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Spinal cord injury, Australia: summary

2008–09 to 2012–13

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Spinal cord injury, Australia

Summary

2008–09 to 2012–13

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Contents

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

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
LOS	length of stay
NISU	National Injury Surveillance Unit
RCIS	Research Centre for Injury Studies
SCI	spinal cord injury
SU	spinal unit

Symbols

CI	confidence interval
p	statistical significance p value
SD	standard deviation

Summary

Between 2008–09 and 2012–13, just over 1,200 people aged 15 and older sustained a traumatic spinal cord injury (SCI) and were admitted to a specialist spinal unit (SU) in an Australian hospital. Nearly all cases (96%) resulted in a persisting traumatic SCI.

In this 5-year period, the highest number of persisting traumatic SCI for Australian residents discharged alive was 255 cases in 2010–11 (22% of the 5-year total), and the lowest number was in 2011–12 (201 cases, or 18%).

Over the 5-year period, the age-standardised incidence rate for Australian residents aged 15 and older and discharged alive with persisting traumatic SCI fell from 14.0 cases per million residents in 2008–09 to 12.2 cases per million residents in 2012–13.

Overall, cases of persisting traumatic SCI among Australian male residents aged 15 and older, discharged alive, far outnumbered female cases. The ratio was roughly constant across the 5-year timespan, at about 4 male cases to 1 female case each year.

A third or more of persisting traumatic SCI cases each year were discharged with incomplete tetraplegia (the neurological impairment of sensory and/or motor function loss at 1 of cervical spine levels C1–C8, with some function preserved below that level). Another 12% to 17% per year sustained a complete injury at the cervical level (that is, no sensory or motor function preserved at S4–S5). Complete paraplegia at the thoracic level was the second most common neurological impairment at discharge, overall, for each of the 5 years. A complete injury at the lumbosacral level was uncommon, with only 2% reported for the 5-year period.

The most severe injuries (complete injury at the cervical level or complete tetraplegia) resulted in the longest median lengths of stay (LOS) in a SU. In 2008–09, the median LOS for complete tetraplegia was 227 days, while in 2012–13, it was 179 days.

Causes of spinal cord injury

Land transport crashes contributed to more than 2 in 5 (43%) of SCI cases during this 5-year period. Of these, 53% were *Unprotected land transport users*, including motor and pedal cyclists, quad-bike riders and pedestrians.

A *High fall* (from a height greater than 1 metre) contributed to 20% of all traumatic SCI causes for the 5-year period, while *Low falls* (on the same level, from less than 1 metre or from an unspecified height) accounted for 16%. Eight per cent of traumatic SCI cases overall were due to a *Water-related* event such as diving into shallow water or being dumped by a wave. A further 3% were injured by a *Heavy falling object*, and 2% each were sustained in a *Horse-related* incident or in relation to *Football*. Rugby codes accounted for 65% of *Football* SCI cases for this 5-year period.

Males outnumbered females for all mechanisms of injury, with the exception of *Horse-related* SCI.

Overall, one-third (33%) of people who sustained a traumatic SCI during this period were *Engaged in a sports or leisure* activity at the time of injury (399 cases). During this 5-year period, approximately 150 cases (13%) of traumatic SCI occurred while the person was *Working for income*.

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 characteristics of people injured, the care provided to them, and the causes of the injuries. This overview provides a summary of information available through the Australian Spinal Cord Injury Register (ASCIR) on traumatic SCI in Australia for the period 2008–09 to 2012–13. It is accompanied by more detailed reports of information for each year in the series.

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 spinal units (SUs) specialising in acute management and rehabilitation of persons with an SCI. The 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. This number underestimates the total number of incident cases of SCI in Australia, as it omits 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's Injury research and statistics series *Spinal cord injury, Australia*. The last edition of this series, *Spinal cord injury, Australia 2007–08,* was published by the AIHW in 2010 (AIHW: Norton 2010). Changes in funding arrangements, staffing, and management practices for ASCIR led to a temporary halt in the production of the *Spinal cord injury, Australia* series until now, but annual data up to 2012–13 are now available. During this period, extensive review and revision of registered cases was undertaken and some changes were made to data coding and to the contents of annual reports. These changes are detailed in Appendix B.

This summary report

The purpose of this *Spinal cord injury, Australia, summary 2008–09 to 2012–13* is to summarise key findings for the period covered by the 5 new editions of *Spinal cord injury, Australia,* and changes to the ASCIR reports since the 2007–08 report was published. Not all topics covered in the annual series are reported in this supplement.

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). Other terms commonly used in this report include persisting traumatic or non-traumatic SCI and complete or incomplete injury. Explanations of these and other terms relevant to this series can be found in boxes 1.1 to 1.4 and in the Glossary.

Structure of this report

Chapter 2 presents an overview of all newly incident traumatic SCI cases that occurred between 2008–09 and 2012–13 and had been registered by 31 December 2014.

Chapter 3 provides an analysis of newly incident cases of persisting traumatic SCI for Australian residents, including trends since 1995–96, and comparison of demographic, social and clinical characteristics of cases according to financial year of injury.

Chapter 4 provides a comparison of external causes of injury and factors associated with the SCI event, for all traumatic cases (irrespective of place of usual residence, ongoing deficit or survival to discharge), according to financial year of injury.

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: Changes in the *Spinal cord injury, Australia* series presents an overview of the structural framework adopted for this series, commencing with the 2008–09 report, and how these changes compare the 2007–08 and earlier reports.

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 residency.

Appendix D: Additional tables consists of data underpinning the selected figures presented in Chapter 3.

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 Overview of traumatic SCI

For the 5-year period between 2008–09 and 2012–13, just over 1,200 people aged 15 and older sustained a traumatic SCI in Australia and were admitted to a specialist SU in an Australian hospital (Table 2.1). Nearly all cases resulted in a persisting traumatic SCI (1,168 cases, or 96%). Thirty-two cases died before discharge and 20 cases were discharged with no ongoing neurological deficit. Twenty-six non-residents were admitted to a specialised SU for treatment during this 5-year period.

Table 2.1: Traumatic SCI cases aged 15 and older, for the period 2008–09 to 2012–13

	Australian residents		Non-residents		Total[a]	
	Number	%	Number	%	Number	%
At discharge from SU:						
Persisting traumatic SCI	[b]1,142	96	26	100	1,168	96
No ongoing neurological deficit	20	2	0	0	20	2
Died on ward	32	3	0	0	32	3
Total[c]	**1,194**	**100**	**26**	**100**	**1,220**	**100**

(a) Any person over the age of 15 who sustained an SCI due to trauma are the focus of Chapter 4.

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

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

Over the 5-year period, some 32 reported SCI cases died while in the SU. Level of neurological impairment was not assessed for 4 cases, and 24 of the remaining 28 cases who died on the ward sustained a cervical level injury. Eleven, nearly half, of these cervical level SCI cases who died, did so within 1 month of their injurious event, and had sustained a complete injury at C6 or higher (11 cases).

Of the 1,142 Australian residents who sustained a persisting traumatic SCI during this 5-year period, the highest number occurred in the 2010–11 financial year (22% of the 5-year total) (Table 2.2). The lowest number occurred in 2011–12. The rate of SCI varied roughly between 11 and 14 cases per million population over the 5-year period.

Table 2.2: Australian residents aged 15 and older, discharged alive, who sustained a persisting traumatic SCI, by financial year of injury, 2008–09 to 2012–13

Financial year of injury	Rate per million population	Number of cases	% of 5-year period
2008–09	14.0	241	21
2009–10	12.3	218	19
2010–11	14.3	255	22
2011–12	10.9	201	18
2012–13	12.2	227	20
Total		**1,142**	**100**

Due to changed arrangements for the ASCIR, retrospective registration was undertaken for 2008–09 and 2009–10. This is likely to have resulted in under-reporting for those years. For cases injured in 2011–12, the proportion of registrations received from one SU was lower than usual (13% compared with an average 20%), and this is likely to have also resulted in under-reporting. More detail on ascertainment issues can be found in the data quality statement in Appendix A.

3 Persisting traumatic SCI cases

This chapter examines the overall trend in persisting traumatic SCI cases among Australia residents aged 15 and older who survived to discharge since 1995–96, and the demographic and social characteristics of the 1,142 Australian residents injured between 2008–09 and 2012–13.

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.

Trends in persisting traumatic SCI cases from 1995–96 to 2012–13

Between 2008–09 and 2012–13, 96% of Australian residents who sustained a traumatic SCI had a persisting neurological deficit on discharge from the participating SU. During the 5-year period relevant to this summary report, the age-standardised incidence rate fell from 14.0 cases per million population aged 15 and older in 2008–09 to 12.2 cases per million population in 2012–13.

Figure 3.1 (and Table D.1 in Appendix D) present the Poisson modelled rate, with 95% confidence intervals, for persisting traumatic SCI registrations in the ASCIR up to 31 December 2013 (see 'Use of confidence intervals' in Appendix A). According to Poisson regression, the incidence rate of persisting traumatic SCI at age 15 and older has tended to decline by an average of 2.2% per year (95% *CI*: –1.6%, –2.7%) since 1995–96. However, while this trend was significantly different from zero ($p = 0.000$), it must be interpreted cautiously, due to the likely under-reporting of SCI cases to the ASCIR (especially for the data years 2009–10 and 2011–12) and other factors potentially contributing to underestimation (see Appendix A).

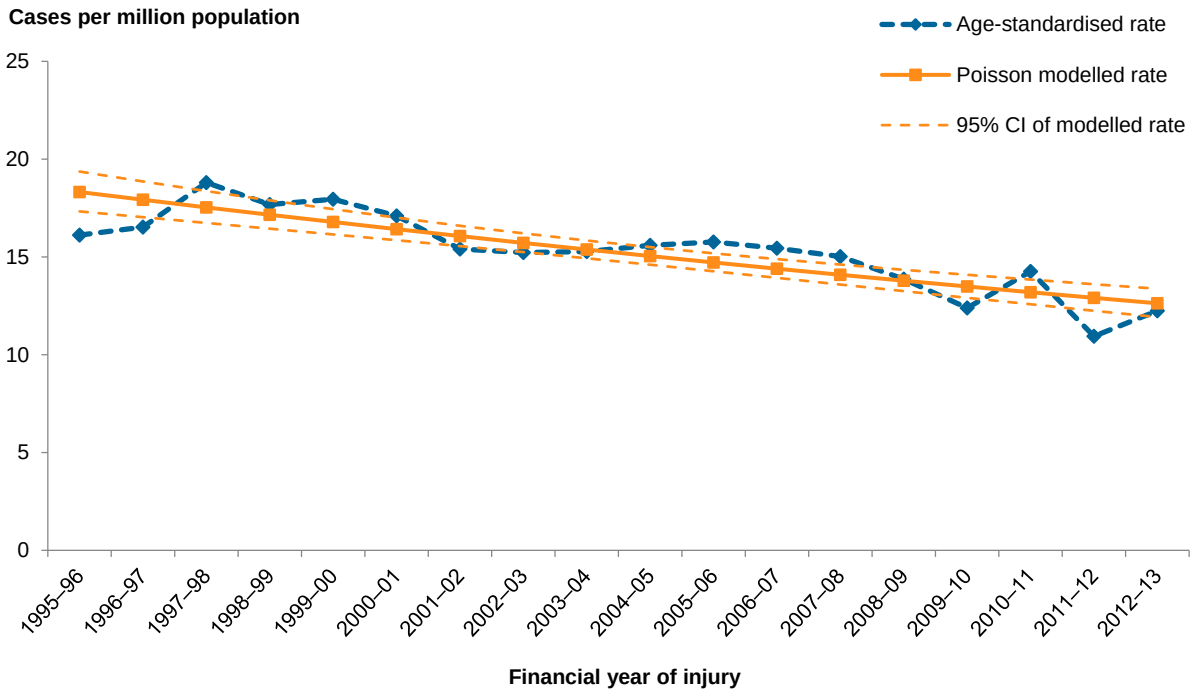


Figure 3.1: Trends in rates of persisting traumatic SCI cases, by financial year of injury, Australian residents aged 15 and older discharged alive, 1995–96 to 2012–13

Demographic and social characteristics of persisting traumatic SCI, 2008–09 to 2012–13

Age and sex distribution

Male cases of persisting traumatic SCI far outnumbered female cases for all years (Figure 3.2 and Table D.2). The ratio was roughly constant across the 5-year timespan, at about 4 male cases to 1 female case each year. The greatest number of males and females who sustained a persisting traumatic SCI was in 2010–11 (204 and 51 cases, respectively) and the lowest reported number of cases for both sexes occurred in 2009–10 (161 and 40 cases, respectively).

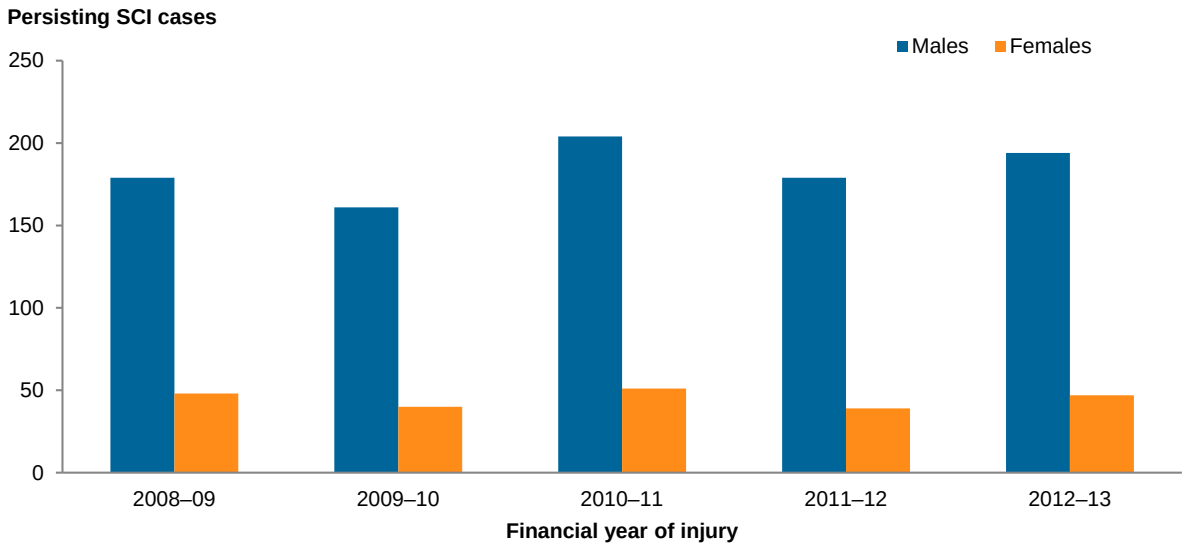


Figure 3.2: Persisting traumatic SCI cases, by sex, by financial year of injury, Australian residents aged 15 and older discharged alive, 2008–09 to 2012–13

Table 3.1 shows the mean age at onset of persisting traumatic SCI for male cases aged 15 and older. This varied little over the 5 years, with the lowest mean age (of 39) reported for 2008–09, and the highest mean age (of 44) reported in 2011–12. The mean age at onset for female cases aged 15 and older showed a little more variation, with the lowest mean age (41) occurring in 2009–10 and the highest (50) in 2010–11. The mean age at onset for females was consistently higher than for males for all years.

Table 3.1: Mean age at onset of persisting traumatic SCI, by sex, by financial year of injury, Australian residents aged 15 and older discharged alive, 2008–09 to 2012–13

Financial year of injury	Males Mean age (years)	Females Mean age (years)	Persons Mean age (years)
2008–09	39	46	41
2009–10	40	41	40
2010–11	41	50	43
2011–12	44	48	45
2012–13	41	44	41

Age-specific rates of persisting traumatic SCI were highest at ages 15–24 for most years (Figure 3.3 and Table D.3). The exception to this was 2011–12, when the rate at ages 65–74 was highest.

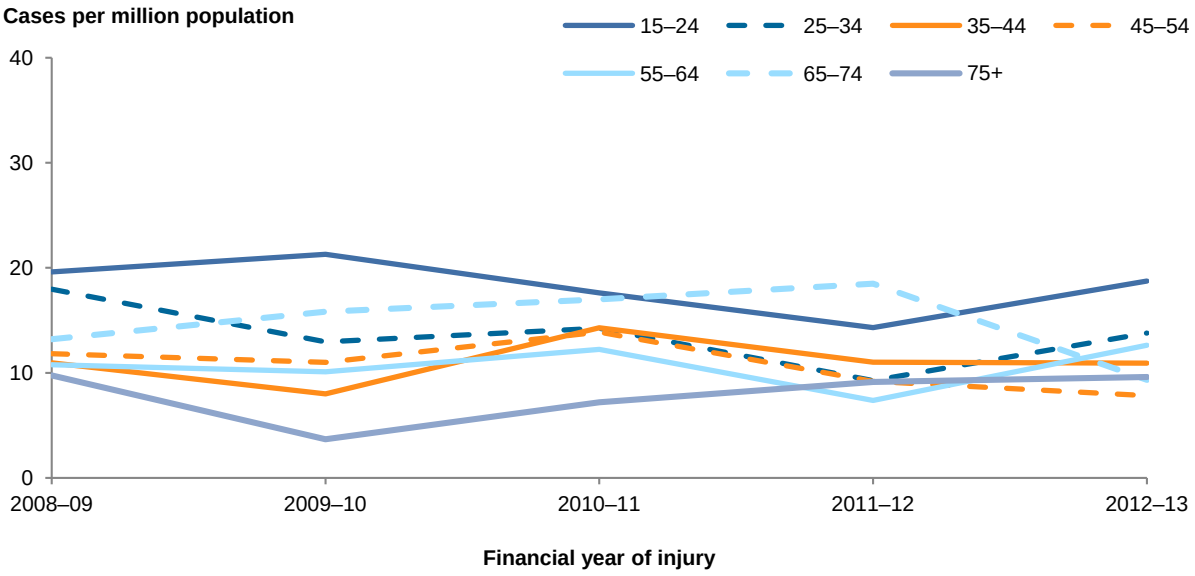


Figure 3.3: Age-specific rates of persisting traumatic SCI cases, by financial year of injury, Australian residents aged 15 and older discharged alive, 2008–09 to 2012–13

The pattern for males is similar to that for persons, because about four-fifths of cases are males (Figure 3.4 and Table D.3). Rates for females were generally lower than for males, and female rates did not vary greatly with age (Figure 3.5 and Table D.3).

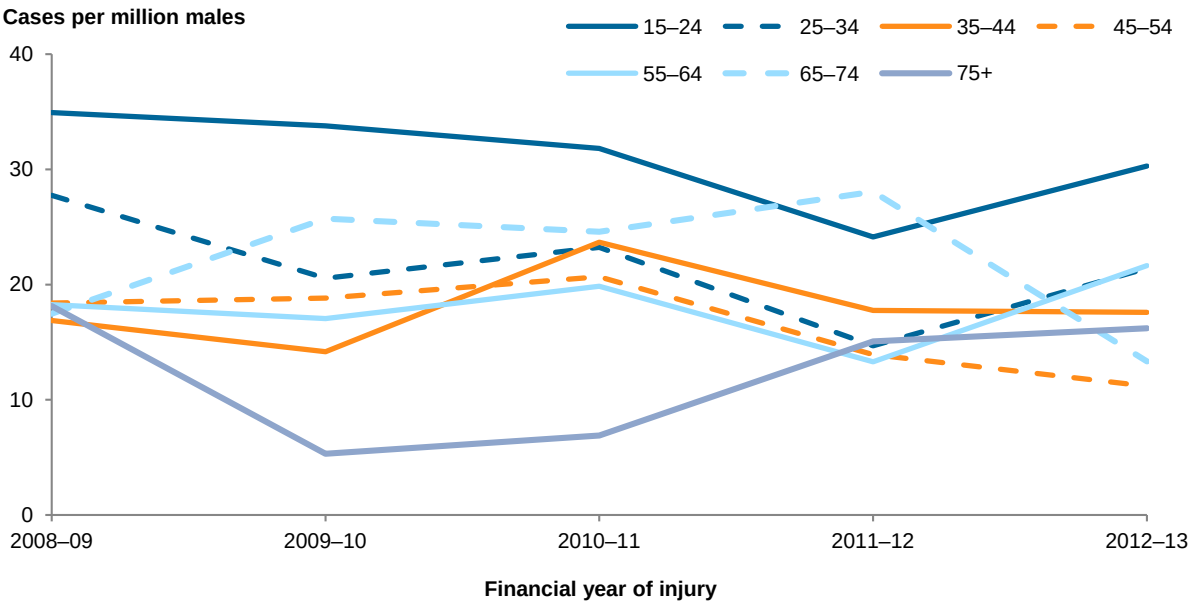


Figure 3.4: Age-specific rates of persisting traumatic SCI cases, by financial year of injury, Australian male residents aged 15 and older discharged alive, 2008–09 to 2012–13

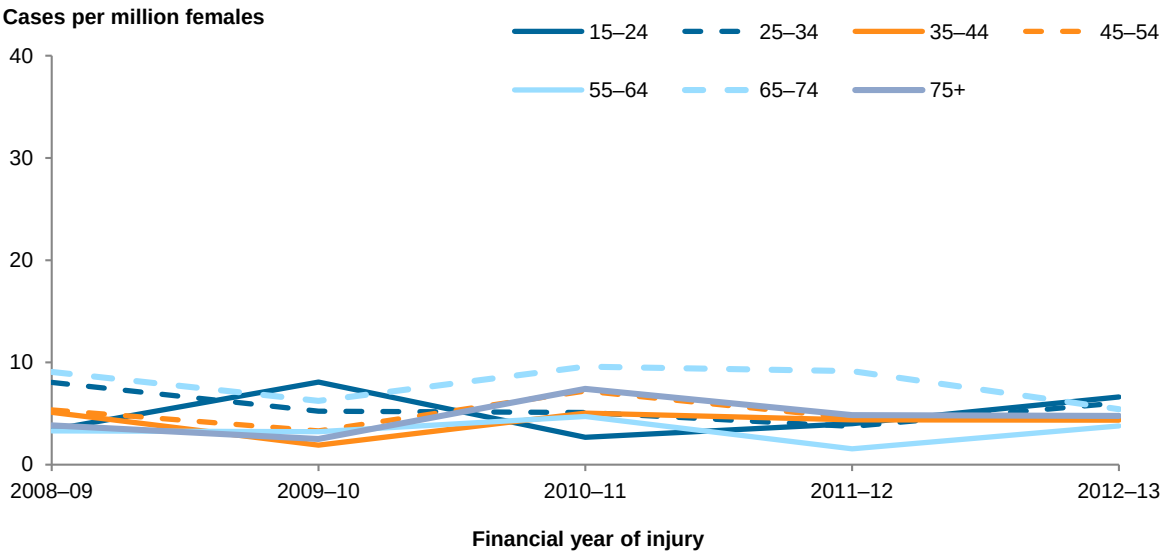


Figure 3.5: Age-specific rates of persisting traumatic SCI cases, by financial year of injury, Australian female residents aged 15 and older discharged alive, 2008–09 to 2012–13

Geographical characteristics

Geographical variables, including 3-year aggregated rates of SCI by state or territory of usual residence and by remoteness of usual residence, are available in the individual annual reports.

Between 56% and 64% of persisting traumatic SCI cases that occurred in each year were sustained by residents of *Major cities*, while residents of both *Remote* and *Very remote Australia* accounted for between 3% and 7% of annual cases.

Rates of persisting traumatic SCI were lowest for residents of *Major cities*, and declined slightly, from 12.7 cases per million residents for the 3-year period 2006–09 to 10.3 cases per million residents for 2010–13. The 3-year injury rates were consistently highest for residents of *Remote Australia*, ranging from 38.3 cases per million residents for the 2006–09 period to 29.3 cases per million residents for the 2008–11 period.

Socioeconomic characteristics

Tables 3.2 to 3.4 provide an overview of marital and employment status, and level of education as at the onset of persisting traumatic SCI for cases sustained in each financial year. The annual reports provide additional information on these 3 socioeconomic characteristics, according to age groups.

With the exception of 2009–10, the majority of SCI cases injured each year reported being *Married (including de facto)* (Table 3.2). *Never married* was the most frequently reported in 2009–10 and the second most common marital status for each of the other reported years.

Table 3.2: Marital status at onset of persisting traumatic SCI, by financial year of injury, Australian residents aged 15 and older discharged alive, 2008–09 to 2012–13

	Number of cases						
Financial year of injury	Never married	Widowed	Divorced	Separated	Married (including de facto)	Not reported	Total
2008–09	99	12	11	7	107	5	241
2009–10	95	6	13	7	94	3	218
2010–11	100	15	12	9	113	6	255
2011–12	68	5	15	8	97	8	201
2012–13	101	7	12	2	98	7	227
5-year total	**463**	**45**	**63**	**33**	**509**	**29**	**1,142**

During the 5-year period 2008–09 to 2012–13, a total of 720 cases (63%) reported being *Employed* at the time of their injury, while 179 cases (16%) reported being a *Pensioner* (Table 3.3). (Note, pensioner status in this context includes Age and Disability Support pension recipients and self-funded retirees.) The proportion of cases *Employed* at the time of injury was relatively stable across the 5 years. The lowest *Employed* proportion was 59% in 2011–12, while the highest was 67% in 2008–09. Overall, 10% of cases reported they were *Not available for employment*, with many of these being due to a study commitment.

Table 3.3: Employment status at onset of persisting traumatic SCI, by financial year of injury, Australian residents aged 15 and older discharged alive, 2008–09 to 2012–13

	Number of cases					
Financial year of injury	Employed	Pensioner	Unemployed	Not available for employment	Not reported	Total
2008–09	162	30	21	21	7	241
2009–10	135	29	21	25	8	218
2010–11	163	45	16	25	6	255
2011–12	119	38	18	18	8	201
2012–13	141	37	12	23	14	227
5-year total	**720**	**179**	**88**	**112**	**43**	**1,142**

Completion of *Highest available secondary school* was the most frequently reported educational level attained at onset of SCI for the 5-year period (172 cases or 15%), closely followed by *Trade qualification/apprenticeship* (166 cases or 15%) (Table 3.4). When analysed by individual year, the most frequently reported educational levels attained were *Trade qualification/apprenticeship* in 2008–09 (15%)*, Highest available secondary school* in 2009–10, 2010–11 and 2011–12 (20%, 18% and 16% respectively), and *Tertiary/ post-graduate* in 2012–13 (15%). Overall, 31 cases reported they were *Still at school*. Educational status was not reported or was missing in approximately one-quarter to one-third of cases for each financial year of injury.

Table 3.4: Educational level attained at onset of persisting traumatic SCI, by financial year of injury, Australian residents aged 15 and older discharged alive, 2008–09 to 2012–13

	Number of cases										
Financial year of injury	Tertiary/ post graduate	Trade qualification/ apprenticeship	Diploma or certificate	Other post-school study	Highest available secondary school level	Left school aged 16 or over	Left school aged 15 or less	Never attended school	Still at school	Not reported or missing data	Total
2008–09	28	35	15	5	28	30	17	0	3	80	241
2009–10	28	40	11	4	44	12	14	0	10	55	218
2010–11	30	40	9	4	46	20	27	0	5	74	255
2011–12	26	20	17	2	33	15	17	2	4	65	201
2012–13	33	31	22	1	21	14	13	0	9	83	227
5-year total	**145**	**166**	**74**	**16**	**172**	**91**	**88**	**2**	**31**	**357**	**1,142**

Clinical characteristics of persisting traumatic SCI

The monitoring of clinical information on SCI enables some injury outcomes to be studied. It also provides an indication of the degree of support that is likely to be 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.

Neurological level of injury at discharge

Roughly one-fifth of persisting traumatic SCI cases reported for each financial year had a neurological level of injury at discharge at C4 (Table 3.5). Cases at this level fall into the high cervical nerve category C1–C4, which is considered the most severe type of SCI. Cases in this category generally require full-time care and support.

The second-highest proportion of injury was C5. Depending on the severity of their injury, cases with an injury at C5 may be able to use adaptive technology for personal grooming and feeding, even driving a car, but generally require assistance with most tasks.

Table 3.5: Proportion of injury at each neurological level for persisting traumatic SCI cases, by financial year of injury, Australian residents aged 15 and older discharged alive, 2008–09 to 2012–13

Neurological level of injury at discharge	Financial year of injury				
	2008–09	2009–10	2010–11	2011–12	2012–13
	%	%	%	%	%
C1	1	2	3	2	1
C2	3	2	3	4	5
C3	4	5	5	6	4
C4	19	17	21	21	20
C5	14	14	14	9	13
C6	4	4	4	7	5
C7	2	4	3	2	5
C8	2	3	1	1	1
T1	2	3	5	3	4
T2	1	1	1	1	1
T3	2	2	2	3	3
T4	5	6	4	5	2
T5	3	3	4	1	1
T6	5	3	1	4	2
T7	2	0	1	2	2
T8	0	0	1	4	0
T9	2	1	2	1	3
T10	4	4	3	4	4
T11	5	4	4	2	4
T12	6	6	5	6	4
L1	6	6	4	4	4
L2	2	4	2	2	5
L3	2	4	3	1	2
L4	0	0	0	0	2
L5	0	0	0	0	0
S1	0	0	0	0	1
S2	0	0	0	0	0
S3	1	0	0	0	0
S4	0	0	0	0	0
S5	0	0	0	0	0
Unknown	2	1	2	0	1
Total[(a)]	**100**	**100**	**100**	**100**	**100**

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

Neurological impairment at discharge

More than one-third of cases of persisting traumatic SCI reported in the 5-year period between 2008–09 and 2012–13 had a discharge assessment of incomplete tetraplegia (422 cases or 37%) (Table 3.6). This was consistently the most frequent category of neurological impairment for each year, ranging from 72 cases in 2009–10 to 95 cases in 2012–13, which amounted to 33% and 42% of the annual cases, respectively. 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, at 233 cases (or 21%) over the 5-year period. Cases with thoracic paraplegia maintain upper body and hand control, and depending on the level of injury, may be able to weight bear for short periods of time.

Table 3.6: Neurological impairment at discharge for persisting traumatic SCI cases, by financial year of injury, Australian residents aged 15 and older discharged alive, 2008–09 to 2012–13

	Number of cases						
	Tetraplegia		Paraplegia				Total with known impairment at discharge
	Cervical		Thoracic		Lumbosacral		
Financial year of injury	Complete	Incomplete	Complete	Incomplete	Complete	Incomplete	
2008–09	35	82	56	31	6	26	236
2009–10	38	72	42	32	5	26	215
2010–11	44	94	49	36	4	24	251
2011–12	27	79	47	31	2	15	201
2012–13	27	95	39	31	6	26	224
5-year total	**171**	**422**	**233**	**161**	**23**	**117**	**1,127**

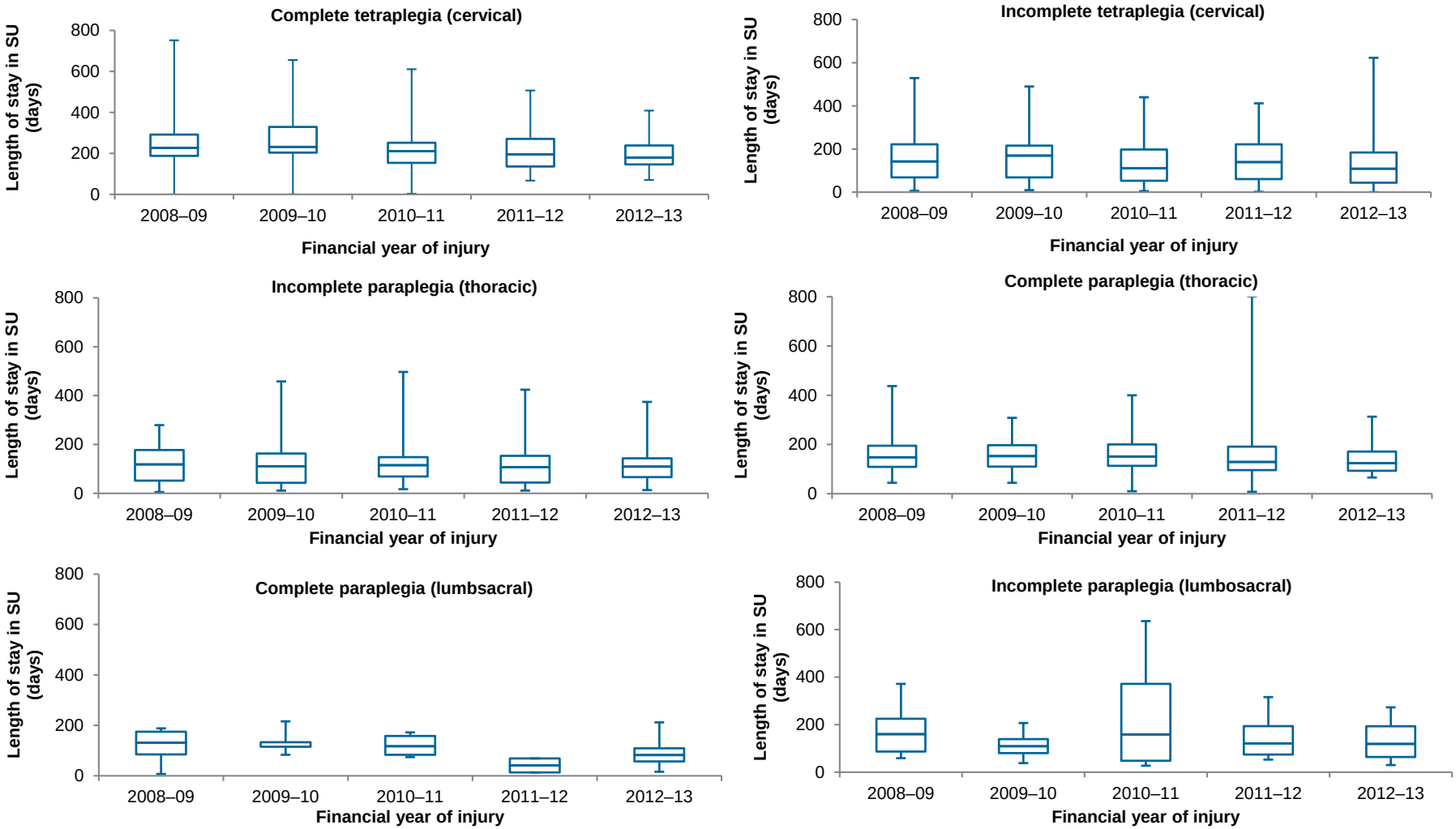
Length of stay in spinal unit

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 unit. Median LOS has been reported because it is not greatly influenced by outliers. 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.

The box-and-whisker plots in Figure 3.6 provides the median, 25th and 75th percentiles and minimum and maximum LOS in an SU, according to the level and extent of the injury (see also Table D.4 in Appendix D, and individual annual reports for 5th and 95th percentiles). The most severe injuries, complete injury at the cervical level or complete tetraplegia, resulted in the longest median lengths of stay in an SU. In 2008–09, the median LOS was 227 days, while in 2012–13, it was 179 days. The length of the whiskers shows the wide range for the number of days spent in an SU.

Cases resulting in incomplete paraplegia at the thoracic level had the most stable median LOS of all the different types and level of impairment, and were generally the shortest. The median LOS for incomplete thoracic paraplegia was 118 days in 2008–09, 111 days in 2009–10, 115 days in 2010–11, 107 days in 2011–12, and 109 days in 2012–13.

The unstable median LOS for complete paraplegia at the lumbosacral level reflects the small number of cases.



Note: The line in each box is at the median LOS. The top and bottom of the box are the 75th and 25th percentiles of LOS and the ends of the whiskers are the longest and shortest LOS.

Figure 3.6: Length of stay in spinal unit (days), by type and level of neurological impairment, Australian residents aged 15 and older discharged alive, 2008–09 to 2012–13

4 External causes of SCI

In addition to recording information on the incidence of traumatic SCI, the ASCIR records information about the event which resulted in injury: the mechanism, the role of human intent, the type of place where the injury occurred, and the type of activity being undertaken at the time of injury. Since its inception, mechanism of injury assignment for the ASCIR has been aligned with the World Health Organization's International Classification of Diseases, and in particular the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification* (ICD-10-AM) (NCCC 2013; NCCH 2010).

This chapter includes all 1,220 traumatic SCI cases reported to the ASCIR for the 5-year period 2008–09 to 2012–13, irrespective of Australian residency and outcome at time of discharge (that is, included whether they were classified as persisting deficit, no deficit or died in an SU).

Mechanism of injury

Land transport crashes contributed to more than 2 in 5 SCI cases during this 5-year period (43%; Table 4.1). Of these 534 cases, 284 cases were *Unprotected land transport users*, including motor and pedal cyclists, and pedestrians, and 250 cases were *Motor vehicle occupants*. With the exception of 2010–11, the proportion of *Unprotected land transport users* injured each year exceeded that of injured *Motor vehicle occupants*.

The lowest mean age recorded for *Motor vehicle occupants* was 35 in 2010–11, while the highest was 42 in 2011–12 (Table 4.2). The mean ages for *Unprotected land transport users* were more stable over the 5-year period, from the lowest, 35 in both 2008–09 and 2009–10, to the highest, 39 in 2011–12.

More detail can be found in the annual reports on the distribution of cases by sex; type of *Motor vehicle occupant* or *Unprotected land transport user* group; age group at injury; and the type of events involved in land transport crashes (for example, vehicle rollover, impact with a motor vehicle or roadside object).

Between 2008–09 and 2012–13, 245 traumatic SCI cases were due to a *High fall*: that is, a fall from a height greater than 1 metre. This amounted to 20% of all cases for the 5-year period. For most years, the proportion of traumatic SCI due to a *High fall* was between 17% and 20%; the exception to this was 29% in 2011–12. Most traumatic SCI cases due to a *High fall* were unintentional, however from 5 to 8 cases annually were reported as *Intentional self-harm*.

A *Low fall* (on the same level, from a drop of less than 1 metre, or from an unspecified height) accounted for 16% of traumatic SCI cases between 2008–09 and 2012–13. The largest number of cases involving a *Low fall* was 45 in 2010–11 (17% of annual traumatic SCI), while the smallest was 32 cases in 2009–10 (14% of annual traumatic SCI).

Annually, the mean age for traumatic SCI cases involving a *Low fall* was at least 10 years older than the mean age for *High fall* cases (Table 4.2). (Readers should refer to the annual reports for more detail on traumatic SCI due to falls.)

In this 5-year period, 92 cases (8%) were admitted to a participating SU due to a *Water-related* SCI. *Water-related* SCI cases were generally due to either diving into shallow water or being dumped by a wave, however most years also included 1 or 2 cases due to falling while water-skiing or knee-boarding, or decompression sickness while scuba diving. Age 29 (in 2008–09) was the youngest mean age recorded for this external cause category,

while the oldest was 39 in 2010–11 (Table 4.2). Seaside beaches and oceans were the most frequently reported type of place where a traumatic SCI *Water-related* event occurred over this 5-year period. More specifically, 12 'surf' cases (53%) were reported in 2008–09, 8 in 2009–10 (38%), 12 in 2010–11 (86%), 10 in 2011–12 (71%) and 13 cases in 2012–13 (65%).

During this 5-year period, 34 traumatic SCI cases (3%) were due to being injured by a *Heavy falling object*. A considerable number of these cases were also work-related cases and included such objects as tree branches, hay bales, machinery and motor vehicles. (See annual reports for more detail.)

Other leading mechanisms of injury mentioned in the annual reports included 25 cases due to a *Horse-related* event, and 20 cases due to an event while playing *Football*. Rugby codes accounted for 13 (65%) of 20 *Football* SCI cases. These 2 mechanisms each accounted for 2% of traumatic SCI cases reported to the ASCIR between 2008–09 and 2012–13.

Males outnumbered females for all major mechanism of injury groupings for each year, with the exception of *Horse-related* SCI, for the first 4 reporting years, 2008–09 to 2011–12 (data not shown here).

The mean ages for traumatic SCI due to *Heavy falling objects*, *Horse-related* or *Football* shown in Table 4.2 should be interpreted cautiously, due to fewer than 10 cases being reported annually for each mechanism of injury.

Between 12 and 24 traumatic SCI cases were reported annually that were due to mechanisms other than those already reported. For reports between 2008–09 and 2010–11, this residual category, *Other and unspecified causes* included cases sustained due to complications of medical care that were reported as 'traumatic' (2 cases in 2008–09 and 4 cases in 2010–11). From 2011–12 onwards, all cases identified as being due to complications of medical care, whether reported as traumatic or non-traumatic, are included in an appendix and not in the body of the reports.

Other types of causes reported in this residual category were assaults with a firearm or knife; other sporting activities such as martial arts, running and wrestling; and other types of transport-related events, including boating and aviation crashes.

Table 4.1: Mechanism of injury for all traumatic SCI cases aged 15 and older, by financial year of injury, 2008–09 to 2012–13

	Financial year of injury											
	2008–09		2009–10		2010–11		2011–12		2012–13		Combined total	
Mechanism of injury	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Land transport crash												
Motor vehicle occupant	59	22	41	18	66	25	33	15	51	21	250	20
Unprotected land transport user	60	23	65	29	49	18	50	23	60	25	284	23
Fall												
Low fall (same level or <1 metre)[(a)]	40	15	32	14	45	17	37	17	42	17	196	16
High fall (>1 metre)	47	18	46	20	49	18	63	29	40	17	245	20
Water-related	23	9	21	9	14	5	14	6	20	8	92	8
Heavy falling object	9	3	6	3	8	3	5	2	6	2	34	3
Horse-related	5	2	2	1	11	4	3	1	4	2	25	2
Football	5	2	3	1	3	1	3	1	6	2	20	2
Other and unspecified causes	15	6	11	5	24	9	12	5	12	5	74	6
Total[(b)]	**263**	**100**	**227**	**100**	**269**	**100**	**220**	**100**	**241**	**100**	**1,220**	**100**

(a) Includes fall from an unspecified height.

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

Table 4.2: Mean age (and standard deviation) at traumatic SCI for cases aged 15 and older, by mechanism of injury, by financial year of injury

	Financial year of injury									
	2008–09		2009–10		2010–11		2011–12		2012–13	
Mechanism of injury	Mean Age	*SD*	Mean Age	*SD*	Mean Age	*SD*	Mean Age	*SD*	Mean Age	*SD*
Land transport crash										
Motor vehicle occupant	38	21	36	19	35	16	42	19	39	19
Unprotected land transport user	35	15	35	15	38	14	39	15	38	16
Fall										
Low fall (same level or <1 metre)[(a)]	54	18	56	15	61	18	65	14	58	19
High fall (>1 metre)	44	20	43	20	43	17	48	21	44	20
Water-related	29	10	34	15	39	19	30	13	31	12
Heavy falling object	42	13	52	11	40	10	47	18	47	18
Horse-related	45	13	57	5	47	14	34	6	56	18
Football	27	10	24	8	20	2	34	18	24	7
Other and unspecified causes	43	17	34	18	46	19	28	14	30	12

(a) Includes fall from an unspecified height.

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*.

One in 3 cases aged 15 and older who sustained a traumatic SCI in the 5-year period 2008–09 to 2012–13, did so *While engaged in sports or leisure* (Table 4.3). Closer adherence to ICD-10-AM coding guidelines for 2011–12 data onwards may account for some of the increase seen between 2008–09 and 2012–13. The types of sports involved in traumatic SCI include rock-climbing, snow-skiing, trampolining, sky-diving and martial arts. The overwhelming majority of cases in this activity category were males, with the largest proportion, 91%, reported in 2009–10, and the smallest, 85%, in 2011–12.

A traumatic SCI sustained *While working for income* was the second most common type of activity specified over this 5-year period, accounting for 156 of the 1,220 cases, or 13% overall. The proportion of work-related traumatic SCI showed a small downward trend over the 5-year period, from 16% in the first year, to 11% in both 2011–12 and 2012–13. *Land transport crashes*, including crashes that occurred on the way to or from work, were common among SCI cases sustained *While working for income*. The annual reports showed a decline in work-related *Land transport* SCI cases, from 51% in 2008–09 to 31% in 2012–13. *High falls* and *Heavy falling objects* were also regularly noted as mechanisms of injury in work-related SCI cases.

Between 12 and 21 cases annually reported being *Engaged in an unpaid work* activity at the time of injury. The proportion of cases varied a little across the 5-year reporting period, with 4% being the lowest proportion for 2010–11, while 10% was the highest in 2011–12. In this activity category, a *High fall* (such as from a roof or ladder) was most common, with *High falls* accounting for 77% of *Unpaid work* cases in 2008–09, and 86%, 67%, 71% and 53% for each of the respective following years. Cases injured *While engaged in other types of work (unpaid*) activities were predominately males, aged 55 or older.

Overall, 6% of SCI cases reported to the ASCIR between 2008–09 and 2012–13 were sustained *While undertaking a personal activity,* including cases being nursed or cared for. Until the change in the operational definition of ‘traumatic SCI’ in 2011–12, this latter activity usually included a small number of cases that occurred while in hospital due to complications of medical care. These complication of medical care cases are not included from 2011–12. *Low falls* were common in this activity group, and the circumstances described for these cases included falling while in or on the way to the bathroom, getting out of bed, while in the kitchen, and tripping on carpet or low furniture.

The residual category, *Other or unspecified activity* primarily includes cases caused by land transport crashes: 64% in 2008–09; 71% in 2009–10; 68% in 2010–11; 57% in 2011–12; and 73% in 2012–13. *Falls* were the next most common cause of SCI in this activity group, and include cases of *Intentional self-harm* due to *High falls*. Less than 10% (113 cases in total) of traumatic SCI cases sustained during the 5-year period 2008–09 to 2012–13, had no specified activity recorded at the time of injury. The proportion of *Unspecified activity* cases decreased from 13% (35 cases) in 2008–09 to 5% (13 cases) in 2012–13, and is again influenced by closer adherence to ICD-10-AM coding guidelines from the 2011–12 series.

Table 4.3: Type of activity engaged in when traumatic SCI occurred, by financial year of injury

	Financial year of injury											
	2008–09		2009–10		2010–11		2011–12		2012–13		5-year total	
Type of activity	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Sports and leisure	64	24	65	29	96	36	79	36	95	39	399	33
Working for income[(a)]	41	16	29	13	36	13	24	11	26	11	156	13
Other type of work	17	6	14	6	12	4	21	10	15	6	79	6
Personal activity[(b)]	18	7	15	7	17	6	12	5	15	6	77	6
Other and unspecified activity	123	47	104	46	108	40	84	38	90	37	509	42
Total[(c)]	**263**	**100**	**227**	**100**	**269**	**100**	**220**	**100**	**241**	**100**	**1,220**	**100**

(a) Includes travel to and from work.

(b) Includes being nursed or cared for.

(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 AIHW's 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 SU 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 summary report is 2008–09 to 2012–13.

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

The date of closure for 2008–09, 2009–10 and 2010–11 data was 30 June 2014.

The date of closure for 2011–12 and 2012–13 data was 31 December 2014.

Data for 2013–14 is planned for release in 2018.

Accessibility

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

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 occurred in Australia and overseas to Australian residents (who received treatment in an Australian SU) since 1995, and up to 2012–13. Cases for 2013–14 onwards are currently being registered.

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

The ASCIR keeps a record of patient demographic information; assessment of level of SU 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. Also, the current system does not capture detailed information on the period from injury to admission to an SU, and does not obtain follow-up data after discharge from an SU.

Accuracy

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

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

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

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

Coherence

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

The data reported for 2008–09 to 2012–13 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). 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 in 2011–12 and later years, cases of SCI due to complications of medical care have been reported with non-traumatic cases in Appendix B: Other SCI. 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 medical 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 complication 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 SCI 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 new incidence cases, but for 2011–12, it contributed only 13%.

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

Population denominators

Population data were obtained from the Australian Bureau of Statistics. 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 2012).

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

Appendix B: Changes in the *Spinal cord injury, Australia* series

A new structural framework was adopted for *Spinal cord injury, Australia 2008–09* and later reports. How this structure compares to 2007–08 and earlier reports is summarised in Table B.1.

Table B.1: Comparison *Spinal cord injury, Australia* chapters/structural framework

2007–08 and earlier series	2008–09 to 2010–11	2011–12 and onwards series
Chapter 1 Introduction	Chapter 1 Introduction	Chapter 1 Introduction
Chapter 2 Overview of SCI case registrations in YYYY–YY	Chapter 2 Traumatic SCI case registrations in YYYY–YY	Chapter 2 Traumatic SCI case registrations in YYYY–YY
Chapter 3 Incidence of persisting SCI in YYYY–YY	Chapter 3 Persisting traumatic SCI	Chapter 3 Persisting traumatic SCI
Chapter 4 Clinical characteristics of persisting SCI cases	Chapter 4 External causes of SCI in YYYY–YY	Chapter 4 External causes of SCI in YYYY–YY
Chapter 5 Factors associated with the SCI event		
Chapter 6 Glossary		
Appendix	Appendix A: Data issues	Appendix A: Data issues
	Appendix B: Non-traumatic SCI	Appendix B: Other SCI cases
	Appendix C: Additional tables	Appendix C: Median duration of initial care for persisting traumatic SCI
	Glossary	Appendix D: Additional tables
		Glossary

Note: Shaded boxes indicate new or substantially modified topic areas.

In reports from 2008–09 onwards:

- Chapter 2 focuses on new cases of traumatic SCI. Data on non-traumatic SCI cases are reported in Appendix B.
- Chapter 3 provides an analysis of newly incident cases of persisting traumatic SCI for Australian residents aged 15 and older who were discharged alive, including trends since 1995–96 and demographic, social and clinical characteristics of cases with onset in the specified financial year. Duration of initial care (DIC) has been omitted from the section on clinical characteristics and replaced with length of stay in SU.
- Chapter 4 is broadly consistent with Chapter 5 in earlier reports, with some changes to the mechanism of injury groupings, as detailed in the next section.
- Appendix A: Data issues provides a data quality statement relevant to interpreting data from the Australian Spinal Cord Injury Register, as well as estimates used to calculate population rates and analysis methods.

Appendix B was introduced to allow reporting on non-traumatic cases reported to the ASCIR in a way that did not detract from the main focus of the reports, which was traumatic cases. The scope of the appendix was widened, beginning with the report for 2011–12. It now includes complications of medical care cases that were often reported with traumatic SCI cases up until 2011–12 (see next section titled ‘Other SCI cases’). This appendix can also be

used to report on all other SCI cases reported to the ASCIR that do not meet the inclusion criteria for the body of the annual report (for example, cases aged under 15).

- An appendix containing tables of the data underpinning figures contained in the report was included. These tables are contained within Appendix C for the 2008–09 to 2010–11 reports, and in Appendix D for the 2011–12 and 2012–13 reports.
- An additional appendix was included in the 2011–12 issue to present data on median DIC for traumatic SCI cases sustained, commencing with 1995–96. (See Box 1.3 and Appendix C).

Mechanism of injury groupings

Effective from the report for 2008–09, the mechanism of injury groupings reported in 'Chapter 4 External causes of SCI' have been revised. The most noteworthy omission is the traffic/non-traffic distinction for *Land transport crashes*, which was reported between 2004–05 and 2007–08. A careful review of the ASCIR data showed that this distinction was not made clearly enough, in a considerable proportion of records, to allow reliable reporting.

Additionally, cases previously grouped as *Stuck by or collision with a person or object* often included 2 main groups of interest. In some, the person was crushed by a heavy falling object, while in others, the person was participating in rugby or football. Requests regarding these types of SCI cases are quite common, and case numbers are generally sufficient to allow reporting. Hence, it was decided to include 2 new mechanism of injury groupings, *Football* and *Heavy falling object*

Horse-related SCI cases have been reported under various mechanism of injury categories over the life of the series, including *Falls* and *Sports-related* causes. Commencing with the 2008–09 data series, *Horse–related* SCI is independently reported (for the same reasons as for the inclusions already discussed).

Table B.2 below provides a guide to comparing mechanism of injury groupings for 2007–08 and earlier reports with 2008–09 onwards reports.

Table B.2: Mapping revised mechanism of injury groupings for *Spinal cord injury, Australia* series

2007–08 and earlier reports	2008–09 onwards reports
Traffic—Land transport: Motor vehicle occupant	Land transport crash: Motor vehicle occupant
Non-traffic—Land transport: Motor vehicle occupant	Omitted
Traffic—Land transport: Unprotected road user (motor cyclists, pedal cyclists, pedestrians)	Land transport crash: Unprotected land transport user (motor cyclists, pedal cyclists, pedestrians, etc.)
Non-traffic—Land transport: Unprotected road user	Omitted
Low falls (same level or <1 metre) (includes unspecified height)	Low fall (same level or <1 metre) (includes unspecified height)
High falls (>1 metre) (includes falls from a horse)	High fall (>1 metre)
Struck by or collision with a person or object	See 'Heavy falling object' and 'Other and unspecified causes'
Water-related	Water-related
Other	Heavy falling object
Various	Horse-related
Various	Football
Other	Other and unspecified causes

Other SCI cases

The scope of the ASCIR and the annual *Spinal cord injury, Australia* series is 'traumatic' cases of SCI.

On review of ASCIR cases in 2014 and 2015, it became apparent that some inconsistency has occurred in the categorisation of cases as traumatic, particularly in relation to cases that arose in the context of clinical care (for example, during a surgical procedure). Cases due to complications of medical care were often reported to the ASCIR as non-traumatic (in which case they were not included in the body of annual reports), but were sometimes reported as traumatic (in which case they were included). To reduce this inconsistency, cases with an injury date of 1 July 2011 or later are coded using the ICD-10-AM coding guidelines, whereby any case which could conceivably be coded in the range S00–T98 (*Chapter XIX Injury, poisoning and certain other consequences of external causes*) (NCCC 2013) is now recorded as traumatic SCI in the ASCIR database. According to our interpretation of the ICD-10-AM, these cases would be coded in the range T80–T88 *Complications of surgical and medical care, not elsewhere classified*. Examples of these complication of medical care SCI include cases arising in the course of surgery or as a result of other medical care such as repairs for abdominal aortic aneurysm; laminectomy or spinal decompression for pain reduction; removal of tumours; epidural haemorrhage due to anaesthesia; or long-term anti-coagulant use; and where the record states the onset of paralysis was post-intervention.

Prior to the 2011–12 report, these complication of medical care cases were reported in the *Other and unspecified causes* section of the 'External cause' chapter. In keeping with other AIHW community injury publications, including the *Hospital separations due to injury and poisoning* series, these cases are now excluded from the body of the annual SCI report, and are being reported alongside non-traumatic SCI cases in an appendix to the annual reports.

Appendix B: Other SCI cases is not included in this summary report. Table B.3 below presents a summary count of the 3 types of spinal cord injuries for each financial year of injury applying this new distinction for complication of medical care SCI cases. This reduces the total number of traumatic SCI due to external causes by 6 cases to 1,214, rather than 1,220, if a comparison is made to numbers in the body of this summary. Readers are advised that the figures should not be interpreted as indicating an increase in the number or proportion of SCI due to complications of medical care in the last 2 reported years.

Table B.3: Summary of all causes of SCI aged 15 and older for 2008–09 to 2012–13, applying new distinction for complication of medical care SCI cases

Financial year of injury	Traumatic SCI due to external causes		Non-traumatic SCI[a]		Traumatic SCI due to complication of medical care		Total[b]	
	Number	%	Number	%	Number	%	Number	%
2008–09	261	75	86	25	2	1	349	100
2009–10	227	72	87	28	0	0	314	100
2010–11	265	68	118	30	4	1	387	100
2011–12	220	70	76	24	18	6	314	100
2012–13	241	68	91	26	20	6	352	100
All registrations	**1,214**	**71**	**458**	**27**	**44**	**3**	**1,716**	**100**

(a) Non-traumatic SCI is assessed as financial year of admission.

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

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 in 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 an 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 an 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		Proportion included[(a)]
Financial year of injury	Complete	Incomplete	Complete	Incomplete	Complete	Incomplete	
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%*

(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 2013, 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 rates of persisting traumatic SCI cases, by financial year of injury, Australian residents aged 15 and older discharged alive, 1995–96 to 2012–13

Financial year of injury	Age-standardised rate per million population	Poisson modelled rate per million population	Upper 95% *CI*	Lower 95% *CI*
1995–96	16.1	18.3	19.4	17.3
1996–97	16.5	17.9	18.9	17.0
1997–98	18.8	17.5	18.4	16.7
1998–99	17.7	17.2	17.9	16.4
1999–00	17.9	16.8	17.4	16.2
2000–01	17.1	16.4	17.0	15.9
2001–02	15.4	16.1	16.6	15.6
2002–03	15.2	15.7	16.2	15.2
2003–04	15.3	15.4	15.8	14.9
2004–05	15.6	15.0	15.5	14.6
2005–06	15.8	14.7	15.2	14.3
2006–07	15.4	14.4	14.9	13.9
2007–08	15.0	14.1	14.6	13.6
2008–09	13.9	13.8	14.3	13.2
2009–10	12.4	13.5	14.1	12.9
2010–11	14.3	13.2	13.8	12.6
2011–12	10.9	12.9	13.6	12.2
2012–13	12.2	12.6	13.4	11.9

Table D.2: Persisting traumatic SCI cases, by sex, by financial year of injury, Australian residents aged 15 and older discharged alive, 2008–09 to 2012–13

	Number of cases		
Financial year of injury	Males	Females	All cases
2008–09	179	48	227
2009–10	161	40	201
2010–11	204	51	255
2011–12	179	39	218
2012–13	194	47	241
5-year total	**917**	**225**	**1,142**

Table D.3: Age-specific rates of persisting traumatic SCI cases, by sex, by financial year of injury, Australian residents aged 15 and older discharged alive, 2008–09 to 2012–13

	Financial year of injury				
	2008–09	2009–10	2010–11	2011–12	2012–13
Age group (years)	Rate per million population				
All cases					
15–24	19.6	21.3	17.6	14.3	18.7
25–34	18.0	12.9	14.2	9.3	13.8
35–44	11.0	8.0	14.3	11.0	10.9
45–54	11.8	11.0	13.9	9.2	7.8
55–64	10.8	10.1	12.2	7.4	12.6
65–74	13.2	15.8	17.0	18.5	9.3
75+	9.8	3.7	7.2	9.1	9.6
Males					
15–24	34.9	33.8	31.8	24.1	30.3
25–34	27.7	20.5	23.2	14.7	21.4
35–44	16.9	14.2	23.7	17.8	17.6
45–54	18.4	18.8	20.7	13.9	11.2
55–64	18.3	17.0	19.8	13.3	21.6
65–74	17.5	25.7	24.6	28.1	13.3
75+	18.1	5.3	6.9	15.1	16.2
Females					
15–24	3.4	8.1	2.7	4.0	6.6
25–34	8.0	5.2	5.1	3.7	6.0
35–44	5.1	1.9	5.0	4.4	4.3
45–54	5.4	3.3	7.2	4.6	4.5
55–64	3.3	3.2	4.7	1.5	3.8
65–74	9.1	6.2	9.6	9.1	5.4
75+	3.8	2.5	7.4	4.8	4.8

Table D.4: Length of stay in spinal unit (days), by type and level of neurological impairment, by financial year of injury, Australian residents aged 15 and older discharged alive, 2008–09 to 2012–13

	Financial year of injury				
	2008–09	**2009–10**	**2010–11**	**2011–12**	**2012–13**
Complete tetraplegia (cervical)					
Minimum	0	0	3	67	70
25th percentile	188	204	154	136	146
Median	227	232	211	195	179
75th percentile	292	329	252	271	239
Maximum	752	656	611	507	409
Number of cases	35	38	43	27	27
Incomplete tetraplegia (cervical)					
Minimum	6	10	5	2	0
25th percentile	69	69	53	61	44
Median	143	170	111	140	109
75th percentile	222	216	198	222	184
Maximum	529	490	440	412	623
Number of cases	82	72	94	79	95
Complete paraplegia (thoracic)					
Minimum	44	44	10	8	66
25th percentile	109	110	113	96	93
Median	148	153	151	129	124
75th percentile	195	197	200	191	171
Maximum	437	308	400	802	313
Number of cases	56	42	49	47	39
Incomplete paraplegia (thoracic)					
Minimum	5	11	17	11	13
25th percentile	52	43	69	44	66
Median	118	111	115	107	109
75th percentile	177	163	148	153	143
Maximum	279	458	497	424	374
Number of cases	31	32	36	31	31
Complete paraplegia (lumbosacral)					
Minimum	7	83	74	13	16
25th percentile	85	115	83	13	57
Median	131	115	117	41	82
75th percentile	175	133	158	69	109
Maximum	188	216	172	69	212
Number of cases	6	5	4	2	6

(continued)

Table D.4 (continued): Length of stay in spinal unit (days), by type and level of neurological impairment, by financial year of injury, Australian residents aged 15 and older discharged alive, 2008–09 to 2012–13

	Financial year of injury				
	2008–09	2009–10	2010–11	2011–12	2012–13
Incomplete paraplegia (lumbosacral)					
Minimum	59	38	27	53	30
25th percentile	87	80	48	74	64
Median	160	109	159	121	119
75th percentile	225	139	372	194	193
Maximum	372	207	636	316	273
Number of cases	26	26	24	15	26

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

The annual *Spinal cord injury, Australia* series can be downloaded without cost from the AIHW website <http://www.aihw.gov.au/publications/>.

The 5 reports covered by this summary are:

AIHW (Australian Institute of Health and Welfare): Tovell A & Harrison JE 2018. Spinal cord injury, Australia, 2008–09. Injury research and statistics series no.78. Cat. no. INJCAT 154. Canberra: AIHW.

AIHW: Tovell A & Harrison JE 2018. Spinal cord injury, Australia, 2009–10. Injury research and statistics series no.79. Cat. no. INJCAT 155. Canberra: AIHW.

AIHW: Tovell A & Harrison JE 2018. Spinal cord injury, Australia, 2010–11. Injury research and statistics series no. 80. Cat. no. INJCAT 156. Canberra: AIHW.

AIHW: Tovell A 2018. Spinal cord injury, Australia, 2011–12. Injury research and statistics series no. 98. Cat. no. INJCAT 174. Canberra: AIHW.

AIHW: Tovell A 2018. Spinal cord injury, Australia, 2012–13. Injury research and statistics series no. 99. Cat. no. INJCAT 175. Canberra: AIHW.

Between 2008–09 and 2012–13, just over 1,200 people aged 15 and older sustained a traumatic spinal cord injury (SCI) in Australia, and were admitted to a specialist spinal unit. Roughly 80% of cases were males. Land transport crashes, including motor vehicles and motor cycles, contributed to more than two-fifths (43%) of traumatic SCI cases during this 5-year period. Falls (36%) were the second most frequent cause.

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