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This report was written by Amanda Tovell at the AIHW NISU at Flinders University, with assistance from James Harrison and 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 15th 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 2013–14.

Two-hundred-and-thirty-six newly incident cases of traumatic SCI due to external causes were reported for 2013–14. Of those, 231 resulted in persisting traumatic SCI.

The age-standardised rate of persisting traumatic SCI for Australian residents discharged alive, including those injured while overseas and later treated in an Australian spinal unit (SU), was estimated to be 11.8 cases per million population aged 15 and older. The age-specific rate was highest for ages 15–24 (16.7 cases per million population), followed by 14.7 cases per million population for ages 65–74.

Incidence rates of persisting traumatic SCI for male residents were higher across all age groups than those for female residents, with the exception of the age group 75 or older.

The median length of stay in a participating SU for Australian residents discharged alive with persisting traumatic SCI was 147 days.

Causes of spinal cord injury

Just under half of all traumatic SCI cases reported to the ASCIR for the 2013–14 period were due to *Land transport crashes* (46%), while close to one-third were due to either a *High* or *Low fall* (32%).

Motorcycle drivers accounted for almost one-third (32%) of land transport-related SCI cases in 2013–14. Motor vehicle drivers were the next most numerous type of user injured in *Land transport* crashes, followed by motor vehicle passengers (23% and 18%, respectively). Cases involving quad-bikes, or a similar type of land transport vehicle, accounted for 3% of all traumatic SCI sustained during 2013–14.

A *Low fall* contributed to 17% of traumatic SCI cases for 2013–14, while *High fall*s accounted for 15%. Other reported mechanisms of injury for traumatic SCI in 2013–14 included *Water-related* events such as diving into shallow water (10%), *Football* (including rugby codes) (3%), *Horse-related* (2%) and *Heavy falling objects* (2%). The remaining 6% of cases were due to violent assaults or while operating heavy machinery.

Of traumatic SCI cases, 45% occurred while the person was *Engaged in sports or leisure* activity. Injuries sustained *While working for income*, including travel to and from work, accounted for 8% of traumatic SCI cases during 2013–14.

1 Introduction

Spinal cord injury (SCI) 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. Hence, there is interest in national statistics on the incidence of traumatic SCI, the nature of people injured, the care provided to them, and the causes of the injuries. This report describes cases of traumatic SCI sustained between 1 July 2013 and 30 June 2014 that required admission to a specialist spinal unit (SU) in Australia. It uses data from the Australian Spinal Cord Injury Register (ASCIR).

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 15th 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, discharged alive, based on data reported to the ASCIR for the previous year, 2012–13, was 12.2 cases per million population (AIHW: Tovell 2018b). Population modelling using ASCIR data, supplementary data from the National Hospital Morbidity Database and data from Victoria’s single paediatric trauma hospital, suggest that, as at 30 June 2011, the true estimate of traumatic SCI for all ages in Australia is between 21.0 and 32.3 cases per million population (New et al. 2015).

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 2013 to 30 June 2014 (this period is abbreviated as '2013–14' in this report). It also includes information on trends in the period 1995–96 to 2013–14. The report is arranged as follows:

- **Chapter 2** presents an overview of all newly incident traumatic SCI cases that occurred in 2013–14 and had been registered by 31 March 2016.
- **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 2013–14. This chapter is restricted to Australian residents, including cases sustained while overseas (but were later treated in

an Australian SU), 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 2013–14 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: Other SCI cases** provides summary information for non-traumatic SCI cases admitted to a participating SU during 2013–14 and complications of medical care SCI cases that occurred during 2013–14.
- **Appendix C: Median duration of initial care** presents trends in median duration of initial care (see Box 1.3) for persisting traumatic SCI incidents since 1995–96, irrespective of place of usual residence.
- **Appendix D: 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.

Complication of medical care SCI is the term used to describe instances where the injury was due to medical or surgical intervention.

These latter 2 types of SCI are often reported to the ASCIR, but are not the main focus of this report.

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**.

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, and when calculating median duration of initial care in Appendix C.

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.

(continued)

Box 1.3 (continued): Other terminology used in this report

Duration of initial care (DIC) is a concept developed by the NISU for the purpose 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 is calculated as the difference, in days, between date of injury and date of discharge from SU, as recorded in the ASCIR. Three types of cases are omitted when calculating DIC:

- Cases discharged from the SU to a place at which initial care as admitted patient can be expected to continue. These cases are omitted because DIC is not complete and so cannot be calculated.
- Cases where death occurred in the SU. These cases are omitted because fatal and non-fatal cases have very different durations.
- Cases where the current episode in an SU is not, or cannot be established to be, part of the person's period of initial admitted patient care after onset of SCI.

As for LOS in a spinal unit, median DIC is reported to reduce the effect of outliers.

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 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.

(continued)

Box 1.4 (continued): Classifying mechanism of injury for SCI cases

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 2013–14

This chapter provides an overview of traumatic SCI incident cases where the injurious event occurred between 1 July 2013 and 30 June 2014, and the case had been registered by 31 March 2016.

For the period 2013–14, a total of 236 incident cases were reported to the ASCIR by participating SUs (Table 2.1).

Table 2.1: Traumatic SCI cases with onset in 2013–14 and reported to the ASCIR by 31 March 2016

	Australian residents		Non-residents		Total[a]	
	Number	**%**	**Number**	**%**	**Number**	**%**
At discharge from spinal unit:						
Persisting deficit	[b]226	98	5	100	231	98
No ongoing neurological deficit	2	1	0	0	2	1
Died on ward	3	1	0	0	3	1
Total	**231**	**100**	**5**	**100**	**236**	**100**

(a) Any persons over the age of 15 who sustained an SCI in 2013–14 due to trauma are the focus of Chapter 4.

(b) Australian residents over the age of 15 who sustained an SCI in 2013–14 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 226 Australian residents discharged alive with a persisting traumatic SCI are the focus of Chapter 3. This includes 12 Australian residents transferred to an Australian SU after incurring a spinal injury overseas.

External causes of injury and other factors related to the injury event are reported in Chapter 4 for all 236 traumatic SCI cases with onset in 2013–14, irrespective of survival to discharge, persistence of deficit or place of usual residence.

Of the 3 cases who died, all were male and over the age of 40. Time between the injury and death was less than 2 weeks for 1 case and approximately 100 days for the remaining 2 cases. The neurological level of injury for these cases was T4 or higher.

3 Persisting traumatic SCI

This chapter examines the characteristics of the 226 Australian residents who sustained a persisting traumatic SCI during 2013–14. 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 12 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 2013–14 and earlier years

In 2013–14, the age-standardised incidence rate of persisting traumatic SCI for Australian residents aged 15 and older was 11.8 cases per million population.

Poisson regression, based on the annual incidence rates, presented as a trend with 95% confidence intervals, is shown in Figure 3.1 (see also Table D.1 in Appendix D). According to this, the incidence rate of persisting traumatic SCI at ages 15 and older have tended to decline, since 1995–96, by an average of 2.2% per year (95% *CI*: –1.6%, –2.7%).

As cautioned in previous years, while this trend was significantly different from zero ($p = 0.000$), this trend must be interpreted prudently, due to the underestimation of SCI cases reported to the ASCIR. Known contributing factors in underestimation include whether the person a) did not consent to be included in the register; b) was released from hospital without the need for inpatient rehabilitation; or c) was admitted to another rehabilitation unit that does not provide data to the ASCIR.

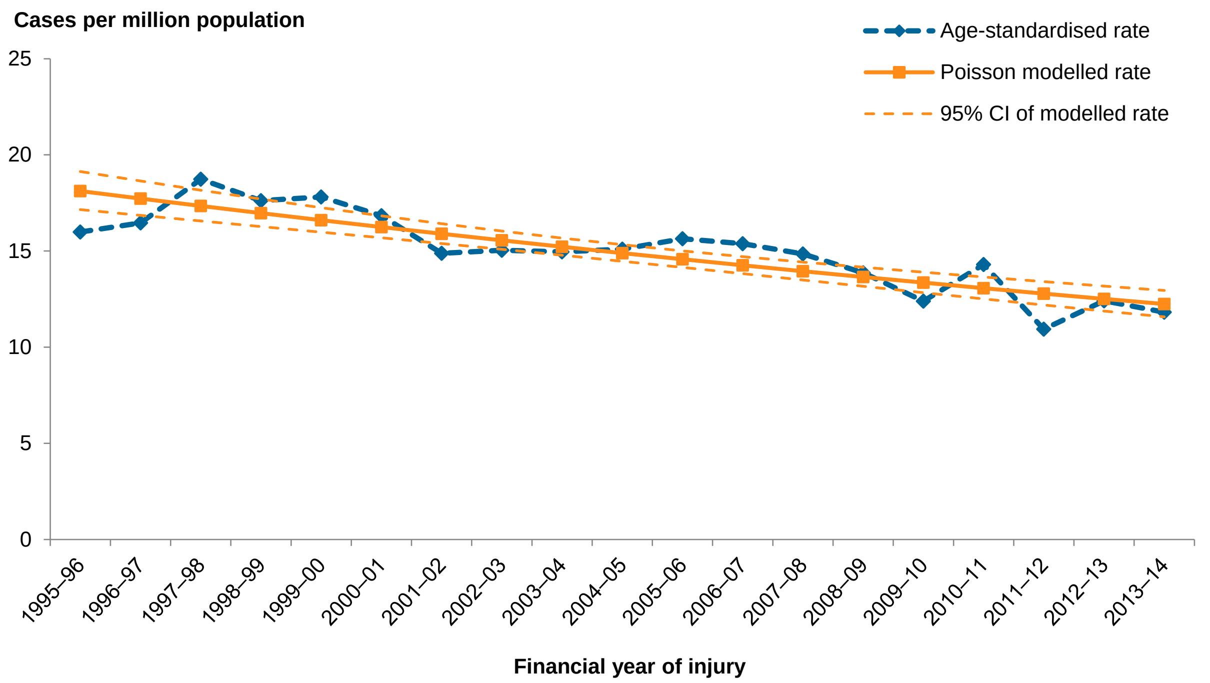


Figure 3.1: Trends in rates of persisting traumatic SCI cases aged 15 and older, by financial year of injury, Australian residents discharged alive, 1995–96 to 2013–14

Demographic and social characteristics of persisting traumatic SCI in 2013–14

Age and sex distribution

Four out of 5 persisting traumatic SCI cases sustained during 2013–14 were male, with 181 male and 45 female cases being reported to the ASCIR. 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 D.2. Almost one-quarter (23%) of new SCI cases reported for 2013–14 were sustained by people aged 15–24 (23%). The age-specific rate was highest for ages 15–24 (16.7 cases per million population), followed by 14.7 cases per million population for ages 65–74.

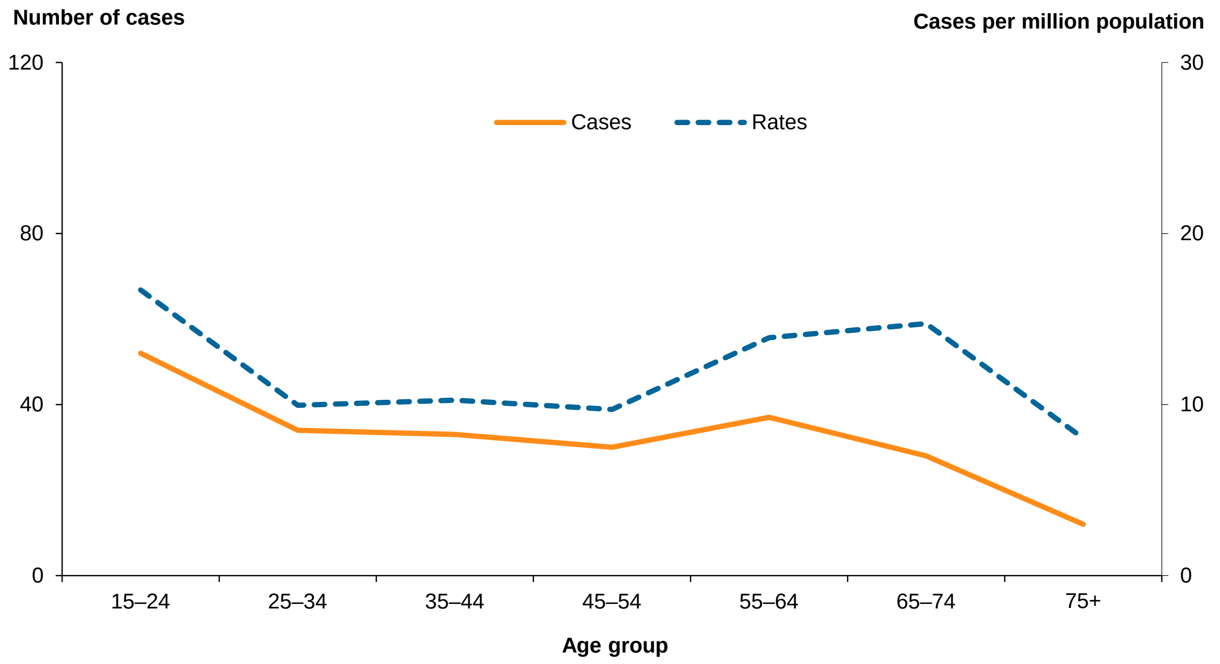


Figure 3.2: Counts and age-specific rates of persisting traumatic SCI, by age group, Australian residents discharged alive, 2013–14

Incidence rates for males were higher across all age groups than those for females, with the exception of the group aged 75 and over (Figure 3.3 and Table D.3). As has been observed in previous years, the greatest disparity between the sexes for persisting traumatic SCI cases occurs in the 15–24 age category. The overall rate for men was 19.4 cases per million population, compared with 4.7 for women, a male:female ratio of 4.1:1.

The mean age at onset for males was 42 (*SD* = 18). The mean age for females was higher, at 53 (*SD* = 20).

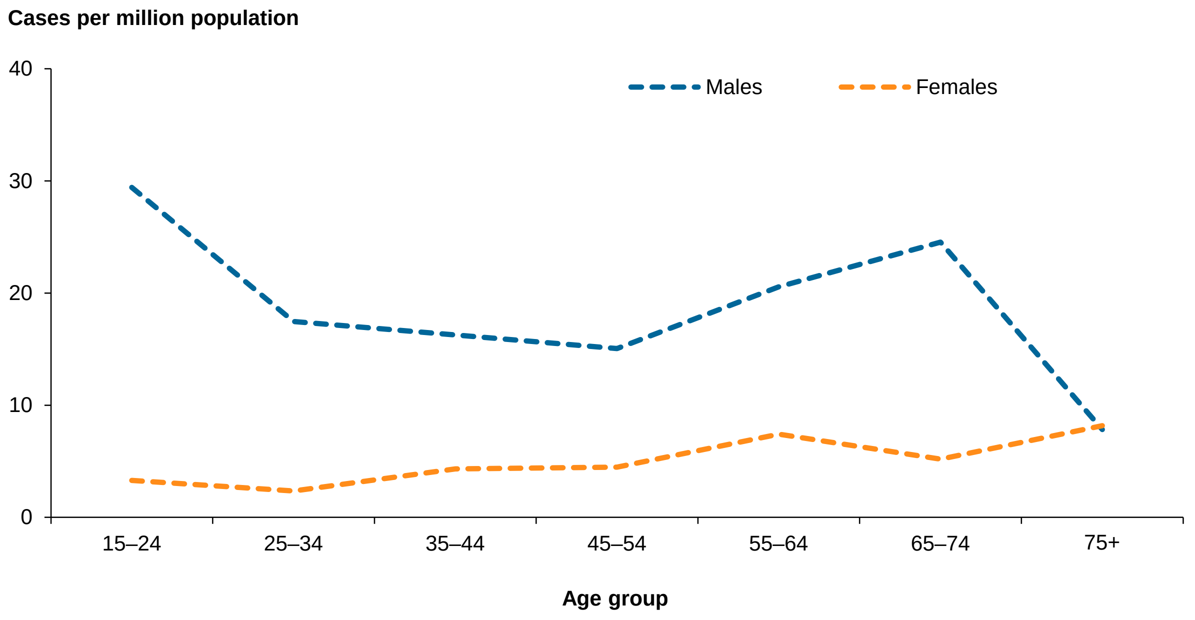
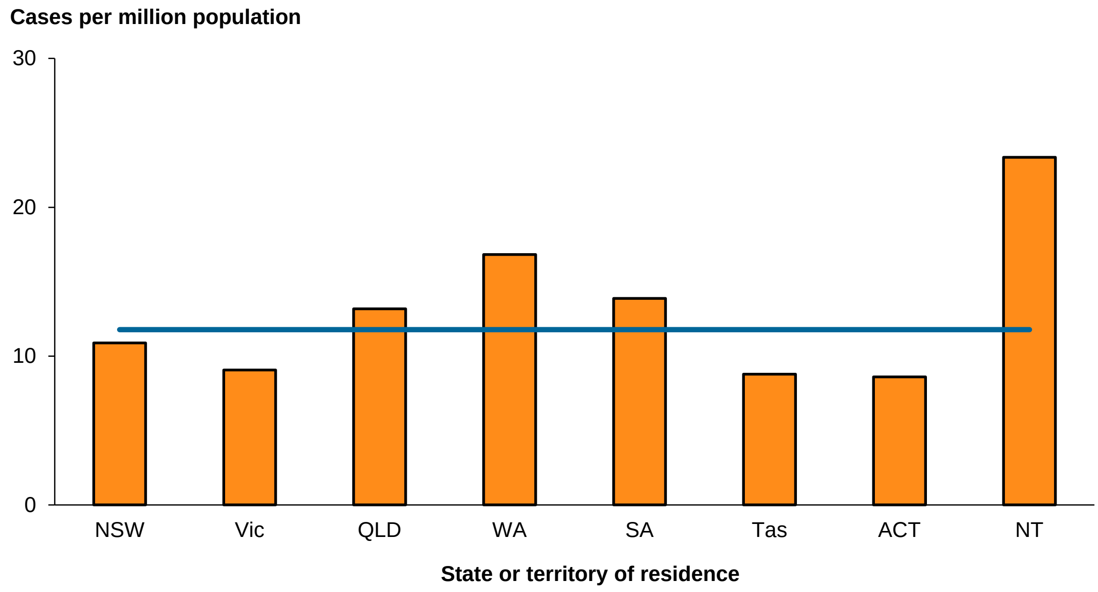


Figure 3.3: Age-specific rates of persisting traumatic SCI, by age group, by sex, Australian residents discharged alive, 2013–14

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 D.4. Due to the small number of cases in some jurisdictions, rates are based on the aggregated state or territory case counts for the 3-year period 2011–12 to 2013–14.

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 3-year rate for residents of the Australian Capital Territory was the lowest (8.1 cases per million population), while the rate for residents of the Northern Territory was the highest (24.2 cases per million population).

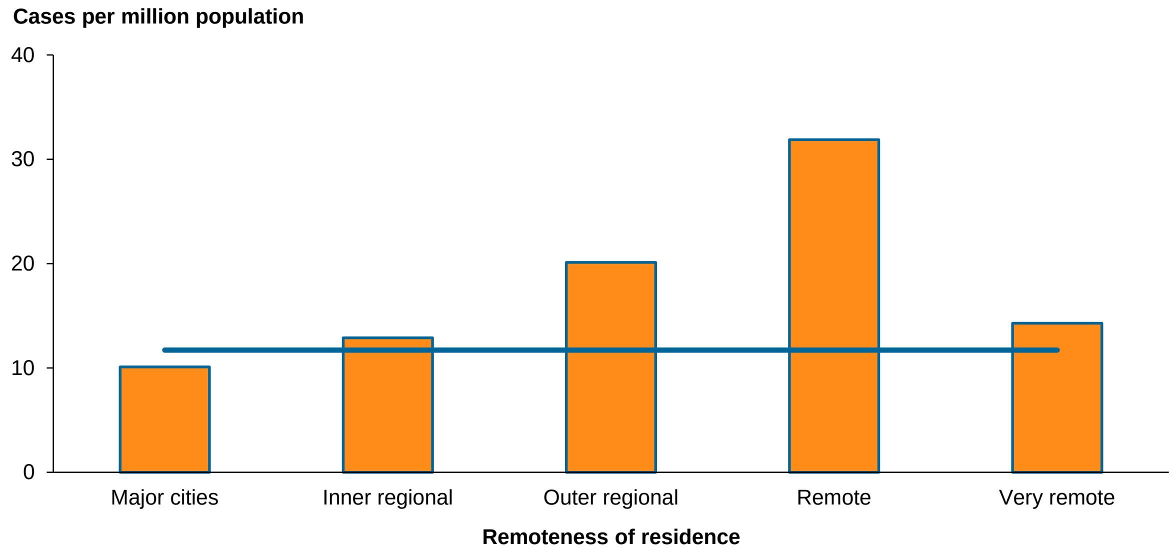


Note: Three-year Australia rate, aged 15 and older, is shown as the solid horizontal line.

Figure 3.4: Age-standardised 3-year rates of persisting traumatic SCI cases, by state or territory of usual residence, Australian residents discharged alive, 2011–12 to 2013–14

Remoteness of residence and place of injury

Three-year incidence rates were calculated for cases grouped according to remoteness of usual residence for the period 2011–12 to 2013–14 (Figure 3.5 and Table D.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* (31.9 cases per million population) and lowest for residents of *Major cities* (10.1 cases per million population).



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, 2011–12 to 2013–14

In 2013–14, 62% of people who sustained a persisting traumatic SCI usually resided in *Major cities of Australia*, while only 4% resided in *Remote Australia* (Table 3.1). Remoteness of usual residence was not able to be determined for 1 case.

In 98 cases (44%), the injury event appeared to occur while the person was in Australia but insufficient information was provided to allow classification of remoteness of the place where injury occurred.

The remoteness areas of place of usual residence and place where injury occurred were both known for 115 cases that occurred in Australia. The majority (82%) occurred in the same remoteness area as the place of usual residence, while 15% occurred in a more remote area. The remaining 3% 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, 2013–14

Area where injury occurred	Remoteness of usual residence					
	Major cities	Inner regional	Outer regional	Remote	Very remote	Total
	Case counts					
Major cities	61	2	0	0	0	63
Inner regional	5	15	1	0	0	21
Outer regional	3	4	15	1	0	23
Remote	0	2	1	3	0	6
Very remote	0	1	0	1	0	2
Australia, place not specified	64	19	10	5	0	98
Overseas	8	4	0	0	0	12
Total[(a)]	**141**	**47**	**27**	**10**	**0**	**226**

(a) Total includes 1 resident of an external Australian territory; these territories are excluded from the Australian Statistical Geography Standard (ASGS) Remoteness Structure.

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 education at the time of onset of the SCI are recorded by the ASCIR and are described here. 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).

In 2013–14, slightly more than 2 in 5 people who sustained a persisting traumatic SCI were married or in a de facto relationship at the time of injury (Table 3.2). A similar proportion (40%) had never been married.

Table 3.2: Marital status at onset of persisting traumatic SCI, by age group, Australian residents discharged alive, 2013–14

	15–24		25–64		65+		All ages	
Marital status	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Never married	49	94	39	29	3	8	91	40
Widowed	0	0	0	0	7	18	7	3
Divorced	0	0	11	8	2	5	13	6
Separated	0	0	10	7	0	0	10	4
Married (including de facto)	2	4	69	51	28	70	99	44
Not reported	1	2	5	4	0	0	6	3
Total(a)	**52**	**100**	**134**	**100**	**40**	**100**	**226**	**100**

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

A review of studies of return to work post-injury between 2000 and 2006 found that between 21% and 67% of people who were employed at onset of SCI returned to work after injury (Lidal et al. 2007). This review also noted that employment rates were found to be higher for cases who sustained their SCI during adolescence than later in adulthood. More recently, an Australian study also identified the contextual environment (such as social support, community integration and access to transport) as important factors in predicting a person's return to work at 2 years post-injury (Murphy et al. 2011).

Roughly two-thirds of those aged between 15 and 64 were *Employed* at the time of injury (Table 3.3). (Note, pensioner status in this context includes Age and Disability Support pension recipients and self-funded retirees.) Study commitments, home duties and retirement were primary reasons provided by those who were *Not available for employment*.

Table 3.3: Employment status at onset of persisting traumatic SCI, by age group, Australian residents discharged alive, 2013–14

	15–24		25–64		65+		All ages	
Employment status	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Employed	32	62	92	69	6	15	130	58
Pensioner	0	0	12	9	27	68	39	17
Unemployed	4	8	14	10	2	5	20	9
Not available for employment	14	27	11	8	5	13	30	13
Not reported	2	4	5	4	0	0	7	3
Total(a)	**52**	**100**	**134**	**100**	**40**	**100**	**226**	**100**

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

The Lidal et al. study (2007) also found that a higher level of education at the time of SCI was associated with a higher likelihood of returning to work post-injury. Of persisting traumatic SCI cases for 2013–14, 35% had a post-school qualification, with the greatest proportion being 14% for *Tertiary/postgraduate* level (Table 3.5). A further 14% had completed the *Highest available secondary school level* (for example, matriculation or higher school certificate). Educational status was not reported for one-third (33%) of cases.

Table 3.4: Educational level attained at onset of persisting traumatic SCI, by age group, Australian residents discharged alive, 2013–14

	15–24		25–64		65+		All ages	
Education level	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Tertiary/postgraduate	4	8	22	16	5	13	31	14
Trade qualification/apprenticeship	9	17	16	12	3	8	28	12
Diploma or certificate	2	4	8	6	0	0	10	4
Other post-school study	1	2	5	4	3	8	9	4
Highest available secondary school level	16	31	15	11	1	3	32	14
Left school aged 16 or over	5	10	11	8	6	15	22	10
Left school aged 15 or under	3	6	10	7	3	8	16	7
Still at school	4	8	0	0	0	0	4	2
Not reported	8	15	47	35	19	48	74	33
Total[(a)]	**52**	**100**	**134**	**100**	**40**	**100**	**226**	**100**

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

Clinical characteristics of persisting traumatic SCI in 2013–14

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 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. At the time of writing this report, all 226 cases had been discharged, and extent and level of injury was known for all but 1 case.

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 D.6.

Just over 3 in 5 (64%) cases of persisting traumatic SCI sustained during 2013–14 had a neurological injury at 1 of the cervical segments, C1–C8. 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 55% of cervical cases and 35% of cases at any level.

Twenty-nine per cent of cases had a neurological level of injury at a thoracic segment (T1–T12) and 8% at a lumbosacral segment (L1–L5 and S1–S5). The impairment resulting from injury at the thoracic or lumbosacral neurological levels is referred to as paraplegia.

Nine per cent of cases had a neurological level injury at the thoraco-lumbar junction (that is, injury at either T12 or L1).

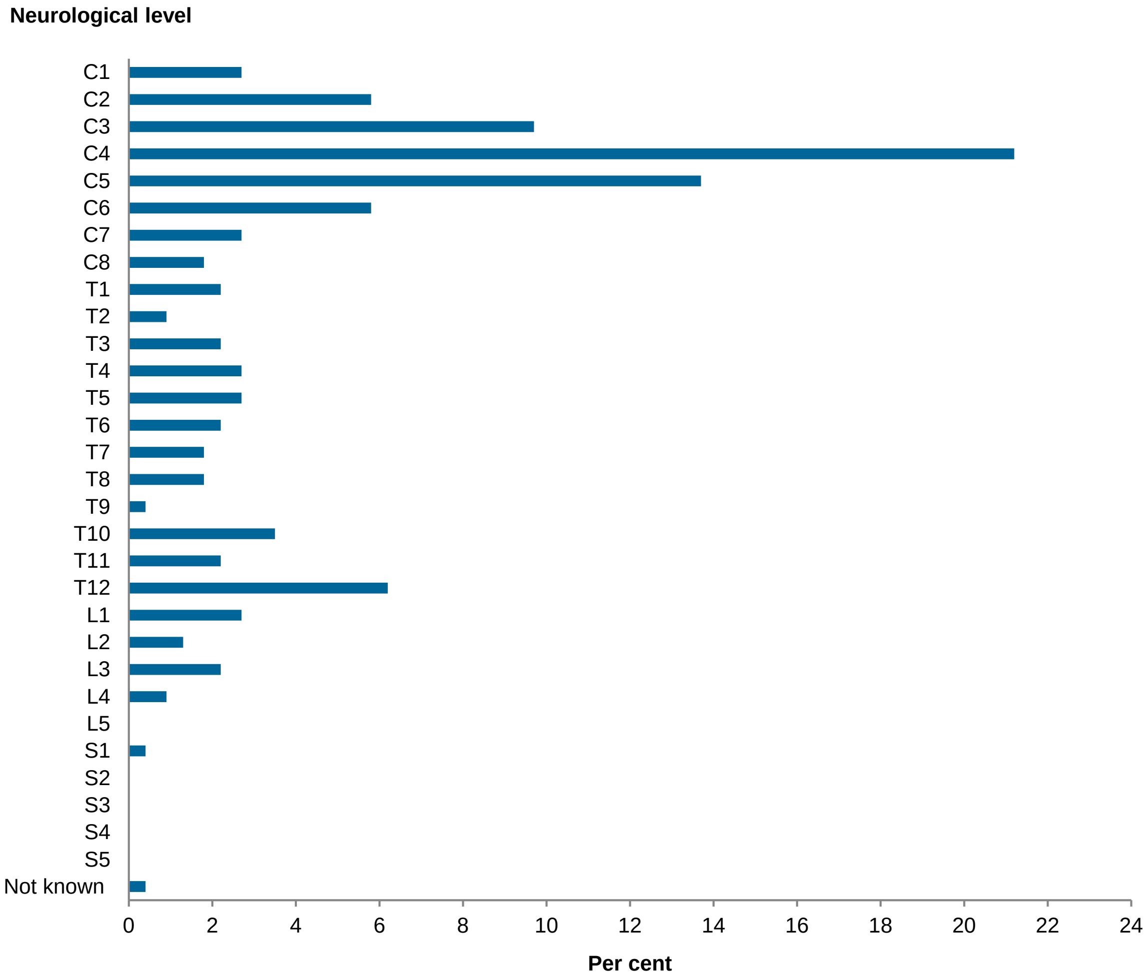


Figure 3.6: Neurological level of injury at discharge for persisting traumatic SCI cases, Australian residents discharged alive, 2013–14

Neurological impairment at discharge

More than half of persisting traumatic SCI cases reported to the ASCIR for 2013–14 were categorised as incomplete tetraplegia on discharge (52%) (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).

The next most common impairment at discharge was complete paraplegia at the thoracic level (16%). Cases of this type had been assessed as having a 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).

All except 1 case involving the lumbosacral region were discharged with incomplete paraplegia.

Table 3.5: Neurological impairment at discharge for persisting traumatic SCI, Australian residents discharged alive, 2013–14

Neurological impairment	Number of cases	%
Tetraplegia		
Cervical		
Complete tetraplegia	25	11
Incomplete tetraplegia	118	52
Paraplegia		
Thoracic		
Complete paraplegia	36	16
Incomplete paraplegia	29	13
Lumbosacral		
Complete paraplegia	1	0
Incomplete paraplegia	16	7
Total[(a)]	**225**	**99**

(a) Neurological level and completeness of SCI was not available for 1 case.

Length of stay in spinal unit

Table 3.6 presents the median LOS in an SU for persisting traumatic SCI cases in 2012–13, by neurological impairment at discharge. The 5th and 95th percentiles provide an indication of the patterns of variation in LOS between types of impairment.

Complete cases at cervical level (complete tetraplegia) had the longest median LOS, 246 days (approximately 8 months), with 5th and 95th percentiles of 49 and 381 days.

The median LOS in an SU decreased according to the extent of injury (complete to incomplete) and lower neurological level of injury (from cervical to thoracic and lumbosacral).

Table 3.6: Length of stay in spinal unit for persisting traumatic SCI, by neurological impairment at discharge, Australian residents discharged alive, 2013–14

Neurological impairment at discharge	Number of cases	Median LOS (days)	5th Percentile (days)	95th Percentile (days)
Tetraplegia				
Cervical				
Complete tetraplegia	25	240	49	381
Incomplete tetraplegia	118	128	15	325
Paraplegia				
Thoracic				
Complete paraplegia	36	159	29	322
Incomplete paraplegia	29	88	34	183
Lumbosacral				
Complete paraplegia	1	74	74	74
Incomplete paraplegia	16	47	18	222
Total[(a)]	**226**	**134**	**18**	**325**

(a) Total includes 1 case of cauda equine syndrome without mention of spinal cord injury.

Information on trends in the duration of initial care (DIC), as measured from the time of injury to time of discharge from a participating SU for persisting traumatic SCI cases registered with the ASCIR since 1995–96, is presented in Appendix C. The focus of LOS is the period of care in an SU, whereas DIC considers the entire period of injury to the end of admitted patient care.

4 External causes of SCI in 2013–14

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 236 cases of traumatic SCI with onset in 2013–14 that were treated in participating SUs and had been reported to the ASCIR by 31 March 2016. This number includes the 226 cases of persisting traumatic SCI that are the subject of Chapter 3, as well as 2 cases in which a person admitted to an SU had no neurological deficit at discharge (that is, not persisting cases); 3 cases where a person with traumatic SCI died while an admitted patient of a participating SU; and 5 non-residents of Australia who were admitted to a participating unit due to SCI sustained in 2013–14 (see Table 2.1).

Mechanism of injury

Land transport crashes involving *Motor vehicle occupants* and *Unprotected land transport users*, such as motor cyclists and pedal cyclists, were the most common mechanism of injury for traumatic SCI in 2013–14 (45%) (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, 2013–14

	Males		Females		Total	
Mechanism of injury	**Number**	**%**	**Number**	**%**	**Number**	**%**
Land transport crash						
Motor vehicle occupant	33	17	11	24	44	19
Unprotected land transport user	59	31	4	9	63	27
Fall						
Low fall (same level or <1 metre)[(a)]	24	13	15	33	39	17
High fall (>1 metre)	29	15	7	15	36	15
Water-related	22	12	1	2	23	10
Heavy falling object	3	2	1	2	4	2
Horse-related	0	0	5	11	5	2
Football	8	4	0	0	8	3
Other and unspecified causes	12	6	2	4	14	6
Total[(b)]	**190**	**100**	**46**	**100**	**236**	**100**

(a) Includes falls from unspecified heights.

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

In 2013–14, more than half (54%) of all traumatic SCI for cases aged 15–24 were due to *Land transport* crashes, while 52% of cases aged 65 or older were due to falls (Table 4.2). 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, 2013–14

	15–24		25–64		65+		All ages	
Mechanism of injury	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Land transport crash								
Motor vehicle occupant	18	33	22	16	4	10	44	19
Unprotected land transport user	11	20	40	29	12	29	63	27
Fall								
Low fall (same level or <1 metre)[(a)]	2	4	20	14	17	40	39	17
High fall (>1 metre)	6	11	25	18	5	12	36	15
Water-related	8	15	14	10	1	2	23	10
Heavy falling object	0	0	3	2	1	2	4	2
Horse-related	1	2	4	3	0	0	5	2
Football	5	9	3	2	0	0	8	3
Other and unspecified causes	3	6	9	6	2	5	14	6
Total[(b)]	**54**	**100**	**140**	**100**	**42**	**100**	**236**	**100**

(a) Includes falls from unspecified heights.

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

Close to two-thirds (65%) of all traumatic SCI cases reported for 2013–14 sustained an injury to the cervical spine (Table 4.3). People who had a *Low fall*, *Unprotected land transport users* and *Motor vehicle occupants* contributed roughly equal proportions to these cervical cases. All except 1 of the 23 *Water-related* SCI cases resulted in a cervical level injury.

Thoracic level injuries were most common (42%) among *Unprotected land transport user* cases, while *Motor vehicle occupants* sustained a large proportion (33%) of the lumbosacral level injuries.

Table 4.3: Mechanism of injury for all traumatic SCI, by neurological level of injury at admission, 2013–14

	Tetraplegia		Paraplegia					
	Cervical		Thoracic		Lumbosacral		Total	
	Number	%	Number	%	Number	%	Number	%
Land transport crash								
Motor vehicle occupant	29	19	9	14	6	33	44	19
Unprotected land transport user	31	20	27	42	5	28	63	27
Fall								
Low fall (same level or <1 metre)[a]	32	21	4	6	2	11	39	17
High fall (>1 metre)	20	13	12	19	4	22	36	15
Water-related	22	14	1	2	0	0	23	10
Heavy falling object	1	1	3	5	0	0	4	2
Horse-related	2	1	3	5	0	0	5	2
Football	8	5	0	0	0	0	8	3
Other and unspecified causes	8	5	5	8	1	6	14	6
Total[b][c]	**153**	**100**	**64**	**100**	**18**	**100**	**236**	**100**

(a) Includes falls from unspecified heights.

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

(c) Total includes 1 case of cauda equine syndrome without mention of spinal cord injury.

Land transport crashes

As shown in Table 4.1, 45% of traumatic SCI cases reported to the ASCIR for 2013–14 were due to *Land transport crashes*.

In 2013–14, 63 *Unprotected land transport users* and 44 *Motor vehicle occupants* sustained a traumatic SCI (Table 4.4). The vast majority (94%) of *Unprotected land transport users* injured were male, while three-quarters of the *Motor vehicle occupants* injured were also male.

Motorcycle drivers accounted for almost one-third (32%) of *Land transport-related* SCI cases in 2013–14. Motor vehicle drivers were the next most numerous type of user injured in *Land transport crashes*, followed by motor vehicle passengers (23% and 18%, respectively). Eight cases of traumatic SCI sustained during 2013–14 involved quad-bikes or a similar type of land transport vehicle, and all except 1 of these cases were male. Cases involving quad-bikes or similar amounted to 13% of *Unprotected land transport users* and 3% of all traumatic SCI cases in 2013–14.

Table 4.4: Land transport user types for all traumatic SCI, 2013–14

	Males		Females		Total	
Land transport user type	**Number**	**%**	**Number**	**%**	**Number**	**%**
Motor vehicle driver	20	22	5	33	25	23
Motor vehicle passenger	13	14	6	40	19	18
Motorcycle driver	32	35	2	13	34	32
Motorcycle passenger	1	1	0	0	1	1
Pedal cyclist or pedal cycle passenger	13	14	1	7	14	13
Pedestrian	6	7	0	0	6	6
Quad-bike rider[(a)]	7	8	1	7	8	7
Total[(b)]	**92**	**100**	**15**	**100**	**107**	**100**

(a) Quad-bike rider classification includes 1 case of *Other type of land transport* vehicle, for example, go-kart, dune buggy.

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

The mean age at onset for traumatic SCI for *Motor vehicle occupants* in 2013–14 was 36 (*SD* = 18), while for *Unprotected land transport users*, the mean age was higher, at 43 (*SD* = 18). This differs a little from the previous year, when the mean ages at onset for *Motor vehicle occupants* was 39 (*SD* = 19) and 38 (*SD* = 16) for *Unprotected land transport users* (AIHW: Tovell 2018b).

Information of the use of seatbelts and the circumstances surrounding *Land transport crashes*, including rollovers, ejection, and impact with another vehicle or roadside hazard are not always available to the staff who complete the case registrations forms for ASCIR. Of the *Motor vehicle occupants* who sustained a spinal injury in 2013–14, 41% were reported to have worn a seatbelt at the time of the crash. Information on the use of seatbelts was not provided in 30% of cases.

The most common type of crash event reported for *Motor vehicle occupants* was impact with a roadside hazard, with 23 confirmed cases (52%). A tree was the most frequently reported roadside hazard (13 cases, or 57%). Compared with the previous year, there were considerably fewer cases reported where there had been an impact with another motor vehicle, with 6 cases being reported for 2013–14 (14%), compared with 21 cases (41%) for

2012–13 (AIHW: Tovell 2018b). Similarly, there were fewer cases reported where the person had been ejected from their vehicle: 4 cases in 2013–14 compared with 9 cases in 2012–13. Just over one-quarter (27%) of *Motor vehicle occupant* cases in 2013–14 were involved a rollover event (12 cases). These types of events are not mutually exclusive and more than 1 event may have been reported for the same person. (For instance, in this reporting period, 2 of the 12 occupants who experienced a rollover also reported being ejected from the vehicle.)

A search of the descriptive narrative for common themes identified ‘high speed’ as a contributing factor in more than half of the *Motor vehicle occupant* cases (24 cases; 55%).

Two-thirds of *Motor vehicle occupants* who sustained a traumatic SCI in 2013–14 had an injury at the cervical level on admission (Table 4.3). Nineteen of these 29 cases resulted in incomplete tetraplegia at discharge.

In addition to the 8 quad-bike (or similar vehicle) cases, 35 motorcycle cases, 14 pedal cyclists, and 6 pedestrians made up the 63 *Unprotected land transport users* who sustained a traumatic SCI during 2013–14 (Table 4.4). Only 4 of these cases were female.

Just over one-quarter (27%) of *Unprotected land transport user* cases involved impact with a motor vehicle, and of these, 8 were motorcyclists, 6 were pedestrians and 3 were pedal cyclists. A further 22% involved an impact with a roadside hazard such as a tree or sign post, and of these, 7 were motorcycle drivers, 4 were pedal cyclists and 3 were quad-bike or similar riders. A collision or near-collision with another pedal cyclist contributed to 4 of the 14 pedal cyclist injury cases.

A traumatic SCI due to a motorcycle crash was more likely to result in a thoracic level injury (20 of 35 cases), while pedal cyclists reported higher numbers of cervical level injuries (10 of 14 cases).

While the majority of *Motor vehicle occupants* were injured on a public road (86%), the types of places where *Unprotected land transport users* were injured were varied and included race tracks, public parks, beaches, private homes and farms as well as urban and non-urban roads.

Falls

In 2013–14, falls contributed to approximately one-third (32%) of all traumatic SCI cases reported to the ASCIR. Similar numbers of cases were reported for the 2 different types of falls, with 39 cases being due a fall on the same of level, from less than 1 metre or an unspecified height (hereafter referred to as a *Low fall*), and 36 cases due to a fall from a height greater than 1 metre (hereafter referred to as a *High fall*) (Table 4.1).

The proportion of males and females who sustained a *High fall* were the same, however *Low falls* contributed to a higher proportion of female SCI cases (33%) than to male cases (13%), although the number of cases was larger for males than for females. The mean age at onset for traumatic SCI due to a *Low fall* was 60 (*SD* = 16), while it was considerably younger, 45 (*SD* = 18) for a *High fall*.

Two *High fall* SCI cases were attributable to acts of *Intentional self-harm* rather than unintentional accidents. This was a lower proportion than has been reported in recent years, at 6% compared with 18% in 2012–13 and 11% in 2011–12 (AIHW: Tovell 2018b; 2018a).

Neurological impairment at the cervical level (tetraplegia) was most frequent for both types of falls cases, but more so for *Low falls* at 82%, compared with 56% of *High falls* (Table 4.3). Thirty of the 39 *Low fall* cases, and 17 of the 36 *High fall* cases were discharged from an SU with incomplete tetraplegia. The neurological level of injury and extent of injury was unknown for 1 *Low fall* SCI case.

Water-related

Ten per cent of traumatic SCI cases reported to the ASCIR for 2013–14 were *Water-related*, and all except 1 of these 23 cases were male (Table 4.1).

Approximately 3 out of 4 *Water-related* spinal injuries were due to diving into shallow water (17 cases, or 74%). A further 4 cases were due to being dumped in surf and the remaining 2 cases were due to other causes, such as scuba diving or unexpectedly falling into water.

The mean age for *Water-related* SCI in 2013–14 was 33 (*SD* = 13). Overall, a *Water-related* event was the third most common cause of traumatic SCI among cases aged 15–24 (15%), after *Motor vehicle* crashes (33%) and crashes involving an *Unprotected land transport* mode (20%) (Table 4.2).

Eleven SCI cases occurred at a seaside beach or in the ocean, 8 cases in a swimming pool and 2 cases at a river.

All except 1 of the *Water-related* SCI cases sustained a neurological injury to the cervical spine (Table 4.3), and of these, 19 were discharged with incomplete tetraplegia.

Heavy falling objects

Three males and 1 female sustained a traumatic SCI in 2013–14 due to a *Heavy falling object*. All except 1 of these cases involved being struck by a tree branch.

The mean age of SCI cases due to a *Heavy falling object* was 50 (*SD* = 25).

Incomplete SCI were most common among cases in this category, with 2 of the 3 thoracic level injuries resulting in incomplete paraplegia, and the single cervical level case resulting in incomplete tetraplegia.

Horse-related

All 5 *Horse-related* SCI cases reported to the ASCIR for 2013–14 were sustained by females, and accounted for 2% of traumatic SCI overall (Table 4.1). Each case involved being thrown or falling off a horse.

The mean age for *Horse-related* SCI in 2013–14 was 47 (*SD* = 17).

All except 1 *Horse-related* SCI case (at the thoracic level) sustained an incomplete SCI.

Football

Football SCI accounted for 3% of traumatic SCI cases overall in 2013–14 (Table 4.1). Football codes in this category include rugby (4 cases), Australian Rules football (3 cases) and soccer (1 case).

All cases were male, and the mean age at injury was 28 (*SD* = 10). As has been the case in previous years, this is the lowest mean age reported among all the mechanisms of injuries included in this report.

All 8 *Football* SCI cases were admitted with cervical level injuries (Table 4.3), however at discharge, 1 case was resolved (that is, ASIA E grade at discharge) and 1 case had improved neurological functioning to include some of the thoracic spine.

Other and unspecified causes

A further 14 traumatic SCI cases reported to the ASCIR for 2013–14 had a mechanism of injury recorded that was different to those mechanisms already described above. Causes in this residual category included traumatic SCI due to a gun-shot (3 cases); assault with a knife (2 cases); or other physical assault (1 case); subsequent to lifting a heavy object (2 cases), and while operating heavy machinery (2 cases).

Twelve males and 2 females were included in this *Other causes* group, and the mean age at injury was 46 (*SD* = 17).

A cervical level injury at admission was most common (57%; 8 cases) (Table 4.3). Four of these cases were subsequently discharged with incomplete tetraplegia and 3 with complete tetraplegia, while 1 case had increased neurological functioning to include part of the thoracic region.

Activity at time of injury

The classification used for reporting type of activity is based on the one in the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification* (ICD-10-AM) (NCCC 2013). 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.

Of traumatic SCI cases reported to the ASCIR for 2013–14, 45% occurred while the person was *Engaged in sports or leisure* activities (Table 4.5). Just over 4 in 5 of these cases were males (83%). *Unprotected land transport users* including motor- and pedal cyclists and quad-bike riders made up the greatest proportion of sporting and leisure activity cases (36%), followed by *Water-related* SCI cases (21%). Five *Motor vehicle occupants* who sustained a traumatic SCI while holidaying or rallying are included in this category. Each of the 5 *Horse*-related and 8 *Football* SCI cases were classified as *While engaged in sports or leisure*, while other types of sports reported for 2013–14 cases included sky-diving, kite-surfing, rock climbing, trampolining, gymnastics and snowboarding. Almost half (49%) of cases in this activity category were aged between 15 and 34, and of these, 92% were males. Alcohol was noted as a contributing factor in 17% of *Sports or leisure* SCI cases.

The next most common type of specified activity when the traumatic SCI occurred was W*hile working for income* (8%). Fifteen of these 18 cases were male (83%). Of the 9 cases due to *Land transport* crashes, 3 cases were travelling to or from work at the time of injury, and 2 cases were operating a quad-bike. Specified types of places where work-related SCI cases occurred included a public road (6 cases); construction site (4 cases); residential house (2 cases); farm (2 cases); as well as restaurant; office building; and mining site. The age-distribution of these *While working for income* cases was highest at age groups 35–44 and 45–54, with 4 cases recorded for each group. A further 3 cases each were recorded for ages 25–34 and 55–64, followed by 2 cases each in the 15–24 and 65–74 age groups. No *While working for income* cases were recorded for cases aged 75 or older.

A further 5% of cases occurred while the person was *Engaged in unpaid work*, including while volunteering, and all except 2 of these 12 cases were male. A *High fall* accounted for more than 50% of cases in this category, and included falling from or through a roof (4 cases); off ladders (2 cases); and from a mezzanine floor (1 case). Two cases occurred as a result of lifting a heavy object. Three-quarters of traumatic SCI cases occurring while *engaged in unpaid work* were aged 55 or older, and two-thirds of these were male (67%).

Of traumatic SCI cases sustained while the person was *Engaged in a personal activity* (such as resting, sleeping or eating), 75% were due to a *Low fall*. Falling from a bed or just after rising from bed was most frequent type of *Low fall* (3 cases), while other *Low fall*s included while in the bathroom, from a chair and while moving around the house. All of the *High fall* SCI cases in this category involved falling down stairs. All *Personal activity* SCI cases were aged 55 or older, and this was the only activity category for which females cases outnumbered males, with 7 women injured compared with 3 men.

Twenty-five cases (28%) in the residual category *Other and unspecified activity* were recorded as *Unspecified activity*. *Land transport* crashes accounted for the largest proportion of cases in the *Other and unspecified activity* category at 61%. *High* and *Low falls* were also common, together accounting for 31% of cases in this residual activity category. Cases of traumatic SCI due to *Intentional self-harm* and *Assault* are included in this activity. One-quarter of *Other and unspecified activity* cases were aged 15–24, and the majority of these were male (20 of 23 cases).

Table 4.5: Traumatic SCI, by mechanism of injury, by type of activity, 2013–14

	Sports and leisure		Working for income[(a)]		Other type of work		Personal activity		Other and unspecified activity		Total	
Mechanism of injury	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Land transport crash												
Motor vehicle occupant	5	5	4	22	1	8	0	0	34	38	44	19
Unprotected land transport user	38	36	5	28	0	0	0	0	20	22	63	27
Fall												
Low fall (same level or <1 metre)[(b)]	12	11	1	6	1	8	7	70	18	20	39	17
High fall (>1 metre)	12	11	4	22	7	58	3	30	10	11	36	15
Water-related	23	21	0	0	0	0	0	0	0	0	23	10
Heavy falling object	2	2	1	6	0	0	0	0	1	1	4	2
Horse-related	5	5	0	0	0	0	0	0	0	0	5	2
Football	8	7	0	0	0	0	0	0	0	0	8	3
Other and unspecified causes	2	2	3	17	3	25	0	0	6	7	14	6
Total[(c)]	**107**	**100**	**18**	**100**	**12**	**100**	**10**	**100**	**89**	**100**	**236**	**100**

(a) Includes travel to and from work.

(b) Includes falls from unspecified heights.

(c) 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 AIHW policies and procedures.

The following SUs, all based in public hospitals, contribute data to the 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, Fiona Stanley Hospital (Perth) (formerly Royal Perth Hospital's Shenton Park campus).

Timeliness

The reference period for this report is 2013–14.

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 2013–14 data was 31 March 2016. Data corrections from SUs up to 18 August 2016 are included in this report. A snapshot file of the ASCIR was taken on 19 August 2016.

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 (who received treatment in an Australian SU) since 1995 and up to 2013–14. Cases for 2014–15 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 2013–14.

The data reported for 2013–14 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. In reports covering cases from 2011–12 and later, cases of SCI due to complications of medical care have been reported with non-traumatic cases in Appendix B. Formerly, some such cases were reported as non-traumatic while others, reported as traumatic, were included in the body of the annual reports (See Box A.1). This change makes clearer how complications of care cases are now handled and better aligns ASCIR statistical reports with other AIHW reports on injury.

Box A.1: Change in definition of traumatic spinal cord injury

The case definition of 'traumatic spinal cord injury' has been changed slightly for new case registrations reported for 2011–12 onwards.

According to ICD-10-AM, some complications of surgical and medical care are codable to disease-specific chapters of the classification, while the remainder are codable to a section of the injury chapter *T80–T88 Complications of surgical and medical care, not elsewhere classified*.

By longstanding convention, AIHW reports on injury generally do not include cases coded to T80–T88. This is because T80–T88 includes a poorly defined part of all complications of medical care cases, and because circumstances of occurrence differ greatly between these cases and other injuries which occur in the community rather than the special circumstances of clinical care.

Beginning with the data year 2011–12, this practice has been applied to the reporting of ASCIR data. The effect is that small numbers of cases (2–5 in most years), which would previously have been reported in the *Other and unspecified causes* category of the 'External causes' chapter in the annual *Spinal cord injury, Australia* series, are now included in an appendix with non-traumatic 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.

For the financial year of injury 2011–12, fewer cases from 1 SU were registered than normal. In most years, this unit contributes an average of 20% of newly incidence cases, but for 2011–12, it contributed only 13%.

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 Australian Bureau of Statistics (ABS) in June 2016 (unpublished). Incidence rates have been calculated as cases per million of the estimated resident population (ERP) of Australia.

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 of 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 the 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 7. Other or unspecified transport-related circumstance, if record also contains reference to quad-bike, go-kart or other similar land transport vehicle
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 categories for both 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) for cases with an injury date prior to 1 January 2012; or the 2012 Postcode to Remoteness Area 2011 Data Cube (ABS 2013a) for cases with an injury date on or after 1 January 2012.

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: Other SCI cases

Two types of SCI cases reported to the ASCIR are not included in the main part of this report. They are cases caused by a disease process (‘non-traumatic SCI) and cases in which the onset of SCI was a complication of medical care for a disease. These cases are summarised here.

Cases that are a complication of medical care usually have a well-defined date of onset, which allows the cases to be reported according to the year of occurrence. Non-traumatic SCI cases often have a gradual onset. Accordingly, they are reported according to year of admission.

Non-traumatic SCI cases

Sixty-five males (59%) and 46 females with a non-traumatic SCI were admitted to a participating SU between 1 July 2013 and 30 June 2014 and consented to being included in the ASCIR.

The mean age of non-traumatic SCI cases admitted in 2013–14 was 57 (*SD* =1 7). The median duration of stay in the SU was approximately 3 months (94 days, 5th percentile 12 days, 95th percentile 295 days).

Three (3%) non-traumatic SCI cases admitted during 2013–14 died before being discharged, while 79 cases were discharged to their previous (51%) or new home (21%).

Complication of medical care SCI cases

Cases included here arose in the course of surgery or as a result of other medical care, commonly during repair of an abdominal aortic aneurysm; laminectomy or spinal decompression for pain reduction; removal of tumours; epidural haemorrhage due to anaesthesia; or long-term anti-coagulant use, where the record states the onset of paralysis was post-intervention.

Nine male (38%) and 15 female SCI cases, with a date of injury onset between 1 July 2013 and 30 June 2014 and which met the criteria for a complication of medical care case, were reported to the ASCIR. The mean age at SCI onset for these cases was 62 (*SD* = 12).

Appendix C: Median duration of initial care for persisting traumatic SCI

This appendix provides summary information on duration of initial care (DIC) for ASCIR cases with persisting SCI due to trauma that was sustained at ages 15 or older, commencing with 1995–96.

For the purposes of this report, **duration of initial care** (DIC) is conceptualised as:

- 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. 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 often not all, is provided in a SU.

DIC is calculated as the difference, in days, between date of injury and date of discharge from SU, as recorded in the ASCIR, provided that the person did not die while in a SU, or the person was not discharged to another hospital or rehabilitation setting where care for their SCI was expected to continue.

The median DIC has been used as the summary measure because it is not greatly affected by outlier values. The data are presented by neurological level (cervical, thoracic, or lumbosacral), extent of lesion (complete or incomplete) and year of injury. Level and extent of lesion are as assessed on admission to a participating SU. Cells in Table C.1 have been shaded if they are based on fewer than 10 cases, in which case the median DIC should be interpreted cautiously.

DIC (the subject of this appendix) may be longer than length of stay in a SU (the subject of Table 3.6) and the inclusion criteria for this appendix differ from those for Table 3.6. Hence, values in Appendix C and in Table 3.6 should not be expected to be the same.

Table C.1: Median duration of initial care for persisting traumatic SCI, by financial year of injury, by neurological impairment at admission

	Median duration of initial care (days)						
	Cervical		Thoracic		Lumbosacral		
Financial year of injury	Complete	Incomplete	Complete	Incomplete	Complete	Incomplete	Proportion included[(a)]
1995–96	261	76	144	134	83	49	*88%*
1996–97	220	104	148	102	97	67	*86%*
1997–98	204	68	143	92	125	69	*93%*
1998–99	245	89	157	84	111	61	*90%*
1999–00	232	80	149	70	106	79	*91%*
2000–01	254	95	136	121	145	67	*88%*
2001–02	224	98	155	106	104	54	*90%*
2002–03	201	95	142	103	112	54	*92%*
2003–04	238	62	138	104	131	61	*88%*
2004–05	227	103	145	111	179	52	*86%*
2005–06	252	139	143	111	104	97	*88%*
2006–07	220	124	161	128	123	74	*91%*
2007–08	228	113	146	104	108	88	*93%*
2008–09	247	143	151	132	106	88	*93%*
2009–10	261	174	164	127	133	54	*87%*
2010–11	227	128	165	115	88	60	*85%*
2011–12	235	123	134	146	117	117	*90%*
2012–13	197	110	135	111	80	99	*86%*
2013–14	239	111	168	114	89	56	*89%*

(a) Proportion is based on the total number of eligible persisting traumatic SCI cases. Cases omitted are mainly those that were discharged from the SU to another hospital, where initial care might have continued.

Note: Shading indicates median DIC has been calculated on fewer than 10 cases and therefore should be interpreted cautiously.

Appendix D: Additional tables

The data included in these additional tables underpin the figures presented in Chapter 3. As a reminder, the inclusion criteria for Chapter 3 was that the SCI must have occurred between 1 July 1995 and 30 June 2014, and the person must have been:

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

Table D.1: Trends in persisting traumatic SCI, by financial year of injury, Australian residents discharged alive, 1995–96 to 2013–14

Financial year of injury	Age-standardised rate per million population	Poisson modelled rate per million population	Upper 95% CI	Lower 95% CI
1995–96	16.0	18.1	19.1	17.2
1996–97	16.5	17.7	18.6	16.9
1997–98	18.7	17.3	18.2	16.6
1998–99	17.6	17.0	17.7	16.3
1999–00	17.8	16.6	17.3	16.0
2000–01	16.8	16.2	16.8	15.7
2001–02	14.9	15.9	16.4	15.4
2002–03	15.0	15.6	16.0	15.1
2003–04	15.0	15.2	15.7	14.8
2004–05	15.1	14.9	15.3	14.5
2005–06	15.6	14.6	15.0	14.1
2006–07	15.4	14.3	14.7	13.8
2007–08	14.8	14.0	14.4	13.5
2008–09	13.9	13.7	14.2	13.2
2009–10	12.4	13.4	13.9	12.8
2010–11	14.3	13.1	13.7	12.5
2011–12	10.9	12.8	13.4	12.2
2012–13	12.4	12.5	13.2	11.9
2013–14	11.8	12.2	13.0	11.6

Table D.2: Counts and age-specific rates of persisting traumatic SCI, by age group, Australian residents discharged alive, 2013–14

Age group	Cases	Rate per million population
15–24	52	16.7
25–34	34	10.0
35–44	33	10.3
45–54	30	9.7
55–64	37	13.9
65–74	28	14.7
75+	12	8.0

Table D.3: Age-specific rates of persisting traumatic SCI, by sex, by age group, Australian residents discharged alive, 2013–14

Age group	Cases	Rate per million population
Males		
15–24	47	29.4
25–34	30	17.5
35–44	26	16.3
45–54	23	15.1
55–64	27	20.6
65–74	23	24.5
75+	5	7.8
Females		
15–24	5	3.3
25–34	4	2.4
35–44	7	4.3
45–54	7	4.5
55–64	10	7.4
65–74	5	5.2
75+	7	8.2

Table D.4: Age-standardised 3-year rates of persisting traumatic SCI cases, by state or territory of usual residence, Australian residents discharged alive, 2011–12 to 2013–14

State or territory	Cases	3-year rate per million population
New South Wales	195	10.9
Victoria	127	9.1
Queensland	146	13.2
Western Australia	100	16.8
South Australia	57	13.9
Tasmania	11	8.8
Australian Capital Territory	8	8.6
Northern Territory	13	23.4
All Australian jurisdictions	**657**	11.8

Table D.5: Age-standardised 3-year rates of persisting traumatic SCI, by remoteness of residence, Australian residents discharged alive, 2011–12 to 2013–14

Remoteness of residence	Cases	3-year rate per million population
Major cities of Australia	402	10.1
Inner regional Australia	129	12.9
Outer regional Australia	94	20.1
Remote Australia	24	31.9
Very remote Australia	7	14.3
All remoteness areas[(a)]	657	11.7

(a) Total includes 1 resident of an external Australian territory; these territories are excluded from the ASGS Remoteness Structure.

Table D.6: Neurological level of injury at discharge for persisting SCI cases, Australian residents discharged alive, 2013–14

Neurological level	Frequency	%
C1	6	3
C2	13	6
C3	22	10
C4	48	21
C5	31	14
C6	13	6
C7	6	3
C8	4	2
T1	5	2
T2	2	1
T3	5	2
T4	6	3
T5	6	3
T6	5	2
T7	4	2
T8	4	2
T9	1	0
T10	8	4
T11	5	2
T12	14	6
L1	6	3
L2	3	1
L3	5	2
L4	2	1
L5	0	0
S1	1	0
S2	0	0
S3	0	0
S4	0	0
S5	0	0
Not known	1	0
Total	**226**	**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 three 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 2013–14*, 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>.

In 2013–14, 236 new incident cases of spinal cord injury (SCI) due to external causes were reported to the Australian Spinal Cord Injury Register. Males accounted for 81% of traumatic SCI cases. Land transport crashes (46%) were the leading mechanism of injury followed by falls (32%). Nearly half (45%) of traumatic SCI occurred while the person was engaged in a sport or leisure activity.

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