ORIGINAL ARTICLE

A population-based study comparing traumatic spinal cord injury and non-traumatic spinal cord injury using a national rehabilitation database

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Study design: A limitation of many studies of non-traumatic spinal cord injury (NT-SCI) and traumatic spinal cord injury (T-SCI) is potential lack of generalizability because of selection bias. An open cohort study using a national rehabilitation database was planned to address this.

Objective: To compare the demographic characteristics and outcomes between NT-SCI and T-SCI patients.

Setting: Rehabilitation hospitals in Australia.

Methods: The Australasian Rehabilitation Outcomes Centre maintains a national database of information on in-patients admitted to almost all (130/145 as at 2006) public and private rehabilitation hospitals in Australia. It collects a range of demographic and clinical outcomes. Patients were included if they were discharged between 1 January 2002 and 31 December 2006. Patients were excluded if they were admitted for <7 days, only for assessment or were a readmission.

Results: There were 3610 patients included (NT-SCI, $n=2241$, 62.1%; T-SCI, $n=1361$, 37.7%). There were numerous significant differences between NT-SCI and T-SCI patients. NT-SCI patients were generally older (median age NT-SCI 67 years vs T-SCI 46 years, $P=0.000$), less likely to be male (male NT-SCI 52.5% vs T-SCI 71.6%, $P=0.000$) and had a shorter length of stay (median NT-SCI 21 days vs T-SCI 44 days, $P=0.000$). NT-SCI patients were also less disabled than T-SCI patients, having higher Functional Independence Measure motor subscale score on admission (median NT-SCI 53 vs T-SCI 38, $P=0.000$) and discharge (median NT-SCI 76 vs T-SCI 74, $P=0.000$).

Conclusion: Previous demographic studies of NT-SCI and T-SCI patients are similar to our population-based results. More population-based research in SCI is required.

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Introduction

Spinal cord injury (SCI) is one of the most devastating conditions possible. There are numerous studies that have been published over many years involving traumatic spinal cord injury (T-SCI) patients that described their demographic characteristics and outcomes.^{1–5} Non-traumatic spinal cord injury (NT-SCI), by comparison, has not been as well studied until relatively recently.^{6–8} A small number of studies have compared samples of both T-SCI and NT-SCI patients from the same population.^{9–13}

A major limitation of many of the studies of T-SCI is the restricted number of participating centres that these patients are admitted to. For example, in the United States, the Model System collects data from only approximately 15% of patients with T-SCI.³ The Australian SCI Register only collects data from the six main SCI units.¹⁴ These units, however, focus on T-SCI.¹⁵ They do not admit all T-SCI patients and usually exclude those with NT-SCI.¹⁶ In addition, most studies of NT-SCI are based on results from a single centre and many are limited by the relatively small sample size. These issues raise concern about the potential for type II error and a lack of generalizability of the results because of selection bias of the study sample.

This project planned to perform an open cohort population-based study using a national database of in-patient rehabilitation admissions to study the demographic charac-

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teristics and rehabilitation outcomes for patients with T-SCI and NT-SCI. The primary objective was to compare the results for these two groups of patients with each other, and with previous studies.

The Functional Independence Measure (FIM) is the most widely used, valid and reliable measure of the severity of disability and rehabilitation outcome,¹⁷ including SCI. It is an ordinal scale that has been shown to consist of two separate domains, a 13-item motor and a 5-item cognitive subscale.¹⁸ A previous study has shown a major ceiling effect for the FIM cognition subscale in patients with T-SCI.¹⁹ This is noteworthy because ceiling and floor effects cause a lack of precision in detecting meaningful change at the upper or lower extremes of a scale and reduce the utility of the scales. It has also been reported that this effect occurs in NT-SCI patients, but the sample was relatively small.²⁰ Therefore, a secondary objective of this paper was to determine the ceiling effect of the FIM subscales in SCI patients.

Another secondary objective was to perform a series of regression analyses on both the T-SCI and NT-SCI cohorts to examine which variables had the most significant influence on the length of stay (LOS) in rehabilitation and the change in the FIM motor subscale during the course of the rehabilitation admission.

Materials and methods

Setting and participants

The Australasian Rehabilitation Outcome Centre (AROC) was established in July 2002 as a joint initiative of the Australian rehabilitation sector, including providers, payers, regulators and consumers (<http://chsd.uow.edu.au/aroc/>). AROC maintains a national database of information for in-patients admitted to public and private rehabilitation hospitals in Australia.^{21,22} By 2006, the coverage of AROC had expanded to include 130 of the 145 rehabilitation units in Australia at that time, with a participation rate at this point of >90%. AROC uses separate impairment classification codes for T-SCI and NT-SCI. Five of the seven spinal rehabilitation units in Australia contributed data to AROC during the study period.

Data submitted to AROC are compiled according to a standard data set of items. Data received by AROC are reviewed for any missing data, errors or inconsistencies. An audit report is then provided to each facility with the request that highlighted episodes be reviewed and amended if necessary. Any revised results are resubmitted to AROC. Staff using the FIM are required to be appropriately trained in its use and to sit a credentialing examination every 2 years. This is to ensure consistency in reporting. These processes are designed to optimize the quality of the data in the AROC database.

All patients with a primary diagnosis of SCI as the reason for inpatient rehabilitation discharged between 1 January 2002 and 31 December 2006 were included in the study sample. Patients were excluded if they were admitted for <7 days, admitted only for assessment or were recorded as

a readmission for the management of late complications and not a recent-onset SCI.

Variables

Demographic details and outcome information were extracted from the AROC data set for patients with SCI. The demographic information included age on admission, gender, usual accommodation and living arrangements before admission and after discharge and premorbid employment status. Clinical information included the level of injury in broad categories (paraplegia or tetraplegia), LOS and the admission and discharge FIM.

Statistical methods

It was planned to compare the demographic characteristics and outcomes for patients with T-SCI to those with NT-SCI. Categorical outcomes (for example, gender and level of SCI) were analysed using the χ^2 -test. The Mann-Whitney test was used to analyse differences in non-normally distributed data, such as age, LOS and FIM motor subscale scores.

For each of the two regression models (dependent variables FIM motor change and LOS) the following independent variables were considered: age, gender, FIM motor admission, level of injury (paraplegia vs tetraplegia), accommodation at episode end, mode of episode end and either FIM motor change or LOS, depending upon the model.

No formal sample size calculations were performed. The number of SCI patients discharged during the study period determined the sample size. *P*-values of ≤ 0.05 were deemed statistically significant. Any missing data were excluded from analysis relevant only to that field. The LOS and FIM results excluded those episodes in which the patient died during in-patient rehabilitation. We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research.

Results

There were a total of 3610 patients with SCI discharged from in-patient rehabilitation at contributing AROC hospitals over the study period. There were many more patients admitted with NT-SCI than with T-SCI (Table 1). Compared with T-SCI patients, those with NT-SCI tended to be older, more likely to be female, have paraplegia, need shorter in-patient admissions and have less physical disability on admission to in-patient rehabilitation and achieve a similar level of function on discharge as measured by the FIM motor subscale. Both groups showed a significant improvement in their physical disability between admission and discharge (NT-SCI Mann-Whitney $Z = -36.0$, $P = 0.000$; T-SCI Mann-Whitney $Z = -28.1$, $P = 0.000$), as measured by the FIM motor subscale, with the T-SCI cohort tending to have a larger increase.

Most NT-SCI and T-SCI patients lived in a private residence premorbidly and were subsequently discharged from rehabilitation back to a private residence. There were no differences between the cohorts regarding the proportions

Table 1 Demographic characteristics

	NT-SCI	T-SCI	P-value
n, %	2246 (62.1%)	1364 (37.7%)	
Median age (IQR)	67 (52–77)	46 (29–66.5)	$Z = -20.5^a$, $P = 0.000$
Male	1179 (52.5%)	976 (71.6%)	$\chi^2 = 128.5^b$, $P = 0.000$
Level of SCI ^{c,d}			
Paraplegia	761 (69.2%)	497 (49.6%)	$\chi^2 = 84.6^b$, $P = 0.000$
Tetraplegia	338 (30.8%)	506 (50.4%)	
LOS median (IQR)	21 (11–45)	44 (17–98)	$Z = -15.0^a$, $P = 0.000$
Median FIM motor admission (IQR)	53 (33–70)	38 (23–63)	$Z = -11.0^a$, $P = 0.000$
Median FIM motor discharge (IQR)	76 (53–83)	74 (43–82)	$Z = -4.0^a$, $P = 0.000$
Median FIM motor change (IQR)	13 (4–23)	14 (4–34.25)	$Z = -4.2^a$, $P = 0.000$

Abbreviations: FIM, Functional Independence Measure; IQR, interquartile range; LOS, length of stay; NT-SCI, non-traumatic spinal cord injury; T-SCI, traumatic spinal cord injury.

^aMann–Whitney.

^b χ^2 test.

^cNT-SCI missing $n = 1142$.

^dT-SCI missing $n = 358$.

Table 2 Accommodation before SCI and at discharge

	Accommodation before SCI ^a		Accommodation at discharge ^b	
	NT-SCI (n = 1555) ^c	T-SCI (n = 1051) ^d	NT-SCI (n = 667) ^e	T-SCI (n = 338) ^f
Private residence	1507 (96.9%)	1004 (95.5%)	552 (82.8%)	329 (84.8%)
Hostel	19 (1.2%)	13 (1.2%)	16 (2.4%)	5 (1.3%)
Nursing home	5 (0.3%)	1 (0.1%)	30 (4.5%)	12 (3.1%)
Community	0 (0.0%)	1 (0.1%)	0 (0.0%)	2 (0.5%)
Boarding house	1 (0.1%)	0 (0.0%)	3 (0.4%)	0 (0.0%)
Transitional	1 (0.1%)	0 (0.0%)	10 (1.5%)	6 (1.5%)
Other	22 (1.4%)	32 (3.0%)	56 (8.4%)	34 (8.8%)

Abbreviations: NT-SCI, non-traumatic spinal cord injury; T-SCI, traumatic spinal cord injury.

^a $P = 0.06$, $\chi^2 = 3.4$, comparing private residence with all others combined.

^b $P = 0.4$, $\chi^2 = 0.7$, comparing private residence with all others combined.

^cMissing $n = 686$.

^dMissing $n = 310$.

^eMissing $n = 1574$.

^fMissing $n = 1023$.

living in a private residence or elsewhere (Table 2). There were, however, significant differences in the living arrangements between the different groups before and after SCI, with NT-SCI patients tending to live alone or with a spouse and T-SCI patients more likely to be living with family or spouse (Table 3). The employment status of patients showed significant differences between the groups, with more T-SCI patients in paid employment or studying before their injury and more NT-SCI patients retired or performing home duties (Table 4). There were no differences ($\chi^2 = 0.3$, d.f. = 1, $P = 0.6$) between the mode of separation for the SCI groups, comparing those who returned to their usual accommodation (NT-SCI = 80.8%, $n = 2129$ vs T-SCI = 80.0%, $n = 1303$) with the other alternatives combined (interim accommodation, another hospital, same ward, another ward in same hospital, change in classification from rehabilitation to another category, discharge at own risk and statistical discharge).

The LOS and FIM motor subscale scores are further compared between the SCI groups by the level of injury in

Table 5. For patients with paraplegia, those with NT-SCI tended to have a much shorter LOS, although the FIM motor score was similar on admission and lower at discharge when compared with T-SCI patients. For patients with tetraplegia, those with NT-SCI again tended to have a much shorter LOS, but in contrast to patients with paraplegia, their FIM motor scores were much higher than T-SCI patients on both admission and discharge.

FIM floor and ceiling effects

The FIM cognitive subscales for both groups of SCI patients showed a high ceiling effect. In NT-SCI patients the ceiling score (35) was observed in 53.5% of patients on admission and 57.8% at discharge. In T-SCI patients the corresponding results were 64.9 and 70.2%. For this reason the cognitive subscale of the FIM was not included in other comparisons presented in this paper. The FIM motor subscale, as expected, did not show any notable floor effect (13) on admission (<9%) or ceiling effect (91) on discharge (<3%) for both study groups.

Regression analysis

The regression analyses of variables influencing the FIM motor change between admission and discharge and LOS in rehabilitation for both T-SCI and NT-SCI patients are shown in Table 6. Regarding the FIM motor change, lower FIM motor score on admission and accommodation

Table 3 Living arrangements before admission and after discharge

	Living arrangements before admission ^a		Living arrangements after discharge ^b	
	NT-SCI n ^c (%)	T-SCI n ^d (%)	NT-SCI n ^e (%)	T-SCI n ^f (%)
Alone	191 (31.3%)	97 (26.4%)	120 (26.4%)	53 (18.5%)
Spouse	303 (49.6%)	134 (36.4%)	247 (54.3%)	112 (39.2%)
Family ^g	104 (17.0%)	119 (32.3%)	75 (16.5%)	98 (34.3%)
Other	13 (2.1%)	18 (4.9%)	13 (2.9%)	23 (8.0%)
Total	611	368	455	286

Abbreviations: NT-SCI, non-traumatic spinal cord injury; T-SCI, traumatic spinal cord injury.

^a $P = 0.000$, $\chi^2 = 40.4$, d.f. = 3.

^b $P = 0.000$, $\chi^2 = 45.8$, d.f. = 3.

^cMissing $n = 896$.

^dMissing $n = 636$.

^eMissing $n = 97$.

^fMissing $n = 43$.

^gIncluding family and spouse.

Table 4 Employment of SCI patients before admission

	NT-SCI ^a n ^b (%)	T-SCI ^a n ^c (%)
Student	10 (1.7%)	18 (4.8%)
Employed	101 (17.5%)	156 (41.4%)
Unemployed	35 (6.1%)	18 (4.8%)
Home duties	30 (5.2%)	7 (1.9%)
Retired	340 (59.0)	129 (34.2%)
Other	60 (10.4%)	49 (13.0%)
Total	576	377

Abbreviations: NT-SCI, non-traumatic spinal cord injury; T-SCI, traumatic spinal cord injury.

^a $P = 0.000$, $\chi^2 = 92.3$, d.f. = 5.

^bMissing $n = 1665$.

^cMissing $n = 984$.

at discharge had the most significant influence on this outcome for both NT-SCI and T-SCI patients. Paraplegia and older age were additional variables that significantly influenced a lower FIM motor change for T-SCI patients. Lower FIM motor score on admission resulted in a higher LOS for both NT-SCI and T-SCI patients, with accommodation at discharge also influencing LOS for NT-SCI patients and female gender resulting in a lower LOS in T-SCI patients.

Discussion

There were a number of important significant differences between NT-SCI and T-SCI patients identified in this study. The main findings were that in comparison with T-SCI patients, those with NT-SCI were generally older, less likely to be male, have a shorter rehabilitation LOS and be less disabled on admission. Although NT-SCI patients also tended to be less disabled on discharge, the difference between the groups and the difference in the amount of change in FIM motor scores between admission and discharge is of questionable clinical significance as it was very small. Regarding FIM motor scores for patients with paraplegia, there was no difference between NT-SCI and T-SCI patients on admission, but the T-SCI patients tended to have a greater gain. This contrasts with patients who had tetraplegia, in which NT-SCI patients tended to have a higher FIM motor score on admission, and on discharge. NT-SCI patients were much more likely to be living alone or with a spouse, both pre-morbidly and after discharge, and less likely to be in paid employment pre-morbidly and more likely to be retired or performing home duties.

A summary of key results from previous studies of T-SCI and NT-SCI patients is shown in Table 7 for ease of comparison with our results. Overall, it would appear that our findings suggest that the results of previous studies of samples of NT-SCI and T-SCI patients are a reasonably accurate reflection of the characteristics of the total rehabilitation population of SCI patients in Australia. It needs to be noted, however, that these studies were conducted at

Table 5 Level of SCI outcome comparisons

	NT-SCI ^a	T-SCI ^b	P-value
<i>Paraplegia</i>	<i>n</i> = 742	<i>n</i> = 486	
LOS (median, IQR)	35 (16–69)	56.5 (22–105)	$Z = -6.5^c$, $P = 0.000$
Paraplegia FIM motor admission median (IQR)	41 (29–60)	41.5 (32–64)	$Z = -1.7^c$, $P = 0.1$
Paraplegia FIM motor discharge median (IQR)	70 (42–81)	78 (67–82)	$Z = -7.2^c$, $P = 0.000$
	$Z = -20.4^c$, $P = 0.000$	$Z = -17.5^c$, $P = 0.000$	
<i>Tetraplegia</i>	<i>n</i> = 324	<i>n</i> = 488	
LOS (median, IQR)	36 (18–79)	74 (28–144)	$Z = -6.9^c$, $P = 0.000$
Tetraplegia FIM motor admission median (IQR)	30 (18–50.75)	22 (14–35)	$Z = -5.5^c$, $P = 0.000$
Tetraplegia FIM motor discharge median (IQR)	58 (28–78)	39 (23–78)	$Z = -2.7^c$, $P = 0.007$
	$Z = -13.4^c$, $P = 0.000$	$Z = -16.6^c$, $P = 0.000$	

Abbreviations: FIM, Functional Independence Measure; IQR, interquartile range; LOS, length of stay; NT-SCI, non-traumatic spinal cord injury; T-SCI, traumatic spinal cord injury.

^aNT-SCI: LOS paraplegia vs tetraplegia, Mann-Whitney $Z = -1.3$, $P = 0.2$.

^bT-SCI: LOS paraplegia vs tetraplegia, Mann-Whitney $Z = -4.1$, $P = 0.000$.

^cMann-Whitney.

Table 6 Regression analysis of variables influencing FIM motor change and rehabilitation LOS

	Unstandardized coefficients β (s.e.)	Standardized coefficients β	t, P-value
<i>FIM motor change</i>			
NT-SCI ^a			
Constant	21.12 (2.65)		8.0, 0.000
FIM motor—admission	−0.28 (0.054)	−0.34	−5.2, 0.000
Accommodation discharge	10.75 (2.46)	0.28	4.4, 0.000
T-SCI ^b			
Constant	40.18 (7.30)		5.5, 0.000
Accommodation discharge	15.90 (3.33)	0.30	4.8, 0.000
FIM motor—admission	−0.37 (0.077)	−0.34	−4.7, 0.000
Paraplegia	−7.41 (2.84)	−0.19	−2.6, 0.01
Age	−0.13 (0.060)	−0.14	−2.2, 0.03
<i>LOS</i>			
NT-SCI ^c			
Constant	79.08 (7.41)		10.6, 0.000
FIM motor—admission	−0.93 (0.15)	−0.39	−6.2, 0.000
Accommodation discharge	14.98 (6.86)	0.14	2.2, 0.03
T-SCI ^d			
Constant	173.39 (14.77)		11.7, 0.000
FIM motor—admission	−1.51 (0.22)	−0.41	−6.8, 0.000
Female	−22.83 (10.39)	−0.13	−2.2, 0.03

Abbreviations: FIM, Functional Independence Measure; LOS, length of stay; NT-SCI, non-traumatic spinal cord injury; T-SCI, traumatic spinal cord injury.

^aAdjusted $R^2 = 0.12$, ($F = 19.1$; $P < 0.000$).

^bAdjusted $R^2 = 0.19$, ($F = 4.9$; $P = 0.03$).

^cAdjusted $R^2 = 0.13$, ($F = 4.8$; $P = 0.03$).

^dAdjusted $R^2 = 0.19$, ($F = 4.8$; $P = 0.03$).

different points in time to ours. Comparisons with other publications are made difficult by different approaches to analysing results; for example, different researchers using means or medians, and the reporting of total FIM scores and not the motor subscale.

An up-to-date comparison of the demographic characteristics of SCI patients from both aetiologies would be helpful for health planning. A World Health Organization report on SCI is currently in the process of being compiled that should address this. In addition, an international project comparing NT-SCI cohorts in different countries is also in the early planning stages.

As others have noted, the FIM cognitive subscales for both groups of SCI patients showed a very high ceiling effect.^{19,20} In NT-SCI patients, this finding has previously only been reported in a small sample.²⁰ The results presented in this study are consistent with and similar to previous studies. Reproducing this finding in this study reinforces the previous assertion that this subscale has questionable utility for SCI patients of either aetiology.

There are a number of limitations of this project that need to be acknowledged. There are many items in the AROC data set that have missing data. A key reason for missing data in some items was the change to the AROC data set from version 1 to version 2 during the time over which the data for this project were collected. Although many items remained unchanged, there were several that were introduced and needed time to be included in the routine collection of each facility's practice. In particular, the newer data items, such as comorbidity and complications, were not well collected during the period of this study (and are therefore not reported here). Data items such as level of

injury, accommodation, living status and employment before SCI are collected for the vast majority of the time.

The coverage of the database as at 2006 was not complete for all rehabilitation hospitals. It is possible that the results from the non-participating rehabilitation units, including the two spinal units not submitting to AROC in 2006, may alter some of the findings. However, given the large numbers in the study cohort, it is unlikely that this would influence the results materially. This will need to be confirmed at a later date when these units hopefully are contributing data to AROC. We feel, therefore, that the results are generalizable to the whole Australian population.

It should be highlighted that the advantage of this study is that it is the most comprehensive population-based study of SCI rehabilitation outcomes reported to date. Therefore, it is likely that some of our results are generalizable to the SCI populations in other countries with similar population profiles and health issues to Australia. In particular, those most likely to be comparable are developed countries without third-party limitations on LOS. We feel that the results that are most likely to be generalizable to these countries are the predominance of NT-SCI, age, gender, level of injury, the trends of pre-morbid employment and the trends regarding FIM motor scores and LOS. The absolute values for the LOS and FIM motor score would depend on numerous health and social system supports that make direct comparisons difficult.

Implications

We recognize that there is a need to improve the participation of rehabilitation hospitals further, and steps are been

Table 7 Summary of previous studies of NT-SCI and T-SCI

Reference country	Institution	Year(s)	SCI group (NT-SCI/T-SCI)	Age	Male	LOS	FIM motor	Paraplegia	Employed	Discharged home	Other comments
Ones <i>et al.</i> ¹¹ Turkey	Single	2002–2005	Both NT-SCI = 63 T-SCI = 131	NT-SCI = 49.9 ^a T-SCI = 35.8 ^a	NT-SCI = 47.6% T-SCI = 69.5%	NT-SCI = 71.3 ^a T-SCI = 76.3 ^a	Admission ^{a,b} NT-SCI = 89.7 T-SCI = 74.4 Discharge ^{a,b} NT-SCI = 92.8 T-SCI = 87.7	NT-SCI = 82.5% T-SCI = 74.8%	NT-SCI = 34.9% T-SCI = 74.8	NR	
Pagliacci <i>et al.</i> ¹⁰ Italy	Multiple n = 37	1997–1999	Both NT-SCI = 349 T-SCI = 725	NT-SCI = 58 ^c T-SCI = 33.7 ^c	NT-SCI = 4:1 T-SCI = 1.6:1	NT-SCI = 57 ^c T-SCI = 122 ^c	NR	NR	NR	NT-SCI = 74.2% T-SCI = 83.1%	
Gupta <i>et al.</i> ¹² India	Single	2005–2007	Both NT-SCI = 38 T-SCI = 38	NT-SCI = 31.1 ^a T-SCI = 32.9 ^a	NT-SCI = 89.5% T-SCI = 42.1%	NT-SCI = 60.7 ^a T-SCI = 66.0 ^a	NR	NR	NR	NR	
McKinley <i>et al.</i> ⁹ USA	Single	1992–1999	Both NT-SCI = 87 T-SCI = 87	NR	NR	NT-SCI = 22.5 ^a T-SCI = 41.5 ^a	Admission ^a NT-SCI = 37.0 T-SCI = 36.7 Discharge ^a NT-SCI = 55.8 T-SCI = 68.0 Admission = 35 ^c Discharge = 71 ^c			NT-SCI = 85.1% T-SCI = 89.7%	
New ²⁰ Australia	Single	1995–1997	NT-SCI = 70	NT-SCI = 69 ^c	NT-SCI = 45.7%	NT-SCI = 55 ^c		NT-SCI = 67.2%	NT-SCI = 20%	NT-SCI = 77.4%	Alone Before SCI = 42.9% After SCI = 21.0% Family Before SCI = 52.9% After SCI = 54.8%
Eastwood <i>et al.</i> ⁴ USA	Multiple n = NR	1990–1997	T-SCI = 3904		T-SCI = 80.9%	T-SCI = 60.8 ^a	NR	50.7%	T-SCI = 54.9	T-SCI = 91.2%	
Tooth <i>et al.</i> ⁵ Australia	Single	1993–1998	T-SCI = 167	T-SCI = 34.9 ^a	T-SCI = 77.8%	T-SCI = 83.0 ^c	Admission = 35.5 ^a Discharge = 67.3 ^a	39.0%	NR	T-SCI = 75.4%	Alone Before SCI = 19.8% After SCI = 7.1% Family Before SCI = 70.1% After SCI = 80.2%
van der Putten <i>et al.</i> ⁶ UK	Single	1993–1997	NT-SCI = 100	NT-SCI = 35 ^a	NT-SCI = 54%	NT-SCI = 31.5 ^a	NT-SCI	NR	NR	NR	
Oosterthum <i>et al.</i> ¹³ The Netherlands	Multiple n = 11	2002–2007	Both NT-SCI = 503 T-SCI = 416	NT-SCI = 57.2 ^a T-SCI = 43.4 ^a	NT-SCI = 54.5% T-SCI = 73.5%	NT-SCI = 109.5 ^c T-SCI = 207.0 ^c	Admission = 64 ^c NR	NT-SCI = 75.8% T-SCI = 50.4%	NR	NR	

Abbreviations: FIM, Functional Independence Measure; LOS, length of stay; NR, not reported; NT-SCI, non-traumatic spinal cord injury; T-SCI, traumatic spinal cord injury.

^aMean.^bFIM total score, not subscale.^cMedian.

taken to try and facilitate this. There is an ongoing need to improve the quality of data, and in particular, to address the problem of missing data mentioned above. AROC has instigated a number of measures that have improved the quality of the data significantly since 2006. It is anticipated that the analyses reported in this study will be repeated in the future to assess any important trends in outcomes. The next phase of research involving AROC data on SCI patients is a plan to perform analyses exploring the differences between patients managed in specialist SCI rehabilitation units compared with those managed in non-specialist rehabilitation units.

It is suggested that population-based studies involving SCI patients of both T-SCI and NT-SCI aetiology are required in different countries to enable more appropriate comparisons to be made. Researchers are encouraged to consider the results of this study when planning future projects. In particular, because NT-SCI patients seem to outnumber T-SCI patients in rehabilitation units, NT-SCI should be better represented in SCI research, particularly in clinical trials and intervention studies.

Conflict of interest

The authors declare no conflict of interest.

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