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Spinal cord injury, Australia

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Contents

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The Australian Spinal Cord Injury Register (ASCIR) is operated by the Australian Institute of Health and Welfare's (AIHW) National Injury Surveillance Unit (NISU) in collaboration with the directors of participating spinal units.

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

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 12th 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 2010–11.

A total of 387 new cases of SCI were reported in 2010–11, with 269 cases resulting from trauma and 118 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 14.3 new cases per million population aged 15 and older.

Persisting traumatic SCI incidence rates for Australian male residents tended to decrease with age while the opposite was true for Australian female residents in 2010–11. The greatest disparity between the sexes was in the 15–24 year age category, with a male: female ratio of 11.9:1. The overall incidence rate for men was 23.0 per million population compared with 5.6 for women, a male:female ratio of 4.1:1.

Persisting traumatic spinal cord injuries were most frequent in the 15–24 aged category (21%). The mean age at injury for male residents was 41, while the mean age for female residents was higher at 50.

The median length of stay in a participating spinal unit (SU) for Australian residents discharged alive with a persisting traumatic SCI was 130 days.

Causes of spinal cord injury

Land transport crashes (43%) were the leading mechanism of injury for cases of traumatic SCI sustained in 2010–11, followed by *Falls* (35%).

Equal numbers of male *Motor vehicle occupants* sustained a traumatic SCI in 2010–11 as did male *Unprotected land transport users* (48 cases, respectively). Seventeen female *Motor vehicle occupants* made up the remainder of cases due to *Land transport crashes*.

Similar proportions of *Falls from a height greater than 1 metre* (18%) and *Low falls or falls from an unspecified height* (17%) were recorded for 2010–11. Three traumatic SCI cases in 2010–11 involved a *High fall* while parachuting or abseiling. A further 4 *Falls* cases involved a fall while snowboarding and 2 cases involved a fall from a trampoline; these cases were not confined to either *Falls* category. While most *Falls* were recorded as being *Unintentional* (that is, accidents) or intent was unknown, cases due to an *Adverse effect or complication of medical or surgical care*, *Assault* and *Intentional self-harm* were also reported.

Other reported mechanisms of injury for traumatic SCI recorded in 2010–11 include *Water-related* events (5%), *Heavy falling objects* (3%), *Horse-related* events (4%), and *Football*, or more specifically, rugby (1%). Nine per cent of cases were due to *Other or unspecified causes* including post-operative complications, other forms of transport including water, air and rail, and violence-related causes.

Approximately 1 in 3 traumatic SCI cases reported to ASCIR in 2010–11 were sustained while the person was *Engaged in sports or leisure* (36%) and the majority (87%) of these were males. Injuries sustained while *Working for income* (including travel to and from work) accounted for 13% of traumatic cases for this reporting period.

1 Introduction

This report describes cases of traumatic spinal cord injury (SCI) sustained between 1 July 2010 and 30 June 2011 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 12th report of that type.

Estimated incidence of traumatic spinal cord injury

The estimated incidence of persisting traumatic SCI for Australian residents aged 15 and older based on data reported to the ASCIR for the previous year, 2009–10, was 12.3 cases per million population (AIHW: Tovell & Harrison 2018).

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 2010 to 30 June 2011 (this period is abbreviated as '2010–11' in this report). It also includes information on trends in the period 1995–96 to 2010–11. The report is arranged as follows:

- **Chapter 2** presents an overview of all newly incident traumatic SCI cases that occurred in 2010–11 and had been registered by 30 June 2014.
- **Chapter 3** provides an analysis of newly incident cases of persisting traumatic SCI for Australian residents discharged alive, including trends since 1995–96 and demographic, social and clinical characteristics of cases with onset in 2010–11. 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 2010–11 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 2010–11.
- **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 cause* 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 2010–11

This chapter provides an overview of traumatic spinal cord injury (SCI) incident cases where the injurious event occurred between 1 July 2010 and 30 June 2011, and the case had been registered by 30 June 2014. For the period, 2010–11, a total of 269 incident cases were reported to ASCIR by participating SUs.

Of the 269 cases, 9 died before being discharged, 1 was discharged with no ongoing neurological deficit and 259 were discharged with a persisting deficit (Table 2.1). Four cases discharged with persisting traumatic SCI were non-residents of Australia.

Table 2.1: Traumatic SCI cases with onset in 2010–11 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)]255	96	4	100	259	96
No ongoing neurological deficit	1	0	0	0	1	0
Died on ward	9	3	0	0	9	3
Total[(c)]	**265**	**100**	**4**	**100**	**269**	**100**

(a) Any persons over the age of 15 who sustained an SCI in 2010–11 due to trauma are the focus of Chapter 4.

(b) Australian residents over the age of 15 who sustained an SCI in 2010–11 due to trauma and had a persisting neurological deficit on discharge from a participating SU are the focus of Chapter 3.

(c) Percentage may not equal 100, due to rounding.

The demographic, social and clinical characteristics of the 255 Australian residents discharged alive with a persisting traumatic SCI are the focus of Chapter 3. This includes 8 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 269 traumatic SCI cases, irrespective of survival to discharge, persistence of deficit or place of usual residence.

The average age of those who died before discharge was 68 (range 56–79). The majority were male (78%) and of these, all except 1 case was due to a low fall.

The time between injury and death ranged from 3 days to 184 days (approximately 6 months), with 5 cases dying within 33 days of the injurious event. All but 1 of the 9 cases who died on the ward had sustained a high level cervical injury (C1 to C5).

3 Persisting traumatic SCI

This chapter examines the characteristics of the 255 Australian residents who sustained a persisting traumatic SCI during 2010–11. 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 chapter is restricted to Australian residents, including 8 cases sustained while overseas (but treated in an Australian SU), as incidence rates are calculated using the ERP of Australia aged 15 or older as provided by the ABS (see ‘Population denominators’ in Appendix A). Direct age-standardisation was employed using the Australian population in 2001 as the reference (ABS 2003).

Persisting traumatic SCI in 2010–11 and earlier years

In 2010–11, the age-standardised incidence rate of persisting traumatic SCI at ages 15 and older was 14.3 cases per million population (95% *CI*: 12.5–16.0).

Poisson regression based on the annual incidence rates, presented as a trend with 95% confidence interval, is shown in Figure 3.1 (and Table C.1 in the Appendix). According to this, the incidence rate of persisting traumatic SCI at ages 15 and older tended to decline over the period since 1995–1996 by an average of 1.9% per year (95% *CI*: –1.2%, –2.5%).

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 15–16 cases per million. Secondly, the rates presented here are thought to be underestimates, and underestimation could have increased over time due to a possible increase in numbers of cases of traumatic SCI admitted to non-participating health units and therefore not reported to ASCIR.

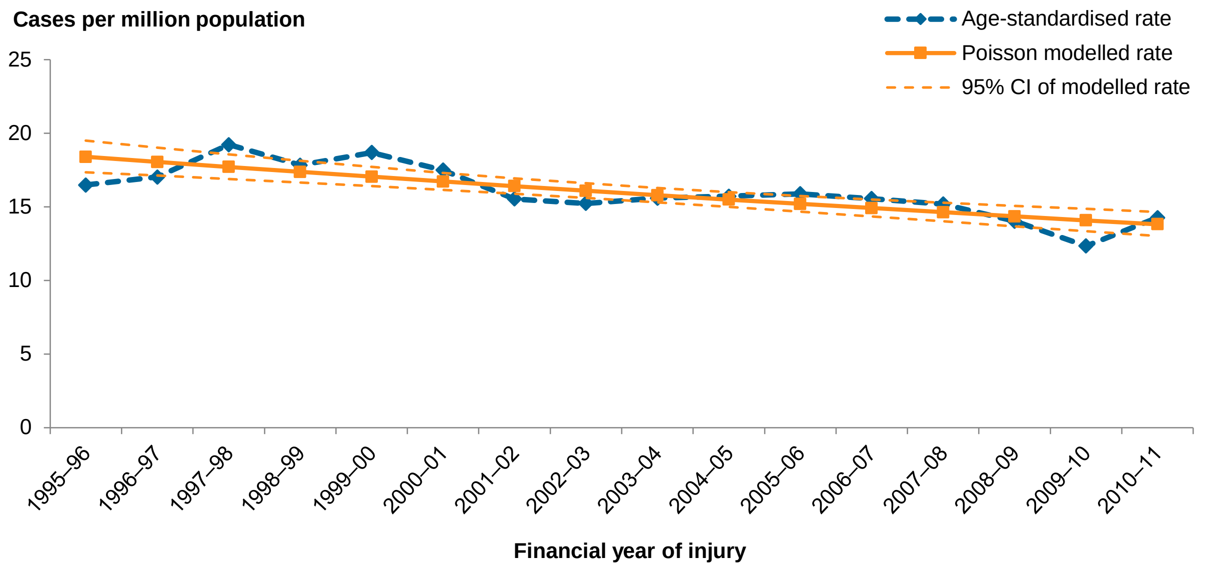


Figure 3.1: Trends in rates of persisting traumatic SCI cases aged 15 and older, by financial year of injury, Australian residents discharged alive, 1995–96 to 2010–11

Demographic and social characteristics of persisting traumatic SCI in 2010–11

Age and sex distribution

In 2010–11, 4 out of 5 persisting traumatic SCI cases were men (204 cases, compared with 51 for women). The distribution of cases and age-specific rates for persisting traumatic SCI are presented in Figure 3.2 and Table C.2. As with previously reported years, spinal cord injuries were most frequent in the 15–24 age group, accounting for 21% of Australian residents discharged alive aged 15 and older. Just 4% of persisting traumatic SCI cases occurred at aged 75 and older.

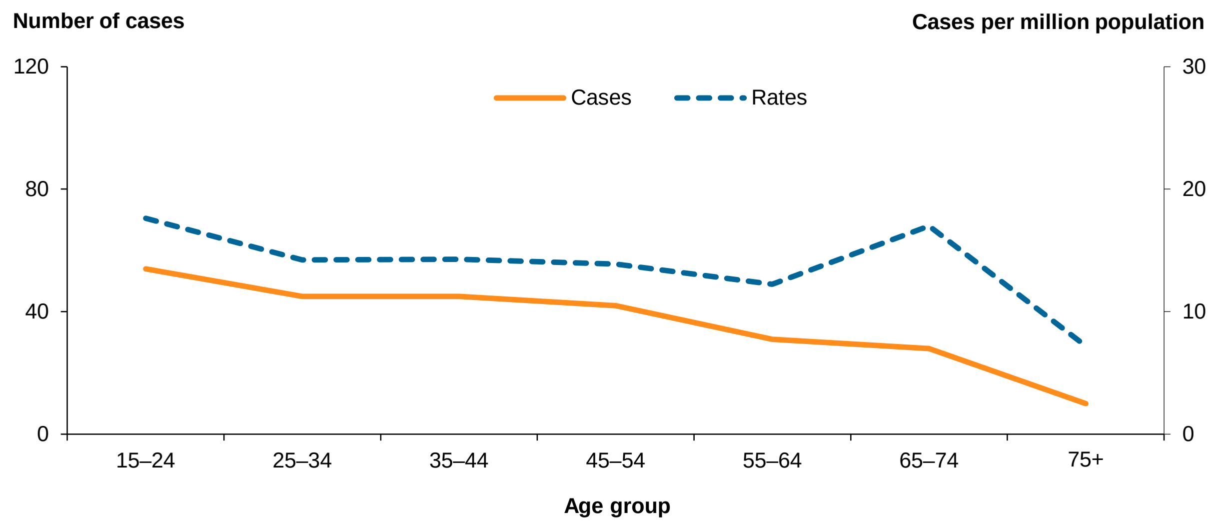


Figure 3.2: Counts and age-specific rates of persisting traumatic SCI, by age group, Australian residents discharged alive, 2010–11

Incidence rates for males tended to decrease with age while the opposite was true for females (Figure 3.3 and Table C.3). The greatest disparity between the sexes was in the 15–24 year age category, with a male:female ratio of 11.9:1. The overall incidence rate for men was 23.0 per million population compared with 5.6 for women, a male:female ratio of 4.1:1.

The mean age at onset for men was 41 (*SD* = 18), while the mean age for women was higher at 50 (*SD* = 19).

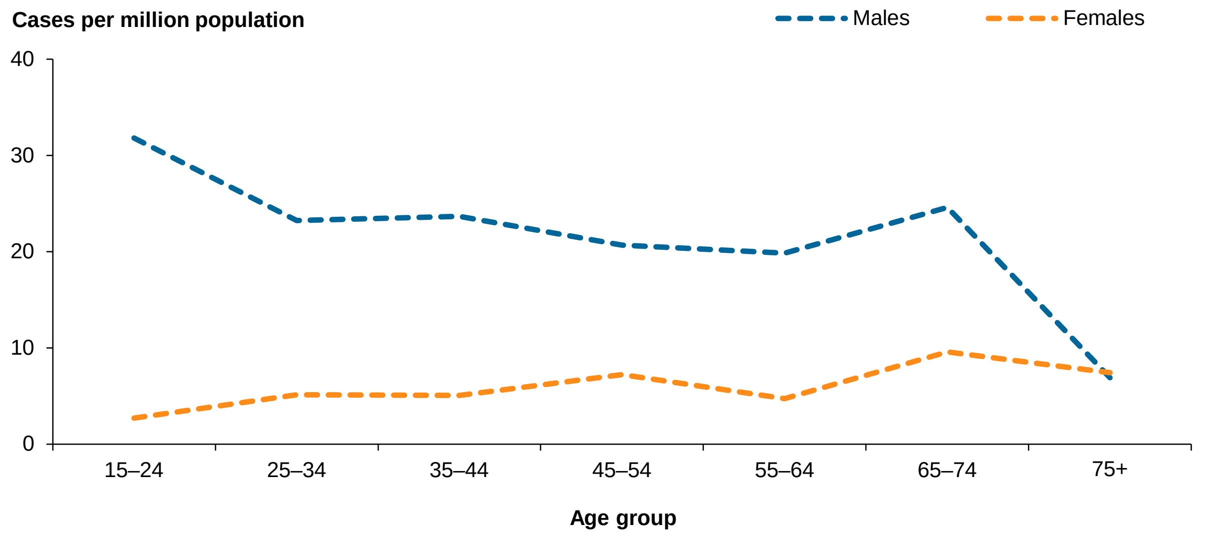
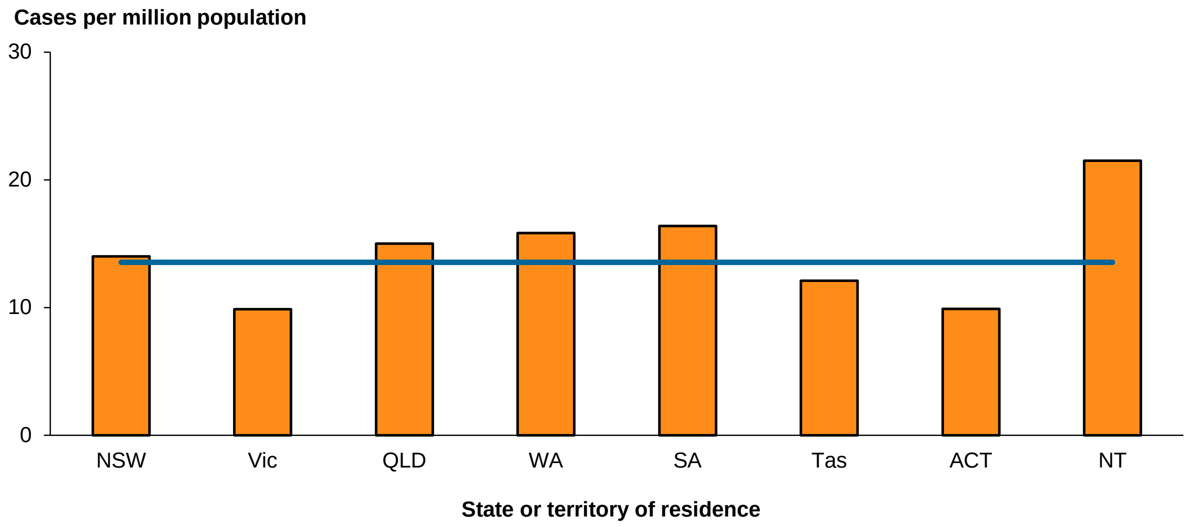


Figure 3.3: Age-specific rates of persisting traumatic SCI, by age group, by sex, Australian residents discharged alive, 2010–11

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, incidence rates are based on the aggregate jurisdictional case counts for the 3-year period 2008–09 to 2010–11.

The 3-year national incidence rate as shown by the horizontal line was 13.5 cases per million population. Residents of Victoria had the lowest 3-year rate per million population at 9.9 cases, while residents of the Northern Territory had the highest, 21.5 cases. Caution is advised in interpreting these rates as even after 3-year aggregation, case counts remained small (under 20 cases each) for the least populous jurisdictions, Tasmania, the Australian Capital Territory and the Northern Territory.

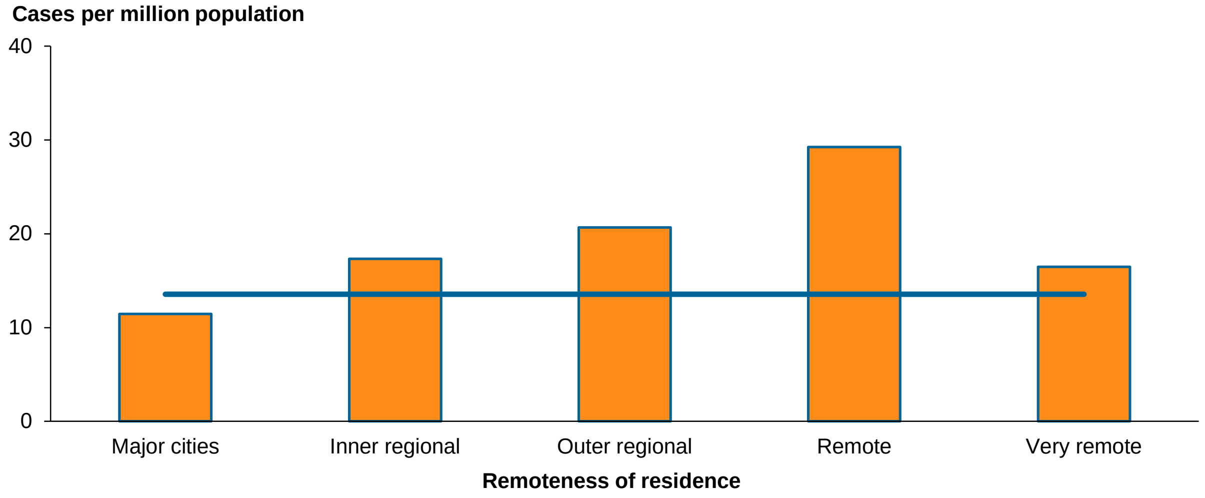


Note: Three-year Australia rate, aged 15 and older is shown as the solid horizontal line.

Figure 3.4: Age-standardised 3-year rates of persisting traumatic SCI cases, by state or territory of usual residence, Australian residents discharged alive, 2008–09 to 2010–11

Remoteness of residence and place of injury

As with state and territory of usual residence, 3-year incidence rates were calculated for cases grouped according to remoteness of usual residence for the period 2008–09 to 2010–11 (Figure 3.5 and Table C.5) (See Assignment to remoteness area in Appendix A). The 3-year incidence rate for persisting traumatic SCI was highest for residents of *Remote Australia* (29.3 cases per million population) and lowest for residents of *Major cities* (11.5 cases per million population). Only the rate for residents of *Major cities* was less than the national rate (as shown by the horizontal line), however the rates for increasingly remote areas should be interpreted cautiously due to small case numbers.



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, by remoteness of residence, Australian residents discharged alive, 2008–09 to 2010–11

In 2010–11, 56% of people who sustained a persisting traumatic SCI usually resided in *Major cities*, while 5% resided in *Remote* or *Very remote* Australia (Table 3.1). All 8 SCI cases injured while overseas involved residents of *Major cities*.

In 115 cases (45%), SCI occurred while the person was in Australia but information provided was not sufficient to allow classification according to remoteness of the place of the occurrence.

The remoteness areas of place of usual residence and place where injury occurred were both known for 132 cases that occurred in Australia. The majority (79%) occurred in the same remoteness area as place of usual residence, while 16% occurred in a more remote area. The remaining 5% occurred in an area less remote than the person's usual place of residence.

Table 3.1: Case counts of persisting traumatic SCI, by remoteness of usual residence, by area where injury occurred, Australian residents discharged alive, 2010–11

	Remoteness of usual residence					
Area where injury occurred	**Major cities**	**Inner regional**	**Outer regional**	**Remote**	**Very remote**	**Total**
	Case counts					
Major cities	59	4	1	0	0	64
Inner regional	6	24	2	0	0	32
Outer regional	5	6	14	0	0	25
Remote	1	0	2	4	0	7
Very remote	1	0	0	0	3	4
Australia, place not specified	62	28	20	5	0	115
Overseas	8	0	0	0	0	8
Total	**142**	**62**	**39**	**9**	**3**	**255**

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.

In 2010–11, 44% of people who acquired a SCI were married or in a de facto relationship at the time of injury, while 39% had never been married (Table 3.2). 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).

Table 3.2: Marital status at onset of persisting traumatic SCI, by age group, Australian residents discharged alive, 2010–11

	15–24		25–64		65+		All ages	
Marital status	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Never married	46	85	53	33	1	3	100	39
Widowed	0	0	5	3	10	26	15	6
Divorced	1	2	6	4	5	13	12	5
Separated	0	0	9	6	0	0	9	4
Married (including de facto)	7	13	87	53	19	50	113	44
Not reported	0	0	3	2	3	8	6	2
Total[(a)]	**54**	**100**	**163**	**100**	**38**	**100**	**255**	**100**

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

Sixty-four per cent of people who acquired SCI in 2010–11 reported being employed at the time of injury (Table 3.3). A review of return to work post-injury studies between 2000 and 2006 found between 21% and 67% of people employed at onset of SCI returned to work after injury (Lidal et al. 2007). This review also noted employment rates were found to be higher for cases who sustained their spinal cord injury during adolescence than later in adulthood.

Table 3.3: Employment status at onset of persisting traumatic SCI, by age group, Australian residents discharged alive, 2010–11

	15–24		25–64		65+		All ages	
Employment status	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Employed	37	69	122	75	4	11	163	64
Pensioner	0	0	18	11	27	71	45	18
Unemployed	4	7	11	7	1	3	16	6
Not available for employment	12	22	8	5	5	13	25	10
Not reported	1	2	4	2	1	3	6	2
Total[(a)]	**54**	**100**	**163**	**100**	**38**	**100**	**255**	**100**

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

A higher level of education at the time of injury is also associated with a likelihood of returning to work post-injury (Lidal et al. 2007). Approximately one-third of people with SCI onset in 2010–11 reported having a post-school qualification such as a tertiary degree or trade qualification (34%) (Table 3.4). Overall, those who had completed the highest available secondary school level accounted for the highest proportion of cases reported to ASCIR in 2010–11 (18%).

Table 3.4: Educational level attained at onset of persisting traumatic SCI, by age group, Australian residents discharged alive, 2010–11

	15–24		25–64		65+		All ages	
Education level	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Tertiary/postgraduate	4	7	23	14	3	8	30	12
Trade qualification/apprenticeship	10	19	26	16	4	11	40	16
Diploma or certificate	1	2	7	4	1	3	9	4
Other post school study	0	0	4	2	0	0	4	2
Highest available secondary school level	18	33	24	15	4	11	46	18
Left school aged 16 or over	6	11	10	6	4	11	20	8
Left school aged 15 or less	6	11	17	10	4	11	27	11
Still at school	3	6	0	0	2	5	5	2
Not reported	6	11	52	32	16	42	74	29
Total[(a)]	**54**	**100**	**163**	**100**	**38**	**100**	**255**	**100**

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

Clinical characteristics of persisting traumatic SCI in 2010–11

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 level 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 a particular 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 255 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.

Fifty-five per cent of the persisting traumatic SCI cases during 2010–11 reported a neurological level of injury at the cervical segments, C1–C8 (138 cases). 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 65% of cervical cases and 35% of cases at any level.

Thirty-three per cent of cases had a neurological level of injury at a thoracic segment (T1–T12), 11% at a lumbosacral segment (L1–L5 and S1–S5). The impairment resulting from injury at the thoracic and 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 10% of cases having neurological levels of T12 or L1.

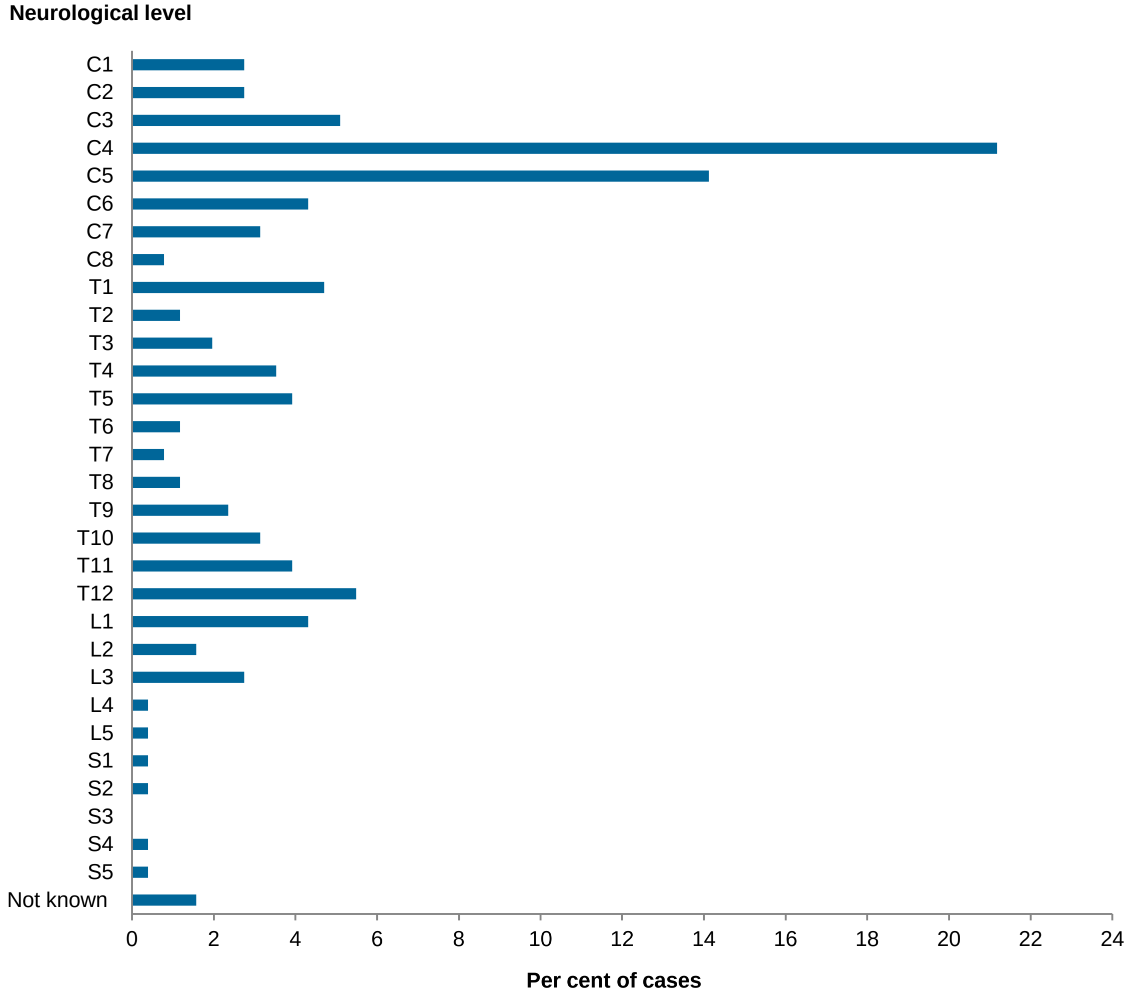


Figure 3.6: Neurological level of injury at discharge for persisting traumatic SCI cases, Australian residents discharged alive, 2010–11

Neurological impairment at discharge

Just over one-third of all new incidences reported to the ASCIR in 2010–11 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).

After incomplete tetraplegia, complete paraplegia at the thoracic level (T1 to T12) was the most frequent type of neurological impairment at discharge (19%). 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).

A spinal cord injury to the lumbosacral level most often resulted in incomplete paraplegia.

Table 3.5: Neurological impairment at discharge for persisting traumatic SCI, Australian residents discharged alive, 2010–11

Neurological impairment	Number of cases	%
Tetraplegia		
Cervical		
Complete tetraplegia	44	17
Incomplete tetraplegia	94	37
Paraplegia		
Thoracic		
Complete paraplegia	49	19
Incomplete paraplegia	36	14
Lumbosacral		
Complete paraplegia	4	2
Incomplete paraplegia	24	9
Total[(a)]	**251**	**98**

(a) Neurological level and/or completeness of SCI was not available for 4 cases.

Length of stay in spinal unit

This section differs from reports prior to 2008–09 in which median duration of initial care (DIC) was reported but length of stay in SUs was not. Length of stay (LOS) in a SU for cases that occurred in 2009–10 is reported here. DIC is not included in this annual report, trends in median DIC 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.

Complete cases at cervical level (complete tetraplegia) had the longest median LOS, 213 days, with 5th and 95th percentiles of 51 and 381 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 paraplegia with an injury to the lumbosacral region; median 58 days, with a 5th percentile of 13 days and 95th percentile of 258 days.

Availability of the ASIA Impairment Scale assessments are dependent on which SU the person is treated. In 2010–11, 4 cases were notified as having a persisting deficit on discharge but with no available ASIA assessment on admission or discharge.

Table 3.6: Length of stay in spinal unit for persisting traumatic SCI, by neurological impairment at discharge, Australian residents discharged alive, 2010–11

Neurological impairment at discharge	Number of cases	Median LOS (days)	5th Percentile (days)	95th Percentile (days)
Tetraplegia				
Cervical				
Complete tetraplegia	44	213	51	401
Incomplete tetraplegia	94	111	19	365
Paraplegia				
Thoracic				
Complete paraplegia	49	151	47	303
Incomplete paraplegia	36	115	23	314
Lumbosacral				
Complete paraplegia	4	117	74	172
Incomplete paraplegia	24	58	13	258
Total[(a)]	**255**	**130**	**17**	**365**

(a) Total include 4 cases of persisting traumatic SCI for which no ASIA assessment on discharge was available.

4 External causes of SCI in 2010–11

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 269 cases of traumatic SCI with onset in 2010–11 that were treated in participating SUs and had been reported to ASCIR by 30 June 2014. This number includes the 255 cases of persisting traumatic SCI that are the subject of Chapter 3, as well as 1 case with no neurological deficit at discharge (that is, not a persisting case); 9 cases where a person with traumatic SCI died while an inpatient of a participating SU; and 4 non-residents of Australia who were admitted to a participating unit due to SCI sustained in 2010–11 (see Table 2.1).

Mechanism of injury

Land transport crashes involving *Motor vehicle occupants* and *Unprotected land transport users,* including motorcyclists and pedal cyclists, were the leading mechanism of injury for cases of traumatic SCI sustained in 2010–11 (43%), followed by *Falls* (35%) (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, 2010–11

	Males		Females		Total	
Mechanism of injury	**Number**	**%**	**Number**	**%**	**Number**	**%**
Land transport crash						
Motor vehicle occupant	49	23	17	32	66	25
Unprotected land transport user	49	23	0	0	49	18
Fall						
Low fall (same level or <1 metre)[(a)]	34	16	11	21	45	17
High fall (>1 metre)	39	18	10	19	49	18
Water-related	14	7	0	0	14	5
Heavy falling object	7	3	1	2	8	3
Horse-related	3	1	8	15	11	4
Football	3	1	0	0	3	1
Other and unspecified causes	18	8	6	11	24	9
Total[(b)]	**216**	**100**	**53**	**100**	**269**	**100**

(a) Includes falls from unspecified heights.

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

Land transport crashes involving *Motor vehicle occupants* were the most common cause of traumatic SCI in 2010–11 for cases aged 15–24 (39%) and 25–64 (24%) (Table 4.2). This was different to the previous reporting year when *Unprotected land transport users*, such as motorcyclists and pedestrians , accounted for the largest proportion of SCI cases for both of these age groupings (AIHW: Tovell & Harrison 2018). While *Low falls* accounted for 50% of 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, 2010–11

	15–24		25–64		65+		All ages	
Mechanism of injury	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Land transport crash								
Motor vehicle occupant	22	39	40	24	4	9	66	25
Unprotected land transport user	12	21	34	20	3	7	49	18
Fall								
Low fall (same level or <1 metre)[(a)]	4	7	19	11	22	50	45	17
High fall (>1 metre)	8	14	34	20	7	16	49	18
Water-related	3	5	9	5	2	5	14	5
Heavy falling object	0	0	8	5	0	0	8	3
Horse-related	1	2	10	6	0	0	11	4
Football	3	5	0	0	0	0	3	1
Other and unspecified causes	3	5	15	9	6	14	24	9
Total[(b)]	**56**	**100**	**169**	**100**	**44**	**100**	**269**	**100**

(a) Includes falls from unspecified heights.

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

Fifty-eight per cent of all traumatic SCI cases reported for 2010–11 sustained an injury to the cervical spine, and of these, 42% were due to a *Land transport crash* (Table 4.3). Equal proportions of *unprotected land transport user* and *high fall* SCI cases sustained injuries to the thoracic spine (24%, respectively), while 26% of lumbosacral injuries were sustained by *Motor vehicle occupants*.

Table 4.3: Mechanism of injury for all traumatic SCI, by neurological level of injury at admission, 2010–11

	Tetraplegia		Paraplegia					
	Cervical		Thoracic		Lumbosacral		Total	
Mechanism of injury	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Land transport crash								
Motor vehicle occupant	42	26	18	21	6	25	66	25
Unprotected land transport user	25	16	20	24	4	17	49	18
Fall								
Low fall (same level or <1 metre)[(a)]	38	24	5	6	2	8	45	17
High fall (>1 metre)	25	16	20	24	4	17	49	18
Water-related	12	8	2	2	0	0	14	5
Heavy falling object	4	3	4	5	0	0	8	3
Horse-related	3	2	7	8	1	4	11	4
Football	3	2	0	0	0	0	3	1
Other and unspecified causes	8	5	9	11	7	29	24	9
Total[(b)]	**160**	**100**	**85**	**100**	**24**	**100**	**269**	**100**

(a) Includes falls from unspecified heights.

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

Land transport crashes

As noted previously in Table 4.1, 43% of traumatic SCI cases reported to ASCIR in 2010–11 were due to *Land transport crashes*.

In 2010–11, 49 males and 17 females who sustained a traumatic SCI were occupants of a motor vehicle (Table 4.4). As many males again were *Unprotected land transport users* at the time of their injurious event. No female *unprotected land transport user* cases were recorded for this reporting period; in the previous 16 years the number ranged between 2 and 8 cases.

Table 4.4: Land transport user types for all traumatic SCI, 2010–11

	Males		Females		Total	
Land transport user type	**Number**	**%**	**Number**	**%**	**Number**	**%**
Motor vehicle driver	31	32	12	71	43	37
Motor vehicle passenger	18	18	5	29	23	20
Motorcycle driver[(a)]	34	35	0	0	34	30
Motorcycle passenger	1	1	0	0	1	1
Pedal cyclist or pedal cycle passenger	11	11	0	0	11	10
Pedestrian	3	3	0	0	3	3
Total[(b)]	**98**	**100**	**17**	**100**	**115**	**100**

(a) Two quad-bike riders are included in the motorcycle driver user group for this reporting period.

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

The mean age at onset for *Motor vehicle occupants* was 35 (*SD* = 16), and 38 (*SD* = 14) for *Unprotected land transport users*.

Information on the use of seatbelts and circumstances 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 registration forms for ASCIR. Of the *Motor vehicle occupants* who sustained a spinal injury in 2010–11, 44% were reported to have worn a seatbelt at the time of the crash. A seatbelt was reported not to have been used by 24% and information on seatbelt use was not provided for the remaining 32%.

The most common type of event reported for *Motor vehicle occupants* was a vehicle rollover with 27 confirmed cases (41%). Impact with a roadside hazard was the next most commonly confirmed event (33%), followed by impact with another motor vehicle (23%). Eighteen per cent of cases confirmed being ejected from the motor vehicle compared to 45% confirmed non-ejection cases. These contributing events are not mutually exclusive and more than 1 event may be reported for the same case. For instance, in this period, 5 *Motor vehicle occupants* (8%) reported both a rollover event and being ejected from the vehicle. Four of these cases also confirmed they were not wearing a seatbelt at the time of injury.

In 2010–11, 3 *Motor vehicle occupants* were sitting in the tray of a utility vehicle when injured.

Approximately 90% of *Land transport crashes* involving *Motor vehicle occupants* occurred on a public street or highway, with 10 cases specifically occurring on a non-urban road. Other types of places where motor vehicle crashes occurred were farms and bushland. Four *motor vehicle occupant* cases had no specified place of injury.

Approximately two-thirds of cases of traumatic SCI sustained by *Unprotected land transport users* in 2010–11 were motorcycle drivers, including 2 quad-bike riders (69%). A further 22% involved pedal cyclists. The mean age for motorcycle drivers injured was 36 (*SD* = 15), compared with 42 (*SD* = 10) for pedal cyclists.

Impact with a roadside hazard such as a tree or pole was reported in 11 *Unprotected land transport user* cases (22%), and 9 cases reported an impact with a motor vehicle (18%).

The majority of traumatic SCI cases involving *Unprotected land transport users* occurred on public streets and highways (59%). Events occurring in public recreation areas or sporting venues including race tracks, equally contributed to 16% of cases, while other types of places reported include farms, forests and beaches. Place of injury was not specified in 14% of cases.

Falls

Similar proportions of *Falls* from a height greater than 1 metre (referred to hereafter as *High falls*) and *Falls* on the same level, or from less than 1 metre or an unspecified height (hereafter referred to as *Low falls*) were recorded for 2010–11 (18% and 17%, respectively) (Table 4.1).

The mean age at onset for traumatic SCI due to *High falls* was 43 (*SD* = 17), and 61 (*SD* = 18) for *Low falls*.

While most *Falls* were recorded as being *Unintentional* (that is, accidents) or intent was unknown, 1 *low fall* was reported as being due to an *Adverse effect or complication of medical or surgical care*, and 2 *High falls* were due to an *Assault* and 7 were the result of *Intentional self-harm*.

In 2010–11, 3 *High falls* cases were associated with either parachute failure while skydiving or a fall while abseiling. A fall while snowboarding was reported for 4 cases, and trampolines for 2 cases. However these were not confined to 1 category of *Falls* as the height of the fall was not always specified or known.

Sixty four per cent of *Low falls* occurred in and around the home compared with 41% for *High falls*. Type of place where the injury occurred was unspecified or not reported for 18% of cases involving a *Low fall*, and 37% of *High fall* cases.

Thirty eight of the 45 *Low fall* SCI cases in 2010–11 involved an injury at the cervical level (84%; Table 4.3). Cervical injuries were also most common for *High fall* SCI cases but to a lesser extent, 25 of the 49 cases or 51%.

Water-related

In 2010–11, 14 (5%) of traumatic SCI cases reported to ASCIR were associated with *Water-related* events (Table 4.1). Half of these were the result of being dumped by a wave, and a further 21% were the result of diving into shallow water. Other *Water-related* events resulting in traumatic SCI in 2010–11 included decompression sickness associated with deep-sea diving, being jumped on by another person. The circumstances surrounding the trauma event were unclear and/or not observed for 2 of the 14 cases.

All *Water-related* SCI cases in 2010–11 involved males, who ranged in age from 15–78 (mean age 39, *SD* = 19).

The majority of *Water-related* SCI events occurred at beaches (12 cases; 86%), while the remainder occurring in private or public swimming pools.

Water-related SCI cases generally involved a neurological injury at the cervical spine (12 of 14 cases) (Table 4.3). Nine of these 12 cases resulted in complete tetraplegia (75%).

Heavy falling objects

A *Heavy falling object* or objects was associated with 3% of traumatic SCI cases in 2010–11 (Table 4.1). Included in this category are cases where heavy objects such as wood and hay bales were in the process of being moved when they became unstable and fell on the person (4 cases) or where a recoil event contributed to the person being hit by a heavy object.

All except 1 case involved males, and all cases occurred while the person was engaged in paid or unpaid work. Cases ranged in age from 28 to 51 (mean age 40).

The types of places where these events occurred were varied, including on farms, construction sites, oil rigs and by a roadside.

Neurological injuries for traumatic SCI cases involving a *Heavy falling object* were equally distributed between the cervical and thoracic spine regions, with 4 cases each (Table 4.3).

Horse-related

Four per cent of traumatic SCI cases reported for 2010–11 were due to falling from a horse (Table 4.1). This is the only mechanism of injury where females outnumbered males, with 8 female cases reported compared with 3 male cases. The mean age at onset for *Horse-related* SCI cases in 2010–11 was 47 (range 19–63).

Seven of the 11 *Horse-related* SCI cases sustained a neurological injury at the thoracic spine (Table 4.3), and 5 of these were complete injuries.

The types of places where traumatic SCI cases due to a falling from a horse occurred included sport and athletics areas, public roads and a farm. The type of place where injury occurred was not specified for the 5 remaining cases.

Football

Cases in this category usually resulted from events that occurred while participating in rugby or Australian Rules football. For this reporting period, all 3 cases resulted from events that occurred while playing rugby (Table 4.1). All cases were male, aged between 15 and 24 (mean age 20).

Each of the 3 *Football-related* SCI cases in 2010–11 reported a neurological injury at the cervical spine (Table 4.3), and each was an incomplete injury.

Other and unspecified causes

Nine per cent of traumatic SCI cases reported to ASCIR for 2010–11 were due to causes other than those described above (22 cases), or due to unspecified causes (2 cases). Specified causes in this residual category include 5 cases due to gun-shot or knife assault, and 7 other transport-related cases, including train, air and boating events. Four cases were classified as an *Adverse effect or complication of medical or surgical care*.

Three-quarters of cases in this residual category were male (Table 4.1), and the mean age for all cases was 46 (*SD* = 19).

Neurological injuries for SCI cases in this residual category were distributed relatively evenly across the 3 reported spinal regions (Table 4.3). Fifteen of the 24 cases reported an incomplete injury, with an equal number of these being spread across each of the 3 spinal regions; 5 cases in each, cervical, thoracic and lumbosacral.

Activity at time of injury

The classification used for reporting type of activity are based on those 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*, *Working for income*, *Engaged in other types of work* (unpaid*), Undertaking a personal activity* (such as resting, 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.

Slightly more than one-third of traumatic SCI cases reported to ASCIR in 2010–11 were sustained while the person was *Engaged in sports or leisure* (36%) and the majority of these were males (87%). Young men aged 15–24 accounted for more than one-quarter of all sporting and leisure cases (28%). *Unprotected land transport users* was the reported mechanism of injury that contributed the largest proportion of cases sustained in this activity classification (25%), and of these, two-thirds involved a motorcycle or quad-bike. *High* and *Low falls* round out the top 3 mechanisms involved in sporting and leisure-related traumatic SCI for 2010–11 (19%, respectively). Alcohol was noted as a contributing factor in the description of 61% of *High fall* cases included this activity category, and 56% of *Low fall* cases.

Thirteen per cent of traumatic SCI cases in 2010–11 were sustained while the person was *Working for income*. *Land transport crashes* accounted for more than one-third of these cases (39%) and include 2 cases where the person was travelling to or from work. *Heavy falling objects* (19%) and *High falls* (17%) were the next most commonly reported mechanisms for work-related SCI cases. After public roads and highways (33%), farm properties (excluding the residential home) were the next most common place where work-related SCI occurred (5 cases; 14%). One-third of work-related SCI cases were aged 45–54 (33%), and a further 22% were aged 35–44. The majority of cases in this activity classification were males (89%).

High falls were the most common mechanism of injury for traumatic SCI cases that occurred while the person was *Engaged in other types of work* (unpaid) (67%). A fall from a ladder was most common (4 cases), followed by falling out of a tree (2 cases). Falls from a balcony or roof were also reported for the 2010–11 period. The age range for cases injured while *Engaged in other types of work* was 32–79 (mean age 55), and those injured were predominately men (83%).

Traumatic SCI sustained while *Undertaking a personal activity* (or being cared for) were mostly due to *Low falls* (71%). *Falls* most often occurred in the bathroom with attending to personal hygiene needs (7 cases). Other falls-related SCI were associated with standing up from a prone position (that is, from a bed) or a sitting position (that is, from a chair). Five cases were associated with surgical complications, such as spinal epidural haematomas. Women accounted for 41% of cases occurring while *Undertaking a personal activity*. More than half (59%) of all cases in this activity were aged 65 and older.

The majority (68%) of traumatic SCI cases in the *Other and unspecified activity* category involved *Land transport crashes*. *Falls* accounted for a further 27%. This activity category also includes cases where the most likely role of human intent was *Intentional self-harm* (7%)

and *Assault* (2%). Intent was unclear or not specified in 4 cases (5%). Males accounted for 75% of cases in this activity category, and of these, almost half were aged between 15 and 34 (40 cases; 49%). Females in the same age range accounted for 30% of the 27 female cases.

Table 4.5: Traumatic SCI, by mechanism of injury, by type of activity, 2010–11

	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	3	3	8	22	0	0	0	0	55	51	66	25
Unprotected land transport user	24	25	6	17	1	8	0	0	18	17	49	18
Fall												
Low fall (same level or <1 metre)[(c)]	18	19	2	6	1	8	12	71	12	11	45	17
High fall (>1 metre)	18	19	6	17	8	67	0	0	17	16	49	18
Water-related	13	14	0	0	0	0	0	0	1	1	14	5
Heavy falling object	0	0	7	19	1	8	0	0	0	0	8	3
Horse-related	9	9	2	6	0	0	0	0	0	0	11	4
Football	3	3	0	0	0	0	0	0	0	0	3	1
Other and unspecified causes	8	8	5	14	1	8	5	29	5	5	24	9
Total[(d)]	**96**	**100**	**36**	**100**	**12**	**100**	**17**	**100**	**108**	**100**	**269**	**100**

(a) Includes travel to and from work.

(b) Includes being nursed or cared for.

(c) Includes falls from unspecified heights.

(d) Percentage 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 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 2010–11.

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 2010–11 data was 30 June 2014. A snapshot file of the ASCIR was taken on 9 April 2015.

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 2010–11 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. Incidence 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 2010–11

In 2010–11, 72 men (61%) and 46 women (39%) 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 2010 and 30 June 2011. Table B.1 provides a summary of neurological deficit at discharge.

Table B.1: Non-traumatic SCI cases with admission in 2010–11 and reported to ASCIR by 30 June 2014

	Number	%
At discharge from spinal unit:		
Persisting non-traumatic SCI	116	98
No ongoing neurological deficit	1	1
Died on ward	1	1
Total	**118**	**100**

The mean age of non-traumatic SCI cases admitted in 2010–11 was 53 (*SD* = 18).

The median duration of stay in a participating SU was 84 days (5th percentile 15 days, 95th percentile 325 days).

A non-traumatic SCI was most commonly secondary to causes such as epidural abscess, malignancies and other diseases.

Sixty one per cent of non-traumatic SCI cases were males, compared with 80% for traumatic SCI cases.

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 2010–11

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	18.4	19.5	17.3
1996–97	17.0	18.0	19.0	17.1
1997–98	19.2	17.7	18.6	16.9
1998–99	17.8	17.4	18.1	16.6
1999–00	18.7	17.0	17.7	16.4
2000–01	17.5	16.7	17.3	16.1
2001–02	15.5	16.4	16.9	15.9
2002–03	15.2	16.1	16.6	15.6
2003–04	15.6	15.8	16.3	15.3
2004–05	15.7	15.5	16.0	15.0
2005–06	15.9	15.2	15.7	14.7
2006–07	15.6	14.9	15.5	14.3
2007–08	15.2	14.6	15.3	14.0
2008–09	14.0	14.3	15.1	13.7
2009–10	12.3	14.1	14.9	13.3
2010–11	14.3	13.8	14.7	13.0

Table C.2: Counts and age-specific rates of persisting traumatic SCI, by age group, Australian residents discharged alive, 2010–11

Age group	Cases	Rate per million population
15–24	54	17.6
25–34	45	14.2
35–44	45	14.3
45–54	42	13.9
55–64	31	12.2
65–74	28	17.0
75+	10	7.2

Table C.3: Age-specific rates of persisting traumatic SCI, by sex, by age group, Australian residents discharged alive, 2010–11

Age group	Cases	Rate per million population
Males		
15–24	50	31.8
25–34	37	23.2
35–44	37	23.7
45–54	31	20.7
55–64	25	19.8
65–74	20	24.6
75+	4	6.9
Females		
15–24	4	2.7
25–34	8	5.1
35–44	8	5.0
45–54	11	7.2
55–64	6	4.7
65–74	8	9.6
75+	6	7.4

Table C.4: Age-standardised 3-year rates of persisting traumatic SCI cases, by state or territory of usual residence, Australian residents discharged alive, 2008–09 to 2010–11

State or territory	Cases	3-year rate per million population
New South Wales	239	14.0
Victoria	129	9.9
Queensland	157	15.0
Western Australia	86	15.8
South Australia	66	16.4
Tasmania	15	12.1
Australian Capital Territory	9	9.9
Northern Territory	13	21.5
All Australian jurisdictions	**714**	**13.5**

Table C.5: Age-standardised 3-year rates of persisting traumatic SCI, by remoteness of residence, Australian residents discharged alive, 2008–09 to 2010–11

	Cases	3-year rate per million population
Major cities of Australia	428	11.5
Inner regional Australia	161	17.3
Outer regional Australia	96	20.7
Remote Australia	21	29.3
Very remote Australia	8	16.5
All remoteness areas	**714**	**13.5**

Table C.6: Neurological level of injury at discharge for persisting SCI cases, Australian residents discharged alive, 2010–11

Neurological level	Frequency	%
C1	7	3
C2	7	3
C3	13	5
C4	54	21
C5	36	14
C6	11	4
C7	8	3
C8	2	1
T1	12	5
T2	3	1
T3	5	2
T4	9	4
T5	10	4
T6	3	1
T7	2	1
T8	3	1
T9	6	2
T10	8	3
T11	10	4
T12	14	5
L1	11	4
L2	4	2
L3	7	3
L4	1	0
L5	1	0
S1	1	0
S2	1	0
S3	0	0
S4	1	0
S5	1	0
Not known	4	2
Total	**255**	**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 2010–11*, 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 2010–11 period, 387 new cases of spinal cord injury (SCI) were reported to the Australian Spinal Cord Injury Register (ASCIR), 70% of which were due to traumatic causes. Males accounted for 80% of traumatic SCI cases. Land transport crashes (43%) were the leading mechanism of injury for cases of traumatic SCI sustained in 2010–11, followed by Falls (35%).

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