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Spinal cord injury, 1999–2005

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Key findings

- During the six year period from 1 July 1999 to 30 June 2005 19,912 hospital separations in Australia involved spinal cord injury.
- Incident rates for males were generally significantly higher than for females across all age groups.
- Almost half of all incident cases sustained an injury to the cervical spinal cord.
- Rates for incident cases remained relatively steady over the reported period.
- Transport-related accidents accounted for over 47% of all incident cases, while fall-related accidents accounted for a further 33%.
- Over 62% of identified rehabilitation episodes of care for patients with SCI involved treatment in a hospital with a spinal unit. This proportion is lower than anticipated, which might be due to data limitations.
- Nearly three-quarters of rehabilitation episodes of care involved an allied health intervention as the principal procedure, most commonly physiotherapy.
- 54% (n = 10,826) of the separations involving SCI were readmissions related to complications of spinal cord injuries sustained at an earlier time.
- Common forms of complication of SCI included urinary tract infections, pressure ulcers and other bacterial infections.
- The introduction of person-based record linkage would allow much more complete and reliable estimation of the incidence of SCI in the community and of the burden of SCI on the hospital sector and community.

Introduction

Spinal cord injury (SCI) is sudden and unexpected, and it can be devastating and costly in human and social terms. Medical advances, especially in initial resuscitation and long-term care, have improved survival rates and increased longevity (Tyroch et al. 1997)

From the 1940s through to the 1960s, the level of acute care and rehabilitation of persons with SCI was poor, with few tetraplegic cases or high level paraplegics surviving (Stover 1995). Changes in acute care and rehabilitation, particularly in the development of a team approach to patient case management in the 1970s, brought about a significant reduction in premature mortality, especially from respiratory and renal diseases (Geisler et al. 1983); (Nakajima 1989); (DeVivo et al. 1993).

Each year in Australia, about 300–400 new cases of SCI from traumatic and non-traumatic causes are added to an estimated prevalent SCI population of about 9,000 (Cripps 2007). However, this number under-estimates the total number of incident cases of SCI since it only includes those people admitted to spinal units. Cases not admitted to these units include cases in which death occurs soon after injury, and cases in which the presence of other conditions necessitate treatment elsewhere.

The main purpose of this report is to describe all hospital separations involving SCI for the period from 1 July 1999 to 30 June 2005. This report not only includes people admitted to hospital directly after having sustained a spinal cord injury, but also includes people readmitted to hospital after experiencing complications associated with a persisting spinal cord injury.

Methods

Case selection

Records of hospital separations from the Australian Institute of Health and Welfare (AIHW) National Hospital Morbidity Database (NHMD) and included episodes in hospital where discharge occurred between 1 July 1999 and 30 June 2005, and where at least one diagnosis field included one of the ICD-10-AM codes listed in Table 1 below.

Table 1: ICD-10-AM codes used in selection of SCI separations

ICD-10-AM code	Description
S14.0	Concussion and oedema of cervical spinal cord
S14.10–S14.13	Other and unspecified injuries of cervical spinal cord
S14.70–S14.78	Functional level of cervical spinal cord injury
S24.0	Concussion and oedema of thoracic spinal cord
S24.10–S24.12	Other and unspecified injuries of cervical thoracic cord
S24.70–S24.77	Functional level of thoracic spinal cord injury
S34.0	Concussion and oedema of lumbar spinal cord
S34.1	Other injury of lumbar spinal cord
S34.70–S34.76	Functional level of lumbar spinal cord injury
T06.0	Injuries of brain and cranial nerves with injuries of nerve and spinal cord at neck level
T06.1	Injuries of nerves and spinal cord involving other multiple body regions
T09.3	Injury of spinal cord, level unspecified
T91.3	Sequelae of injury of spinal cord

Hospital type

Hospitals were grouped according to whether or not they incorporated a spinal unit. Hospitals which incorporated a spinal unit are listed in Table 2 below.

Table 2: Hospitals incorporating a spinal unit

State	Hospital
NSW	Prince of Wales Hospital (2003–04 to 2004–05)
	Prince Henry Hospital (1999–00 to 2002–03)
	Royal North Shore Hospital
	Royal Rehabilitation Centre (Moorong)
Vic	Austin Hospital
	Royal Talbot Rehabilitation Centre
Qld	Princess Alexandra Hospital
SA	Royal Adelaide Hospital
	Hampstead Hospital
WA	Royal Perth Hospital

Incident and readmission separations

Incident separations were classified as those separations where one or more of the diagnosis fields contained one of the SCI codes listed in Table 1, but excluding separations where any diagnosis field contained the code T91.3 *Sequelae of spinal cord injury*. Conversely, separations in which any diagnosis field contained T91.3 were classified as readmission separations.

Incident cases

Records were included as incident cases if they met one the following criteria:-

- Principal diagnosis included one of the SCI codes listed in Table 1; or
- Principal diagnosis included one of the codes in the community injury[1] range (S00–T75, T79) AND any additional diagnosis included one of the codes listed in Table 1.

Records were excluded if:-

- Any diagnosis field included T91.3 *Sequelae of spinal cord injury*, as these were regarded as readmission records.
- The mode of admission was either ‘Admitted patient transferred from another hospital’ or ‘Statistical admission—type change’, in order to reduce multiple counting of cases.

[1] Community injury is defined as any injury which occurs in settings such as motor vehicle crashes, interpersonal violence, sporting and recreational activities, and work.

Residual cases

Records were included as residual cases if their principal diagnosis was not any of the codes in the community injury range (S00–T75, T79) AND any additional diagnosis was one of the codes listed in Table 1.

Records were excluded if:-

- Any diagnosis field included T91.3 *Sequelae of spinal cord injury*, as these were regarded as readmission records.
- The mode of admission was either 'Admitted patient transferred from another hospital' or 'Statistical admission—type change' in order to reduce multiple counting of cases.
- They met the selection criteria for a rehabilitation case as described immediately below.

Rehabilitation cases

Records were included as rehabilitation cases if they met one the following criteria:-

- Any additional diagnosis included one of the codes listed in Table 1; and
- Type of episode of care is 'Rehabilitation care' OR Principal diagnosis = Z50 *Care involving use of rehabilitation procedures.*

Records were excluded if:-

- Any diagnosis field included T91.3 *Sequelae of spinal cord injury*, since these were regarded as readmission records.
- They met the selection criteria for an incident case as described above.

Readmission cases

Records were included as readmission cases if any diagnosis field included T91.3 *Sequelae of spinal cord injury* and were excluded if their mode of admission was either 'Admitted patient transferred from another hospital' or 'Statistical admission—type change' in order to reduce multiple counting of cases.

Overview

There were 19,912 SCI-related hospital separations resulting from an estimated[2] 16,223 cases during the period of interest (Tables 3 and 4). Overall, 46% (*n* = 9,086) of these separations involved episodes of care related to the initial injury event in which the SCI was sustained. Just over three-quarters (77%, *n* = 15,236) of separations involved males. More than half (56%, *n* = 9,017) of the estimated cases involved patients readmitted to hospital following complications of a SCI sustained in a previous incident, while more than a quarter (28%, *n* = 4,592) were newly incident cases.

Table 3: SCI-related hospital separations by year of separation by sex, Australia 1999–00 to 2004–05

Year of separation	Incident separations			Readmission separations			All separations		
	Males	Females	Persons	Males	Females	Persons	Males	Females	Persons
1999–00	923	350	1,273	1,036	328	1,364	1,959	678	2,637
2000–01	1,005	424	1,429	1,081	254	1,335	2,086	678	2,764
2001–02	1,091	435	1,526	1,043	306	1,349	2,134	741	2,875
2002–03	1,121	369	1,490	1,640	422	2,062	2,761	791	3,552
2003–04	1,189	423	1,612	1,843	432	2,275	3,032	855	3,887
2004–05	1,292	464	1,756	1,972	469	2,441	3,264	933	4,197
Total	**6,621**	**2,465**	**9,086**	**8,615**	**2,211**	**10,826**	**15,236**	**4,676**	**19,912**

Table 4: Estimated SCI-related cases by case type and sex, Australia, 1999–00 to 2004–05

Case type	Males		Females		Persons	
	Count	Per cent	Count	Per cent	Count	Per cent
Incident	3,245	26.3	1,347	34.8	4,592	28.3
Residual	277	2.2	162	4.2	439	2.7
Rehabilitation	1,676	13.6	499	12.9	2,175	13.4
Readmission	7,155	57.9	1,862	48.1	9,017	55.6
Total	**12,353**	**100.0**	**3,870**	**100.0**	**16,223**	**100.0**

[2] Estimated cases refers to all separations other than those where the patient has been transferred from another acute hospital or the patient has been transferred from one type of episode of care to another type of episode of care within the same hospital—i.e. statistical type change.

Incident cases

Overview

Selection criteria for incident cases are described on page 3 of this report. Over the period of interest, there were 4,592 cases which met these criteria (Table 5). Of these cases, 71% (*n* = 3,245) were males, and 75% (*n* = 3,425) had a principal diagnosis of spinal cord injury (SCI).

Table 5: Incident SCI cases by case type by sex, Australia 1999–00 to 2004–05

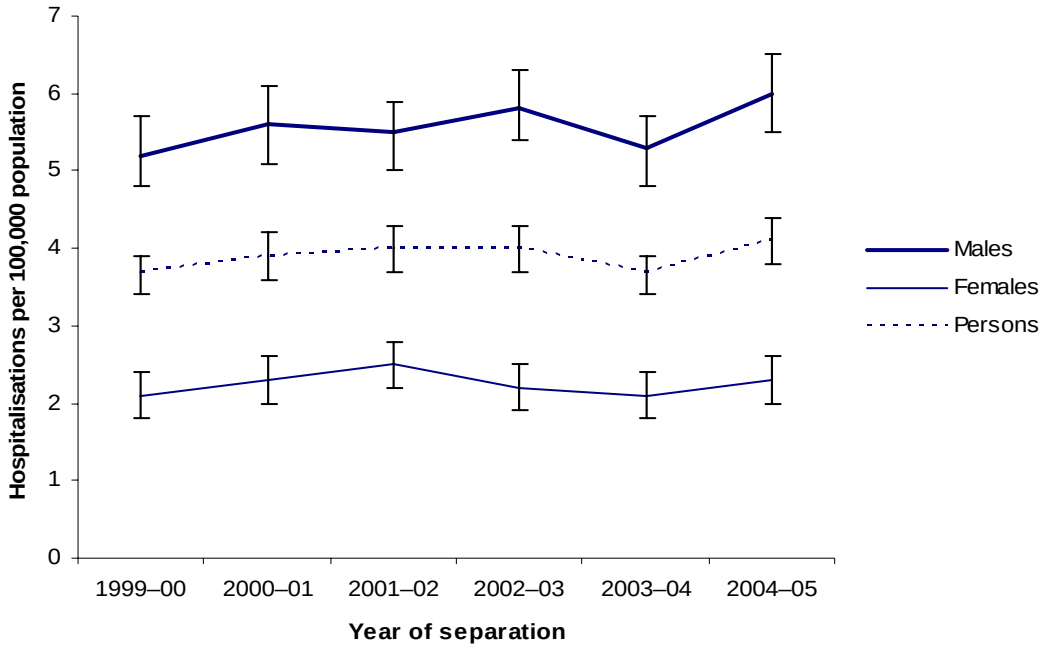
Case type	Males	Females	Persons
Principal diagnosis = SCI	2,434	991	3,425
Principal diagnosis = Spinal column injury[3] & additional diagnosis = SCI	338	136	474
Principal diagnosis = Community injury[(a)] (excluding spinal injury) & additional diagnosis = SCI	473	220	693
Total	**3,245**	**1,347**	**4,592**

(a) Community injury refers to cases where the principal diagnosis is in the range S00–T75, T79.

[3] Australian Coding Standards indicate that the spinal cord injury should be coded before the spinal column injury (NCCH 2002). Hence, it is believed that these cases should have the spinal cord injury as their principal diagnosis.

Trends

Incident case rates for males were consistently 2–2 ½ times higher than rates for females over the period of interest (Figure 1). Rates for males were relatively constant over this period ranging from a low of 5.2 hospitalisations per 100,000 population in 1999–00 to a high of 6.0 in 2004–05. Rates for females also displayed low variability, ranging from a low of 2.1 hospitalisations per 100,000 population in both 1999–00 and 2003–04 to a high of 2.5 in 2001–02.

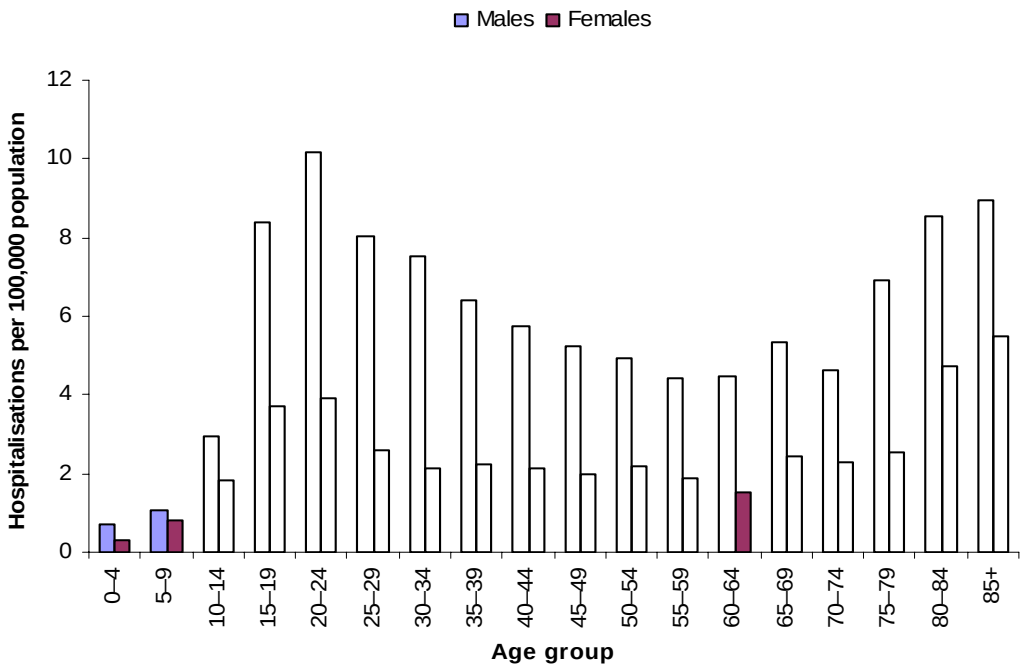


Note: Rates are age-adjusted against the 2001 Australian population.
Error bars are 95% confidence intervals based on a Poisson distribution.

Figure 1: Incident cases per 100,000 population, due to spinal cord injury by sex, Australia, 1999–00 to 2004–05

Age and sex

Age-specific incidence rates for males were markedly higher than for females across all age groups (Figure 2). Rates for both sexes were lowest for infants aged 0–4 years and continued to rise with age until the early twenties. Rates for males decreased from the early twenties until the mid-fifties, before continuing to rise until the mid-eighties. A similar, although less pronounced pattern, was seen for females.



Note: Excludes inward transfers from other hospitals (*m* = 2,186; *f* = 667).

Figure 2: Incident cases per 100,000 population, due to spinal cord injury by age and sex, Australia, 1999–00 to 2004–05

Principal diagnosis

Table 6 displays principal diagnosis categories for incident cases where principal diagnosis did not include a spinal injury. Just over 50% (n = 349) of cases had a principal diagnosis relating to a head injury, with 51% (n = 177) of these cases sustaining some form of intracranial injury. Other prominent body regions included the thorax (12%, n = 82) and the abdomen, lower back, lumbar spine and pelvis (11%, n = 78).

Table 6: Principal diagnosis for incident cases due to SCI where principal diagnosis did not include a spinal injury, Australia 1999–00 to 2004–05

	Males		Females		Persons	
Principal diagnosis	**Count**	**Per cent**	**Count**	**Per cent**	**Count**	**Per cent**
Injuries to the head (S00–S09)	250	52.9	99	45.0	349	50.4
Fracture of skull and facial bones (S02)	*50*	*20.0*	*13*	*13.1*	*63*	*18.1*
Intracranial injury (S06)	*127*	*50.8*	*50*	*50.5*	*177*	*50.7*
Injuries to the neck (S10-S19)	28	5.9	21	9.5	49	7.1
Injuries to the thorax (S20–S29)	56	11.8	26	11.8	82	11.8
Injuries to the abdomen, lower back, lumbar spine and pelvis (S30–S39)	43	9.1	35	15.9	78	11.3
Injuries to the shoulder and upper arm (S40–S49)	20	4.2	14	6.4	34	4.9
Injuries to the elbow and forearm (S50–S59)	12	2.5	..	..	16	2.3
Injuries to the wrist and hand (S60–S69)	..	..	..	..	8	1.2
Injuries to the hip and thigh (S70–S79)	15	3.2	7	3.2	22	3.2
Injuries to the knee and lower leg (S80–S89)	14	3.0	6	2.7	20	2.9
Injuries to the ankle and foot (S90–S99)	..	..	..	..	5	0.7
Other injury and poisoning codes (T00–T75)	25	5.3	5	2.3	30	4.3
Total	**473**	**100**	**220**	**100**	**693**	**100**

.. Cell counts in tables that are 4 cases or fewer have been suppressed, as have rates derived from them, to protect confidentiality.

Type of spinal cord injury

Almost 48% (*n* = 2,190) of incident cases sustained a lesion to the cervical spinal cord (Table 7). Of these cases, 8% (*n* = 184) experienced a complete lesion of the cervical spinal cord, with males being more likely than females to sustain this type of injury. Just over 18% (*n* = 832) of those hospitalised sustained a lesion to the thoracic spinal cord, whilst 13% (*n* = 584) sustained an injury to the lumbar spinal cord. Of those cases who sustained a lesion to the thoracic spinal cord, 26% (*n* = 212) experienced a complete lesion, with males being far more likely than females to sustain this type of injury. Notably, 23% (*n* = 1,074) of cases were not assigned an ICD-10-AM code which related to a type of cord lesion.

Table 7: Type of cord lesion by sex for incident cases due to SCI, Australia 1999–00 to 2004–05

	Males		Females		Persons	
Type of cord lesion	**Count**	**Per cent**	**Count**	**Per cent**	**Count**	**Per cent**
Cervical spinal cord	**1,599**	**49.3**	**591**	**43.9**	**2,190**	**47.7**
Concussion and oedema of cervical spinal cord (S14.0)	213	13.3	65	11.0	278	12.7
Injury of cervical spinal cord, unspecified (S14.10)	828	51.8	374	63.3	1,202	54.9
Complete lesion of cervical spinal cord (S14.11)	145	9.1	39	6.6	184	8.4
Central cord syndrome of cervical spinal cord (S14.12)	222	13.9	62	10.5	284	13.0
Other incomplete cord syndrome of cervical spinal cord (S14.13)	272	17.0	78	13.2	350	16.0
Thoracic spinal cord	**615**	**19.0**	**217**	**16.1**	**832**	**18.1**
Concussion and oedema of thoracic spinal cord (S24.0)	64	10.4	17	7.8	81	9.7
Injury of thoracic spinal cord, unspecified (S24.10)	275	44.7	134	61.8	409	49.2
Complete lesion of thoracic spinal cord (S24.11)	182	29.6	30	13.8	212	25.5
Incomplete cord syndrome of thoracic spinal cord (S24.12)	117	19.0	40	18.4	157	18.9
Lumbar spinal cord	**373**	**11.5**	**211**	**15.7**	**584**	**12.7**
Concussion and oedema of lumbar spinal cord (S34.0)	25	6.7	15	7.1	40	6.8
Other injury of lumbar spinal cord (S34.1)	357	95.7	197	93.4	554	94.9
Injuries of brain and cranial nerves with injuries of nerve and spinal cord at neck level (T06.0)	**..**	**..**	**..**	**..**	**..**	**..**
Injuries of nerve and spinal cord involving other multiple body regions (T06.1)	**10**	**0.3**	**9**	**0.7**	**19**	**0.4**
No code assigned	**716**	**22.1**	**358**	**26.6**	**1,074**	**23.4**
Total	**3,245**		**1,347**		**4,592**	

Note: Includes cases with type of spinal cord lesion recorded in any diagnosis field.

.. Cell counts in tables that are 4 cases or fewer have been suppressed, as have rates derived from them, to protect confidentiality.

Level of spinal cord injury

Of all incident cases with a cervical spinal cord lesion, only 39% (n = 850) were assigned a specified level of injury (Table 8). This percentage was higher for cases with a lesion of the thoracic spinal cord (60%, n = 502), as well as for cases with a lesion of the lumbar spine (55%, n = 321). Of cases for which no spinal cord lesion was assigned, only 37% (n = 397) had a specified level of injury recorded.

Table 8: Level of spinal cord injury by type of cord lesion by sex for incident cases due to SCI, Australia 1999–00 to 2004–05

Level of spinal cord injury[(a)] by type of spinal cord lesion	Males		Females		Persons	
	Count	Per cent	Count	Per cent	Count	Per cent
Cervical spinal cord lesion	**1,599**	**49.3**	**591**	**43.9**	**2,190**	**47.7**
Functional spinal cord injury, cervical level unspecified (S14.70)	326	20.4	125	21.2	451	20.6
Functional spinal cord injury, C1–C8 (S14.71–S14.78)	645	40.3	205	34.7	850	38.8
No level of injury code assigned	628	39.3	261	44.2	889	40.6
Thoracic spinal cord lesion	**615**	**19.0**	**217**	**16.1**	**832**	**18.1**
Functional spinal cord injury, thoracic level unspecified (S24.70)	84	13.7	41	18.9	125	15.0
Functional spinal cord injury, T1–T12 (S24.71–S24.77)	386	62.8	116	53.5	502	60.3
No level of injury code assigned	145	23.6	60	27.6	205	24.6
Lumbar spinal cord lesion	**373**	**11.5**	**211**	**15.7**	**584**	**12.7**
Functional spinal cord injury, lumbar level unspecified (S34.70)	74	19.8	42	19.9	116	19.9
Functional spinal cord injury, L1–sacrum (S34.71–S34.76)	212	56.8	109	51.7	321	55.0
No level of injury code assigned	87	23.3	60	28.4	147	25.2
No spinal cord lesion code assigned	**716**	**22.1**	**358**	**26.6**	**1,074**	**23.4**
Functional spinal cord injury, cervical level unspecified (S14.70)	72	10.1	33	9.2	105	9.8
Functional spinal cord injury, C1–C8 (S14.71–S14.78)	122	17.0	58	16.2	180	16.8
Functional spinal cord injury, thoracic level unspecified (S24.70)	9	1.3	8	2.2	17	1.6
Functional spinal cord injury, T1–T12 (S24.71–S24.77)	64	8.9	26	7.3	90	8.4
Functional spinal cord injury, lumbar level unspecified (S34.70)	21	2.9	13	3.6	34	3.2
Functional spinal cord injury, L1–sacrum (S34.71–S34.76)	84	11.7	43	12.0	127	11.8
No level of injury code assigned	344	48.0	177	49.4	521	48.5
Total	**3,245**		**1,347**		**4,592**	

(a) Where more than one level of spinal cord injury is recorded within a single case, only the code corresponding to the highest level is included.

External cause of injury

Just over 47% (*n* = 2,167) of incident cases were admitted to hospital after being involved in some form of transport accident (Table 9). Of these cases, 52% (*n* = 1,128) were car occupants and 20% (*n* = 426) were motorcyclists. Injuries sustained from falls were also a common cause of hospitalisation, accounting for 33% (*n* = 1,515) of incident cases. Of these cases, 13% (*n* = 199) involved slipping, tripping and stumbling on the same level, 12% (*n* = 179) involved falling from, out of or through a building or structure, and 10% (*n* = 147) involved diving or jumping into water.

Table 9: External cause group by sex for incident cases due to SCI, Australia 1999–00 to 2004–05

	Males		Females		Persons	
External cause group	**Count**	**Per cent**	**Count**	**Per cent**	**Count**	**Per cent**
Transportation (V01–V99)	**1,493**	**46.0**	**674**	**50.0**	**2,167**	**47.2**
Pedestrian (V01–V09)	82	5.5	41	6.1	123	5.7
Pedal cyclist (V10–V19	103	6.9	12	1.8	115	5.3
Motorcyclist (V20–V29)	396	26.5	30	4.5	426	19.7
Car occupant (V40–V49)	662	44.3	466	69.1	1,128	52.1
Animal-rider or occupant of animal-drawn vehicle injured in transport accident (V80)	56	3.8	70	10.4	126	5.8
Other land transport (V30–V39, V50–V79, V81-V89)	126	8.4	35	5.2	161	7.4
Water (V90–V94)	25	1.7	10	1.5	35	1.6
Air and space (V95–V97)	27	1.8	..	..	..	1.3
Other and unspecified	16	1.1	8	1.2	24	1.1
Falls (W00–W19)	**1,079**	**33.3**	**436**	**32.4**	**1,515**	**33.0**
Fall on same level from slipping, tripping and stumbling (W01)	107	9.9	92	21.1	199	13.1
Other fall on same level due to collision with, or pushing by, another person (W03)	119	11.0	20	4.6	139	9.2
Fall involving furniture (W06–W08)	53	4.9	30	6.9	83	5.5
Fall involving playground equipment (W09)	28	2.6	17	3.9	45	3.0
Fall on or from steps and stairs (W10)	58	5.4	47	10.8	105	6.9
Fall on or from ladder (W11)	88	8.2	13	3.0	101	6.7
Fall from, out of or through building or structure (W13)	152	14.1	27	6.2	179	11.8
Diving or jumping into water causing injury other than drowning or submersion (W16)	132	12.2	15	3.4	147	9.7
Other unintentional (W20–W64, W75–X59, Y85, Y86)	**475**	**14.6**	**161**	**12.0**	**636**	**13.9**
Overexertion and repetitive or strenuous movements (X50)	89	18.7	48	29.8	137	21.5
Intentional, self inflicted (X60–X84, Y87.0)	**35**	**1.1**	**22**	**1.6**	**57**	**1.2**
Intentional, inflicted by another (X85–Y09, Y35, Y36, Y87.1)	**112**	**3.5**	**34**	**2.5**	**146**	**3.2**
Undetermined intent (Y10–Y34, Y87.2)	**..**	**..**	**..**	**..**	**6**	**0.1**
Medical misadventure, complications, etc. (Y40–Y84, Y88)	**27**	**0.8**	**12**	**0.9**	**39**	**0.8**
No external cause listed	**20**	**0.6**	**6**	**0.4**	**26**	**0.6**
Total	**3,245**	**100.0**	**1,347**	**100.0**	**4,592**	**100.0**

.. Cell counts in tables that are 4 cases or fewer have been suppressed, as have rates derived from them, to protect confidentiality.

Activity at time of injury

Almost 13% (*n* = 589) of incident cases involved some form of sporting activity at the time of spinal cord injury (Table 10). Males were almost twice as likely as females to sustain injury whilst engaged in this sort of activity. Nine per cent (*n* = 413) of cases sustained their SCI while working for income. These cases accounted for 11% (*n* = 362) of hospitalisations for males and only 4% (*n* = 51) of hospitalisations for females. Notably for 46% (*n* = 2,105) of cases, the activity was either unspecified or not reported.

Table 10: Activity at time of injury by sex for incident cases due to SCI, Australia 1999–00 to 2004–05

	Males		Females		Persons	
Activity	**Count**	**Per cent**	**Count**	**Per cent**	**Count**	**Per cent**
While engaged in sports	483	14.9	106	7.9	589	12.8
While engaged in leisure	197	6.1	76	5.6	273	5.9
While working for income	362	11.2	51	3.8	413	9.0
While engaged in other types of work	98	3.0	41	3.0	139	3.0
While resting, sleeping, eating, etc.	64	2.0	57	4.2	121	2.6
Other specified activity	642	19.8	310	23.0	952	20.7
Unspecified activity	1,340	41.3	683	50.7	2,023	44.1
Activity not reported/not applicable	59	1.8	23	1.7	82	1.8
Total	**3,245**	**100**	**1,347**	**100**	**4,592**	**100**

Place of occurrence

Almost 35% (*n* = 1,361) of incident cases sustained their injuries while on a street or highway, while a further 16% (*n* = 609) sustained their injuries while in the home (Table 11). Notably for 21% (*n* = 802) of cases, the place of occurrence was either unspecified or not reported.

Table 11: Place of occurrence of injury by sex for incident cases due to SCI, Australia 1999–00 to 2004–05

	Males		Females		Persons	
Place of occurrence	**Count**	**Per cent**	**Count**	**Per cent**	**Count**	**Per cent**
Home	374	13.6	235	20.5	609	15.6
Residential institution	26	0.9	14	1.2	40	1.0
School	22	0.8	11	1.0	33	0.8
Health Service area	29	1.1	16	1.4	45	1.2
Other specified institution and public administrative area	9	0.3	6	0.5	15	0.4
Sports and athletics area	228	8.3	47	4.1	275	7.1
Street and highway	896	32.6	465	40.6	1,361	34.9
Trade and service area	77	2.8	24	2.1	101	2.6
Industrial and construction area	94	3.4	..	..	..	2.5
Farm	84	3.1	20	1.7	104	2.7
Other specified place of occurrence	329	12.0	84	7.3	413	10.6
Unspecified place of occurrence	545	19.8	208	18.2	753	19.3
Place not reported/not applicable	36	1.3	13	1.1	49	1.3
Total	**2,749**	**100**	**1,146**	**100.0**	**3,895**	**100.0**

.. Cell counts in tables that are 4 cases or fewer have been suppressed, as have rates derived from them, to protect confidentiality.

Comparison with the Australian Spinal Cord Injury Register (ASCIR)

The estimated number of admissions to hospitals with a spinal unit based on data and methods used in this report is higher than the number of new cases entered into the Australian Spinal Cord Injury Register (Table 12).

Factors that might contribute to this apparent difference are:

- Data used for this report are not person-linked, and so it is possible that some cases were counted more than once.
- Some SCI cases admitted to a hospital with a spinal unit might have been cared for elsewhere in the institution (e.g. a case of multiple trauma including spinal injury treated in the intensive care unit).
- Differences in types of cases counted. Although all of the cases included in our analysis have a Principle Diagnosis of injury, about 300 also include diagnosis codes for disease conditions, which might result in these cases being classified as 'non-traumatic' in the ASCIR.

Table 12: Comparison between number of admissions to a hospital with a spinal unit and Australian Spinal Cord Injury Registrations, Australia 1999–00 to 2004–05

Year of separation	Admissions to a hospital with a spinal unit	Australian Spinal Cord Injury Registrations[(a)]
1999–00	375	261[(b)]
2000–01	341	259[(b)]
2001–02	379	239[(b)]
2002–03	324	245[(b)]
2003–04	309	289
2004–05	335	280
Total	**2,063**	**1,573**

(a) Registrations exclude cases where SCI is due to non-traumatic causes.

(b) Registrations for these years exclude traumatic cause SCI cases with no neurological deficit and cases where death occurred in hospital ward.

Residual cases

Selection criteria for residual cases are described on page 4 of this report. It is possible that some of these cases could be regarded as incident cases, as SCI was included as one of the conditions which accounted for hospitalisation. However, due to the difficulty in distinguishing between cases in this set which are truly incident from those which are not, it was decided to include these cases, but to present them separately from incident SCI.

Principal diagnosis

Overall, 32% (n = 142) of cases had a principal diagnosis related to diseases of the musculoskeletal system and connective tissue (Table 13). Of these cases, 85% (n = 120) had some form of dorsopathy (back pain). Other prominent categories of principal diagnoses included diseases of the genitourinary system (11%, n = 50) and diseases of the nervous system (11%, n = 47).

Table 13: Residual cases due to SCI by principal diagnosis by sex, Australia 1999–00 to 2004–05

	Males		Females		Persons	
Principal diagnosis	**Count**	**Per cent**	**Count**	**Per cent**	**Count**	**Per cent**
Neoplasms (C00–D48)	8	2.9	8	4.9	16	3.6
Diseases of the nervous system (G00–G99)	27	9.7	20	12.3	47	10.7
Diseases of the circulatory system (I00–I99)	25	9.0	5	3.1	30	6.8
Diseases of the respiratory system (J00–J99)	14	5.1	10	6.2	24	5.5
Diseases of the musculoskeletal system and connective tissue (M00–M99)	81	29.2	61	37.7	142	32.3
Dorsopathies (M40–M54)	73	90.1	47	77.0	120	84.5
Diseases of the genitourinary system (N00–N99)	39	14.1	11	6.8	50	11.4
Urinary tract infection (N39.0)	25	64.1	5	45.5	30	60.0
Symptons, signs and abnormal clinical and laboratory findings, nec (R00–R99)	27	9.7	9	5.6	36	8.2
Complications of surgical and medical care, nec (T80–T88)	16	5.8	8	4.9	24	5.5
Factors influencing health status and contact with health services (Z00–Z49, Z51–Z99)	8	2.9	7	4.3	15	3.4
Other (A00–B99, D50–E99, H00–H99, K00–L99, O00–Q99)	32	11.6	23	14.2	55	12.5
Total	**277**	**100**	**162**	**100**	**439**	**100**

Rehabilitation cases

Overview

Selection criteria for rehabilitation cases are described on page 4 of this report. The number of hospital separations involving rehabilitation for SCI almost doubled from 242 separations in 1999–00 to 479 in 2004–05 (Table 14). The ratio of separations involving males to separations involving females ranged from 2.5 in 2001–02 to 5.2 in 2002–03.

Table 14: Number of hospital separations involving rehabilitation for SCI by sex, Australia 1999–00 to 2004–05

Year of separation	Males	Females	Persons	M:F ratio
1999–00	186	56	242	3.3
2000–01	242	85	327	2.8
2001–02	245	99	344	2.5
2002–03	271	52	323	5.2
2003–04	362	98	460	3.7
2004–05	370	109	479	3.4
Total	**1,676**	**499**	**2,175**	**3.4**

Mode of admission

Hospitals which incorporated a spinal unit accounted for 62% (*n* = 1,354) of all separations involving rehabilitation (Table 15). For these hospitals, 65% (*n* = 874) of admissions were patients transferred from another acute hospital, while a further 31% (*n* = 415) involved statistical admission—type changes within the hospital. For hospitals which did not incorporate a spinal unit, only 40% (*n* = 330) of admissions were patients transferred from another acute hospital, while a further 17% (*n* = 136) involved statistical admission—type changes within the hospital.

Table 15: Number of hospital separations involving rehabilitation for SCI by mode of admission by hospital type by sex, Australia 1999–00 to 2004–05

	Males		Females		Persons	
Mode of admission	**Count**	**Per cent**	**Count**	**Per cent**	**Count**	**Per cent**
Hospitals with spinal unit	**1,079**	**64.4**	**275**	**55.1**	**1,354**	**62.3**
Admitted patient transferred from another hospital	707	65.5	167	60.7	874	64.5
Statistical admission—type change	321	29.7	94	34.2	415	30.6
Other	51	4.7	14	5.1	65	4.8
Hospitals without spinal unit	**597**	**35.6**	**224**	**44.9**	**821**	**37.7**
Admitted patient transferred from another hospital	228	38.2	102	45.5	330	40.2
Statistical admission—type change	95	15.9	41	18.3	136	16.6
Other	274	45.9	81	36.2	355	44.3
Total	**1,676**	**100**	**499**	**100**	**2,175**	**100**

Principal procedures

Nearly three-quarters (74%, *n* = 1,611) of all hospital admissions involving rehabilitation involved some form of generalised allied health intervention as their principal procedure (Table 16). Of these admissions, physiotherapy was by far the most common intervention, accounting for 58% (*n* = 940) of all procedures.

Table 16: Number of hospital separations involving rehabilitation for SCI by principal procedure by sex, Australia 1999–00 to 2004–05

	Males		Females		Persons	
Principal procedure	**Count**	**Per cent**	**Count**	**Per cent**	**Count**	**Per cent**
Generalised allied health interventions	1,218	72.7	393	78.8	1,611	74.1
Physiotherapy	723	59.4	217	55.2	940	58.3
Occupational therapy	193	15.8	93	23.7	286	17.8
Social work	132	10.8	44	11.2	176	10.9
Dietetics	131	10.8	27	6.9	158	9.8
Other allied health intervention	39	3.2	12	3.1	51	3.2
Intravenous pyelography	39	2.3	12	2.4	51	2.3
Magnetic resonance imaging	29	1.7	7	1.4	36	1.7
Diagnostic tests—Genitourinary system	25	1.5	..	..	..	1.3
Urinary catheterisation	21	1.3	6	1.2	27	1.2
Computer tomography of brain	28	1.7	..	..	..	1.5
Hydotherapy	10	0.6	..	..	..	0.6
Cystoscopy	10	0.6	..	..	..	0.6
Other procedures	193	11.5	48	9.6	241	11.1
No procedure recorded	103	6.1	18	3.6	121	5.6
Total	**1,676**	**100**	**499**	**100**	**2,175**	**100**

.. Cell counts in tables that are 4 cases or fewer have been suppressed, as have rates derived from them, to protect confidentiality.

Readmission cases

Overview

Selection criteria for SCI-related readmission cases are described on page 5 of this report. There was a significant increase in the number of readmissions over the reported period, particularly in the period from 2001–02 to 2004–05 where numbers jumped from 1,117 to 2,014, an increase of close to 80% (Table 17). The ratio of readmissions involving males to readmissions involving females ranged from 3.3 in 1999–00 to 4.3 in 2003–04.

Table 17: Number of SCI-related readmissions by year of separation by sex, Australia 1999–00 to 2004–05

Year of separation	Males	Females	Persons	M:F ratio
1999–00	925	281	1,206	3.3
2000–01	891	220	1,111	4.1
2001–02	868	249	1,117	3.5
2002–03	1,334	356	1,690	3.7
2003–04	1,524	355	1,879	4.3
2004–05	1,613	401	2,014	4.0
Total	**7,155**	**1,862**	**9,017**	**3.8**

Type of episode of care

Just over 95% (*n* = 8,587) of SCI-related readmissions involved episodes of acute care (Table 18).

Table 18: Number of SCI-related readmissions by type of episode of care by sex, Australia 1999–00 to 2004–05

Type of episode of care	Males		Females		Persons	
	Count	Per cent	Count	Per cent	Count	Per cent
Acute care	6,850	95.7	1,737	93.3	8,587	95.2
Rehabilitation care	229	3.2	104	5.6	333	3.7
Other	76	1.1	21	1.1	97	1.1
Total	**7,155**	**100**	**1,862**	**100**	**9,017**	**100**

Principal diagnosis

Diseases of the genitourinary system accounted for 20% (*n* = 1,769) of principal diagnoses of all SCI-related readmissions (Table 19). Of these readmissions, 43% (*n* = 758) had a urinary tract infection as their principal diagnosis. Other prominent reasons for readmission were diseases of the skin and subcutaneous tissue which accounted for 13% of all principal diagnoses, with pressure ulcers accounting for 68% (*n* = 803) of these readmissions. Of readmissions whose principal diagnosis was injury or poisoning (10%, *n* = 906), 50% (*n* = 457) were complications of surgical and medical care and 13% (*n* = 113) had a fracture of the femur.

Table 19: Principal diagnosis for SCI-related readmissions by sex, Australia 1999–00 to 2004–05

	Males		Females		Persons	
Principal diagnosis	**Count**	**Per cent**	**Count**	**Per cent**	**Count**	**Per cent**
Certain infectious and parasitic diseases (A00–B99)	**156**	**2.2**	**50**	**2.7**	**206**	**2.3**
Sepsis (A41)	114	73.1	35	70.0	149	72.3
Neoplasms (C00–D48)	**137**	**1.9**	**56**	**3.0**	**193**	**2.1**
Malignant neoplasm of bladder (C67)	37	27.0	6	10.7	43	22.3
Endocrine, nutritional and metabolic diseases (E00–E89)	**99**	**1.4**	**32**	**1.7**	**131**	**1.5**
Mental and behavioural disorders (F00–F99)	**91**	**1.3**	**40**	**2.1**	**131**	**1.5**
Diseases of the nervous system (G00–G99)	**550**	**7.7**	**134**	**7.2**	**684**	**7.6**
Paraplegia (G82.0–G82.2)	77	14.0	14	10.4	91	13.3
Tetraplegia (G82.3–G82.5)	97	17.6	20	14.9	117	17.1
Autonomic dysreflexia (G90.8)	122	22.2	28	20.9	150	21.9
Diseases of the circulatory system (I00–I99)	**323**	**4.5**	**65**	**3.5**	**388**	**4.3**
Haemorrhoids (I84)	108	33.4	15	23.1	123	31.7
Diseases of the respiratory system (J00–J99)	**426**	**6.0**	**141**	**7.6**	**567**	**6.3**
Pneumonia (J12–J18)	192	45.1	65	46.1	257	45.3
Diseases of the digestive system (K00–K93)	**493**	**6.9**	**139**	**7.5**	**632**	**7.0**
Diseases of the skin and subcutaeous tissue (L00–L99)	**979**	**13.7**	**196**	**10.5**	**1,175**	**13.0**
Cellulitis (L03)	170	17.4	33	16.8	203	17.3
Pressure ulcer (L89)	668	68.2	135	68.9	803	68.3
Diseases of the musculoskeletal system and connective tissue (M00–M99)	**466**	**6.5**	**107**	**5.7**	**573**	**6.4**
Dorsalgia (M54)	84	18.0	24	22.4	108	18.8
Diseases of the genitourinary system (N00–N99)	**1,473**	**20.6**	**296**	**15.9**	**1,769**	**19.6**
Urolithiasis (N20–N23)	190	12.9	45	15.2	235	13.3
Disorders of the bladder (N30–N32)	256	17.4	41	13.9	297	16.8
Urinary tract infection (N39.0)	622	42.2	136	45.9	758	42.8
Symptoms, signs and abnormal clinical and laboratory findings, nec (R00–R99)	**426**	**6.0**	**122**	**6.6**	**548**	**6.1**
Symptons and signs involving the urinary system (R30–R39)	145	34.0	26	21.3	171	31.2
Injury, poisoning and certain other consequences of external causes (S00–T98)	**720**	**10.1**	**186**	**10.0**	**906**	**10.0**
Fracture of femur (S72)	93	12.9	20	10.8	113	12.5
Complications of surgical and medical care, nec (T80–T88)	360	50.0	97	52.2	457	50.4
Factors influencing health status and contact with health services (Z00–Z99)	**756**	**10.6**	**229**	**12.3**	**985**	**10.9**
Care involving use of rehabilitation procedures (Z50)	230	30.4	109	47.6	339	34.4
Other diseases and conditions (D50–D89, H00–H95, O00–Q99)	**60**	**0.8**	**69**	**3.7**	**129**	**1.4**
Total	**7,155**	**100**	**1,862**	**100**	**9,017**	**100**

Type of hospital

This section explores differences between hospitals which incorporate a spinal unit (listed in Table 2 of this report) and those hospitals without a spinal unit.

Overview

Overall, 44% (*n* = 8,819) of hospitalisations involved admissions to a hospital with a spinal unit (Table 20). Readmission separations accounted for 57% (*n* = 5,013) of all those admitted to hospitals with a spinal unit and 52% (*n* = 5,813) of those admitted to hospitals without a spinal unit. Overall, the average length of stay (ALOS) was almost three times longer in hospitals with a spinal unit, than when compared to hospitals without. For incident separations, the ALOS was 4.5 times longer in hospitals with a spinal unit, when compared to hospitals without. Also for hospitals with a spinal unit, the ALOS was almost 2.5 times longer for incident separations when compared to readmission separations, whereas for hospitals without a spinal unit, the ALOS was similar for both incident and readmission separations. These differences are likely to reflect treatment of more severe or complex cases at spinal units.

Table 20: Type of hospital by case type for SCI-related hospitalisations, Australia 1999–00 to 2004–05

	Hospitals with spinal unit			Hospitals without spinal unit			ALOS
Case type	Count	Per cent	ALOS	Count	Per cent	ALOS	ratio
Incident separations	3,806	43.2	51.0	5,280	47.6	11.3	4.5
Readmission separations	5,013	56.8	20.8	5,813	52.4	12.0	1.7
Total	**8,819**	**100.0**	**33.8**	**11,093**	**100.0**	**11.6**	**2.9**

Type of episode of care

Acute care admissions accounted for the bulk of all hospitalisations for both hospitals with a spinal unit (77%, *n* = 6,813) and hospitals without a spinal unit (87%, *n* = 9,654) (Table 21). Those admitted to hospitals with a spinal unit were more than two times more likely to receive rehabilitation care than those admitted to hospitals without a spinal unit. On average, those admitted to acute care within hospitals with a spinal unit, experienced an ALOS almost three times that of those admitted to acute care within hospitals without a spinal unit. The equivalent comparison for those admitted to rehabilitation care resulted in a ratio of just over two.

Table 21: Type of hospital by type of episode of care for SCI-related hospitalisations, Australia 1999–00 to 2004–05

	Hospitals with spinal unit			Hospitals without spinal unit			ALOS
Type of episode of care	Count	Per cent	ALOS	Count	Per cent	ALOS	ratio
Acute care	6,813	77.3	26.0	9,654	87.0	9.0	2.9
Rehabilitation care	1,971	22.3	59.8	1,173	10.6	29.0	2.1
Palliative care	..	..	66.0	21	0.2	16.6	4.0
Other	34	0.4	103.0	245	2.0	31.2	3.3
Total	**8,819**	**100**	**33.8**	**11,093**	**100**	**11.6**	**2.9**

.. Cell counts in tables that are 4 cases or fewer have been suppressed, as have rates derived from them, to protect confidentiality.

Incident admissions

The cases used in this section of the report differ slightly from the 'Incident cases' as defined on page 3 of this report in that they also include cases where the patient was transferred from another acute hospital. This modification is to take account of cases where a patient is transported to a hospital close to place of occurrence of injury (e.g. a rural hospital) for initial treatment prior to be transferred to a hospital with a spinal unit.

Principal diagnosis

Patients admitted to a hospital with a spinal unit were far more likely to have sustained a complete lesion of the either the cervical or thoracic spinal cord than patients admitted to a hospital without a spinal unit (Table 22). 12% of patients admitted directly to a hospital with a spinal unit and 16% of patients admitted to this type of hospital after being transferred from another acute care hospital had a complete lesion of the cervical spinal cord. The equivalent percentages for a complete lesion of the thoracic spinal cord were 13% and 14% respectively. The comparative percentages for hospitals without a spinal unit were 1.1% and 3.1% for patients with a complete lesion of the cervical spinal cord, and 1.6% and 2.1% for patients with a complete lesion of the thoracic spinal cord. Patients admitted to hospital without a spinal unit were also much more likely to be recorded as having unspecified spinal cord injuries.

Table 22: Type of hospital by percentage of incident admissions by Principal Diagnosis, Australia 1999–00 to 2004–05

	Hospitals with spinal unit		Hospitals without spinal unit	
Principal Diagnosis	**Direct admission**	**Via another acute hospital**	**Direct admission**	**Via another acute hospital**
Concussion and oedema of cervical spinal cord	2.8	2.7	1.8	5.0
Injury of cervical spinal cord, unspecified	5.3	4.6	23.5	19.9
Complete lesion of cervical spinal cord	11.6	16.1	1.1	3.1
Central cord syndrome (incomplete cord injury) of cervical spinal cord	11.8	12.1	3.8	3.7
Other incomplete cord syndrome of cervical spinal cord	15.2	15.0	3.9	5.5
Concussion and oedema of thoracic spinal cord	0.5	1.2	0.5	1.6
Injury of thoracic spinal cord unspecified	1.6	2.4	6.4	6.5
Complete lesion of thoracic spinal cord	13.1	13.9	1.6	2.1
Incomplete cord syndrome of thoracic spinal cord	6.3	7.8	1.8	3.9
Other injury of lumbar spinal cord [conus medullaris]	8.5	8.1	9.2	8.9
Injury of spinal cord, level unspecified	1.9	0.8	10.4	3.7
Other Principal Diagnoses	21.4	15.3	35.8	36.1
Total	**100**	**100**	**100**	**100**

Mode of separation

Patients admitted to a hospital with a spinal unit were much more likely to undergo a statistical discharge than patients admitted to a hospital without a spinal unit (Table 23). This type of separation usually occurs in cases requiring a long period in hospital, and typically marks an internal transfer to a rehabilitation service. The proportion of cases transferred to other acute hospitals was high and similar for both types of hospitals, whilst patients admitted to a hospital without a spinal unit were more likely to be discharged to their place of usual residence, suggesting relatively low severity.

Table 23: Type of hospital by percentage of each mode of separation for incident admissions, Australia 1999–00 to 2004–05

	Hospitals with spinal unit		Hospitals without spinal unit	
Mode of separation	Direct admission	Via another acute hospital	Direct admission	Via another acute hospital
Trans—other acute	43.2	49.4	54.3	39.5
Trans—nursing	0.6	1.3	0.4	1.0
Trans—other health	0.3	0.8	0.9	1.3
Stat disch—type change	17.7	14.5	2.6	4.7
Discharge at own risk	0.9	0.6	0.6	0.3
Died	4.5	5.6	3.2	7.3
Other—usual residence	32.8	27.7	37.8	45.5
Total	**100**	**100**	**100**	**100**

Patients admitted to a hospital with a spinal unit experienced much longer average lengths of stay than patients admitted to a hospital without a spinal unit (Table 24).[4] Patients admitted directly to a hospital with a spinal unit experienced an average length of stay (ALOS) of 42.4 days, while patients admitted to this type of hospital after being transferred from another acute care hospital experienced an ALOS of 54.3 days, not including the time spent at the referring hospital. The equivalent values for patients admitted to a hospital without a spinal unit were 5.7 and 15.8 days respectively. Patients who were eventually transferred to a nursing home had the longest ALOS regardless of the type of hospital to which they were admitted.

Table 24: Type of hospital by average length of stay (days) of each mode of separation for incident admissions, Australia 1999–00 to 2004–05

	Hospitals with spinal unit		Hospitals without spinal unit	
Mode of separation	Direct admission	Via another acute hospital	Direct admission	Via another acute hospital
Trans—other acute	37.8	44.0	4.5	9.7
Trans—nursing	198.0	166.1	43.3	90.5
Trans—other health	41.0	154.3	11.7	20.4
Stat disch—type change	38.9	33.5	20.5	18.3
Disch own risk	34.8	35.7	3.4	2.0
Died	10.8	40.6	5.6	10.9
Other—usual residence	52.0	78.8	6.0	20.0
Total	**42.4**	**54.3**	**5.7**	**15.8**

[4] The length of stay data presented here are per separation, because the data are not person-linked.

Rehabilitation cases

Nature of spinal cord injury

As with incident admissions, patients admitted for rehabilitation care to a hospital with a spinal unit were far more likely to have sustained a complete lesion of either the cervical or thoracic spinal cord than patients admitted to a hospital without a spinal unit (Table 25). Close to 20% of patients admitted to a hospital with a spinal unit had a complete lesion of the cervical spinal cord, while a further 19% had a complete lesion of the thoracic spinal cord. The equivalent percentages for patients admitted to a hospital without a spinal unit were 3% and 2.3% respectively.

Table 25: Type of hospital by nature of spinal cord injury for rehabilitation cases, Australia 1999–00 to 2004–05

	Hospital with spinal unit		Hospital without spinal unit	
Nature of spinal cord injury	**Count**	**Per cent**	**Count**	**Per cent**
Concussion and oedema of cervical spinal cord	17	1.3	36	4.4
Injury of cervical spinal cord, unspecified	40	3.0	104	12.7
Complete lesion of cervical spinal cord	264	19.5	25	3.0
Central cord syndrome (incomplete cord injury) of cervical spinal cord	160	11.8	91	11.1
Other incomplete cord syndrome of cervical spinal cord	251	18.5	86	10.5
Concussion and oedema of thoracic spinal cord	..	0.3	..	1.1
Injury of thoracic spinal cord unspecified	20	1.5	46	5.6
Complete lesion of thoracic spinal cord	250	18.5	19	2.3
Incomplete cord syndrome of thoracic spinal cord	106	7.8	33	4.0
Concussion and oedema of lumbar spinal cord	..	0.2	..	0.2
Other injury of lumbar spinal cord	103	7.6	59	7.2
Nature of SCI not specified	136	10.0	311	37.9
Total	**1,354**	**100**	**821**	**100**

.. Cell counts in tables that are 4 cases or fewer have been suppressed, as have rates derived from them, to protect confidentiality.

Complications of spinal cord injury

The distribution of types of complications of spinal cord injury was similar for both types of hospital (Table 26). The most prominent complications included urinary tract infections, bacterial infections and pressure ulcers. Almost 71% (n = 2,823) of patients admitted to a hospital with a spinal unit had at least one of the complications listed in Table 23 compared to 66% of patients admitted to a hospital without a spinal unit. Notably, 45% (n = 4,013) of readmissions were to a hospital with a spinal unit, despite the total numbers of admissions to this type of hospital representing only a very small percentage of all hospital admissions. In nearly three-quarters of hospitalisations the Principal Diagnosis was a complication of SCI, indicating that in most instances the complication was the cause of the hospital admission and was not acquired while the patient was undergoing treatment in hospital.

Table 26: Type of hospital by type of complication of spinal cord injury for readmission separations, Australia 1999–00 to 2004–05

	Hospitals with spinal unit		Hospitals without spinal unit	
Type of complication	**Count[(a)]**	**Per cent**	**Count[(a)]**	**Per cent**
Sepsis (A41)	120	3.0	250	5.0
Streptococcus/Staphylococcus infection (B95)	554	13.8	748	14.9
Other bacterial infection (B96)	952	23.7	1,107	22.1
Bladder cancer (C67)	36	0.9	38	0.8
Autonomic dysreflexia (G90.8)	283	7.1	135	2.7
Spinal cord disease (G95)	192	4.8	59	1.2
Hypertension (I10)	244	6.1	337	6.7
Pulmonary embolism (I26)	16	0.4	21	0.4
Deep vein thrombosis (I80.2)	22	0.5	29	0.6
Hypotension (I95)	130	3.2	142	2.8
Pneumonia (J12–J18)	150	3.7	256	5.1
Atelectasis (J98.1)	52	1.3	42	0.8
Dorsalgia (M54)	109	2.7	192	3.8
Osteoporosis (M80–M82)	27	0.7	40	0.8
Renal failure (N17–N19)	125	3.1	181	3.6
Urolithiasis (N20–N23)	244	6.1	172	3.4
Disorders of the bladder (N30–N32)	688	17.1	372	7.4
Urinary tract infection (N39.0)	976	24.3	1,174	23.5
Cellulitis (L03)	145	3.6	250	5.0
Pressure ulcer (L89)	776	19.3	1,005	20.1
Spasticity (R25.2)	122	3.0	50	1.0
At least one complication from above	2,823	70.6	3,313	66.2
Total	**4,013**		**5,004**	

(a) Includes complications normally associated with spinal cord injury. It is possible that some complications may not be as a direct result of sustaining a spinal cord injury.

(b) Includes all readmissions where at least one of the listed complications appears in any diagnosis field.

Combination of admission and separation codes

Combinations of admission and separation codes by hospital type are presented in Table 27. Overall, those admitted to hospitals with a spinal unit (33%, *n* = 2,903), were almost three times more likely to have been transferred from another hospital than those admitted to hospitals without a spinal unit (12%, *n* = 1,349) and almost twice as likely to have undergone a statistical admission-type within the same hospital. Over 83% (*n* = 9,227) of admissions to hospitals without spinal units were from sources other than other acute hospitals or statistical admission—type changes compared to only 59% (*n* = 5,202) for hospitals with a spinal unit. Patients admitted to hospitals with a spinal unit were also more likely to have a longer length of stay, regardless of their mode of admission.

When looking at mode of separation, 60% (*n* = 5,325) of separations from hospitals with a spinal cord unit were to the patients usual residence, while a further 25% (*n* = 2,232) were to another acute hospital. The corresponding values for hospitals without spinal units were similar at 63% (*n* = 6,978) and 26% (2,893) respectively.

This pattern of admission sources and separation destinations is broadly as expected:

- cases from hospitals without a spinal unit are often transferred to another acute hospital (presumably often one with a spinal unit, but this cannot be confirmed without person-linked data)
- stays tend to be longer at hospitals with a spinal unit, reflecting the expected concentration of severe cases. Length of stay per separation record is not a good measure of total length of stay for these patients: The high frequency of statistical type change indicates that many patients had more than one separation episode in the course of their treatment at a single hospital. Again case-level data linkage is required to assess this thoroughly.

Table 27: Combination of admission and separation codes by type of hospital for spinal cord injury separations, Australia 1999–00 to 2004–05

Combination of admission and separation codes	Hospitals with spinal unit			Hospitals without spinal unit		
	Count	Per cent	ALOS	Count	Per cent	ALOS
Transferred from another hospital and :–						
transferred to another acute hospital	1,323	45.6	44.7	371	27.5	17.3
transferred to nursing home	30	1.0	140.0	29	2.1	64.0
transferred to other health facility	40	1.4	79.6	10	0.7	20.3
statistical discharge—type change	202	7.0	40.5	86	6.4	36.3
discharged at own risk	16	0.6	42.4	9	0.7	19.7
statistical discharge leave	18	0.6	43.1	7	0.5	28.1
died in hospital	73	2.5	35.0	56	4.2	29.6
discharged to usual residence	1,199	41.3	62.3	778	57.7	26.2
other type of separation	..	..	9.5	..	..	96.0
Total transferred from another hospital	**2,903**	**32.9**	**52.9**	**1,349**	**12.2**	**25.4**
Statistical admission—type change and :–						
transferred to another acute hospital	46	6.5	42.9	43	8.9	39.6
transferred to nursing home	6	0.8	67.5	31	6.4	60.7
transferred to other health facility	16	2.3	49.3	8	1.7	22.1
statistical discharge—type change	338	47.5	38.6	155	32.2	26.7
discharged to usual residence	298	41.9	55.2	221	45.9	29.8
other type of separation	7	1.0	57.1	23	4.8	28.7
Total statistical admission-type change	**711**	**8.1**	**46.5**	**481**	**4.3**	**31.4**
Other admission and :–						
transferred to another acute hospital	863	16.6	28.1	2,479	26.9	6.6
transferred to nursing home	52	1.0	36.6	125	1.4	21.9
transferred to other health facility	84	1.6	15.2	67	0.7	11.5
statistical discharge—type change	216	4.2	41.0	254	2.8	28.5
discharged at own risk	51	1.0	27.2	92	1.0	7.4
statistical discharge leave	9	0.2	13.8	7	0.1	19.0
died in hospital	95	1.8	35.5	210	2.3	9.6
discharged to usual residence	3,828	73.6	18.4	5,979	64.8	8.1
other type of separation	..	..	1.8	14	0.2	9.2
Total other admission	**5,202**	**59.0**	**21.5**	**9,227**	**83.2**	**8.5**
Total admission type unknown	**..**	**..**	**51.5**	**36**	**0.3**	**39.6**
Total	**8,819**	**100.0**	**33.8**	**11,093**	**100.0**	**11.6**

.. Cell counts in tables that are 4 cases or fewer have been suppressed, as have rates derived from them, to protect confidentiality

Procedures during hospitalisation

Incident separations

Overall, 91% (*n* = 3,448) of incident hospitalisations involving admission to a hospital with a spinal unit resulted in at least one form of allied health intervention, compared to only 45% (*n* = 2,377) of incident hospitalisations involving admission to hospital without a spinal unit (Table 28). The most common form of intervention for both types of hospital was physiotherapy. Those admitted to a hospital with a spinal unit (48%, *n* = 1,823) were also more likely to have some form of spinal procedure, than those admitted to a hospital without a spinal unit (39%, *n* = 2,051). The most common forms of spinal procedure for both types of hospitals were computerised tomography of spine, magnetic resonance imaging and some form of spinal repair. Those admitted to a hospital with a spinal unit were also more likely to undergo procedures such as continuous ventilatory support and airway management.

Table 28: Medical procedures by type of hospital for incident spinal cord injury separations, Australia, 1999–00 to 2004–05

	Hospitals with spinal unit		Hospitals without spinal unit	
Hospital procedures	**Count**	**Per cent**	**Count**	**Per cent**
Generalised allied health intervention	**3,448**	**90.6**	**2,377**	**45.0**
Physiotherapy	3,289	95.4	2,114	88.9
Occupational therapy	2,508	72.7	1,274	53.6
Social work	2,398	69.5	1,074	45.2
Dietetics	1,315	38.1	566	23.8
Other	2,086	60.5	962	40.5
Spinal procedures	**1,823**	**47.9**	**2,051**	**38.8**
Computerised tomography of spine	877	48.1	1,376	67.1
Magnetic resonance imaging of spine	1,076	59.0	880	42.9
Repair of spine	782	42.9	349	17.0
Incision of spinal canal and spinal cord structures	304	16.7	263	12.8
Reduction of spine	357	19.6	197	9.6
Excision of spinal canal and spinal cord structures	145	8.0	153	7.5
Excision of spine	194	10.6	82	4.0
Application, insertion or removal of spine	116	6.4	74	3.6
Application, insertion or removal of spinal cord and spinal cord structures	55	3.0	63	3.1
Repair of spinal canal and spinal cord structures	16	0.9	35	1.7
Other procedures on spinal canal and spinal cord structures	13	0.7	22	1.1
Other procedures on spine	16	0.9	22	1.1
Continuous ventilatory support	**577**	**15.2**	**452**	**8.6**
Airway management	**215**	**5.6**	**112**	**2.1**
Procedure involving bladder	**430**	**11.3**	**149**	**2.8**
Other procedures	**60**	**1.6**	**256**	**4.8**
Total	**3,806**		**5,280**	

Readmission separations

Overall, 49% (n = 2,442) of readmission hospitalisations involving admission to a hospital with a spinal unit and 43% (n = 2,494) of readmission hospitalisations involving admission to a hospital without a spinal unit received some form of allied health intervention, with physiotherapy being the most common form of intervention for both types of hospitals (Table 29). Spinal procedures were relatively uncommon for readmitted patients, with 9% of those admitted to a hospital with a spinal unit and 5% of those admitted to a hospital without a spinal unit undergoing at least one of these types of procedures. Procedures involving the bladder were relatively prominent with 22% of those admitted to a hospital with a spinal unit undergoing at least one of these types of procedures, double the figure of 11% for those admitted to a hospital without a spinal unit.

Table 29: Medical procedures by type of hospital for readmission spinal cord injury separations, Australia, 1999–00 to 2004–05

	Hospitals with spinal unit		Hospitals without spinal unit	
Hospital procedures	**Count**	**Per cent**	**Count**	**Per cent**
Generalised allied health intervention	**2,442**	**48.7**	**2,494**	**42.9**
Physiotherapy	1,805	73.9	1,734	69.5
Occupational therapy	1,127	46.2	1,054	42.3
Social work	1,025	42.0	870	34.9
Dietetics	754	30.9	758	30.4
Other	759	31.1	705	28.3
Spinal procedures	**447**	**8.9**	**262**	**4.5**
Application, insertion or removal of spinal cord and spinal cord structures	185	41.4	126	48.1
Magnetic resonance imaging of spine	160	35.8	63	24.0
Computerised tomography of spine	71	15.9	44	16.8
Incision of spinal canal and spinal cord structures	29	6.5	35	13.4
Repair of spine	29	6.5	24	9.2
Other procedures on spinal canal and spinal cord structures	35	7.8	14	5.3
Excision of spinal canal and spinal cord structures	12	2.7	16	6.1
Reduction of spine	6	1.3	6	2.3
Other procedures on spine	72	16.1	27	10.3
Continuous ventilatory support	**99**	**2.0**	**156**	**2.7**
Airway management	**131**	**2.6**	**86**	**1.5**
Procedure involving bladder	**1,087**	**21.7**	**627**	**10.8**
Other procedures	**964**	**19.2**	**1,152**	**19.8**
Total	**5,013**		**5,813**	

Discussion

During the six year period from 1 July 1999 to 30 June 2005 there were 19,912 hospital separations involving some form of spinal cord injury (SCI). Notably, 54% (*n* = 10,826) of these separations were readmissions related to complications of spinal cord injuries sustained at an earlier time. This highlights the serious nature of SCI and the long-term effects on quality of life for a significant proportion of people who sustain these injuries.

The number of incident cases was estimated to be 4,592 (average of 765 cases per year). Incident rates of SCI remained relatively steady for both males and females over the reported period. This was as expected, since hospitalisation rates for transportation and fall-related injury – two of the major external causes of SCI – have remained steady over this period (Berry & Harrison 2007). Hospitalisation rates for males were generally significantly higher than for females across all age groups for incident cases. This is most likely a reflection of different behaviour and risk factor exposure patterns between the two genders.

Notably, almost 50% of all incident cases sustained a lesion to the cervical spinal cord, although of these, only 8% were recorded as having a complete lesion. However, these figures are likely to under-estimate the number of cases, since for 23% of cases, no type of spinal cord lesion was assigned. This appears to be contrary to published coding standards, which indicate that for all SCI-related cases, the type of spinal cord lesion should always be coded first (NCCH 2002).

Transportation-related accidents accounted for over 47% of all incident SCI hospitalisations for both males and females. This is not unexpected since these types of events are likely to involve high-speed impacts. Fall-related injuries were also prominent, accounting for a further 33% of all SCI hospitalisations for males, and a further 32% for females. Falls from heights, including falls from ladders, falls from buildings and diving into shallow water can often result in the person's head making heavy contact with a hard surface, resulting in the spinal cord being either stretched or severed.

During the study period, the annual number of SCI rehabilitation cases nearly doubled. The reason for this increase is not clear, although marked rises in some states between years may reflect administrative or procedural changes. Hospitals which incorporated a spinal unit accounted for over 62% of all rehabilitation cases, presumably reflecting the fact that patients with serious SCI which requires rehabilitation are likely to be transferred to one of these hospitals. Almost three-quarters of rehabilitation cases had an allied health intervention as their principal procedure, which was physiotherapy in more than half of the cases.

The number of readmission cases increased by about 80% between 2001–02 and 2004–05. As for the rise in rehabilitation cases, the reasons for this increase are not clear, but may also reflect administrative changes within some jurisdictions.

Over 95% of readmission cases involved an acute episode of care, suggesting that most readmissions involved complications of a relatively serious nature. Almost 20% of readmissions involved patients with a Principal Diagnosis relating to a disease of the genitourinary system, while a further 13% had a Principal Diagnosis relating to a disease of the skin and subcutaneous tissue, predominantly pressure ulcers. This pattern is in keeping with known patterns of complications of SCI.

SCI patients admitted to a hospital that incorporates a spinal care unit had a length of stay that was, on average, almost three times as long as for SCI patients admitted to

other hospitals. When looking at incident hospitalisations only, this figure increased to four and a half times for hospitals with a spinal unit. Longer durations are to be expected at the specialised centres, because they are the setting for definitive care and rehabilitation, and the likely destination for serious cases.

For incident separations, those admitted to a hospital with a spinal unit were about two times more likely than those admitted to a hospital without a spinal unit to receive some form of general health intervention, particularly physiotherapy and occupational therapy. They were also more likely to require continuous ventilatory support, airway management and undergo procedures related to bladder problems. As for the longer length of stay in the specialised units, these differences are likely to be due to patients with more serious forms of SCI tending to be transferred to a hospital with a spinal unit.

A major limitation of this study is that we were not able to link the separation records that refer to the same person. For example, a person sustaining a SCI might be admitted to a regional hospital for initial stabilisation and assessment, be transferred to a larger urban hospital for advanced acute care, then to a spinal unit for further care and rehabilitation. A few months later the person is readmitted to hospital following complications related to their SCI. This sequence of events would result in the creation of four hospital records all related to a single injury event. The ability to link these records would allow for a far more accurate estimate of incident SCI cases to be determined. It would also enable a more accurate assessment of the length of stay in hospital of individual patients and the burden placed on the community by various types of SCI.

Another useful form of linkage would be the ability to link hospital records for patients admitted with a SCI to records contained within the Australian Spinal Cord Injury Register (ASCIR). A NSW study utilised this method of linkage to investigate the frequency, cause and duration of re-hospitalisations of individuals with SCI living in the community (Middleton et al. 2004). The authors concluded that incorporating linkage into their study design enabled them to overcome the limitations of previous studies such as the inability to separate planned and unplanned hospitalisations, as well as the inability to reliably identify where hospitalisations were for medical purposes only. They argued that this information is invaluable to health-care providers, consumers and administrators alike, allowing more considered planning of service models and facilities with projections of future care requirements and resource allocation necessary for both the treatment and prevention of secondary complications after SCI.

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