INJURY RESEARCH & STATISTICS

AIHW

Spinal cord injury, Australia, 1999–00

Peter O'Connor

Spinal cord injury, Australia 1999–00

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Injury Research and Statistics Series
Number 10

Spinal cord injury, Australia 1999–00

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December 2001

Australian Institute of Health and Welfare
Canberra

AIHW cat. no. INJCAT 40

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

ISSN 1444-3791

ISBN 1 74024 172 X

Suggested citation

O'Connor, P. 2001. Spinal cord injury, Australia 1999–00. Injury Research and Statistics Series. Adelaide: AIHW (AIHW cat no. INJCAT 40).

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Published by Australian Institute of Health and Welfare

Printed by Snap Printing

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Acknowledgments

The ASCIR is a cooperative arrangement of the six Australian spinal units and the National Injury Surveillance Unit of the Flinders University Research Centre for Injury Studies (RCIS), funded by the Australian Institute of Health and Welfare.

The assistance of the Directors and staff of the spinal units is gratefully acknowledged.

Introduction

The prevention and control of injury is one of four National Health Priority Areas (AIHW & DHFS, 1997a; AIHW & DHFS, 1997b). One of the performance indicators for this priority area is the annual incidence rate of spinal cord injury (SCI) from traumatic causes. The Australian Spinal Cord Injury Register (ASCIR), established in 1995, enables the patterns and trends in SCI to be monitored. Australia was the first country to implement a national registry of SCI (O'Connor, 1999a).

In order to facilitate national and international comparisons, the case definition that has been adopted for the registration of traumatic cases of SCI in Australia is the US Centers for Disease Control (CDC) clinical definition:

> … a case of spinal cord injury is defined as the occurrence of 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., 1995a)

This report presents statistical information on new cases of spinal cord injury (SCI) from traumatic causes that occurred during the financial year 1999–00 in Australia to Australian residents.

This is the fifth statistical report based on data from the ASCIR, reported on the basis of financial year. The previous reports, based on annual data from 1995–96 to 1998–99, were published in the Australian Injury Prevention Bulletin (O'Connor & Cripps, 1997; Cripps & O'Connor, 1998; O'Connor & Cripps, 1998, O'Connor, 2000a). Terms used in the report are defined in the Glossary.

The ASCIR is now in its sixth year of operation and has over 9,000 cases registered.

Overview of spinal cord injury from traumatic causes

There are six specialist spinal cord treatment / management units (SUs) located in five Australian States. The SUs reported 261 new cases of SCI from traumatic causes in 1999–00, excluding cases that had suffered no neurological loss at admission and / or discharge. The SU Directors confirmed complete enumeration of their cases. The ASCIR is known to provide complete coverage of the adult cases of SCI in Australia that result in persisting neurological loss. It also provides coverage of approximately half of the paediatric cases of SCI, estimated to total about six cases annually at present.

Trends in SCI

The age-adjusted incidence rate of SCI in 1999–00 was estimated to be 14.0 new cases per million population, a small decrease from 1998–99 (14.5 new cases per million population). The 1991 Australian population was used as the standard population for the calculation of age adjusted rates. Figure 1 shows the age-adjusted rate of SCI for 1999–00 compared with the rates for earlier years.

State or Territory of usual residence

Figure 2 shows the age adjusted incidence rate of SCI from traumatic causes by State and Territory of usual residence.

- It was evident from a comparison of the incidence rates and their 95% confidence intervals (Poisson distribution) that South Australia had a significantly higher than the national rate and those for New South Wales, Victoria, Queensland and Tasmania.
- Victoria has had the lowest rate of SCI over the period 1995–96 to 1999–00 (although not significantly different from the national rate in any individual year).

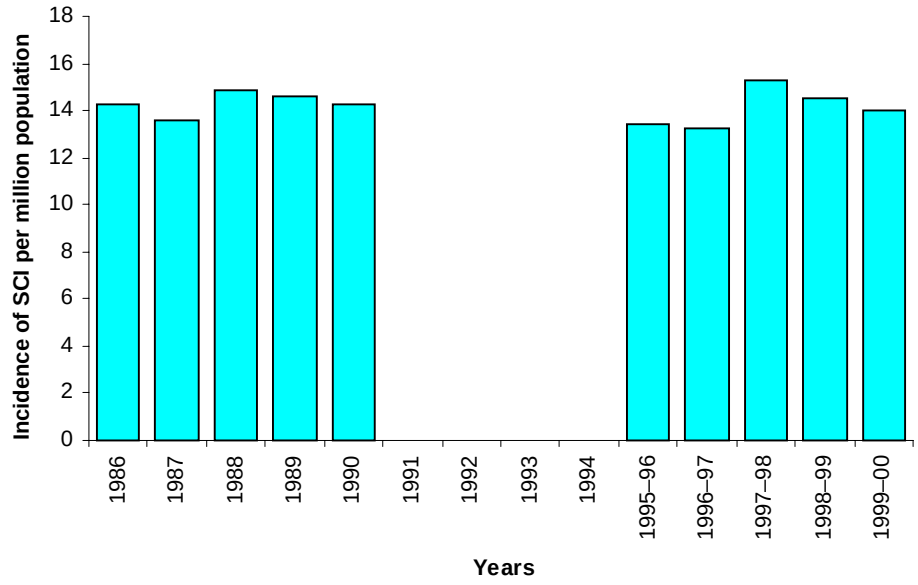
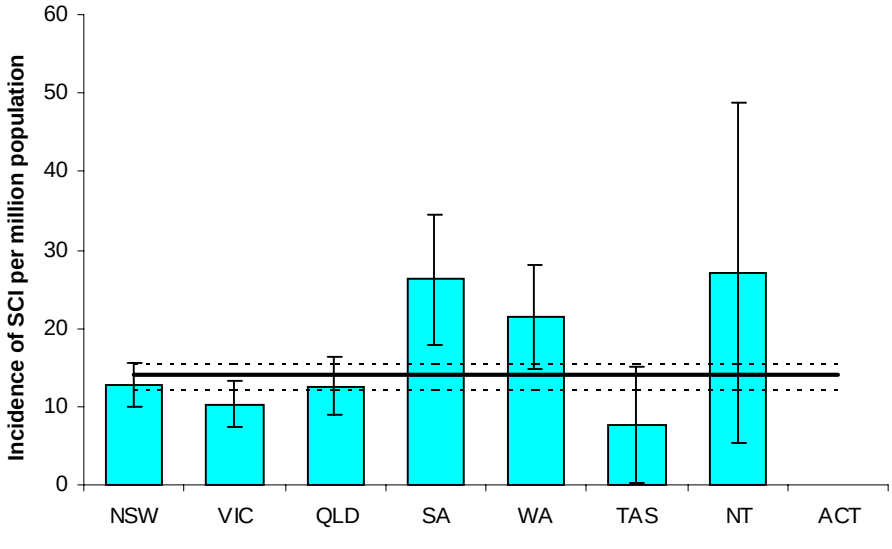


Figure 1: Incidence of SCI from traumatic causes by year, Australia 1999–00 (age-adjusted rates)



Note: Error bars indicate 95% confidence intervals for rates. Rate not shown for ACT due to low case count.

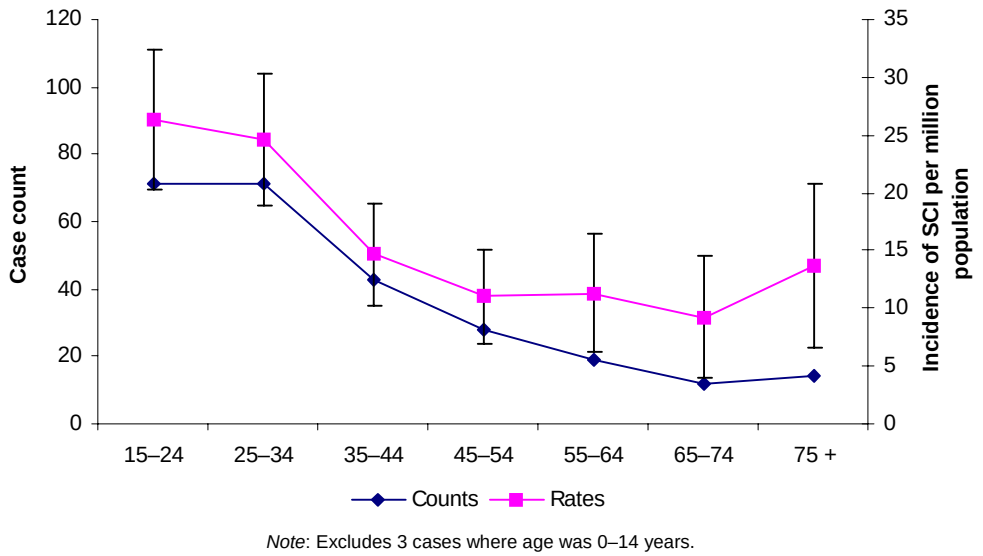
Figure 2: Incidence of SCI from traumatic causes by State/Territory of usual residence, Australia 1999–00 (age-adjusted rates)

Age and sex distribution

The age distribution of SCI from traumatic causes is presented in Figure 3. The age group of 0 to 14 years was excluded from the figure because of a suspected poor coverage of this group by SUs.

From Figure 3, it was evident that:

- The highest age specific rate, occurred in the age group 15–24 years. With increasing age, the age specific rate declined substantially to the age group 45–54 years.
- The wide 95% confidence intervals on the rates (Poisson distribution) reflect the small case count for individual age groups. When age groups 15–24 years and 25–34 years were combined it was evident that the rate for this group (25.4 new cases per million of population) was significantly higher than the rate for the older combined age group of 35 years and above (12.3 new cases per million of population).



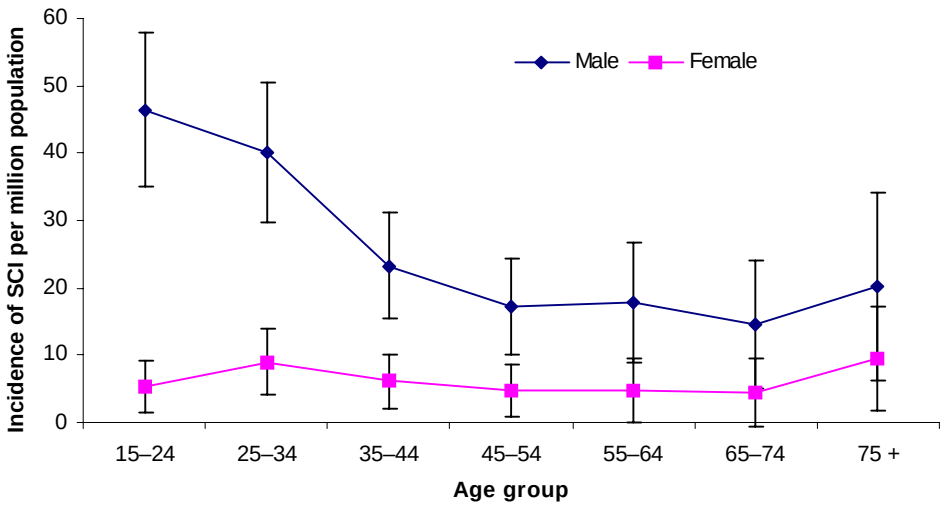
Note: Excludes 3 cases where age was 0–14 years.

Figure 3: Incidence of SCI from traumatic causes by age group, Australia 1999–00 (counts and age-specific rates)

Of the cases of SCI from traumatic causes aged 15 years and above, 81% were male and 19% were female. The incidence of SCI by age group and sex, presented in Figure 4, shows the following:

- A higher rate of SCI for males at all ages (statistically significant under the age of 55 years).

- A substantial sex difference in a number of the age groups. The male to female rate ratios ranged from a low of 1.3:1 (in the age group 75 plus) to a high of 9.1:1 (in the age group 15–24 years).



Note: Excludes 3 cases where age was 0–14 years.

Figure 4: Incidence of SCI from traumatic causes by age group and sex, Australia 1999–00 (age-specific rates)

Factors associated with the SCI event

In addition to collecting information on the demographic features of cases of SCI, the ASCIR also collects information about factors associated with the injury event such as external cause of injury, role of human intent, type of place of injury, and type of activity at the time of injury. These factors, which were coded in ASCIR according to the National Injury Surveillance Unit (NISU) National Data Standards for Injury Surveillance (NDS-IS), provide useful information for understanding the causes and prevention of SCI (NISU, 1995).

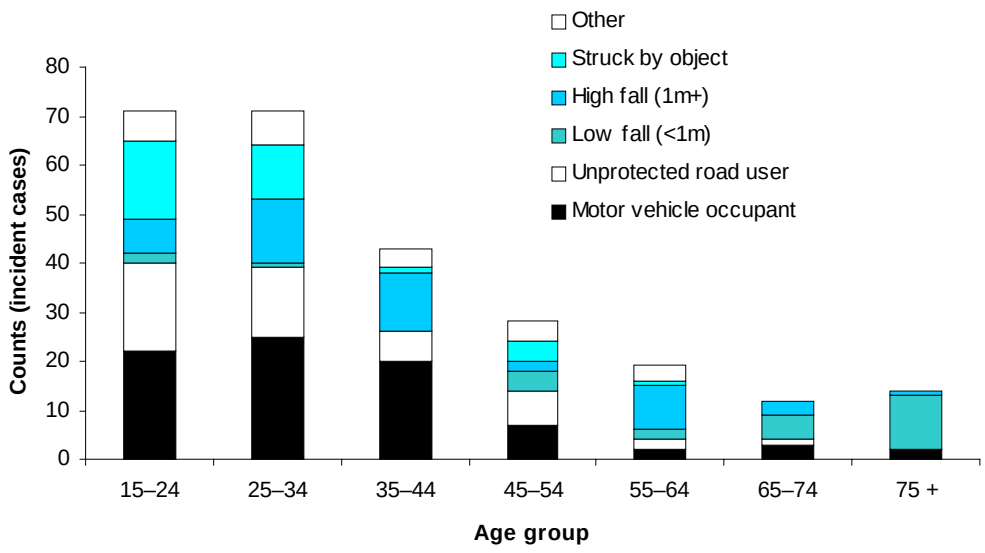
Intent

Most of the cases of SCI arose from accidental causes (n=237). Six cases arose from suicide attempts and six were due to assaults. Twelve cases arose from other and unspecified causes.

External cause of injury

The external cause of injury for cases of SCI from traumatic causes is presented in Figure 5. It was evident that:

- Transport related injury accounted for 50% of the cases of SCI (n=131). Thirty-one per cent were motor vehicle occupants (n=82) and 19% were unprotected road users (n=49). Eighty per cent (n=105) of the cases of transport related SCI were aged 15–44 years.
- Eighteen per cent (n=47) were from high falls (drop of 1 metre or more) and 10% (n=25) were from low falls. Forty-four per cent (n=11) of the low falls cases were aged 75 years or older.



Note: Excludes 3 cases where age was 0–14 years.

Figure 5: Incidence of SCI from traumatic causes by external cause of injury (major groupings) and age group, Australia 1999–00 (counts)

Motor vehicle occupants

Further assessment of the cases that were occupants of motor vehicles (n=82), using the text description of the injury event provided on the ASCIR registration form, revealed that:

- 37 % were due to vehicle rollover;
- 16% were due to collision with a roadside hazard (i.e. tree, pole or other fixed object);
- 7% were due to ejection from the motor vehicle;
- and 40% were due to other collisions (Figure 6).

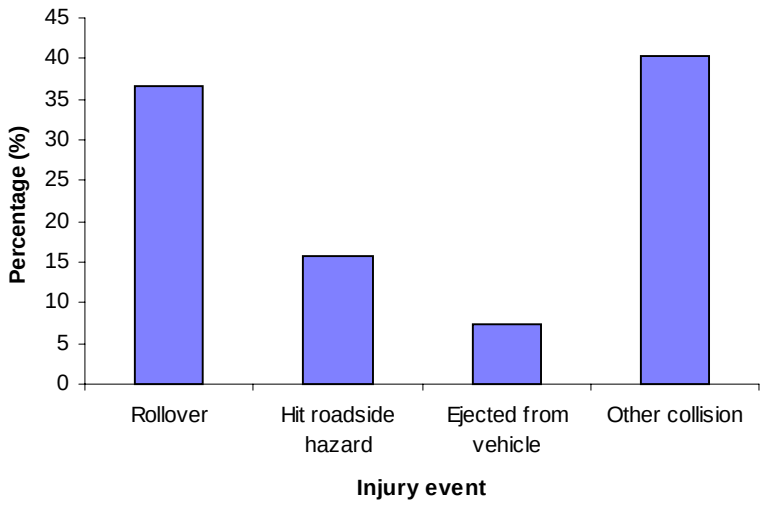


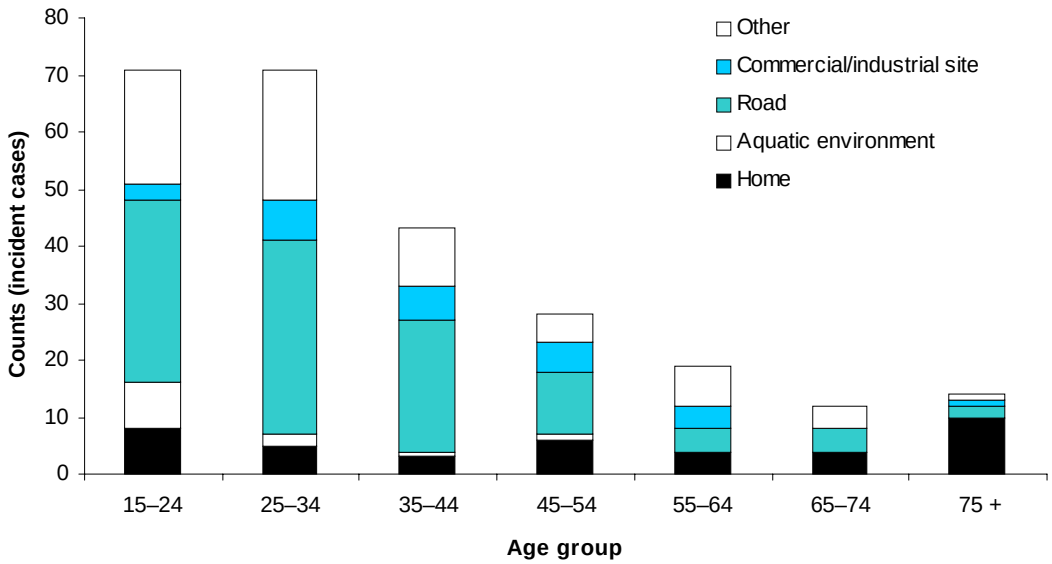
Figure 6: Description of the injury event for cases suffering their SCI as occupants of vehicles, Australia 1999–00 (percentages)

Falls in the elderly

The leading cause of injury death and hospitalisation in the elderly (i.e. those aged 65 years or older) is falls (Harrison & Dolinis, 1995; Fildes, 1994). Falls are also an important cause of SCI in the elderly. In 1999–00, 28% of all falls related SCIs, and 64% of low falls SCIs, occurred in elderly persons (i.e. those aged 65 years or older).

Place of injury

The road environment was the primary place of SCI for those aged 15–44 years (Figure 7). Commercial and industrial sites, which define the main places of work-related SCI, were a common place of SCI amongst those aged 25–64 years.



Note: Excludes 3 cases where age was 10–14 years.

Figure 7: Incidence of SCI from traumatic causes by place of injury (major groupings) and age group, Australia 1999–00 (counts)

Further assessment of the cases that suffered their SCI in an aquatic environment (n=13), using the text description of the injury event provided on the ASCIR registration form, revealed that:

- three were surfing or swimming and were dumped by waves;
- two were diving into swimming pools;
- four were diving, or fell, into a river or lake;
- two were entering the surf, dived into the water and hit their head on the sand / sand-bar; and
- two cases had another specified event (Figure 8).

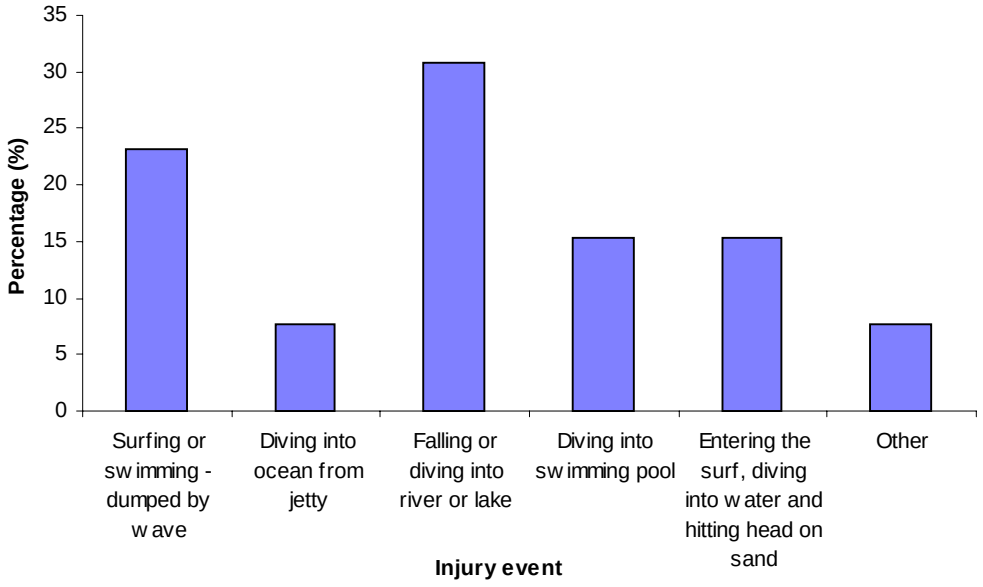


Figure 8: Description of the injury event for cases suffering their SCI in aquatic environments, Australia 1999–00 (percentages)

Type of activity when injured

Most of the cases were undertaking some form of non-sporting leisure activity (n=100, 38%) or domestic activity (n=19, 7%) when they suffered their SCI. Twenty-five of the cases (10%) were engaged in a sporting activity. Forty-four cases (17%) were working for income. The remaining cases were engaged in 'other and unspecified' activities (n=73, 28%).

Further assessment of the cases that suffered their SCI while working for income (n=44), using the text description of the injury event provided on the ASCIR registration form, revealed that:

- 39% were driving a motor vehicle;
- 7% were felling trees, and either fell from a tree or were crushed by falling branches or the tree itself;
- 11% fell from a roof, ladder or scaffolding;
- 20% fell whilst engaged in some other work activity;
- 5% were unloading and were crushed by a falling load;
- and the remaining 18% were engaged in some other type of work activity (Figure 9).

At admission, only 24 of the 44 people injured at work (i.e. 55%) were reported to be eligible for some form of compensation payment through an insurance scheme. The uncompensated costs of work-related SCI to the

Australian community has been estimated to be more than $10 million per year (O'Connor, 2000b).

Qualitative research with Barristers, Lawyers and Medical Practitioners involved in SCI legal cases (O'Connor, 2000c) has identified a number of reasons why a person suffering a work-related SCI may not receive workers compensation in Australia: they are self employed and have not taken out personal insurance cover, even though they are required to take out cover for all employees; the workers compensation scheme in some States does not cover the journey to work; where a worker is not covered by workers compensation, they may also not be covered by compulsory third party motor vehicle insurance where fault can be proven (e.g. where the driver was affected by alcohol, was not wearing a seat belt or was involved in a single vehicle crash).

Those who have no insurance cover obviously face a more challenging future financially. In addition, it has been shown on numerous measures of well-being, that SCI patients who are not eligible for compensation payments have worse outcomes (Tate et al., 1994; DeVivo et al., 1989). Evidence from other Australian studies suggests that between 60% and 70% do not return to paid employment after their SCI (Athanasou et al., 1996; Murphy et al., 1997).

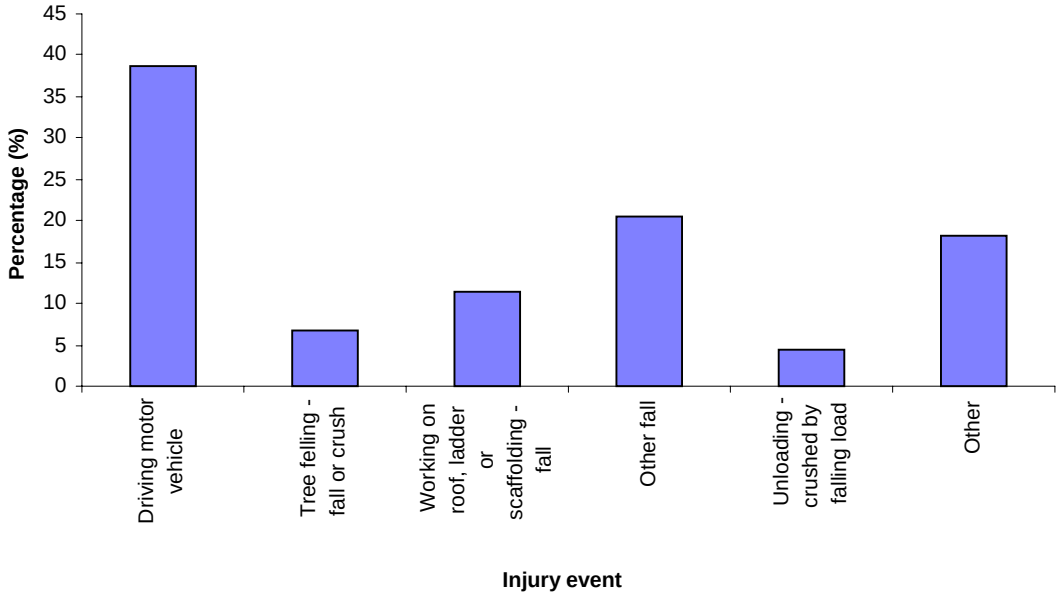


Figure 9: Description of the injury event for cases suffering their SCI while working for income, Australia 1999–00 (percentages)

Clinical information

Information on the neurological level of SCI and extent of injury to the cord is routinely reported by SUs.

Neurological level of injury

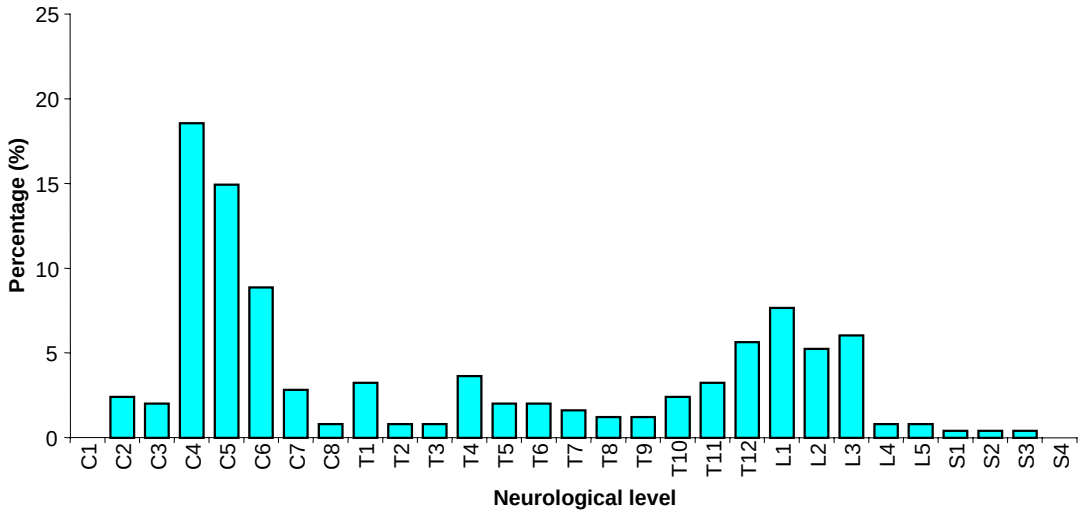
The neurological level of SCI at admission is presented in Figure 10. The most commonly injured spinal cord segments, amongst the 248 cases with a defined neurological level of injury, were: the cervical segments, particularly C4 (19%, n=46), C5 (15%, n=37), and C6 (9%, n=22); the lumbar segments L1–L3 (19%, n=47); and the lower thoracic segment T12 (6%, n=14).

Neurologic category

The overall severity of SCI, for cases with a neurological deficit, is usually measured by a combination of the neurological level and extent of injury into four neurologic categories (complete tetraplegia, incomplete tetraplegia, complete paraplegia, and incomplete paraplegia). Table 1 presents the counts and column percentages for the four neurological categories of SCI, as well as a finer breakdown of the paraplegia category.

- Of the cases with a specified neurologic category (n=249), 51% had an injury to the cord at the cervical level, resulting in impairment or loss of motor and / or sensory function in the arms as well as in the trunk, legs, and pelvic organs (n=126). This degree of impairment is referred to as tetraplegia.
- Forty-nine per cent of the cases with a specified neurologic category had an injury at the thoracic, lumbar, or sacral (but not cervical) levels, with an impairment or loss of motor and / or sensory function in these segments of the spinal cord (n=123). This degree of impairment is referred to as paraplegia. With paraplegia, upper limb function is spared, but depending on the level of injury, the trunk, pelvic organs, and lower limbs may be functionally impaired.
- The most common neurologic category was incomplete tetraplegia (33% of the cases with a specified neurologic category, n=82), followed by incomplete paraplegia (25% of total, n=63), complete paraplegia (23% of total, n=57), and complete tetraplegia (17% of total, n=43).

- Complete injury was most common in the thoracic spinal segments, a finding which is explainable by the smallness of the spinal canal in this region in relation to the size of the cord (Bauer & Errico, 1991; Bohlman, 1985; Bohlman et al., 1985; White & Panjabi, 1990).



Note: Excludes 12 cases with undefined level & one case with cervical central cord syndrome not at a specific level.

Figure 10: Incidence of SCI from traumatic causes by neurological level of injury at admission, Australia 1999–00 (percentages)

The external cause of injury for cases of SCI from traumatic causes is presented by neurological level in Table 2.

- Motor vehicle occupants most often suffered from injury to the cervical segments of the spine, resulting in tetraplegia, with incomplete damage to the cord being most common at this level (68%, n=25).
- Unprotected road users most often suffered thoracic level injuries, which generally involved complete damage to the cord (88%, n=21).
- Low falls primarily resulted in cervical level injury and most of these involved incomplete damage to the cord (85%, n=17).
- High falls most often resulted in paraplegia, which involved incomplete damage in 52% of cases (n=16).
- SCI arising from being struck by an object primarily resulted in tetraplegia (74%, n=25), 56% of which involved incomplete damage to the cord (n=14).

Table 1: Incidence of SCI from traumatic causes by neurological level (major grouping) and extent of injury at admission, Australia 1999–00 (counts and column percentages)

	Tetraplegia		Paraplegia								Not specified			
	Cervical		Thoracic		Lumbar		Sacral		All Paraplegia				Total	
Extent of injury	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
Complete	43	34	43	62	12	24	2	67	57	46	1	8	101	39
Incomplete	82	65	25	36	37	73	1	33	63	51	1	8	146	56
Not specified	1	1	1	1	2	4	0	0	3	2	10	83	14	5
Total	**126**	**100**	**69**	**100**	**51**	**100**	**3**	**100**	**123**	**100**	**12**	**100**	**261**	**100**

Table 2: Incidence of SCI from traumatic causes by external cause (major groupings), and neurological level, of injury at discharge, Australia, 1999–2000 (counts and column percentages)

	Tetraplegia		Paraplegia								Not specified			
	Cervical		Thoracic		Lumbar		Sacral		All Paraplegia				Total	
External cause	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
Motor vehicle occupant	37	29	19	28	17	33	1	33	37	30	8	67	82	31
Unprotected road user	20	16	24	35	4	8	0	0	28	23	1	8	49	19
Low fall (<1m)	20	16	3	4	1	2	0	0	4	3	1	8	25	10
High fall (1m +)	16	13	16	23	13	25	2	67	31	25	0	0	47	18
Struck by object	25	20	3	4	6	12	0	0	9	7	0	0	34	13
Other cause	8	6	4	6	10	20	0	0	14	11	2	17	24	9
Total	**126**	**100**	**69**	**100**	**51**	**100**	**3**	**100**	**123**	**100**	**12**	**100**	**261**	**100**

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Glossary

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.

Neurological level of SCI: refers to the most caudal segment of the spinal cord with normal sensory and motor function on both sides of the body (i.e. the lowest level that has full function).

New incident case of SCI: a person who suffers an SCI, as defined by the CDC clinical definition, during this reporting period (i.e. in 1999–00).

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

Tetraplegia: refers to 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. It is generally preferred outside the US.

Unprotected road users: refers to pedestrians, pedal cyclists and motor cycle riders.

Data issues

Rates

Incidence rates have been calculated as cases per million of the usually resident population of Australia. ABS population data were used for this purpose. Annual rates were calculated using finalised population estimates for each year.

All-ages rates have been adjusted to overcome the effects of differences in the proportions of people at different ages (and different injury risks) in the populations that are compared. Direct standardisation was employed, taking the Australian population in 1991 as the standard.

Confidence intervals

All (or nearly all) cases of SCI are registered, so sampling errors do not apply to these data. However, the time periods used to group the cases (i.e. calendar years) are arbitrary. Use of another period (e.g. July to June) 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 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 out of 20 occasions. An extreme rate in a single period of enumeration should not be ignored simply because of a wide confidence interval—a time series may show such a rate to be part of a trend.

INJURY RESEARCH & STATISTICS

Spinal cord injury (SCI) is one of the most debilitating injuries that a person can suffer. Australia was the first country to implement a national population-based register of SCI to enable surveillance and help prevent and control this problem. This report provides information for 1999–00 from that register.

During the year, there were 261 new cases SCI in Australia. Approximately one-third of these arose from motor vehicle accidents, a third of which were due to motor vehicle rollover. Falls were a significant cause of SCI in the elderly. Thirteen cases arose from acquatic activities, including diving. Forty-four cases were work related.

The most common outcome was incomplete tetraplegia (82 cases), indicating a significant level of dysfunction in both the upper and lower limbs.