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Contents

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This report was written by Amanda Tovell and James Harrison at the AIHW's NISU at Flinders University, with assistance from Stacey Avefua and Sophie Pointer.

Abbreviations

ABS	Australian Bureau of Statistics
ASCIR	Australian Spinal Cord Injury Register
AIHW	Australian Institute of Health and Welfare
ASIA	American Spinal Injury Association
DIC	duration of initial care
ERP	Estimated Resident Population
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification
ISNCSCI	International Standards for Neurological Classification of Spinal Cord Injury
LOS	length of stay
NISU	National Injury Surveillance Unit
RCIS	Research Centre for Injury Studies
SCI	spinal cord injury
SU	spinal unit
WHO	World Health Organization

Symbols

CI	confidence interval
p	statistical significance p value
SD	standard deviation
SMR	standard mortality ratio

Summary

This 10th report in the *Spinal cord injury, Australia* series presents national statistics on spinal cord injury (SCI) using data from case registrations to the Australian Spinal Cord Injury Register (ASCIR) for 2008–09. Overall, the rates and causes of SCI, and the characteristics of people affected by SCI, remained broadly similar to previous years.

A total of 349 new cases of SCI were reported in 2008–09, with 263 cases resulting from trauma and 86 from other non-traumatic causes.

The age-standardised rate of persisting SCI from traumatic causes for Australian residents (excluding those who died before discharge) was estimated to be 14.0 new cases per million population aged 15 and older. Incidence rates of persisting SCI were higher for males than females at all ages. The overall rate for Australian male residents aged 15 and older was 22.6 per million population, while for Australian female residents aged 15 and older, the rate was 5.4 cases per million population; a male:female ratio of 4.2:1.

Persisting traumatic spinal cord injuries were most frequent in the 15–24 aged category. Mean age at onset for male residents was 39 and 46 for female residents

Patients with SCI tend to have lengthy hospitalisations. Overall, Australian residents who sustained a persisting SCI in 2008–09 and survived to discharge had a median length of stay of 150 days in a participating spinal unit (SU).

Causes of spinal cord injury

Land transport crashes (45%) and falls (33%) accounted for the majority of the 263 cases of traumatic SCI during 2008–09. The great majority of land transport crashes occurred on a public street or highway (90%), including 7 non-urban roads. The remainder occurred on race-tracks and other public recreation areas, car parks, farms or in bushland.

In 2008–09, the number of *Motor vehicle occupants* (59 cases) who sustained a traumatic SCI was almost the same as for *Unprotected land transport users* (60 cases). The majority of SCI cases due to *Land transport crashes* were male (75%).

Falls led to 87 cases of traumatic SCI in 2008–09. Fewer than 20% were reported for cases aged 15–24, compared with more than 60% for cases aged 65 or older. While the majority of *Falls* were unintentional accidents, cases of assault and intentional self-harm were also recorded.

Other reported mechanisms of injury for traumatic SCI recorded in 2008–09 include *Water-related* events such as diving into shallow water (9%), *Heavy falling objects* (3%), *Horse-related* events (2%), and rugby and Australian Rules football (2%). Six per cent of cases were due to post-operative complications, other sports, and violence-related causes.

Pedestrian and *Horse-related* injury events were the only circumstances in which women outnumbered men for new cases of traumatic SCI in 2008–09.

Approximately one-quarter (24%) of traumatic SCI in 2008–09 were sustained while the person was participating in a *Sports or leisure* activity. Injuries sustained *While working for income* (including travel to and from work) accounted for 16% of traumatic cases for this reporting period.

1 Introduction

This report describes cases of traumatic spinal cord injury (SCI) sustained between 1 July 2008 and 30 June 2009 that required admission to a specialist spinal unit (SU) in Australia. It uses data from the Australian Spinal Cord Injury Register (ASCIR). Spinal cord injury from traumatic causes imposes a heavy physical, psychological and economic burden on the injured people, their families and society because it often results in a high level of long-term disability and morbidity and in increased mortality risk.

Australian Spinal Cord Injury Register

The ASCIR was established in 1995 by the National Injury Surveillance Unit (NISU), a collaborating centre of the Australian Institute of Health and Welfare (AIHW) and Australian hospital SUs specialising in acute management and rehabilitation of persons with an SCI. ASCIR built on a register established a decade earlier by Mr John Walsh AM.

Each year, approximately 300–400 new cases of SCI from traumatic and non-traumatic causes are added to the register (See Box 1.1). This number underestimates the total number of incident cases of SCI in Australia as it does not include people who were not admitted to a participating SU and those who did not consent to be included in the register. The data quality statement in Appendix A provides more information on the operation and management of the ASCIR and case ascertainment.

Annual reports on the incidence of SCI have been produced from the ASCIR since its inception. Early reports, based on data from the period 1995–96 to 1998–99, were published in the *Australian injury prevention bulletin*. Subsequent reports have been published in the AIHW Injury research and statistics series *Spinal cord injury, Australia*, and this is the 10th report of that type.

Estimated incidence of traumatic spinal cord injury

A recent study of the global incidence of traumatic spinal cord injuries estimated a global rate of 23 cases per million population in 2007: that is, nearly 180 thousand new traumatic SCI cases each year (Lee et al. 2014). The incidence rate for Australia, based on ASCIR data at a similar time period, 2007–08, was 15.0 cases per million population aged 15 and older (AIHW: Norton 2010). The global study by Lee et al. (2014) noted that estimated rates varied considerably by geographical region; for example, there were 40 cases per million population for North America compared with 16 per million for Western Europe. An international comparison conducted for the World Health Organization (WHO) found country-specific rates that varied even more widely: 53 cases per million in Canada, compared with 13 cases per million for the Netherlands (Bickenbach et al. 2013). Caution needs to be applied in these estimates however, as inclusion criteria may differ (for example, criteria concerning age, or where death occurs soon after injury), as may the types and quality of data sources on which the estimates are based. (For example, few countries have national compulsory registers.) This caution also applies to the data reported for Australia, as the ASCIR does not have complete population coverage.

Mortality, life expectancy and estimated costs for traumatic SCI injury

People who acquire SCI and survive the early period with neurological deficits are, given current treatment options, likely to have a persisting condition (See Box 1.2). The level and extent of a neurological deficit are usually measured by the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI), and include the American Spinal Injury Association (ASIA) Impairment Scale, a practice followed in this report (see Glossary). These international standards were most recently revised in 2011 (Kirshblum et al.).

Middleton et al. (2012) studied the mortality and life expectancy of people in NSW who acquired SCI in the 50 years from 1955 to 2006. Early mortality varied with level of injury: 8.2% of persons with tetraplegia (injury to the cervical segments C1–C8) and 4.1% of persons with paraplegia (injury to the lower spinal segments of thorax, lumbar and sacrum) died within 12 months of injury. Mortality in the first year declined over time. Comparing the period 1975–1984 with 1995–2006, mortality in the first year declined from 9.1% to 6.6% for all tetraplegia, while for all paraplegia it decreased from 4.1% to 2.8%. For those with complete high injury (C1–C4), first-year mortality dropped from 32.4% to 13.5%.

Mortality remained higher for people with SCI than for the general population after the first year. For those with tetraplegia who survived the first year, the subsequent mortality rate was twice that of the general population, with a standardised mortality ratio (*SMR*) of 2.2 (Middleton et al. 2012). Mortality after the first year for survivors with paraplegia was also higher than for the general population, though to a smaller extent (*SMR* 1.7).

Access Economics' analysis of the estimated cost of traumatic SCI in Australia, undertaken in 2009, remains the most comprehensive study to date. Total economic costs for tetraplegia amounted to A$1.3 billion, while paraplegia amounted close to A$690 million (Access Economics 2009). Individual lifetime costs were estimated to be A$9.5 million per case of tetraplegia and A$5 million per case of paraplegia. With medical advances and the positive trend in survival post 12 months after injury, lifetime costs will become more significant as people live longer with SCI.

Structure of this report

The primary focus of this report is traumatic SCI, resulting from injurious events that occurred during the period 1 July 2008 to 30 June 2009 (this period is abbreviated as '2008–09' in this report). It also includes information on trends in the period 1995–96 to 2008–09. The report is arranged as follows:

- **Chapter 2** presents an overview of all newly incident traumatic SCI cases that occurred in 2008–09 and had been registered by 30 June 2014.
- **Chapter 3** provides an analysis of newly incident cases of persisting traumatic SCI for Australian residents, including trends since 1995–96 and demographic, social and clinical characteristics of cases with onset in 2008–09. This chapter is restricted to Australian residents, including cases sustained while overseas, as incidence rates are calculated using the Estimated Resident Population (ERP) of Australia aged 15 or older as provided by the Australian Bureau of Statistics (ABS) (see Appendix A: Population denominators). Direct age-standardisation was employed using the Australian population in 2001 as the reference (ABS 2003).

- **Chapter 4** provides information on external causes of injury and factors associated with the SCI event for all 2008–09 traumatic cases, irrespective of survival to discharge, persistence of deficit or place of usual residence.
- **Appendix A: Data issues** provides summary information on the ASCIR, estimates used to calculate population rates, analysis methods, and information on data quality.
- **Appendix B: Non-traumatic SCI** provides summary information for non-traumatic SCI cases admitted to a participating SU during 2008–09.
- **Appendix C: Additional tables** consists of data underpinning the figures presented in Chapter 3.

While a very small number of people under the age of 15 have been included in the ASCIR over time, children with SCI are generally treated in specialist paediatric hospitals, and are not reported to the register. For this reason, cases occurring under the age of 15 are not in scope for this report.

Box 1.1: Defining traumatic spinal cord injury

When the ASCIR was established, the *Guidelines for the surveillance of central nervous system injury* case definition of SCI was adopted. According to this source, SCI is:

…an acute, traumatic lesion of neural elements in the spinal canal (spinal cord and cauda equina) resulting in temporary or permanent sensory deficit, motor deficit, or bladder/bowel dysfunction (Thurman et al. 1995).

The term **spinal cord injury** has also been used to describe episodes where damage to the spinal cord has resulted from disease, tumour and congenital conditions or other underlying pathology. As such, SCI is now often described in terms of **traumatic** or **non-traumatic SCI** (Bickenbach et al. 2013).

Traumatic SCI is the term used to describe instances where the cause of injury was external to the person (for instance, a road crash, falling, or diving into shallow water).

Non-traumatic SCI is the term used to describe instances where the cause of injury was due to disease.

Box 1.2: Describing types of neurological impairment for spinal cord injury

Spinal cord injuries are generally classified by neurological level of injury and the extent of injury (Kirshblum et al. 2011). The neurological level of injury refers to loss of function at 1 of the **cervical** (C1–C8), **thoracic** (T1–T12), **lumbar** (L1–L5), or the **sacral** (S1–S5) segments of the spine. From the top of the body, the cervical spine is the highest part of the spine and includes the neck. The sacral segments are the lowest and include the sacrum and coccyx. Injuries to the sacrum are the least common type of SCI, therefore for reporting purposes these cases are combined with lumbar cases and reported as 1 group: **lumbosacral**.

An injury to the spinal cord at the cervical level results in the reduction or loss of motor and/or sensory function in the arms as well as in the trunk, legs and pelvic organs. This type of impairment is referred to as **tetraplegia** (sometimes also called 'quadriplegia'). An injury to the thoracic, lumbar or sacral levels of the spinal cord may result in a reduction or loss of motor and/or sensory functions of the trunk, legs and pelvic organs. This type of impairment is referred to as **paraplegia**.

(continued)

Box 1.2 (continued): Describing types of neurological impairment for spinal cord injury

Extent of injury is reported as complete or incomplete injury. This refers to the preservation of sensory and motor functioning at different levels of the spine. **Complete injury** is the term used when there is an absence of sensory and motor function in the lowest sacral segments (S4–S5) (that is, no 'sacral sparing'). (Note: 'Completeness' of injury is a different concept to the neurological level of injury.) **Incomplete injury** is the term used when there is preservation of any sensory and/or motor function below the neurological level of injury that includes the lowest sacral segments S4–S5 (that is, presence of 'sacral sparing').

A complete injury of the spinal cord at a high cervical neurological level is considered the most severe type of SCI.

Spinal cord injuries may result in a temporary or persisting deficit. For the purposes of this report, cases are designated as **persisting traumatic** or **non-traumatic SCI,** based on a finding of an American Spinal Injury Association (ASIA) Impairment Scale grade of A, B, C or D either 90 days after injury, or on discharge from rehabilitation (ASIA 2003; Kirshblum et al. 2011); or presence of deficit on discharge was reported by the SU. A description of the ASIA Impairment Scale can be found in the Glossary.

Neurological level of injury at time of discharge is the measure used to describe the clinical characteristics of persisting traumatic SCI in Chapter 3. Neurological injury at time of admission is the measure used when describing external causes of traumatic SCI in Chapter 4.

Box 1.3: Other terminology used in this report

Length of stay (LOS) is a common index used in hospital and health reports and is measured in number of days between admission to and discharge from the SU. Median LOS is reported, because it is not greatly influenced by outliers. Fifth and 95th percentiles have also been reported, to provide an indication of the patterns of variation in LOS between types of impairment. LOS can be expected to vary between cases with the same level and completeness for many reasons, including the presence of other injuries and the health status and age of the person when injured. In addition, time may pass between completion of rehabilitation and discharge, because of lack of suitable accommodation or carers.

Duration of initial care (DIC) is a concept developed by NISU for the purposes of measuring the period from the date of injury to the date of discharge from a participating SU to the person's previous home, or to a new home, nursing home or other accommodation. The DIC includes retrieval of the person from the scene of the injurious event, stabilisation and all acute care and rehabilitation as an admitted patient. Part of the care, but often not all, is provided in a SU. DIC measures are omitted from the 2008–09 to 2010–11 series.

Box 1.4: Classifying mechanism of injury for SCI cases

In keeping with previous reports, traumatic SCI due to *Transport-related* crashes is categorised into 2 main groups: cases due to a *Land transport* crash or cases due to *Other transport* (including water, air or rail) crashes. Due to the large number of cases and diversity of types of land transport vehicles involved, *Land transport crash* cases are further divided into 2 groups*: Motor vehicle occupants* and *Unprotected land transport users*.

- *Motor vehicle occupants* includes drivers, passengers and unspecified occupants of sedans, station wagons, 4-wheel drive vehicles, buses, vans, trucks, semi-trailers and other similar vehicles where the person is usually afforded some impact protection in the event of a traffic crash (for example, seatbelts and crumple zones).
- *Unprotected land transport users* include users of motor cycles, quad-bikes and bicycles as well as pedestrians. (This latter term, commonly used in road safety statistics, refers to the greater vulnerability to injury in a crash, of road users who are not occupants of a car or other large motor vehicle.)

Cases due to *Other transport* (including water, air or rail) *crashes* are included in the *Other and unspecified causes* category. *Other transport crashes* may include farm machinery such as tractors or heavy machinery such as excavators.

SCI cases due to a *Fall* may be classified as either due to a *Low fall* (a fall on the same level or from a height of less than 1 metre), or a *High fall* (a fall from a height 1 metre or more). In a small number of cases, details regarding the height of the fall are missing from the record. These cases are traditionally recorded as a *Low fall* in the ASCIR.

Water-related SCI cases are grouped following a search of descriptive injury text for terms related to events as diving into shallow water, being dumped in the surf by a wave, falling while water-skiing, or while scuba diving.

There are generally sufficient cases reported each year to include additional external cause categories for *Heavy falling objects*, *Horse-related* and *Football* SCI. Any remaining cases are grouped into the residual category *Other and unspecified causes*.

More detailed information on how cases are assigned to a mechanism of injury category is included in Appendix A: Data issues.

2 Traumatic SCI case registrations in 2008–09

This chapter provides an overview of traumatic SCI incident cases where the injurious event occurred between 1 July 2008 and 30 June 2009, and the case had been registered by 30 June 2014. For the period, 2008–09, a total of 263 incident cases were reported to ASCIR by participating SUs.

Of the 263 cases, 5 died before being discharged, 7 were discharged with no ongoing neurological deficit and 251 were discharged with a persisting deficit (Table 2.1). Ten cases discharged with persisting traumatic SCI were non-residents of Australia.

Table 2.1: Traumatic SCI cases with onset in 2008–09 and reported to ASCIR by 30 June 2014

	Australian residents		Non-residents		Total[(a)]	
	Number	**%**	**Number**	**%**	**Number**	**%**
At discharge from spinal unit:						
Persisting deficit	[(b)]241	95	10	100	251	95
No ongoing neurological deficit	7	3	0	0	7	3
Died on ward	5	2	0	0	5	2
Total	**253**	**100**	**10**	**100**	**263**	**100**

(a) Any persons over the age of 15 who sustained an SCI in 2008–09 due to trauma are the focus of Chapter 4.

(b) Australian residents over the age of 15 who sustained an SCI in 2008–09 due to trauma and had a persisting neurological deficit on discharge from a participating SU are the focus of Chapter 3.

The demographic, social and clinical characteristics of the 241 Australian residents with a persisting traumatic SCI are the focus of Chapter 3. This includes 9 Australian residents transferred to an Australian SU after incurring spinal injury overseas.

External causes of injury and other factors related to the injury event are reported in Chapter 4 for all 263 traumatic SCI cases with onset in 2008–09, irrespective of survival to discharge, persistence of deficit or place of usual residence.

The average age of those who died before discharge was 60 (range 18–81). All were males who had sustained a cervical level injury assessed as complete (that is, ASIA Impairment Scale = A) on admission. The time between injury and death was less than a week for 3 of the cases, and more than one year for the remaining 2 cases.

3 Persisting traumatic SCI

This chapter examines the characteristics of the 241 Australian residents who sustained a persisting traumatic SCI during 2008–09. In accordance with the annual *Spinal cord injury, Australia* reports, the injured person must meet the following criteria for inclusion in this chapter:

- an Australian resident at time of injury
- reported to have a spinal cord deficit at discharge
- discharged alive.

This includes 9 Australian residents transferred to Australia after sustaining an SCI overseas.

This chapter is restricted to Australian residents, including cases sustained while overseas, as incidence rates are calculated using the ERP of Australia aged 15 or older as provided by the ABS (see Appendix A: Population denominators). Direct age-standardisation was employed using the Australian population in 2001 as the reference (ABS 2003).

Persisting traumatic SCI in 2008–09 and earlier years

In 2008–09, the age-standardised incidence rate of persisting traumatic SCI at ages 15 and older, based on cases reported to ASCIR, was 14.0 cases per million population (95% *CI*: 13.8–15.7) (Figure 3.1 and Table C.1). This is the lowest rate based on the cases reported to ASCIR in the 14 years presented. Poisson regression based on annual incidence rates since 1995–1996, presented as a trend with 95% confidence interval, is also shown in Figure 3.1. According to this, the incidence rate of persisting traumatic SCI at ages 15 and older tended to decline by an average of 1.6% per year (95% *CI*: –0.8%, –2.4%).

While this trend was significantly different from zero ($p = 0.000$), cautious interpretation is required. Firstly, most of the observed decline was in the late 1990s, and annual rates varied little from 2001–02 to 2007–08, fluctuating from 15 to16 cases per million population. Secondly, the rates presented here are thought to be underestimates, and underestimation could have increased over time due to a possible increase in the number of cases of traumatic SCI admitted to non-participating health units and therefore not reported to ASCIR.

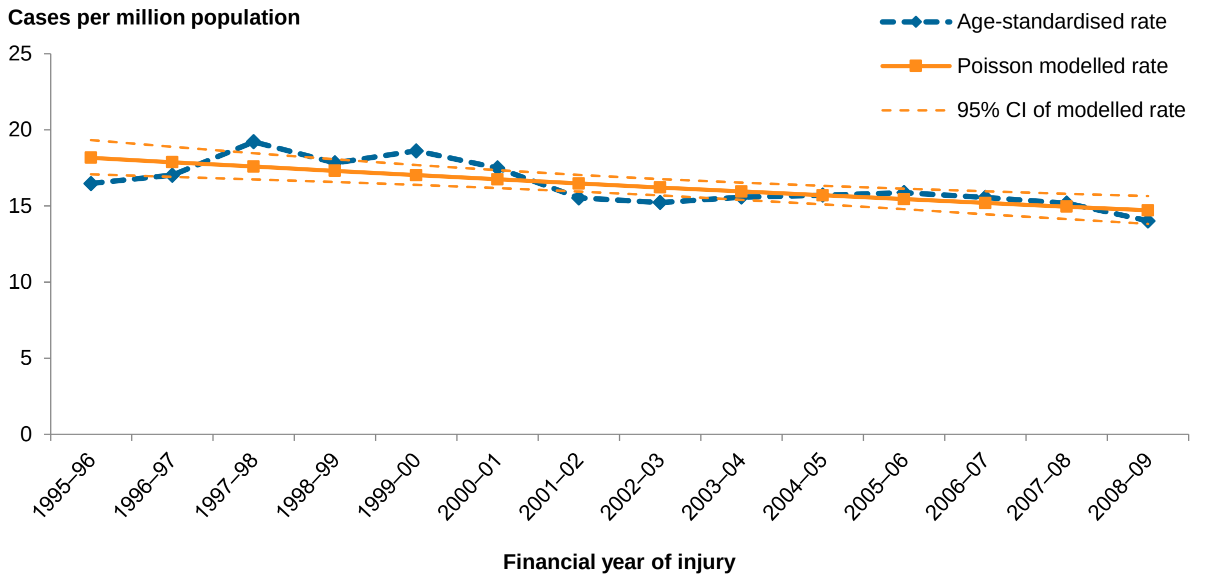


Figure 3.1: Trends in rates of persisting traumatic SCI cases aged 15 and older, by financial year of injury, Australian residents discharged alive, 1995–96 to 2008–09

Demographic and social characteristics of persisting traumatic SCI in 2008–09

Age and sex distribution

In 2008–09, 4 out of 5 persisting traumatic SCI cases were men (194 cases compared with 47 for women). The age distribution of case counts and age-specific rates for new cases of persisting traumatic SCI are presented in Figure 3.2 and Table C.2. Spinal cord injuries were most frequent in the 15–24 age group, which accounted for 25% of all cases at ages 15 and older. The second highest count was in the 25–34 age group (54 cases; 22%). Just 5% of the cases occurred at ages 75 and older.

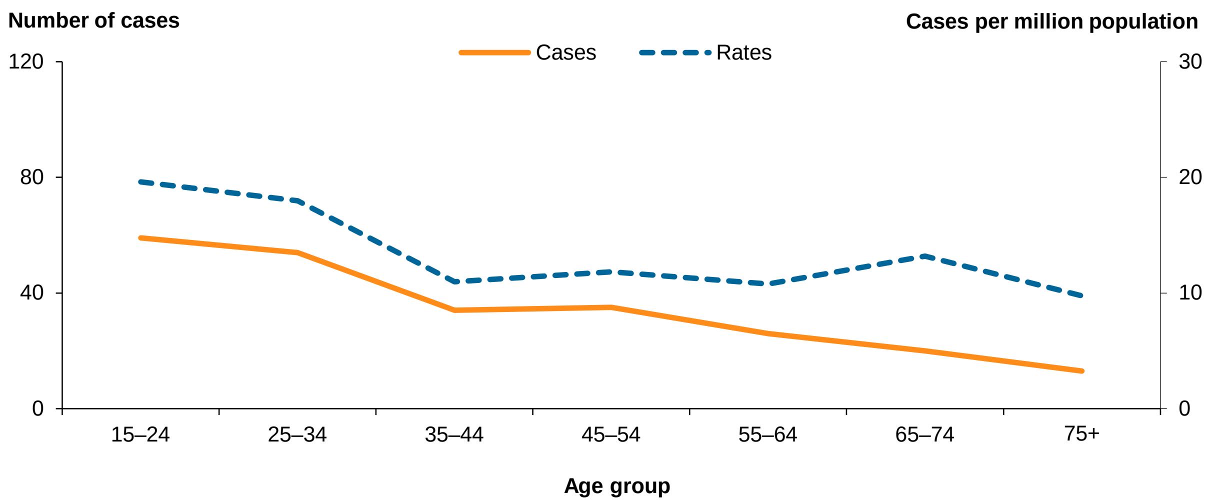


Figure 3.2: Counts and age-specific rates of persisting traumatic SCI, by age group, Australian residents discharged alive, 2008–09

Incidence rates for males were higher across all age groups than those for females, with the greatest disparity in the 15–24 age category (Figure 3.3 and Table C.3). The overall rate for men was 22.6 per million population compared with 5.4 for women, a male:female ratio of 4.2:1. A global review of SCI found a male excess in all countries studied, male:female rate ratios ranging from 2:1 to as high as 8.3:1 (Bickenbach et al. 2013).

The mean age at onset for men was 39 (*SD* = 18). The mean age for women was higher, at 46 (*SD* = 19). This difference reflects the higher incidence rate of persisting traumatic SCI in men than in women under the age of 35.

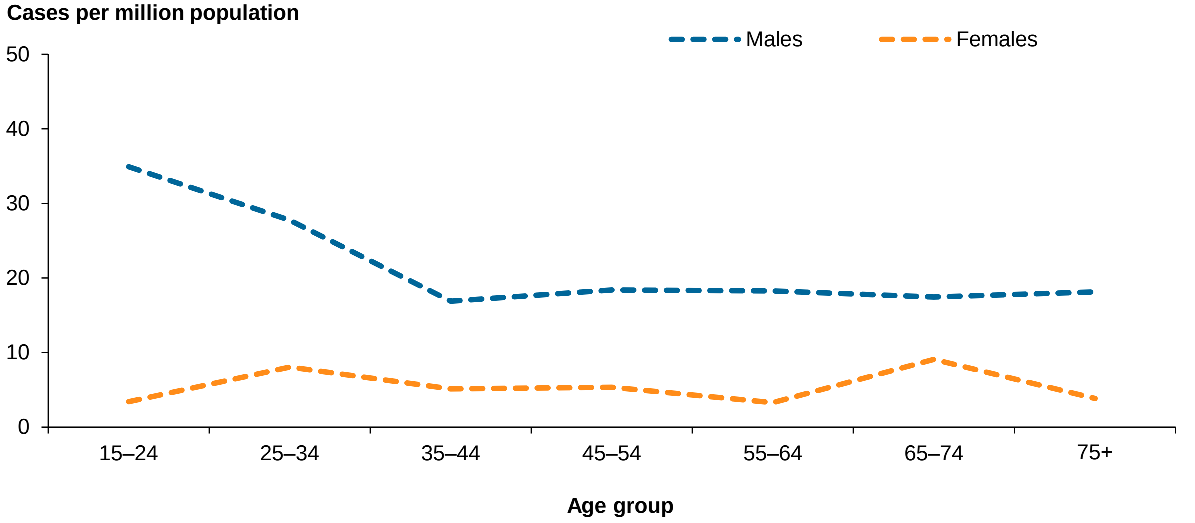
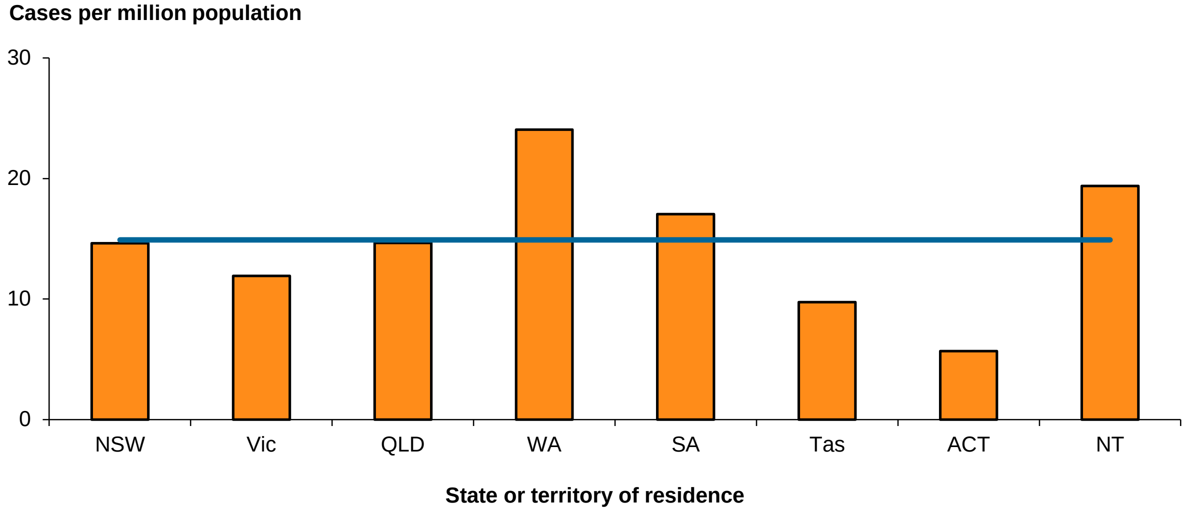


Figure 3.3: Age-specific rates of persisting traumatic SCI, by age group, by sex, Australian residents discharged alive, 2008–09

State and territory of usual residence

Age-standardised incidence rates of persisting traumatic SCI by state and territory of usual residence are presented in Figure 3.4 and Table C.4. Because of the small number of cases in some jurisdictions, rates are based on the aggregated state or territory case counts for the 3-year period 2006–07 to 2008–09.

Despite that, the rates are based on quite low numbers of cases, especially those for the smaller-population jurisdictions of Tasmania, South Australia, and the 2 territories. The rate for residents of Tasmania, Victoria and the Australian Capital Territory were lower than the national rate and the rate for residents of Western Australia, South Australia and the Northern Territory were higher.



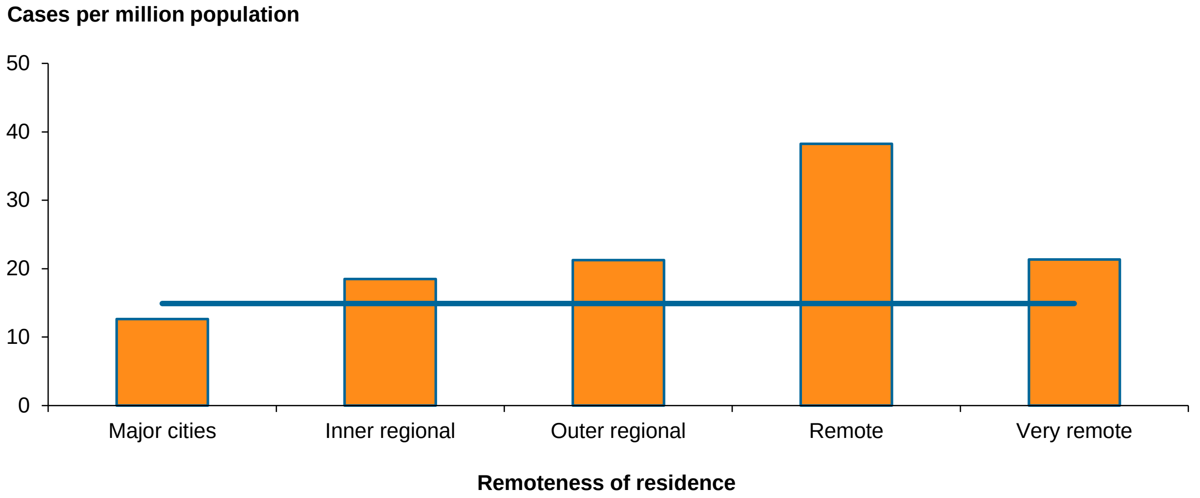
Note: Three-year Australia rate, aged 15 and older is shown as the solid horizontal line.

Figure 3.4: Age-standardised 3-year rates of persisting traumatic SCI cases, by state or territory of usual residence, Australian residents discharged alive, 2006–07 to 2008–09

Remoteness of residence and place of injury

As with state and territory of usual residence, 3-year rates were calculated for cases grouped according to remoteness of usual residence for the period 2006–07 to 2008–09 (Figure 3.5 and Table C.5) (See 'Assignment to remoteness area' in Appendix A). The 3-year rate for persisting traumatic SCI was highest for residents of *Remote Australia* (38.3 cases per million population) and lowest for residents of *Major cities* (12.7 cases per million population).

Only the 3-year rate for residents of *Major cities* was lower than the national rate (horizontal blue line). While the 3-year rates for residents of *Inner regional*, *Outer regional*, *Remote* and *Very Remote* areas were all higher, with the most noteworthy difference observed for residents of *Remote* areas. Rates for *Outer regional*, *Remote* and *Very Remote Australia* are based on fewer than 100 cases each.



Note: Three-year Australia rate, aged 15 and older is shown as the solid horizontal line.

Figure 3.5: Age-standardised 3-year rates of persisting traumatic SCI cases, by remoteness of residence, Australian residents discharged alive, 2006–07 to 2008–09

In 2008–09, nearly 2 out of 3 people who sustained a persisting traumatic SCI usually resided in *Major cities of Australia* (64%), while only 3% resided in *Remote* or *Very remote Australia* (Table 3.1). All 9 SCI cases in which injury occurred while overseas involved residents of *Major cities*.

In 51 cases (21%), SCI occurred while the person was in Australia but information provided was not sufficient to allow classification according to remoteness of the place of occurrence.

The remoteness of place of residence and place of injury were both known for 181 cases that occurred in Australia. In comparison with the remoteness area of residence, the place where injury occurred was in a more remote area for 29 (16%) of these cases, a less remote area for 7 (4%) and the same remoteness area for 145 (80%).

Table 3.1: Case counts of persisting traumatic SCI, by remoteness of usual residence, by area where injury occurred, Australian residents discharged alive, 2008–09

	Remoteness of usual residence					
Area where injury occurred	**Major cities**	**Inner regional**	**Outer regional**	**Remote**	**Very remote**	**Total**
	Case counts					
Major cities	100	3	0	0	0	103
Inner regional	12	24	4	0	0	40
Outer regional	5	6	15	0	0	26
Remote	1	2	0	5	0	8
Very remote	1	1	1	0	1	4
Australia, place not specified	27	15	6	3	0	51
Overseas	9	0	0	0	0	9
Total	**155**	**51**	**26**	**8**	**1**	**241**

Socioeconomic characteristics

Spinal cord injuries have enormous health, social and economic impacts on individuals, families, and communities. As well as the physical and psychological impact on those affected directly by SCI, there is also a heavy burden on those involved with the injured person. Socioeconomic factors that are known to be important in relation to injury and rehabilitation, such as marital status, employment status and level of educational at the time of onset of the SCI are recorded by the ASCIR and are described here.

Some studies have measured marital status in terms of the effects on life-expectancy; for example, Krause et al. (2010) found that being married was associated with lower mortality for people with SCI. A systematic review on the role of social support and social skills in people with SCI concluded that being married was an important source of social support only if the marriage was perceived positively (Müller et al. 2012). Nearly all people who acquired SCI at ages 15–24 (95%) were *Never married*, while 57% of people who acquired SCI at an older age were *Married (including de facto)* at the time (Table 3.2).

Table 3.2: Marital status at onset of persisting traumatic SCI, by age group, Australian residents discharged alive, 2008–09

	15–24		25–64		65+		All ages	
Marital status	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Never married	56	95	42	28	1	3	99	41
Widowed	0	0	4	3	8	24	12	5
Divorced	0	0	10	7	1	3	11	5
Separated	0	0	5	3	2	6	7	3
Married (including de facto)	3	5	85	57	19	58	107	44
Not reported	0	0	3	2	2	6	5	2
Total	**59**	**100**	**149**	**100**	**33**	**100**	**241**	**100**

A person's participation in the workforce at the time of injury has been identified as an important predictor of their return to work post-injury (Pflaum et al. 2006). Approximately two-third of the persisting traumatic SCI cases reported to the ASCIR in 2008–09 had a status of *Employed* at the time of injury (Table 3.3). This was similar to the annual average labour force participation rate in Australia, which was 65% in 2008–09 (ABS 2009).

Table 3.3: Employment status at onset of persisting traumatic SCI, by age group, Australian residents discharged alive, 2008–09

	15–24		25–64		65+		All ages	
Employment status	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Employed	46	78	110	74	6	18	162	67
Pensioner	0	0	9	6	21	64	30	12
Unemployed	5	8	16	11	0	0	21	9
Not available for employment	8	14	10	7	3	9	21	9
Not reported	0	0	4	3	3	9	7	3
Total[(a)]	**59**	**100**	**149**	**100**	**33**	**100**	**241**	**100**

(a) Percentages may not equal 100, due to rounding.

A higher level of education at the time of SCI has been found to be associated with a higher likelihood of returning to work post-injury (Lidal et al. 2007). Approximately 1 in 3 persons who sustained a persisting traumatic SCI in 2008–09 reported that they had a post-school qualification or were engaged in post-school education at the time of injury (Table 3.4).The most commonly reported type was a *Trade qualification/apprenticeship* (15%). Educational level was not reported for one-third of cases.

Table 3.4: Educational level attained at onset of persisting traumatic SCI, by age group, Australian residents discharged alive, 2008–09

	15–24		25–64		65+		All ages	
Education level	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Tertiary/postgraduate	5	8	19	13	4	12	28	12
Trade qualification/apprenticeship	11	19	21	14	3	9	35	15
Diploma or certificate	4	7	10	7	1	3	15	6
Other post school study	2	3	2	1	1	3	5	2
Highest available secondary school level	9	15	18	12	1	3	28	12
Left school aged 16 or over	9	15	21	14	0	0	30	12
Left school aged 15 or less	3	5	9	6	5	15	17	7
Still at school	3	5	0	0	0	0	3	1
Not reported	13	22	49	33	18	55	80	33
Total[(a)]	**59**	**100**	**149**	**100**	**33**	**100**	**241**	**100**

(a) Percentages may not equal 100, due to rounding.

Clinical characteristics of persisting traumatic SCI in 2008–09

The monitoring of clinical information on SCI enables injury outcomes to be studied. It also indirectly provides an indication of the degree of support required by people with an SCI at discharge from hospital. Information on the neurological level of SCI, extent of injury to the cord, and the degree of impairment is routinely reported by SUs during the initial hospitalisation for the SCI, and at discharge from rehabilitation.

The neurological level of SCI is the lowest level (that is, the one furthest from the head) that has preservation of full neurological function, both motor and sensory. Further information on neurological level and how it is assessed is provided in the Glossary.

The period of hospitalised admitted care for people with persisting traumatic SCI is often prolonged. It is not uncommon for people injured in 1 financial year to not be discharged until the following financial year, sometimes later. Some cases had not been discharged at the time of preparing previous annual reports. Due to the time elapsed since the end of the reporting period for this report, all 241 cases had been discharged and extent level of injury was known for all but 5 cases (98% coverage).

Neurological level of injury at discharge

The distribution of neurological level of persisting traumatic SCI at discharge is presented in Figure 3.6 and Table C.6.

Almost half of the persisting SCI cases that occurred during 2008–09 have a neurological level of injury in the cervical segments (49%, 117 cases). The equivalent proportion was 53% in 2007–08 (AIHW: Norton 2010). The impairment resulting from this neurological level is referred to as tetraplegia.

The most common neurological levels of injury were C4 and C5, which accounted for 68% of cervical cases and 33% of cases at any level.

Thirty-six per cent of cases had a neurological level of injury at a thoracic segment, 12% at a lumbar segment, and 1% at a sacral segment. The impairment resulting from injury at the thoracic or lumbosacral neurological levels is referred to as paraplegia.

Next most numerous, after injuries at the C4 and C5 levels, were cases with neurological level at the thoraco-lumbar junction, with 12% of cases having neurological levels of T12 or L1.

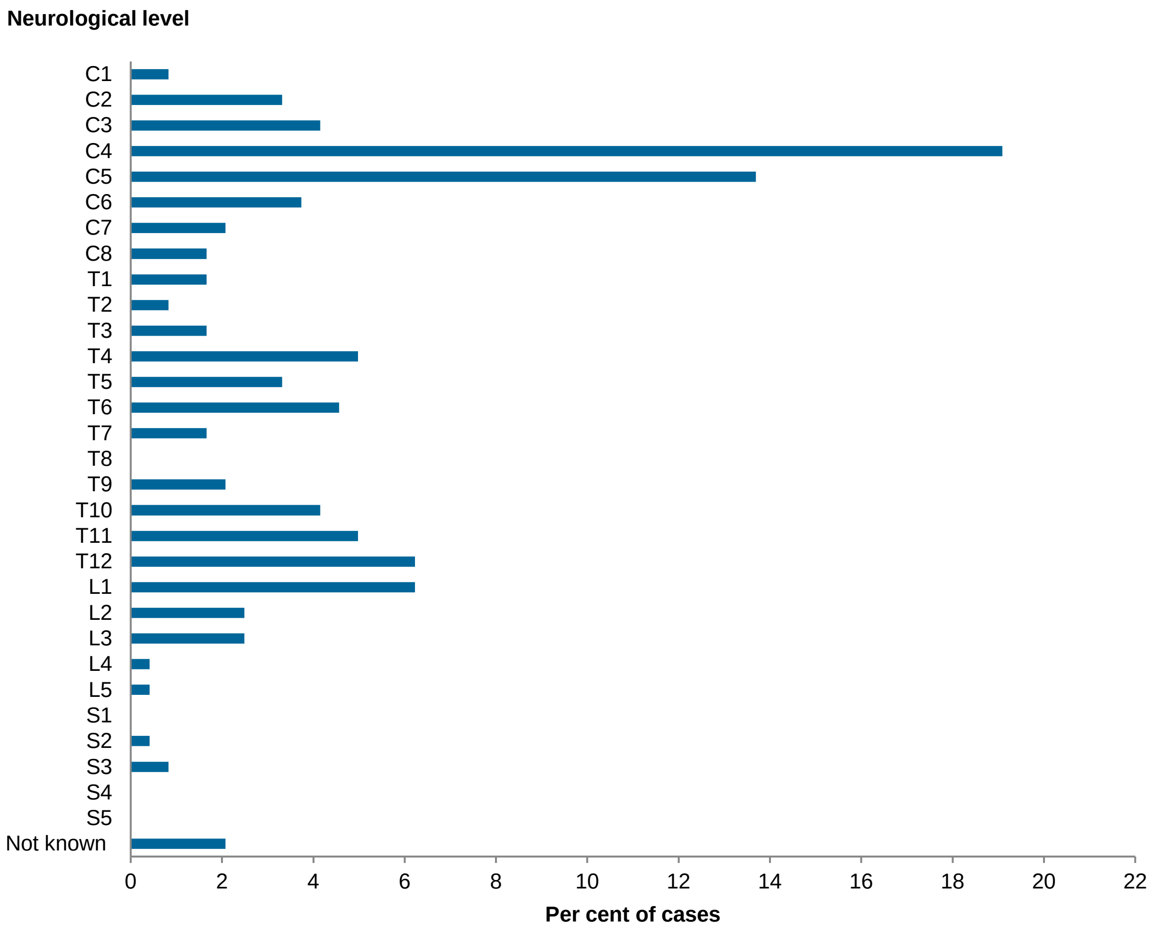


Figure 3.6: Neurological level of injury at discharge for persisting traumatic SCI cases, Australian residents discharged alive, 2008–09

Neurological impairment at discharge

Approximately one-third (34%) of new persisting traumatic SCI incidence cases reported to the ASCIR in 2008–09 were categorised as incomplete tetraplegia on discharge (Table 3.5). Cases in this category had been assessed as having a cervical level injury, and an ASIA Impairment Scale grade of either B (some sensory but no motor function preserved), C or D (some motor function preserved).

Nearly one-quarter (23%) of the 2008–09 cases had a complete injury at a thoracic level. Cases of this type had been assessed as neurological level of injury between T1 and T12, with an ASIA Impairment Scale grade A (no sensory or motor function at S4–S5, that is, no sacral sparing).

Cases involving the lumbosacral region were mostly discharged with incomplete paraplegia.

Table 3.5: Neurological impairment at discharge for persisting traumatic SCI, Australian residents discharged alive, 2008–09

Neurological impairment	Number of cases	%
Tetraplegia		
Cervical		
Complete tetraplegia	35	15
Incomplete tetraplegia	82	34
Paraplegia		
Thoracic		
Complete paraplegia	56	23
Incomplete paraplegia	31	13
Lumbosacral		
Complete paraplegia	6	2
Incomplete paraplegia	26	11
Total[(a)]	**236**	**98**

(a) Neurological level and/or completeness of SCI were not available for 5 cases.

Length of stay in spinal unit

This section differs from previous reports in which median duration of initial care (DIC) was reported but length of stay (LOS) in SUs was not. Length of stay in a SU for cases that occurred in 2008–09 is reported here. DIC is not reported in this report, trends in median DIC since 1995–96 recommences with the 2011–12 report.

Length of stay is a common index used in hospital and health reports and is measured in number of days between admission to and discharge from the unit (Table 3.6). Median LOS has been reported because it is not greatly influenced by outliers.

Fifth and 95th percentiles have also been reported to provide an indication of the patterns of variation in LOS between types of case. LOS can be expected to vary between cases with the same level and completeness for many reasons, including the presence of other injuries and the health status and age of the person when injured. In addition, time may pass between completion of rehabilitation and discharge because of lack of suitable accommodation or carers.

Complete cases at cervical level (complete tetraplegia) had the longest median LOS, 227 days, with 5th and 95th percentiles of 30 and 533 days.

Considering only types with cases numbering more than 20 (for which the median can be expected to be stable), the shortest LOS was for incomplete lumbosacral injuries; median 83 days, with a 5th percentile of 6 days and 95th percentile of 207 days.

Availability of the ASIA Impairment Scale assessments are dependent on which SU the person is admitted to, and whether they moved from an acute ward to a rehabilitation ward within the SU. Full ASIA Impairment Scale discharge data was not available for 5 cases injured in 2008–09. Of these, 3 cases had been assessed as incomplete (ASIA C or D) cervical level injury at admission.

Table 3.6: Length of stay in spinal unit for persisting traumatic SCI, by neurological impairment at discharge, Australian residents discharged alive, 2008–09

Neurological impairment at discharge	Number of cases	Median LOS (days)	5th Percentile (days)	95th Percentile (days)
Tetraplegia				
Cervical				
Complete tetraplegia	35	227	30	533
Incomplete tetraplegia	82	143	21	389
Paraplegia				
Thoracic				
Complete paraplegia	56	148	62	288
Incomplete paraplegia	31	118	8	246
Lumbosacral				
Complete paraplegia	6	131	7	188
Incomplete paraplegia	26	83	6	207
Total[(a)]	**241**	**147**	**21**	**367**

(a) Total include 5 cases of persisting traumatic SCI for which no ASIA assessment on discharge was available.

4 External causes of SCI in 2008–09

In addition to recording information on the incidence of traumatic SCI, the ASCIR records information about the event which resulted in injury: the mechanism; role of human intent; type of place where the injury occurred; and the type of activity involved in at the time of injury. Information on the factors associated with occurrence of traumatic SCI is important for injury prevention.

This chapter includes all 263 cases of traumatic SCI with onset in 2008–09 that were treated in participating SUs and had been reported to ASCIR by 30 June 2014. This number includes the 241 cases of persisting traumatic SCI that are the subject of Chapter 3, as well as 7 cases in which a person admitted to a SU had no neurological deficit at discharge (that is, not persisting cases); 5 cases where a person with traumatic SCI died while an inpatient of a participating SU; and 10 non-residents of Australia who were admitted to a participating unit due to SCI sustained in 2008–09 (see Table 2.1).

Mechanism of injury

Land transport crashes (45%) and *Falls* (33%) were the most frequent mechanisms of injury for traumatic SCI in 2008–09 (Table 4.1). Characteristics of the cases due to each of the mechanisms shown in Table 4.1 are presented in following subsections. The method for grouping cases by mechanism is described in Appendix A.

Table 4.1: Mechanism of injury of all traumatic SCI, by sex, 2008–09

	Males		Females		Total	
Mechanism of injury	**Number**	**%**	**Number**	**%**	**Number**	**%**
Land transport crash						
Motor vehicle occupant	37	18	22	42	59	22
Unprotected land transport user	52	25	8	15	60	23
Fall						
Low fall (same level or <1 metre)[(a)]	32	15	8	15	40	15
High fall (>1 metre)	40	19	7	13	47	18
Water-related	22	11	1	2	23	9
Heavy falling object	8	4	1	2	9	3
Horse-related	2	1	3	6	5	2
Football	5	2	0	0	5	2
Other and unspecified causes	12	6	3	6	15	6
Total[(b)]	**210**	**100**	**53**	**100**	**263**	**100**

(a) Includes falls from unspecified heights.

(b) Percentages may not equal 100, due to rounding.

Land transport crashes involving *Unprotected land transport users* were the most common cause of traumatic SCI in 2008–09 for cases aged 15–24 (31%) and 25–64 (23%) (Table 4.2). While *Low falls* accounted for 2 out of 5 traumatic SCI cases among those aged 65 or older. Further data on the age-distribution of cases is presented in each relevant subsection.

Table 4.2: Mechanism of injury of all traumatic SCI, by age group, 2008–09

	15–24		**25–64**		**65+**		**All ages**	
Mechanism of injury	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Land transport crash								
Motor vehicle occupant	20	29	30	19	9	24	59	22
Unprotected land transport user	21	31	36	23	3	8	60	23
Fall								
Low fall (same level or <1 metre)[(a)]	4	6	21	13	15	41	40	15
High fall (>1 metre)	8	12	31	20	8	22	47	18
Water-related	10	15	13	8	0	0	23	9
Heavy falling object	1	1	8	5	0	0	9	3
Horse-related	0	0	5	3	0	0	5	2
Football	2	3	3	2	0	0	5	2
Other and unspecified causes	2	3	11	7	2	5	15	6
Total[(b)]	**68**	**100**	**158**	**100**	**37**	**100**	**263**	**100**

(a) Includes falls from unspecified heights.

(b) Percentages may not equal 100, due to rounding.

Approximately half of all of traumatic SCI cases reported for 2008–09 sustained an injury to the cervical spine (51%; Table 4.3). Of the cervical injury cases, more than one-quarter (28%) were sustained by *Motor vehicle occupants*. Of traumatic SCI cases at the thoracic level, 40% were sustained by unprotected users in *Land transport crashes*, and 21% were due to falling from a height greater than 1 metre. *High falls* accounted for more than one-third (39%) of the lumbosacral SCI cases in 2008–09.

Table 4.3: Mechanism of injury for all traumatic SCI, by neurological level of injury at admission, 2008–09

	Tetraplegia		Paraplegia					
	Cervical		Thoracic		Lumbosacral		Total	
	Number	%	Number	%	Number	%	Number	%
Land transport crash								
Motor vehicle occupant	38	28	19	20	2	7	59	22
Unprotected land transport user	19	14	38	40	3	11	60	23
Fall								
Low fall (same level or <1 metre)[(a)]	25	18	9	9	6	21	40	15
High fall (>1 metre)	16	12	20	21	11	39	47	18
Water-related	21	15	2	2	0	0	23	9
Heavy falling object	3	2	3	3	3	11	9	3
Horse-related	2	1	2	2	0	0	5	2
Football	5	4	0	0	0	0	5	2
Other and unspecified causes	9	7	3	3	3	11	15	6
Total[(b)(c)]	**138**	**100**	**96**	**100**	**28**	**100**	**263**	**100**

(a) Includes falls from unspecified heights.

(b) Percentages may not equal 100, due to rounding.

(c) Total includes 1 case where neurological level of injury could not be determined.

Land transport crashes

As shown in Table 4.1, 119 of the 263 traumatic SCI cases reported to ASCIR in 2008–09 were due to *Land transport crashes*.

In this report, *Land transport crashes* are divided into 2 groups, *Motor vehicle occupants* and *Unprotected land transport users*. *Motor vehicle occupants* includes drivers, passengers and unspecified occupants of sedans, station wagons, 4-wheel drive vehicles, buses, vans, trucks, semi-trailers and other similar vehicles where the person is usually afforded some impact protection in the event of a traffic crash (for example, seatbelts and crumple zones). *Unprotected land transport users* includes users of motorcycles, quad-bikes and bicycles as well as pedestrians. Cases due to water, air or rail transport crashes are included in the *Other and unspecified causes* category.

In 2008–09, the number of *Motor vehicle occupants* (59 cases) who sustained a traumatic SCI was almost the same as for *Unprotected land transport users* (60 cases). The majority of SCI cases due to *Land transport crashes* were male (75%) (Table 4.4).

More motorcycle drivers than drivers of other types of motor vehicles sustained a traumatic SCI in 2008–09 (44 and 39 cases, respectively).

Five pedestrians sustained a traumatic SCI, and this was the only land transport user type for which injured females outnumbered males.

Table 4.4: Land transport user types for all traumatic SCI, 2008–09

	Males		Females		Total	
Land transport user type	**Number**	**%**	**Number**	**%**	**Number**	**%**
Motor vehicle driver	27	30	12	40	39	33
Motor vehicle passenger	10	11	10	33	20	17
Motorcycle driver[(a)]	41	46	3	10	44	37
Pedal cyclist or pedal cycle passenger	9	10	2	7	11	9
Pedestrian	2	2	3	10	5	4
Total[(b)]	**89**	**100**	**30**	**100**	**119**	**100**

(a) Seven cases involving three- or four-wheeled vehicle riders are included in the motorcycle drivers' counts for 2008–09.

(b) Percentages may not equal 100, due to rounding.

The mean age for *Motor vehicle occupants* was 38 (*SD* = 21), and 35 (*SD* = 15) for *Unprotected land transport users.*

Information on the use of seatbelts and contributing factors including impact with another motor vehicle or roadside hazard, rollovers and ejection from a motor vehicle is not always available to the staff who complete the case registrations forms for ASCIR. Of the 59 people who sustained SCI as *Motor vehicle occupants*, 25 (42%) were reported to have been wearing a seatbelt and 13 (22%) not be wearing one, while information was not provided for the remaining 21 cases (36%).

The most common type of event reported for cases involving *Motor vehicle occupants* was a vehicle rollover (54%). Ejection from a motor vehicle was the next most commonly reported event (24%), followed by impact with a motor vehicle (19%) and impact with a roadside hazard (15%). These contributing events are not mutually exclusive and more than one event may be reported for the same case. For instance, 4 cases (7%) reportedly involved an impact with a roadside hazard and a rollover event.

Of the 32 cases involving a vehicle rollover, 38% occurred in people aged 15–24, with twice as many males sustaining a traumatic SCI than females (8 and 4 cases, respectively). A further 25% of cases were aged between 25 and 34, with equal numbers of men and women (4 cases each).

Only 1 case was reported where the person was ejected from the vehicle during a rollover event while wearing a seatbelt. Confirmation of the use or not of a seatbelt in the other 8 rollover and ejection cases was not available. Lack of seat belt use was reported in each of the 5 non-rollover cases where the person was ejected from the vehicle.

The great majority of *Land transport crashes* occurred on a *public street or highway* (90%), with 7 of these occurring on non-urban roads. The remainder occurred on race-tracks and other public recreation areas, car parks and farm or bushland areas. Only 1 traumatic SCI case involving *Motor vehicle occupants* had no specified place of injury.

Nearly three-quarters of the cases of traumatic SCI sustained by *Unprotected land transport users* during 2008–09 were motorcyclists or quad-bike riders (73%), and all but 3 cases were male. Nine male and 2 female pedal cyclists, and 2 male and 3 female pedestrians also sustained a traumatic SCI during this period.

Impact with a motor vehicle was reported in 27% of *Unprotected land transport user* cases and impact with a roadside hazard was reported in 4 cases (7%).

Three- or four-wheeled vehicles (quad-bikes) were involved in 7 of the traumatic SCI cases reported to ASCIR for 2008–09. This amounted to 12% of the *Unprotected land transport user* cases and 3% of all traumatic SCI cases for this period.

More than half of the *Unprotected land transport user* cases had injuries to the thoracic spine (63%; Table 4.3), and of these, 26 cases resulted in complete paraplegia (74%).

Fifty-five per cent of traumatic SCI cases involving *Unprotected land transport users* reportedly occurred on public streets and highways, 12% occurred in bushland or on beaches, 10% on farms and 6% on spaces designated for public recreation such as bicycle and motor-cross tracks. Place of injury was not specified in 9 cases (15%).

Falls

A fall from a height greater than 1 metre (referred to here as a *High fall*) was the third most common mechanism of injury for reported traumatic SCI cases in 2008–09 (18%), and the second most common cause for males (19%) (Table 4.1).

Less than 20% of traumatic SCI cases due to any type of fall were reported for cases aged 15–24, compared with more than 60% for cases aged 65 or older (Table 4.2). The age-distribution pattern differed however when the type of fall was analysed. Double the number of *High fall* SCI cases were reported among the youngest age group, compared with *Low fall* cases, while the reverse was true for the eldest age group. This difference is reflected in the mean age of 44 for *High falls* (*SD* = 20) and 54 for *Low falls* (*SD* = 18).

While most falls were recorded as being *Unintentional* (that is, accidents), 2 *Low falls* were recorded as being due to *Assault* and 5 *High falls* were due to *Intentional self-harm*.

In and around the home was the most common place of injury reported for falls-related SCI, with 60% of *Low falls* and 57% of *High falls* occurring in the home or in a residential setting. Place where injury occurred was not specified for 18% of *Low falls* and 13% of *High falls*.

In 2008–09, 7 *High falls* and 3 *Low falls* were work-related.

More than half (63%) of the *Low fall* SCI cases in 2008–09 sustained an injury at the cervical level, while thoracic level injuries were most frequent (43%) for *High fall* SCI cases (Table 4.3).

Water-related

Water-related events accounted for 9% of traumatic SCI cases reported in 2008–09 (Table 4.1).

Young people aged 15–24 made up the largest proportion of cases in this category, with 10 of the 23 cases (43%) being reported for this age group (Table 4.2). The age range for *Water-related* SCI cases was 16–46, with a mean age of 29.

The majority of *Water-related* SCI cases were due to diving into shallow water (14 cases; 61%). While 6 cases sustained a traumatic SCI after being dumped in surf. Other *Water-related* SCI events reported for this period include falling while knee-boarding and decompression sickness associated with deep-sea diving.

Seaside beaches were the most common places where *Water-related* SCI cases were sustained during 2008–09 (12 cases), followed by inland waterways such as rivers and lakes (6 cases). The remaining 5 cases occurred in a swimming pool or aquatic recreation area.

All but 2 of the *Water-related* SCI cases sustained an injury at the cervical (neck) vertebrae (91%) (Table 4.3), and of these, 52% were complete injuries. The 2 thoracic level SCI cases were assessed as incomplete paraplegia.

Heavy falling objects

Eight males and 1 female sustained a traumatic SCI in 2008–09 due to a *Heavy falling object* (Table 4.1). Included in this category are cases involving tree branches, poles, bales and machinery, with the object often weighing in excess of 100kg and the person requiring extraction from beneath the object.

The mean age of people injured by this type of mechanism was 42 (*SD* = 13). A high proportion of these cases were injured while working for income (78%) which is further reflected in the age range of 21–62.

The types of places where traumatic SCI due to *Heavy falling objects* occurred included farms, warehouses, mines and other work environments.

Equal numbers of cases were reported for the 3 neurological levels of injury for traumatic SCI cases due to *Heavy falling objects* in 2008–09 (Table 4.3). All of the higher level spine injuries, that is those at the cervical and thoracic level, were complete, while the lower level injuries, involving the lumbosacral region, were incomplete.

Horse-related

Three cases of traumatic SCI in 2008–09 were due to falling from a horse, while a further 2 cases were due to being knocked over or pinned by a horse. These *Horse-related* SCI events accounted for 2% of traumatic SCI in 2008–09 (Table 4.1).

Three of the 5 *Horse-related* SCI cases were female. The mean age at onset for *Horse-related* SCI cases in this reporting year was 45, (range 31–60).

The 2 cervical injuries were incomplete, while the 2 thoracic injuries were complete (Table 4.3). Neurological level of injury was not available for 1 case but this was reported to be an incomplete injury.

The types of places where *Horse-related* spinal injuries occurred in 2008–09 included farms (3 cases) and areas designed for sporting and recreational activities (2 cases).

Football

Cases in this category resulted from events that occurred while participating in rugby (3 cases) or Australian Rules football (2 cases).

All were males (Table 4.1) and the mean age was 27, (range 16–41). This was the lowest mean age among the mechanisms included in this report.

All *Football* SCI cases involved a neurological injury at the cervical spine (Table 4.3). The spinal injuries which led to 2 of the 3 rugby cases being admitted to a SU had resolved by discharge (that is, assessed as ASIA Impairment Scale grade = E).

Other and unspecified causes

Fifteen traumatic SCI cases were admitted to a participating SU due to causes other than those described above, or due to unspecified causes. Specified causes in this residual category include cases resulting from post-operative complications, physical activities such as wrestling and snow-skiing, weapons and physical assault related injuries, being crushed by machinery in operation and an aviation crash.

Males outnumbered females in this residual category at a ratio of 4:1 (Table 4.1). The age range for *Other or unspecified causes* of traumatic SCI cases in 2008–09 was 21–68, with a mean age of 43.

The majority of *Other and unspecified* SCI cases involved a neurological injury at the cervical spine (66%; Table 4.3).

Activity at time of injury

The classification used for reporting type of activity is based on the one in the *International Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM)* (NCCH 2010). It includes the following categories: *While engaged in sports or leisure, While working for income, While engaged in other types of work (unpaid*), *While undertaking a personal activity* (such as resting, eating or showering) or *While engaged in other or unspecified activity*.

The types of activity being undertaken at the time of injury, together with the mechanism of injury, are in Table 4.5.

Approximately one-quarter of traumatic SCI cases reported to ASCIR in 2008–09 were sustained while the person was *Engaged in sports or leisure* activity, and 90% of these were males. One-third of all the sporting and leisure cases were due to a *Water-related* mechanism of injury such as diving into the shallow end of pool. A further 28% involved *Unprotected land transport users*, including 9 motorcyclists and 5 quad-bike operators. Forty-five per cent of people injured during sporting and leisure activities were aged 15–24 (29 cases). Three traumatic SCI cases sustained during sport and leisure pursuits were discharged with no ongoing deficit. Overall, alcohol was noted as a contributing factor in 19% of *Sports or leisure* SCI cases.

Land transport crashes accounted for 51% of cases sustained while the person was *Working for income*. Four cases occurred while the person was travelling to or from their place of work. *High falls* and *Heavy falling objects* each accounted for 17% of cases sustained *While working for income*. Males made up 81% of cases for this type of activity.

Six per cent of reported traumatic SCI cases for 2008–09 occurred while the person was *Engaged in other unpaid work*, and all but 1 case were male. No cases were reported for persons under the age of 39 and the maximum age was 75. More than three-quarters of unpaid work cases involved a *High fall*, most often from a ladder (6 cases) or roof (5 cases). Two cases of traumatic SCI that occurred while the person was carrying out unpaid work activities had resolved at the time of discharge (ASIA Impairment Scale = E).

A *Low fall* was the leading mechanism of injury for people who sustained a traumatic SCI *While undertaking personal activities* such as resting, eating, bathing (including cases *being nursed or cared for*. People over the age of 45 made up the greatest proportion of these cases (72%). Falling while in the bathroom attending to personal hygiene was reported in 5 cases. Two cases resulted from post-operative complications. One traumatic SCI case sustained during personal activity had resolved by discharge.

The majority of cases in the *Other and unspecified activity* category involved *Land transport crashes* (64% overall). In particular, 29 cases were motor vehicle drivers, 18 passengers, 24 motorcycle drivers, 5 pedal cyclists and 3 pedestrians. This activity category also includes cases where the most likely role of human intent was *Intentional self-harm* (6 cases), *Assault* (3 cases) and *Legal intervention including avoiding police* (2 cases). Seventy-six per cent of cases in this residual activity group were males, and of these 51% were aged 15–34 (48 cases). Females in the same age range accounted for 37% of the 30 female cases.

Table 4.5: Traumatic SCI, by mechanism of injury, by type of activity, 2008–09

	Sports and leisure		Working for income(a)		Other type of work		Personal activity(b)		Other and unspecified activity		Total	
Mechanism of injury	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Land transport crash												
Motor vehicle occupant	1	2	11	27	0	0	0	0	47	38	59	22
Unprotected land transport user	18	28	10	24	0	0	0	0	32	26	60	23
Fall												
Low fall (same level or <1 metre)(c)	6	9	3	7	2	12	11	61	18	15	40	15
High fall (>1 metre)	7	11	7	17	13	76	3	17	17	14	47	18
Water-related	21	33	0	0	0	0	0	0	2	2	23	9
Heavy falling object	1	2	7	17	0	0	0	0	1	1	9	3
Horse-related	2	3	1	2	0	0	0	0	2	2	5	2
Football	5	8	0	0	0	0	0	0	0	0	5	2
Other and unspecified causes	3	5	2	5	2	12	4	22	4	3	15	6
Total(d)	**64**	**100**	**41**	**100**	**17**	**100**	**18**	**100**	**123**	**100**	**263**	**100**

(a) Includes travel to and from work.

(b) Includes being nursed or cared for.

(c) Includes falls from unspecified heights.

(d) Percentages may not equal 100, due to rounding.

Appendix A: Data issues

Data quality statement

This data quality statement provides information relevant to interpretation of the Australian Spinal Cord Injury Register (ASCIR).

Summary of key data quality issues

- The Australian Institute of Health and Welfare (AIHW) National Injury Surveillance Unit (NISU) compiles the ASCIR using data provided by participating spinal units (SUs) in hospitals in Australia.
- The ASCIR is estimated to cover a large proportion of adult cases of spinal cord injury (SCI) due to trauma.
- The ASCIR database changes over time, adding new records and improving the quality of existing records as new information becomes available. Reported information on ASCIR records may therefore change from year to year.

Description

The ASCIR is an opt-in national register of incident cases of SCI which occur in Australia and overseas to Australian residents if they are treated in an SU in Australia. The ASCIR has operated as a cooperative venture of the directors of the participating SUs in Australia and the AIHW through the AIHW NISU since 1995. The ASCIR is part of the NISU program, which is managed and operated by the Research Centre for Injury Studies (RCIS), Flinders University. The ASCIR is based on the national register originally established by Mr John Walsh AM, in 1986.

The ASCIR is managed by a Board of Directors comprising the directors of the SUs; Professor James Harrison, Director of the NISU; and invited specialists in epidemiology, paediatric rehabilitation and other fields of relevance.

The registration process begins in the SU after patient stabilisation. The director at each participating SU is responsible for data collection and patient consent arrangements in their unit. The registration process and reporting to the NISU differs between SUs: some SUs use a 2-phase registration and reporting process, on admission and on discharge, while others may register and report at the time of discharge only.

Institutional environment

The AIHW is a major national agency set up by the Australian Government under the *Australian Institute of Health and Welfare Act 1987* to provide reliable, regular and relevant information and statistics on Australia’s health and welfare. It is an independent corporate Commonwealth entity established in 1987, governed by a management board, and accountable to the Australian Parliament through the Health portfolio.

The AIHW aims to improve the health and wellbeing of Australians through better health and welfare information and statistics. It collects and reports information on a wide range of topics and issues, ranging from health and welfare expenditure, hospitals, disease and injury, and mental health, to ageing, homelessness, disability and child protection.

The AIHW also plays a role in developing and maintaining national metadata standards. This work contributes to improving the quality and consistency of national health and welfare statistics. The AIHW works closely with governments and non-government organisations to achieve greater adherence to these standards in administrative data collections, to promote national consistency and comparability of data and reporting.

One of the main functions of the AIHW is to work with the states and territories to improve the quality of administrative data and, where possible, to compile national data sets based on data from each jurisdiction, to analyse these data sets and to disseminate information and statistics.

The *Australian Institute of Health and Welfare Act 1987*, in conjunction with compliance to the *Privacy Act 1988*, ensures that the data collections managed by the AIHW are kept securely and under the strictest conditions with respect to privacy and confidentiality. (For further information, see the AIHW website <www.aihw.gov.au>.)

The AIHW is the Data Custodian for ASCIR data, through the NISU. The Data Custodian ensures that the analysis and dissemination of the data are in accord with purposes approved by the AIHW Ethics Committee, as well as security provisions required by Section 29 of the *Australian Institute of Health and Welfare Act 1987*. The NISU is responsible for the security, proper operation, access to and use of ASCIR data. The Director, Professor Harrison, is responsible to the AIHW for ensuring that the operation of the ASCIR and the use of ASCIR data comply with the AIHW policies and procedures.

The following SUs, all based in public hospitals, contribute data to ASCIR:

- New South Wales State Spinal Cord Injury Services
  - Prince of Wales Hospitals (Sydney)
  - Royal North Shore Hospital (Sydney)
  - Royal Rehabilitation Centre (Sydney)
- Queensland Spinal Cord Injury Services, Princess Alexandria Hospital (Brisbane)
- South Australia Spinal Cord Injury Service, Hampstead Rehabilitation Unit (Adelaide)
- Victorian Spinal Cord Services, Austin Health (Melbourne)
- Western Australia State Rehabilitation Services, Royal Perth Hospital's Shenton Park campus.

Timeliness

The reference period for this report is 2008–09.

The main focus for reporting is incident cases of persisting traumatic SCI. 'Persisting' cases are those in which the ASIA Impairment Scale is A to D at 90 days after injury, or at discharge from rehabilitation. Long periods in rehabilitation are not unusual. Finalising register data, particularly for cases that arise late in the reference year, requires follow-up for a period after the end of that period.

The date of closure for 2008–09 data was 30 June 2014. A snapshot file of the ASCIR was taken on 14 August 2014.

Data for 2008–09 to 2012–13 and a summary report for that period are planned to be released in 2018.

Accessibility

The AIHW provides the published annual epidemiological *Spinal cord injury, Australia* series based on the ASCIR. These products may be accessed on the AIHW website <www.aihw.gov.au>.

Additional data requests can also be made on an ad hoc basis, facilitated through the AIHW.

Aggregated jurisdictional data may be released with the permission of the AIHW Data Custodian and the relevant SU director(s). Aggregated national data may be released with the permission of the AIHW Data Custodian.

Interpretability

The annual publications include a glossary and an appendix on data issues, as well as inclusion and exclusion criteria for each chapter or subsection.

Further information on the ASCIR is available on request by email <nisu@flinders.edu.au>.

Relevance

The Australian Spinal Cord Injury Register contains records of newly incident cases of SCI which occur in Australia and overseas to Australian residents since 1995 and up to 2012–13. Cases for 2013–14 onwards are currently being registered.

The scope of the ASCIR includes patients who are admitted to 1 of the 7 specialised SUs in Australia chiefly responsible for care and rehabilitation of people with this condition.

The ASCIR keeps a record of patient demographic information; assessment of level of SCI at admission; a description of the event that led to their SCI; details of clinical status at discharge; and any complications during the course of treatment and rehabilitation.

Although the ASCIR is a valuable source of information on the incidence of SCI care characteristics and trends, the data have limitations. Notably, the system does not include cases that are not treated at any of the participating units, which includes paediatric cases and some others. Also, the current system does not capture detailed information on the period from injury to admission to an SU, and does not obtain follow-up data after discharge from an SU.

Accuracy

The participating SUs are primarily responsible for the quality of the data they provide. However, the NISU undertakes extensive validations on receipt of data. Data are checked for valid values, logical consistency and historical consistency. Potential errors and gaps in data are queried with the relevant SU, and corrections and resubmissions may be made in response to these queries. Despite these processes, values of some variables remain unspecified, due to information not having been volunteered or recorded. The number of records for which data on tabulated variables was not available is generally stated in tables and footnotes. The NISU does not adjust data to account for possible data errors or missing or incorrect values, except as stated in reports.

Ideally, all cases would be added to the ASCIR during the initial period of hospitalisation following injury. However, in practice there has often been a substantial time lag between a patient's admission and the start of the case registration process. Each SU has a different system for completing and compiling case registrations before submission to the NISU, and delays at different stages of the process occur from time to time.

The ASCIR is continuously updated. Sometimes information comes to hand after the closure of a reporting period. Closure of a reporting period usually occurs following an audit/review period extending for at least 1 year after the reporting period ends. This allows for sometimes long periods of admitted patient care. As a result, analysis of data from the register over longer periods of time will reflect these changes to data on cases that occurred in earlier years, and will not necessarily match the results of analyses in previous reports.

Known contributing factors in underestimation include that the person a) did not consent to be included in the register, b) was released from hospital without the need for admitted patient rehabilitation, c) was admitted to another rehabilitation unit that does not provide data to the ASCIR or d) died before admission to a specialist SU occurred.

Coherence

The ASCIR includes data for each year from 1995–96 to 2012–13.

The data reported for 2008–09 are broadly consistent with data reported for the ASCIR for previous years.

Extensive checking of ASCIR records was undertaken in 2014 and 2015. This revealed some errors and inconsistencies, mostly mistakes in transcription from paper records. In most instances, these were able to be corrected on the basis of stored register forms or by consultation with the submitting SU.

In addition, it was found that the assignment of external causes of traumatic SCI on the basis of short text descriptions in submitted registration data was not always consistent. A revised method was implemented, based more directly on the available text and aligned more closely with the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification* (ICD-10-AM) and the previous version of the classification (ICD-9-CM). The main effect of this is that, in reports covering cases occurring in 2008–09 and later, Land transport cases have not been sub-divided into traffic and non-traffic cases, as available text was not sufficient to make this distinction reliably in many cases.

Time series presentations may be affected by changes in admission practices and/or in reporting of cases to the ASCIR. This applies particularly to the least severe cases, namely those that were admitted to 1 of the participating SUs but were later found to have no ongoing neurological injury (that is, ASIA impairment score = E). Such cases were more numerous in the decade from 1995–96 than more recently.

Funding for the ASCIR was not provided in 2008–09 and 2009–10. During this period, case registration and compilation slowed considerably. When funding was reinstated, some SUs experienced difficulties in retrospectively achieving full case registration.

Further information on the ASCIR data set is available on request by email <nisu@flinders.edu.au>.

Population denominators

Population data were obtained from the ABS. Rates have been calculated as cases per million of the ERP of Australia. The ERPs for jurisdiction, sex and 5-year age groups was sourced from *3101.0 Australian Demographic Statistics, June 2013*; released

Tuesday 17 December 2013 (ABS 2013a). ERPs are calculated and published by the ABS to 30 June and:

- for 2007–2011 have a status of Final
- for 1992–2006 have a status of Final (recast)
- before 1992 have a status of Final

  and

- are by State, Territory and Australia (including Other Territories).

ERPs for remoteness was sourced from *3235.0—Population by age and sex, regions of Australia, 2012;* released Friday 30 August 2013 (ABS 2013c). The ABS advise the ERPs in this issue are final for 2001 to 2011 and preliminary for 2012.

Annual rates to 31 December were manually calculated by adding the ERPs for the first and second year and dividing by 2.

Direct standardisation was employed, taking the Australian population in 2001 as the standard (ABS 2003).

This report adopts the ABS definition of *Place of usual residence* as:

> …that place where each person has lived or intends to live for six months or more from the reference date for data collection (ABS 2012b).

As with Australian Census data, place of residence at the time on injury for the ASCIR is self-reported and some visitors to Australia may have reported an address in Australia as their place of residence, rather than apply this technical distinction. This may have resulted in some non-residents being assigned *Australian resident* status in this report.

Use of confidence intervals

The ASCIR is designed to register new cases of SCI at ages 15 and older, so sampling errors do not apply to these data. However, the time periods used to group the cases (that is, financial year) are arbitrary. Use of another period (for example, January to December) would result in different rates.

Where case numbers are small, the effect of chance variation on rates can be large. Confidence intervals (95%, based on a Poisson assumption about the number of cases in a time period) have been placed around rates in Figure 3.1 as a guide to the size of this variation. Chance variation alone would be expected to lead to a rate outside the interval only once in 20 occasions.

Assignment to reported mechanism of injury

Cases were assigned to 1 of the following mechanism of injury categories:

- Land transport crashes
  - Motor vehicle occupants
  - Unprotected land transport users
- Falls
  - Low falls (same level or <1 metre) (includes falls from an unspecified height)
  - High falls (>1 metre)
- Water-related

- Heavy falling object
- Horse-related
- Football.

The method for allocating cases into mechanism of injury categories shown in Table A.1 was a 3-step process as follows:

- Step 1: Draft allocation to the *Land transport crashes*, *Falls* and *Horse-related* SCI on the basis of the numeric code values in the 'Main External Cause A' data field.
- Step 2: Draft allocation to the next 3 categories on the basis of the presence of key words or phrases in the 'Description of the traumatic SCI event' data field.
- Step 3: Cases were reviewed for errors and inconsistencies, and re-assigned if these were found. If a case met criteria for more than 1 row, then it was assigned to the 1 occurring highest in the table.

Table A.1: Assignment to reported mechanism of injury

Reported mechanism of injury	Assignment according to ASCIR field 'Main External Cause A' numeric code or content of ASCIR field 'Description of the traumatic SCI event'
Motor vehicle occupants	1. Motor vehicle—driver 2. Motor vehicle—passenger *(includes unspecified occupants)*
Unprotected land transport users	3. Motorcycle—driver 4. Motorcycle—passenger *(includes unspecified occupants)* 5. Pedal cyclist or pedal cycle passenger *(includes unspecified occupants)* 6. Pedestrian
Low falls (same level or <1 metre)	9. Fall—low (on same level, or <1 metre drop) *(also includes fall from an unspecified height)*
High falls (>1 metre)	10. Fall—high (drop of 1 metre or more)
Water-related	Records searched for mention of: dive, diving, swim, surf, pool, shallow, water-skiing, wakeboarding, snorkelling
Heavy falling object	Records searched for mention of: branch fell, tree fell, pinned by, bales slid, falling telephone pole, clay fell, hit by a metal ramp, metal falling off truck
Horse-related	8. Horse related (fall from, struck or bitten by)
Football	Records searched for mention of: football, AFL, rugby, soccer
Other and unspecified causes	Any remaining records not assigned to a mechanism above

Assignment to remoteness area

The ABS Remoteness Structure is a common measurement used in Australian health data and provides a classification system which provides an indication of road distances people may have to travel to access their nearest service centres. The Remoteness Structure was developed by the Australian Government in 1997 and had a methodology update in 2011 (ABS 2013b). The classification of remoteness areas remains the same however and includes:

- Major cities of Australia
- *Inner regional Australia*
- *Outer regional Australia*
- *Remote Australia*
- *Very remote Australia.*

In this report, remoteness for place of residence and place of injury were calculated using 2 interactive map look-up tools.

The first step involved converting postcodes recorded in the ASCIR to remoteness areas using Table 3 in the Postcode 2011 to Remoteness Area 2006 Data Cube (ABS 2012a).

Where a postcode had more than 1 remoteness area assigned, the street address or location recorded in the ASCIR was used to search the Department of Health DoctorConnect website <http://www.doctorconnect.gov.au/internet/otd/Publishing.nsf/Content/locator>.

Appendix B: Non-traumatic SCI

Summary of non-traumatic SCI cases reported to ASCIR for 2008–09

In 2008–09, 57 men (66%) and 29 women (34%) with a non-traumatic SCI consented to being included in the ASCIR based on being admitted to 1 of the participating SUs between 1 July 2008 and 30 June 2009. Table B.1 provides a summary of neurological deficit at discharge.

Table B.1: Non-traumatic SCI cases with admission in 2008–09 and reported to ASCIR by 30 June 2014

	Number	%
At discharge from spinal unit:		
Persisting non-traumatic SCI	83	97
No ongoing neurological deficit	1	1
Died on ward	2	2
Total	**86**	**100**

The mean age for non-traumatic SCI cases admitted in 2008–09 was 53 (*SD* = 18).

The median LOS in a participating SU was 129 days (5th percentile 18 days, 95th percentile 395 days).

A non-traumatic SCI was most commonly secondary to causes such as epidural abscess, osteomyelitis or tumours.

The proportion of males in the non-traumatic SCI group was lower than that for males in the traumatic SCI group (66% versus 80%).

Appendix C: Additional tables

The data included in these additional tables underpin the figures presented in Chapter 3.As a reminder, the injured person must meet the following criteria for inclusion:

- an Australian resident at time of injury
- reported to have a spinal cord deficit at discharge
- discharged alive.

Table C.1: Trends in persisting traumatic SCI, by financial year of injury, Australian residents discharged alive, 1995–96 to 2008–09

Financial year of injury	Age-standardised rate per million population	Poisson modelled rate per million population	Upper 95% CI	Lower 95% CI
1995–96	16.5	18.2	19.3	17.1
1996–97	17.0	17.9	18.9	16.9
1997–98	19.2	17.6	18.5	16.7
1998–99	17.8	17.3	18.1	16.6
1999–00	18.6	17.0	17.7	16.4
2000–01	17.5	16.7	17.3	16.2
2001–02	15.5	16.5	17.0	15.9
2002–03	15.2	16.2	16.8	15.7
2003–04	15.6	16.0	16.5	15.4
2004–05	15.7	15.7	16.3	15.1
2005–06	15.9	15.4	16.1	14.8
2006–07	15.6	15.2	16.0	14.5
2007–08	15.2	15.0	15.8	14.1
2008–09	14.0	14.7	15.7	13.8

Table C.2: Counts and age-specific rates of persisting traumatic SCI, by age group, Australian residents discharged alive, 2008–09

Age group	Cases	Rate per million population
15–24	59	19.6
25–34	54	18.0
35–44	34	11.0
45–54	35	11.8
55–64	26	10.8
65–74	20	13.2
75+	13	9.8

Table C.3: Age-specific rates of persisting traumatic SCI, by sex, by age group, Australian residents discharged alive, 2008–09

Age group	Cases	Rate per million population
Males		
15–24	54	34.9
25–34	42	27.7
35–44	26	16.9
45–54	27	18.4
55–64	22	18.3
65–74	13	17.5
75+	10	18.1
Females		
15–24	5	3.4
25–34	12	8.0
35–44	8	5.1
45–54	8	5.4
55–64	4	3.3
65–74	7	9.1
75+	3	3.8

Table C.4: Age-standardised 3-year rates of persisting traumatic SCI cases, by state or territory of usual residence, Australian residents discharged alive, 2006–07 to 2008–09

State or Territory	Cases	3-year rate per million population
New South Wales	242	14.6
Victoria	152	11.9
Queensland	146	14.7
Western Australia	123	24.1
South Australia	66	17.0
Tasmania	11	9.7
Australian Capital Territory	5	5.7
Northern Territory	11	19.4
All Australian jurisdictions	**756**	**14.9**

Table C.5: Age-standardised 3-year rates of persisting traumatic SCI cases, by remoteness of residence, Australian residents discharged alive, 2006–07 to 2008–09

	Cases	3-year rate per million population
Major cities of Australia	454	12.7
Inner regional Australia	163	18.5
Outer regional Australia	97	21.2
Remote Australia	28	38.3
Very remote Australia	10	21.4
All remoteness areas	**756**	**14.9**

Table C.6: Neurological level of injury at discharge for persisting traumatic SCI cases, Australian residents discharged alive, 2008–09

Neurological level	Frequency	%
C1	2	1
C2	8	3
C3	10	4
C4	46	19
C5	33	14
C6	9	4
C7	5	2
C8	4	2
T1	4	2
T2	2	1
T3	4	2
T4	12	5
T5	8	3
T6	11	5
T7	4	2
T8	0	0
T9	5	2
T10	10	4
T11	12	5
T12	15	6
L1	15	6
L2	6	2
L3	6	2
L4	1	0
L5	1	0
S1	0	0
S2	1	0
S3	2	1
S4	0	0
S5	0	0
Not known	5	2
Total	**241**	**100**

Glossary

ASIA Impairment Scale: The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) (revised 2011) uses the American Spinal Injury Association Impairment Scale, also known as the ASIA Impairment Scale or AIS, to classify spinal injuries using a combination of measurements of motor and sensory function (ASIA 2003; Kirshblum et al. 2011). This scale is a modification of an earlier classification system known as the Frankel Scale, which was commonly used between 1969 and 1992 (Frankel et al. 1969). To avoid confusion with the more widely known Abbreviated Injury Scale (AIS) classification system, this report has adopted the term ASIA Impairment Scale. The following ASIA Impairment Scale categories are used to grade the degree of impairment:

> **A = Complete.** No sensory or motor function is preserved in the sacral segments S4–S5, meaning there is 'no sacral sparing'. This is measured by light touch, pin prick at S4–S5, or deep anal pressure.
>
> **B = Sensory Incomplete.** Sensory but not motor function is preserved below the single neurological level of injury and includes the sacral segments S4–S5 (that is, there is 'sacral sparing'), AND no motor function is preserved more than 3 levels below the motor level on either side of the body.
>
> **C = Motor Incomplete.** Motor function is preserved at the most caudal sacral segments for voluntary anal contraction OR the patient meets the criteria for sensory incomplete status (sensory function preserved at the most caudal sacral segments (S4–S5) as measured by light touch, pin prick at S4–S5, or deep anal pressure), and has some sparing of motor function more than 3 levels below the ipsilateral motor level on either side of the body. For a grade of C, less than half of the key muscle functions below the single neurological level of injury should have a muscle grade equal to or greater than 3, which is defined as having 'active movement, and full range of motion against gravity'.
>
> **D = Motor Incomplete.** Motor incomplete status as defined above, with at least half or more of key muscle functions below the single neurological level of injury having a muscle grade equal to or greater than 3.
>
> **E = Normal.** If sensation and motor function as tested with the ISNCSCI are graded as normal in all segments, and the patient had prior deficits, then the ASIA Impairment Scale grade is E (Kirshblum et al. 2011).

complete injury: A SCI case with a complete injury is assessed as ASIA Impairment Scale grade A.

incomplete injury: A SCI case with an incomplete injury is assessed as an ASIA Impairment Scale grade of B, C or D.

duration of initial care: The period from the date of injury to the date of discharge from a participating spinal unit to a person's previous home, or to a new home, nursing home or other accommodation. This period includes retrieval of the person from the scene of the injurious event; stabilisation; and all acute care and rehabilitation as an admitted patient. Part of the care, but usually not all, is provided in a SU.

extent of SCI: Refers to the extent of neurological damage, which is either ‘complete’ or ‘incomplete’. If partial preservation of sensory and/or motor functions is found below the neurological level and includes the lowest sacral segment, the injury is defined as incomplete. The term ‘complete injury’ is used when there is an absence of sensory and motor function in the lowest sacral segment (see **ASIA Impairment Scale**).

incident case of SCI: A person who suffers a temporary or permanent (persisting) spinal cord injury, as defined by the US Centers for Disease Control, during a reporting period.

neurological level of SCI: The most caudal segment of the spinal cord with normal sensory and motor function on both sides of the body (that is, the level furthest from the head that has full function—see **ASIA Impairment Scale**, above). Neurological level of SCI is often described according to the region of the spine injured (cervical, thoracic, lumbar or sacral). These regions include the:

- cervical spine, consisting of segments C1–C8
- thoracic spine, consisting of segments T1–T12
- lumbar spine, consisting of segments L1–L5
- sacral spine, consisting of segments S1–S5. (‘Lumbosacral’ is the combined region consisting of segments L1–L5 and S1–S5.)

paraplegia: An impairment or loss of motor and/or sensory function in the thoracic, lumbar or sacral (but not cervical) segments of the spinal cord, due to damage of neural elements within the spinal canal.

persisting spinal cord injury: An ASIA Impairment Scale grade of A, B, C or D either 90 days after injury, or at discharge from rehabilitation, or a deficit on discharge was advised by the SU.

tetraplegia: An impairment or loss of motor and/or sensory function in the cervical segments of the spinal cord due to damage of neural elements within the spinal canal. This term is etymologically more accurate than ‘Quadriplegia’, combining *tetra* + *plegia*, both from Greek, rather than *quadri* + *plegia*, a Latin/Greek amalgam. Tetraplegia is generally preferred outside the US.

unprotected land transport users: A pedestrian, pedal cyclists, motorcycle rider or a quad-bike rider. By contrast, occupants of cars, trucks and most other motor vehicles are afforded some protection from injury by the vehicle in the case of a crash.

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Related publications

This report, *Spinal cord injury, Australia 2008–09*, is part of an annual series. Earlier editions and any published subsequently can be downloaded without cost from the AIHW website <www.aihw.gov.au>.

For the 2008–09 period, 349 new cases of spinal cord injury (SCI) were reported to the Australian Spinal Cord Injury Register (ASCIR); three-quarters of which were due to traumatic causes. Males accounted for 80% of traumatic SCI cases. Land transport crashes and Falls were the most common cause of traumatic SCI, accounting for 78% overall, and 45% and 33% respectively.

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