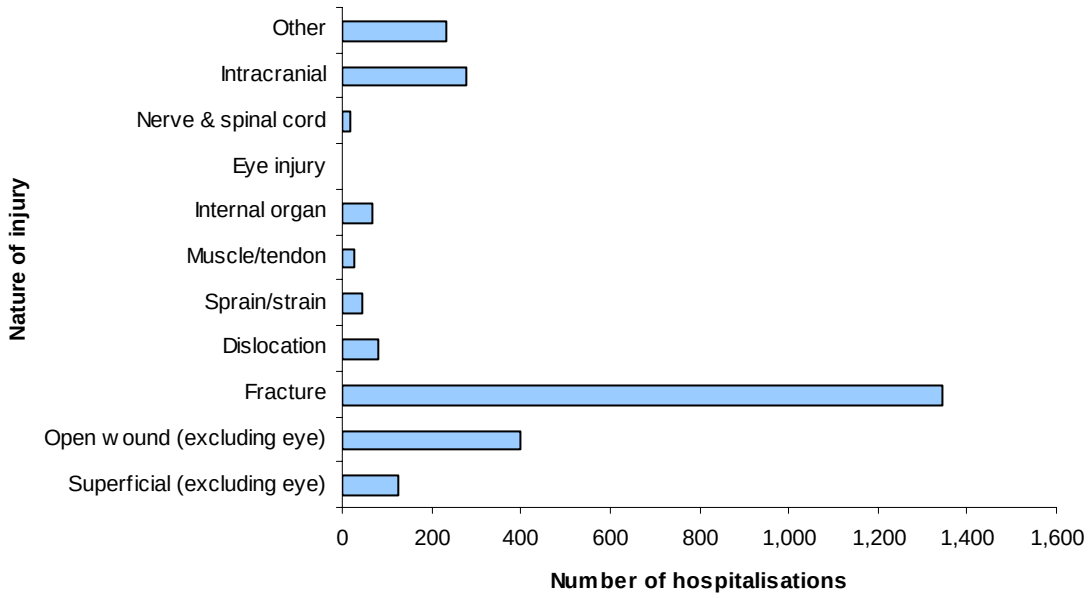


Note: Excludes 100 cycling cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 6.6: Hospitalisations due to cycling, by age group and principal body region injured, Australia, 2002–2003

The profile of principal body region injured in sports and recreation related cycling hospitalisations across the age range was similar. However, hip and thigh injury did become much more prevalent in the 65+ year age group (19.6% of injuries). Head injury admission rate peaked in the 0–14 year age group with 30.4% of admissions (n=394) followed by the 15–24 year age group with 27.8% of admissions (n=144) (Figure 6.6).

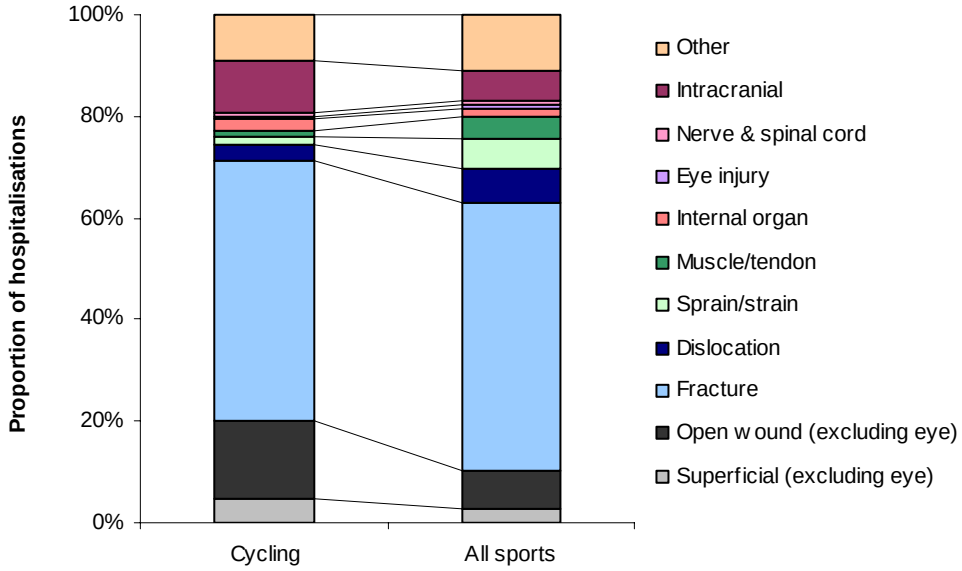
Nature of injury



Note: Excludes 100 cycling cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 6.7: Hospitalisations due to cycling, by nature of injury, Australia, 2002–2003

The majority of sports and leisure related cycling hospitalisations had a fracture as the principal diagnosis (n=1,344, 51.2%). This is very similar to the 52.8% of all sports related hospitalisations which had a fracture as the principal diagnosis. Intracranial injury was the reason for admission in 10.6% (n=277) of cases. This compared with 6.1% for all sports related hospitalisations (Figures 6.7 and 6.8).



Note: Excludes 100 cycling cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 6.8: Hospitalisations due to cycling injury and all sports injury, by nature of injury, Australia, 2002–2003

Mechanism of injury

In the majority of cycling hospitalisations the mechanism was classified as pedal cyclist (n=2,520, 92.5%).

Length of stay

Table 6.3: Cycling and all sport related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]
Cycling	6,986	3.2	1,316	2.6	8,302	3.0
All sports	85,269	2.5	32,720	2.8	117,989	2.6

[†] This is total bed days, including inward transfers.
[††] This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Length of stay is an indication of severity of injury. Cycling had a higher mean number of bed days (3.0) than all sport related hospitalisations (2.6) (Table 6.3).

Place of occurrence

The majority (51.4%) of sports and recreation related cycling injury occurred at unspecified (n=1,243) and other specified (n=159) locations. Following this, the most common place of occurrence of sports and recreation related cycling injury was the street and highway (n=859, 31.5%).

Month of admission

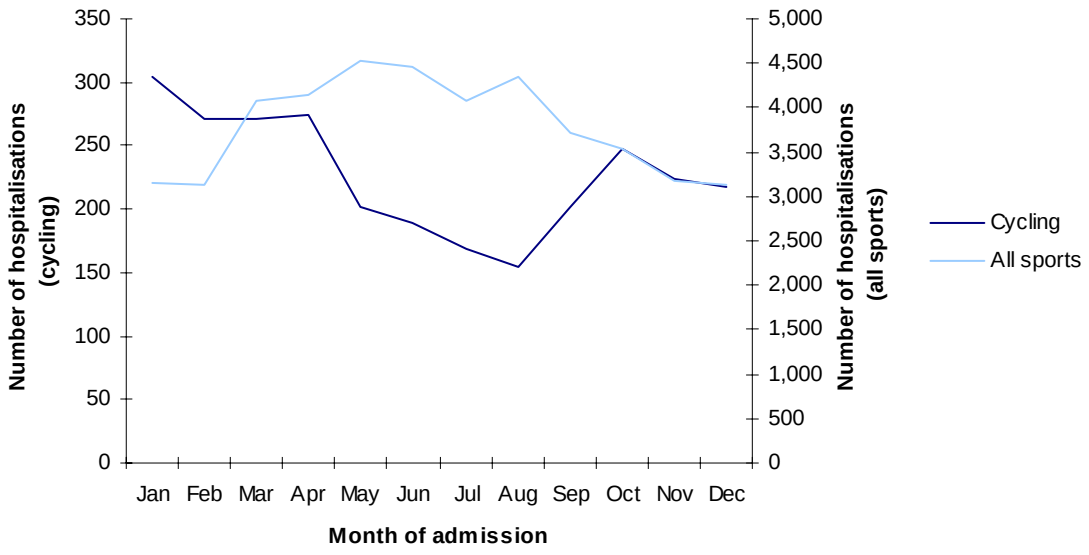


Figure 6.9: Hospitalisations due to cycling injury, by month of admission, Australia, 2002–2003

Sports and recreation related cycling injury hospitalisation was most common in the warmer months with a peak in January (n=304, 11.2%), the trough was in August (n=154, 5.7%) (Figure 6.9).

Discussion

Cycling was the fourth most popular sport in 2003 in terms of participation (Australian Sports Commission 2003). It is more popular with males than females with 12.4% of males and 6.5% of females participating (Australian Sports Commission 2003). It is most popular with those 25–44 years. The majority (81.1%) of hospitalisations occurred in males (n=2,209). 47.6% of hospitalisations occurred in the 0–14 year age group (n=1,298). The predominance of males is consistent with the literature. Jeys et al. found that 83% of off–road cycling related orthopaedic trauma referrals were male (Jeys et al. 2001). Scott et al. found that two thirds of cycling related emergency presentees in Queensland were male, almost 75% were in the 0–14 year age group (Scott et al. 2005).

Head injury was the most common reason for admission (n=723, 26.5%) followed by elbow and forearm injury (n=610, 22.4%). Scott et al. found that the elbow, forearm, wrist or hand was involved in 30% of cases and the head, neck or face was involved in 23% of cases (Scott et al. 2005), however, this was a review of emergency presentations rather than hospital admissions.

There were 7 deaths from sports and recreation related cycling in those who were hospitalised, i.e. this does not include persons who died before arriving at hospital. Of these, 85.7% were admitted with head injuries. Thompson and Patterson found that three quarters of cycling related deaths were due to head injury and that the majority (more than 90%) were due to collisions with motor vehicles (Thompson & Patterson 1998). It has been shown that cycle helmets are effective in reducing head injury (Thompson & Patterson 1998; Thompson et al. 1996a; Thompson et al. 1996b; Kronisch & Pfeiffer 2002; Scott et al. 2005)

The majority of sports and leisure related cycling hospitalisations were due to fractures (n=1,344, 51.2%). Intracranial injury was the reason for admission in 10.6% (n=277) of cases. Scott et al. found that 25% of injuries were fractures and 7% of injuries were intracranial. However, Scott et al. were reviewing emergency presentations not hospitalisations (Scott et al. 2005).

Sports and recreation related cycling injury hospitalisation was most common in the warmer months with a peak in January (n=304, 11.2%).

7 Roller sports

U66.1, U66.2, U66.3, U66.4

0.8% of the Australian population 15 years and over (1.0% of males and 0.5% of females) participated in roller sports in 2003. It is mainly a sport of the young, with 2.4% of those 15–24 years and 1.3% of those 25–34 years participating (Australian Sports Commission 2003). Roller sports can involve a low–impact aerobic workout, speed skating or extreme and artistic skating with jumps, spins and cartwheels (Schieber et al. 1994). Rollerbladers can reach speeds of greater than 50km/hr (Heitkamp et al. 2000). Skateboarders can reach speeds up to 80km/hr (Fountain & Meyers 1996).

Heller 1993 studied rollerblading injuries in Victoria using VISS data in 1992 and found that most injury (59%) occurred in 10–14 year. In 1992, there were 113 injury related VISS hospital visits due to rollerblading, 115 due to skateboarding and 206 due to roller skating (Heller 1993).

Cassell and Clapperton 2002 studied sports injury in Victoria using the NCIS (July 2000–June 2002), VAED (July 2000–June 2001) and VEMD (January 1999–December 2001). There were no deaths from roller sports. 5.1% of sport and recreation related emergency presentations were due to skateboarding (52%) and rollerblading (48%), 1.0% due to scooter riding and 0.3% due to rollerskating. The majority of rollerblading and skateboarding injury related admissions were in males (more than 75%) and 0–14 years (64%) (Cassell & Clapperton 2002).

Schieber et al. 1994 conducted a study in the USA of emergency department visits to all hospitals using the National Electronic Injury Surveillance System (91 hospitals) in the 1992–1993 financial year resulting from rollerblading, roller skating or skateboarding injury. In their study, roller skating had a 57% greater participation rate than skateboarding and rollerblading (which had a similar participation rate). They found 3.3 roller skating and 1.2 skateboarding injuries for every rollerblading injury. For injured rollerbladers the mean age was 19.7 years and the majority were male (1.3:1) (Schieber et al. 1994).

Skateboarding involves high speed and sometimes extreme manoeuvres and injury can result from falling off or collision with objects (Fountain & Meyers 1996). Uneven ground e.g. stones or sticks can cause the skateboard to suddenly stop with possible resultant injury because of the rider ‘s forward momentum (Fountain & Meyers 1996). Heller 1993 found that the mechanism of injury was most commonly loss of control of the rollerblades (63%) with resultant fall onto a hard surface with outstretched arms (Heller 1993). Cassell and Clapperton 2002 found that the majority of rollerblading and skateboarding injury admissions were due to falls (93% of upper limb, 82% of lower limb and 75% of head, neck and face injury admissions) (Cassell & Clapperton 2002). The majority of deaths from skateboarding are due to collision with moving vehicles (Fountain & Meyers 1996).

In the study by Schieber et al. 1994, 37% of rollerbladers, 44% of roller skaters and 19% of skateboarders had sustained an injury at the wrist or lower arm, of which approximately two thirds were fractures or dislocations. For rollerbladers, elbow, face and ankle injuries were the most common injuries after wrist injuries. 4.8% of rollerblader injuries, 3.8% of roller skating and 6.9% of skateboarding injuries involved the head. 2.4% of rollerblading injuries, 2.1% of roller skating injuries and 3.1% of skate boarding injuries were concussion, closed head injury, blunt trauma or skull fracture (Schieber et al. 1994).

Cassell and Clapperton 2002 found that for skateboarders and rollerbladers, 27% of injury presentations involved the forearm, 20% the hand/wrist/fingers, 13% the head/face, 10% the ankle, 9% the lower leg and 6% the elbow. Injury admissions had hand/wrist/fingers as most frequent (32%), followed by the forearm and the head/face (both 12%), the ankle and elbow (both 10%) and the lower leg 3%. The majority of skateboarding and rollerblading forearm injury admissions were fractures (26% of all skateboarding and rollerblading admissions) (Cassell & Clapperton 2002).

Heller 1993 found that 75% of injuries to rollerbladers involved the upper limb, 13% the lower limb and 11% the head (Heller 1993). Heller found that most (58%) of injuries in rollerbladers were fractures, followed by sprains (15%), bruising (9%) and lacerations (5%) (Heller 1993). In the study by Schieber et al. 1994, 63% of rollerbladers, 67% of roller skaters and 50% of skateboarders had sustained fractures, dislocations, sprains, strains or avulsions (Schieber et al. 1994).

In the study by Cassell and Clapperton, 8% of all rollerblading and skateboarding injury admissions were intracranial injuries (Cassell & Clapperton 2002). Fountain and Meyers reviewed skateboarding injury and found that there is a higher incidence of head trauma in young children, possibly because of a lack of psychomotor development in children. The majority of fatal head injuries in children resulted from collisions with moving vehicles (Fountain & Meyers 1996).

Protective gear includes helmet, wrist guards, elbow and knee pads, shoes, gloves and long sleeves and long pants (Fountain & Meyers 1996). Schieber et al. found that wrist guards and elbow pads were significantly protective against wrist and elbow injury (Schieber et al. 1996).

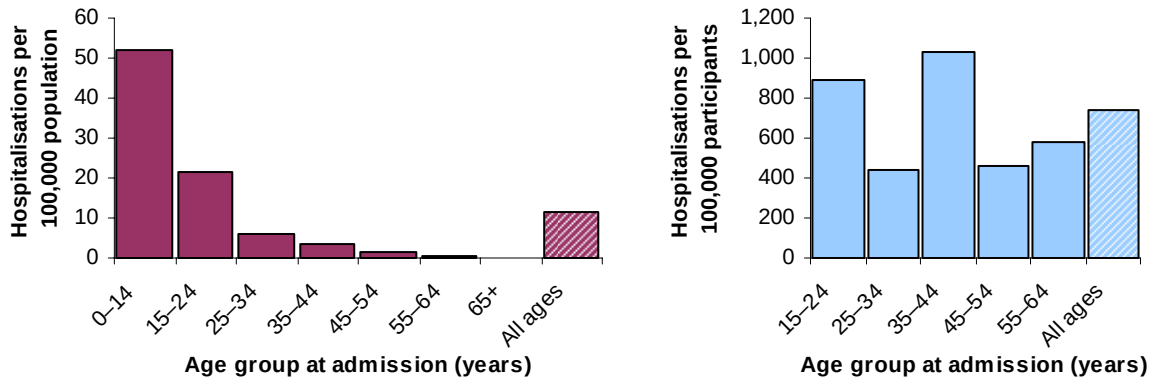
Age

The majority (60.1%) of roller sports admissions occurred in those 0–14 years with 1,361 occurring in this age group. Unfortunately, participation data is not available for this age group. The rate of injury for those 0–14 years was 52.0 per 100,000 population. The rate of hospitalisation per 100,000 participants was highest in the 35–44 year age group with 1,030.9 (Table 7.1 and Figure 7.1).

Table 7.1: Summary measures for roller sports related injury hospitalisations, by age group at admission, Australia, 2002–2003

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages (%)
Proportion of hospitalised sports (%)	9.6	4.6	2.0	2.2	1.5	0.8	0.4	5.0
Cases[††]: Roller sports	1,361	588	161	100	37	11	7	2,265 (100)
Skate boarding	648	466	88	38	12	…	0	1,253 (55.3)
In-line skating & rollerblading	378	82	41	36	15	…	…	557 (24.6)
Scooter riding	216	17	4	8	…	…	…	253 (11.2)
Roller skating	108	21	25	17	6	4	…	182 (8.0)
Estimated number of participants ('000)	NA	65.7	37	9.7[*]	8.1[*]	1.9[**]	0.0[**]	122.4[†]
Rate/100,000 population	52.0	21.6	6.0	3.4	1.3	0.5	0.2	11.5
Rate/100,000 participants	NA	895.0	435.1	1,030.9[*]	456.8[*]	NA[†]	NA[‡]	738.6[†]

[*] Estimate has a relative standard error of between 25% and 50% and should be used with caution.
[**] Estimate has a relative standard error of greater than 50% and is considered too unreliable for general use.
[†] The estimated number of participants and the rate per100,000 participants for all ages excludes those less than 15 years (n=1,361).
[‡] The rate per 100,000 participants has not been included in those 55+ years due to high uncertainty in the participation data.
[††] There were 20 hospitalisations, including 11 in those 0–14 years, involving other and unspecified roller sports.
Case numbers when n<4 are not shown.



Note: The hospitalisation rate per 100,000 participants excludes 1,361 injuries in those less than 15 years.
The hospitalisation rate per 100,000 participants 55+ years is included in the total but not shown separately due to high uncertainty in the participation data.

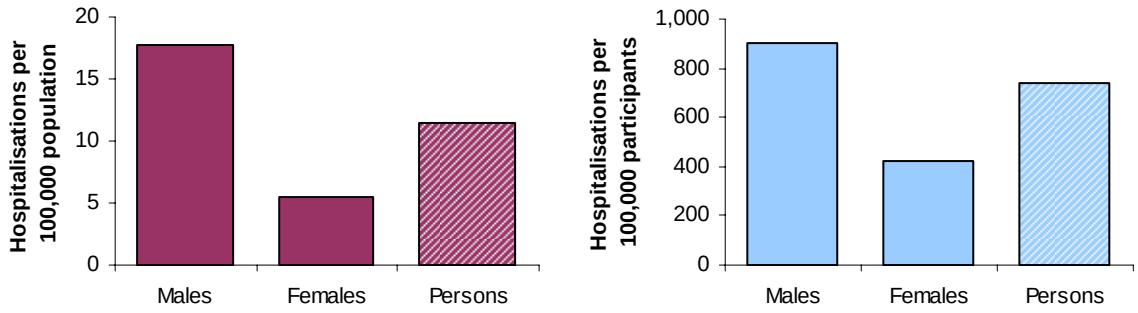
Figure 7.1: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to roller sports, by age group at admission, Australia, 2002–2003

Sex

Table 7.2: Summary measures for roller sports related injury hospitalisations, by sex, Australia, 2002–2003

	Males (%)	Females (%)	Persons (%)
Proportion of hospitalised sports (%)	5.2	4.5	5.0
Cases: Roller sports	1,730 (100)	535 (100)	2,265 (100)
Skate boarding	1,144 (66.1)	109 (20.4)	1,253 (55.3)
Rollerblading	333 (19.2)	224 (41.9)	557 (24.6)
Scooter riding	160 (9.2)	93 (17.4)	253 (11.2)
Roller skating	79 (4.6)	103 (19.3)	182 (8.0)
Other roller sports	14 (0.8)	6 (1.1)	20 (0.9)
Estimated number of participants ('000)[†]	80.6	41.8	122.4
Rate/100,000 population	17.7	5.4	11.5
Rate/100,000 participants[†]	900.7	425.8	738.6

[†] The estimated number of participants and the rate of hospitalisation per 100,000 participants excludes those less than 15 years (n=1,361).

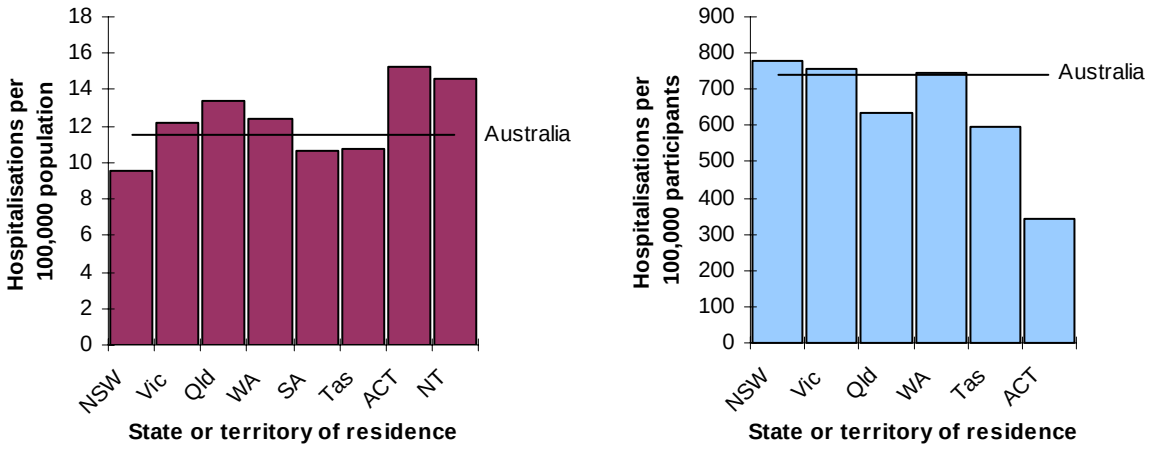


Note: The hospitalisation rate per 100,000 participants excludes 1,361 cases of roller sport injury in those under 15 years.

Figure 7.2: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to roller sports, by sex, Australia, 2002–2003

The majority of roller sport related hospitalisations occurred in males (n=1,730, 76.4%). This is to be expected as there are higher participation rates in males (1.0 versus 0.5) (Australian Sports Commission 2003). However, the rate per 100,000 participants was also much higher in males (900.7 versus 425.8) (Table 7.2 and Figure 7.2).

State or territory of residence

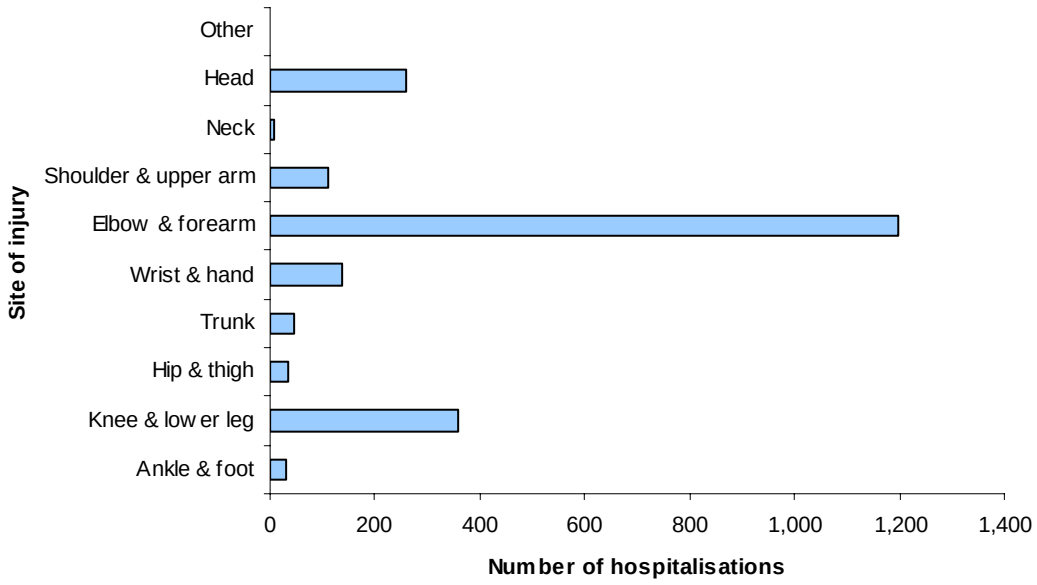


Note: The horizontal bar represents the hospitalisation rate for Australia as a whole.
The hospitalisation rate per 100,000 participants excludes 1,298 cases of roller sport injury in those under 15 years.
There were 16 cases with unreported state or territory of residence including 1 in those less than 15 years. These have been included in the rates for Australia as a whole.
Participation data were not available for SA and the NT.

Figure 7.3: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) by state or territory of residence, due to roller sports, Australia, 2002–2003

Participation data was not available for those under 15 years and for those in SA and the NT. Hence, participation rates exclude those under 15 years, which in the case of roller sports is the majority of those hospitalised. The ACT has the largest variation from the Australian rate. There were 340.4 hospitalisations per 100,000 participants and 15.2 hospitalisations per 100,000 population in the ACT compared with 738.6 hospitalisations per 100,000 participants and 11.5 hospitalisations per 100,000 population for Australia as a whole. There is a much higher participation rate in ACT compared with the other reported states with 1.9% of the population participating (compared with NSW which has the lowest rate with 0.6% of the population participating) (Figure 7.3).

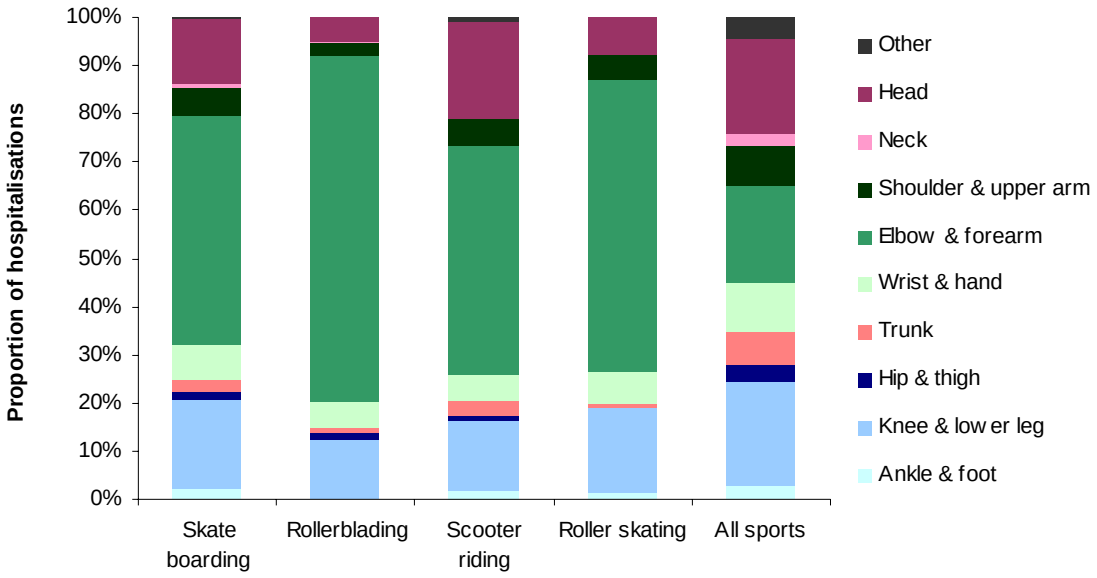
Body region



Note: Excludes 73 roller sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

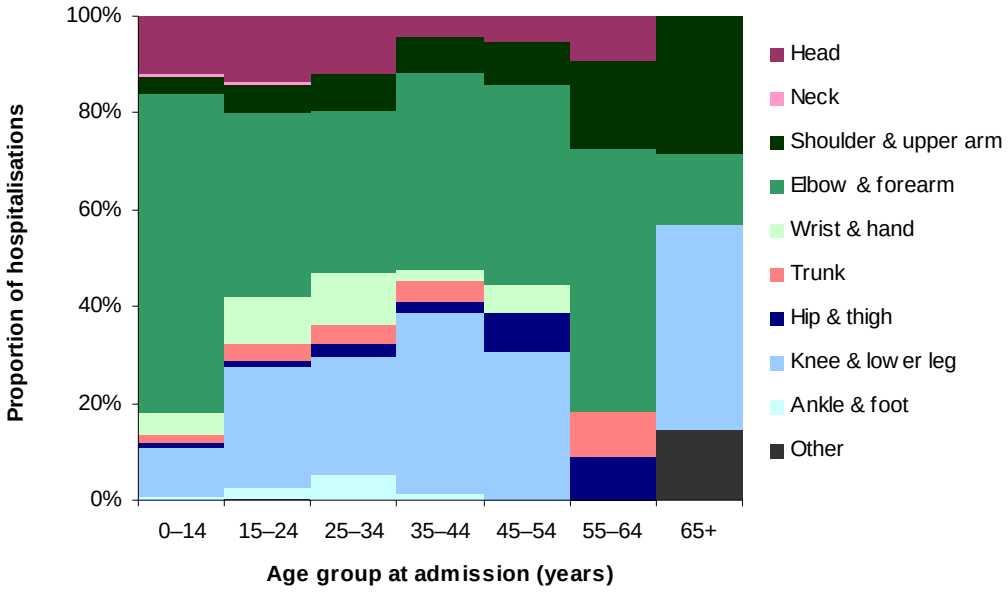
Figure 7.4: Hospitalisations due to roller sports, by principal body region injured, injury in Australia, 2002–2003

The elbow and forearm (n=1,197, 52.8%) was the principal body region injured in the majority of persons requiring hospitalisation for roller sports injury. In hospitalised roller sport injury, the elbow and forearm is more likely to be the principal body part injured in rollerblading (n=384, 68.9%) versus skateboarding (n=585, 46.7%) or scooter riding (n=119, 47.0%). Elbow and forearm injury was much more common in roller sports as compared to all sport related hospitalisations (52.8% versus 19.1%) (Figures 7.4 and 7.5).



Note: Excludes 73 roller sports cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 7.5: Hospitalisations due to roller sport injury and all sports injury, by principal body region injured, Australia, 2002–2003

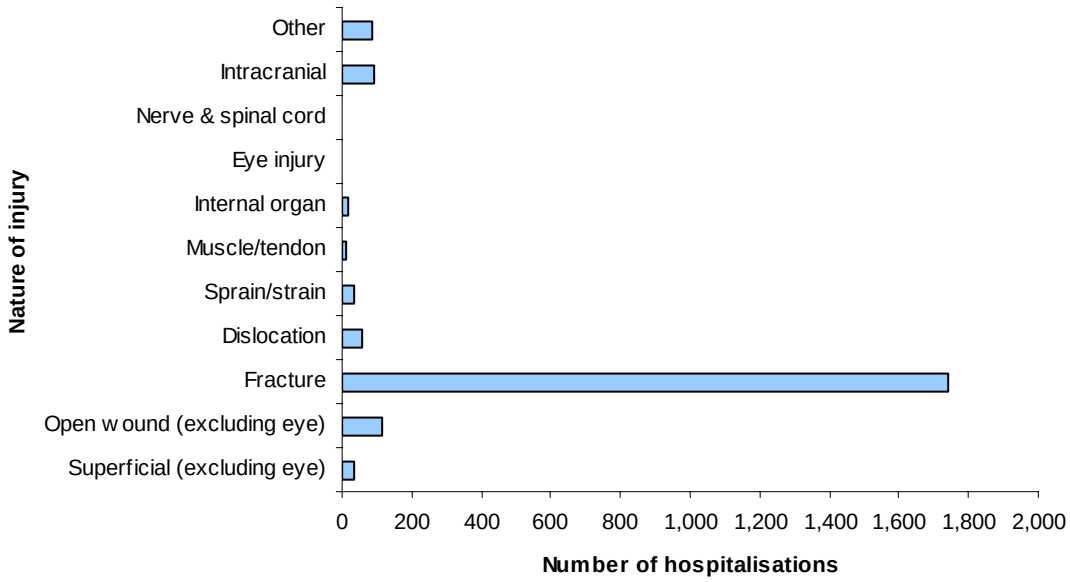


Note: Excludes 73 roller sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 7.6: Hospitalisations due to roller sports injury, by age group at admission and principal body region injured in Australia, 2002–2003

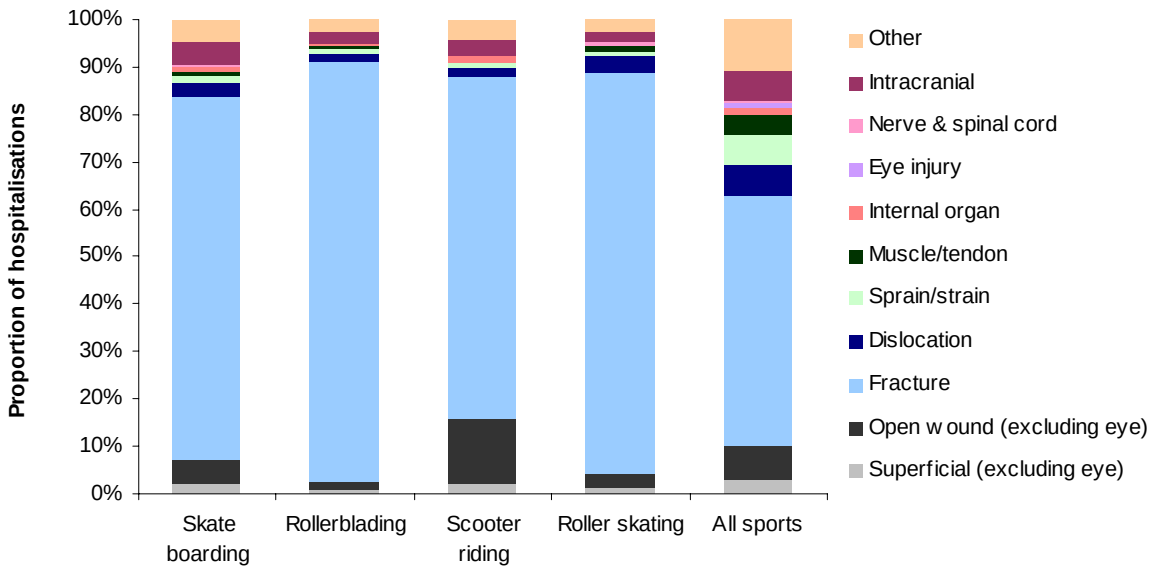
Elbow and forearm injury requiring hospitalisation was most common in the 0–14 years age group (n= 875, 64.3%), followed by the 15–24 year age group (n=212, 36.1%). 54.5% of admissions due to roller sport injury in the 55–64 year age group involved the elbow and forearm, but only small numbers were involved (Figure 7.6).

Nature of injury



Note: Excludes 73 roller sports cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 7.7: Hospitalisations due to roller sports injury, by nature of injury, Australia, 2002–2003



Note: Excludes 73 roller sports cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 7.8: Hospitalisations due to roller sports injury and all sports injury, by nature of injury, Australia, 2002–2003

The majority of roller sport related admissions were due to fractures (n=1,739, 79.3%). They were more common in roller sports compared to all sport related injury admissions (79.3% versus 52.8%) (Figures 7.7 and 7.8).

Mechanism of injury

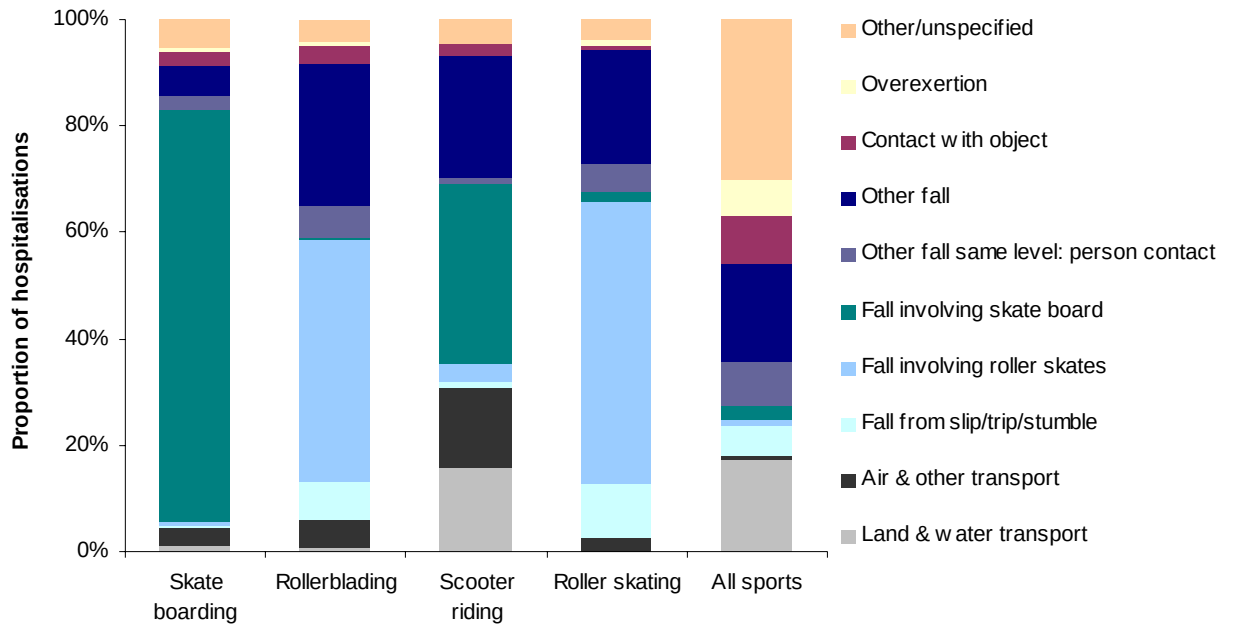


Figure 7.9: Hospitalisations due to roller sports and all sports, by mechanism of injury, Australia, 2003–2003

The majority of roller sport injury admissions resulted from falls (n=1,897, 83.8%) compared with 36.0% for all sport related hospitalisations. 91.8% of roller skating admissions resulted from falls (n=167), 87.1% of skate boarding hospitalisations (n=1,091) and 85.6% of rollerblading related hospitalisations resulted from falls (n=477). The percentage was lower with scooter riding, with 62.5% of scooter riding related hospitalisations being due to falls (n=158). Falls being the predominant mechanism of injury has previously been reported in the literature (Cassell & Clapperton 2002) (Figure 7.9).

Length of stay

Table 7.3: Roller sports and all sport related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]
Roller sports	3,416	2.0	1,008	1.9	4,424	2.0
All sports	85,269	2.5	32,720	2.8	117,989	2.6

[†] This is total bed days, including inward transfers.
[††] This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Roller sports had a lower mean number of bed days (2.0) than all sport related hospitalisations (2.6) (Table 7.3).

Place of occurrence

A large proportion of roller sport injuries occurred at other and unspecified (n=1,651) place of occurrence. The most common specified place of occurrence of injury was a skating rink (n=233, 10.3%).

Month of admission

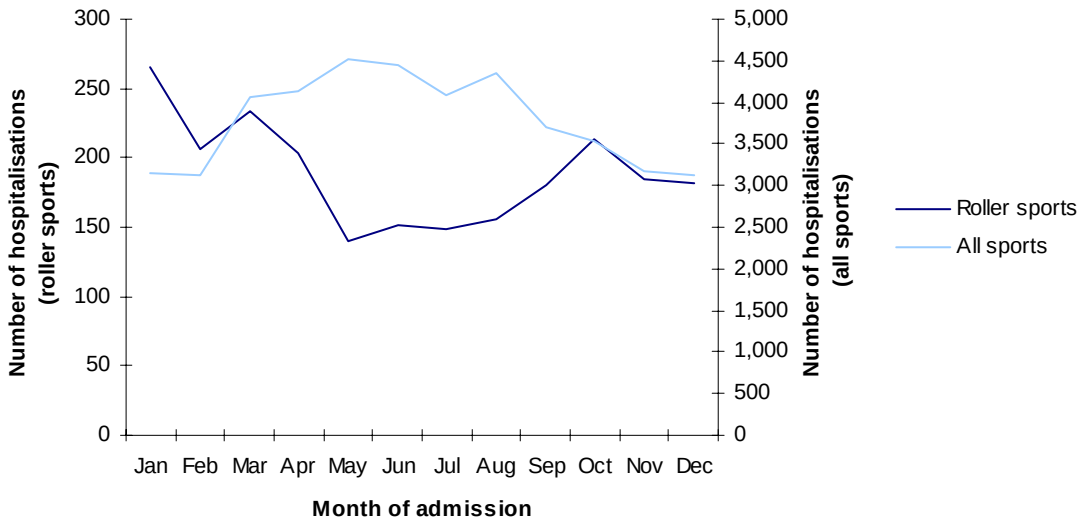


Figure 7.10: Hospitalisations due to roller sports injury, by month of admission, Australia, 2002–2003

Roller sport injury was most common over the warmer months. The highest number of admissions was in January (n=265, 11.7%), followed by March (n=234), October (n=213) and February (n=206) (Figure 7.10).

Discussion

Roller sports is mainly a sport of the young with 2.4% of those 15–24 years and 1.3% of those 25–34 years participating. Participation is more common in males than females (1.0% versus 0.5%) (Australian Sports Commission 2003). The majority (60.1%) of admissions occur in those 0–14 years (n=1,361). The majority of admissions (76.4%) occurred in males (n=1,730). The rate per participant and per population was much higher in males than in females. However, the rate per participant excludes those under 15 years which is the majority of admissions in roller sports. The majority of admissions occurring in males and the young is consistent with the literature. Cassell and Clapperton studied rollerblading and skateboarding injury admissions and found that the majority occurred in males (more than 75%) and the majority were 0–14 years (64%) (Cassell & Clapperton 2002) which is similar to the values in this report.

The elbow and forearm were the most commonly injured principal body part in those requiring admission for roller sports (n=1,197, 52.8%). The elbow and forearm is more likely to be the principal body part injured in rollerblading (n=384, 68.9%) versus skateboarding (n=585, 46.7%) or scooter riding (n=119, 47.0%). The elbow and forearm being the most commonly injured body part is consistent with the literature, however, this report had a higher percentage of elbow and

forearm injuries than some studies. Schieber et al. found that 37% of rollerbladers, 44% of roller skaters and 19% of skateboarders had wrist or lower arm injury (Schieber et al. 1994). Cassell and Clapperton found that in injured skateboarders and rollerbladers 27% of injuries involved the forearm and 6% the elbow (Cassell & Clapperton 2002). Both studies included emergency department visits.

The majority of roller sport related admissions were due to fractures (n=1,739, 79.3%). Heller found that the majority of injuries in rollerbladers were due to fractures (58%) (Heller 1993). The higher percentage of fractures in this report may be because this report only includes hospital admissions and not emergency department visits.

The majority (83.8%) of roller sport injury admissions resulted from falls. This is consistent with the literature. Cassel and Clapperton found that 93% of upper limb injury and 82% of lower limb injury was due to falls (Cassell & Clapperton 2002). However, the majority of deaths from skateboarding are due to collision with moving vehicles (Fountain & Meyers 1996).

The majority of roller sport injury occurred over the warmer months. There were most admissions in January (n=265, 11.7%).

8 Wheeled motor sports

U65

1.1 % of the Australian population, 15 years and over participated, in motor sports in 2003 (2.0% of males). There was a participation rate of 1.6% in both the 15–24 and 25–34 year age groups, and a participation rate of 1.4% in the 35–44 year age group (Australian Sports Commission 2003).

Motor racing drivers travel at 150–300 km per hour (Klarica 2001). Minoyama and Tsuchida 2004 retrospectively studied injuries sustained during and after races at the Fuji Speedway, Japan, between 1996 and 2000. They reviewed injuries sustained during professional races in single seat/formula cars and saloon cars. Formula cars have no roof and have a cramped cockpit, whereas, saloon cars have a roof and the cockpits are relatively roomy. In their study there were 1,030 formula cars in 39 races and 1,577 saloon cars in 42 races. Bruising was the most common type of in–race injury in formula racing, comprising 58% (n=29) of injuries sustained, followed by neck sprain which comprised 34% of injuries (n=17). Injuries to the head accounted for 6 injuries, including 1 death from cerebral contusion in the formula car series and 1 other episode of concussion. During formula racing the neck was the most commonly injured body region (34%), followed by the lower limbs (24%), the upper limbs (14%) and the head/face (10%). In saloon cars neck sprain was the most common type of injury sustained during the race (n=33, 53%), followed by bruising (n=17, 27%). There were 5 fractures and 2 episodes of concussion. During saloon racing, the neck was the most commonly injured body region (53%), followed by the upper limbs (21%), the lower limbs (16%) and the head/face (5%). The difference in frequency of lower and upper limb injury in formula and saloon cars may be explained by the more cramped nature of the cockpit in formula cars (Minoyama & Tsuchida 2004).

Chesser et al. 2001 studied 9,000 competitors from a motor racing circuit in Queensland over a 5 year period. There were 521 medical centre attendances. For each race started competitors had a 4% chance of requiring an on circuit medical assessment and a 0.17% chance of hospitalisation. Major trauma was sustained by 20 competitors including 2 spinal, 5 pelvic and 6 multiple rib fractures and 2 significant intraabdominal haemorrhages. For competitors hospitalised there was a mean time of 1 year before their return to motor sport. There was a mortality rate of 0.023% (n=2 deaths) (Chesser et al. 2001).

Leonard et al. 2005 retrospectively reviewed injuries sustained at the Castle Combe racing circuit, England, before and after improvements to the circuit including the addition of two chicanes in the fastest regions of the track in order to improve safety. They compared injures sustained during 1994–1996 with those sustained during 2000–2002. There were 329 car races with 6,693 drivers and 37 motorcycle races with 818 participants in the first period and 290 car races with 6,090 drivers and 47 motorcycle races with 1,575 participants in the second period. There was a significant decrease ($p<0.001$) in the number of car drivers presenting to the medical centre over the two periods (3.4% of starters compared with 2.1% of starters). There was also a significant decrease ($p<0.05$) in the risk of sustaining major injury (including any injury requiring hospitalisation) from 0.1% to 0.03%. For motorcyclists, 3.3% of starters in the first period and 3.9% of starters in the second period, presented to the medical centre. There was a significant increase ($p<0.05$) in the severity of motorcyclist injuries. For motorcyclists there was a 0.02% risk of severe injury (including any injury requiring hospitalisation) from 2000–2002. There were no severe injuries amongst motorcyclists in the first period (Leonard et al. 2005).

Chapman and Oni 1991 studied injuries to motorcyclists and car drivers at Brands Hatch racetrack, United Kingdom, from August 1988–August 1989. 70 out of the 33,184 competitors were injured. Of these 56 were motorcyclists (n=19 required admission and there were 3 deaths on arrival). Hence, 0.24% of motorcyclists who started a race required hospital review and 0.08% required hospitalisation. 14 motorcar racers required hospital treatment (5 admissions and no deaths). Hence, 0.14% of motorcar competitors starting a race required hospital treatment and 0.05% required admission. The injury rate was 15,270 injured per 100 million kilometres travelled for bike riders (compared with 789 on the public highway) and 2,922 injuries per 100 million kilometres travelled for car drivers (compared with 58 on the public highway) (Chapman & Oni 1991).

In motor car, all-terrain vehicle and motorcycling related hospitalisations it can be difficult to determine whether the incident has occurred during sport and recreation as such or during transportation. This report includes all motor car, all-terrain vehicle and motorcycling hospitalisations that have been coded as U65.0, U65.1 and U65.2 i.e. an external cause of morbidity and mortality occurring whilst engaged in sports or leisure.

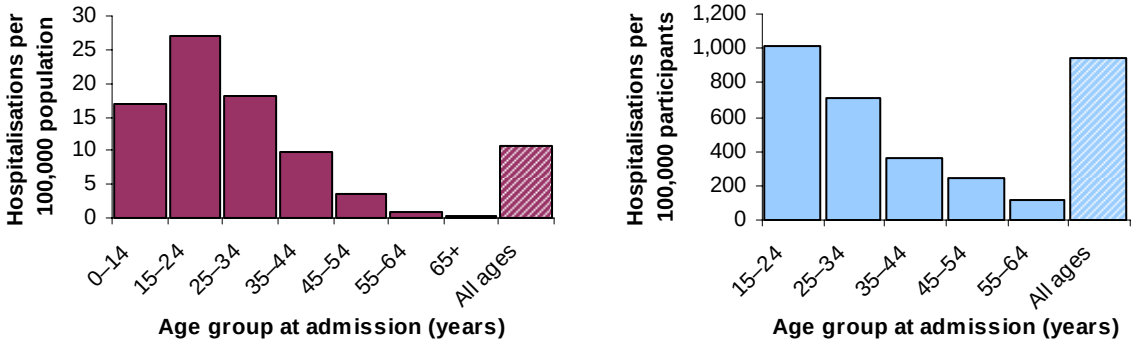
Age

The highest number of hospitalisations were in the 15–24 year age group (n=738, 35.3%). The majority of these persons were riding motorcycles (n=646, 87.5%). This age group also had the highest rate per 100,000 participants at 1,681.1 (excluding the 0–14 year age group) (Table 8.1 and Figure 8.1).

Table 8.1: Summary measures for wheeled motor sport related injury hospitalisations, by age group at admission, Australia, 2002–2003

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages (%)
Proportion of hospitalised sports (%)	3.1	5.8	6.1	6.2	4.0	1.6	0.3	4.6
Cases: Wheeled motor sports	447	738	494	288	99	21	6	2,093 (100)
Motorcycling	373‡‡	646	435	238	70	11	4	1,777 (84.9)
Go–carting	35	32	19	18	11	…	…	119 (5.7)
Riding an all-terrain vehicle	20	17	9	6	5	…	0	59 (2.8)
Motor car racing	0	10	18	14	6	4	…	53 (2.5)
Other wheeled motor sport	19	33	13	12	7	…	0	85 (4.1)
Estimated number of participants ('000)	NA	43.9	48.5	40.5	27.8	8.5*	5.4**	174.6†
Rate/100,000 population	17.1	27.1	18.3	9.7	3.4	0.9	0.2	10.7
Rate/100,000 participants	NA	1,681.1	1,018.6	711.1	356.1	247.1*	NA‡	942.7†

* Estimate has a relative standard error of between 25% and 50% and should be used with caution.
** Estimate has a relative standard error of greater than 50% and is considered too unreliable for general use.
† The estimated number of participants and the rate of hospitalisation per 100,000 participants for all ages excludes cases in those 0–14 years (n=447).
‡ The rate per 100,000 participants has not shown in those 65+ years due to high uncertainty in the participation data.
Case numbers when n<4 are not shown.
‡‡ Given the age group these are likely off road participants.



Note The hospitalisation rate per 100,000 participants excludes 447 cases in those less than 15 years.
The hospitalisation rate per participant for those 65+ years is included in the total but not presented separately due to high uncertainty in the participation data.
The hospitalisation rate per participant for the 55–64 year age group has a relative standard error of between 25% and 50% and should be used with caution.

Figure 8.1: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to wheeled motor sport injury, by age group at admission, Australia, 2002–2003

Sex

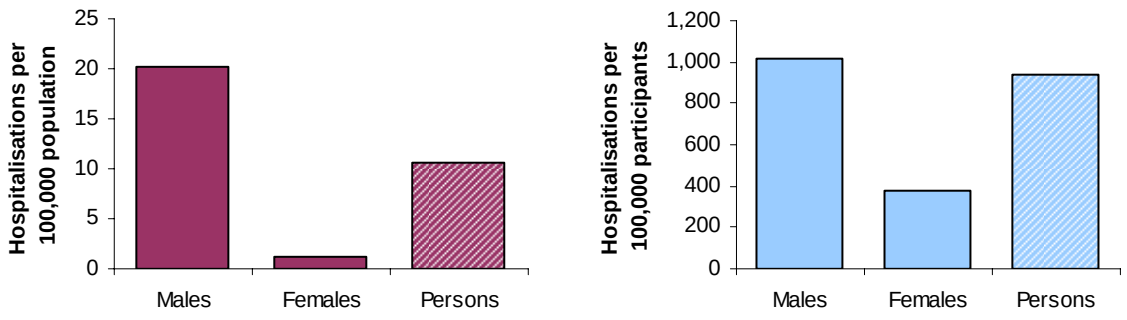
The majority of wheeled motor sport participants are males. In 2003, for those 15 years and over, there was a 2.0% participation rate for males and a 0.2% participation rate for females (the female participation rate has a relative standard error of between 25% and 50%) (Australian Sports Commission 2003). The vast majority of hospitalisations occurred in males (94.0%). Females had a lower proportion of hospitalisations involving motorcyclists (61.6% versus 86.4%) (Table 8.2 and Figure 8.2).

As would be expected males had a higher rate of hospitalisation per 100,000 population than males (16.0 times higher). Males also had a higher rate per 100,000 participants (2.7 times higher). However, the rate per participant for females has a relative standard error of between 25% and 50% (Table 8.2 and Figure 8.2).

Table 8.2: Summary measures for wheeled motor sport related injury hospitalisations, by sex, Australia, 2002–2003

	Males (%)	Females (%)	Persons (%)
Proportion of hospitalised sports (%)	5.9	1.1	4.6
Cases: Wheeled motor sports	1,968 (100)	125 (100)	2,093 (100)
Motorcycling	1,700 (86.4)	77 (61.6)	1,777 (84.9)
Go-carting	102 (5.2)	17 (13.6)	119 (5.7)
Riding an all-terrain vehicle (ATV)	46 (2.3)	13 (10.4)	59 (2.8)
Motor car racing	45 (2.3)	8 (6.4)	53 (2.5)
Other wheeled motor sport	75 (3.8)	10 (8.0)	85 (4.1)
Estimated number of participants ('000)[†]	155.5	19.0[*]	174.6
Rate/100,000 population	20.2	1.3	10.7
Rate/100,000 participants[†]	1,012.9	373.7[*]	942.7

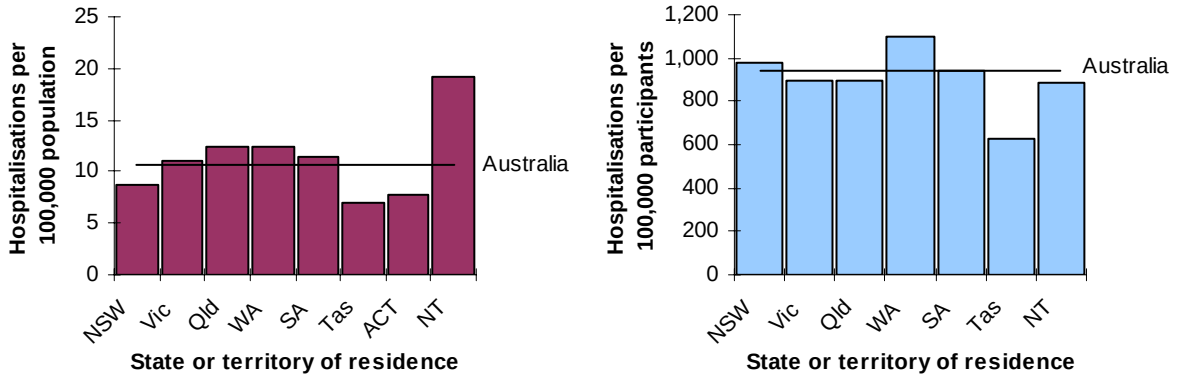
[†] Estimated number of participants and rate of hospitalisation per 100,000 participants excludes those less than 15 years (n=447).
[*] Estimate has a relative standard error of between 25% and 50% and should be used with caution.



Note: Hospitalisation rate per 100,000 participants excludes 447 cases of motor sport injury in those under 15 years.
Estimate for female hospitalisation rate per 100,000 participants has a relative standard error of between 25% and 50% and should be used with caution.

Figure 8.2: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to motor sports, by sex, Australia, 2002–2003

State or territory of residence

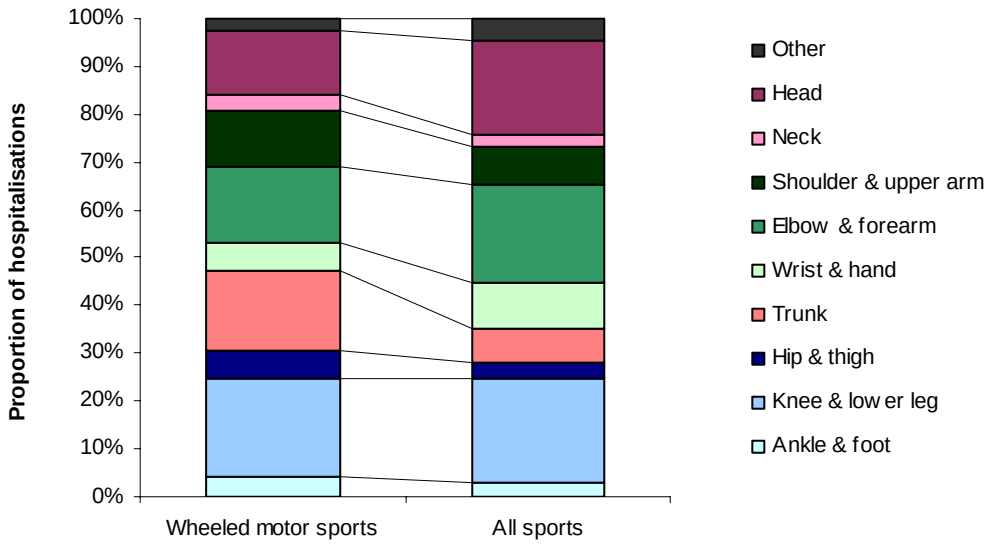


Note: The horizontal bar represents the motor sport related hospitalisation rate for Australia as a whole.
The hospitalisation rate per 100,000 participants excludes 447 cases of motor sport injury in those under 15 years.
There were 14 cases with unreported state or territory of residence, but none in those under 15 years. These cases have been included in the rate for Australia as a whole.
Participation data was not available for ACT.

Figure 8.3: Hospitalisation rate per 100,000 population and per 100,000 participants (15 year and over) due to motor sports, by state or territory of residence, Australia, 2002–2003

The NT had the highest number of hospitalisations due to wheeled motor sport with 19.1 per 100,000 population compared with the rate for Australia as a whole of 10.7 per 100,000 population. However, when hospitalisation rate per 100,000 participants is reviewed, WA and NSW have the highest rates with 1,094.1 and 976.5, respectively, compared with the rate for Australia as a whole of 942.7 (Figure 8.3).

Body region

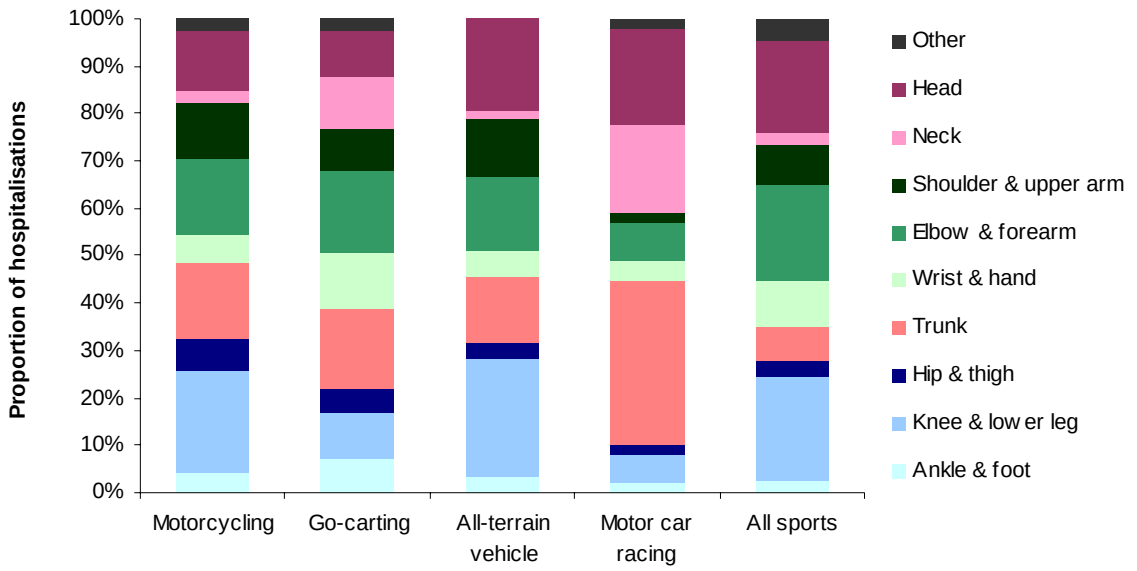


Excludes 66 cases of wheeled motor sports that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 8.4: Hospitalisations due to wheeled motor sport injury, by principal body region injured, Australia, 2002–2003

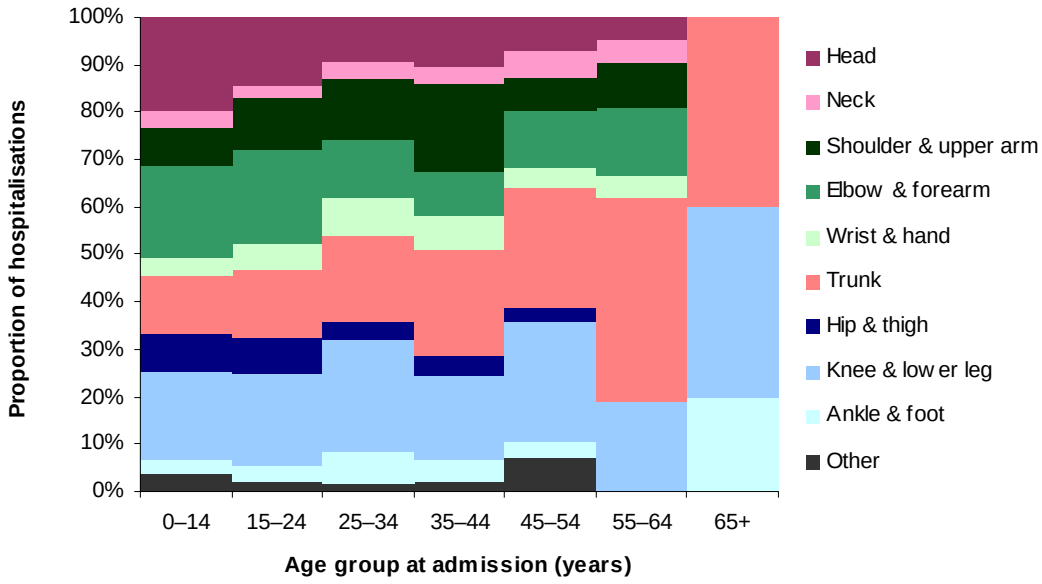
The knee and lower leg was the most commonly the principal body region injured in those hospitalised for motor sport injury (n=409, 19.5%), followed by the trunk (n=339, 16.2%), the elbow and forearm (n=323, 15.4%) and the head (n=271, 12.9%) (Figure 8.4).

The various types of wheeled motor sports had different profiles in regard to principal body region injured. The knee and lower leg was the most commonly injured body part in hospitalised motorcyclists (n=372, 20.9%), followed by the trunk (n=282, 15.9%) and elbow and forearm (n=275, 15.5%). In those hospitalised for go-carting related injuries, there were 20 (16.8%) injuries involving the elbow and forearm and 19 (16.0%) injuries involving the trunk as the principal body part injured. For all terrain vehicle riders the knee and lower leg was the most commonly injured body parts in those hospitalised the (n=14, 23.7%), followed by the head (n=11, 18.6%). For motor car racing, the trunk was the most commonly injured body part in those hospitalised (n=17, 32.1%) (Figure 8.5).



Note: Excludes 64 cases of motorcycling, go-carting, all-terrain vehicle riding and motor car racing and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 8.5: Hospitalisations due to wheeled motor sports injury and all sports injury, by principal body region injured, Australia, 2002–2003

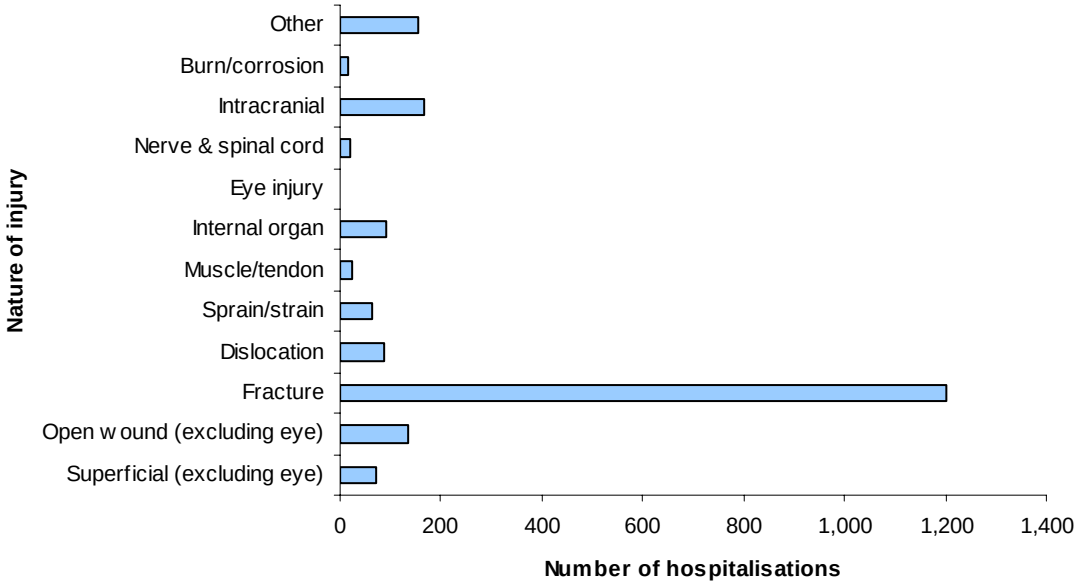


Note: Excludes 66 cases of wheeled motor sport that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 8.6: Hospitalisations due to wheeled motor sports injury, by age group at admission and body region in Australia, 2002–2003

The largest number of a principal diagnosis of head injuries occurred in the 15–24 year age group (n=104), however, in terms of percentage of hospitalised persons for the age group the largest percentage was in the 0–14 year age group (n=86, 19.2%). The trunk as the principal body region injured was most common in the 15–24 year age group (n=103, 14.0%) but in terms of percentage of hospitalised persons for the age group there was an increasing frequency until a peak in the 55–64 year age group (n=9, 42.9%). There were small numbers in the 65+ year age group (Figure 8.6).

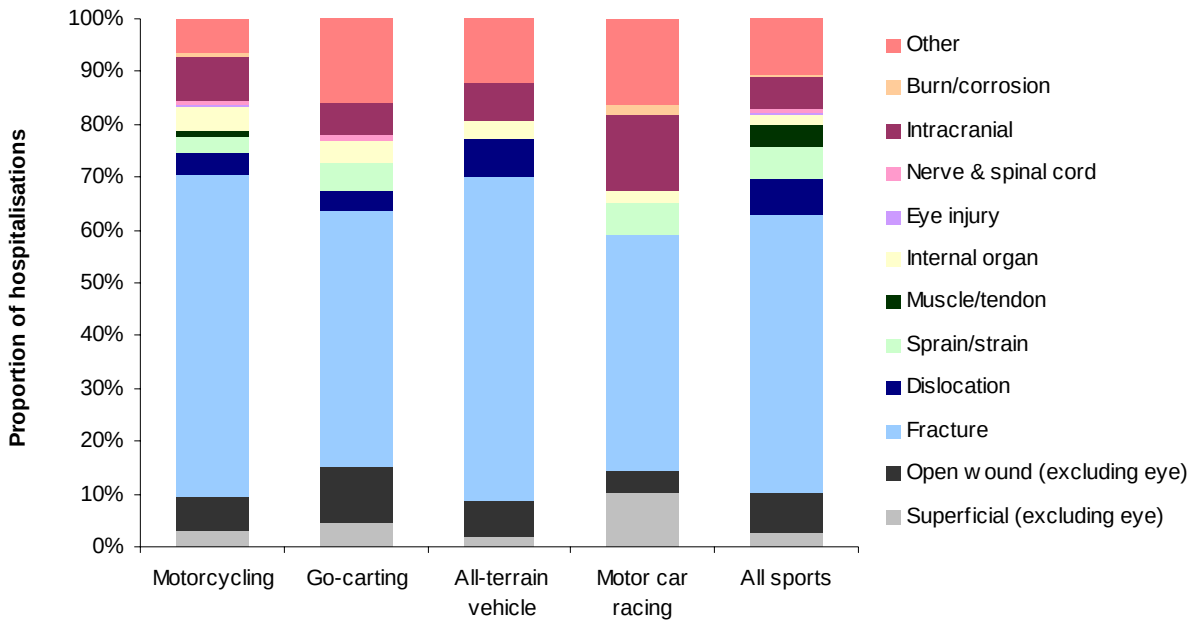
Nature of injury



Note: Excludes 66 cases of wheeled motor sports that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 8.7: Hospitalisations due to wheeled motor sport injury, by nature of injury, Australia, 2002–2003

Fractures were the principal diagnosis in the majority (59.2%) of persons admitted as a result of wheeled motor sport (n=1,200). The next most common principal diagnosis was intracranial injury (n=168, 8.3%). Fractures were less common (n=22, 44.9%) and intracranial injury more common (n=7, 14.3%) in motor car racing. For all sport related hospitalisations, fracture was the principal diagnosis in 52.8% of admissions and intracranial injury was the diagnosis in 6.1% of admissions (Figures 8.7 and 8.8).



Note: Excludes 64 cases of motorcycling, go-carting, all-terrain vehicle riding and motor car racing and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 8.8: Hospitalisations due to wheeled motor sport injury and all sports injury, by nature of injury, Australia, 2002–2003

Mechanism of injury

For 80.4% of persons hospitalised due to wheeled motor sports the mechanism of injury was motorcyclist (n=1,683).

Length of stay

Table 8.3: Wheeled motor sports and all sport related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]
Wheeled motor sports	8,319	4.2	395	3.2	8,714	4.2
All sports	85,269	2.5	32,720	2.8	117,989	2.6

[†] This is total bed days, including inward transfers.
[††] This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Wheeled motor sports had a higher mean number of bed days (4.2) than all sport related hospitalisations (2.6) by 1.6 times (Table 8.3).

Place of occurrence

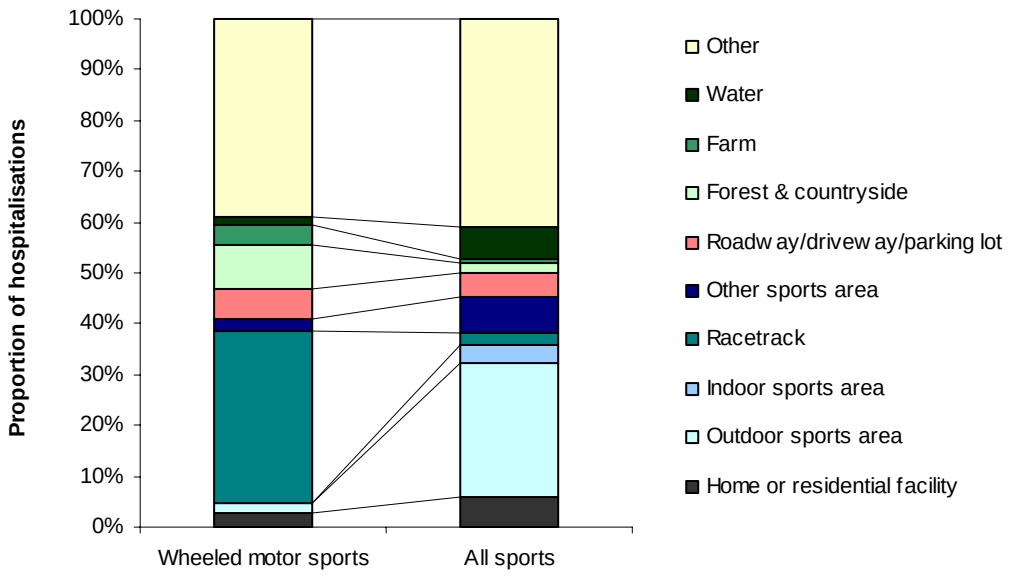


Figure 8.9: Hospitalisations due to wheeled motor sports and all sports, by place of occurrence, Australia, 2002–2003

For wheeled motor sport related hospitalisations the racetrack was the most common single specified place of occurrence (n=708, 33.8%), which was much more common than in all sport related hospitalisations (2.3%) (Figure 8.9).

Month of admission

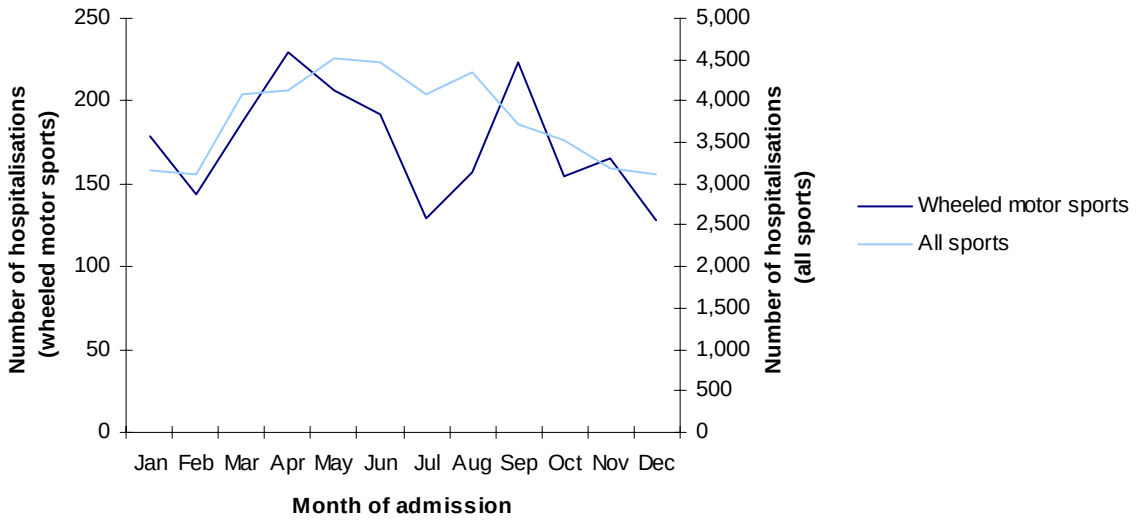


Figure 8.10: Hospitalisations due to wheeled motor sports, by month of admission, Australia, 2002–2003

Wheeled motor sports showed two peaks in hospitalisations, one in April (n=229, 10.9%) and the other in September (n=223, 10.7%) (Figure 8.10).

Discussion

Wheeled motor sports are predominately a sport of males with 2.0% of the Australian population (15 years and over) participating (Australian Sports Commission 2003). 94.0% of all hospitalisations, in 2002–2003, due to wheeled motor sport were in males (n=1,968). The rate of hospitalisation per 100,000 population and per 100,000 participants (15 years and over) was higher in males that females. Motor cycling was the most common type of vehicle involved in those hospitalised for wheeled motor sport (n=1,777, 84.9%).

In 19.5% of wheeled motor sport hospitalisations (n=409) the knee and lower leg was the principal body region injured, this was followed by the trunk (n=339, 16.2%), the elbow and forearm (n=323, 15.4%) and the head (n=271, 12.9%). There were 5 deaths in those hospitalised for wheeled motor sports and in 4 of these the head was the principal body region injured. This does not include deaths before arrival at hospital. Fractures were the most common type of principal injury sustained (n=1,200, 59.2%).

33.8% of hospitalisations resulted from incidents that occurred on the racetrack (n=708). Wheeled motor sports showed two peaks in hospitalisations, one in April (n=229, 10.9%) and the other in September (n=223, 10.7%).

9 Equestrian pursuits

U63.0 (excludes modern pentathlon)

1.2% of the Australian population 15 years and over participated in horse riding/equestrian activities/polocrosse in 2003 (0.9% of males and 1.6% of females). Of those 15 years and over, it was most popular in those 15–24 years with a participation rate of 1.8%, followed by those 35–44 years (1.6%) and those 25–34 years and 45–54 years (both 1.5%) (Australian Sports Commission 2003).

Equestrian pursuits are unique compared with most sports in that an animal is involved and it can act independently. Horses have a good memory but no reasoning ability (Firth 1985). The rider's head is 3 metres above the ground (Hockey & Miles 2001; Firth 1985) thus placing the rider at risk of injury should a fall occur. A horse can travel at up to 65 km/hr (Williams & Ashby 1995; Firth 1985) and weighs up to 500kg (Firth 1985).

Firth suggests horse–riding is more hazardous than motorcycle riding and car racing (Firth 1985; Cripps 2000). Injury rate is estimated at 1 injury per 1,000 riding hours (Cripps 2000).

Cripps 2000 reviewed horse related injury in Australia from using ABS mortality unit data (1979–1998) and AIHW hospitalisation separation data (1996–1997). There were approximately 20 horse related deaths per year, with a mean annual death rate of 0.13 deaths per 100,000 population. There were 3,539 hospital separations due to horse related injury. The highest injury rate per 100,000 population occurred in the 10–14 year age group. Females were 1.4 times more likely to be injured than males. However, over 34 years the injury rate for females decreased such that, in the older age group of 55–74 years females were significantly less likely to be injured (Cripps 2000).

Hockey and Miles 2001 studied all horse–related injury presenting to Queensland Injury Surveillance Hospital emergency departments from 1998–2000. There were 1,169 emergency department presentations. The peak incidence was in those 10–14 years, with females 10–14 years comprising 15% of all horse–related injuries. The majority of injuries were due to falls (65%), followed by contact with animal (22%), contact with object e.g. tree (5%), pinching or crushing (2%) and biting (1%). In the contact with animal cases, in 40% the mechanism was kicks and in 15% the mechanism was being stepped on. Farm was the most common place of injury (almost 45%), followed by park/bushland (15%) and private house (14%). 56% occurred during leisure or sport (Hockey & Miles 2001).

Fractures were the most common reason for emergency department presentations (33.6%), followed by sprain/strain (21.6%), superficial injury (14.9%) and intracranial injury (8.4%) (Hockey & Miles 2001). The upper limbs were most commonly injured (36.4%), followed by the lower limb (23.4%), the head and neck (18%) and the trunk (14.5%). The majority of fractures involved the upper limb (56.3%. Almost 30% of hospital presentations required admission (Hockey & Miles 2001).

Williams and Ashby 1995 studied horse related injury emergency presentations using the VISS database to five public hospitals in Victoria. They reviewed 1,068 cases. 59% of injuries were in females. The peak incidence was in those 10–14 years and 15–19 years. The most common location of injury was field/paddock (29%) followed by, unknown (18%) and public road (16%). Horse riding injuries most commonly occur over the warmer months (October to April) (Williams & Ashby 1995).

The majority of injuries were caused by falls (77%). 7% of injuries were caused by crushing (horse rolled on or stood on patient), 4% of injuries were caused by kicks and 2% by the dragging due to the patient's foot being caught in the stirrup (Williams & Ashby 1995). When thrown/falling from a horse (n=1,009) the upper limbs were the most commonly injured body part (47%). When kicked by a horse (n=51) the lower limbs (43%) and the head/face (35%) were the most commonly injured body part (Williams & Ashby 1995).

In horse related injuries in children requiring emergency presentation, the upper limbs are most commonly injured (50%), followed by the lower limbs (17%), the head (13%), the face (9%) and the trunk (7%). For adults, the upper limbs are most commonly injured (33%), followed by the lower limbs (27%), trunk (19%), head (12%) and face (8%) (Williams & Ashby 1995). 43% of horse–related injuries in children and 30% in adults were fractures. 33% of child and 29% of adult injuries were soft tissue injury. 8% of injuries were concussion and 65% of these required admission (Williams & Ashby 1995).

Williams and Ashby 1995 also studied the Victorian Inpatient Minimum Dataset (VIMD) from 1987–1993. This collates public hospital admissions in Victoria. The most common age group was 10–14 years. 29% of admissions were due to head and face injury (12% intracranial, 11% concussion and other head/face injuries 6%) and 26% of admissions were due to upper limb injury. 4% of admissions were due to spinal injury. 4% of admissions were due to spinal injury (including n=14 cases of spinal cord injury). From the NCIS there were 17 horse related deaths (n=10 were riding related) from July 1988–June 1992 (Williams & Ashby 1995).

Moss et al. 2002 performed a retrospective study of persons presenting to the emergency department of the Royal Surrey County Hospital, England, between February 2000 and February 2001 with horse riding related sports injury (n=276). Only 260 of these presentations could be analysed. 84.6% of presentees were female. The majority of injuries resulted from falls (78.8%), 11.1% were due to kicks and 5.4% were due to being trodden on (Moss et al. 2002). 29.2% of injuries involved the upper limbs, 22.3% the lower limbs and 17.3% the head. 53.3% (n=24) of those with head injury had cerebral injury but only 20.8% of these (n=5) required admission. There was 1 fatality (Moss et al. 2002).

It has been suggested that the majority of equestrian related fatalities are the result of head injury (Pounder 1984). It is thus logical to assess whether helmets reduce the risk of head injury. Firth suggests that for fatally injured riders, 1/3 were not wearing a helmet, 1/3 the helmet falls off (due to the chin strap being inadequate or not done up) and 1/3 the helmet is inadequate or is dislodged (Firth 1985).

Bond et al. 1995 reviewed all horse related injuries in those under 15 years, presenting to the University of Virginia Pediatric Emergency Department from November 1990–October 1992. Bond et al. particularly studied helmet use. There were 32 children in the study. There was 1 death. 30 of the patients were thrown or fell from a horse and the remaining 2 were stepped on by a horse. Helmet use is reviewed in these thirty patients. Five of the 20 wearing helmets and 5 of the 10 not wearing helmets had central nervous system injury. Only 1 of the 5 helmeted riders required hospitalisation. Riders not wearing helmets were significantly more likely to have a Glasgow Coma Score less than 15 (i.e. more severe), have a higher Multiple Injury Severity Scale score (i.e. more severe) and to be hospitalised. Bond et al. did not attempt to characterise the helmet type worn and it was a small paediatric study (Bond et al. 1995).

It is recommended that horse–riders wear a helmet with four point chin strap that conforms to the Australian safety standard. However, the effect of equestrian helmets on injury rates needs to be more fully evaluated. The classic riding helmet offers little protection against head injury (Williams & Ashby 1995).

Injury can occur from the rider's foot being caught in the stirrup. The stirrup should be two to three centimetres larger than the rider's boot (Hockey & Miles 2001). Safety stirrups have been developed with a pressure release to allow quick release with increased foot pressure. However, the effect of these on injury rates also needs to be more fully evaluated (Williams & Ashby 1995). Non–slip gloves should be worn (Williams & Ashby 1995).

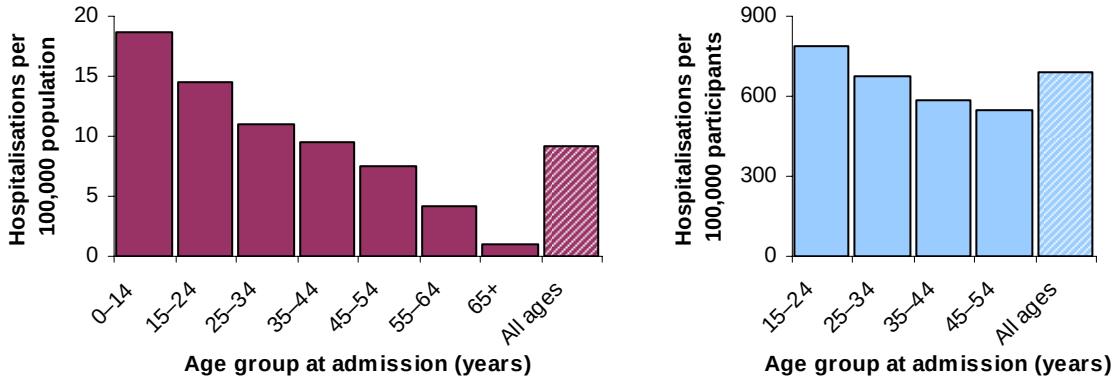
This report includes all hospitalised cases which have been coded to U63 (which excludes modern pentathlon). It includes equestrian related hospitalisations coded as 'occurring while engaged in sport or leisure'. However, the distinction between horse riding for sport or leisure and for transportation or work is not always clear.

Age

Table 9.1: Summary measures for equestrian pursuit related injury hospitalisations, by age group at admission, Australia, 2002–2003

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages
Proportion of hospitalised sports (%)	3.4	3.1	3.7	6.1	8.7	7.7	1.6	4.0
Cases: Equestrian pursuits	488	396	299	284	217	101	31	1,816
Estimated number of participants ('000)	NA	50.1	44.1	48.6	39.4	6.7**	2.9**	191.7†
Rate/100,000 population	18.6	14.5	11.1	9.5	7.5	4.2	0.9	9.2
Rate/100,000 participants	NA	790.4	678.0	584.4	550.8	NA‡	NA‡	692.7†

** Estimate has a relative standard error of greater than 50% and is considered too unreliable for general use.
† The estimated number of participants and the rate of hospitalisation per 100,000 participants for all ages excludes those 0–14 years (n=488).
‡ The rate of hospitalisation per 100,000 participants has not shown in those 55+ years due to high uncertainty in the participation data.



Note: The hospitalisation rate per participant excludes 488 cases in those less than 15 years.
The hospitalisation rate per participant for those 55+ years is included in the total but not presented separately due to high uncertainty in the participation data.

Figure 9.1: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to equestrian pursuit related injury, by age group at admission, Australia, 2002–2003

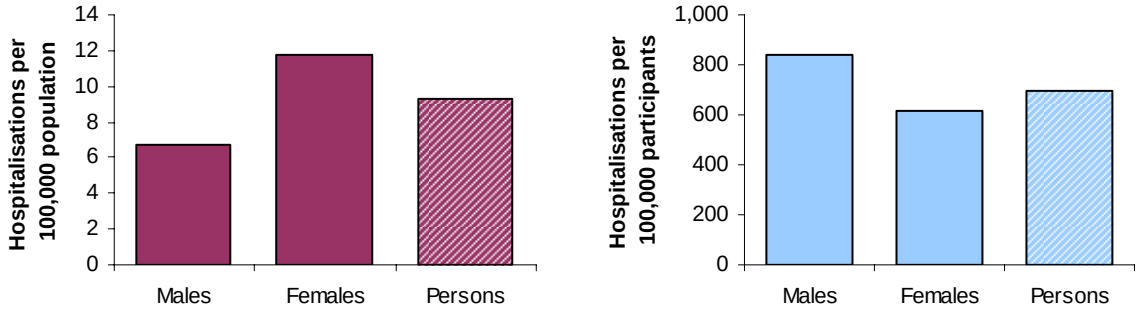
The largest number of hospitalisations for equestrian pursuits was in the 0–14 year age group with 488 cases, followed by the 15–24 year age group with 396 cases. The peak incidence occurring in the young is consistent with the literature. Hockey and Miles found that the peak incidence of horse related emergency department presentations was in the 10–14 year age group (Hockey & Miles 2001). The rate per 100,000 participants was highest in the 15–24 year age group with 790.4. Unfortunately, participation data, and hence hospitalisation rate per participation is not available in those under 14 years (Table 9.1 and Figure 9.1).

Sex

Table 9.2: Summary measures for equestrian pursuit related injury hospitalisations, by sex, Australia, 2002–2003

	Males	Females	Persons
Proportion of hospitalised sports (%)	2.0	9.8	4.0
Cases: Equestrian pursuits (%)	658 (36.2)	1,158 (63.8)	1,816 (100)
Estimated number of participants ('000)[†]	66.6	125.1	191.7
Rate/100,000 population	6.7	11.7	9.2
Rate/100,000 participants[†]	836.3	616.3	692.7

[†] Estimated number of participants and rate of injury per 100,000 participants excludes 488 cases in those less than 15 years.



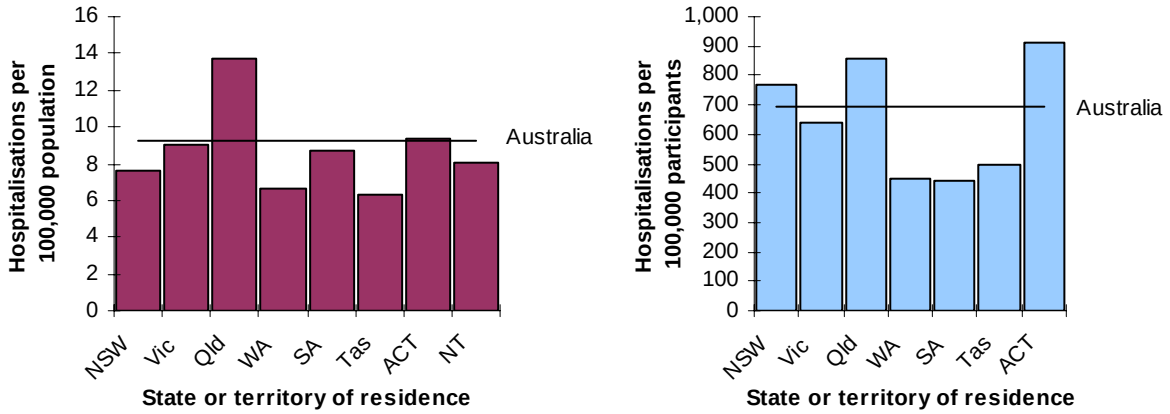
Note: Hospitalisation rate per 100,000 participants excludes 488 cases of equestrian pursuit related injury in those under 15 years.

Figure 9.2: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to equestrian pursuit related injury, by sex, Australia, 2002–2003

The majority (n=1,158, 63.8%) of equestrian related admissions occurred in females. This was consistent with the literature with Williams and Ashby finding that 59% of emergency presentations in Victoria were in females (Williams & Ashby 1995). The rate of hospitalisation per 100,000 population was 11.7 in females and 6.7 in males. However, the rate of hospitalisation per 100,000 participants (15 years and over) was higher in males than females (863.6 versus 616.3) (Table 9.2 and Figure 9.2).

State or territory of residence

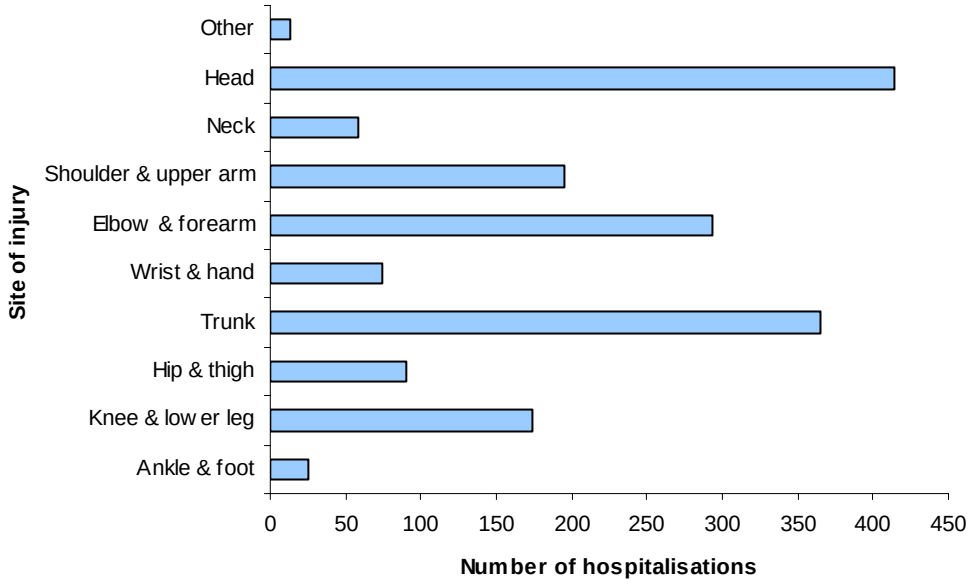
Queensland had the highest rate of equestrian pursuit related hospitalisations with 13.7 per 100,000 population, compared with the population based hospitalisation rate for Australia as a whole of 9.2. However, when participation is considered, the ACT has the highest rate of equestrian related hospitalisations per 100,000 participants with 909.1, which was 1.3 times higher than the Australian rate of 692.7. SA had the lowest rate with 439.4 hospitalisations per 100,000 participants. Participation data was not available for the NT (Figure 9.3).



Note: The horizontal line represents the equestrian pursuit related hospitalisation rate for Australia as a whole.
Participation data was not available for NT.
The hospitalisation rate per 100,000 participants excludes 488 cases of equestrian pursuit injury in those under 15 years.
There were 25 cases with unreported state or territory of residence but none in those less than 15 years. These cases have been included in the rate for Australia as a whole.

Figure 9.3: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) by state or territory of residence, due to equestrian pursuits, Australia, 2002–2003

Body region

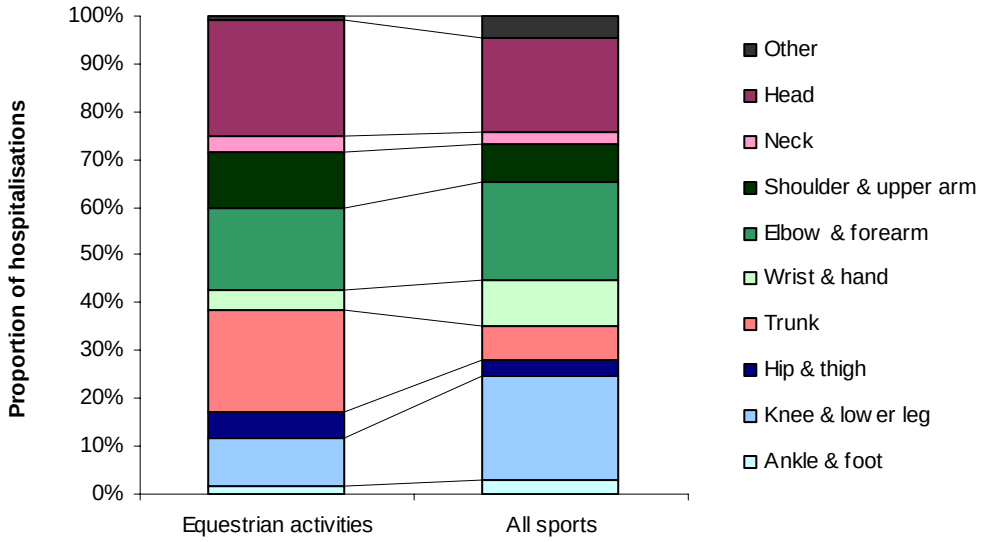


Excludes 113 equestrian pursuit related cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 9.4: Hospitalisations due to equestrian pursuits, by principal body region injured, Australia, 2002–2003

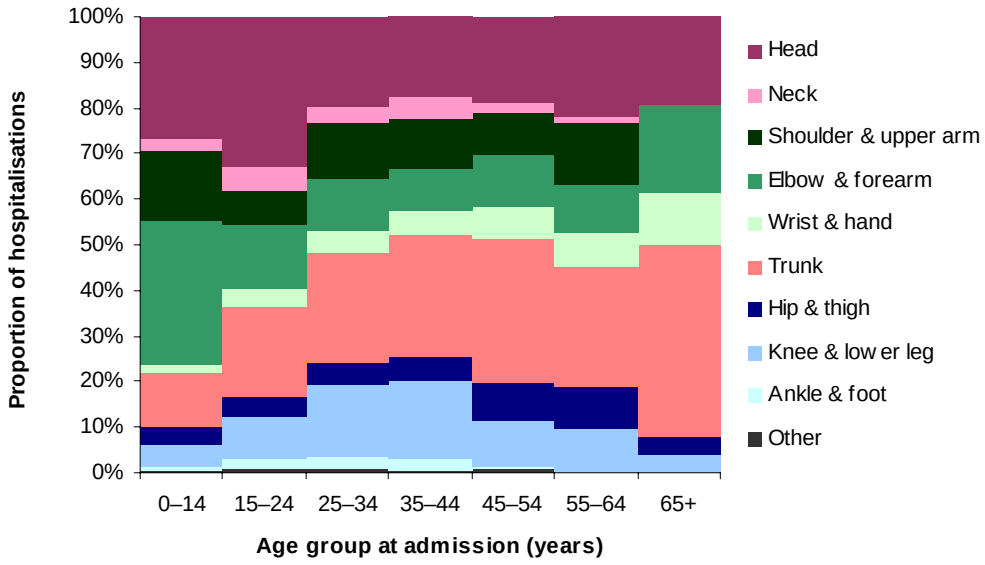
Head injury was the principal body region injured in 22.8% (n=414) and trunk injury was the principal body region injured in 20.1% (n=365) of equestrian pursuit related hospitalisations. In all sport related hospitalisations, the head was the principal body region injured in 18.5% and the trunk in 6.7% (Figures 9.4 and 9.5).

The highest number of head injuries, where the head was the principal body region injured, occurred in the 15–24 year age group (n=126, 31.8%). The trunk was the principal body region injured in 75 of cases in the 15–24 year age group (18.9%), however, the largest proportion was in the 65+ year age group (n=11, 35.5%) (Figure 9.6).



Note: Excludes 113 equestrian activities cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

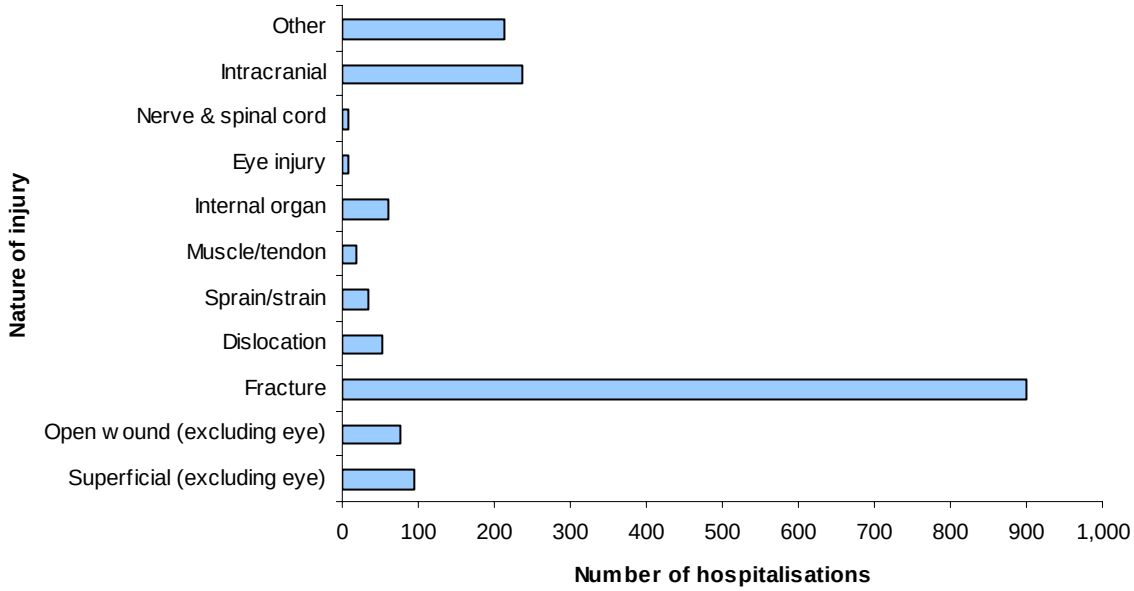
Figure 9.5: Hospitalisations due to equestrian pursuits and all sports, by principal body region injured, Australia, 2002–2003



Note: Excludes 113 equestrian activities cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 9.6: Hospitalisations due to equestrian pursuits, by age group at admission and principal body region injured, Australia, 2002–2003

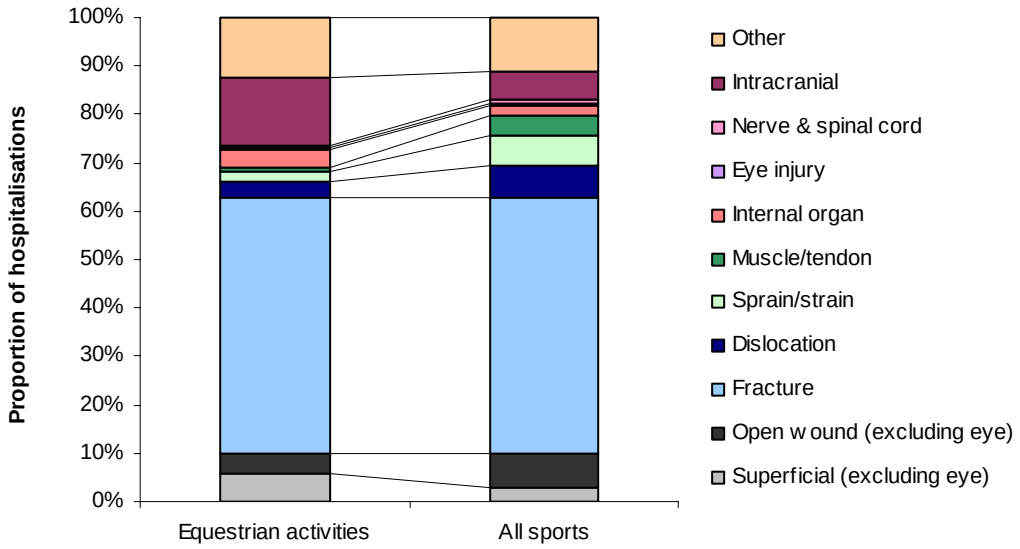
Nature of injury



Note: Excludes 113 equestrian activities cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 9.7: Hospitalisations due to equestrian pursuit related injury, by nature of injury, Australia, 2002–2003

52.8% of equestrian related injury hospitalisations had a fracture as the principal diagnosis (n=899) which is the same percentage as for all sports related injury hospitalisations. Intracranial injury was the next most common principal diagnosis in equestrian related hospitalisations (n=238, 14.0%), compared with 6.1% of all sport related injury hospitalisations (Figures 9.7 and 9.8).



Note: Excludes 113 equestrian activities cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 9.8: Hospitalisations due to equestrian pursuit related injury and all sports injury, by nature of injury in Australia, 2002–2003

Mechanism of injury

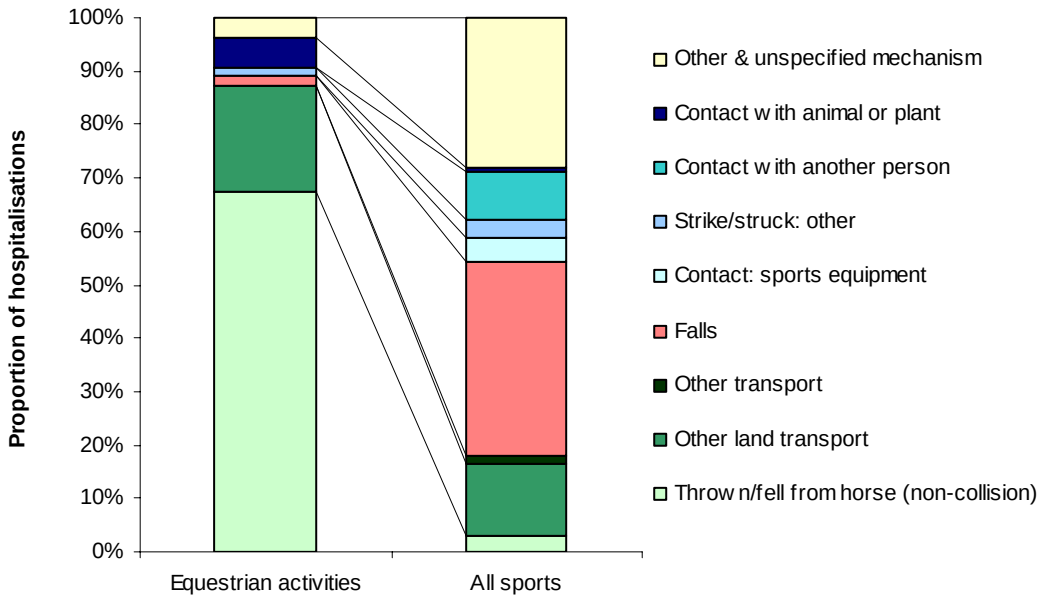


Figure 9.9: Hospitalisations due to equestrian pursuits and all sports, by mechanism of injury, Australia, 2003–2003

Thrown or fell from a horse (non-collision) was the mechanism of injury in the majority of persons hospitalised for equestrian related reasons (n=1,227, 67.6%) (Figure 9.9).

Length of stay

Table 9.3: Equestrian pursuit and all sport related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days†	Mean bed days††	Total bed days†	Mean bed days††	Total bed days†	Mean bed days††
Equestrian pursuits	2,716	4.1	3,789	3.3	6,505	3.6
All sports	85,269	2.5	32,720	2.8	117,989	2.6

† This is total bed days, including inward transfers.
†† This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Equestrian pursuit related hospitalisations had a higher mean number of bed days (3.6) than all sport related hospitalisations (2.6) (Table 9.3).

Place of occurrence

The place of occurrence in 62.5% (n=1,135) of equestrian pursuit related hospitalisations was other or unspecified place. 139 (7.7%) occurred at a farm, 114 (6.3%) occurred at an equestrian centre and 101 (5.6%) occurred at a racetrack (Figure 9.10).

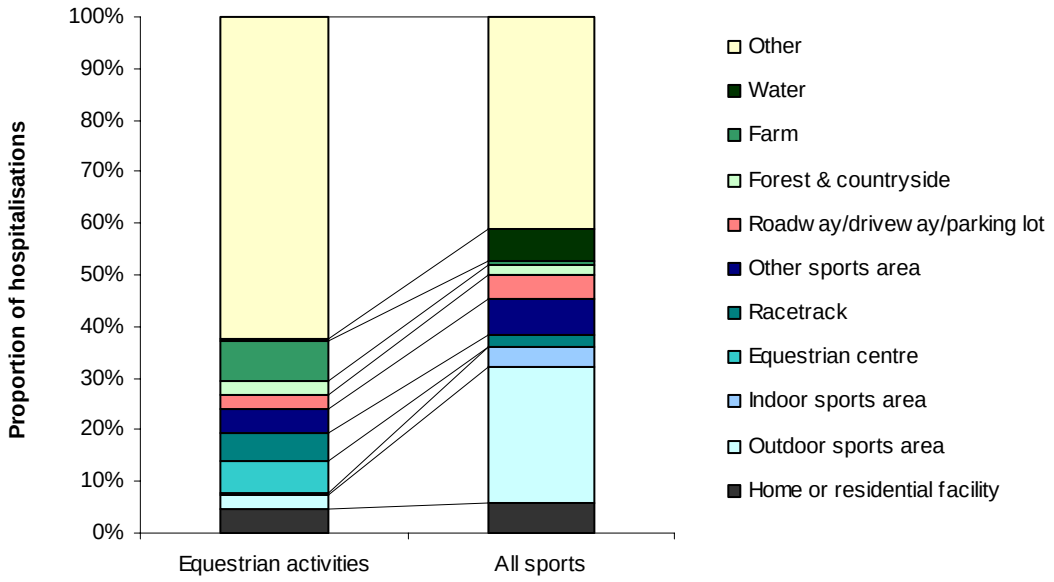


Figure 9.10: Hospitalisations due to equestrian pursuits and all sports, by place of occurrence, Australia, 2002–2003

Month of admission

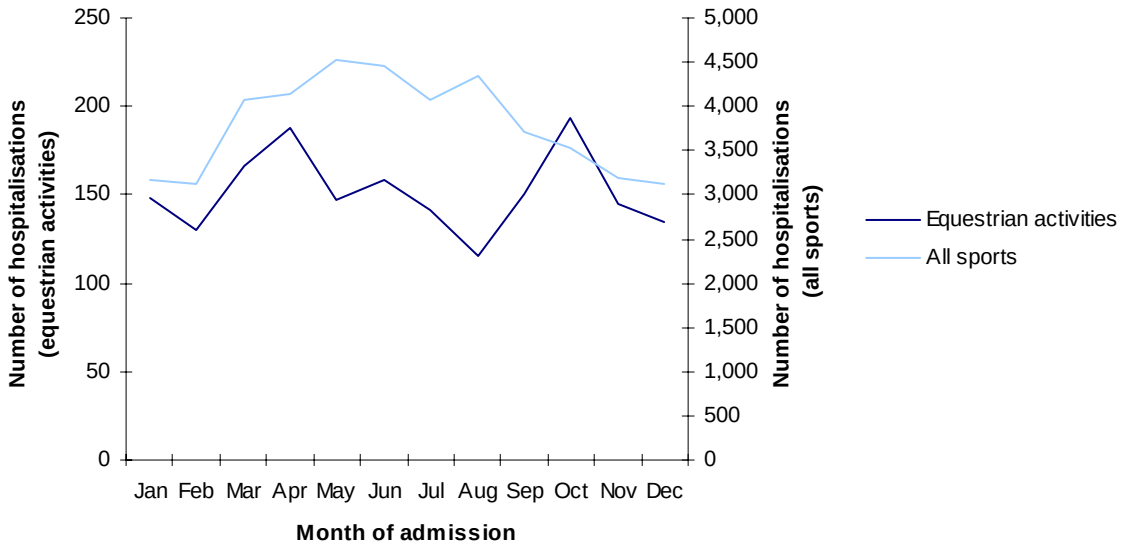


Figure 9.11: Hospitalisations due to equestrian pursuit related injury, month of admission, Australia, 2002–2003

Equestrian pursuit related hospitalisations had two peaks, one in October (n=193, 10.6%) and the other in April (n=188, 10.4%). The trough was in August (n=134, 6.6%) (Figure 9.11).

Discussion

The highest number of equestrian related hospitalisations occurred in the 0–14 year age group (n=488, 26.9%). The majority of hospitalisations occurred in females (n=1,158, 63.8%). The peak incidence of equestrian related hospitalisations was in 10–14 year females (n=271, 14.9%) and there were 387 hospitalisations (21.3%) in 0–14 year females. Hockey and Miles found that the peak incidence of horse related emergency presentations was in 10–14 year age group females with 15% of all presentations occurring in this group (Hockey & Miles 2001). Williams and Ashby found that 59% of horse related emergency presentations in Victoria occurred in females with the peak incidence of presentations in the 10–14 and 15–19 year age groups (Williams & Ashby 1995).

The head and the trunk were the two most prevalent principal body regions injured (n=414, 22.8% and n=365, 20.1% respectively). Williams and Ashby studied public hospital horse related hospitalisations in Victoria. 29% of admissions were due to head and face injury (12% intracranial, 11% concussion and other head/face injuries 6%) and 26% of admissions were due to upper limb injury. 4% of admissions were due to spinal injury (Williams & Ashby 1995).

Fractures were the most common type of principal injury diagnosis (n=899, 52.8%) and intracranial injury was the next most common principal diagnosis (n=238, 14.0%). Horse–riders should wear a helmet with a four point chin strap that conforms to the Australian safety standard. The classic riding helmet offers little protection against head injuries (Williams & Ashby 1995).

In the majority (n=1,227, 67.6%) of persons hospitalised for equestrian related reasons, thrown or fell from a horse (non-collision) was the mechanism of injury. Hockey and Miles found that falls was the mechanism of injury in the majority (65%) of emergency department presentations (Hockey & Miles 2001). Williams and Ashby found that 77% of emergency department horse related presentations were due to falls (Williams & Ashby 1995).

Equestrian pursuit related hospitalisations had two peaks, one in October (n=193, 10.6%) and the other in April (n=188, 10.4%).

10 Basketball and netball

U50.1 (basketball) and U50.3 (netball).

In 2003, basketball was the seventh and in 2002, the sixth most organised popular sport. In 2003, basketball had a participation rate of 3.6% in those 15 years and over, and was more popular with males (4.3% male and 2.9% female) (Australian Sports Commission 2003). 74.6% of basketball participants are less than 35 years (Australian Sports Commission 2000a).

Netball was the fourth most popular organised sport, for participation, in Australia in 2002 and 2003. In 2003, 6.9% of females and 0.9% of males (15 years and over) participated in netball (Australian Sports Commission 2003). 80.4% of netball participants are less than 35 years (Australian Sports Commission 2000b).

In Australian children, 5–14 years, in the 12 months prior to April 2003, basketball was the fifth most popular organised sport, with 7.7% of those 5–14 years participating (8.6% of males and 6.9% of females) and netball was the third most popular organised sport for participation, with 9.1% participating (0.6% of males and 18.1% of females) (Australian Bureau of Statistics 2005).

Basketball is a non contact sport (Sonzogni & Gross 1993). Injury can result from falls and poor landings after jumps, collisions, pivots and rapid acceleration or deceleration (Sickles & Lombardo 1993). The lower limb is the most common site of injury with ankle injuries being most commonly injured part. Inversion of the plantar flexed foot is the most common mechanism of injury (Sonzogni & Gross 1993). The knee is the second most commonly injured body region in basketball, however, likely accounts for more time off play (Sonzogni & Gross 1993)

Gomez et al. 1996 studied girls' high school basketball injuries in Texas in the 1993/1994 season. 890 players on the school basketball teams were included. There were 436 injuries that season, i.e. 0.49 injuries per athlete, with an approximate risk of injury of 0.4% per hour of exposure. 49% of injuries but only 12.5% of exposure time were during competitions. There was a 0.038 rate of serious injury per athlete per year (i.e. hospitalisation or surgery). 56% of injuries were sprain/strains, 15% were contusions, 14% were dental and 6% were fractures. The ankle was the most commonly injured body region (31%), followed by the knee (19%). However, 32% of all severe injuries involved the ACL (Gomez et al. 1996).

Netball is a game requiring rapid changes in direction, acceleration and elevated leaps to catch the ball (Hopper & Elliott 1993). Hopper and Elliott 1993 studied injuries sustained at the National Schoolgirls' Netball Championship and the Open and under 21 years All Australia Netball Championships held in Perth in 1988. Almost one quarter (23%) of players were injured. In the All Australian Netball Championship, the ankle was the most commonly injured body part (36.6%), followed by the calf/shins (19.2%), the knee (17.2%), the back (13.5%) and the foot (11.5%). Incorrect landing or contact with another player was the most common reasons, perceived by the player, contributing to their injury (both 28.8%). However, for knee injury alone, it was slip, trip or sudden stop (Hopper & Elliott 1993).

Hopper et al. 1995 studied injuries sustained during competition (A1 to D6 grades) at the Western Australia Netball Association Matthew's centre from 1985–1989. There were 608 injured players out of a total of 11,228 players (5.4%). There was a 8.5% injury rate for those in A grade compared with 3.3% for those in D grade. The majority of injuries involved the ankle (84.3%), followed by the knee (8.3%), other (4.6%) and the hand (2.8%). The majority of ankle injuries involved the lateral ligament complex (67%) but 4% had fractured lateral malleolus and 1.5% a fractured medial malleolus. 2.6% of total injuries involved the menisci of the knee and 1.8% the ACL. The majority of injuries were ligamentous (81%), followed by fractures (11%) and muscle or soft tissue injuries (8%). At least 38% of players regarded incorrect landing to be the reason for their ankle and knee injuries. Knee injuries tend to be more severe compared with ankle injuries with more being referred to hospital (27% versus 15%) (Hopper et al. 1995).

Age

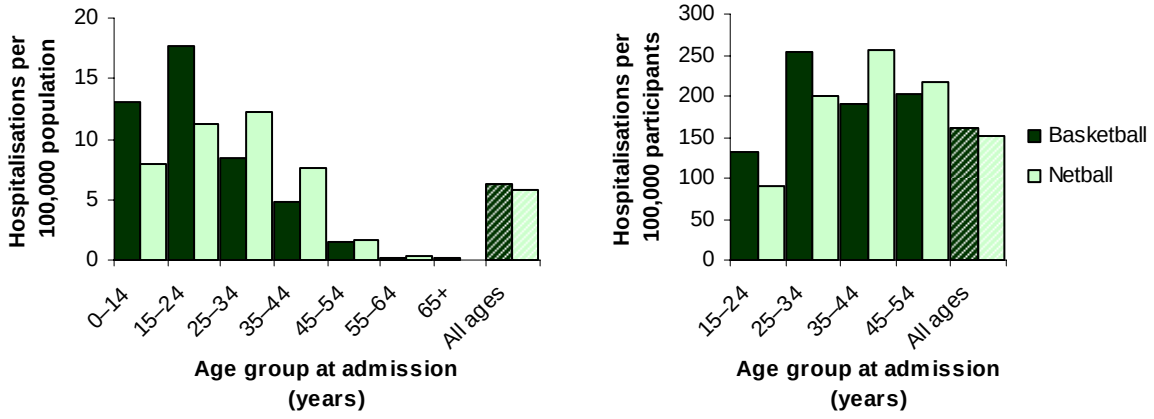
Table 10.1: Summary measures for basketball and netball related hospitalisations, by age group at admission, Australia, 2002–2003

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages
Proportion of hospitalised sports (%):								
Basketball	2.4	3.8	2.8	3.1	1.8	0.2	0.2	2.7
Netball	1.5	2.4	4.1	4.9	2.0	0.6	0.1	2.5
Cases:								
Basketball	340	482	229	143	45	…	…	1,244
Netball	207	306	332	226	49	8	…	1,129
Estimated number of participants ('000)								
Basketball	NA	367.7	90.1	75.1	22.1*	2.3**	2.1**	559.3†
Netball	NA	334.6	166.6	88.1	22.7	0.5**	1.5**	614.0†
Rate/100,000 population								
Basketball	13.0	17.7	8.5	4.8	1.6	0.1	0.1	6.3
Netball	7.9	11.2	12.3	7.6	1.7	0.3	0.0	5.7
Rate/100,000 participants								
Basketball	NA	131.1	254.2	190.4	203.6*	NA	NA	161.6†
Netball	NA	91.5	199.3	256.5	215.9	NA	NA	150.2†

† The estimated number of participants and the rate of hospitalisation per 100,000 participants for all ages excludes those less than 15 years (n=340 for basketball and n=207 for netball).
* Estimate has a relative standard error of between 25% and 50% and should be used with caution.
** Estimate has a relative standard error of greater than 50% and is considered too unreliable for general use.
Case numbers when n<4 are not shown.

The largest number of basketball related admissions occurred in the 15–24 year age group (n=482, 38.7%). This group had the highest rate per 100,000 population with 17.7 hospitalisations per 100,000 population. The highest rate per 100,000 participants (15 years and over) was in the 25–34 year age group with 254.2 hospitalisations per 100,000 participants (Table 10.1 and Figure 10.1).

The peak number of netball related hospitalisations occurred in the 25–34 year age group (n=332, 29.4%). This age group had the highest rate per 100,000 population with 12.3 hospitalisations per 100,000 population (Table 10.1 and Figure 10.1).



Note: The hospitalisation rate per participant excludes 340 basketball and 207 netball cases in those less than 15 years.
The hospitalisation rate per 100,000 participants for those 55+ years are included in the total but not presented separately due to high uncertainty in the participation data.
The estimate for the 45–54 year age group for netball has a relative standard error of between 25% and 50% and should be used with caution.

Figure 10.1: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to basketball and netball, by age group at admission, Australia, 2002–2003

Sex

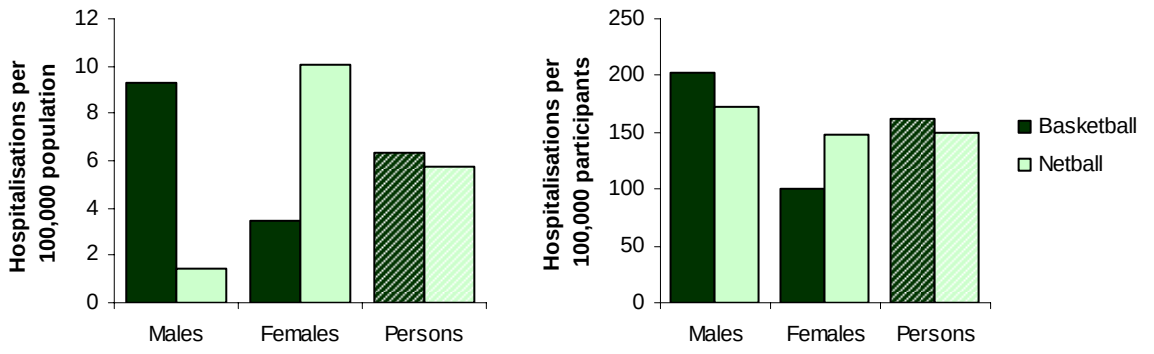
Table 10.2: Summary measures for basketball and netball related hospitalisations, by sex, Australia, 2002–2003

	Basketball			Netball		
	Males	Females	Persons	Males	Females	Persons
Proportion (%) of hospitalised sports	2.7	2.9	2.7	0.4	8.4	2.5
Cases (%)	904 (72.7)	340 (27.3)	1,244 (100)	136 (12.0)	993 (88.0)	1,129 (100)
Estimated number of participants ('000)[†]	335.0	224.3	559.3	73.3	540.6	614.0
Rate/100,000 population	9.3	3.4	6.3	1.4	10.0	5.7
Rate/100,000 participants[†]	203.0	99.9	161.6	173.3	147.1	150.2

[†] The estimated number of participants and the rate of hospitalisation per 100,000 participants excludes 207 netball cases and 340 basketball cases in those 0–14 years.

Basketball is more commonly played by males than females with 4.3% of males and 2.9% of females (15 years and over) participating (Australian Sports Commission 2003). There is a much higher number of hospitalised males than females (904 versus 340) giving a higher rate of hospitalisation per 100,000 participants (203.0 versus 99.9) (Table 10.2 and Figure 10.2).

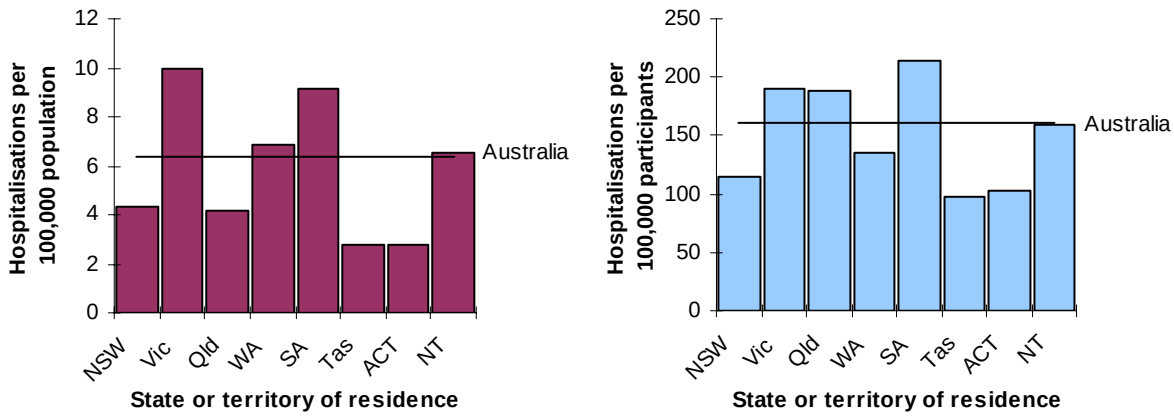
Netball is predominately played by females with a 6.9% for participation rate for females versus 0.9% for males (Australian Sports Commission 2003). The majority of netball injury related hospitalisations occurred in females. As would be expected, the rate per 100,000 population was higher in females than males (10.0 versus 1.4). However, the rate per 100,000 participants was higher in males (173.3) than females (147.1). Males playing netball could be more likely to be injured, have a different style of play, could be more likely to be hospitalised given the same injury or all three (Table 10.2 and Figure 10.2).



Note: Hospitalisation rate per participation excludes 207 netball cases and 340 basketball cases in those under 15 years.

Figure 10.2: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to basketball and netball, by sex, Australia, 2002–2003

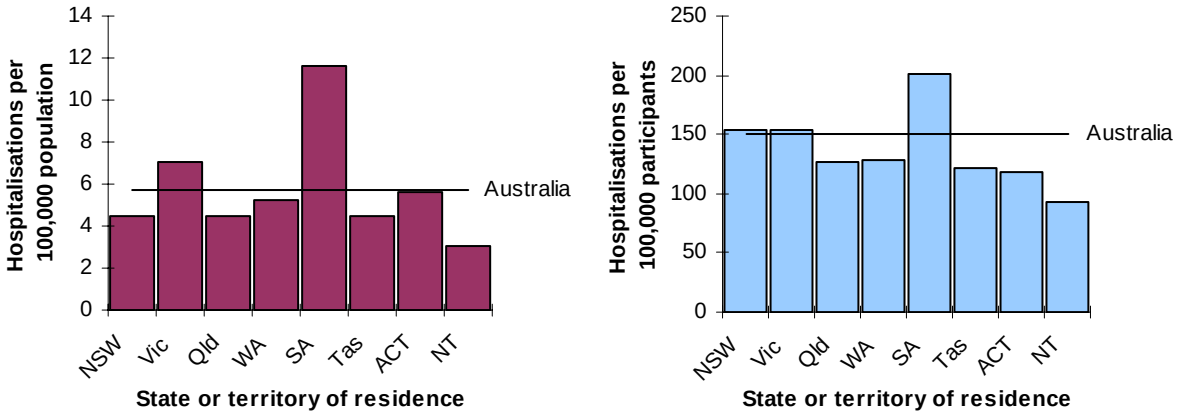
State or territory of residence



Note: Horizontal bar represents the hospitalisation rate for Australia as a whole.
The hospitalisation rate per 100,000 participants excludes 340 cases of basketball injury in those under 15 years.
There were 15 cases with unreported state or territory of residence including 1 in those less than 15 years. These have been included in the rate for Australia as a whole.

Figure 10.3: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) by state or territory of residence, due to basketball, Australia, 2002–2003

Victoria had the highest participation rate for basketball with 4.9% of the population participating, followed by WA with 4.6% and SA with 4.2% (Australian Sports Commission 2003). Victoria had the highest number of hospitalisations per 100,000 population (9.9 per 100,000 population), followed by SA (9.2 per 100,000 population). SA had the highest rate of hospitalisation per 100,000 participants with 214.7 hospitalisations per 100,000 participants (Figure 10.3).

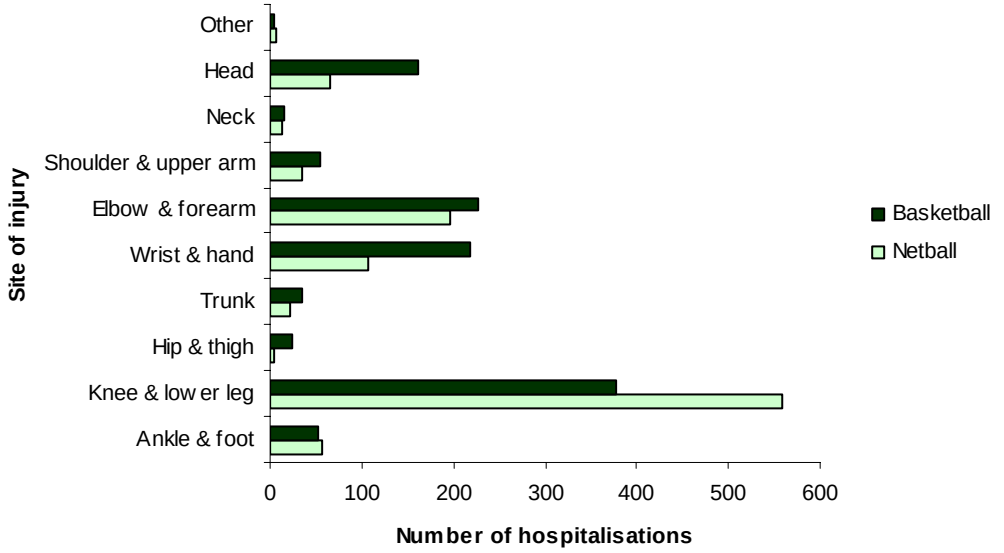


Note: Horizontal bar represents the hospitalisation rate for Australia as a whole.
The hospitalisation rate per 100,000 participants excludes 207 cases of netball injury in those under 15 years.
There were 2 cases with unreported state or territory of residence but none in those under 15 years. These cases have been included in the rate for Australia as a whole.

Figure 10.4: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) by state or territory of residence, due to netball, Australia, 2002–2003

SA had the highest number of hospitalisations for netball injury per 100,000 population with 11.6 per population and the highest number of hospitalisations for netball injury per 100,000 participants with 200.6 per 100,000 participants compared with 5.7 and 150.2, respectively for Australia as a whole. SA also had the highest participation rate with 6.0% (Figure 10.4).

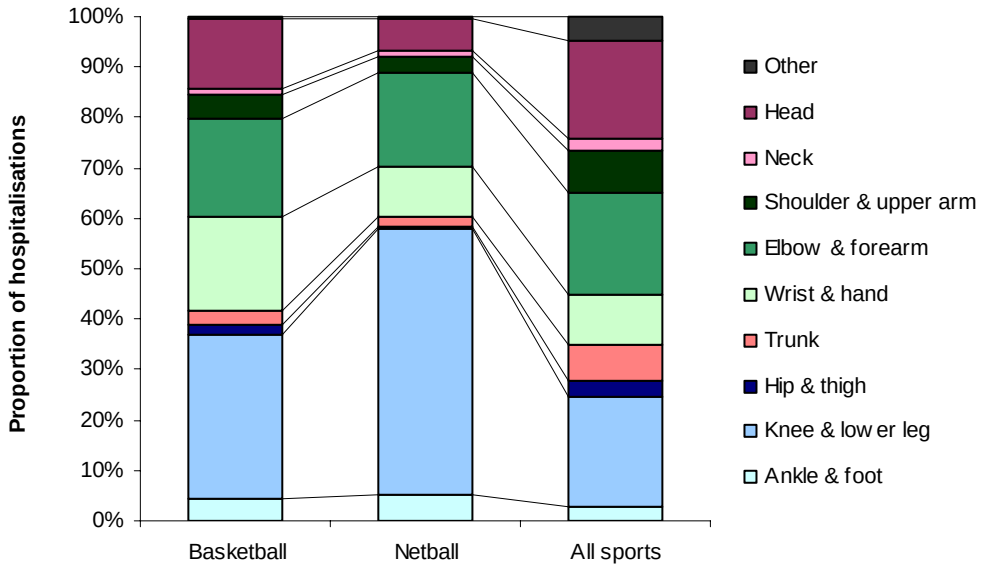
Body region



Note: Excludes 73 basketball and 68 netball cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

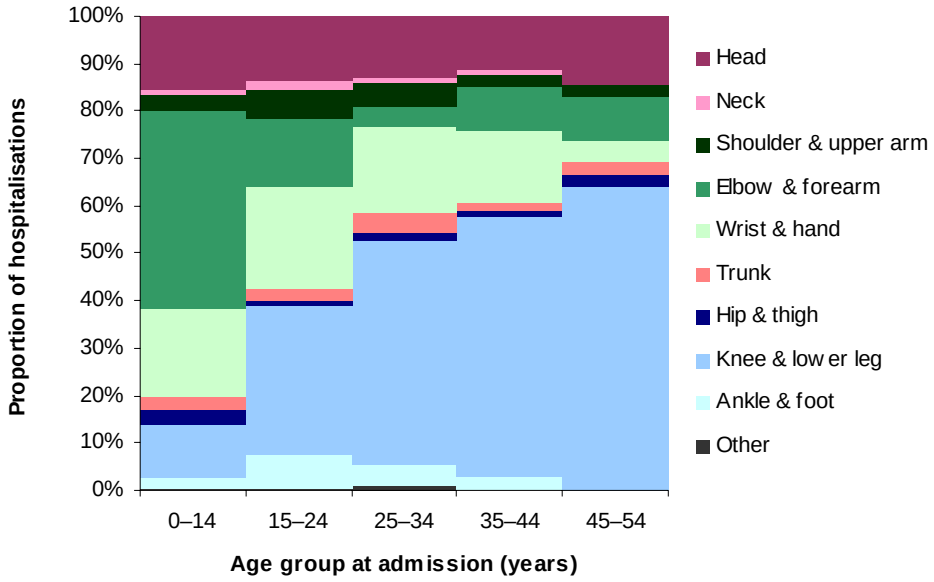
Figure 10.5: Hospitalisations due to basketball and netball, by principal body region, Australia, 2002–2003

In both basketball and netball the knee and lower leg was the most common principal body region injured in those requiring hospitalisation. This predominance was more marked in netball with 49.4% (n=558) of injuries involving the knee and lower leg compared with 30.4% (n=378) in basketball and 20.7% (n=9,395) in all sports. Elbow and forearm injuries occurred at similar frequencies (n=227, 18.2% for basketball versus 196, 17.4% for netball). Wrist and hand injuries requiring admission were more common in basketball (n=219, 17.6%) than netball (n=107, 9.5%) and all sports (n=4,224, 9.3%). Head injuries were more common in basketball (n=161, 12.9%) compared with netball (n=66, 5.8%) but less common than in all sports (n=8,390, 18.5%) (Figures 10.5 and 10.6).



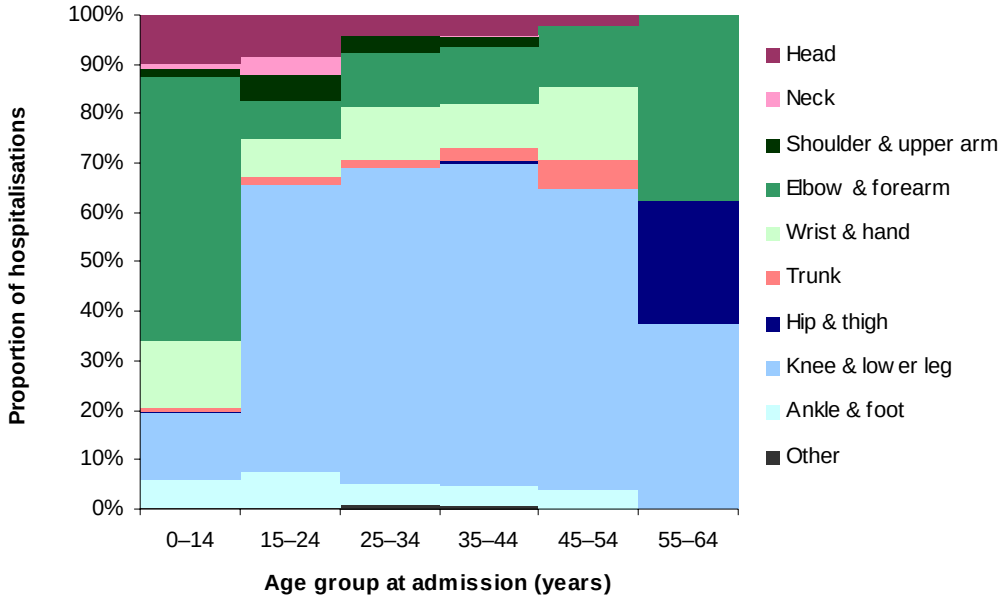
Note: Excludes 73 basketball, 68 netball cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 10.6: Hospitalisations due to basketball, netball and all sports injury, by principal body region injured, Australia, 2002–2003



Note: Excludes 73 basketball cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code. Injuries in those over 54 years are not shown due to low numbers (n<4).

Figure 10.7: Hospitalisations due basketball, by age group at admission and principal body region injured, Australia, 2002–2003



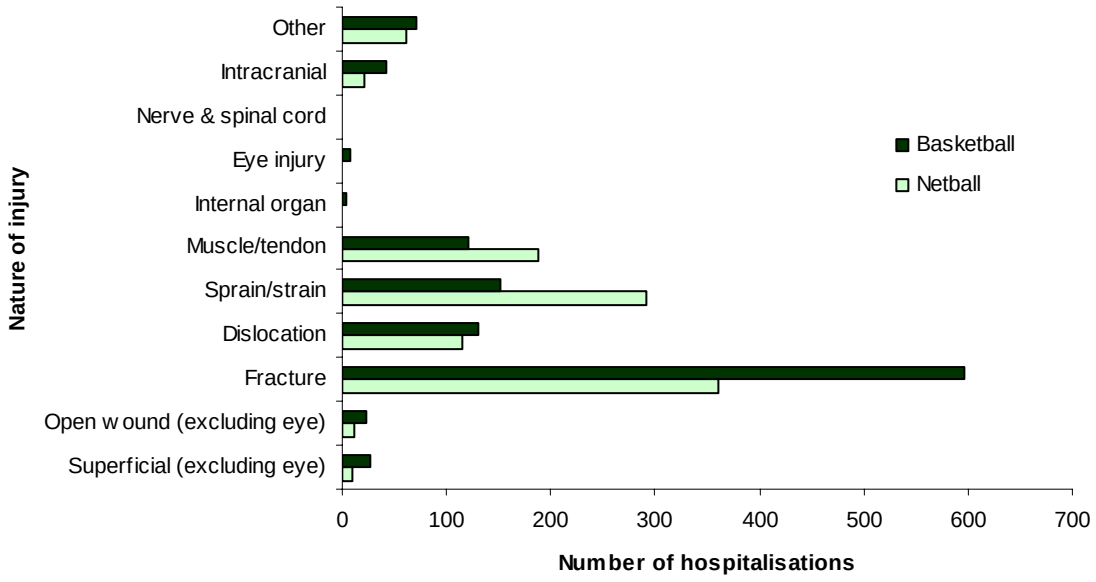
Note: Excludes 68 netball cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code. Injuries in those over 64 years are not shown due to low numbers (n<4).

Figure 10.8: Hospitalisations due to netball, by age group at admission and principal body region injured, Australia, 2002–2003

For basketball related hospitalisations, knee and lower leg injury was most common in the 15–24 year age group (n=141, 29.3%), however, in terms of proportion of all injury for the age group, knee and lower leg injury reached a peak in the 45–54 year age group with 60.0% of injuries (n=27) (Figure 10.7).

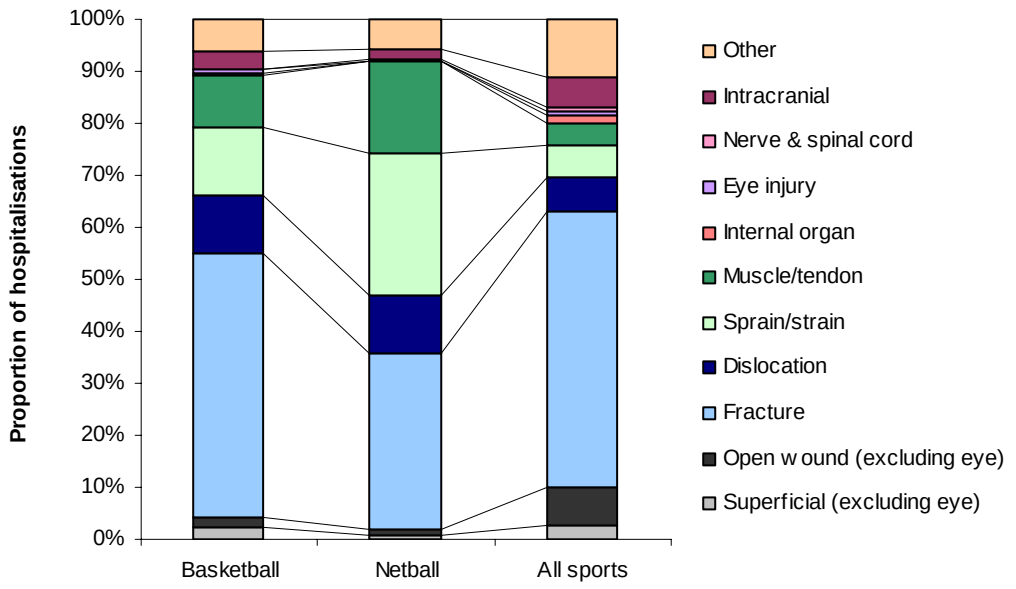
Knee and lower leg injuries formed a similar percentage of all netball related injury hospitalisations for the 15–54 year age groups (54.6–59.3%). However, they were uncommon in the 0–14 year age group (n=27, 13.0%). In the 0–14 year group the elbow and forearm was the most common principal body region injured in those hospitalised (n=108, 52.2%) (Figure 10.8).

Nature of injury



Note: Excludes 73 basketball and 68 netball cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 10.9: Hospitalisations due to basketball and netball injury, by nature of injury, Australia, 2002–2003



Note: Excludes 73 basketball, 68 netball cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 10.10: Hospitalisations due to basketball, netball and all sports injury, by nature of injury, Australia, 2002–2003

Fractures were the most common type of injury in those requiring hospitalisation for basketball (n=597, 51.0%) and netball (n=360, 33.9%). Sprain/strain (n=291, 27.4%) and muscle/tendon (n=188, 17.7%) were much more common in netball than in basketball (12.9% and 10.2% respectively) (Figures 10.9 and 10.10).

Mechanism of injury

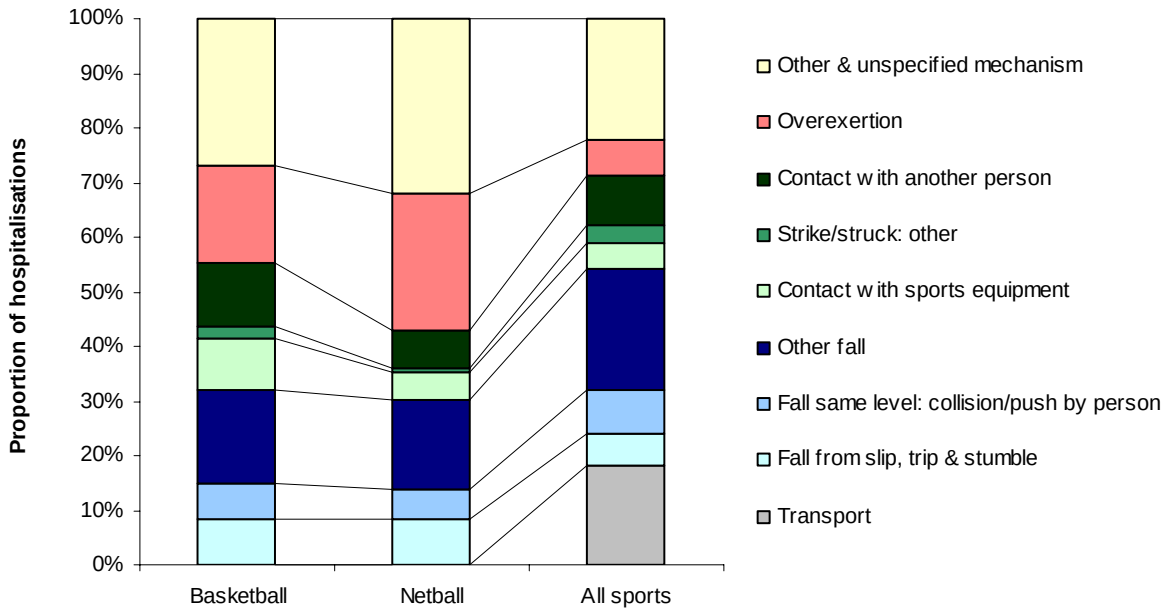


Figure 10.11: Hospitalisations due to basketball, netball and all sports, by mechanism of injury, Australia, 2003–2003

Falls were a common mechanism of injury in both basketball and netball. Falls were the cause of injury in 32.2% (n=400) of basketball cases and in 30.0% (n=339) of netball cases (n=282 other falls and n=66 fall on same level from contact by person). Overexertion was also common and was the cause of admission in 17.7% (n=220) of basketball and 25.2% (n=284) of netball hospitalisations (Figure 10.11).

Length of stay

Table 10.3: Basketball, netball and all sport related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]
Basketball	1,590	2	536	1.6	2,126	1.7
Netball	230	1.7	1,500	1.5	1,730	1.5
All sports	85,269	2.5	32,720	2.8	117,989	2.6

[†] This is total bed days, including inward transfers.
[††] This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Basketball and netball both had a lower mean number of bed days (1.7 and 1.5 respectively) than all sport related hospitalisations (2.6) (Table 10.3).

Place of occurrence

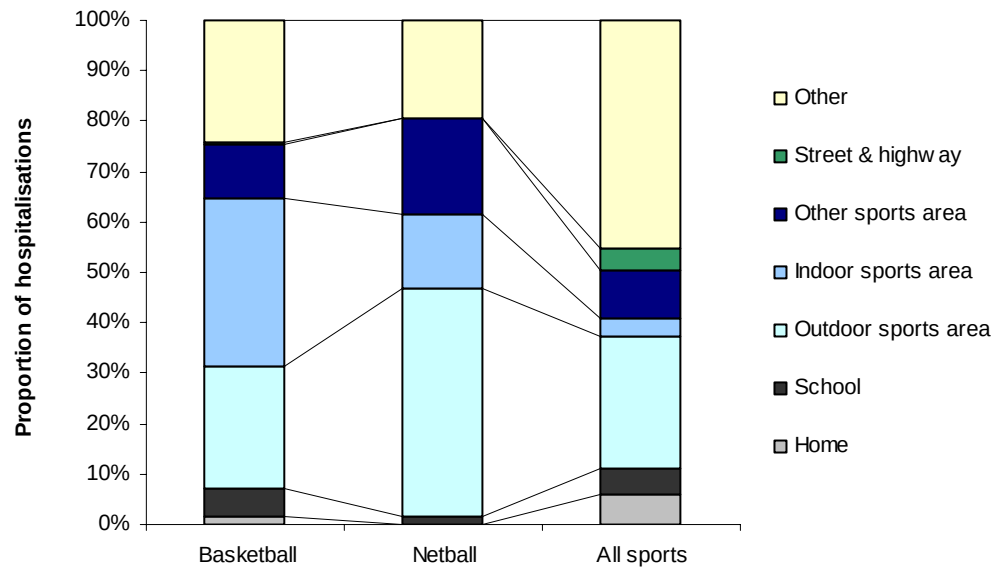


Figure 10.12: Hospitalisations due to basketball and netball, by place of occurrence, Australia, 2002–2003

The majority of basketball and netball injuries requiring hospitalisation occurred at a sports area. 24.2% (n=301) of basketball injuries occurred at an outdoor sports area and 33.4% (n=415) occurred at an indoor sports area. 45.3% (n=512) of netball injuries occurred at an outdoor sports area and 14.6% (n=165) occurred at an indoor sports area (Figure 10.12).

Month of admission

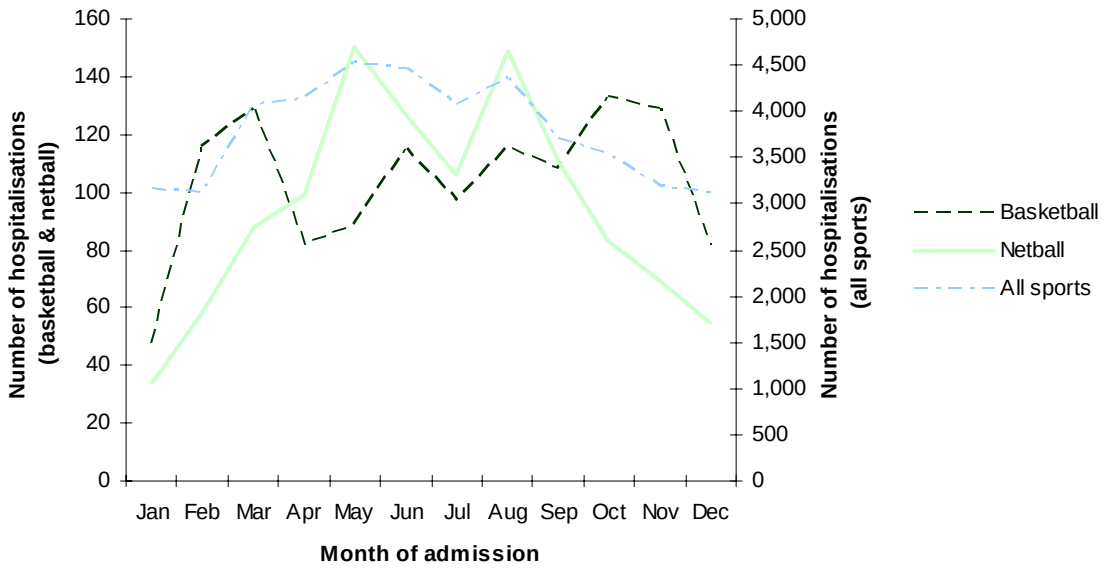


Figure 10.13: Hospitalisations due to basketball and netball, by month of admission, Australia, 2002–2003

Basketball injuries resulting in hospitalisation were more evenly spread across the year than in netball. Peaks for basketball injuries occurred in March and November (n=129, 10.4% for both). Netball injuries resulting in hospitalisation were most common over the colder months with peak numbers in May (n=150, 13.3%) and August (n=149, 13.2%) (Figure 10.13).

Discussion

More hospitalisations occurred in basketball (n=1,244) than in netball (n=1,129), with the peak age group of admission 15–24 years for basketball and 25–34 years for netball. The peak rate of hospitalisation per 100,000 participants 15 years and over, was similar for basketball and netball with basketball peaking at 254.2 in the 25–34 year age group and netball peaking at 256.5 in the 35–44 year age group.

Basketball is predominately a sport of males and netball is predominately a sport of females (Australian Sports Commission 2003). 72.7% of basketball related hospitalisations occurred in males and 88.0% of netball related hospitalisations occurred in females. The rate of hospitalisation per 100,000 participants (15 years and over) was highest in males for both basketball (203.0 versus 99.9) and netball (173.3 versus 147.1).

The knee and lower leg was the most common principal body region injured in those hospitalised for basketball (30.4%) and netball (49.4%). In our data, Achilles tendon injuries are included in knee and lower leg injuries. From the brief literature review done, the ankle is usually the most commonly injured body region in basketball, followed by the knee (Sonzogni & Gross 1993; Gomez et al. 1996). In netball, the ankle is the most commonly injured body site (Hopper & Elliott 1993; Hopper et al. 1995).

51.0% of basketball related hospitalisations and 33.9% of netball related hospitalisations had a fracture as the principal diagnosis.

Basketball injuries resulting in hospitalisation were more evenly spread across the year than in netball. Peaks for basketball injuries occurred in March and November. Netball injuries resulting in hospitalisation were most common over the colder months with peak numbers in May and August.

11 Ice and snow sports

U55

In 2003, 1.3% of the Australian population (15 years and over) participated in ice and snow sports (1.6% of males and 1.0% of females) (Australian Sports Commission 2003). Participation is more evenly spread across the age groups than in many sports, with 1.7% of those 15–24 years participating in ice and snow sports, 2.1% of those 25–34 years participating, 1.3% of those 35–44 years participating and 1.3% of those 45–54 years participating (Australian Sports Commission 2003).

Skiing

Skiing injury rates are about 2–3 per 1,000 skiers/day (Koehle et al. 2002; Chissell et al. 1996). Beginners are three to five times more likely to be injured than advanced skiers (Chissell et al. 1996). Approximately 30% of all injuries in adult alpine skiers are knee sprains (Koehle et al. 2002). The MCL is injured in 20% (Warme et al. 1995). ACL injury occurs in 10–20% of all alpine skiing injury, with the older skier at a higher risk (Chissell et al. 1996). Less than 3% of alpine skiing injuries are due to ankle fractures (Chissell et al. 1996). Approximately 0.4% of skiing injuries are due to femoral fractures with up to 30% resulting from collisions with rocks or trees (Chissell et al. 1996).

25–30% of all alpine skiing injuries involve the upper limb (Chissell et al. 1996). More than 40% of fractures occur in the upper limb (Chissell et al. 1996). The ulnar collateral ligament damage accounts for 7–8% of all injury (Koehle et al. 2002). Skiers should drop their pole when they fall to minimise the risk of ulnar collateral ligament damage (Koehle et al. 2002). The shoulder is injured in up to 11% of injuries (Koehle et al. 2002) with rotator cuff injury being most common (24%), followed by anterior glenohumeral subluxation or dislocation (22%), acromioclavicular separations (20%) and clavicular fractures (11%) (Koehle et al. 2002).

Warme et al. 1995 performed a retrospective study of injuries at Jackson Hole Ski Resort, in Wyoming, USA, from 1982–1993. The injury rate was 3.7 injuries per 1,000 skier days. There were 9,749 skiing injuries. The ratio of lower limb to upper limb injury decreased during the study from 4:1 to 2:1 ($p<0.03$). 30% of skiing injuries were due to knee sprains (18% MCL and 16% ACL) and 7% of skiing injuries were ulnar collateral ligament damage. There were increasing numbers of ACL injuries over time ($p<0.04$). Overall, 5% of injuries involved the ankle but the number of ankle injuries decreased significantly over the duration of the study ($p<0.03$) (Warme et al. 1995).

Spinal injuries are uncommon (0.01 injuries per 1,000 skier days) with the majority resulting from jumping and falls (Koehle et al. 2002). 14% of all ski and snowboard injuries are head injuries. Greater than half of skiing related deaths are from head injuries and their incidence has been increasing in recent decades. Helmets have been recommended by some but they have not yet been proven to be effective (Koehle et al. 2002).

Snowboarding

Snowboarders are almost two times more likely to be injured than skiers with about 6–10 injuries per 1,000 skiers/day. Injuries mainly occur in beginners, with approximately 60% occurring in those with less than 20 days of snowboarding experience (Chissell et al. 1996). Pino and Colville surveyed snowboarders at ski fields in 1986 and 1987. The majority of snowboarders were young (average age 21 years) (Pino & Colville 1989).

The ankle is injured in 25–30% of snowboarding incidents. The upper limb is injured in 30% of snowboarding accidents (Chissell et al. 1996). Pino et al. 1989 found that the ankle was most commonly injured (n=29), followed by shoulder and knee (13 injuries each). Pino et al. found that ligament sprain was the most common injury (26.4%), followed by fractures (24.6%) and contusion (11.8%) (Pino & Colville 1989).

Bladin et al. 1993 performed a prospective study of snowboarding injuries presenting to Mt Hotham, Falls Creek and Mt Buller ski resort medical centres from 1989–1992. 58% of those injured were novices. The knee and the ankle/foot were most commonly injured (both 23%) followed by the wrist/hand (16%) and the head/neck/face (11%). 53% of injuries were sprains, followed by fractures (24%), and contusion (12%) (Bladin et al. 1993).

In the study by Warme et al. 1995, 47 snowboarding injuries were found. 17% of injuries were soft tissue knee injury (n=6 MCL and n=2 meniscal tears) and 21% involved the ankle/foot (50% fractures, 50% sprains). There was a 2% incidence of ulnar collateral ligament damage (Warme et al. 1995).

In the study by Pino et al., impact was the most common mechanism of injury (63%), followed by torsion (34%) (Pino & Colville 1989).

12% of injuries are spinal injuries (Chissell et al. 1996). Jumps were the mechanism of injury in the majority of spinal injuries (77%) and in 30% of head injuries (Koehle et al. 2002). Nakaguchi and Tsutsumi 2002 studied severe head injuries resulting from snowboarding. The mechanism of injury was most commonly falling on the ski slope (58%), followed by falling during a jump (21%) and collisions (with people or objects) in 21%. The occipital region was affected in 66% of cases (Nakaguchi & Tsutsumi 2002).

Figure skating

Smith and Ludington 1989 prospectively studied 48 elite pair ice skaters and dancers in the USA (i.e. 24 teams) for nine months (one competitive season). There were 12 senior, 10 junior and 2 novice teams. Ranking as senior, junior or novice is made on skill and not age. There were no injuries reported by the novice skaters, however, there were 33 serious injuries reported (one week or more off training) in 24 skaters and 16 less serious injuries (limitation to training of less than one week) in 13 skaters. 25 of the 33 serious injuries and 10 of the 16 less serious injuries involved the lower limb. Of the serious injuries, 7 were related to the skating boot and 11 to lifts but none to throws (Smith & Ludington 1989).

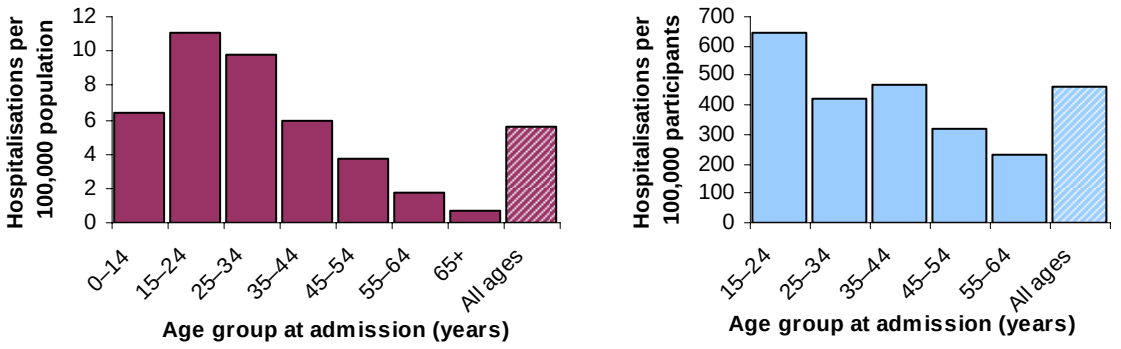
Age

Table 11.1: Summary measures for ice and snow sports related hospitalisations, by age group at admission, Australia, 2002–2003

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages (%)
Proportion of hospitalised sports (%)	1.2	2.4	3.3	3.8	4.4	3.2	1.3	2.4
Cases: Ice & snow sports	169	302	264	177	109	42	24	1,087 (100)
Skiing	69	124	157	122	89	36	22	619 (56.9)
Ice skating & ice dancing	23	117	80	11	7	0	0	238 (21.9)
Snow boarding	64	46	19	35	7	5	…	178 (16.4)
Other ice & snow sports	13	15	8	9	6	…	0	52 (4.8)
Estimated number of participants ('000)	NA	46.6	63.1	37.6	34.1	18.2*	0.1**	199.8†
Rate/100,000 population	6.5	11.1	9.8	5.9	3.8	1.8	0.7	5.5
Rate/100,000 participants	NA	648.1	418.4	470.7	319.6	230.8*	NA	459.5†

† The estimated number of participants and the rate of hospitalisation per 100,000 participants for all ages excludes those 0–14 years (169).
* Estimate has a relative standard error of between 25% and 50% and should be used with caution.
** Estimate has a relative standard error of greater than 50% and is considered too unreliable for general use.
Case numbers when n<4 are not shown.

The 15–24 year age group had the largest number of hospitalisations for ice and snow sports with 302 cases (27.8%), followed by the 25–34 year age group with 264 cases (24.3%) hospitalisations. These two age groups had the highest rate of hospitalisation per 100,000 population with 11.1 and 9.8, respectively. The 15–24 year age group had the highest rate of hospitalisation per 100,000 participants with 648.1 (for those 15 years and over) (Table 11.1 and Figure 11.1).



Note: Hospitalisation rate per participant excludes 169 cases in those less than 15 years.

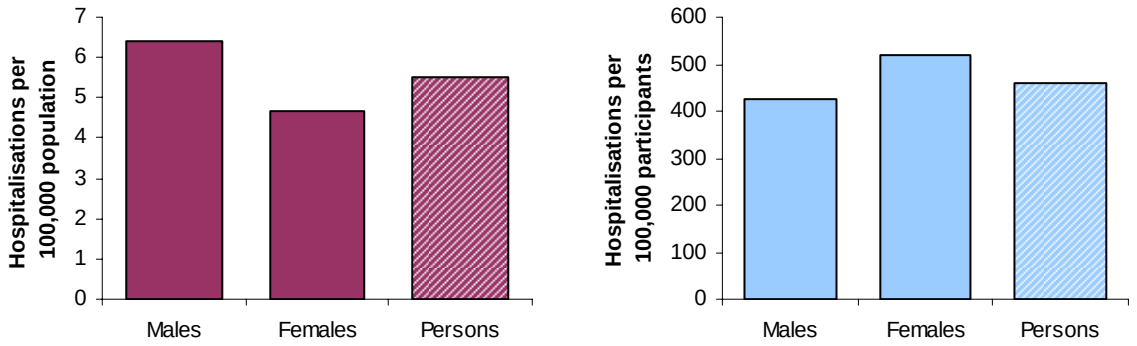
Figure 11.1: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to ice and snow sports, by age group at admission, Australia, 2002–2003

Sex

Table 11.2: Summary measures for ice and snow sports related hospitalisations, by sex, Australia, 2002–2003

	Males (%)	Females (%)	Persons (%)
Proportion of hospitalised sports (%)	1.9	3.9	2.4
Cases: Ice & snow sports	627 (100)	460 (100)	1,087 (100)
Skiing	312 (49.8)	307 (66.7)	619 (56.9)
Snow boarding	186 (29.7)	52 (11.3)	238 (21.9)
Ice skating & dancing	93 (14.8)	85 (18.5)	178 (16.4)
Other ice & snow sports	36 (5.7)	16 (3.5)	52 (4.8)
Estimated number of participants ('000)[†]	124.9	74.9	199.8
Rate/100,000 population	6.4	4.7	5.5
Rate/100,000 participants[†]	423.5	519.4	459.5

[†] Estimated number of participants and the rate of hospitalisation per 100,000 participants excludes the 169 cases in those less than 15 years (n=169).



Note: Hospitalisation rate per participation excludes 169 cases of ice and snow sport related hospitalisations in those under 15 years.

Figure 11.2: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to ice and snow sports, by sex, in Australia

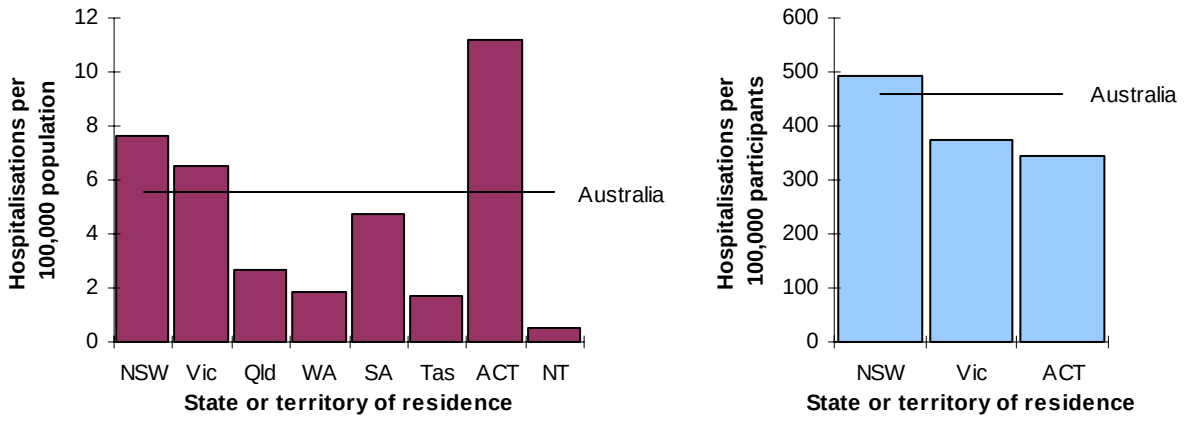
Participation in ice and snow sports is a more common pastime for males than females with 1.6% of males and 1.0% of females participating (Australian Sports Commission 2003). Males were more commonly injured (n=627, 57.7%). However, ice and snow sports were one of the few sports where females had a higher rate of hospitalisation per 100,000 participants (519.4 versus 423.5) (Table 11.2 and Figure 11.2).

State or territory of residence and hospitalisation

Table 11.3: Summary measures for ice and snow sports related hospitalisations, by state or territory of residence, Australia, 2002–2003

	State or territory of residence								
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
Proportion of hospitalised sports (%)	3.5	2.8	1.0	0.9	2.1	0.8	5.3	0.2	2.4
Cases: Ice & snow sports	506	317	99	36	72	8	36	…	1,087
Estimated number of participants ('000)[†]	88	70.9	NA	NA	NA	NA	7.8	NA	199.8
Rate/100,000 population	7.6	6.5	2.7	1.9	4.7	1.7	11.2	0.5	5.5
Rate/100,000 participants[†]	490.9	375.2	NA	NA	NA	NA	346.2	NA	459.5

[†] The estimated number of participants and the hospitalisation rate per 100,000 participants excludes those under 15 years (169).
[‡] There were 12 cases with unreported state or territory of residence including 1 in those less than 15 years. These cases have been included in the rates for Australia as a whole.
Participation estimates were only available for NSW, Victoria, ACT and Australia.
Case numbers when n<4 are not shown.



Note: Horizontal bar represents the hospitalisation rate for Australia as a whole.
The hospitalisation rate per 100,000 participants excludes 169 cases of ice and snow injury in those under 15 years.
There were 12 cases with unreported state or territory of residence including 1 case in those under 15 years.

Figure 11.3: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) by state or territory of residence, due to ice and snow sports, Australia, 2002–2003

The ACT has a relatively small population when compared with most states. ACT hospitals have some of surrounding NSW as part of their catchment area, including some of its major snowfields (e.g. Thredbo). Hence, in this chapter, state or territory of *hospitalisation* and state or territory of *residence* have been reviewed.

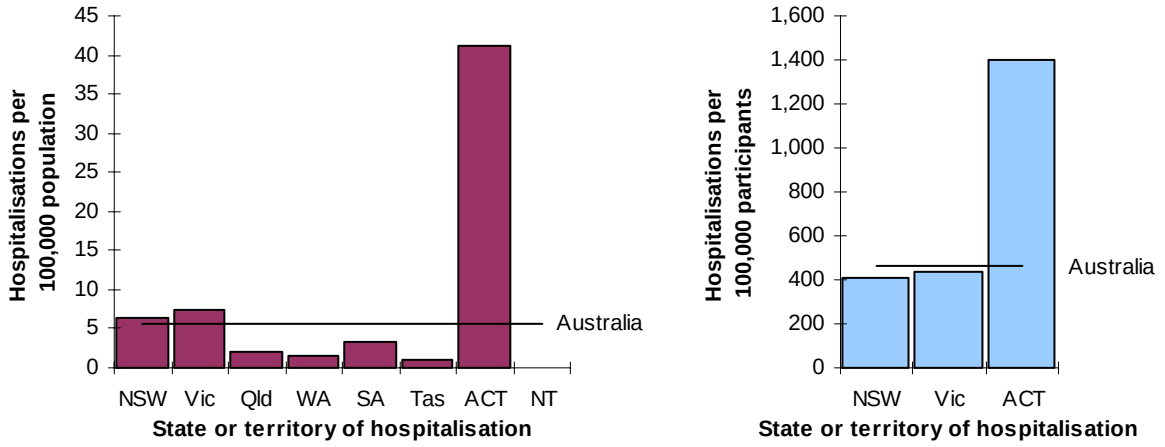
The ACT had the highest rate of hospitalisation per 100,000 population by state or territory of *residence* with 11.2 compared with the Australian rate of 5.5. This difference is more pronounced when state or territory of *hospitalisation* is reviewed, with the rate for the ACT being 41.1 per 100,000 which is 7.5 times higher than the Australian rate of 5.5 per 100,000 (Tables 11.3 and 11.4 and Figures 11.3 and 11.4).

Participation data for ice and snow sports is only available for NSW, Victoria and ACT, which apart from Tasmania are the only States or Territories with snow fields. NSW had the highest rate of hospitalisation per 100,000 participants by state or territory of *residence* with 490.9 compared with the Australian rate of 459.5. The ACT had a rate of hospitalisation per 100,000 participants of 346.2 by state or territory of *residence* but a rate of 1,397.4 by state or territory of *hospitalisation*. As mentioned above, the ACT has some major NSW snow fields as part of the catchment area for its hospitals (Tables 11.3 and 11.4 and Figures 11.3 and 11.4).

Table 11.4: Summary measures for ice and snow sports related hospitalisations, by state or territory of hospitalisation, Australia, 2002–2003

	State or territory of hospitalisation								
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
Proportion of hospitalised sports (%)	3.0	3.2	0.8	0.7	1.5	0.5	15.2	0.0	2.4
Cases: Ice & snow sports	426	366	78	29	51	5	132	0	1,087
Estimated number of participants ('000)[†]	88	70.9	NA	NA	NA	NA	7.8	NA	199.8
Rate/100,000 population	6.4	7.5	2.1	1.5	3.4	1.1	41.1	0.0	5.5
Rate/100,000 participants[†]	412.5	438.6	NA	NA	NA	NA	1,397.4	NA	459.5

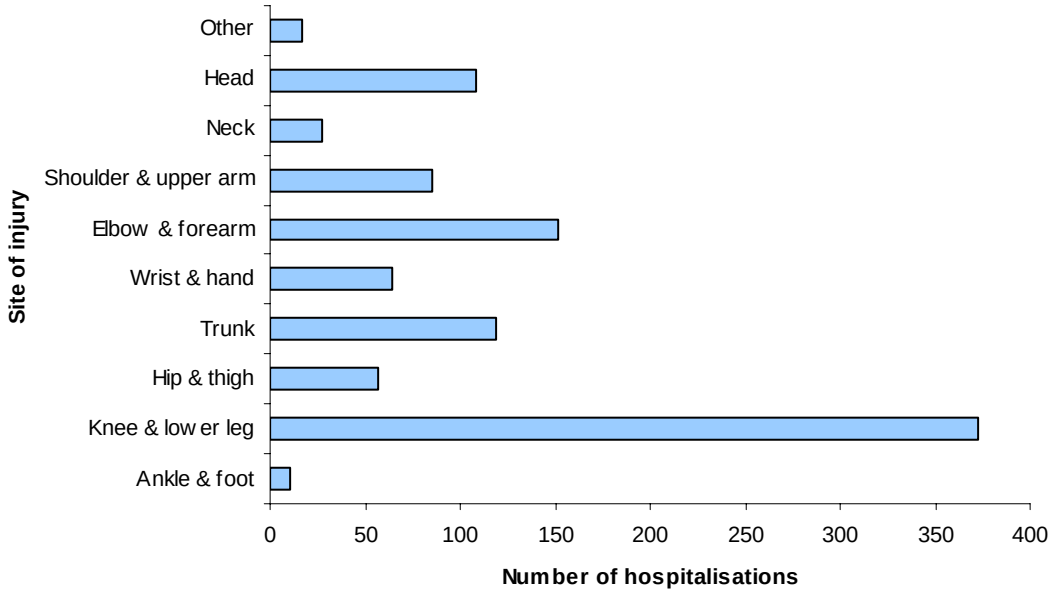
[†] The estimated number of participants and the rate of hospitalisation per 100,000 participants excludes those under 15 years (n=169).
Participation estimates were only available for NSW, Victoria, ACT and Australia.



Note: Horizontal bar represents the hospitalisation rate for Australia as a whole.
The hospitalisation rate per 100,000 participants excludes 169 cases of ice and snow injury in those under 15 years.
Participation estimates were only available for NSW, Victoria, ACT and Australia.

Figure 11.4: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) by state or territory of hospitalisation, due to ice and snow sports, Australia, 2002–2003

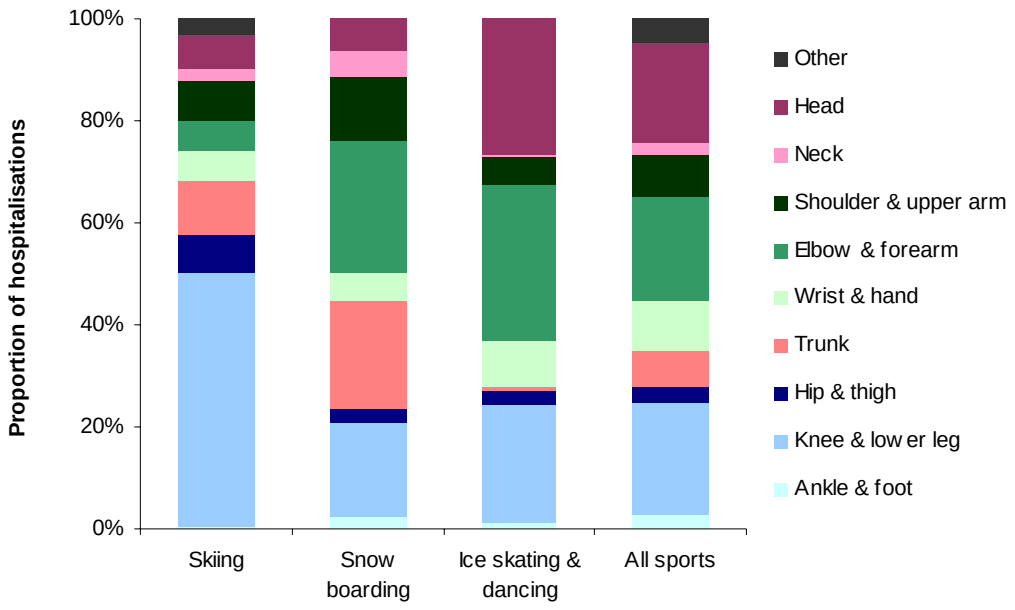
Body region



Note: Excludes 75 ice and snow sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

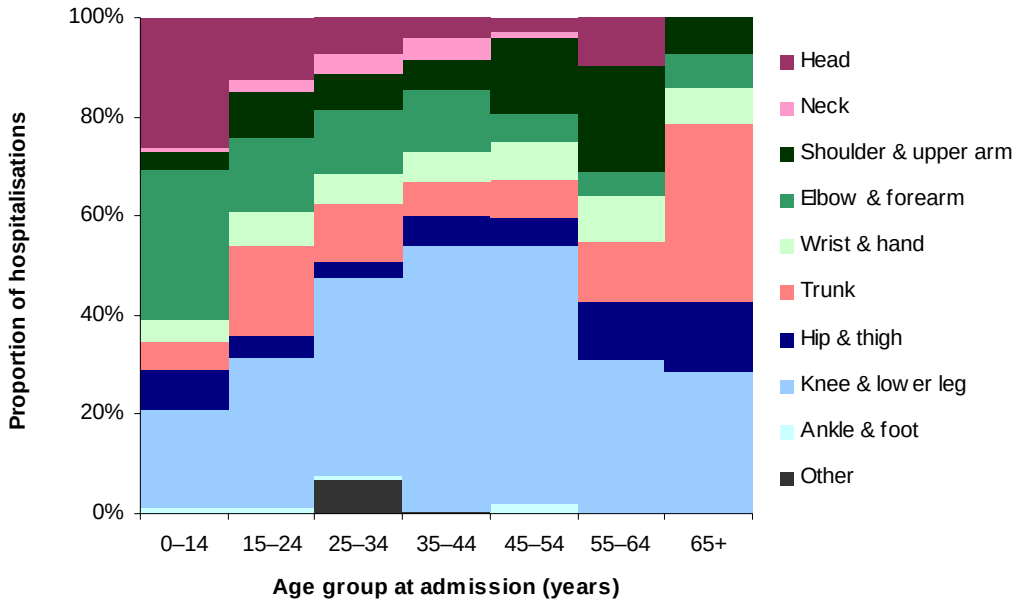
Figure 11.5: Hospitalisations due to ice and snow sports injury, by principal body region injured, Australia, 2002–2003

In 34.3% of ice and snow sports related injury hospitalisations, the knee and lower leg was the principal body region injured (n=373). Knee and lower leg injuries (as the principal diagnosis) were more common in skiing (n=281, 45.4%) compared with ice skating and dancing (n=40, 22.5%) and snow boarding (n=42, 17.6%). Elbow and forearm injuries (as the principal diagnosis) were more common in ice skating and dancing (n=53, 29.8%) and snow boarding (n=58, 24.4%) than in skiing (n=34, 5.5%). Head injuries were the primary reason for admission in 108 (9.9%) of cases. Head injuries were the reason for admission in 25.8% (n=46) of ice skating and dancing hospitalisations, in 6.3% (n=39) of skiing hospitalisations and in 5.9% (n=14) of snowboarding hospitalisations (Figures 11.5 and 11.6).



Note: Excludes 73 skiing, snow boarding and ice skating and dancing cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 11.6: Hospitalisations due to ice and snow sport injury and all sports injury, by principal body region injured, Australia, 2002–2003

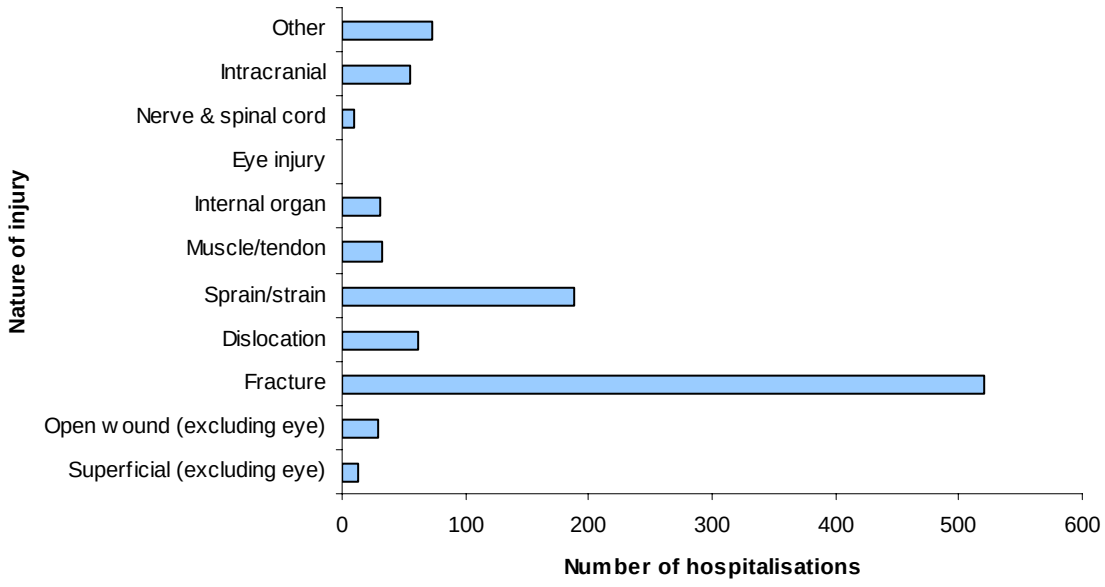


Note: Excludes 75 ice and snow cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 11.7: Hospitalisations due to ice and snow sport injury, by age group at admission and principal body region injured, Australia, 2002–2003

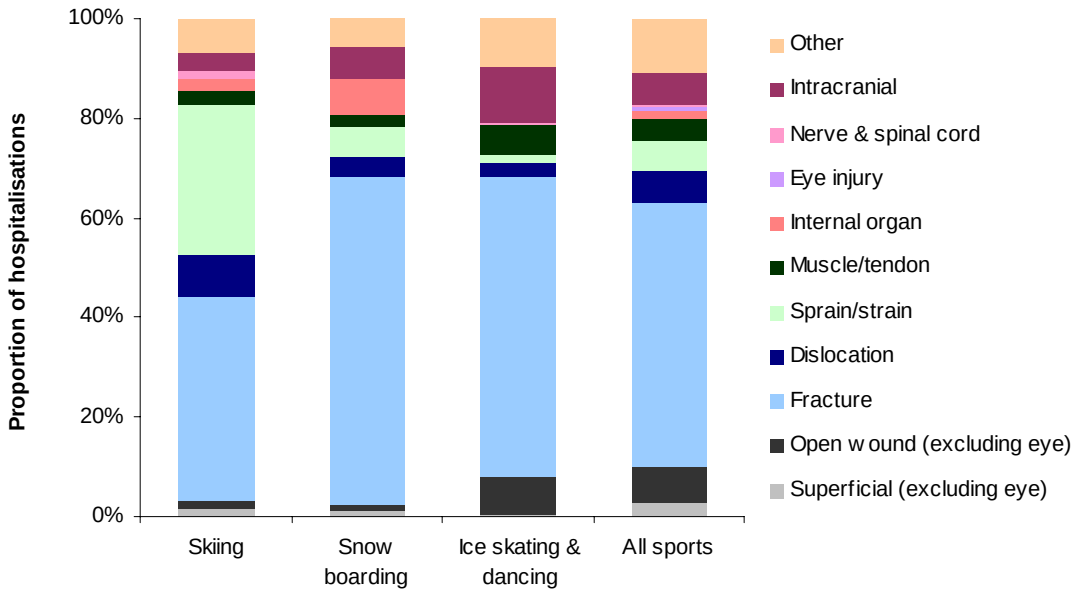
The knee and lower leg are the most common principal body part injured in ice and snow sports (n=373, 34.3%). Knee and lower leg injury increases in frequency to a peak proportion in the 35–44 year age group (n=89, 50.3%) and then declines again. Head injury admission (as principal diagnosis) is most common in the 0–14 year age group (n=41, 24.3%) (Figure 11.7).

Nature of injury



Note: Excludes 75 ice and snow sport that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 11.8: Hospitalisations due to ice and snow sports injury, by nature of injury, Australia, 2002–2003



Note: Excludes 73 skiing, snow boarding and ice skating and dancing cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 11.9: Hospitalisations due to ice and snow sports and all sports injury, by nature of injury, Australia, 2002–2003

Fractures were the most common principal type of injury for hospitalised ice and snow sports (n=520, 51.4%). Fractures were more common as a proportion of all types of principal injury in snow boarding (n=149, 66.2%), than in ice skating and dancing (n=104, 60.1%) or skiing (n=231,

41.0 %). Intracranial injury was the principal diagnosis in 11.0% (n=19) of ice skating and dancing hospitalisations (Figures 11.8 and 11.9).

Mechanism of injury

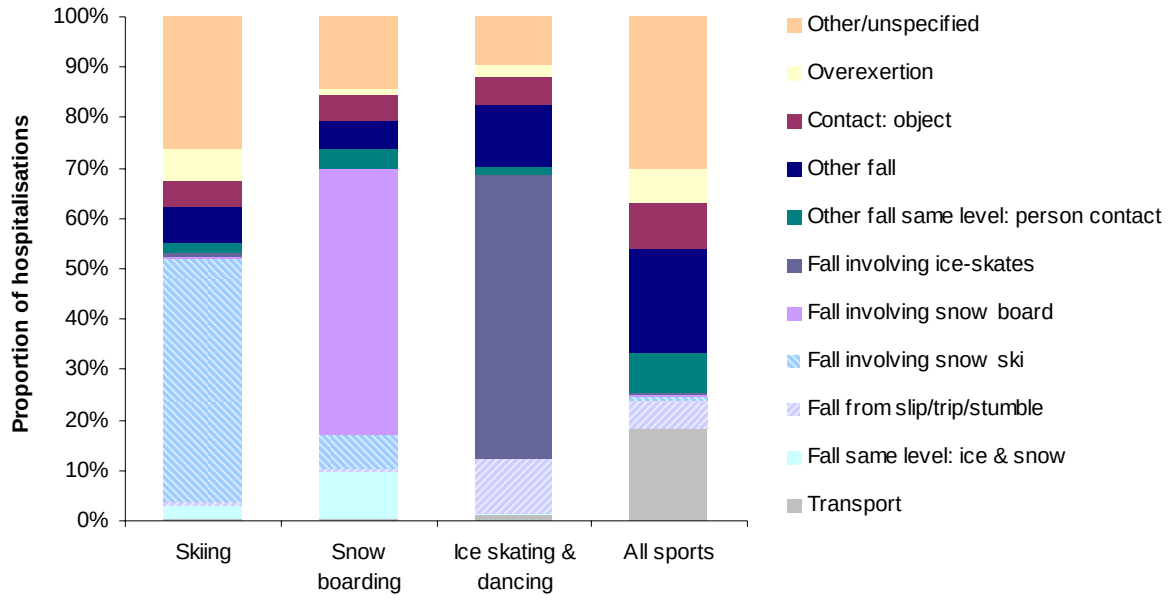


Figure 11.10: Hospitalisations due to ice and snow sports and all sports, by mechanism of injury, Australia, 2003–2003

The majority (n=748, 68.8%) of ice and snow hospitalised injury resulted from falls compared with 36.0% for all sport related hospitalisations. 61.9% of skiing related hospitalisations were fall related (n=383) with 297 of these being fall involving snow ski. 79.0% of snow boarding related hospitalisations were due to falls (n=188) with 125 of these fall involving snow board. 81.5% of ice skating and dancing related hospitalisations were due to falls (n=145) with 100 being fall involving ice skates (Figure 11.10)

Length of stay

Table 11.5: Ice and snow sports and all sport related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]
Ice & snow sports	1,923	3.1	1,132	2.5	3,055	2.8
All sports	85,269	2.5	32,720	2.8	117,989	2.6

[†] This is total bed days, including inward transfers.
[††] This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Ice and snow sports had a similar mean number of bed days (2.8) to all sports related hospitalisations (2.6) (Table 11.5).

Place of occurrence

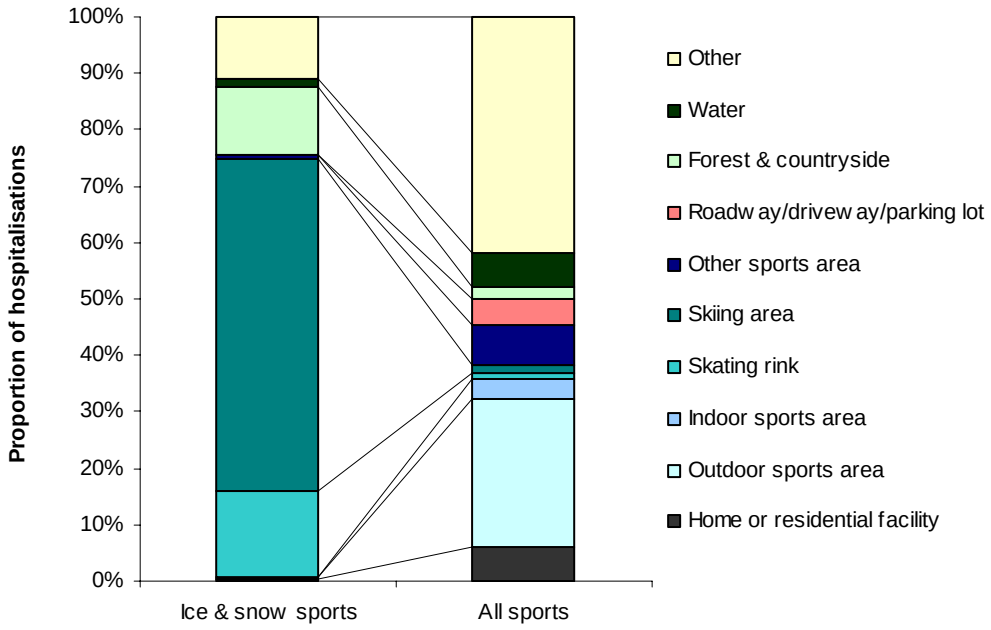


Figure 11.11: Hospitalisations due to ice and snow sports and all sports, by place of occurrence, Australia, 2002–2003

The majority of ice and snow sports related injuries occurred in a skiing area (n=642, 59.1%), compared with 1.5% of all sports related injuries. 15.2% of ice and snow sports related injuries occurred on a skating rink (n=165) (Figure 11.11).

Month of admission

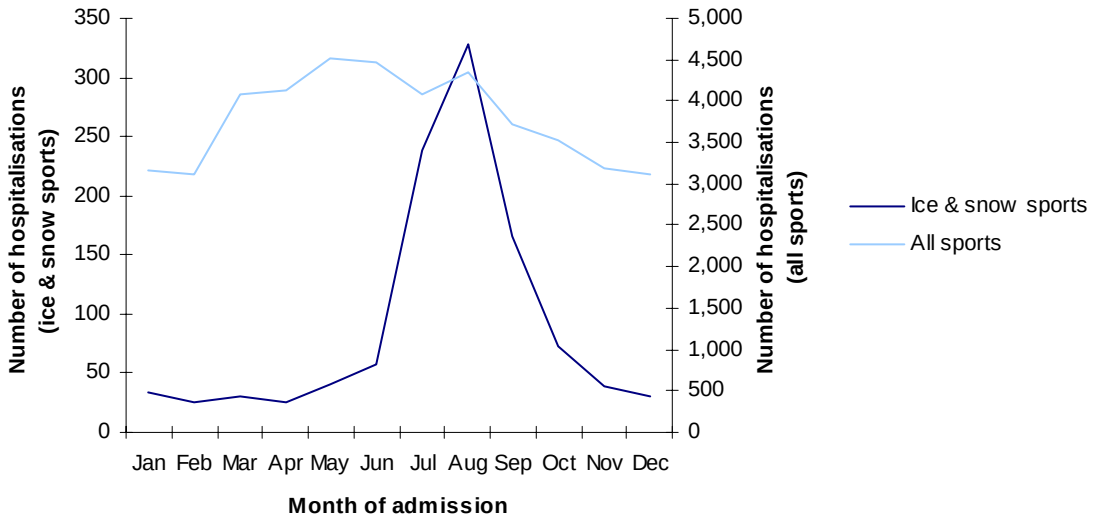


Figure 11.12: Hospitalisations due to ice and snow sports and all sports, by month of admission, Australia, 2002–2003

As would be expected the majority of ice and snow sports occurred in the colder months with a sharp peak over this period. The peak was in August with 30.2% (n=328) of injuries occurring in this month. 21.9% (n=238) of ice and snow related sports injuries occurred in July and 15.3% (n=166) occurred in September (Figure 11.12).

Discussion

Hospitalisations related to ice and snow sports were most common in the 15–24 year age group (n=302). The highest number of hospitalisations related to skiing were in the 25–34 year age group (n=157), the highest number of hospitalisations related to ice skating and dancing were in the 0–14 year age group (n=64) and the highest number of hospitalisations related to snow boarding were in the 15–24 year age group (n=117). In the study by Pino and Colville the average age of injured snowboarders was 21 years (Pino & Colville 1989). There were more ice and snow related hospitalisations in males than females (627 versus 460). However, the rate of hospitalisation per 100,000 participants was higher in females than males (519.4 versus 423.5).

The knee and lower leg was the most common principal body region injured in those hospitalised for ice and snow sports (n=373, 34.3%). Koehle et al. found that approximately 30% of all skiing injuries in adults are knee sprains (Koehle et al. 2002). Bladin et al. found that the knee and the ankle/foot were most commonly injured in snowboarders (both 23%) (Bladin et al. 1993). Smith and Ludington found that in pair ice skaters and dancers 25 of the 33 serious injuries and 10 of the 16 less serious injuries involved the lower limb (Smith & Ludington 1989).

Fractures were the most common principal type of injury for hospitalised ice and snow sports (n=520, 51.4%). Fractures were more common as a proportion of all types of principal injury in snow boarding (n=149, 66.2%), than in ice skating and dancing (n=104, 60.1%) or skiing (n=231, 41.0 %). 30.1% (n=170) of hospitalised skiing related injuries (principal diagnosis) were sprain/strain. Warme et al. found that 30% of skiing injures were knee sprains (Warme et al. 1995).

3.5% (n=20) of skiing related and 6.2% (n=14) of snow board related hospitalisations were due to intracranial injuries. 11.0% (n=19) ice skating and dancing related hospitalisations had intracranial injury as the principal diagnosis. Koehle et al. reports that 14% of all ski and snowboard related injuries are head injuries (Koehle et al. 2002).

68.8% (n=748) of hospitalised ice and snow sport related injury resulted from falls. A skiing area was the place of occurrence in 59.1% (n=642) of ice and snow sport related hospitalisations and a skating rink was the place of occurrence in 15.2% (n=165) of ice and snow sport related hospitalisations. The peak incidence of ice and snow sport related hospitalisations was in August (n=328).

12 Cricket

U51.1

Cricket is popular in Australia. 8.2 % of males, and 0.9% of females (15 years and over) participated in cricket (outdoor and indoor) in 2003. Outdoor cricket was the ninth most popular organised sport in 2001–2003 (Australian Sports Commission 2003). It was more popular with children (eighth most popular) with 5.0% of children, 5–14 years (9.1% of males and 0.7% of females), participating in organised outdoor cricket in the 12 months to April 2003 (Australian Bureau of Statistics 2005). It is predominately played in summer.

Orchard et al. studied first class Australian players from 1995–1996 to 2000–2001 and found an overall injury prevalence of 8% with an injury prevalence of 14% for pace bowlers, 4% for spin bowlers, 4% for batsmen and 2% for wicket keepers (Orchard et al. 2002). Stretch performed a similar study of South African provincial and national teams and found 41.3% of injuries were related to bowling, 28.6% to fielding and wicket keeping and 17.1% to batting (Stretch 2003). Bowling involves twisting, rotation and extension of the trunk and absorption of ground reaction forces. This puts bowlers at risk of overuse back injury (Finch et al. 1999b).

Although it is a non-contact sport, injury can occur by overuse (especially in bowling), impact with the ball, another player, ground or boundary fence. Batters face a ball travelling up to 140 kilometres/hour (Finch et al. 1999b). Before the start of the 2000–2001 season, the Australian Cricket Board changed its policy and began using a rope to mark the boundary to reduce the risk of players impacting the boundary fence (Orchard et al. 2002).

Hockey and Knowles collected data of emergency department presentations in Queensland related to sports injury in 1998–1999. 6.1% of such admissions were due to cricket. 55.0% of injury was due to being struck by or collision with an object, 23.7% due to falls and 6.1% due to being struck by or collision with a person (Hockey & Knowles 2000). Routley and Valuri reviewed adult (15 years and over) sports injury related emergency department visits to several hospitals in Victoria in 1992 and 1993. 9% of sports presentations and 7% of sports admissions were due to cricket. The majority of injuries (58%) were caused by a moving ball, with 27 % caused by another moving object (bat or other player) and 21% caused by strain or overexertion (Routley & Valuri 1993).

Stretch found that the lower limbs were most commonly injured (49.8%). The upper limbs accounted for 23.3% of injuries and the back and trunk, 22.8% (Stretch 2003). In the study by Hockey and Knowles the hand was the most commonly injured body part (30.2%), followed by the face (9.8%), the knee (8.9%), the shoulder (6.8%), the ankle (6.3%), the lower arm (5.6%), the head (5.2%) and the elbow and the foot (each 3.7%) (Hockey & Knowles 2000). Routley and Valuri found that the face was the most commonly injured (23%), followed by the hand (21%) (Routley & Valuri 1993).

In the study by Hockey and Knowles, sprain/strain was the most common type of injury (37.2%), followed by fracture (26.0%), open wound (9.4%), superficial (6.3%) and intracranial (3.3%) (Hockey & Knowles 2000).

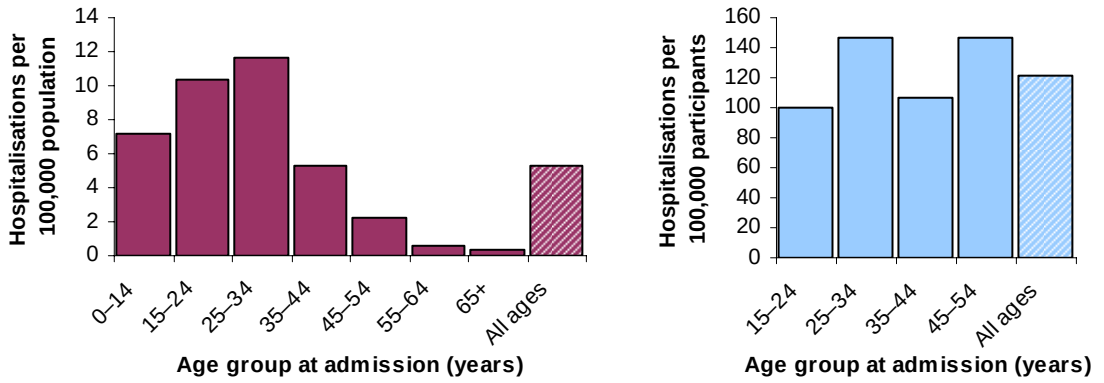
Various types of protective equipment are available for use in cricket, including: helmets, visors, padding, gloves, boxes and mouthguards. Controlled trials have not been done to demonstrate the value of this equipment (Finch et al. 1999b).

Age

Table 12.1: Summary measures for cricket related hospitalisations, by age group at admission, Australia, 2002–2003

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages
Proportion of hospitalised sports (%)	1.3	2.2	3.9	3.4	2.6	1.0	0.7	2.3
Cases: Cricket	189	281	315	157	66	13	13	1,034
Estimated number of participants ('000)[†]	NA	279.8	214.7	147.6	45[*]	0.5[**]	0.0[**]	696.7[††]
Rate/100,000 population	7.2	10.3	11.6	5.3	2.3	0.5	0.4	5.3
Rate/100,000 participants[†]	NA	100.4	146.7	106.4	146.7[*]	NA[‡]	NA[‡]	121.3[††]

[*] Estimate has a relative standard error of between 25% and 50% and should be used with caution
[**] Estimate has a relative standard error of greater than 50% and is considered too unreliable for general use
[†] The hospitalisation rate per 100,000 participants and the estimated number of participants for cricket have been calculated from the estimated number of participants for indoor and outdoor cricket from Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003). Hospital separation data does not provide detail as to whether cricket is indoor or outdoor. Attempts to separate cricket in separation data into indoor and outdoor by venue were unsuccessful.
[‡] The rate of hospitalisation per 100,000 participants has not been included in those 55+ years due to high uncertainty in the participation data.
[††] The estimated number of participants and the hospitalisation rate per 100,000 participants excludes those less than 15 years (n=189).



Note: The hospitalisation rate per 100,000 participants excludes 189 cases in those less than 15 years.
Hospitalisation rates per 100,000 participants for those 55+ years are included in the total but not presented separately due to high uncertainty in the participation data.
Participation rates for cricket have been calculated from the estimated number of participants in indoor and outdoor cricket.

Figure 12.1: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to cricket, by age group at admission, Australia, 2002–2003

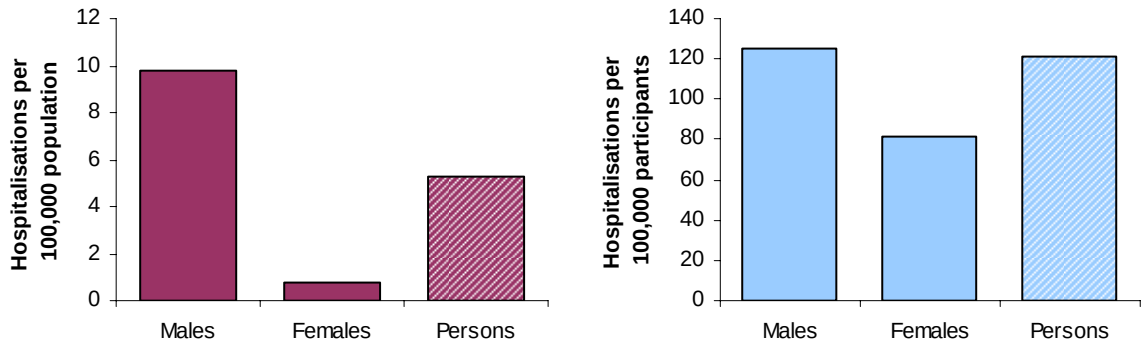
Cricket is most popular in younger age groups as shown by the estimated number of participants being highest in the 15–24 and 25–34 year age groups. It is also popular with children with 5.5% of children participating in organised outdoor cricket (Australian Bureau of Statistics 2005). The highest numbers of hospitalisations are also in these age groups (n=281 and n=315 respectively) (Table 12.1 and Figure 12.1).

Sex

Table 12.2: Summary measures for cricket related hospitalisations, by sex, Australia, 2002–2003

	Males	Females	Persons
Proportion of hospitalised sports (%)	2.8	0.7	2.3
Cases: Cricket	956	78	1,034
Estimated number of participants ('000)[†‡]	629.3	67.3[*]	696.7
Rate/100,000 population	9.8	0.8	5. 3
Rate/100,000 participants[†‡]	125.5	81.7	121.3

[*] Estimate has a relative standard error of between 25% and 50% and should be used with caution.
[†] The estimated number of participants and rate of hospitalisation per 100,000 participants excludes those less than 15 years (189).
[‡] The participation rates for cricket have been calculated from the estimated number of participants in indoor and outdoor cricket found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003). The hospital separation data does not provide detail as to whether cricket is indoor or outdoor. Attempts to separate cricket in separation data into indoor and outdoor by venue were unsuccessful.

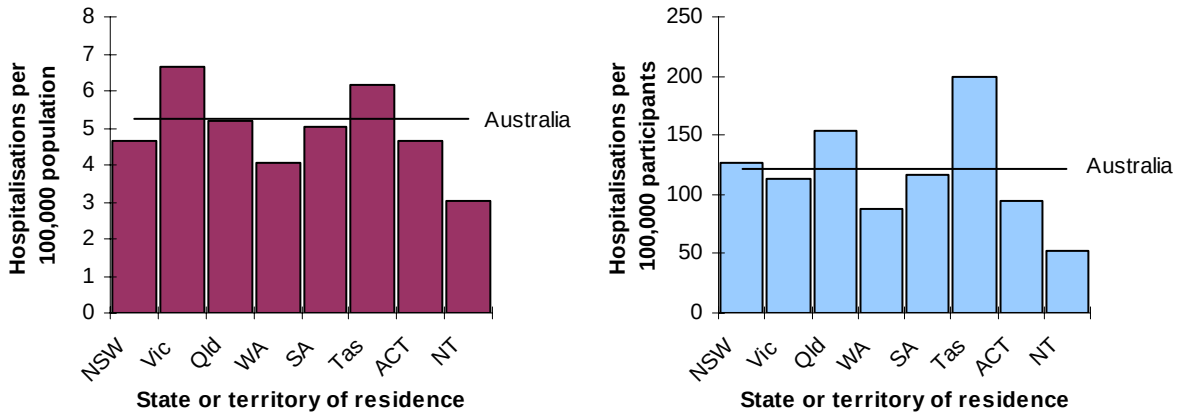


Note: The hospitalisation rate per 100,000 participants excludes 189 cases of cricket injury in those under 15 years.
The participation rates for cricket have been calculated from the estimated number of participants in indoor and outdoor cricket found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).

Figure 12.2: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to cricket, by sex, Australia, 2002–2003

Cricket is much more popular in males than females. As would be expected there is a much higher hospitalisation rate per 100,000 population in males compared with females (9.8 versus 0.8 per 100,000). The hospitalisation rate per 100,000 participants (15 years and over) is also higher in males than females (125.5 versus 81.7) (Table 12.2 and Figure 12.2).

State or territory of residence

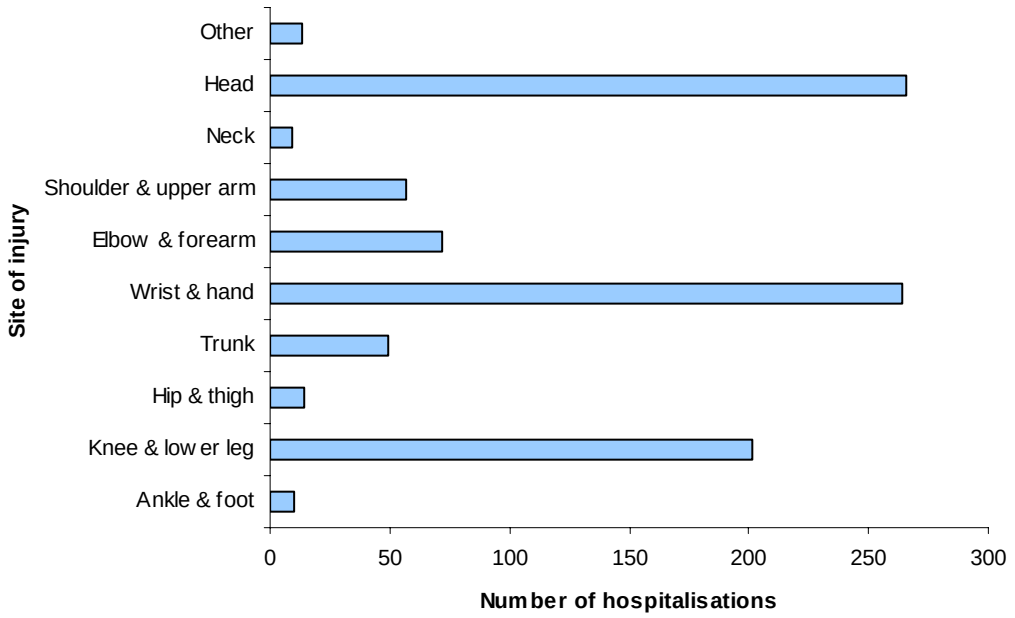


Note: The horizontal bar represents the hospitalisation rate for Australia as a whole.
The hospitalisation rate per 100,000 participants excludes 189 cases of cricket injury in those under 15 years.
There were 4 cases with unreported state or territory of residence but none in those under 15 years. These have been included in the rate for Australia as a whole.
Participation rates for cricket have been calculated from the estimated number of participants for indoor and outdoor cricket found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).

Figure 12.3: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to cricket, by state or territory of residence, Australia, 2002–2003

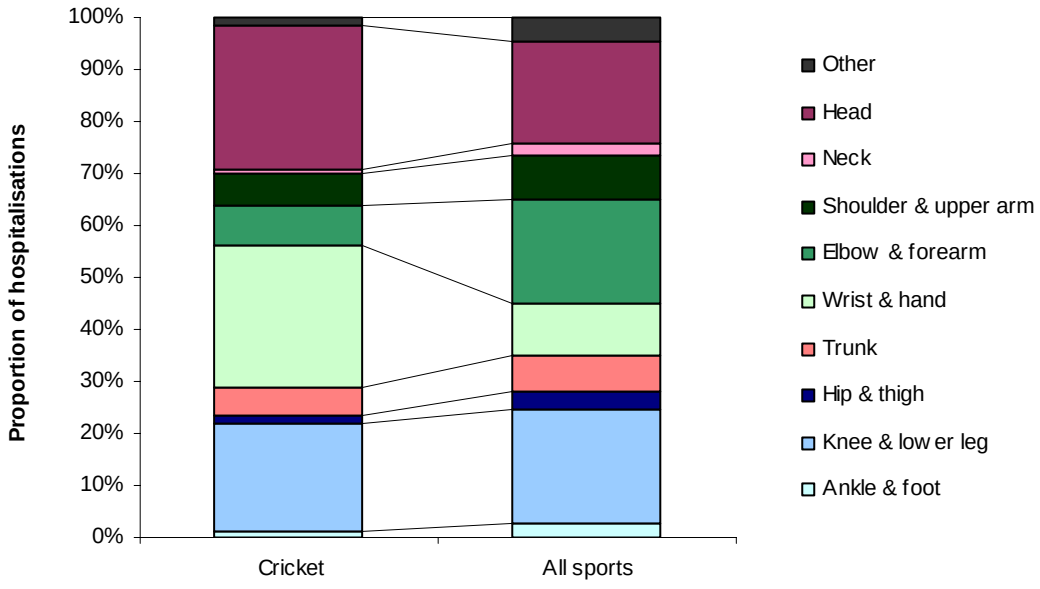
Victoria and Tasmania have the highest rates of hospitalisation for cricket injury per 100,000 population (6.7 and 6.1, respectively). For Victoria this is likely due to the high participation rate in that state. When participation rates are taken into account the rate of hospitalisation for cricket injury in Victoria (113.8 per 100,000) is below the Australian rate (121.3 per 100,000). Tasmania, however, continues to have the highest rate of hospitalisation for cricket injury (200.0). However, being a smaller state, there are fewer numbers (n=29) and any year to year variation is more apparent (Figure 12.3).

Body region



Note: Excludes 79 cricket cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

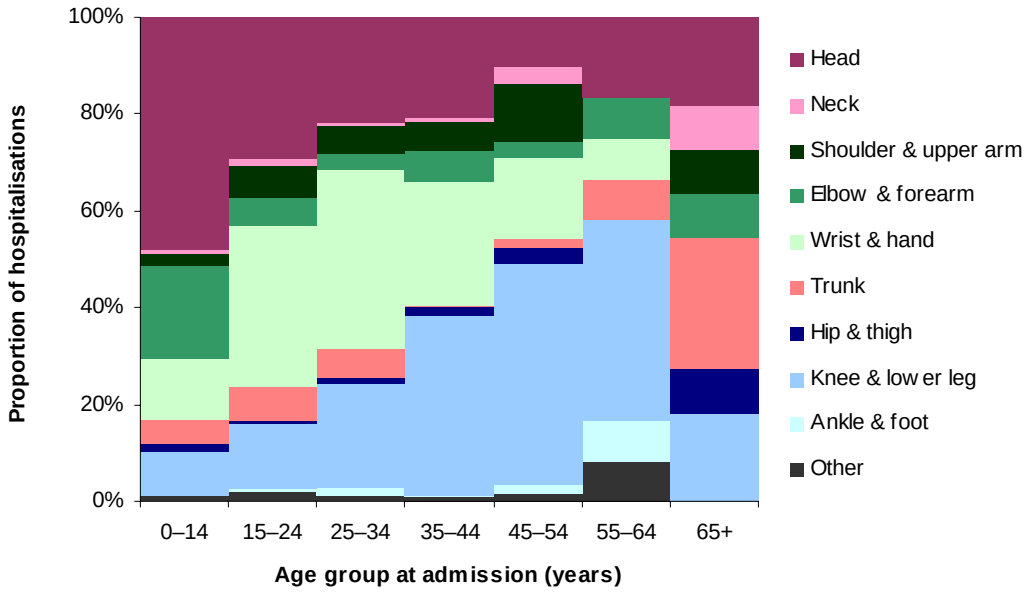
Figure 12.4: Hospitalisations due to cricket, by principal body region injured, Australia, 2002–2003



Note: Excludes 79 cricket cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 12.5: Hospitalisations due to cricket injury and all sports injury, by principal body region injured, Australia, 2002–2003

The head (n=266) and the wrist/hand (n=264) were the most common principal body region injured in persons requiring hospitalisation from cricket injury. Head and wrist/hand injuries (as principal body region injured) are more common in cricket injury as compared to all sports related hospitalisations (Figures 12.4 and 12.5). This is similar to the study by Routley and Valuri which found that the face (23%) was most commonly injured, followed by the hand (21%) (Routley & Valuri 1993).

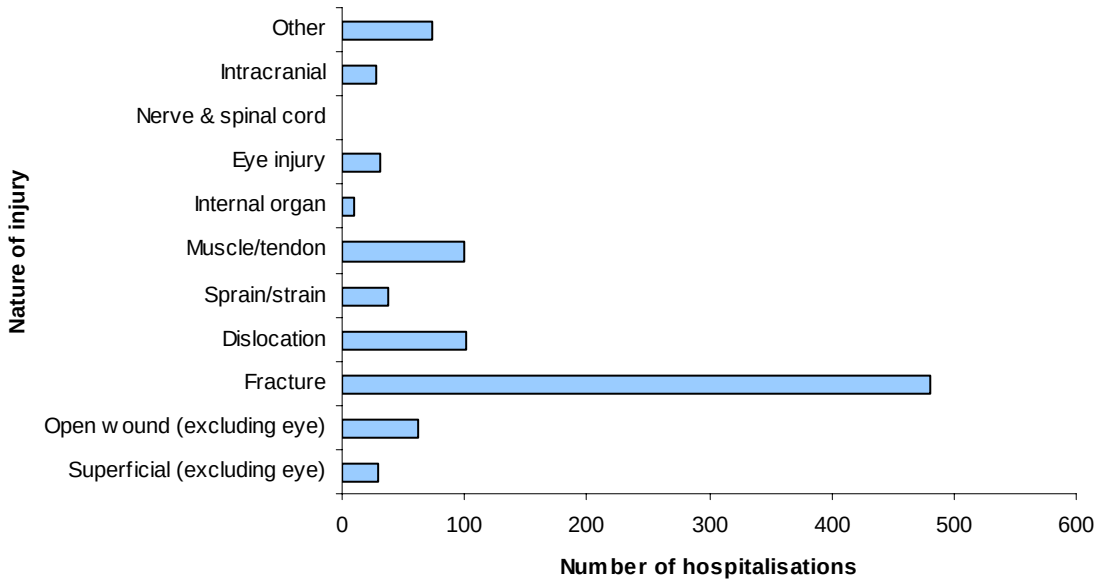


Note: Excludes 79 cricket cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 12.6: Hospitalisations due to cricket, by age group at admission and principal body region injured, Australia, 2002–2003

In regards to principal body region injured, almost half (48.6%) of elbow and forearm injuries resulting from cricket and requiring hospitalisation were in the 0–14 year age group (35, 18.5%). Head injuries were also frequent in the 0–14 year age group with 32.7% of head injuries occurring in this age group (n=87, 46.0%). Head injuries requiring hospitalisation resulting from cricket were next most common in the 15–24 year age group (n=77, 27.4%). Wrist and hand injuries resulting from cricket and requiring hospitalisation were most common in the 25–34 year age group (n=106, 33.7%), followed by the 15–24 year age group (n=88, 31.3%). Knee and lower leg injuries were most common in the 25–34 year age group (n=61, 34.4%) in terms of total numbers, however, in terms of percentage of total injuries for the age group knee and lower leg injury (as principal diagnosis) was most common in the 55–64 year age group (n=5, 38.5%). Injuries to the trunk (n=49) were most common in the 15–24 year age group (n=18, 6.4%). Trunk injuries were a common cause for admission in those 65+ years and over (23.1% of admissions in this age group) (Figure 12.6).

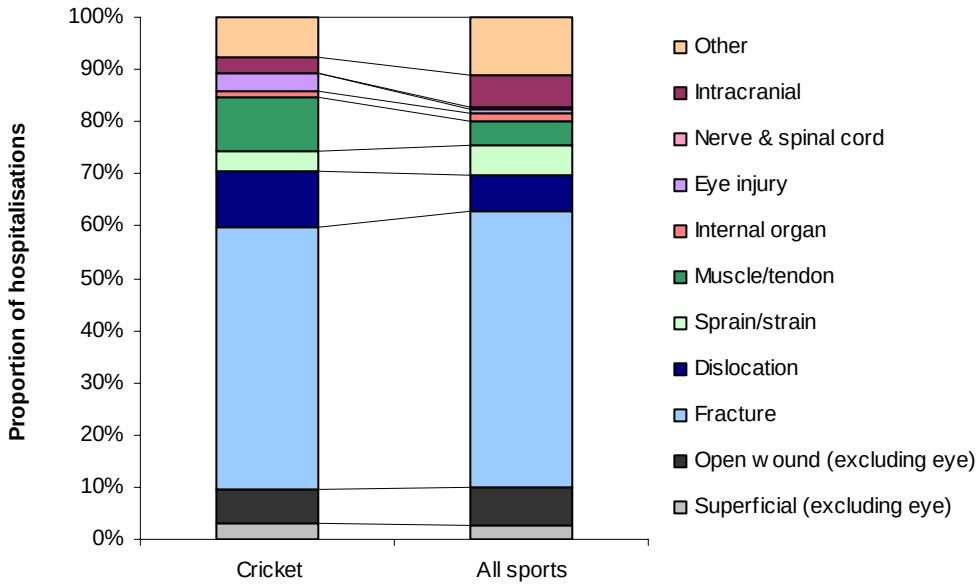
Nature of injury



Note: Excludes 79 cricket cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 12.7: Hospitalisations due to cricket, by nature of injury of principal diagnosis, Australia, 2002–2003

In the majority (50.3%) of hospitalisations due to cricket the principal diagnosis was a fracture (n=480). This was a similar proportion of hospitalisations when compared to all sports related hospitalisations (52.8%). There was a higher frequency of muscle/tendon injury (10.5%) and dislocations (10.7%) requiring hospitalisation for cricket as compared with all sports related hospitalisations (4.3% and 6.6% respectively). Eye injury requiring hospitalisation was more frequent in cricket (n=31) as compared with all sports related hospitalisations (3.2% versus 0.6%). 2.9% (n=28) of cricket injury hospitalisations were due to intracranial injury, compared with 6.1% for all sports related hospitalisation (Figures 12.7 and 12.8).



Note: Excludes 79 cricket cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 12.8: Hospitalisations due to cricket injury and all sports injury, by nature of injury, Australia, 2002–2003

Mechanism of injury

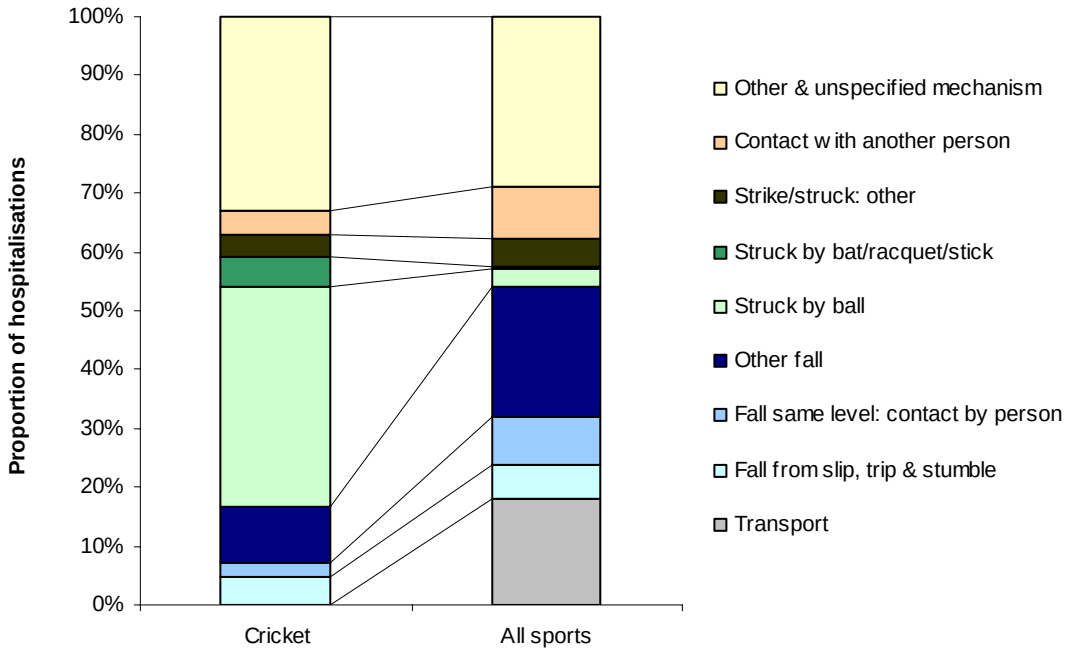


Figure 12.9: Hospitalisations due to cricket and all sports, by mechanism of injury, Australia, 2003–2003

Struck by ball was the most common reason for hospitalisation due to cricket (n=388, 37.5%), followed by 'other' (n=341, 33.0%) and 'other falls' (n=97, 9.4%). In contrast, for all sport related hospitalisations, 'other falls' comprised 22.2% of admissions, 'other', 28.8% of admissions and

struck by ball only 2.9% of admissions (Figure 12.9). The study by Hockey and Knowles of emergency department presentations in Queensland, found that 55.0% of cricket injury presentations were due to being struck by or collision with an object, 23.7% were due to falls and 6.1% were due to being struck by or collision with a person (Hockey & Knowles 2000).

Length of stay

Table 12.3: Cricket and all sport related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]
Cricket	1,582	1.7	143	1.8	1,725	1.7
All sports	85,269	2.5	32,720	2.8	117,989	2.6

[†] This is total bed days, including inward transfers.
[††] This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Cricket had a lower mean number of bed days (1.7) to all sports related hospitalisations (2.6) (Table 12.3).

Place of occurrence

The majority of cricket injuries occurred at an outdoor sports area (n=524, 50.7%), compared with (26.3%) for all sport related injuries. These persons were likely playing outdoor cricket. 11.7% (n=121) occurred at an indoor sports area, compared with 3.7% for all sport related injuries. These persons were likely playing indoor cricket. There was a large proportion occurring at other or unknown venue (27.3%). (Figure 12.10)

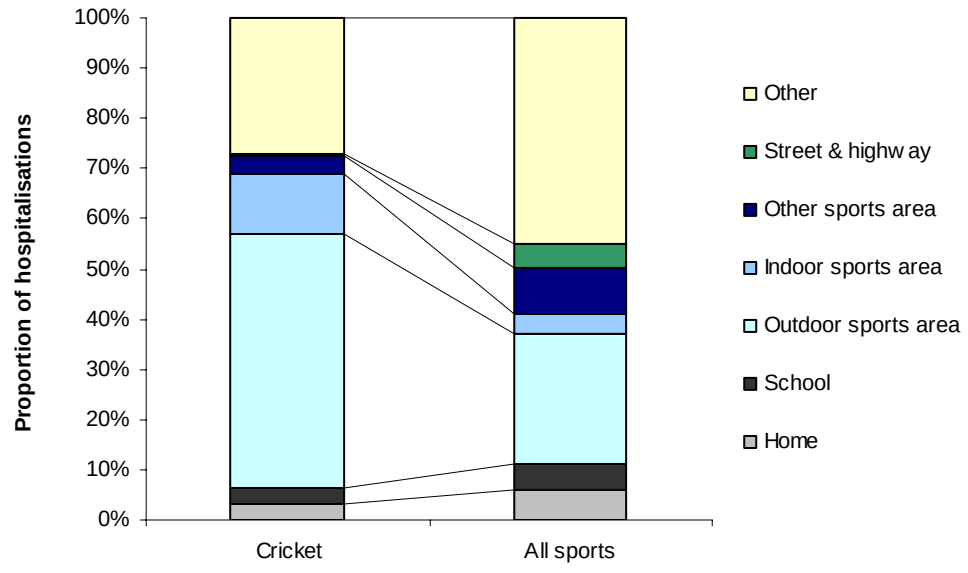


Figure 12.10: Hospitalisations due to cricket and all sports, by place of occurrence, Australia, 2002–2003

Month of admission

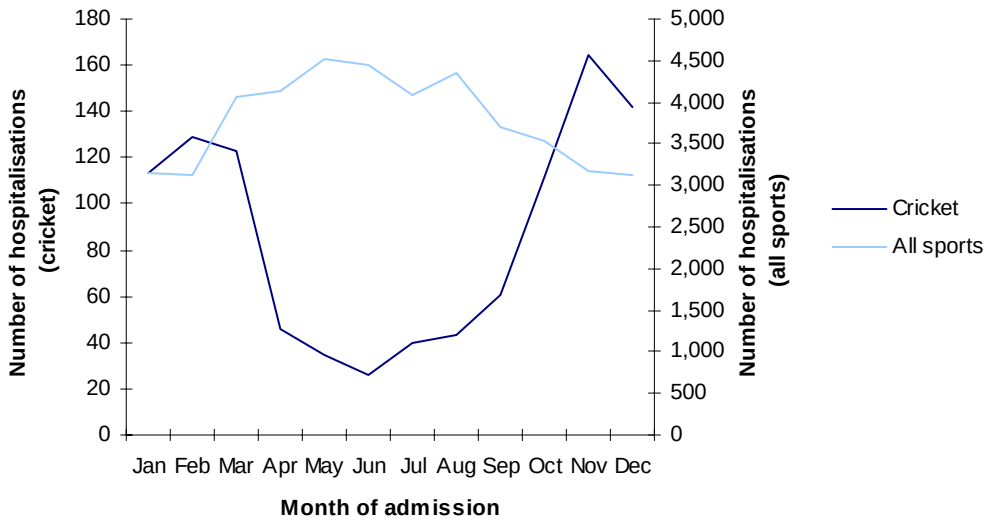


Figure 12.11: Hospitalisations due to cricket, by month of admission, Australia, 2002–2003

Cricket is a summer sport. In common with many other season sports, the peak occurred early in the season. The peak incidence occurred in November (n=164, 15.9%). 13.7% (n=142) of cricket injuries occurred in December, 12.5% (n=129) occurred in February, 11.9% (n=123) occurred in March and 10.9% (n=113) occurred in January (Figure 12.11) .

Discussion

Cricket is a summer sport which is predominately played by young males. The majority of cricket injury cases also occur in males (n=956 versus n=78 for females). The rate of hospitalisation per 100,000 participants is higher for males than females (125.5 versus 81.7).

The head (n=266) and wrist/hand (n=264) are the most commonly injured body parts. These can be protected by a helmet with visor and gloves. However, controlled trials have not been done to demonstrate the value of this equipment (Finch et al. 1999b).

As with many sports, fractures are the most common type of injury (principal diagnosis) requiring hospitalisation (n=480, 50.3%). This report uses only hospital admission data and so other types of injury such as sprain/strain, open wound and superficial may be much more common in injuries not requiring hospitalisation. Hockey and Knowles who reviewed emergency department sporting injury related visits in Queensland found that sprain/strain was the most common type of injury (37.2%) followed by fracture (26.0%) (Hockey & Knowles 2000).

37.5% of cricket injuries were caused by contact with the ball (n=388). The ball can travel at up to 140 kilometres/hour (Finch et al. 1999b). Hockey and Knowles found that collision with an object was the most common cause of injury (55.0%). Routley and Valuri reviewed adult sport related emergency department visits in Victoria. In their study, the majority of injuries (58%) were caused by a moving ball (Routley & Valuri 1993).

As would be expected the majority of cricket injury occurred at an outdoor sports area (n=524). Participation data shows that 508,200 persons participated in outdoor cricket and 188,500 persons participated in indoor cricket in 2003 (Australian Sports Commission 2003). The ICD-10-AM does not have separate categories for indoor and outdoor cricket. We did attempt to divide the hospitalised sport data into indoor and outdoor cricket using the place of injury, however, there were multiple venues where it was impossible to determine whether the person was playing indoor or outdoor cricket.

13 Racquet sports

U59

In Australia, in 2003, tennis was the fifth most popular sport with adults (15 years and over) with a participation rate of 9.5% for males and 8.6% for females (Australian Sports Commission 2003). In the 12 months to April 2003, tennis was the forth most popular organised sport with children 5–14 years (8.6% participation rate with 9.5% males and 7.8% females) (Australian Bureau of Statistics 2005). Squash and racquetball had a participation rate in adults (15 years and over) of 2.2% (3.3% males and 1.1% females) (Australian Sports Commission 2003). Badminton had a participation rate of 0.8% in adults 15 years and over (males and females equally represented) (Australian Sports Commission 2003). 0.5% of adults (15 years and over) participated in table tennis (0.9% of males) in 2003 (Australian Sports Commission 2003).

Racquet sports are high velocity sports with the squash ball travelling 210–230 kilometres/hour and the squash racquet travelling 150–190 kilometres/hour. The tennis ball travels 150–190 kilometres/hour and the badminton shuttlecock travels 210–220 kilometres/hour (Fong 1994).

Høy et al. 1994 studied badminton related injuries at Randers city hospital casualty department, Denmark, during a one year period. In this study there were 100 injuries, which represented 5% of all sporting injuries. The most common body part injured was the lower limbs. Almost 55% of injuries were sprains. 10–15% of injury presentations were due to a ruptured Achilles tendon. There were 3 eye injuries all of which were minor. 27% of all injuries were severe, 56% were moderate and 17% were minor (Høy et al. 1994).

Chard and Lachmann 1987 performed an eight year retrospective study of persons with racquet sport related injuries attending the Sports Injury Clinic at Addenbrooke Hospital, Cambridge. However, lacerations, eye injuries, fractures and head injuries were usually seen at the emergency department rather than at the clinic. There were 631 injuries reviewed with 59% being squash related, 21% tennis related and 20% badminton related. When participation data is considered squash players attended almost three times more frequently, however, comparative risk cannot be calculated as frequency of play is unknown. The male: female ratios were as follows: 2:1 for squash, 1.47:1 for tennis and 1.37:1 for badminton. The lower limbs were injured most frequently (58% in squash, 59% in badminton and 45% in tennis), followed by the upper limbs (22% in squash, 25% in badminton and 35% in tennis) and the trunk least frequently (20% in both squash and tennis and 16% in badminton) (Chard & Lachmann 1987).

Berson et al. conducted telephone interviews of 200 randomly selected squash players in New York City, USA. There was a 77.5% response rate. 48% of injuries involved the lower limb with 15.9% of total injuries involving the ankle and 15.9% the leg. 36.2% of injuries were non-orthopaedic e.g. facial lacerations. Muscle strains were the next most common type of injury (18.8%). Only 2.9% of injuries were fractures. Fractures had a lower average age (27 years) than cartilage (40 years) or tendon injury (41 years) (Berson et al. 1981).

Barr et al. 2000 studied all hospitalisations due to ocular trauma in Scotland during a one year period. There were 52 patients which was 12.5% of all ocular trauma related hospitalisations. Racquet sports accounted for 47.5% of injuries. For racquet sports 42.5% of injuries were sustained from contact with the racquet and 17.5% from contact with the ball/shuttlecock. The majority (87.5%) of admissions were due to macroscopic hyphaema (bleeding in the front chamber of the eye), which results from blunt trauma (Barr et al. 2000).

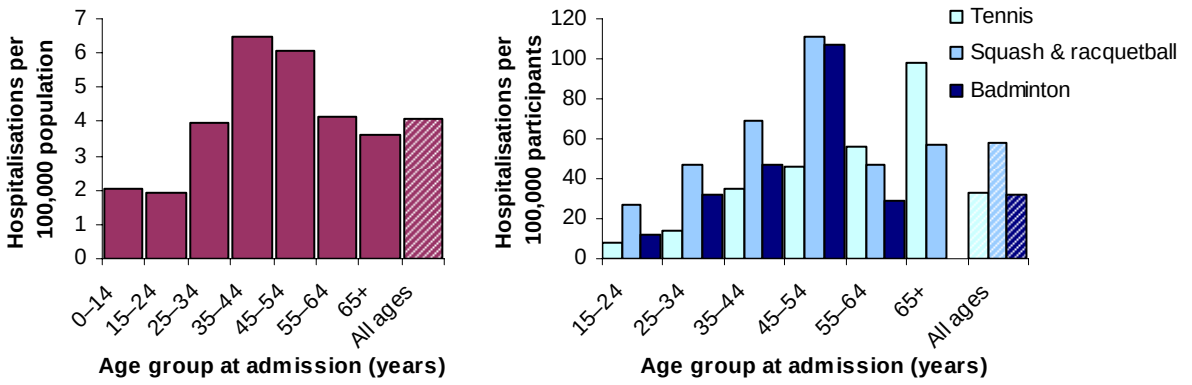
Fong 1994 studied sports–related eye injuries presenting to the Royal Victorian Eye and Ear hospital, Melbourne, between November 1989 and October 1991 and included both inpatients and outpatients. There were 700 patients with 709 sports related eye injuries, which was 5% of total ocular trauma. 35% of inpatient and 28% of outpatient sport related ocular injuries were due to racquet sports with 17% of total ocular trauma due to squash, 8% due to tennis and 3% due to badminton. Squash ball impact injury was more common than racquet injury and accounted for 72% of inpatient and 59% of outpatient injuries. All the badminton related ocular injuries were related to shuttlecock impact. There was an incidence of 64 sports-related eye injuries for every 100,000 participants of squash, 33 for badminton and 17 for tennis (Fong 1994).

Age

Table 13.1: Summary measures for racquet sport related hospitalisations, by age group at admission, Australia, 2002–2003

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages (%)
Proportion of hospitalised sports (%)	0.4	0.4	1.3	4.2	7.0	7.6	6.3	1.8
Cases: Racquet sports[††]	54	53	107	192	175	99	120	800 (100)
Tennis	43	26	43	116	106	82	89	505 (63.1)
Squash	…	17	52	58	52	7	5	194 (24.3)
Table tennis & ping pong	4	…	5	4	4	7	22	48 (6.0)
Badminton	4	7	7	9	11	…	…	43 (5.4)
Racquetball	0	0	0	5	…	…	0	7 (0.9)
Estimated number of participants ('000)[†]								
Tennis	NA	311.4	302.2	327.3	228.7	146.9	90.9	1,407.3
Squash & racquetball	NA	64.1	111.4	91	47.8	16.9*	8.8*	340.1
Table tennis	NA	25.8*	15.4*	14.2*	6.4**	3.4**	18*	83.2
Badminton	NA	58.8	22*	19*	10.3*	7*	4**	121.0
Rate/100,000 population: Racquet sports	2.1	1.9	4.0	6.5	6.1	4.1	3.6	4.1
Tennis	1.6	1.0	1.6	3.9	3.7	3.4	2.7	2.6
Squash	0.1	0.6	1.9	1.9	1.8	0.3	0.1	1.0
Table tennis & ping pong	0.2	0.1	0.2	0.1	0.1	0.3	0.7	0.2
Badminton	0.2	0.3	0.3	0.3	0.4	0.1	0.1	0.2
Racquetball	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Rate/100,000 participants[‡]								
Tennis	NA	8.3	14.2	35.4	46.3	55.8	97.9	32.8[†]
Squash & racquetball	NA	26.5	46.7	69.2	110.9	47.3*	56.8*	58.2[†]
Badminton	NA	11.9	31.8*	47.4*	106.8*	28.6*	NA	32.2[†]

* Estimate has a relative standard error of between 25% and 50% and should be used with caution.
** Estimate has a relative standard error of greater than 50% and is considered too unreliable for general use.
† The estimated number of participants and the crude of hospitalisation per 100,000 participants for all ages excludes cases in those 0–14 years (n=54).
‡ The crude of hospitalisation rate per 100,000 participants for table tennis and ping pong is not shown due to inconsistency between the numerator data (table tennis and ping pong) and the denominator data (table tennis).
†† There were 3 cases of other racquet sports which are not shown separately.
Case numbers when n<4 are not shown.



Note: The hospitalisation rate per participant excludes 50 cases of tennis, squash and racquetball and badminton in those less than 15 years.

Figure 13.1: Hospitalisation rate per 100,000 population due to racquet sports and per 100,000 participants (15 years and over) due to tennis, squash and racquetball, and badminton, by age group at admission, Australia, 2002–2003

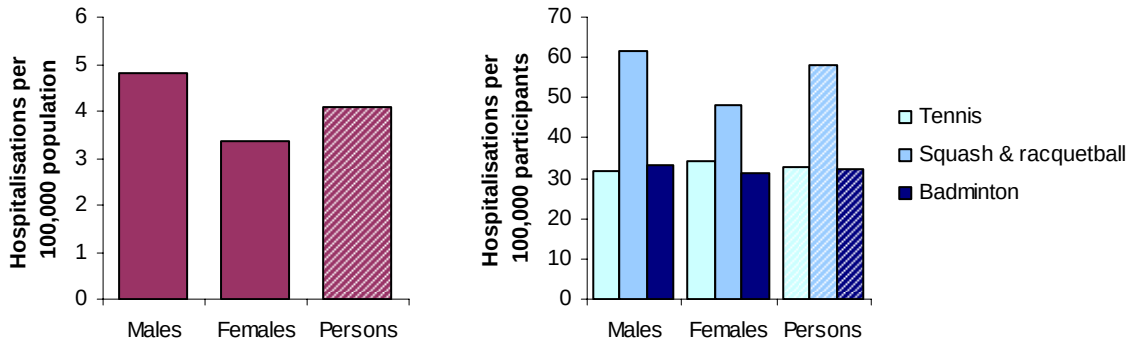
For tennis and squash the highest number of admissions occurred in the 35–44 year age group, with 192 (24.0%) of all racquet sport hospitalisations occurring in this age group. Unlike many sports, tennis had a higher number of admissions occurring in the older age groups than the younger age groups with 89 (17.6%) occurring in the 65+ year age group. The 65+ year age group had the highest hospitalisation rate per 100,000 tennis participants with 97.9 (Table 13.1 and Figures 13.1).

Sex

Table 13.2: Summary measures for racquet sport related hospitalisations, by sex, Australia, 2002–2003

	Males (%)	Females (%)	Persons (%)
Proportion of hospitalised sports (%)	1.4	2.8	1.8
Cases: Racquet sports[††]	468 (100)	332 (100)	800 (100)
Tennis	256 (54.7)	249 (75.0)	505 (63.1)
Squash	155 (33.1)	39 (11.7)	194 (24.3)
Table tennis & ping–pong	28 (6.0)	20 (6.0)	48 (6.0)
Badminton	23 (4.9)	20 (6.0)	43 (5.4)
Racquetball	5 (1.1)	2 (0.6)	7 (0.9)
Estimated number of participants ('000)[†]			
Tennis	734.4	672.9	1,407.3
Squash & racquetball	254.8	85.3	340.1
Table tennis	68	15.2[*]	83.2
Badminton	60.3	60.7	121.0
Rate/100,000 population: Racquet sports	4.8	3.4	4.1
Tennis	2.6	2.5	2.6
Squash	1.6	0.4	1.0
Table tennis & ping–pong	0.3	0.2	0.2
Badminton	0.2	0.2	0.2
Racquetball	0.1	0.0	0.0
Rate/100,000 participants[†]			
Tennis	31.6	34.2	32.8
Squash & Racquetball	61.6	48.1	58.2
Badminton	33.2	31.3	32.2

[†] The estimated number of participants and the rate of hospitalisation per 100,000 participants excludes those less than 15 years (n=54).
[*] Estimate has a relative standard error of between 25% and 50% and should be used with caution.
[††] There were 3 cases of other racquet sports are which are not shown separately.
The rate per 100,000 participants for table tennis and ping pong is not shown due to inconsistency between the numerator data (table tennis and ping pong) and the denominator data (table tennis).

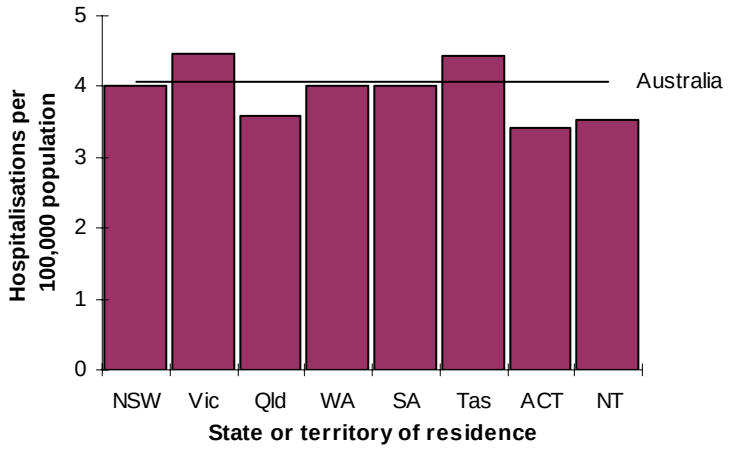


Note: Hospitalisation rate per participation excludes 50 cases of tennis, squash and racquetball, and badminton related hospitalisations in those under 15 years.

Figure 13.2: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to racquet sports, by sex, Australia, 2002–2003

58.5% (n=468) of racquet sport related hospitalisations occurred in males, however, in squash 79.9% (n=155) of hospitalisations were males and in tennis only 50.7% (n=256) of hospitalisations were males. The rate of hospitalisation per 100,000 participants (15 years and over) for males and females was similar for tennis (31.6 for males and 34.2 for females) and for badminton (33.2 for males and 31.3 for females), however, for squash the hospitalisation rate per 100,000 participants (15 years and over) was much higher for males (61.6) than females (48.1) (Table 13.2 and Figure 13.2).

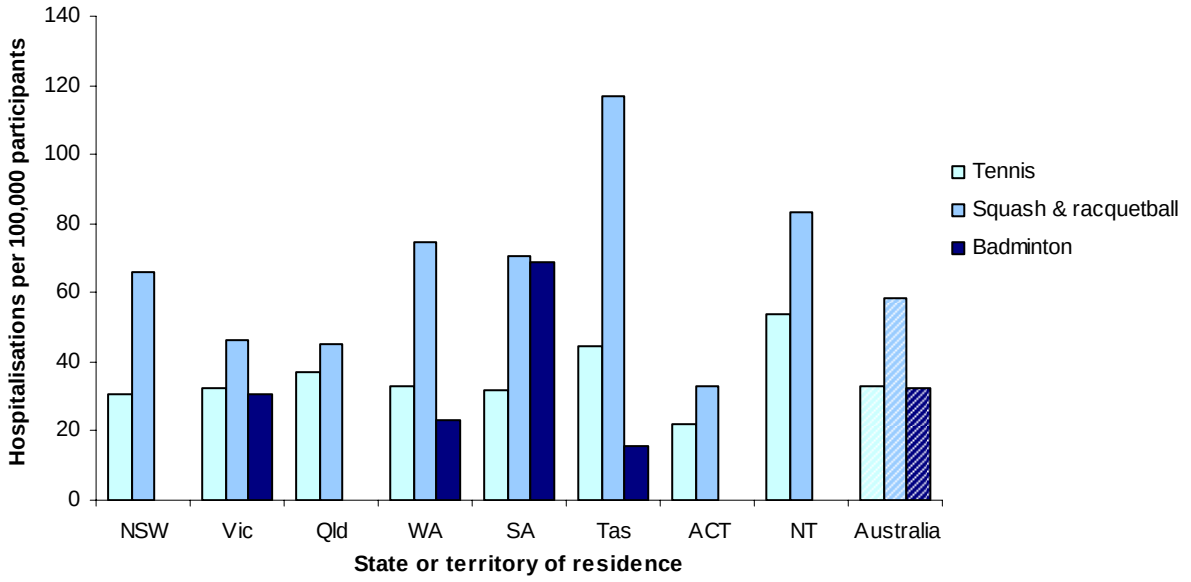
State or territory of residence



Note: Horizontal bar represents the hospitalisation rate for Australian as a whole.
Hospitalisation rate per participation excludes 54 cases of racquet sport injury in those under 15 years.
There were 6 cases with unreported state or territory of residence but none in those under 15 years. These cases have been included in the rate for Australia as a whole.

Figure 13.3: Hospitalisation rate per 100,000 population, due to racquet sports, by state or territory of residence, Australia, 2002–2003

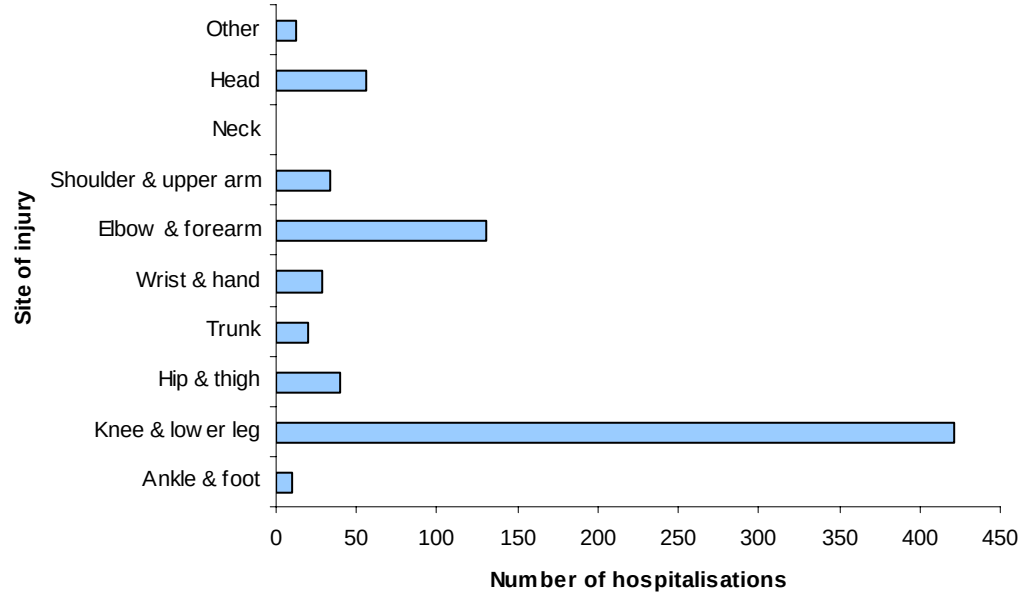
Tasmania had the highest rate of hospitalisation per 100,000 population for racquet sports with 4.4 compared with the rate for Australia as a whole of 4.1. Participation data was not available for racquet sports as a whole. Squash and racquetball had the highest rate of hospitalisation per 100,000 participants (15 years and over) with 58.2, with the rate being highest in Tasmania (116.7) and lowest in the ACT (32.8). The hospitalisation rate per 100,000 participants (15 years and over) for tennis was highest for the NT (54.1) and lowest for the ACT (22.2), compared with 32.8 for Australia as a whole. Participation data for badminton was only available in SA, Victoria, WA, Tasmania and for Australia as a whole. SA had the highest hospitalisation rate for badminton per 100,000 participants (15 years and over) with 68.6 compared with 32.2 for Australia as a whole (Figures 13.3 and 13.4).



Note: Hospitalisation rate per 100,000 participants excludes 50 cases of tennis, squash and racquetball, and badminton hospitalisation in those under 15 years.
There were 4 cases for tennis and 2 cases for squash with unreported state or territory of residence. These have been included in the rate for Australia as a whole.

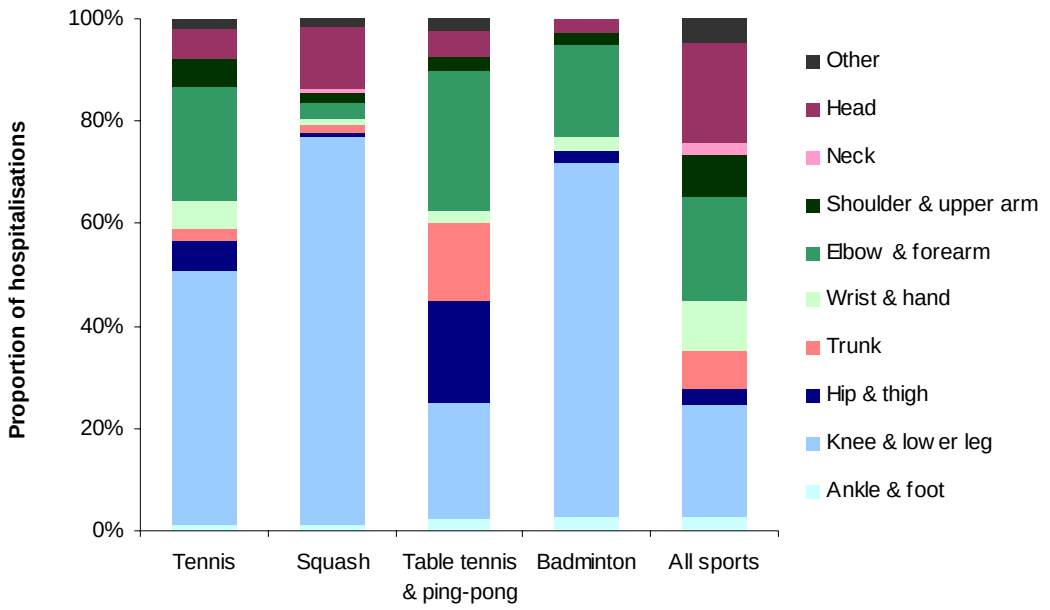
Figure 13.4: Hospitalisation rate per 100,000 participants (15 years and over) due to tennis, squash and racquetball and badminton, by state or territory of residence, Australia, 2002–2003

Body region



Note: Excludes 46 racquet sport cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

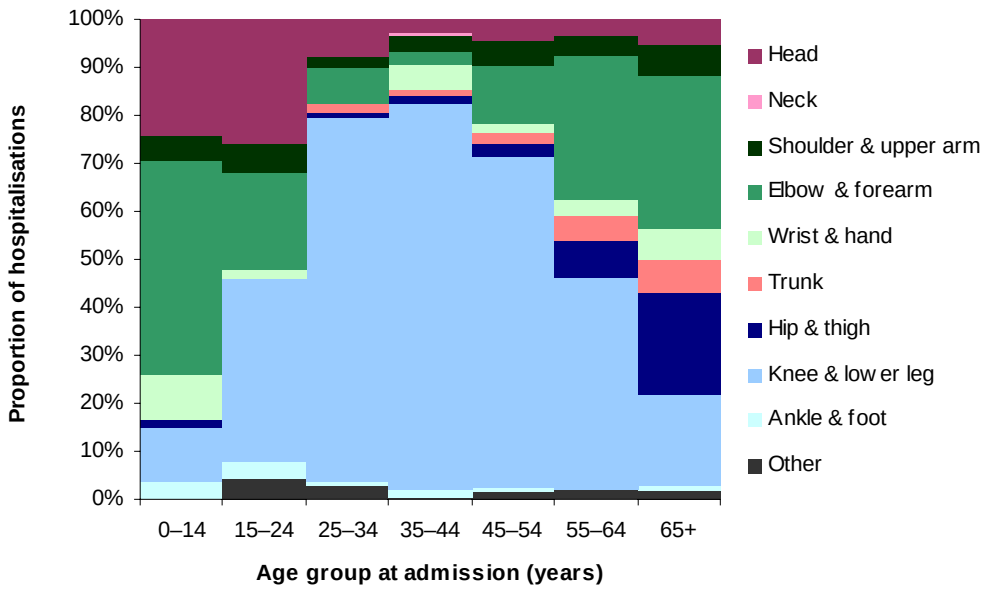
Figure 13.5: Hospitalisations due to racquet sport injury, by principal body region injured, Australia, 2002–2003



Note: Excludes 46 tennis, squash, badminton, table tennis and ping-pong cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 13.6: Hospitalisations due to racquet sport injury and all sports injury, by principal body region injured, Australia, 2002–2003

In the majority of racquet sports related hospitalisations the lower limbs was the principal body region injured (59.0%). The majority of this was due to knee and lower leg injury (n=422, 52.8% of total). In badminton, 62.8%, and in squash, 73.7%, of injury hospitalisations had the knee and lower leg as the principal body region injured. However, in table tennis and ping pong, lower limb injury was more evenly split between knee and lower leg injury (18.8%) and hip and thigh injury (16.7%). Upper limb injury (as principal body region injured) was much more frequent in tennis and in table tennis and ping pong, than in badminton and squash. 21.0% of tennis injuries and 22.9% of table tennis and ping pong, injuries had the elbow and forearm as the principal body region injured (Figures 13.5 and 13.6).

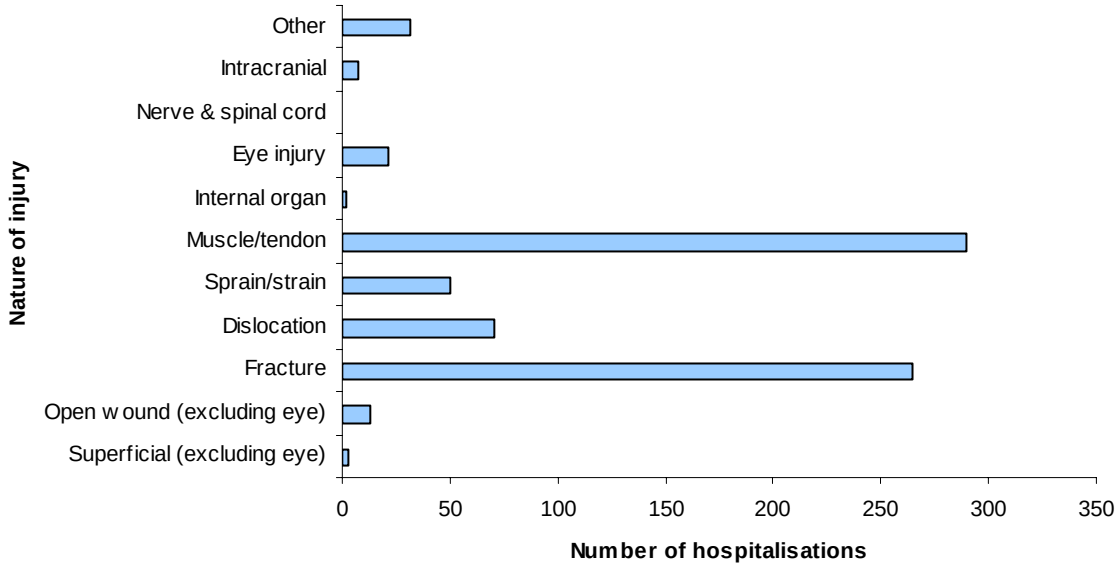


Note: Excludes 46 racquet sport cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 13.7: Hospitalisations due to racquet sport injury, by principal body region injured and age group at admission, Australia, 2002–2003

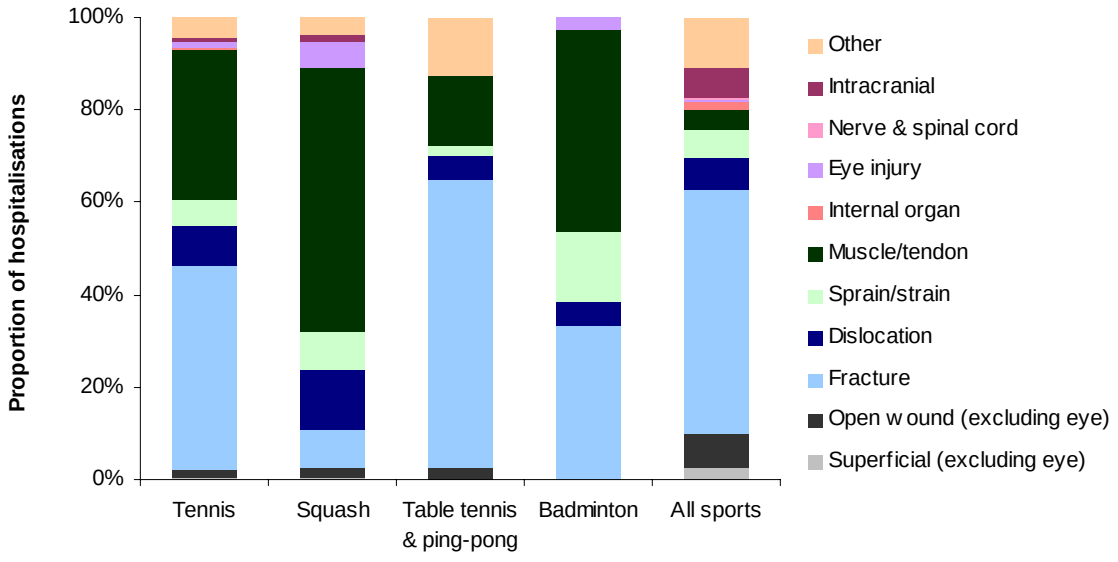
Knee and lower leg injury dominated the principal body region injured in racquet sports related injury hospitalisations in the 25–54 year age groups (65.7% to 74.5%). However, in the older and younger age groups this was not the case. In the 0–14 year age group upper limb injury predominated (n=32, 59.3%), especially injury to the elbow and forearm (n=24, 44.4%). In the 65+ year age group 26.2% (n=35) of injuries involved the elbow and forearm as the principal body region injured (Figure 13.7).

Nature of injury



Note: Excludes 46 racquet sport cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 13.8: Hospitalisations due to racquet sports, by nature of injury, Australia, 2002–2003



Note: Excludes 46 tennis, squash, badminton, table tennis and ping-pong cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 13.9: Hospitalisations due to racquet sport injury and all sports injury, by nature of injury, Australia, 2002–2003

Racquet sports were unusual in that muscle and tendon injury (n=290, 38.5%) rather than fractures (n=265, 35.1%) were the most common principal nature of injury. However, in tennis, 44.2% (n=211), and in table tennis, 62.5% (n=25), of principal diagnoses were fractures. In squash, 57.4% (n=108), and in badminton, 43.6% (n=17), of principal diagnoses were muscle and tendon injury (Figures 13.8 and 13.9).

Eye injury as the principal diagnosis was much more common in racquet sports than in all sports related hospitalisations. Eye injury as the principal diagnosis was most common in squash with 10 hospitalisations (5.3% of squash hospitalisations), followed by tennis (n=8, 1.7% of tennis hospitalisations), compared with 0.6% of all sports related hospitalisations (Figure 13.9).

Mechanism of injury

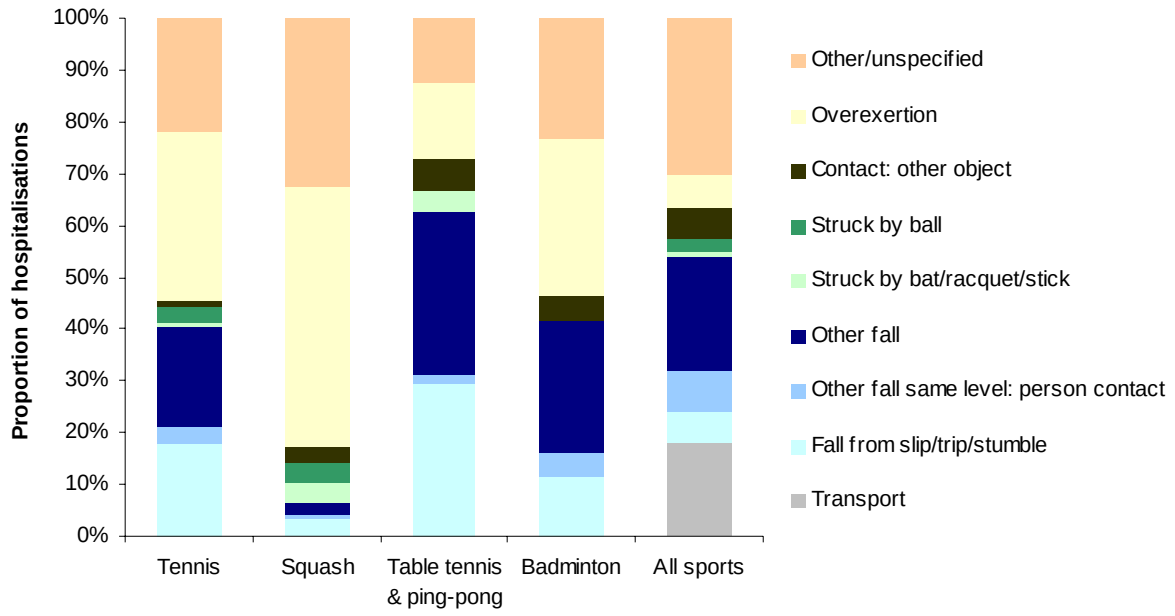


Figure 13.10: Hospitalisations due to racquet sports and all sports, by mechanism of injury, Australia, 2003–2003

Falls were the most common mechanism of injury for table tennis (n=30, 62.5%), badminton (n=18, 41.9%) and tennis (n= 205, 40.6%). Falls comprised 33.4% of all racquet sport related hospitalisations (n=267). In squash, overexertion was the most common mechanism of injury (n=97, 50.0%). 32.3% of tennis admissions (n=163) and 30.2% of badminton admissions (n=13) were due to overexertion (Figure 13.10).

Length of stay

Table 13.3: Racquet sport and all sport related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]
Racquet sports	1,222	2.6	874	2.6	2,096	2.6
All sports	85,269	2.5	32,720	2.8	117,989	2.6

[†] This is total bed days, including inward transfers.
[††] This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Racquet sports and all sports related hospitalisations had a mean bed stay of 2.6 days (Table 13.3).

Place of occurrence

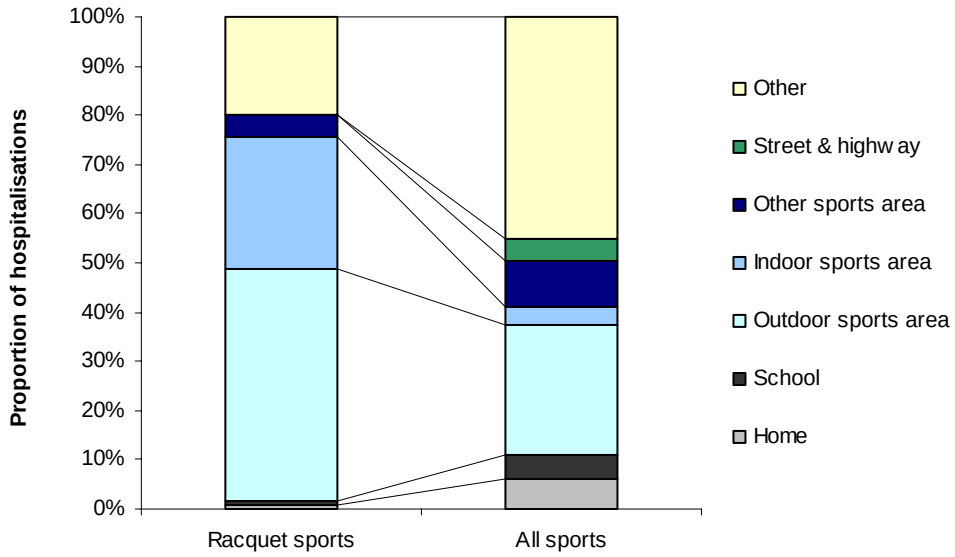


Figure 13.11: Hospitalisations due to racquet sports, by place of occurrence, Australia, 2002–2003

The majority of racquet sports injuries requiring hospitalisation happened at an outdoor (n=377, 47.1%) or an indoor (n=213, 26.6%) sports area (Figure 13.11).

Month of admission

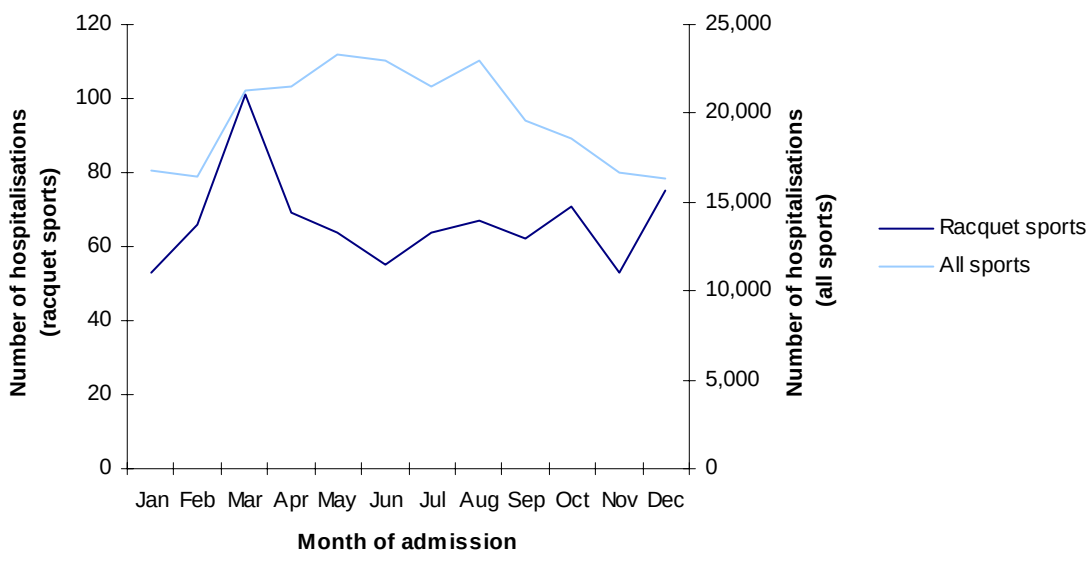


Figure 13.12: Hospitalisations due to racquet sports, by month of admission, Australia, 2002–2003

The peak incidence of racquet sports injury hospitalisations occurred in March with 101 (12.3%) cases. The trough was in January and November both with 53 cases each (6.6%) (Figure 13.12).

Discussion

The 63.1% of racquet sport related hospitalisations were due to tennis (n=505) and 24.3% (n=194) were due to squash. Participation data was only available for squash and racquetball combined. There were only 7 admissions due to racquetball. Squash and racquetball had a rate of hospitalisation per 100,000 participants (15 years and over) 1.8 times higher than tennis or badminton (58.2 versus 32.8 and 32.2 respectively). Chard and Lachmann found that squash players attended the Addenbrooke Sports Injury Clinic almost three times more frequently than badminton or tennis players, when numbers of participants is considered. However, frequency of participation is unknown (Chard & Lachmann 1987).

For the major racquet sports (excluding table tennis and ping pong) the majority of hospitalisations occurred in the 35–44 year age group with 24.0% of admissions (n=192) occurring in this age group. Table tennis and ping pong had the peak number of hospitalisations in the 65+ year age group with 45.8% (n=22) of admissions occurring in this age group. Tennis had higher numbers of hospitalisations occurring in the older age groups (35+ years) than in the younger age groups.

The lower limbs were the most frequent principal body part injured (59.0%), with 52.8% of the total due to knee and lower leg injury. Chard and Lachmann found that the lower limbs were most frequently injured with 58% of squash injury, 59% of badminton injury and 45% of tennis injury involving the lower limbs (Chard & Lachmann 1987). Berson et al. reviewed squash injuries and found that 48% involved the lower limb with 15.9% of total injuries involving the ankle and 15.9% the leg (Berson et al. 1981).

Muscle and tendon injury was the most common principal diagnosis (n=290, 38.5%). Berson et al. found that muscle strains (18.8%) were the second most common type of squash injury after non-orthopaedic injuries (Berson et al. 1981). Høy et al. found that almost 55% of badminton injuries were strains (Høy et al. 1994).

Falls accounted for 33.4% of racquet sport related hospitalisations. The peak incidence of racquet sport related admissions was in March (n=101, 12.3%).

14 Walking and running

U56.1, U56.2, U56.31, U56.32, U56.4, U56.5

Walking was the most popular sports and recreation activity, for those 15 years and over, in 2001–2003 with 5,905,600 participants in walking and 902,500 participants in bush walking in 2003. Running was the seventh most popular sports and recreation activity, for those 15 years and over, in 2001–2003 with 1,181,100 participants in 2003. (Australian Sports Commission 2003)

Jennings 2000 reviewed running injuries. Most injuries involve the lower limb (especially the knee) with an annual incidence between 25–75%. The majority (50–75%) of injuries are overuse injuries (Jennings 2000). McGrath and Finch reviewed running injuries and their prevention. 25% of running injuries involve the knee. The majority of injuries (70–80%) result from the knee downward action (McGrath & Finch 1996).

Taunton et al. 2002 reviewed 2,002 running related injuries seen at the Allan McGavin Sports Medicine Centre at the University of British Colombia, Canada. 46% of injuries were in males and 54% in females. Knee injury was most common (42.1%), followed by the foot/ankle (16.9%), the lower leg (12.8%), the hip/pelvis (10.9%), the Achilles/calf (6.4%), the upper leg (5.2%) and the lower back (3.4%) (Taunton et al. 2002).

Taunton et al. 2003 reviewed 844 subjects who attended Vancouver Sun Run 'In Training' Clinics between 1996 and 2000. These 13 week clinics are to help novices train for the 10 kilometre Vancouver Sun Run. 844 runners participated out of the 1,020 who enrolled at the 'In Training' Clinics. Participants completed a two page questionnaire. 75.2% of participants were female. 29.5% of the participants sustained an injury during the 13 week programme (n=249 injuries). The knee was the most commonly injured region (36% of men and 32% of women), followed by the shin (17% of men and 15% of women) and foot (14% of men and 13% of women) (Taunton et al. 2003).

Powell et al. 1998 used data from the Injury Control and Risk Survey in the USA and British Colombia in 1994. This was a telephone survey of those 18 years and over. There was a response rate of 56.1% with 5,238 completed interviews. 73.0% of respondents had participated in walking for exercise (66.3% of males and 79.1% of females). 70.6% of those 18–44 years and 76.2% of those 45+ years had participated in walking for exercise. 1.4% of participants had been injured (1.3% of males and 1.4% of females). 1.8% of participants 18–44 years and 0.9% of participants 45+ years had been injured (Powell et al. 1998).

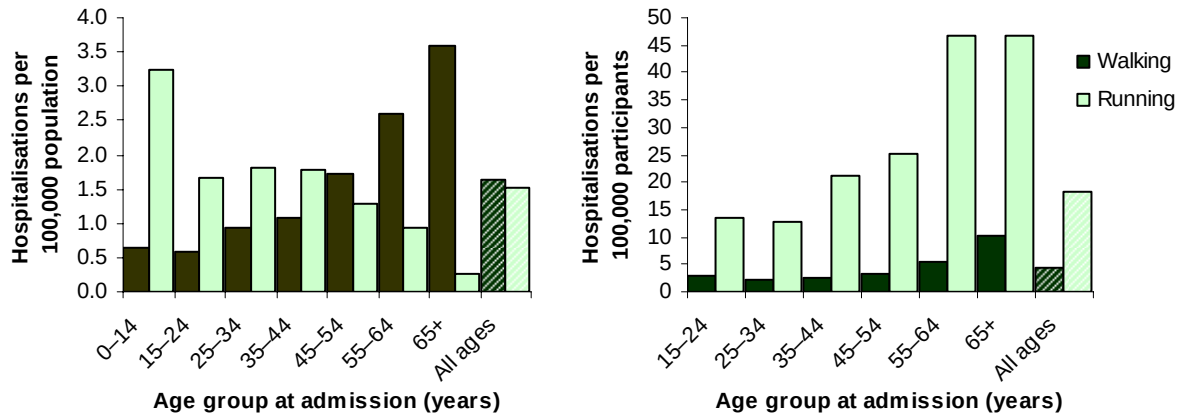
This report includes walking and running that has been coded as occurring whilst engaged in sports or leisure. In this report, walking includes bush walking and track and field related walking and running includes jogging, sprinting, middle and long distance running and marathon running but does not include orienteering.

Age

Table 14.1: Summary measures for walking and running related hospitalisations, by age group at admission, Australia, 2002–2003

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages (%)
Proportion of hospitalised sports (%):								
Walking	0.1	0.1	0.3	0.7	2.0	4.8	6.3	0.7
Running	0.6	0.4	0.6	1.1	1.5	1.7	0.5	0.7
Cases:								
Walking	17	16	25	32	50	62	120	322 (51.8)
Running	85	45	49	53	37	22	9	300 (48.2)
Estimated number of participants ('000)								
Walking‡	NA	521.1	1,162.0	1,348.6	1,499.9	1,112.6	1,164.0	6,808.1†
Running	NA	334.3	381.6	252.3	146.6	47.1	19.2*	1,181.1†
Rate/100,000 population								
Walking	0.6	0.6	0.9	1.1	1.7	2.6	3.6	1.6
Running	3.2	1.7	1.8	1.8	1.3	0.9	0.3	1.5
Rate/100,000 participants								
Walking‡	NA	3.1	2.2	2.4	3.3	5.6	10.3	4.5†
Running	NA	13.5	12.8	21.0	25.2	46.7	46.9*	18.2†

†Estimated number of participants and rate of hospitalisation per 100,000 participants excludes those less than 15 years (n=17 for walking and n=85 for running)
‡ The estimated number of participants for walking and rate of hospitalisation per 100,000 participants has been calculated from estimated number of participants in walking, bush and walking, other
* Estimate has a relative standard error of between 25% and 50% and should be used with caution.



Note: The hospitalisation rate per 100,000 participants excludes 17 walking and 85 running cases in those less than 15 years.
The hospitalisation rate per 100,000 running participants for those 65+ years has a relative standard error of between 25% and 50% and should be used with caution.
The estimated number of participants for walking has been calculated from estimated number of participants in walking, bush and walking, other.

Figure 14.1: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to walking and running, by age group at admission, Australia, 2002–2003

Walking had 5.8 times as many participants (15 years and over) than running. There were more hospitalisations related to walking (n=322, 51.8%) than running (n=300, 48.2%). However, the ratio of walking hospitalisations to running hospitalisations was 1.1:1 and the ratio of participants was 5.8:1 (Table 14.1 and Figure 14.1).

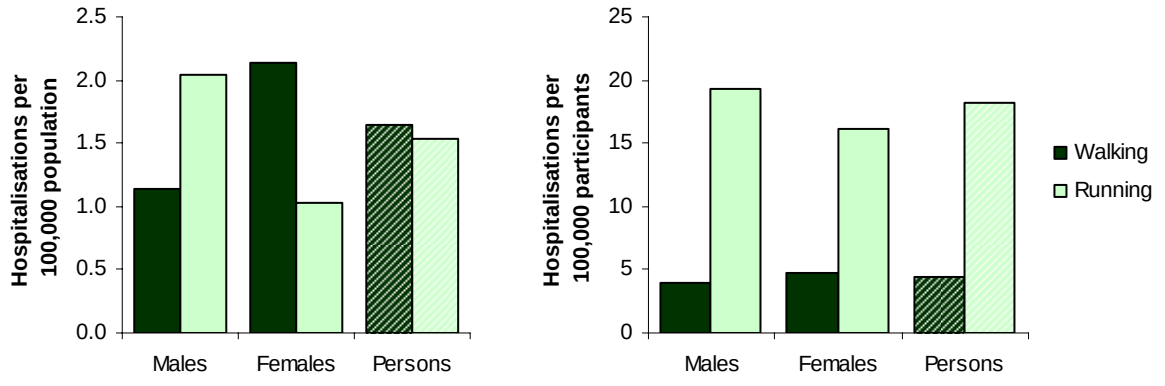
The highest number of hospitalisations due to walking was in the 65+ year age group (n=120, 37.3%). On the contrary, the highest number of running related hospitalisations was in the 0–14 year age group (n=85, 28.3%). The rate of hospitalisation per 100,000 participants (15 years and over) was highest in the 65+ year age group, with the peak rate of 10.3 for walking and 46.9 for running. For all ages (15 years and over) the rate of hospitalisation was 4.0 times higher for running than walking (18.2 versus 4.5) (Table 14.1 and Figure 14.1).

Sex

Table 14.2: Summary measures for walking and running related hospitalisations, by sex, Australia, 2002–2003

	Walking			Running		
	Males	**Females**	**Persons**	**Males**	**Females**	**Persons**
Proportion of hospitalised sport (%)	0.3	1.8	0.7	0.6	0.9	0.7
Cases (%)	111 (34.5)	211 (65.5)	322 (100)	199 (66.3)	101 (33.7)	300 (100)
Estimated number of participants ('000)[†‡]	2,548.4	4,259.9	6,808.1	779.8	401.3	1,181.1
Rate/100,000 population	1.1	2.1	1.6	2.0	1.0	1.5
Rate/100,000 participants[†‡]	4.0	4.8	4.5	19.2	16.2	18.2

[†] The estimated number of participants and the hospitalisation rate per participant excludes those less than 15 years (n=17 walking and n=85 running cases).
[‡] The estimated number of participants and rate per 100,000 participants for walking have been calculated from estimated number of participants in walking, bush and walking, other.

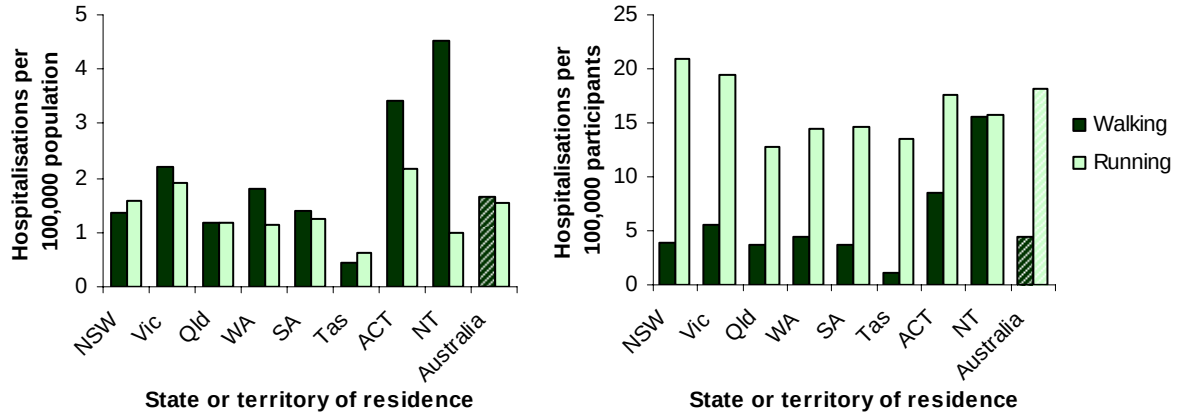


Note: Hospitalisation rate per participation excludes 17 walking and 85 running cases in those under 15 years

Figure 14.2: Hospitalisation rate due to walking and running, by sex, per 100,000 population and per 100,000 participants (15 years and over) Australia, 2002–2003

Walking had a higher number of female participants (n=4,259,900) than male participants (n=2,548,400) by 1.7 times (for those 15 years and over). Running had a higher number of male participants (n=779,800) than female participants (n=401,300) by 1.9 times (for those 15 years and over). There were more hospitalisations for walking (65.5% females) than running (66.3% males). The rate of hospitalisation per 100,000 participants was much higher in running than walking (18.2 versus 4.5). The rate of hospitalisation per 100,000 participants was higher for female walkers than male walkers (4.8 versus 4.0), however, the rate of hospitalisation per 100,000 participants was higher for male runners than female runners (19.2 versus 16.2) (Table 14.2 and Figure 14.2).

State or territory of residence



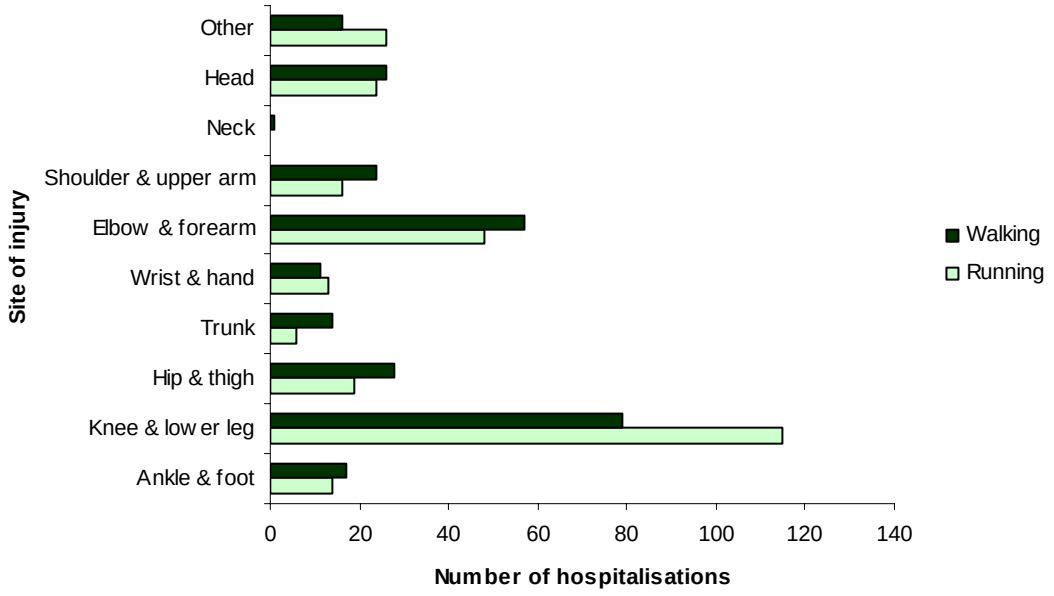
Note: Horizontal bar represents the hospitalisation rate for Australia as a whole.
The hospitalisation rate per 100,000 participants excludes 17 cases of walking injury in those under 15 years.
There were 2 cases with unreported state or territory of residence but none in those under 15 years.
Participation rates for walking have been calculated from values for bush walking and walking other in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).

Figure 14.3: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to walking and running, by state or territory of residence, Australia, 2002–2003

The hospitalisation rate per 100,000 population for walking was highest for the NT (4.5) and lowest for Tasmania (0.4) which compares with 1.6 for Australia as a whole. The NT also had the highest rate of hospitalisation per 100,000 participants (15 years and over) with 15.6 compared with 4.5 for Australia as a whole (Figure 14.3).

The ACT had the highest rate of hospitalisation per 100,000 population for running with 2.2, compared with 1.5 for Australia as a whole. However, NSW had the highest rate of running related hospitalisation per 100,000 participants (15 years and over) with 20.9 compared with 18.2 for Australia as a whole (Figure 14.3).

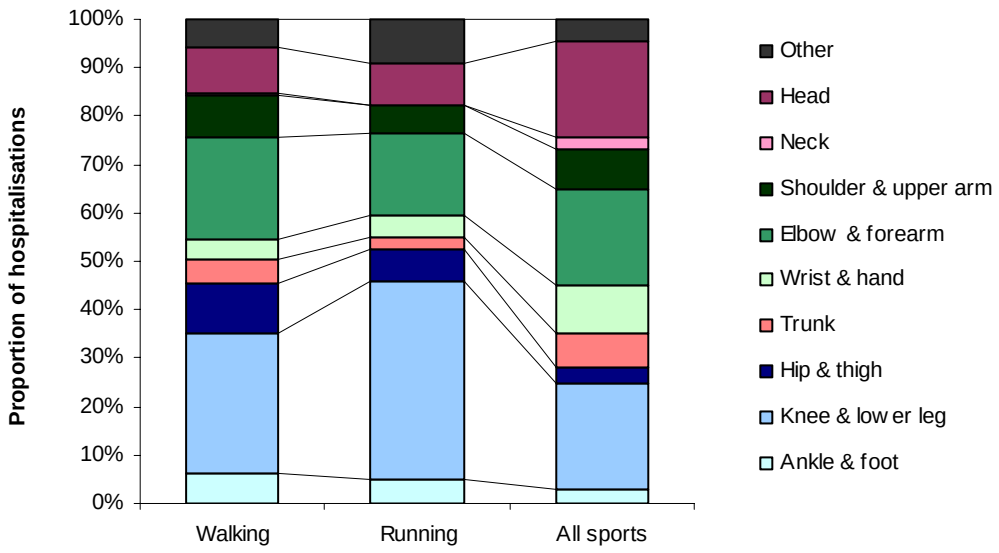
Body region



Note: Excludes 49 walking cases and 19 running cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

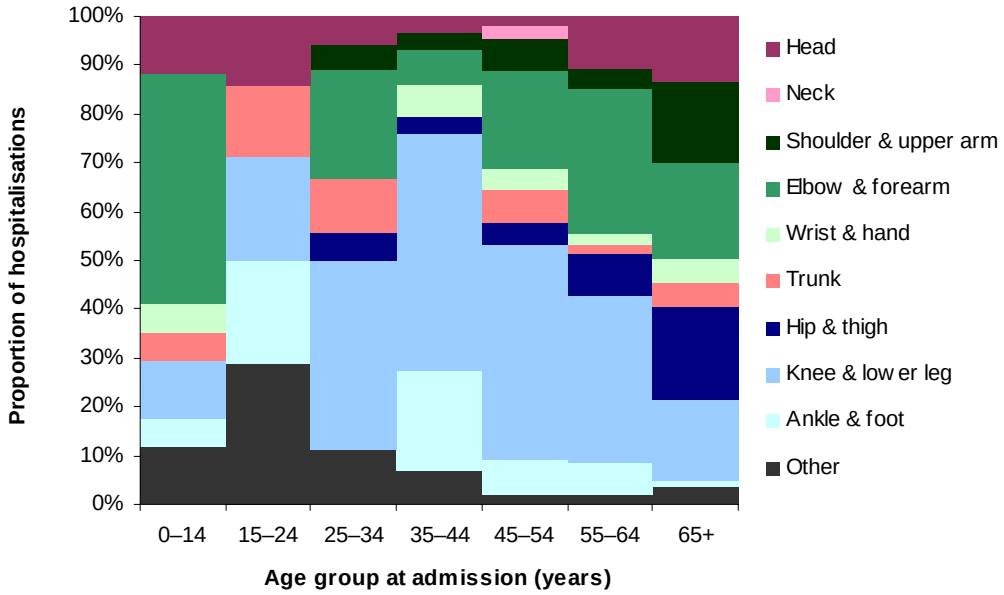
Figure 14.4: Hospitalisations due to walking and running injury, by principal body region injured, Australia, 2002–2003

For both walking and running, the knee and lower leg was the most common principal body region injured, with 79 (24.5%) hospitalisations due to walking and 115 (38.3%) hospitalisations due to running. 20.7% of all sports related hospitalisations had knee and lower leg as the principal body region injured. For both walking and running the elbow and forearm was the next most common principal body region injured with 57 (17.7%) hospitalisations due to walking and 48 (16.0%) hospitalisations due to running (Figures 14.4 and 14.5).



Note: Excludes 49 walking cases, 19 running cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

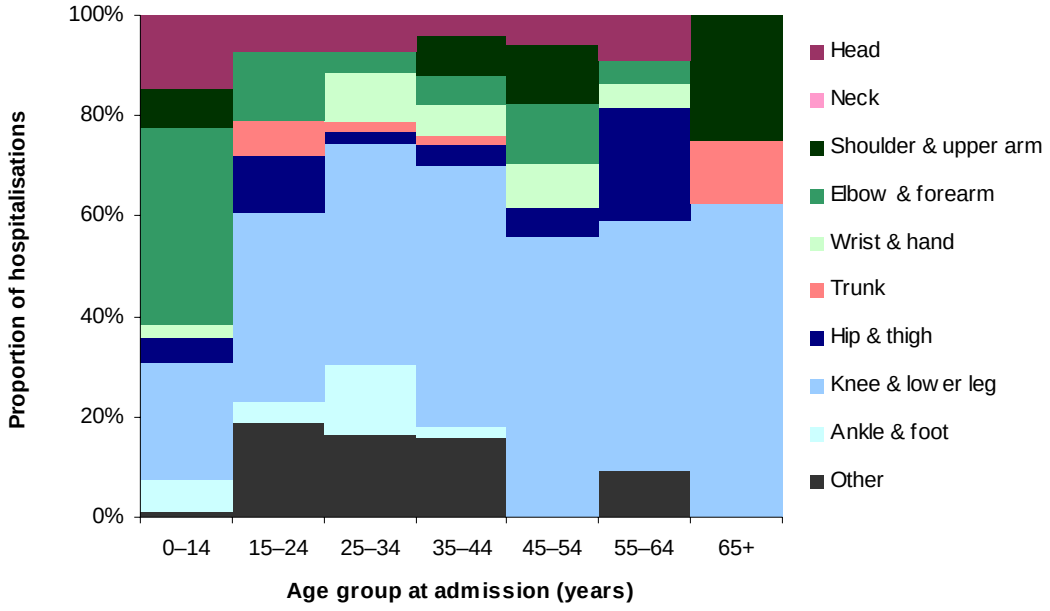
Figure 14.5: Hospitalisations due to walking, running and all sports, by principal body region injured, Australia, 2002–2003



Note: Excludes 49 walking cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 14.6: Hospitalisations due to walking, by age group at admission and principal body region injured, Australia, 2002–2003

Knee and lower leg was the most common principal region injured in those hospitalised for walking related reasons (n=79, 24.5%). Knee and lower leg injury (as principal body region injured) reached a peak in total numbers in the 45–54 year age group (n=20, 40.0%), but as a proportion of total injuries for the age group peaked in the 35–44 year age group (n=14, 43.8%). Elbow and forearm injury as the principal body region injured was most common in the 65+ year age group (n=20, 16.7%) but in terms of the proportion of all walking related injury, the 0–14 year age group had the highest proportion with 47.1% (n=8) (Figure 14.6).

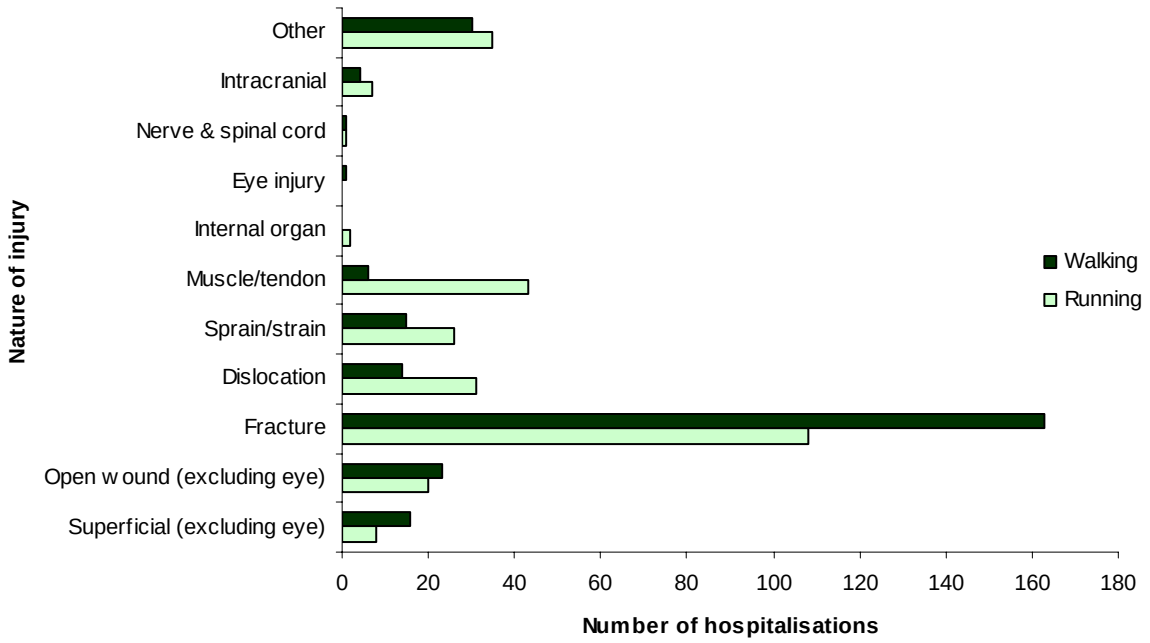


Note: Excludes 19 running cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 14.7: Hospitalisations due to running, by age group at admission and principal body region injured, Australia, 2002–2003

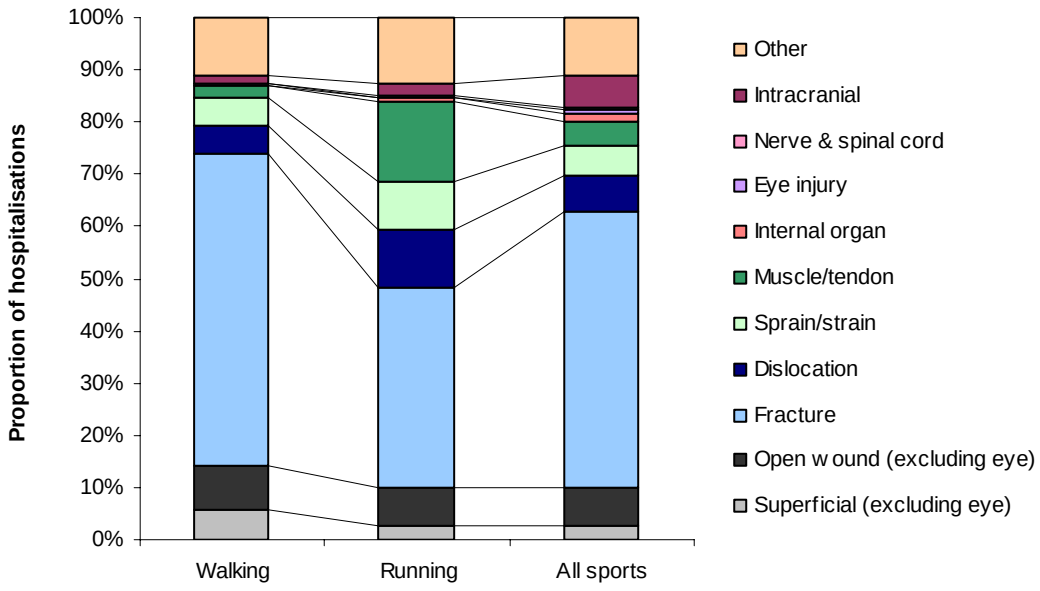
The knee and lower leg was the most common principal body region injured in those hospitalised for running related reasons (n=115, 38.3%). Knee and lower leg injury reached a peak as a proportion of hospitalisations in the 65+ year age group (n=5, 55.6%) but in terms of numbers the highest number of running knee and lower leg related hospitalisations (as principal body region injured) was in the 35–44 year age group (n=26, 49.1%). Elbow and forearm injury as principal body region injured, peaked in the 0–14 year age group (n=32, 37.6%) (Figure 14.7).

Nature of injury



Note: Excludes 49 walking cases and 19 running cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 14.8: Hospitalisations due to walking, running and all sports, by nature of injury, Australia, 2002–2003



Note: Excludes 49 walking cases, 19 running cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 14.9: Hospitalisations due to walking, running and all sports, by nature of injury, Australia, 2002–2003

For both walking and running a fracture was the most common principal diagnosis in persons hospitalised, with 163 (59.7%) fracture hospitalisations in walking and 108 (38.4%) fracture hospitalisations in running. 52.8% of all sport related hospitalisations had a fracture as the principal diagnosis (Figures 14.8 and 14.9).

Mechanism of injury

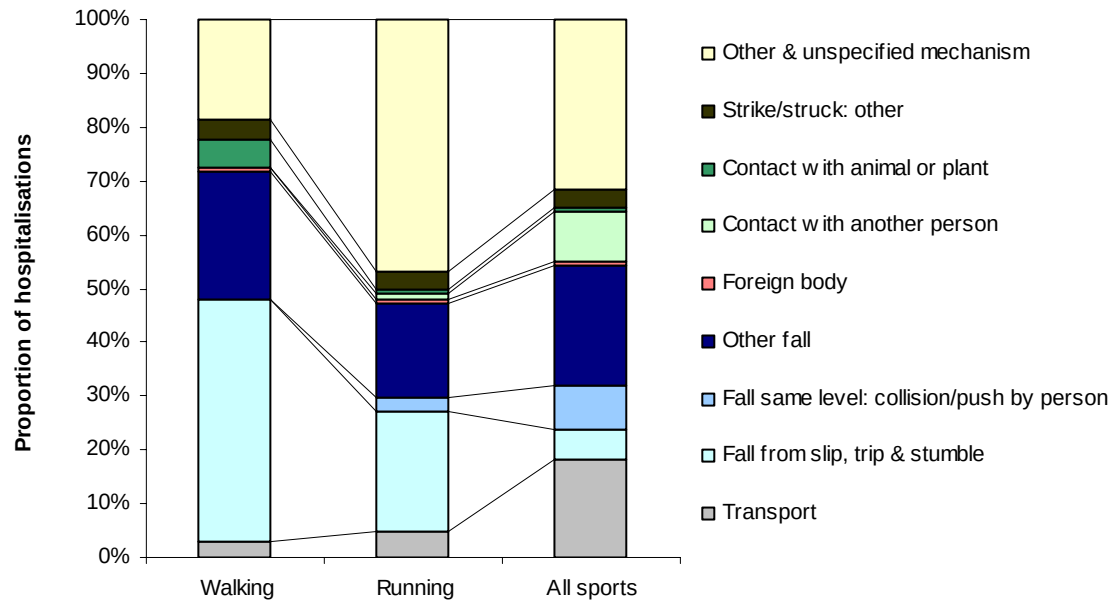


Figure 14.10: Hospitalisations due to walking and running, by mechanism of injury, Australia, 2003–2003

36.0% of all sport related hospitalisations were due to falls. 68.6% (n=221) of walking related hospitalisations had a fall as the mechanism of injury, with 144 of these from slipping, tripping or stumbling. 42.3% (n=127) of running related hospitalisations were due to falls with 66 of these from slipping, tripping or stumbling. There were 141 hospitalisations related to running with other and unspecified mechanism (Figure 14.10).

Length of stay

Table 14.3: Walking, running and all sport related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]
Walking	712	6.4	1,220	5.8	1,932	6.0
Running	458	2.3	174	1.7	632	2.1
All sports	85,269	2.5	32,720	2.8	117,989	2.6

[†] This is total bed days, including inward transfers.
[††] This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Walking had a mean bed stay of 6.0 days versus 2.1 days for running and 2.6 days for all sports related hospitalisations. The bed stay for walking was 2.3 times longer than for all sport related hospitalisations (Table 14.3).

Place of occurrence

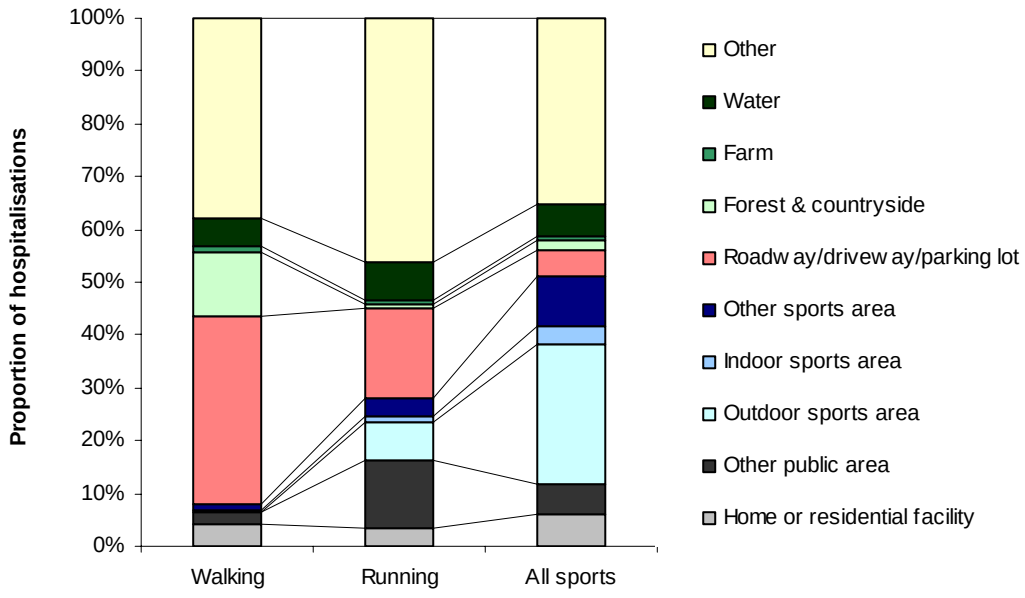


Figure 14.11: Hospitalisations due to walking, running and all sports, by place of occurrence, Australia, 2002–2003

35.4% (n=114) of walking and 17.0% (n=51) of running related hospitalisations occurred on the roadway/driveway/parking lot compared with only 4.6% of all sport related hospitalisations. There were large numbers of hospitalisations occurring at other locations (n=122 for walking and n=139 for running) (Figure 14.11).

Month of admission

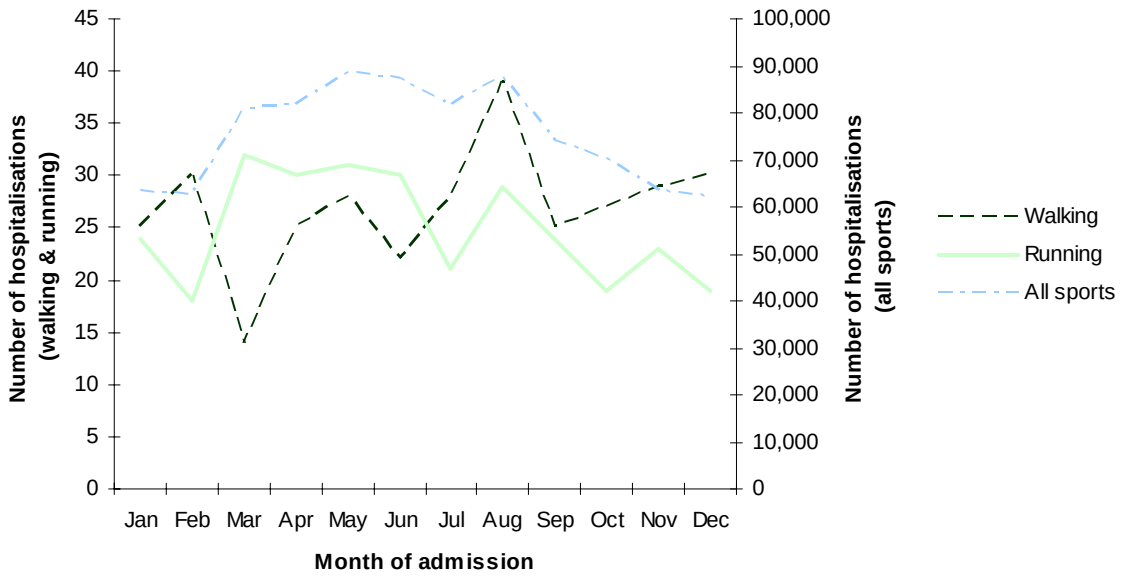


Figure 14.12: Hospitalisations due to walking, running and all sports, by month of admission, Australia, 2002–2003

The peak number of hospitalisations related to walking occurred in August with 39 hospitalisations (12.1%) and the trough was in March with 14 hospitalisations (4.3%). The peak number of hospitalisations related to running occurred in March with 32 cases (10.7%) and May with 31 cases (10.3%) and the trough was in February with 18 cases (6.0%) (Figure 14.12).

Discussion

Walking had 5.8 times as many participants (15 years and over) as running. Reflecting the larger number of walkers, there were more hospitalisations related to walking (n=322, 51.8%) than running (n=300, 48.2%). However, the ratio of walking to running hospitalisations was 1.1:1.

Walking is primarily a sport of middle aged and older persons with the peak number of participants (15 years and over) in the 45–54 year age group (estimated 1,499,900 participants). Whereas, running is primarily a sport of young adults with the peak number of participants (15 years and over) in the 25–34 year age group (estimated 381,600 participants) (Australian Sports Commission 2003). The highest number of hospitalisations was in the 65+ year age group for walking and in the 0–14 year age group for running. The highest rate of hospitalisation per 100,000 participants (15 years and over) for walking and running was in the 65+ year age group.

Hospitalisations in walkers were predominately female (65.5%), whereas, hospitalisations in runners were predominately male (66.3%). The rate of hospitalisation per 100,000 participants was higher in female than male walkers (4.8 versus 4.0) but lower in female than male runners (16.2 versus 19.2).

The knee and lower leg was most commonly the principal body region injured. 24.5% of walking related hospitalisations and 38.3% of running related hospitalisations involved the knee and lower leg as the principal body region injured. Taunton et al. found that 42.1% of running related injuries

involved the knee (Taunton et al. 2002). McGrath and Finch report that 25% of running injuries involve the knee (McGrath & Finch 1996).

59.7% of persons hospitalised due to walking and 38.4% of persons hospitalised due to running had sustained a fracture as the principal diagnosis. 68.6% of walking and 42.3% of running hospitalisations were due to falls.

15 Combative sports

U61

2.3% of the Australian population (15 years and over) participated in martial arts in 2003 (2.0% of males and 2.7% of females). It was most popular in those 15–24 years with 5.1% of the Australian population participating, followed by those 25–34 years with 3.2% participating (Australian Sports Commission 2003). 4.9% of children, 5–14 years (6.2% of males and 3.6% of females), participated in martial arts in the 12 months prior to interview in April 2003 (Australian Bureau of Statistics 2005). 0.4% of the Australian population (15 years and over) participated in boxing in 2003 (0.7% of males). The majority of those (15 years and over) who participated in boxing were in the 15–24 year age group (1.5% participation rate) (Australian Sports Commission 2003).

Martial Arts

Birrer and Halbrook 1988 reviewed martial arts injury data from 1980–1984 using the National Electronic Injury Surveillance System in the USA. There were 1,916 injuries reviewed in the study. This is an approximate injury rate of 16.9 injuries per 100,000 population. 75% of those injured were male and 28% were 5–14 years, 55% were 15–24 years, and 17% were 25–64 years. The majority of injuries were minor but 1% of injuries required hospitalisation, including 4 concussions, 2 liver/spleen injuries, 9 fractures (including spinal fractures), 2 retinal haemorrhages, and 1 case of nerve damage. There were no deaths. 46.9% of injuries involved the lower limb, 26.8% involved the upper limb, 18.2% involved the trunk and 6.5% the head/neck. Only 1.6% of injuries could be attributed to weapons. 35.6% of injuries were contusions/abrasions, 27.7% were strains/sprains, 15.3% were fractures/dislocations and 14.2% were lacerations (Birrer & Halbrook 1988).

Birrer 1996 performed a questionnaire study from 1976–1994 of all martial arts (including judo but excluding boxing) and review of the literature (Birrer 1996). 45,455 questionnaires were mailed with 41% returned. 36% of participants performed TaeKwon-Do, 31% karatedo, 8% gong–fu, 7% judo and 4% tai chi. The severity and rate of injuries was significantly ($p<0.005$) higher in males than females. Less experienced (less than one year) and younger participants (12–19 years) had higher rates of injury and more severe injuries. 74% of injuries were sustained whilst fighting (69% defender, 23% attacker and 8% both) but only 2% whilst using weapons (Birrer 1996).

40% of injuries involved the lower limb. The thigh was the most commonly injured (17%), followed by foot/toes (14%) and fingers/hand (11%). The head was injured in 3% of cases, the neck in 1% and the face in 8%. 43% of injuries were contusions, 27% sprains/strains, 13% abrasions/lacerations, 6% fractures, 5% dislocations and 6% other (Birrer 1996).

Severe injury (hospitalisation and more than four weeks training time lost) occurred in 1.7% of participants. Concussion was the most common type of severe injury (63%), followed by long bone fractures (11%). There were 6 deaths of which 4 were from head trauma, 1 from neck trauma (punch to carotid region) and 1 from chest trauma (Birrer 1996). Life–threatening injury occurred in 1 in 500 to 600 injuries. There were 9 cases of spinal fracture and 9 cases of testicular torsion (Birrer 1996).

Zetaruk et al. 2005 compared Shotokan karate, Olympic style TaeKwon-Do, Aikido, Kung Fu and Tai Chi. There were 263 participants in the survey (84% response rate). Injuries were most common

in TaeKwon-Do (59.2%), followed by Aikido (51.1%), Kung Fu (38.5%), Karate (29.8%) and Tai Chi (14.3%). Shotokan Karate and Kung Fu had similar injury rates and kinds of injury. Most injuries were minor. There was a significantly ($p<0.001$) lower risk of injury and of multiple injury for participants in Shotokan Karate compared with participants in TaeKwon-Do (Zetaruk et al. 2005). The risk of injury in TaeKwon-Do was three times the risk in Shotokan Karate. Participants in Shotokan Karate were significantly ($p<0.005$) less likely to sustain an injury to the head and neck than participants of TaeKwon-Do and Aikido (10% compared with 31% and 32% respectively). Injuries to the upper limb, lower limb and groin were significantly ($p<0.001$) more common in TaeKwon-Do participants compared with Shotokan Karate participants. Participants in Aikido were significantly ($p<0.001$) more likely than participants in Shotokan Karate to sustain upper limb injury. No significant difference was found between male and female participants. Zetaruk et al. found that those under 18 years had a significantly lower risk of injury than those over 18 years (Zetaruk et al. 2005).

Zazryn et al. 2003 reviewed injuries to professional kickboxers in Victoria from 1985–2001 using data from the Victorian Professional Boxing and Combat Sports Board database. The injury rate was 250.6 injuries per 1,000 fight participations (22%). 89.8% of injuries involved the head/neck/face and 7.4% of injuries involved the upper limbs. 15.9% of injuries were concussions (39.8 injuries per 1,000 fight participations). There were no deaths. The majority of injuries were open wounds (66.4%), followed by concussions (15.9%). Only 4.7% of injuries were fractures (Zazryn et al. 2003).

Protective equipment reduces the frequency and severity of injuries, but it is probably more beneficial to the attacker than to the defender (Birrer 1996).

Boxing

There is much debate on the ethics of boxing. Some doctors have called for it to be banned. Repeated blows to the head is the standard path to victory (Leclerc & Herrera 1999) and so there is an obvious risk of head injury. Jako argues that Amateur and Professional boxing should be considered separately, with amateur boxing being no more dangerous than any other contact sport (Jako 2002). Scoring points is the main objective in amateur boxing whereas in professional boxing a knockout is the objective. Head guards are compulsory in amateur boxing but prohibited in professional boxing. The ringside doctor suspends fights much more frequently in amateur boxing (Jako 2002). In amateur boxing there is a minimum of a 28 day break after a concussion. As repeated concussions or sub concussive blows may result in chronic traumatic brain injury, boxers who have repeated episodes of multiple blows to the head or knockouts, must have one year's rest period or perhaps enforced retirement (Jako 2002). However, chronic traumatic encephalopathy occurs in both amateur and professional boxers, although at a reduced frequency in amateur boxers (Moriarity et al. 2004).

Eye injury can also result from boxing. Boxers have a ten times higher incidence of serious ocular lesions than non-boxers (Vinger 2005).

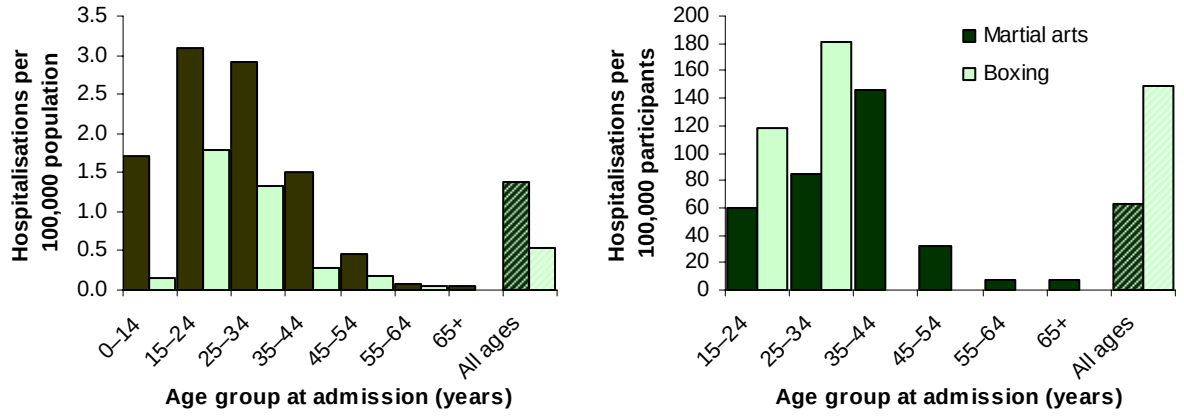
Age

Table 15.1: Summary measures for combative sports related injury hospitalisations in Australia, 2002–2003, by age group at admission

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages (%)
Proportion of hospitalised sports (%)	0.5	1.6	2.0	1.3	1.0	0.3	0.1	1.2
Cases: Combative sports[††]	74	205	158	62	24	4	…	529 (100)
Martial arts:								
Karate	18	24	31	24	5	…	…	105 (19.8)
TaeKwon-Do	14	19	11	…	0	0	0	47 (8.9)
Kick–boxing	…	19	14	…	…	0	0	40 (7.6)
Other martial arts	7	14	18	9	5	0	0	53 (10.0)
Wrestling	24	69	40	8	6	…	0	148 (28.0)
Boxing	4	49	36	8	5	…	0	103 (19.5)
Judo	4	8	5	6	…	0	…	25 (4.7)
Estimated number of participants ('000): [†]								
Martial arts	NA	138.7	93.3	30.9	39.9	29.5	29.0	361.3
Boxing	NA	41.2	19.9[*]	1.7[**]	1.8[**]	2.1[**]	0.0[**]	66.7
Rate/100,000 population:								
Combative sports	2.8	7.5	5.8	2.1	0.8	0.2	0.1	2.7
Martial arts	1.7	3.1	2.9	1.5	0.4	0.1	0.1	1.4
Boxing	0.2	1.8	1.3	0.3	0.2	0.0	0.0	0.5
Rate/100,000 participants:								
Martial arts	NA	60.6	84.7	145.6	32.6	6.8	6.9	62.3[†]
Boxing	NA	118.9	180.9[*]	NA[‡]	NA[‡]	NA[‡]	NA[‡]	148.4[†]

[*] Estimate has a relative standard error of between 25% and 50% and should be used with caution.
[**] Estimate has a relative standard error of greater than 50% and is considered too unreliable for general use.
[†] The estimated number of participants and the rate of hospitalisation per 100,000 participants for all ages excludes those 0–14 years (n=80).
[‡] Rate per 100,000 participants is not shown for boxing in those 35+ years due to high uncertainty in participation data.
[††] Includes 8 cases not separately categorised.
Case numbers when n<4 are not shown.

For all types of combative sports the highest number of hospitalisations was in the 15–24 year age group with 38.7% of all combative sports hospitalisations occurring in this age group (n=205). This was also the age group with the highest estimated number of participants. For martial arts the highest rate of hospitalisation per 100,000 participants (15 years and over) was in the 35–44 year age group with 145.6 (Table 15.1 and Figure 15.1).



Note: The hospitalisation rate per 100,000 participants is not shown for boxing in those 35+ years due to high uncertainty in participation data. The hospitalisation rate per 100,000 participants for all ages excludes those less than 15 years (n=45 for martial arts and n=4 for boxing).

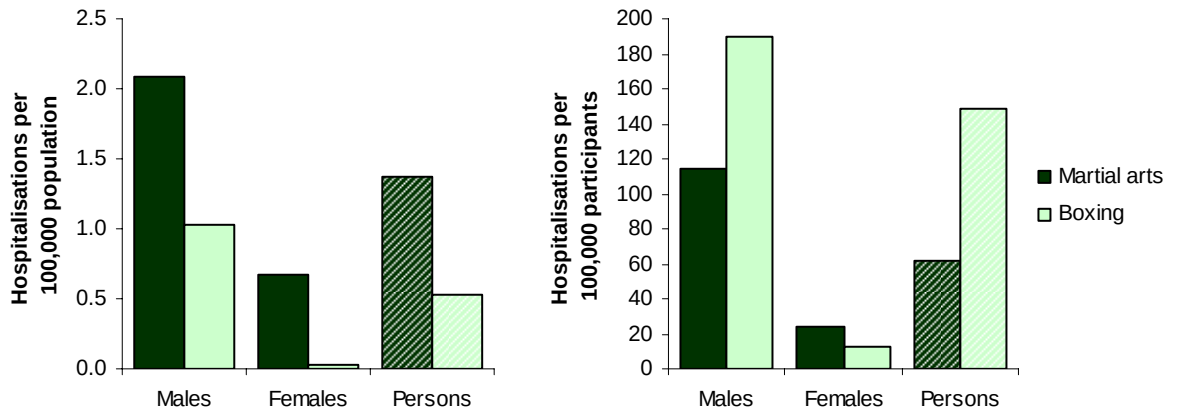
Figure 15.1: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to martial arts and boxing, Australia, 2002–2003, by age group at admission.

Sex

Table 15.2: Summary measures for combative sports related injury hospitalisations, by sex, Australia, 2002–2003

	Males (%)	Females (%)	Persons (%)
Proportion of hospitalised sports (%)	1.3	0.7	1.2
Cases: Combative sports[††]	450 (100)	79 (100)	529 (100)
Martial arts			
Karate	79 (17.6)	26 (32.9)	105 (19.8)
TaeKwon-Do	34 (7.6)	13 (16.5)	47 (8.9)
Kick–boxing	34 (7.6)	6 (7.6)	40 (7.6)
Other martial arts	37 (8.2)	16 (20.3)	53 (10.0)
Wrestling	140 (31.1)	8 (10.1)	148 (28.0)
Boxing	100 (22.2)	…	103 (19.5)
Judo	20 (4.4)	5 (6.3)	25 (4.7)
Estimated number of participants ('000)[†]			
Martial arts	151.9	209.4	361.3
Boxing	51.1	15.7[*]	66.7
Rate/100,000 population:			
Combative sports	4.6	0.8	2.7
Martial arts	2.1	0.7	1.4
Boxing	1.0	0.0	0.5
Rate/100,000 participants[†]			
Martial arts	114.5	24.4	62.3
Boxing	189.8	12.7[*]	148.4

[†] The estimated number of participants and the rate of hospitalisation per 100,000 participants excludes those less than 15 years (n=45 for martial arts and n=4 for boxing).
[††] Includes 8 cases not separately categorised.
[*] Estimate has a relative standard error of between 25% and 50% and should be used with caution.



Note: The hospitalisation rate per participation excludes 45 cases of martial arts related hospitalisation and 4 cases of boxing related hospitalisation in those under 15 years.
The hospitalisation rate per 100,000 participants for female boxers has a relative standard error of between 25% and 50% and should be used with caution.

Figure 15.2: Hospitalisation rate per 100,000 population, due to combative sports and per 100,000 participants (15 years and over) due to martial arts and boxing, by sex, Australia, 2002–2003

There were 5.7 times as many hospitalisations due to combative sports in males as in females with 450 hospitalisations in males and 79 hospitalisations in females. 31.1% of admissions in males were due to wrestling (n=140). In females, Karate was the most common type of hospitalised combative sport with 26 hospitalisations (32.9%). The rate of hospitalisation for martial arts, in those 15 years and over, was 4.7 times higher in males (114.5) than in females (24.4) (Table 15.2 and Figure 15.2).

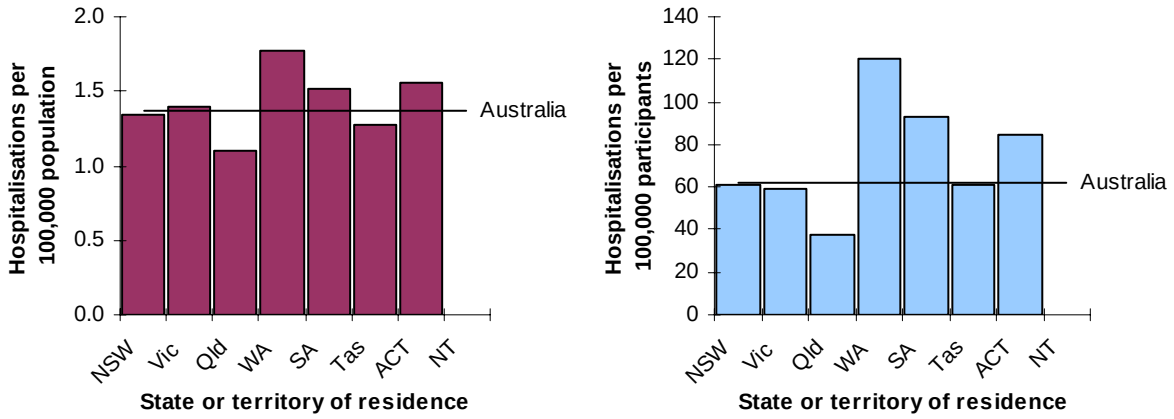
State or territory of residence

Note: There were 9 cases with unreported state or territory of residence. These have been included in the total for Australia as a whole.
The horizontal line represents the hospitalisation rate for Australia as a whole.

Figure 15.3: Hospitalisation rate per 100,000 population, due to combative sports, by state or territory of residence, Australia, 2002–2003

The ACT had the highest hospitalisation rate per 100,000 population for combative sports with 3.7 compared with the 2.7 for Australia as a whole. For martial arts alone, WA had the highest hospitalisation rate per 100,000 population with 1.8 compared with 1.4 for Australia as a whole. Participation data by state or territory was only available for martial arts and not for other types of combative sport. When rate of hospitalisation per 100,000 participants (15 years and over) is reviewed, WA still has the highest rate of hospitalisation for martial arts with 120.7 compared with

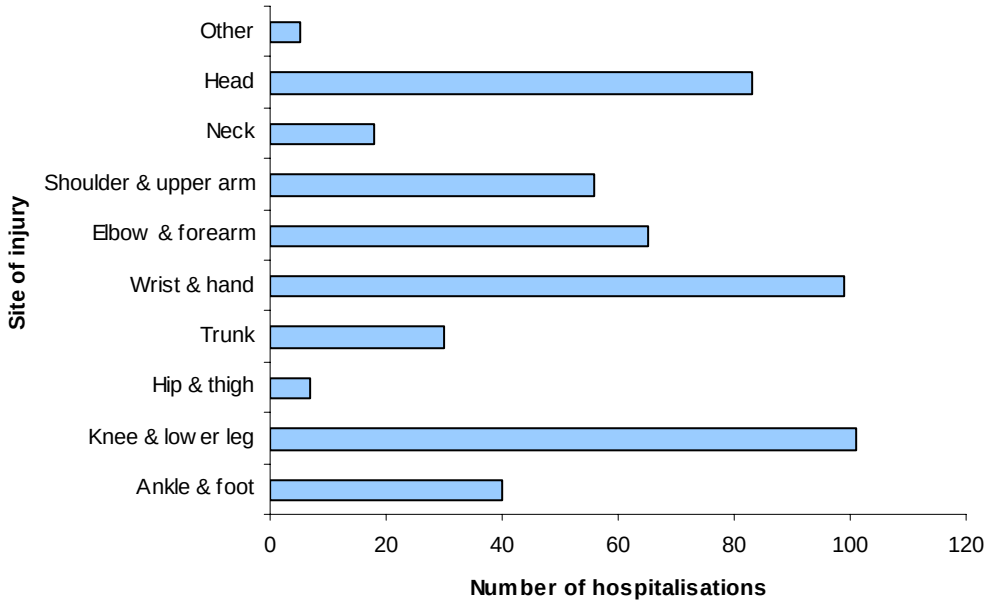
62.3 for Australia as a whole. There were no hospitalisations for martial arts in the NT (Figures 15.3 and 15.4).



Note: Participation data was only available for martial arts and not for other forms of combative sports.
There were 4 cases of martial arts with unreported state or territory of residence (but none in those less than 15 years). These have been included in the hospitalisation rate for Australia as a whole
Hospitalisation rate per 100,000 participants excludes 45 cases of martial arts hospitalisations in those less than 15 years.
The horizontal line represents the hospitalisation rate for Australia as a whole.

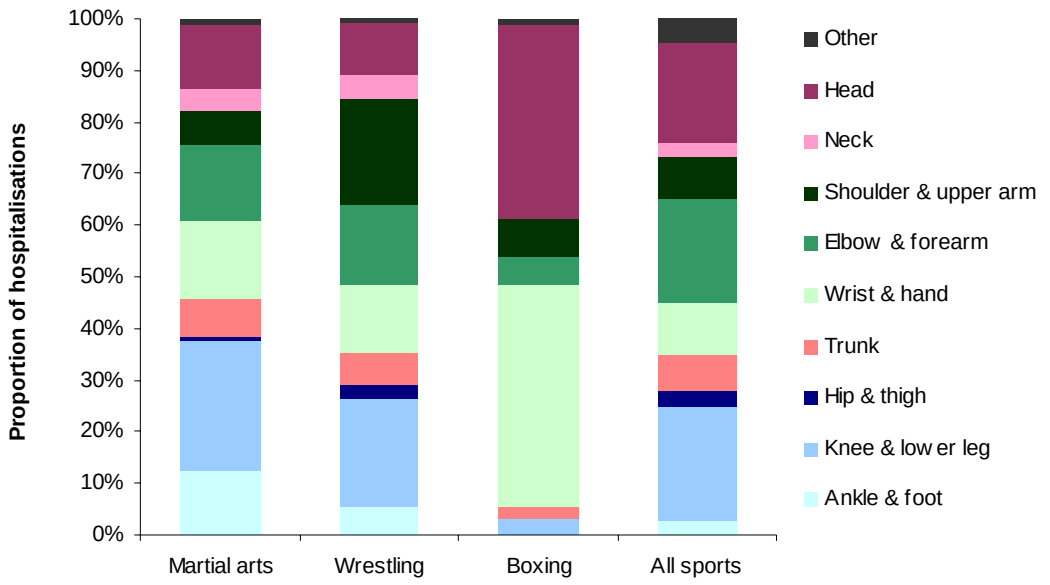
Figure 15.4: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to martial arts, by state or territory of residence, Australia, 2002–2003

Body region



Excludes 25 combative sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 15.5: Hospitalisations due to combative sports injury, by principal body region injured, Australia, 2002–2003

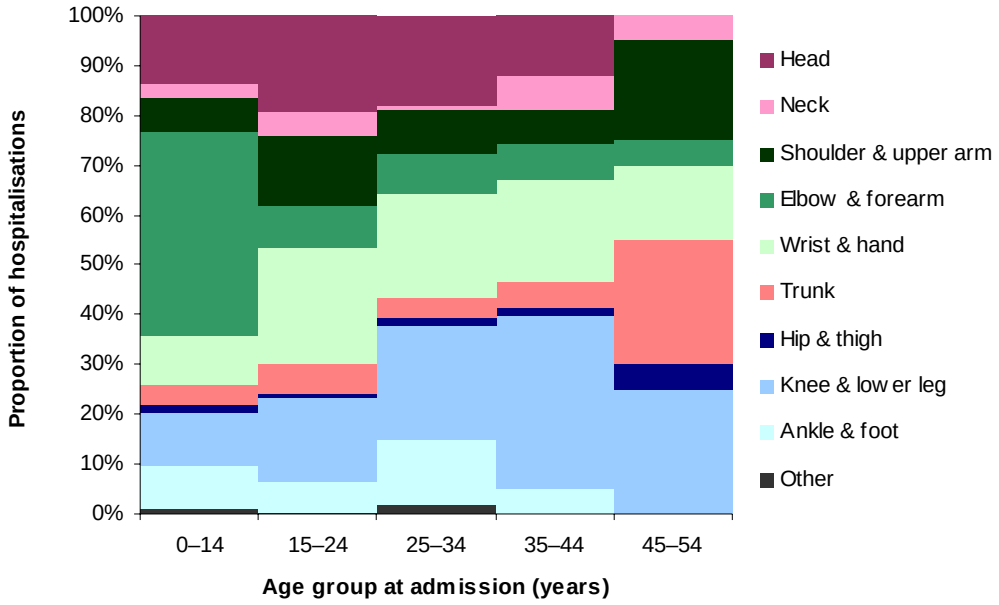


Note: Excludes 25 martial arts, wrestling and boxing cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 15.6: Hospitalisations due to combative sports and all sports, by principal body region injured, Australia, 2002–2003

When combative sports are viewed as a whole there is a much more even spread of principal body regions injured than in most sports, with knee and lower leg (n=101, 19.1%) and wrist and hand (n=99, 18.7%) injuries being most common. However, when boxing, martial arts and wrestling are compared a difference in body regions most frequently injured (and requiring hospitalisation) is noticed. In hospitalised boxing injury, there is a predominance of wrist and hand (n=40, 38.8%) and head (n=35, 34.0%) injures. In hospitalised martial arts injury there were similar numbers of lower limb (n=98, 36.3%) and upper limb (n=93, 34.4%) injuries, with the knee and lower leg being the most common principal body part injured (n=64, 23.7%). For hospitalised wrestling injury, knee and lower leg (n=31, 20.9%) and shoulder and upper arm (n=30, 20.3%) were most commonly the principal body parts injured (Figures 15.5 and 15.6).

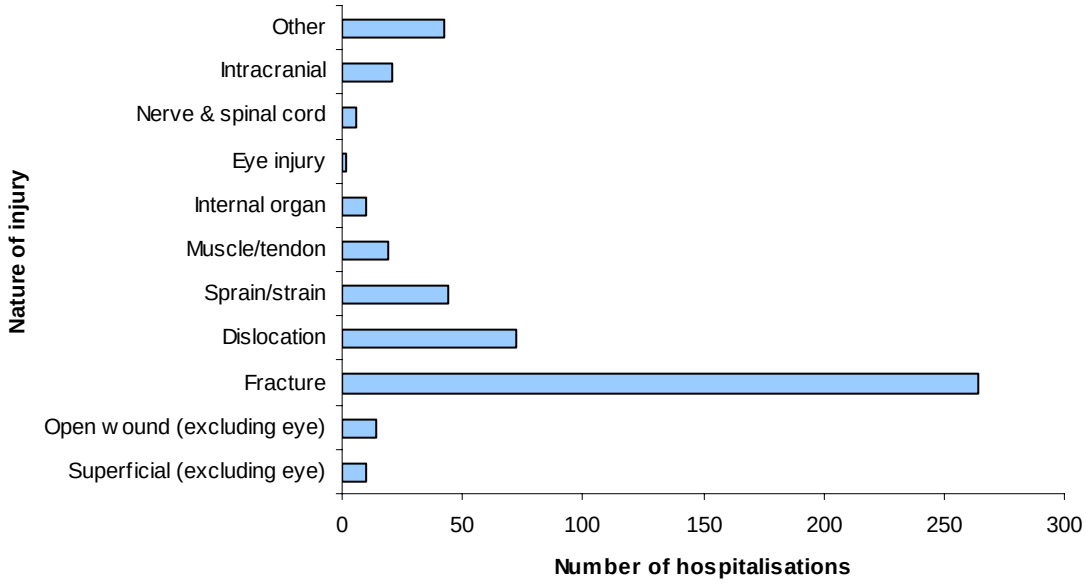
The number and percentage of elbow and forearm injury requiring hospitalisation is highest in the 0–14 year age group (n=30, 40.5%). The number of knee and lower leg injury as principal diagnosis reached a peak in terms of numbers in the 25–34 year age group (n=34, 21.5%) (Figure 15.7).



Note: Excludes 25 combative sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code. Injuries in those 55+ years are not shown due to low case numbers (n<4).

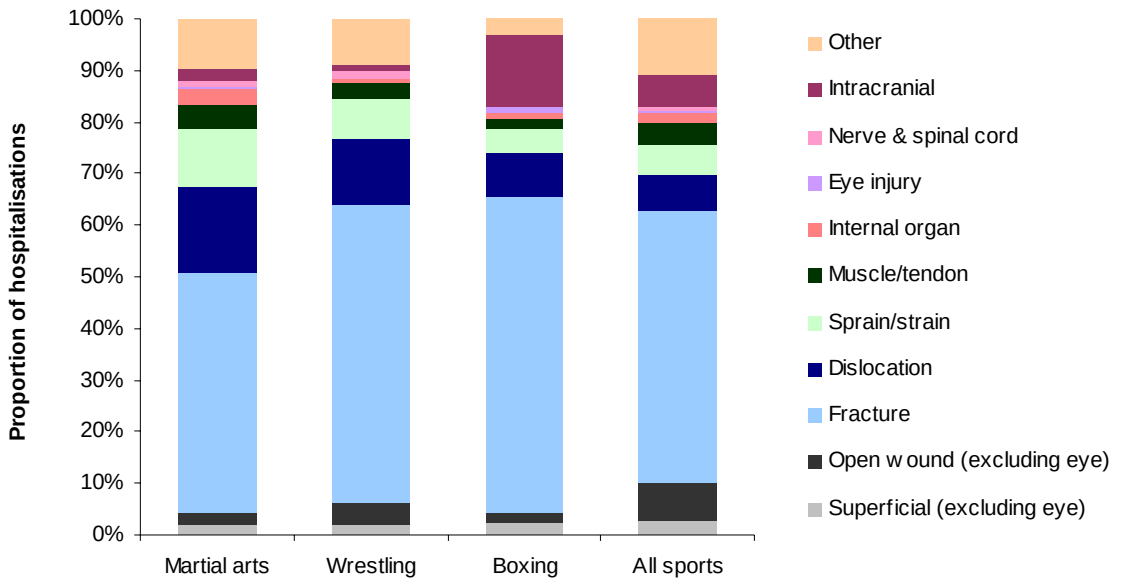
Figure 15.7: Hospitalisations due to combative sports injury, by age group at admission and principal body region injured, Australia, 2002–2003

Nature of injury



Note: Excludes 25 combative sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 15.8: Hospitalisations due to combative sports injury, by nature of injury, Australia, 2002–2003



Note: Excludes 25 martial arts, wrestling and boxing cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 15.9: Hospitalisations due to combative sports and all sports injury, by nature of injury, Australia, 2002–2003

Fractures were the most common type of principal diagnosis with 264 hospitalisations (52.4%), which was similar to the percentage for all sports (52.8%). Intracranial injury as the principal cause of admission was more common in boxing (n=13, 14.0%) than in martial arts (2.3%), wrestling (1.4%) and all sports (6.1%) (Figures 15.8 and 15.9).

Mechanism of injury

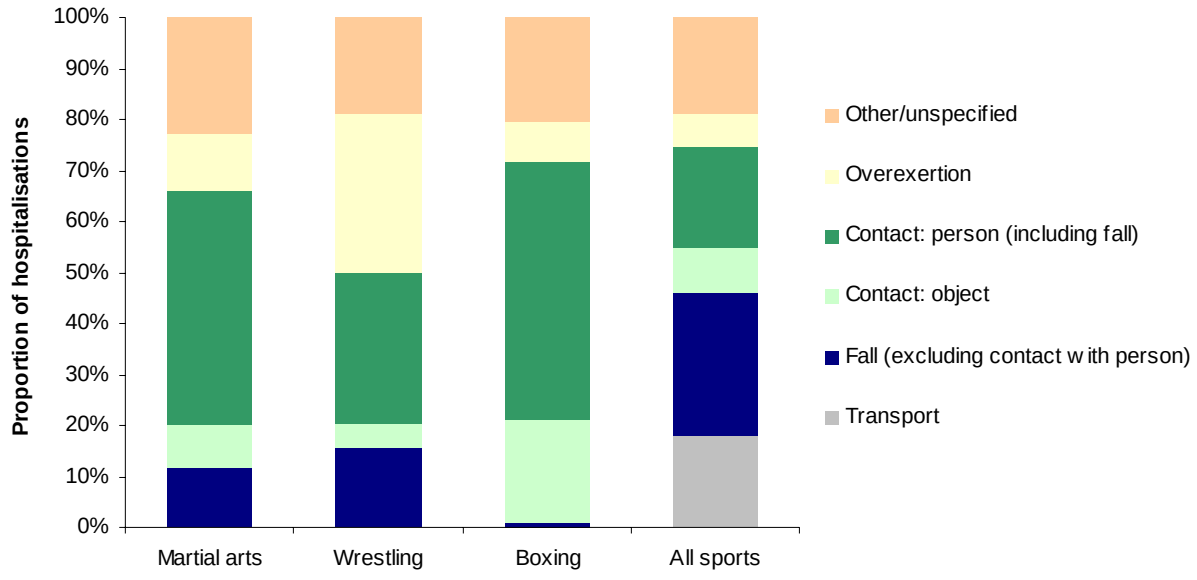


Figure 15.10: Hospitalisations due to combative sports and all sports, by mechanism of injury, Australia, 2003–2003

50.5% (n=21) of boxing admissions and 45.9% (n=124) of martial arts hospitalisations were due to contact with a person. Overexertion was the most common reason for admission in wrestling (n=46, 31.1%) (Figure 15.10).

Length of stay

Table 15.3: Combative sports and all sport related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]
Combative sports	821	1.8	101	1.3	922	1.7
All sports	85,269	2.5	32,720	2.8	117,989	2.6

[†] This is total bed days, including inward transfers.
[††] This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Combative sports had a shorter mean bed stay (1.7 days) compared with all sports related hospitalisations (2.6 days) (Table 15.3).

Place of occurrence

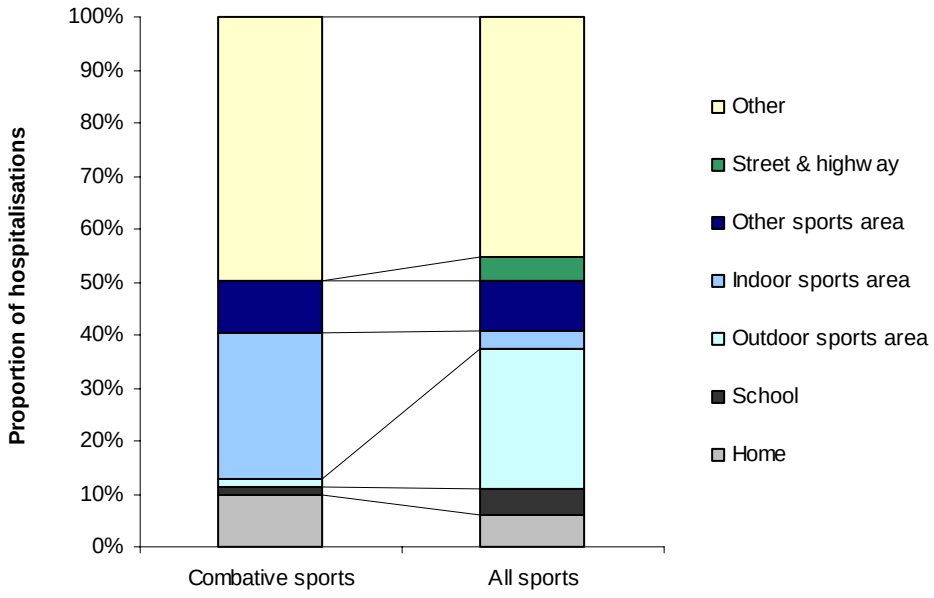


Figure 15.11: Hospitalisations due to combative sports and all sports, by place of occurrence, Australia, 2002–2003

27.8% of combative sports injury hospitalisations occurred in an indoor sports arena (n=147) compared with 3.7% for all sports related injury hospitalisations. A large proportion of combative sports injury hospitalisations occurred at other place (n=264, 49.9%) (Figure 15.11).

Month of occurrence

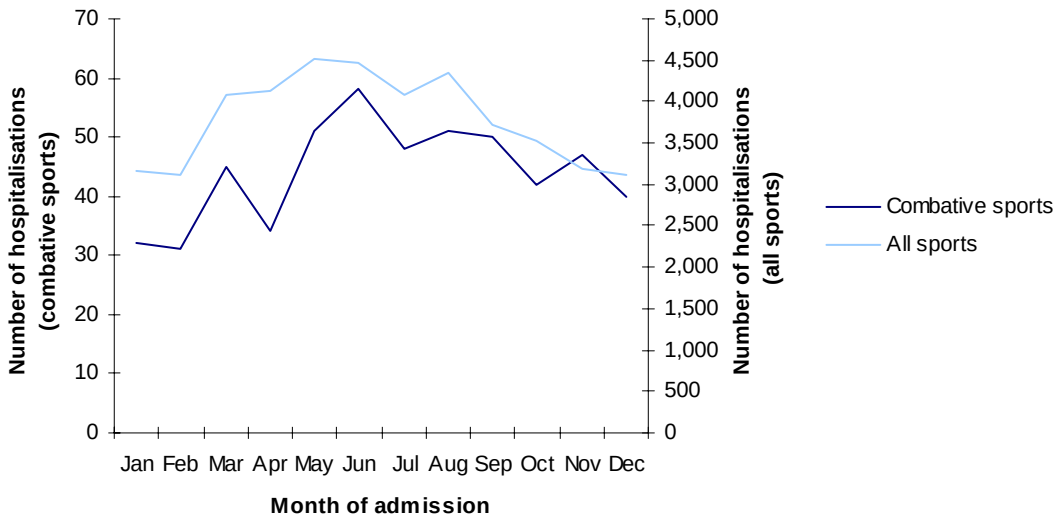


Figure 15.12: Hospitalisations due to combative sports and all sports, by month of admission, Australia, 2002–2003

Combative sports related hospitalised injuries were more evenly spread across the year than many sports. There was a peak in June with 58 cases (11.0%) and a trough in January and February with 32 and 31 cases respectively (Figure 15.12).

Discussion

The highest number of admissions for combative sports was in the 15–24 year age group (205, 38.8%). However, for martial arts the highest rate per 100,000 participants (15 years and over) was in the 35–44 year age group (145.6). Birrer and Halbrook found that 55% of persons injured in martial arts were 15–24 years (Birrer & Halbrook 1988).

85.1% (n=450) of hospitalisations for combative sports were in males. Birrer and Halbrook found that 75% of persons injured in martial arts were male (Birrer & Halbrook 1988). However, Zetaruk found no difference between male and female participants (Zetaruk et al. 2005).

Overall for combative sports, the knee and lower leg (19.1%) and the wrist and hand (18.7%) were most commonly the principal body region injured. For martial arts the knee and lower leg was most commonly injured (23.7%) and there were similar numbers of lower limb (n=98) and upper limb (n=93) injures. Birrer and Halbrook found that 46.9% of all martial arts injuries involved the lower limb and 26.8% involved the upper limb (Birrer & Halbrook 1988). Birrer found that 40% of all martial arts injuries involved the lower limb with the thigh being most commonly injured (17%), followed by the foot and toes (14%) (Birrer 1996).

Fractures were the most common type of principal diagnosis with 264 (52.4%) hospitalisations. Birrer found that only 6% of all injures were fractures, with contusions being the most common type of injury (43%) (Birrer 1996). However, this study included injuries which did not require medical treatment.

50.5% (n=21) of boxing admissions and 45.9% (n=124) of martial arts hospitalisations were due to contact with a person. 27.8% of combative sports injury hospitalisations occurred in an indoor sports arena (n=147).

Combative sports related hospitalised injuries were more evenly spread across the year than many sports. There was a peak in June with 58 cases (11.0%).

16 Gymnastics and trampolining

U57.0

3.5% of children (1.7% of males, 5.4% of females) participated in organised gymnastics and trampolining in the 12 months prior to interview in April 2003 (Australian Bureau of Statistics 2005).

Murphy 2000 studied trampoline injuries in Victoria using data from public hospital admissions (VIMD) from 1996–1998 and emergency presentations (VEMD) from 1995–1999. VEMD covers approximately 80% of Victorian emergency presentations. There were an approximately equal number of males and females injured. In Victoria, the majority (95%) of hospitalisations due to trampoline injuries occurred in children (0–14 years). In Victoria, 18.6 children per 100 000 are hospitalised each year (179 children on average) due to trampolining injuries (Murphy 2000).

The majority (almost 75%) of trampolining injuries requiring hospitalisation involved the upper limb, followed by 13% involving the head/face and 9% the lower limbs. The majority were fractures (80%), followed by intracranial injury (9%) and open wounds (6%) (Murphy 2000).

The majority (90.5%) of emergency presentations for trampoline related injuries were in those less than 15 years, with 41% being between 4 and 7 years (Murphy 2000). 41% of injuries involved the upper limbs, 22% the lower limbs and 19% the head and neck. 78% of upper limb injuries were fractures (mainly the forearm and elbow fractures). 19% of lower limb injuries were fractures (mainly the lower leg). 36% of emergency presentations were due to fractures, 22% due to sprain/strain and 12% due to open wounds. 2% of presentations were due to intracranial injury (Murphy 2000).

Falls were the most common mechanism of injury. 61% of injuries involved falls off the trampoline and 28% were falls whilst on the trampoline. In 20% of the falls whilst on the trampoline, the patient fell onto the frame or springs (Murphy 2000).

Meeusen and Borms 1992 reviewed gymnastic injuries. They found a large difference in the incidence of injuries reported by various studies (0.7% to 294%). There was a higher risk of injury with higher skill level. Sprains and strains were the most commonly reported injuries in most studies. The lower limb is more commonly injured than the upper limb with the ankle and knee being involved in 55% of cases. In common with any running or jumping sport most knee injuries are most commonly around the patellofemoral joint. Elbow and wrist overuse injuries are common in the upper limb. The trunk and spine is injured in 15–20% of cases (Meeusen & Borms 1992).

Kolt and Kirkby 1999 performed a prospective study on 64 female gymnasts (11–19 years) who were either elite (in contention for the national team) or sub-elite (competing at state and national competitions) in Australia. An injury booklet was completed weekly by the participants during the 18 month study, with a response rate of 86% (Kolt & Kirkby 1999).

There were 3.64 injuries per gymnast per year. All gymnasts sustained at least one injury during the study (Kolt & Kirkby 1999). 59.0% of injuries involved the lower limbs with 31.2% involving the ankle/foot and 13.5% the knee. This predominance could be because gymnasts perform multiple landings which are often from a great height after twisting and rotating. The upper limb was injured in 20.9% of cases with 9.7% of total cases being wrist/hand injuries. The spine/trunk was injured in 17.2% of cases. 29.7% of injuries were sprains, 23.2% of injuries were strains, 12.3% of injuries were growth plate injuries, 11.2% of injuries were inflammation and 8.3% of injuries were fractures. The majority (64.2%) of injuries were acute (50.3% in the elite group and 75% in the subelite group) (Kolt & Kirkby 1999).

Spinal injuries are uncommon but those that occur usually occur on the trampoline or mini-tramp. The majority occur on the trampoline from backwards or forwards somersaults (Hume 1999). Such injuries are more likely to occur in experienced gymnasts and trampolinists (Hume 1999). There were 2 reported cases of spinal injury from trampolining in Australia from 1986–1997, both occurred in adults, with 1 occurring whilst moving a trampoline (Murphy 2000).

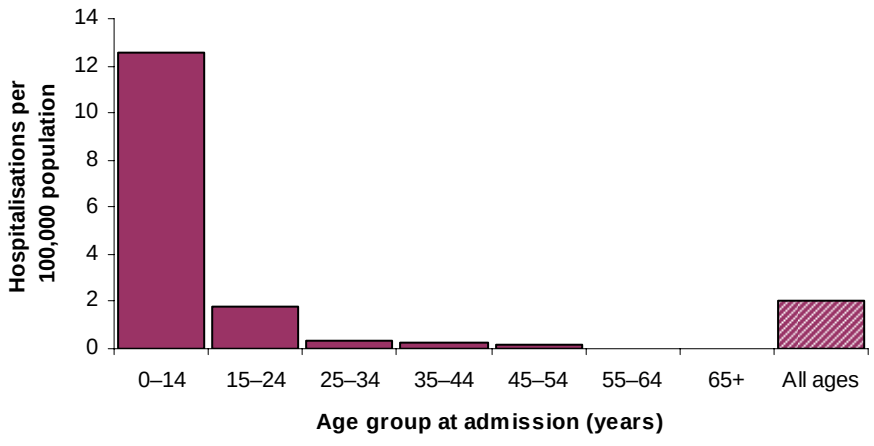
Age

Table 16.1: Summary measures for gymnastics and trampolining related hospitalisations, by age group at admission, Australia, 2002–2003

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages
Proportion of hospitalised sports (%)	2.3	0.4	0.1	0.2	0.2	0.0	0.0	0.9
Cases	328	49	10	7	6	0	0	400
Rate/100,000 population	12.5	1.8	0.4	0.2	0.2	0.0	0.0	2.0

An estimate of the number of participants was not available for gymnastics and trampolining in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).

The majority (82.0%) of gymnastics and trampolining injury occurs in the 0–14 year age group (n=328). Participation data from the Australian Bureau of Statistics, Year Book Australia, Culture and recreation, children's participation in organised sport, reports that 3.5% of those 5–14 years participate in gymnastics and trampolining giving a rate per 100,000 participants of 326.8 hospitalisations per 100,000 participants (Australian Bureau of Statistics 2005). Unfortunately, there is no participation data for gymnastics and trampolining in the Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003) (Table 16.1 and Figure 16.1).



Note: An estimated number of participants was not available in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).

Figure 16.1: Hospitalisation rate per 100,000 population, due to gymnastics and trampolining, by age group at admission, Australia, 2002–2003

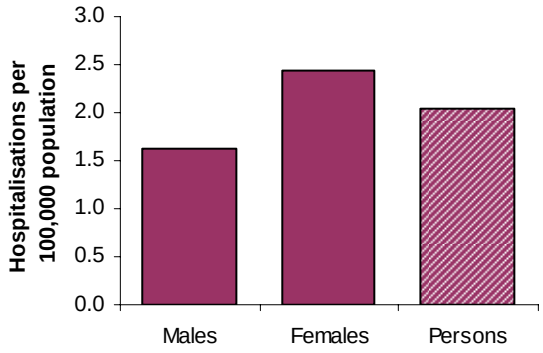
Sex

Table 16.2: Summary measures for gymnastics and trampolining hospitalisations, by sex, Australia, 2002–2003

	Males	Females	Persons
Proportion of hospitalised sports (%)	0.5	2.0	0.9
Cases: Gymnastics & trampolining (%)	158 (39.5)	242 (60.5)	400 (100)
Rate/100,000 population	1.6	2.4	2.0

An estimated number of participants was not available in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).

The majority (59.7%) of hospitalisations for gymnastics and trampolining occur in females. The rate per 100,000 population was 2.4 in females compared with 1.6 in males. Unfortunately, there is no participation data for gymnastics and trampolining in the Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003) (Table 16.2 and Figure 16.2).

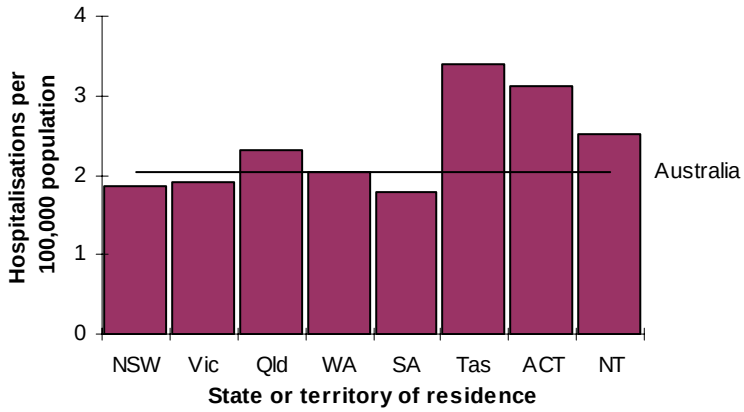


Note: An estimated number of participants was not available in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).

Figure 16.2: Hospitalisation rate per 100,000 population, due to gymnastics and trampolining, by sex, Australia, 2002–2003

State or territory of residence

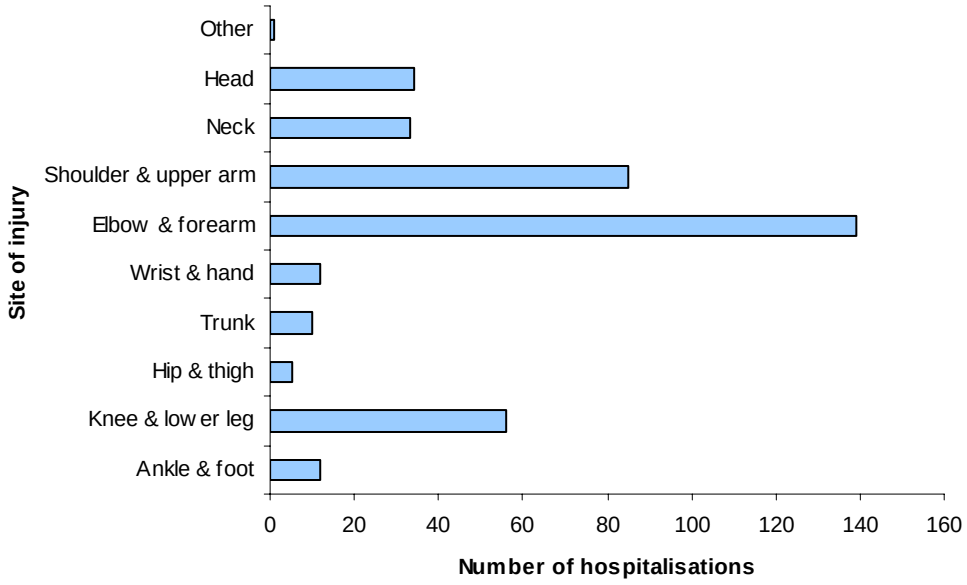
Tasmania had the highest rate of hospitalisation per 100,000 population for gymnastics and trampolining (3.4). The three states and territories with the lowest populations (Tasmania, ACT and NT) had the highest rates of gymnastics and trampolining injury. This could be because of the lower numbers of hospitalisations any year to year variation is more apparent (Figure 16.3).



Note: Horizontal bar represents the rate of hospitalisation for Australia as a whole.
There were no cases with unreported state or territory of residence.
An estimate of the number of participants was not available for gymnastics and trampolining in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).

Figure 16.3: Hospitalisation rate per 100,000 population due to gymnastics and trampolining, by state or territory of residence, Australia, 2002–2003

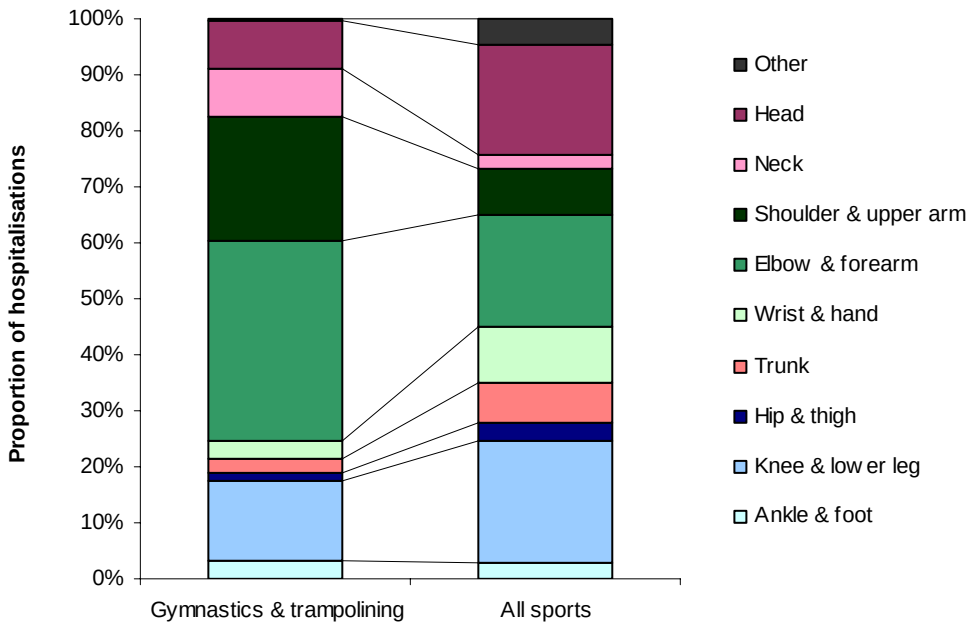
Body region



Note: Excludes 13 gymnastics and trampolining cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

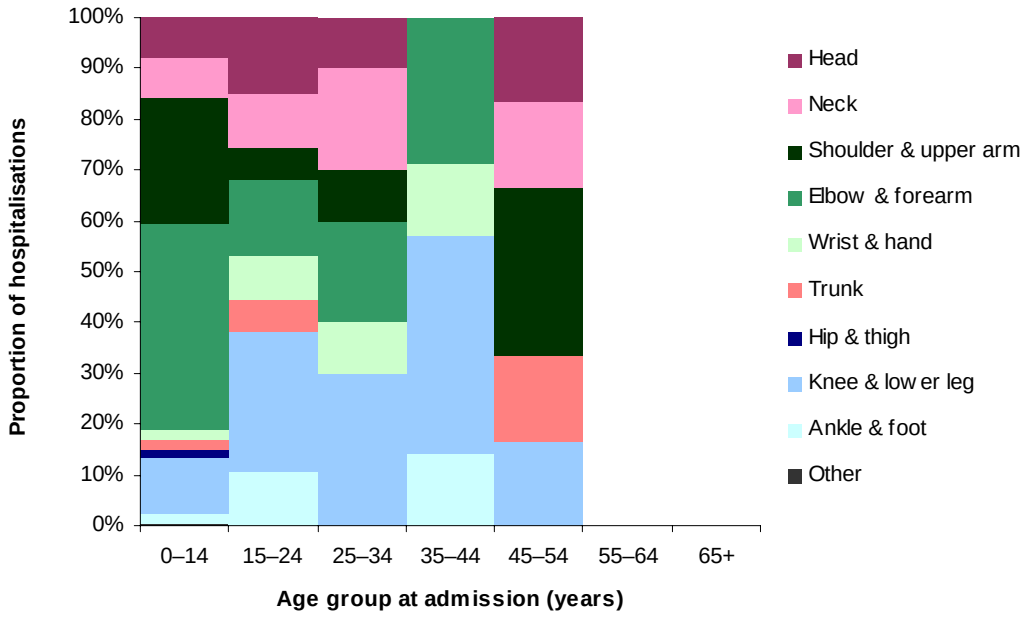
Figure 16.4: Hospitalisations due to gymnastics and trampolining injury, by principal body region injured, Australia, 2002–2003

The upper limb was the most common principal body region injured in those requiring hospitalisation due to gymnastics and trampolining. 34.8% (n=139) of gymnastics and trampolining related admissions involved the elbow and forearm compared with 19.1% of all sports related hospitalisations. 21.3% (n=85) of gymnastics and trampolining related hospitalisations involved the shoulder and upper arm compared with 7.8% of all sports related hospitalisations. Neck injury was more common in gymnastics and trampolining as compared with all sports related hospitalisations (n=33, 8.3% versus 2.3%). Head injury occurred in 34 (8.5%) of gymnastics and trampolining related hospitalisations (Figures 16.4 and 16.5).



Note: Excludes 13 gymnastics and trampolining cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 16.5: Hospitalisations due to gymnastics and trampolining and all sports, by principal body region injured, Australia, 2002–2003

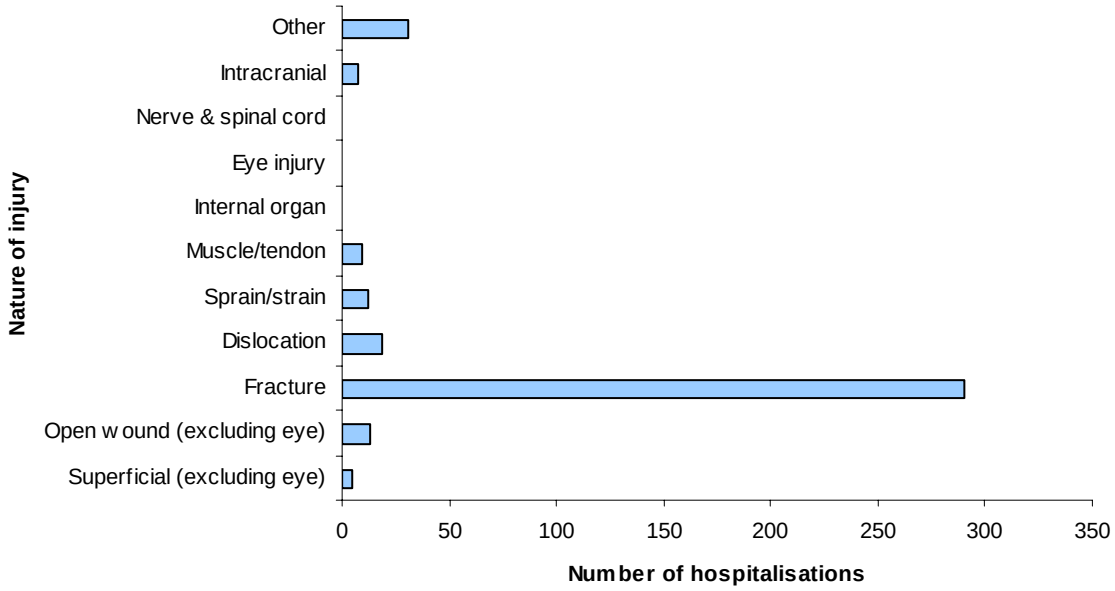


Note: Excludes 13 gymnastics and trampolining cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code. There were no injuries in those 55+ years.

Figure 16.6: Hospitalisations due to gymnastics and trampolining, by principal body region injury and age group at admission, Australia, 2002–2003

39.0% (n=128) of hospitalisations due to gymnastics and trampolining in the 0–14 year age group involved the elbow and forearm as the principal body region injured. The vast majority of gymnastics and trampolining injury occurs in this age group (n= 328, 82.0%). The knee and lower leg was the most common principal body region injured in those hospitalised in the 15–24 year age group (n=13, 26.5%) (Figure 16.6).

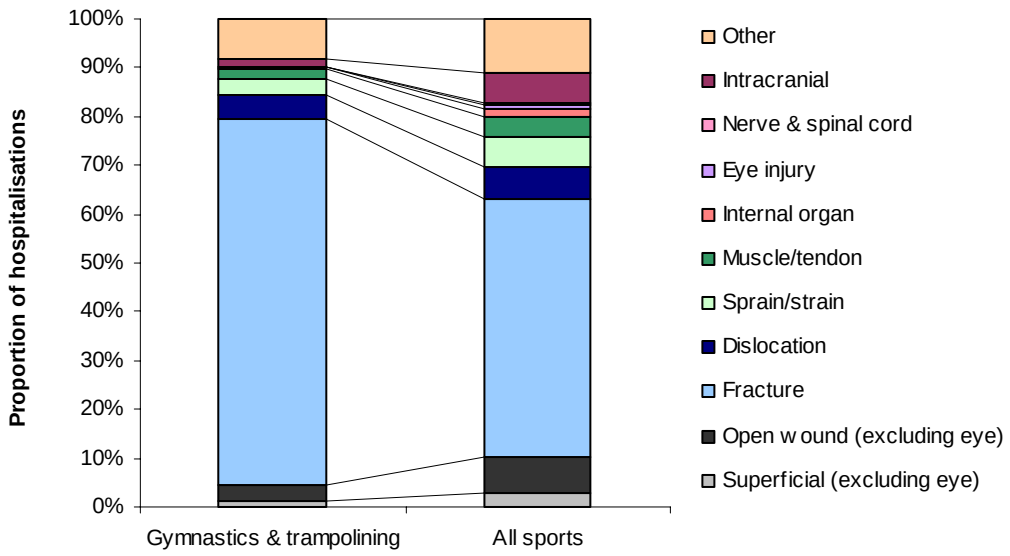
Nature of injury



Note: Excludes 13 gymnastics and trampolining cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 16.7: Hospitalisations due to gymnastics and trampolining, by nature of injury, Australia, 2002–2003

In the majority (74.9%) of persons hospitalised for gymnastics and trampolining the principal diagnosis was a fracture (n=290). This compares with 52.8% of all sports related hospitalisations having a principal diagnosis of a fracture. There were no hospitalisations with nerve and spinal cord related conditions as the principal diagnosis and only 1.8% (n=7) of hospitalisations were due to intracranial injury (Figures 16.7 and 16.8).



Note: Excludes 13 gymnastics and trampolining cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 16.8: Hospitalisations due to gymnastics and trampolining and all sports, by nature of injury, Australia, 2002–2003

Mechanism of injury

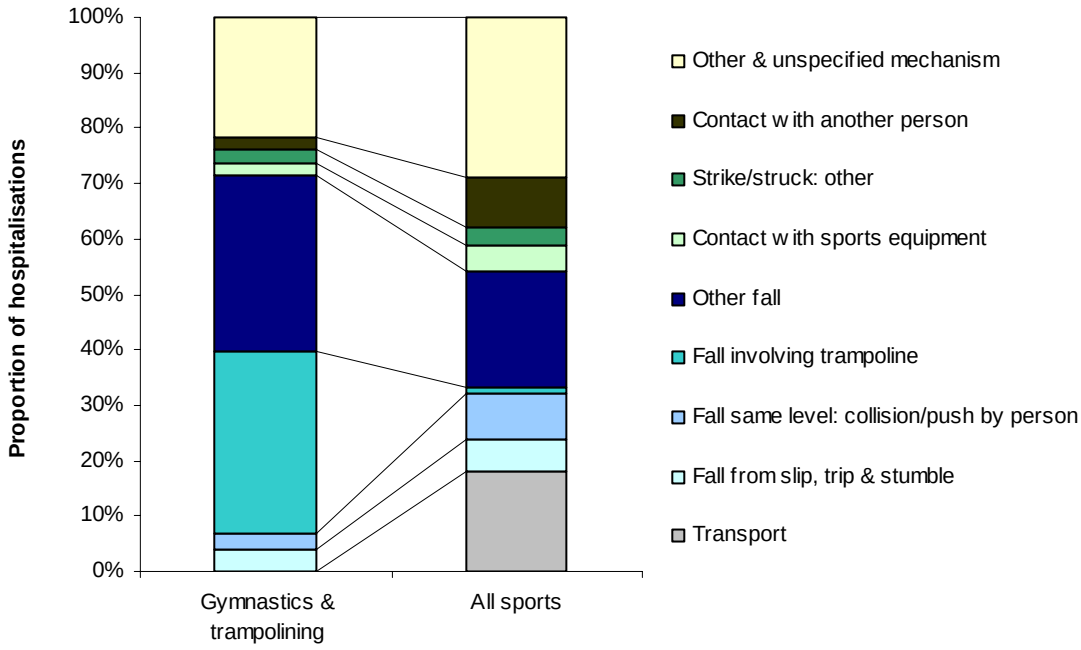


Figure 16.9: Hospitalisations due to gymnastics and trampolining and all sports, by mechanism of injury, Australia, 2003–2003

The majority (n=286, 71.5%) of gymnastics and trampolining injuries requiring hospitalisation were due to falls, with 132 fall involving a trampoline, 127 due to other falls and 11 due to fall on same level from contact by person. This compares with 36.0% for all sports related hospitalisations (Figure 16.9).

Length of stay

Table 16.3: Gymnastics and trampolining and all sport related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]	Total bed days[†]	Mean bed days[††]
Gymnastics & trampolining	247	1.6	400	1.7	647	1.6
All sports	85,269	2.5	32,720	2.8	117,989	2.6

[†] This is total bed days, including inward transfers.
[††] This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Gymnastics and trampolining had a shorter mean bed stay (1.6 days) compared with all sports related hospitalisations (2.6 days) (Table 16.3).

Place of occurrence

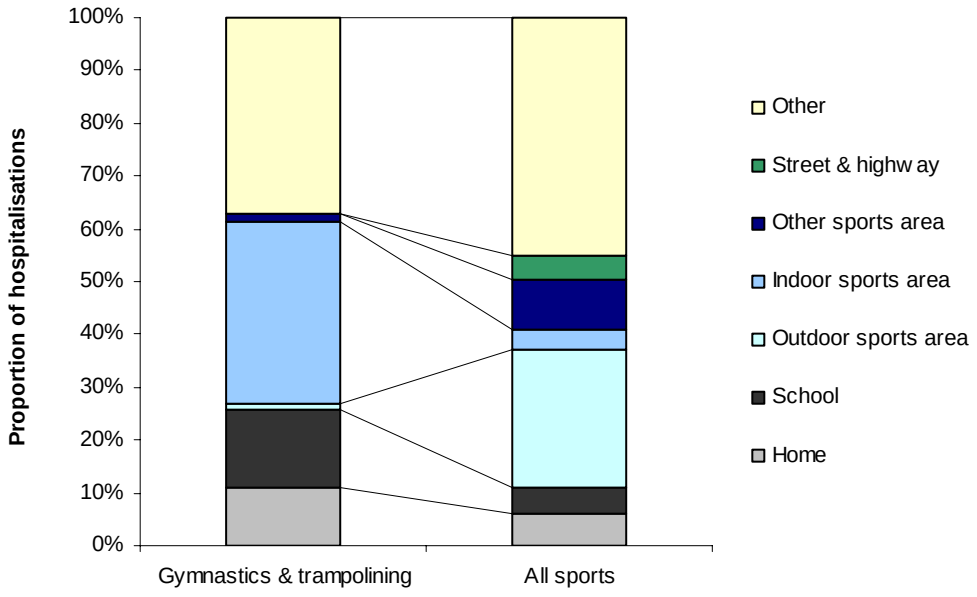


Figure 16.10: Hospitalisations due to gymnastics and trampolining and all sports, by place of occurrence, Australia, 2002–2003

Apart from other (n=149), indoor sports area was the most common place of occurrence for gymnastics and trampolining injury requiring hospitalisation (n=138, 34.5%). Injury occurring at home or school was more frequent than all sports related hospitalised injury (11.0% versus 6.0% for home and 14.8% versus 5.0% for school) (Figure 16.10).

Month of admission

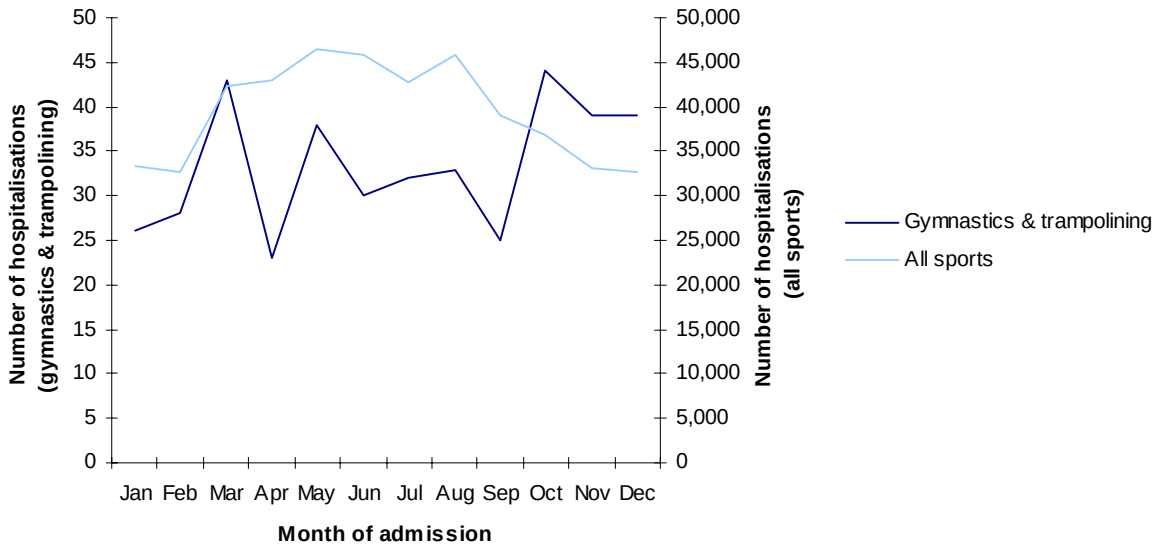


Figure 16.11: Hospitalisations due to gymnastics and trampolining and all sports, by month of admission, Australia, 2002–2003

Gymnastics and trampolining injury requiring hospitalisation was most common in October (n=44, 11.0%) and March (n=43, 10.8%) but was relatively evenly spread across the year (Figure 16.11).

Discussion

Unfortunately, participation data is not available for those over 15 years. For those 5–14 years, gymnastics and trampolining is predominately a sport of females with 5.4% of females and 1.7% of males participating in organised gymnastics and trampolining in the 12 months to interview in April 2003 (Australian Bureau of Statistics 2005).

Those injured in gymnastics and trampolining are predominately young with 82.0% (n=328) of cases being in the 0–14 year age group. Almost two thirds (65.5%) of those 0–14 years are females (n=215). Males were more commonly hospitalised in all the other age groups except the 35–44 year age group (but only 7 cases occurred in this age group). Of the 42 injured in the 15–24 year age group, 64.3% (n=27) were males.

The elbow and forearm (n=139, 34.8%) and shoulder and upper arm (n=85, 21.3%) were the most commonly injured body parts in those hospitalised for gymnastics and trampolining injury (as principal diagnosis). From the literature gymnastics has a predominance on lower limb injury and trampolining has a predominance on upper limb injury (Murphy 2000; Kolt & Kirkby 1999; Meeusen & Borms 1992).

The majority of injuries in those hospitalised were fractures (n=290, 74.9%). Murphy studied trampolining injuries in Victoria and found that 80% of injuries in those hospitalised were fractures (Murphy 2000). Kolt and Kirkby studied self reported injury in gymnasts and found an 8.3% incidence of fractures (Kolt & Kirkby 1999).

The majority (n=286, 71.5%) of injuries were due to falls. Murphy found for trampoline related injuries, that 61% of injuries involved falls off the trampoline and 28% of injuries involved falls whilst on the trampoline (Murphy 2000).

17 Field hockey

U51.22

Field hockey is the second most popular team sport in the world (after soccer) (Murtaugh 2001). In Australia, 2.5% of children 5–14 years (2.5% of males and 2.6% of females) participated in organised hockey in the 12 months prior to interview in April 2003 (Australian Bureau of Statistics 2005). 1.0% of the Australian population (15 years and over) participated (0.7% of males and 1.2% of females) in outdoor hockey and 0.2% of the Australian population (15 years and over) participated in indoor hockey in 2003 (Australian Sports Commission 2003). The majority of outdoor hockey players (15 years and over) were in the 15–24 year age group (3.3% participation rate) (Australian Sports Commission 2003).

Murtaugh 2001 performed a cross-sectional study of 161 female field hockey players. The questionnaire included questions about personal information, playing position and injuries. There were 0.44 injuries per athlete-year with 74.7% of participants having had one or more acute injuries during field hockey. The most common injury was ankle sprain. 51% of injuries involved the lower limb, 34% the head/face, 14% the upper limb and 1% the back/torso. 39.7% of injuries were sprains, 17.1% were contusions and 16.4% were fractures. 7.7% of injuries were concussions and the majority (47%) resulted from collision with another player. 42% of the head/face injuries were due to the ball, 36% due to the hockey stick, 18% due to collision with another player and 4% due to contact with the ground (Murtaugh 2001).

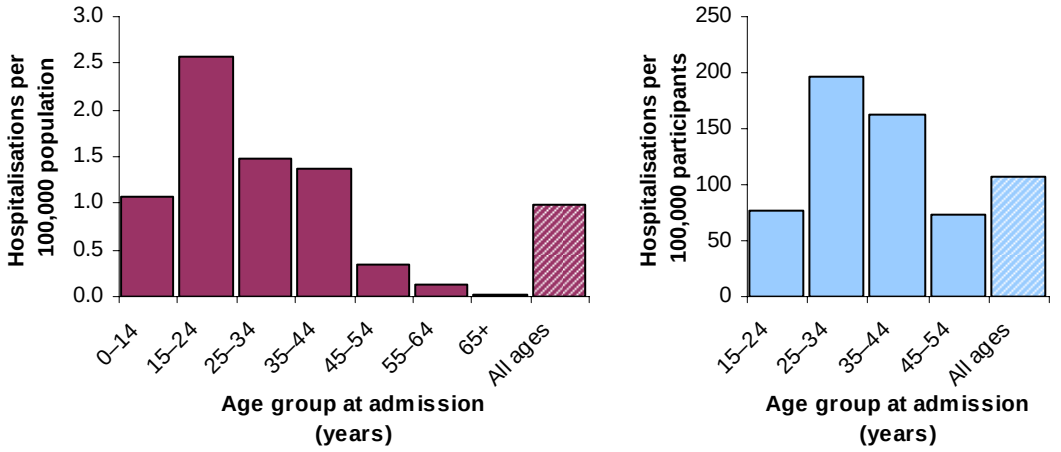
Injury rates varied depending on the position played. Goalkeepers had 0.58 injuries per athlete-year (highest) compared with the 0.37 injuries per athlete-year in forwards and 0.36 injuries per athlete-year in backfielders (lowest) (Murtaugh 2001). Goalkeepers had a back/torso injury rate of 0.03 injuries per athlete-year which was 16.7 times that in fielders and the biggest upper limb injury rate of 0.12 injuries per athlete-year. Concussion was the most common injury to goalkeepers. Injuries in goalkeepers were most commonly caused by collision with another player, the ground or the goal (Murtaugh 2001).

Age

Table 17.1: Summary measures for field hockey hospitalisations, by age group at admission, Australia, 2002–2003

	Age group at admission (years)							
	0–14	15–24	25–34	35–44	45–54	55–64	65+	All ages
Proportion of hospitalised sports (%)	0.2	0.5	0.5	0.9	0.4	0.2	0.1	0.4
Cases: Field hockey	28	70	40	41	10	…	…	193
Estimated number of participants ('000)[†]	NA	90.4	20.3[*]	25.1[*]	13.8[*]	3.6[**]	0[**]	153.2[††]
Rate/100,000 population	1.1	2.6	1.5	1.4	0.3	0.1	0.0	1.0
Rate/100,000 participants	NA	77.4[*]	197.0[*]	163.3[*]	72.5[*]	NA[‡]	NA[‡]	107.7[††]

[*] Estimate has a relative standard error of between 25% and 50% and should be used with caution.
[**] Estimate has a relative standard error of greater than 50% and is considered too unreliable for general use.
[†] The participation rates are for outdoor hockey and have been calculated from the estimated number of participants found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).
[‡] The rate of hospitalisation per 100,000 participants has not been included in those 55+ years due to high uncertainty in the participation data.
[††] The estimated number of participants and rate of hospitalisation per 100,000 participants for all ages excludes those less than 15 years (n=28).
Case numbers when n<4 are not shown.



Note: The hospitalisation rate per 100,000 participants excludes 28 injuries in those less than 15 years.
The hospitalisation rate per 100,000 participants 55+ years is included in the total but not presented separately due to high uncertainty in the participation data.

Figure 17.1: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to field hockey, by age group at admission, Australia, 2002–2003

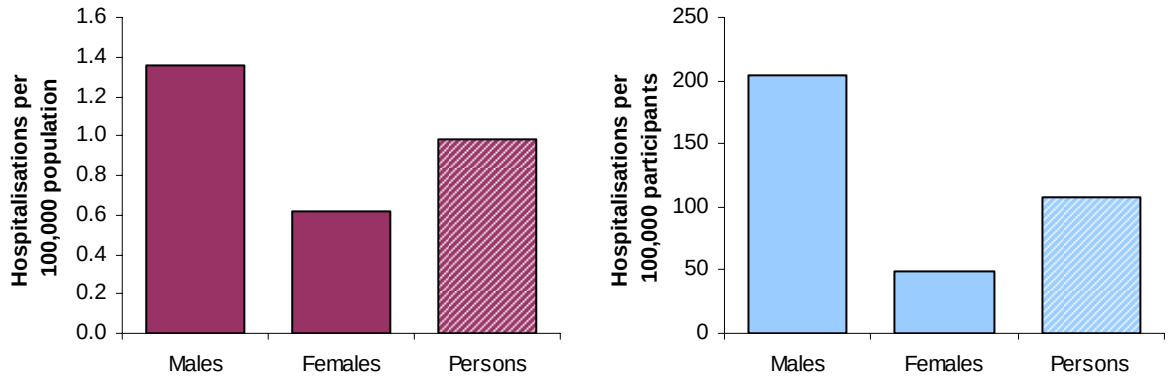
The highest number of hospitalisations due to field hockey occurred in the 15–24 year age group (n=70, 36.3%). This was also the age group (15 years and over) with the highest number of participants. The highest rate of hospitalisation per 100,000 participants was in the 25–34 year age group with 197.0, however, this has a relative standard error of between 25% and 50% (Table 17.1 and Figure 17.1).

Sex

Table 17.2: Summary measures for field hockey hospitalisations, by sex, Australia, 2002–2003

	Males	Females	Persons
Proportion of hospitalised sports (%)	0.4	0.5	0.4
Cases: Field hockey (%)	132 (68.4)	61 (31.6)	193 (100)
Estimated number of participants ('000)[†‡]	57.6	95.6	153.2
Rate/100,000 population	1.4	0.6	1.0
Rate/100,000 participants[†‡]	204.9	49.2	107.7

[†] The estimated number of participants and rate of injury per 100,000 participants excludes those less than 15 years (n=28).
[‡] Participation rates and the rate of hospitalisation per 100,000 participants for field hockey have been calculated from the estimated number of participants in outdoor hockey found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).



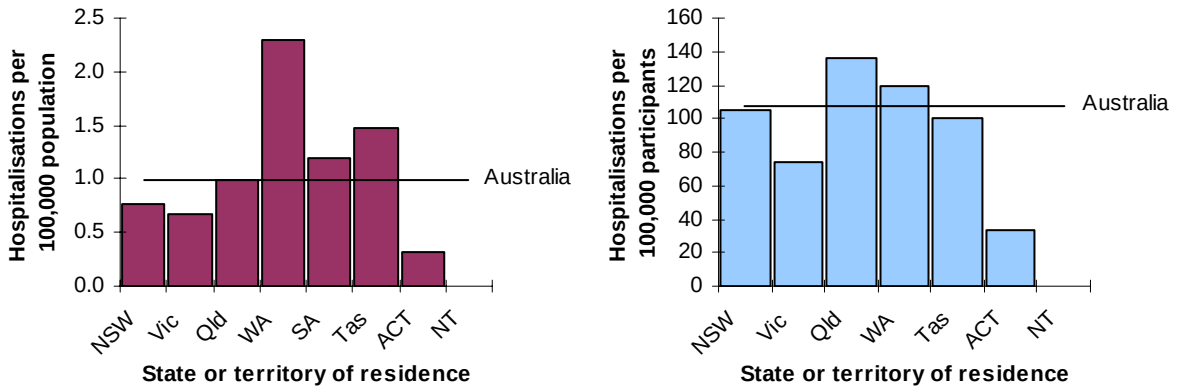
Note: The hospitalisation rate per 100,000 participants excludes 28 cases of field hockey injury in those under 15 years.
Participation rates for field hockey have been calculated from the estimated number of participants in outdoor hockey found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).

Figure 17.2: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) by sex, due to field hockey, Australia, 2002–2003

There were more hospitalisations related to field hockey in males (n=132, 68.4%) than females (n=61, 31.6%), however, there was a higher number of female participants than male participants (15 years and over) by 1.7 times. Hence, the rate of hospitalisation per 100,000 participants (15 years and over) was much higher in males (204.9) than in females (49.2) (Table 17.2 and Figure 17.2).

State or territory of residence

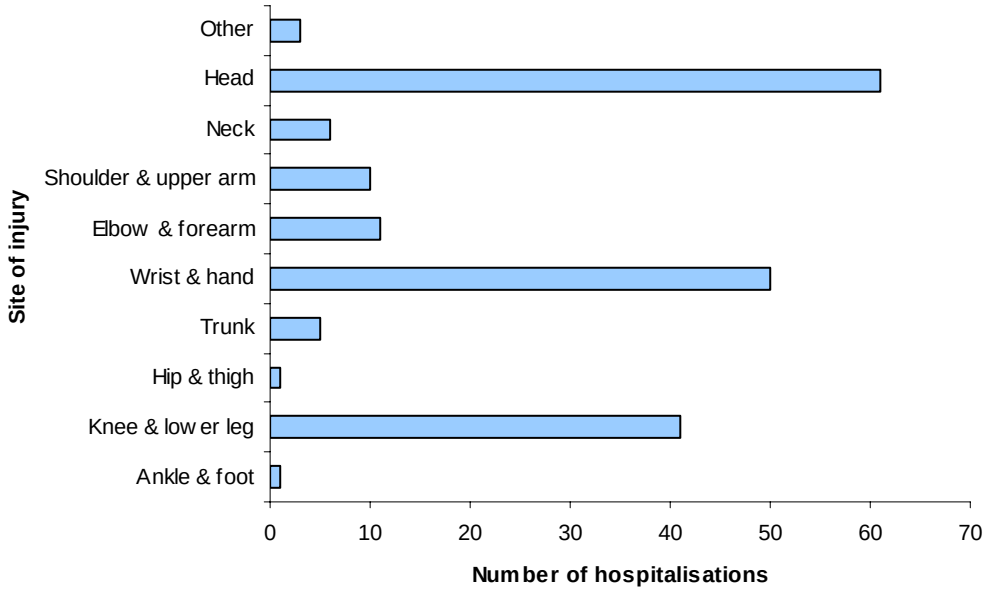
The highest rate of hospitalisation per 100,000 population was in WA with 2.3 compared with 1.0 for Australia as a whole. Queensland had the highest rate of hospitalisation per 100,000 participants (15 years and over) with 135.7, followed by 120.0 for WA. This compares with a hospitalisation rate per participant of 107.7 for Australia as a whole. There were no hospitalisations in NT in the 2002–2003 financial year. Hospitalisation rates per participant have been calculated using the estimated number of participants in outdoor hockey found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).



Note: The horizontal bar represents the hospitalisation rate for Australia as a whole.
The hospitalisation rate per 100,000 participants excludes 28 cases of field hockey injury in those under 15 years.
Participation rates were unavailable for SA.
There were no hospitalisations related to field hockey in the NT in 2002–2003.
There were 2 cases with unreported state or territory of residence, but none in those under 15 years. These have been included in the rate for Australia as a whole.
Participation rates for field hockey have been calculated from the estimated number of participants in outdoor hockey found in Participation in Exercise Recreation and Sport Annual Report 2003 (Australian Sports Commission 2003).

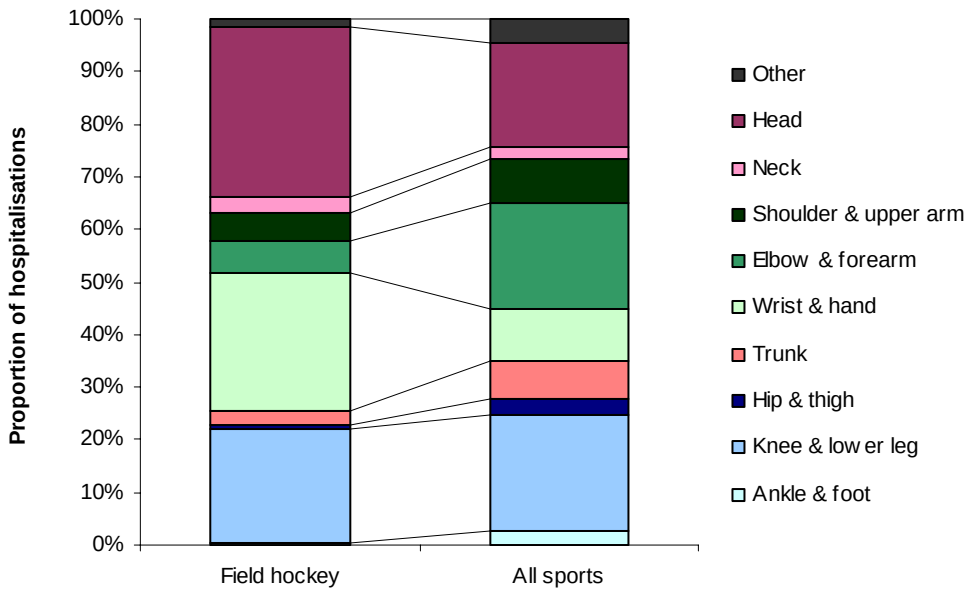
Figure 17.3: Hospitalisation rate per 100,000 population and per 100,000 participants (15 years and over) due to field hockey, by state or territory of residence, Australia, 2002–2003

Body region



Note: Excludes 4 field hockey cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 17.4: Hospitalisations due to field hockey, by principal body region injured, Australia, 2002–2003

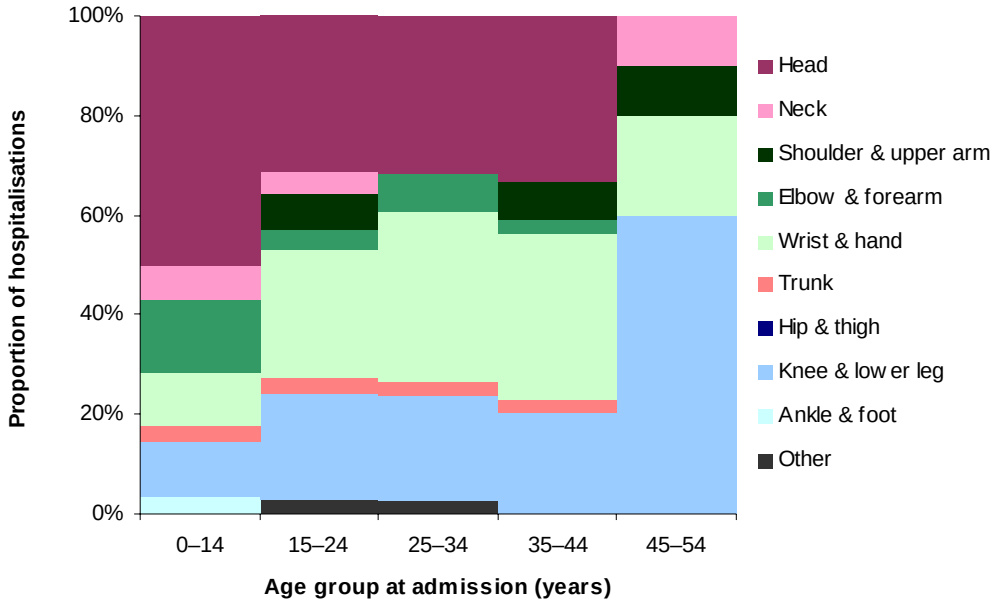


Note: Excludes 4 field hockey cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 17.5: Hospitalisations due to field hockey and all sports, by principal body region injured, Australia, 2002–2003

Head injury was the most common principal body part injured in those requiring hospitalisation for field hockey related injury (n=61, 31.6%) compared with 18.5% for all sports related injury hospitalisations (Figures 17.4 and 17.5).

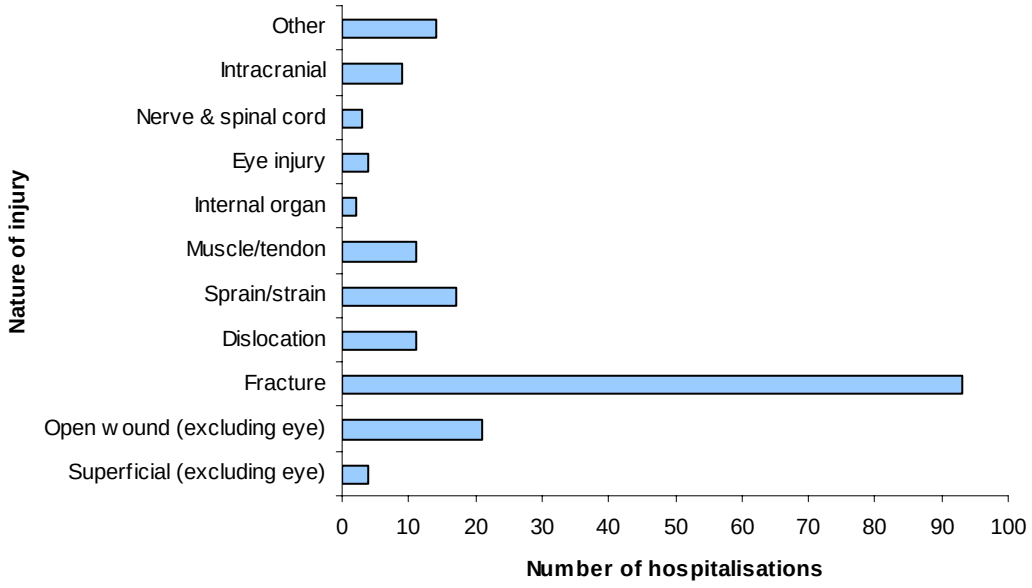
50% (n=14) of injuries in those 0–14 years involved the head, as the principal body region injured. 21.2% (n=41) of injuries for all ages involved the knee and lower leg as principal body region injured in hospitalised persons. The majority (60.0%) of admissions in those 45–54 years involved the knee and lower leg (Figure 17.6).



Note: Excludes 4 field hockey cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code. Injuries in those greater than 54 years are not shown due to small numbers (n<4).

Figure 17.6: Hospitalisations due to field hockey, by principal body region injured and age group at admission, Australia, 2002–2003

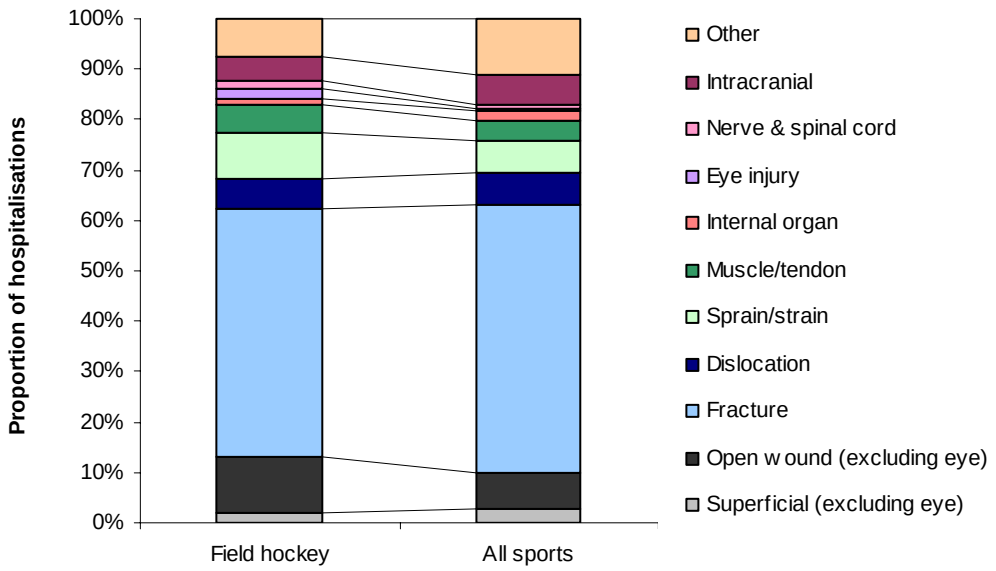
Nature of injury



Note: Excludes 4 field hockey cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 17.7: Hospitalisations due to field hockey, by nature of injury, Australia, 2002–2003

Fracture was the most common type of principal diagnosis in persons admitted for field hockey related injury (n=93, 49.2%). For all sport related hospitalisations fractures comprised 52.8% of principal diagnoses (Figures 17.7 and 17.8).



Note: Excludes 4 field hockey cases and 2,578 all sports cases that had ICD-10-AM codes for injury (U50–U72) but did not include an external cause code.

Figure 17.8: Hospitalisations due to field hockey and all sports, by nature of injury, Australia, 2002–2003

Mechanism of injury

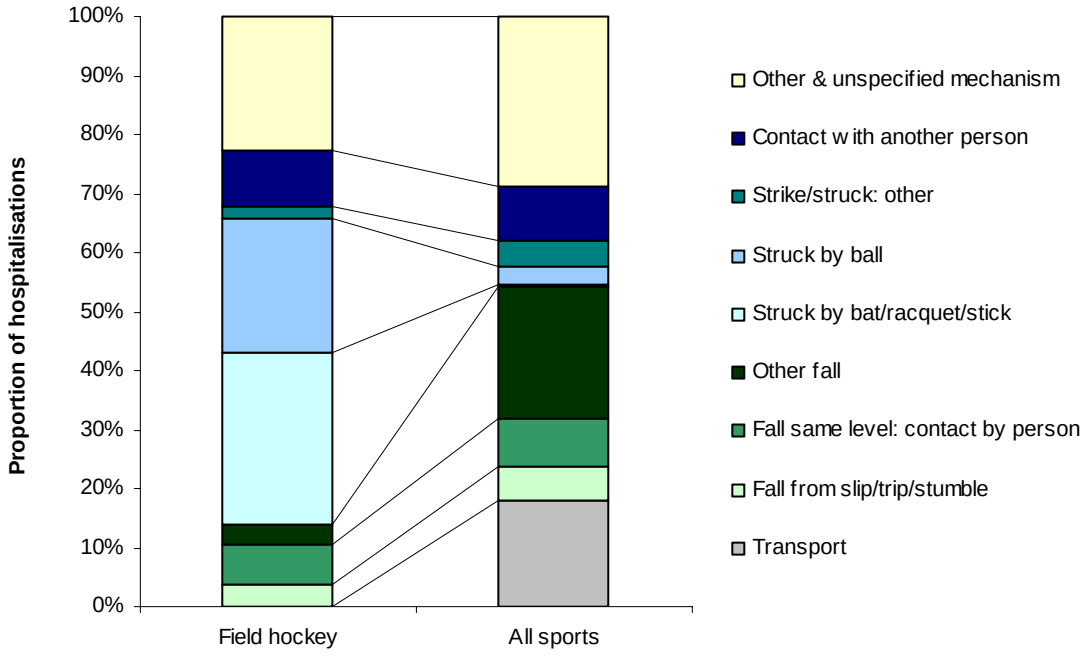


Figure 17.9: Hospitalisations due to field hockey, by mechanism of injury, Australia, 2003–2003

In the majority (52.3) of field hockey related hospitalisations the mechanism was contact with sports equipment and this was much more frequent than in all sports related hospitalisations (4.6%). There were 56 due to struck by bat/racquet/stick and 44 hospitalisations due to struck by ball (Figure 17.9).

Length of stay

Table 17.3: Field hockey and all sport related hospitalisations by mean bed days and total bed days, Australia, 2002–2003

	Males		Females		Persons	
	Total bed days†	Mean bed days††	Total bed days†	Mean bed days††	Total bed days†	Mean bed days††
Field hockey	181	1.4	97	1.6	278	1.4
All sports	85,269	2.5	32,720	2.8	117,989	2.6

† This is total bed days, including inward transfers.
†† This is total bed days (including inward transfers) divided by cases (excluding inward transfers).

Field hockey had a shorter mean bed stay (1.4 days) compared with all sports related hospitalisations (2.6 days) (Table 17.3).

Place of occurrence

91.2% of field hockey related hospitalisations occurred at an outdoor sports area (n=176) compared with 26.3% for all sport related hospitalisations.

Month of admission

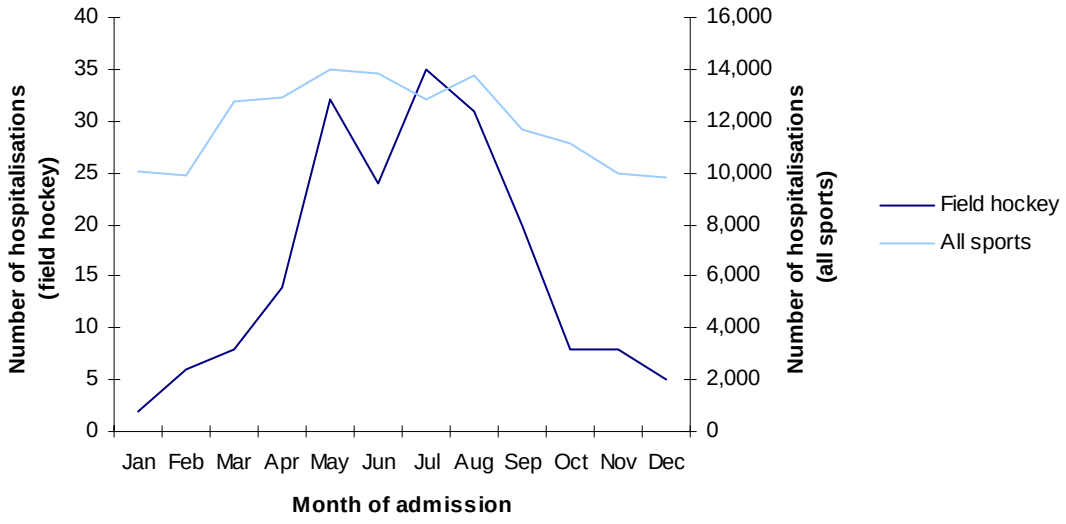


Figure 17.10: Hospitalisations due to field hockey and all sports, by month of admission, Australia, 2002–2003

This being a winter sport the peak number of hospitalisations for hockey occurred over winter with the maximum in July (n=35, 18.1%). The trough was in January (Figure 17.10).

Discussion

The 15–24 year age group had the highest number of field hockey related hospitalisations (n=70, 36.3%). However, the rate of hospitalisation per 100,000 participants was highest for the 25–34 year age group with 197.0 but this has a relative standard error of between 25% and 50%. 68.4% of hospitalisations were in males (n=132). Males had a rate of hospitalisation per 100,000 participants (15 years and over) of 204.9 which is 4.2 times higher the rate in females (49.2).

In 31.6% (n=61) of field hockey related hospitalisations, head injury was the principal reason for hospitalisation. Murtaugh found that 34% of injuries involved the head/face (Murtaugh 2001). Fracture was the most common type of principal diagnosis in persons admitted for field hockey related injury (n=93, 49.2%). Murtaugh found that 16.4% of all self reported injuries were fractures (Murtaugh 2001).

The majority (52.3%) of field hockey related hospitalisations were due to contact with sports equipment, with 56 due to struck by bat/racquet/stick and 44 due to struck by ball. 91.2% of field hockey related hospitalisations occurred at an outdoor sports area (n=176). The peak number of hospitalisations occurred in July (n=35, 18.1%).

18 Data issues

Case data for this report are a subset of records from the National Hospital Morbidity Database (NHMD) compiled by the AIHW. We included all records in the NHMD that refer to episodes of inpatient care provided by acute care hospitals in Australia that concluded during the year ending 30 June 2003 and contain an ICD-10-AM 'Activity at the time of injury' code in the range U50–U72 (sports or leisure) anywhere in the record (n=48,649).

Some cases of injury due to sports or leisure result in more than one episode in hospital and, hence, may be represented by more than one record in the dataset available for this project. Since the main focus of this report is numbers of cases, we wanted to minimise such over counting. The data collection does not include data items that would enable this adjustment to be made directly and completely. It does include an item (source of referral) that enables control of multiple counting due to transfer of patients from one hospital to another and this item was used to omit from case counts the records shown as being inward transfers (n=3,197). A direct means to allow for readmissions due to the same injury was not available to us. Omission of the inward transfers leaves 45,452, the estimated case count used in this report.

ICD-10-AM diagnosis codes in the range S00 to T75, plus T79 are those currently used by NISU to specify injury occurring in the community. 44,473 (97.8%) of the 45,452 estimated cases included a diagnosis code in this range. In 42,744 (94.0%) cases this was the Principal Diagnosis code. Principal Diagnoses codes of the cases that did not include a diagnosis code in this range (2.2%; n=979) were most often for a musculoskeletal condition (44.3%). The remainder were for a diverse range of other conditions and reasons for admission. Cases without an injury as the Principal Diagnosis were excluded from analysis in the nature of injury section of each chapter.

Omission of inward transfer separation records improves estimation of the number of incident cases. However, the bed-days occupied during these episodes in hospital should be included in estimates of bed-days attributable to sports injury cases. Hence we have calculated total bed days as the sum of length of stay for all separation records meeting relevant selection criteria, including those that are inward transfers. Mean length of stay has been calculated by dividing bed-days obtained in this way by the corresponding estimated case count (i.e. excluding inward transfers).

Population data were final ABS Estimated Resident Population values for 30 June 2002, obtained from the AIHW.

Participation rates were calculated using the participation data found in the Participation in Exercise and Recreation and Sport Annual Report 2003. The Participation in Exercise and Recreation and Sport Annual Report 2003 is compiled using telephone surveys conducted in February, May, August and November about the preceding 12 months. Survey participants are selected randomly using the Electronic White Pages, with the person with the most recent birthday at that dwelling participating. The total sample was 13,644 persons, in private dwellings. There was a 45.3% response rate (Australian Sports Commission 2003).

The Participation in Exercise and Recreation and Sport Annual Report 2003 only included persons 15 years and over, hence, all the rates of hospitalisation per 100,000 participants, shown in the graphs and tables are for persons 15 years and over (Australian Sports Commission 2003).

All rates shown in this report are crude rates or age-specific rates (i.e. not age adjusted). Case numbers less than four have not been shown in the tables in order to maintain confidentiality and because small counts are susceptible to potentially misleading fluctuations.

In many of the sports groupings there were small numbers of deaths among the hospitalised cases. These have generally not been reported separately (except in cycling, wheeled motor sports and water sports) for several reasons. Firstly, as there are only small numbers, there is risk of breach of confidentiality. Secondly, small numbers are subject to fluctuations which could be misleading. Thirdly, since this report only includes hospitalised persons, these values would not include deaths of persons who died without admission to a hospital.

Some activities may be undertaken for reasons of sport, recreation, work or transport. This is particularly so for walking, running, cycling, motor sports and equestrian pursuits. Furthermore, many sporting activities can be undertaken formally (e.g. as a participant in an event organised by or in association with a recognised sports governing body) or informally. These distinctions cannot be made using the data available in the NHMD. This report includes all hospitalised cases where an activity code meaning 'while engaged in sports or leisure' (U50–U72) was assigned by clinical coders, on the basis of information available to them in hospital records.

19 Conclusions

This project is the first to have made extensive use of the additional information about hospitalised sports injuries that result from the expanded coverage of this topic in the 3rd edition of the Australian version of the 10th revision of the International Classification of Diseases (ICD-10-AM). The expanded classification provides categories for a large number of specific types of sport and related activities. We found that the new categories had been used extensively by clinical coders and that the resulting data were sufficient to warrant detailed analysis.

Fourteen sport groupings are discussed in detail. These groups were chosen by reviewing the total number of hospitalisations and the number of participants for each sporting group and using the sport groupings with the highest numbers.

This report has the limitation that it discusses only hospitalised sports injury and not all sporting injury and as such it only reviews more severe sporting injury. However, hospitalised injuries tend to be more severe and costly than other injuries (Watson & Ozanne-Smith 1997). Hence, while hospitalised sports injuries are small as a proportion of all sport injuries they deserve attention. This report also has the limitation that as it reviews all hospitalised sports injury, specific injuries such as, anterior cruciate ligament injury in football, were beyond the scope of the report.

- Of the 6,653,772 hospitalisations in the 2002–2003 financial year in Australia, 0.7% were sports and recreation related (n=45,452).
- The highest number of sports and recreation related hospitalisations was in the 0–14 year age group (n=14,218) and the least number was in the 55–64 year age group (n=1,304).
- The majority (73.9%) of sports and recreation related hospitalisations occurred in males despite a greater number of females (15 years and over) participating in sports and recreation.
- There were 12,600 football related hospitalisations making it the most common type of sporting activity involved in at the time of injury, with 3,944 of these due to Australian football and 3,270 due to soccer. There were 2,799 water sports and 2,725 sports and recreation cycling related hospitalisations.
- Wheeled motor sports had the highest rate of hospitalisation per 100,000 participants (15 years and over) with 942.7, followed by roller sports with 738.6, Australian football with 734.3 and equestrian pursuits with 692.7. However, these rates cannot be used to compare the level of danger of particular sports.
- 52.8% of sports and recreation related hospitalisations had a fracture as the principal diagnosis (n=22,655).

The data in this report can help with development of strategies to improve sports and recreation related safety.

References

Acton CHC, Thomas S, Clark R, Pitt WR, Nixon JW & Leditschke JF 1994. Bicycle incidents in children—abdominal trauma and handlebars. Medical Journal of Australia 160 (6):344–6.

Ashby K & Cassell E 2004. Boating-related sports and recreational injury, Victoria July 2000 to June 2002. Hazard 56 (Summer):1–15.

Australian Bureau of Statistics 1997. Sport and recreation: A statistical overview, Australia. Canberra: p59.

Australian Bureau of Statistics 2003. National Health Survey: Injuries. Canberra: Australian Bureau of Statistics.

Australian Bureau of Statistics 2005. Year book Australia. Culture and recreation. Children's participation in organised sport. Canberra: Australian Bureau of Statistics: p1–4.

Australian Government Department of Health and Ageing 2004. Sports safety in Australia. An update. Canberra: Australian Government Department of Health and Ageing.

Australian Institute of Health and Welfare 2004. Australian hospital statistics 2002–03. Canberra: Australian Institute of Health and Welfare.

Australian Sports Commission 2000a. The numbers game. Basketball. Canberra: Active Australia.

Australian Sports Commission 2000b. The numbers game. Netball. Canberra: Active Australia.

Australian Sports Commission 2003. Participation in exercise recreation and sport. Annual report 2003. Canberra: Australian Sports Commission: p1–65.

Barr A, Baines PS, Desai P & MacEwen CJ 2000. Ocular sports injuries: the current picture. British Journal of Sports Medicine 34 (6):456–8.

Berson BL, Rolnick AM, Ramos CG & Thornton J 1981. An epidemiologic study of squash injuries. The American Journal of Sports Medicine 9 (2):103–6.

Birrer RB 1996. Trauma epidemiology in the Martial Arts. The results of an eighteen-year international survey. The American Journal of Sports Medicine 24 (6):S72–9.

Birrer RB & Halbrook SP 1988. Martial arts injuries. The results of a five year national survey. The American Journal of Sports Medicine 16 (4):408–10.

Bladin C, Giddings P & Robinson M 1993. Australian snowboard injury data base study. A four-year prospective study. The American Journal of Sports Medicine 21 (5):701–4.

Blair SN, Kohl HW, III, Paffenbarger RS, Jr, Clark DG, Cooper KH & Gibbons LW 1989. Physical fitness and all-cause Mortality. A prospective study of healthy men and women. JAMA 262 (17):2,395–2,401.

Blanksby BA, Wearne FK, Elliot BC & Blitvich JD 1997. Aetiology and occurrence of diving injuries. A review of diving safety. Sports Medicine 23 (4):228–46.

Bond GR, Christoph RA & Rodgers BM 1995. Pediatric equestrian injuries: Assessing the impact of helmet use. Pediatrics 95 (4):487–9.

Bradley C & Harrison J 2004. Descriptive epidemiology of traumatic fractures in Australia. Injury Research and Statistics Series Number 17. Adelaide: Australian Institute of Health and Welfare.

Cassell E & Clapperton A 2002. Preventing injury in sport and active recreation. Hazard 51 (Winter):1–18.

Chapman MAS & Oni J 1991. Motor racing accidents at Brands Hatch, 1988/9. British Journal of Sports Medicine 25 (3):121–3.

Chard MD & Lachmann SM 1987. Racquet sports—Patterns of injury presenting to a sports injury clinic. British Journal of Sports Medicine 21 (4):150–3.

Chesser T, Norton S, Nolan J & Baskett P 2001. Motor racing trauma—The requirement for medical intervention. Journal of Bone and Joint Surgery (British) 83-B (Supplement III):308.

Chissell HR, Feagin JA, Jr,, Warme WJ, Lambert KL, King P & Johnson L 1996. Trends in ski and snowboard injuries. Sports Medicine 22 (3):141–5.

Chow TK, Bracker MD & Patrick K 1993. Acute injuries from mountain biking. The Western Journal of Medicine 159 (2):145–9.

Cripps RA 2000. Horse-related injury in Australia. Australian Injury Prevention Bulletin 24 (May).

Dempsey RL, Layde PM, Laud PW, Guse CE & Hargarten SW 2005. Incidence of sports and recreation related injuries resulting in hospitalization in Wisconsin in 2000. Injury Prevention 11 (2):91–6.

Edmonds CW & Walker DG 1999. Snorkelling deaths in Australia, 1987–1996. Medical Journal of Australia 171 (11):591–4.

Elias SR 2001. 10-year trend in USA Cup soccer injuries: 1988–1997. Medicine & Science in Sports & Exercise 33 (3):359–67.

Finch C, Cassell E & Stathakis V 1999a. The epidemiology of sports and active recreation injury in the Latrobe Valley. Research Report 151. Melbourne: Monash Accident Research Centre.

Finch C, Elliot BC & McGrath A C 1999b. Measures to prevent cricket injuries: an overview. Sports Medicine 28 (4):263–72.

Firth JL 1985. Equestrian Injuries. In: Schneider RC, Plant ML & Kennedy JC(eds). Sports injuries: mechanisms, prevention and treatment. Baltimore: Williams & Wilkins: 431–49.

Fong LP 1994. Sports-related eye injuries. Medical Journal of Australia 160 (12):743–50.

Fountain JL & Meyers MC 1996. Skateboarding injuries. Sports Medicine 22 (6):360–6.

General TS 1999. Physcial activity and health. At-a-glance. National Center for Chronic Disease Prevention and Health Promotion. Last updated. Nov 17 1999. Date accessed. 6/4/2005

Gomez E, DeLee JC & Farney WC 1996. Incidence of injury in Texas Girls' High School basketball. The American Journal of Sports Medicine 24 (5):684–7.

Haylen PT 2004. Spinal injuries in rugby union, 1970–2003: lessons and responsibilities. Medical Journal of Australia 181 (1):48–50.

Heitkamp HC, Horstmann T & Schalinski H 2000. In-line skating: Injuries and prevention. Journal of Sports Medicine and Physical Fitness 40 (3):247–53.

Heller D 1993. Rollerblading injuries. Hazard 15 (July):11–3.

Hockey R & Knowles M 2000. Sports Injuries. Queensland Injury Surveillance Unit Injury Bulletin 59 (May):1–6.

Hockey R & Miles E 2001. Horse-related injury. Injury Bulletin 67 (August):1–4.

Hopper D & Elliott B 1993. Lower limb and back injury patterns of elite netball players. Sports Medicine 16 (2):148–62.

Hopper D, Elliott B & Lalor J 1995. A descriptive epidemiology of netball injuries during competition: a five year study. British Journal of Sports Medicine 29 (4):223–8.

Høy K, Lindblad BE, Terkelsen CJ, Helleland HE & Terkelsen CJ 1994. Badminton injuries—a prospective epidemiological and socioeconomic study. British Journal of Sports Medicine 28 (4):276–9.

Hume P 1999. Minimising Injuries in Gymnastics Activities. Last updated: 11/04/2003. Date accessed: 21/09/2005. <www.coachesinfo.com/article/?id=67>

Hume PA & Marshall SW 1994. Sports injuries in New Zealand: Exploratory analyses. New Zealand Journal of Sports Medicine 22 (Winter 1994):18–22.

Jako P 2002. Safety measures in amateur boxing. British Journal of Sports Medicine 36 (6):394–5.

Jennings K 2000. Factors associated with running injuries. Last updated. 2000/03/07. Date accessed. 6/04/2005

Jeys LM, Cribb G, Toms AD & Hay SM 2001. Mountain biking injuries in rural England. British Journal of Sports Medicine 35 (3):197–9.

Junge A, Cheung K, Edwards T & Dvorak J 2004. Injuries in youth amateur soccer and rugby players—comparison of incidence and characteristics. British Journal of Sports Medicine 38 (2):168–72.

Kirkendall DT, Jordan SE & Garrett WE 2001. Heading and head injuries in soccer. Sports Medicine 31 (5):369–86.

Klarica AJ 2001. Performance in motor sports. British Journal of Sports Medicine 35 (5):290–1.

Koehle MS, Lloyd-Smith R & Taunton JE 2002. Alpine ski injuries and their prevention. Sports Medicine 32 (12):785–93.

Kolt GS & Kirkby RJ 1999. Epidemiology of injury in elite and subelite female gymnasts: a comparison of retrospective and prospective findings. British Journal of Sports Medicine 33 (5):312–8.

Kronisch RL, Chow TK, Simon LM & Wong PF 1996. Acute injuries in off-road bicycle racing. The American Journal of Sports Medicine 24 (1):88–93.

Kronisch RL & Pfeiffer RP 2002. Mountain biking injuries: an update. Sports Medicine 32 (8):523–37.

Leclerc S & Herrera CD 1999. Sports medicine and the ethics of boxing. British Journal of Sports Medicine 33 (6):426–9.

Leonard L, Lim A, Chesser TJS, Norton SA & Nolan JP 2005. Does changing the configuration of a motor racing circuit make it safer? British Journal of Sports Medicine 39 (3):159–61.

Lindsay M, Luschwitz D, Moorhead G & Finch C 2000. Sports injury in Australia. An evaluation of current sports injury data collection, research and interventions. Canberra: Commonwealth Department of Health and Aged Care, Sports Medicine Australia, Active Australia: p42.

Matser EJT, Kessels AG, Lezak MD, Jordan BD & Troost J 1999. Neuropsychological impairment in amateur soccer players. JAMA 282 (10):971–3.

McCrory P 2003. Brain injury and heading in soccer. British medical journal 327 (7,411):351–2.

McCrory PR, Berkovic SF & Cordner SM 2000. Deaths due to brain injury among footballers in Victoria, 1968–1999. Medical Journal of Australia 172 (5):217–9.

McGrath AC & Finch CF 1996. Running the race against injuries: A review of the literature. Melbourne: Monash University Accident Research Centre.

Meeusen R & Borms J 1992. Gymnastic injuries. Sports Medicine 13 (5):337–56.

Milburn PD 1993. Biomechanics of rugby union scrummaging. Sports Medicine 16 (3):168–79.

Minoyama O & Tsuchida H 2004. Injuries in professional motor car racing drivers at a racing circuit between 1996 and 2000. British Journal of Sports Medicine 38 (5):613–6.

Moriarity J, Collie A, Olson D, Buchanan J, Leary DO, McStephen M, et al. 2004. A prospective controlled study of cognitive function during an amateur boxing tournament. Neurology 62:1497–502.

Moss PS, Wan A & Whitlock MR 2002. A changing pattern of injuries to horse riders. Emergency Medicine Journal 19 (5):412–5.

Murphy C 2000. Trampoline injuries. Hazard 42 (March):1–11.

Murtaugh K 2001. Injury patterns among female field hockey players. Medicine & Science in Sports & Exercise 33 (2):201–7.

Nakaguchi H & Tsutsumi K 2002. Mechanisms of snowboarding-related severe head injury: shear strain induced by the opposite-edge phenomenon. Journal of Neurosurgery 97 (3):542–8.

National Public Health Partnership (NPHP) 2004. The National Injury Prevention and Safety Promotion Plan: 2004–2014. Canberra: NPHP.

Office for Recreation and Sport 2000. Active Alert. A report on the prevention of activity injuries in young people. It's a matter for everybody. Adelaide: Office for Recreation and Sport, Department of Industry & Trade: p1–6.

Orchard J, James T, Alcott E, Carter S & Farhart P 2002. Injuries in Australian cricket at first class level 1995/1996 to 2000/2001. British Journal of Sports Medicine 36 (4):270–4.

Orchard J, Seward H, McGivern J & Hood S 1999. Rainfall, evaporation and the risk of non-contact anterior cruciate ligament injury in the Australian Football League. Medical Journal of Australia 170 (7):304–6.

Pikora T 2005. Boating-related fatalities, injuries and incidents in Western Australia. Injury Research Bulletin 10:1–2.

Pino EC & Colville MR 1989. Snowboard injuries. The American Journal of Sports Medicine 17 (6):778–81.

Pounder DJ 1984. "The grave yawns for the horseman" Equestrian deaths in South Australia 1973–1983. Medical Journal of Australia 141 (10):632–5.

Powell KE, Heath GW, Kresnow M, Sacks JJ & Branche CM 1998. Injury rates from walking, gardening, weightlifting, outdoor bicycling, and aerobics. Medicine & Science in Sports & Exercise 30 (8):1,246–9.

Putukian M, Knowles WK, Swere S & Castle NG 1996. Injuries in indoor soccer. The Lake Placid Dawn to Dark Soccer Tournament. The American Journal of Sports Medicine 24 (3):317–22.

Richardson AB 1999. Injuries in competitive swimming. Clinics in Sports Medicine 18 (2):287–91.

Rotem TR, Lawson JS, Wilson SF, Engel S, Rutkowski SB & Aisbett CW 1998. Severe cervical spinal cord injuries related to rugby union and league football in New South Wales, 1984–1996. Medical Journal of Australia 168 (8):379–81.

Routley V & Valuri J 1993. Adult sports injury. Hazard 15:1–10.

Rubin BD 1999. The basics of competitive diving and its injuries. Clinics in Sports Medicine 18 (2):293–303.

Sacco RL, Gan R, Boden-Albala B, Lin I, Kargman DE, Hauser WA, et al. 1998. Leisure-time physical activity and ischaemic stroke risk: The Northern Manhattan Stroke Study. Stroke 29 (2):380–7.

Schieber RA, Branche-Dorsey CM & Ryan GW 1994. Comparison of in-line skating injuries with rollerskating and skateboarding injuries. JAMA 271 (23):1856–8.

Schieber RA, Branche-Dorsey CM, Ryan GW & Rutherford GW, Jr, 1996. Risk factors for injuries from in-line skating and the effectiveness of safety gear. The New England Journal of Medicine 335 (22):1630–5.

Scott D, Hockey R, Barker R & Pitt R 2005. Bicycle injury in Queensland. Injury Bulletin 86 (April).

Seward HG, Orchard JW & Jowett AD 2004. Football Australasia: controversies in 2003. Medical Journal of Australia 180 (7):321–2.

Sickles RT & Lombardo JA 1993. The adolescent basketball player. Clinics in Sports Medicine 12 (2):207–19.

Siscovick DS, Laporte RE & Newman JM 1985. The disease-specific benefits and risks of physical activity and exercise. Public Health Reports 100 (2):180–8.

Smith AD & Ludington R 1989. Injuries in elite pair skaters and ice dancers. The American Journal of Sports Medicine 17 (4):482–8.

Sonzogni JJ & Gross ML 1993. Assessment and treatment of basketball injuries. Clinics in Sports Medicine 12 (2):221–37.

Stevenson MR, Hamer P, Finch CF, Elliot B & Kresnow M 2000. Sport, age, and sex specific incidence of sports injuries in Western Australia. British Journal of Sports Medicine 34 (3):188–94.

Stretch RA 2003. Cricket injuries: a longitudinal study of the nature of injuries to South African cricketers. British Journal of Sports Medicine 37 (3):250–3.

INJURY RESEARCH & STATISTICS

It is common for persons participating in sport to be injured. Only a minority of these injuries require hospitalisation. However, hospitalised injuries are usually more severe and costly than others. This report describes hospitalised sports injury in 2002–2003, in Australia. Fourteen sports groupings are reviewed in detail, including football, water sports, cycling and roller sports. Topics covered for these groupings include body region most frequently injured, type of injury and mechanism of injury, age and sex.

It is of relevance to both health personnel and sporting bodies.

ISBN 1 74024 549 0

Szabadi E 1988. Physical exercise and mental health. British medical journal 296 (5 March):659–60.

Taunton JE, Ryan MB, Clement DB, McKenzie DC, Lloyd-Smith DR & Zumbo BD 2002. A retrospective case-control analysis of 2002 running injuries. British Journal of Sports Medicine 36 (2):95–101.

Taunton JE, Ryan MB, Clement DB, McKenzie DC, Lloyd-Smith DR & Zumbo BD 2003. A prospective study of running injuries: the Vancouver Sun Run "In Training" clinics. British Journal of Sports Medicine 37 (3):239–44.

Thompson DC, Nunn ME, Thompson RS & Rivara FP 1996a. Effectiveness of bicycle safety helmets in preventing serious facial injury. JAMA 276 (24):1974–5.

Thompson DC & Patterson MQ 1998. Cycle helmets and the prevention of Injuries. Recommendations for competitive sport. Sports Medicine 25 (4):213–9.

Thompson DC, Rivara FP & Thompson RS 1996b. Effectiveness of bicycle safety helmets in preventing head injuries: A case-control study. JAMA 276 (24):1968–73.

Vinger PF 2005. Commentary on ocular complications of boxing. British Journal of Sports Medicine 39:75.

Warme WJ, Feagin JA, Jr, King P, Lambert KL & Cunningham RR 1995. Ski injury statistics, 1982 to 1993, Jackson Hole Ski Resort. The American Journal of Sports Medicine 23 (6):597–600.

Watson W, L, & Ozanne-Smith J 1997. The cost of injury to Victoria.124. Clayton, Victoria: Monash University Accident Research Centre.

Williams F & Ashby K 1995. Horse related injuries. Hazard 23 (June):1–13.

Zazryn TR, Finch CF & McCrory P 2003. A 16 year study of injuries to professional kickboxers in the state of Victoria, Australia. British Journal of Sports Medicine 37 (4):321–4.

Zetaruk MN, Violán MA, Zurakowski D & Mitcheli LJ 2005. Injuries in martial arts: a comparison of five styles. British Journal of Sports Medicine 39 (1):29–33.

INJURY RESEARCH & STATISTICS

It is common for persons participating in sport to be injured. Only a minority of these injuries require hospitalisation. However, hospitalised injuries are usually more severe and costly than others. This report describes hospitalised sports injury in 2002–2003, in Australia. Fourteen sports groupings are reviewed in detail, including football, water sports, cycling and roller sports. Topics covered for these groupings include body region most frequently injured, type of injury and mechanism of injury, age and sex.

It is of relevance to both health personnel and sporting bodies.

ISBN 1 74024 549 0