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ARTICLE

Employment outcomes following spinal cord injury: a population-based cross-sectional study in Australia

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Abstract

Study Design: Self-reported cross-sectional data for the Australian cohort participating in the International Spinal Cord Injury Community survey.

Objectives: To contextualise post-injury employment for people with spinal cord injury (SCI) in Australia, including work participation rates, time to resuming work, underemployment and pre- and post-SCI employment changes.

Setting: Australian survey data from four state-wide SCI services, one government insurance agency and three not-for-profit consumer organisations across New South Wales, Queensland, South Australia and Victoria.

Methods: Data were analysed from 1579 participants with SCI who are at least 1-year post discharge from an inpatient facility. Survey measures included 16-items dedicated to employment. Pre- and post-injury job titles were based on the International Standard Classification of Occupations (ISCO-08) major classification. A mix of chi-squared, *t*-test and negative binomial regression were used to analyse data.

Results: The absolute post-injury employment rate was 49.9%, with one-third of the sample currently working. Pre-injury employment and engagement with vocational rehabilitation resulted in higher employment rates. Individuals who were unable to return immediately following inpatient rehabilitation took mean 28 months (SD, 35.9) to return. Time to employment was significantly lengthier for those without pre-injury jobs, at 59.7 months [SD, 43.8] ($p < 0.001$). Engagement in less manual roles increased post-injury, accounting for three quarters of post-SCI jobs. Underemployment was identified by 16.6% of those currently working.

Conclusions: While there are current services and programmes in place in Australia that support post-injury employment, findings indicate a need for more comprehensive early intervention focused services targeted towards employers and individuals.

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Introduction

After a spinal cord injury (SCI), sustainable employment outcomes are a priority for many people. Engaging in employment post-injury improves a person's sense of identity and personal growth, provides a daily structure for distracting from disability and pain, increases financial security and establishes a platform for better social integration [1, 2]. Sustained employment is also associated with better quality of life, regardless of whether individuals return to their pre-injury positions, or engage with a new employer [3]. Yet, the processes of recommencing or gaining new employment are often fraught with barriers and challenges due to an array of modifiable and non-modifiable personal, job-related and environmental factors [1, 4]. People who sustain a SCI can experience extensive

physical, functional and psychosocial changes that negatively impact on reengaging with employers [5]. Furthermore, those who regain work typically experience reduced workloads [3] and often require adaptions to work design and environments [6].

Internationally, post-injury employment rates for adults with SCI vary, however, rates of 35–40% are generally reported in high-income countries [1, 7], with observed rates in Australia between 31–47% [8]. This is well below the 2018 national employment participation of 84% for those without disability [9]. This is due in part to the lengthy and difficult process, where the average time to post-injury employment is 5 years [10], likely influenced by improved stability of daily life and adjustment with longer duration of injury [11]. Difficulties in returning to work or gaining new positions are often greater for individuals who lack higher education or previous employment [11]. Recommencing or obtaining post-injury employment has been found to be a lengthier process for people with traumatic SCI, often requiring a change to work type, with individuals engaging in less physically demanding occupations [12].

Returning to work can be complex and lengthy, particularly when not returning to a pre-injury employer or similar field of work [3]. Vocational rehabilitation (VR) can play an important role in increasing post-injury employment [7, 13, 14]. There are various types of vocationally focused programmes, with increasing evidence for the effectiveness of earlier interventions. One such programme in Australia, In-Voc, based in New South Wales resulted in 34.5% of participants involved in paid work at 3 weeks post discharge [13]. Another Australian study in Victoria reported similar rates (33%) of individuals returning to paid employment when receiving early VR intervention, although at an average time of 3.5 years post SCI [15]. Other Australian states have similar programmes, including Back2Work in Queensland, and one through ParaQuad South Australia, offering early intervention and support in the community. VR programmes are not the only means of support for post-injury employment, with other funding schemes (e.g. worker compensation schemes) offering assistance including travel payment to the workplace.

Arguably, the complexity of post-injury employment deserves greater attention due to its implications for health and wellbeing, which necessitate responsive services and policies. The primary objective of this study was to provide an overview of post-injury employment in Australia for people living in the community. This includes current employment rates, time to recommencing or gaining employment, VR service use, visible underemployment (specifically relating to individuals engaged part-time who are willing and capable of increased workloads as opposed to all types of underemployment, which also includes insufficient use of an individuals' skills and abilities [16]) and pre- and post-SCI employment type changes. Given the larger numbers of variables included we hypothesise the following: (1) those employed prior to their injury will be more likely to resume earlier employment; (2) engagement with VR services will increase rates of resumption of work; and (3) those employed pre-injury in less manual roles are more likely to resume employment within the same or similar work role.

Methods

The International Spinal Cord Injury (InSCI) community survey is a multi-national cross-sectional survey for persons living with SCI. Self-reported data were obtained from the Australian arm of the InSCI (Aus-InSCI) Community Survey. The survey consists of 193 questions, with 125 common to all participating countries, from which a subset of 16 questions was dedicated to employment. This includes pre- and post-injury employment, VR engagement and barriers to resuming work [17]. Further details of the InSCI survey can be found elsewhere [18].

Study setting

The study includes data from the national Aus-InSCI dataset, supplied by nine data custodians across four Australian states (New South Wales, Queensland, South Australia and Victoria). Linkage, de-duplication, cleaning, and preparation of the datasets supplied by custodians was undertaken by a third party, the Population Health Research Network, Centre for Data Linkage (PHRN-CDL) based at Curtin University, Western Australia. Following this, data were forwarded to the Australian Institute of Health and Welfare (AIHW) for linkage with the National Death Index (NDI), to identify individuals who had died. AIHW returned the NDI-linked dataset to the PHRN-CDL (for removal of any persons deceased) and a final cleaned, re-identifiable dataset with national and international IDs were sent to the respective data custodians for recruitment. The international cohort profile is detailed by Fekete and colleagues [19].

Implied consent was utilised for participants who completed surveys. Ethics were approved by the Northern Sydney Local Health District HREC (HREC/16/HAWKE/495) and the Australian Institute of Health and Welfare Ethics Committee (EO2017/1/341).

Participants

In line with the international study protocol, potential participants were sourced from a hierarchy of databases to

counteract potential selection bias [17]. In Australia, this included ten databases from nine data custodians, including four state-wide SCI services, one state-wide health organisation (which included two databases), one government insurance agency and three not-for-profit consumer organisations. Participants were 18 years or over and at least 12-months post-injury. Paper-based surveys were mailed to eligible Australian participants in 2018 and could be completed as a paper-copy or online via enclosed unique participant login details. Follow-up reminders were sent at 3- and 6-months to non-responders. Data for all Aus-InSCI responders were included in the current study to provide a clear picture of employment outcomes following SCI, including current working and unemployment statuses. The minimum sample size for each participant country was 200, with calculations detailed in the international study protocol [17].

Data measures

The structure for the data model and questionnaire is published elsewhere [18]. The employment questions were derived from multiple tools, in particular, the Model Disability Survey [20, 21]. Measures included in this study are detailed below. Sociodemographic factors (e.g. marital status, education level, weekly household income), lesion characteristics (i.e. level and completeness of injury), cause of injury (i.e. traumatic or non-traumatic) and rurality were collected. Time since injury was calculated from the date of injury.

Different work definitions (i.e. 'working for wages', 'employed or actively looking for work') have previously clouded employment rates [1]. To avoid such confusion, both post-injury employment (i.e. 'never' 'immediately' or 'after some time' following inpatient rehabilitation) and current engagement in paid work ('yes' or 'no') were assessed. An absolute post-injury employment rate (i.e. returned to employment following injury but not necessarily currently working) was based on those who indicated employment after their inpatient rehabilitation, either immediately or otherwise. The current work situation provided additional detail around employment (e.g. 'working for wages with an employer', 'self-employed'). Those currently working also specified their weekly hours worked.

Pre-injury employment and disability pension were also assessed as 'yes' or 'no'. Vocational service use was measured on a 5-point scale ('a great deal', 'some extent', 'small extent', 'not at all' or 'didn't need vocational rehabilitation services'). The latter two categories for VR services were collapsed given ambiguity in distinction. Visible underemployment (henceforth referred to as underemployment, unless otherwise specified) was assessed using a work hour preference question ('more hours' 'less hours' 'the same amount').

Main pre- and post-injury job titles were recorded as open-labelled text. Responses were coded by two researchers independently according to the International Standard Classification of Occupations 10 category major classification (ISCO-08) system (e.g. 1 = Managers, 2 = Professionals) [22]. Job titles with insufficient details for coding (e.g. 'self-employed') were classed as 'unidentifiable'. Any disagreements between the two researchers were resolved by discussion and, when necessary, arbitrated by a third researcher.

Data analysis

Analyses were performed in IBM SPSS Statistics version 26. Evidence of a statistical difference was accepted at an α of 0.05, unless otherwise specified. Data are presented as number (percent) for count variables and mean ± standard deviation (range) for continuous variables (e.g. time to resuming work).

Demographic, lesion characteristics and socioeconomic variables are presented for the total sample. The analysis comprised multiple steps. In step 1, Pearson's chi-squared (χ^2) tests were used to detect statistical differences for characteristic variables for current employment status. Chi-squared tests were also used to determine differences in post-injury employment rates for pre-injury employment and engagement in VR services (i.e. did or did not engage with services). A Mann Whitney *U* Test was used to compare time to resuming work for those with and without a pre-injury job.

Step 2 was determining differences in employment and unemployment variables between lesion severity. Contingency tables were used for count variables (e.g. 4×2 tables for resumed work, disability pension, engagement with paid work). Where there was evidence of differences, χ^2 tests were used to detect differences between lesion severities. A Bonferroni correction for multiple comparisons was used (i.e. six comparisons, corrected p value of 0.0083). Continuous variables (i.e. time to resuming work [months] and hours worked per week) were fit using a negative binomial regression, suitable for data with non-normally distributed errors. All models were adjusted for age, sex and duration since injury. Differences for time to post-injury employment for states were also determined using negative binomial regression. This model was adjusted for the above variables, as well as injury type and completeness.

Step 3 involved identifying changes in employment, assessed using the ISCO-08 major classifications from pre- to post-injury roles. Frequencies were completed for (1) pre- and post-injury job types, (2) post-injury job types by lesion

severity and (3) transition patterns for individuals with a pre- and post-injury work category. Lesion severity differences for post-injury ISCO-08 work category were assessed using 4×2 contingency tables, and utilised the previously described approach, whereby evidence of differences was further investigated with χ^2 tests, again using a Bonferroni corrected p value of 0.0083. Individuals with matched pre- and post-injury job titles were small, preventing a more detailed analysis of transition patterns at the work category level.

Results

A total of 9617 records were supplied for data linkage. After removal of duplicate records ($n = 1649$), those who had deceased ($n = 1645$) and those not eligible ($n = 398$), a total of 5925 surveys were sent. Of these, 1579 surveys completed (26.6% response rate). Participant and non-responder data were similar (Table 1), with slightly lower participant representation of 31–45 age group and corresponding higher participant representation of the 61–75 age group. Demographic data are presented in Table 2. Individuals identifying as currently engaged in paid work were more likely to be younger, male and have a higher household income. Figure 1 illustrates the flow for employment outcomes from pre- to post-injury.

Pre- and post-injury employment and disability pension status are detailed in Table 3 for the total sample and by lesion severity. The absolute post-injury employment rate was 49.9%, with 8.3% having returned immediately following their discharge. Those who returned at a later stage took on average 28 months (SD, 35.9). There was variation for time to employment among differing lesion severities, where individuals with incomplete paraplegia returned at 20.9 months (SD, 27.5) and those with complete tetraplegia at 46.7 months (SD, 40.5 months) ($p < 0.001$). After adjusting for age ($p < 0.001$), sex ($p = 0.003$), injury type ($p = 0.001$), completeness of injury ($p < 0.001$) and years with SCI ($p < 0.001$), there was no difference between Australian states for time to resuming work ($p = 0.09$). Almost half the population indicated current retirement, with a third currently engaged in paid work.

Table 1 Characteristics of participants and non-responders.

Characteristic	Participants ($n = 1579$)	Non-responders ($n = 4346$)
Gender, *n* (%)		
Male	1157 (73)	3254 (76)
Female	422 (27)	1029 (24)
Age (years), *n* (%)		
18–30	76 (5)	386 (9)
31–45	246 (16)	1165 (28)
46–60	532 (34)	1331 (31)
61–75	590 (37)	960 (23)
≥76	135 (9)	389 (9)
Injury level, *n* (%)		
Paraplegia	936 (60)	1792 (52)
Tetraplegia	621 (40)	1676 (48)
Time since injury (years), mean ± SD	17 ± 14	17 ± 14

Those with pre-injury employment were significantly more likely to recommence employment (54.1%) than those without pre-injury employment required to engage new employment (27.2%) (χ^2 (1, $n = 1493$) = 54.8, $p < 0.001$). Recommencing work was significantly faster compared to those without a pre-injury job who were required to engage new employment, at 25.2 months (SD, 33.5 months) vs. 59.7 months (SD, 43.8 months), respectively ($p < 0.001$). Those who engaged with VR services (i.e. a great deal, to some extent, or a small extent) were also significantly more likely to recommence employment (43.8%) than those who did not engage VR services (27.4%) (χ^2 (1, $n = 1483$) = 43.5, $p < 0.001$). Of those who engaged with VR services (7.4% a great deal; 7.8% to some extent; 12.1% a small extent), 27.3% ($n = 203$) did not obtain post-injury employment.

Table 4 shows ISCO-08 categories for employment pre- and post-injury, grouped by lesion severity. Craft and Trade Related Workers accounted for highest pre-injury work category, followed by Professionals and Managers. Engagement in non-manual roles (i.e. ISCO-08 categories 1–5) increased post-injury, accounting for three-quarters of post-SCI jobs. There was no difference between work categories for those with paraplegia and tetraplegia.

Table 5 details the transition patterns for 390 participants who provided pre- and post-injury job titles. Professionals, Clerical Support Workers and Technicians and Associate Professionals were among the highest groups to resume employment within the same work category post-injury at 63%, 56% and 54%, respectively. Meanwhile, much lower proportions of individuals in more physically demanding pre-injury roles resumed employment within the same or similar manual professions following injury: Elementary Occupations (8% only), Craft and Related Trades (23%) and Skilled Agriculture, Forestry and Fishery Workers (30%).

Underemployment (i.e. preference for more hours) was present among 16.6% of working individuals, with 59.7% and 23.7% preferring the same or less hours per week, respectively. Underemployment tended to be higher for men (17.5%) than women (13.0%) (χ^2 (1, $n = 447$) = 1.03, $p = 0.31$) but did not differ for lesion severity.

Reasons for not working and ability to work are presented in Table 6. Health condition or disability was the

Table 2 Population characteristics for total population and by engagement in paid work.

Characteristic, *n* (%)	Total sample $N = 1579$	Engaged in paid work		*p* value
		In paid work $n = 450$	Not in paid work $n = 1085$	
Male	1157 (73.3)	356 (79.1)	769 (70.9)	0.001
Age (years)				<0.001
18–30	76 (4.8)	24 (5.3)	47 (4.3)	
31–45	246 (15.6)	120 (26.7)	116 (10.7)	
46–60	532 (33.7)	211 (46.9)	310 (28.6)	
61–75	588 (37.3)	90 (20.0)	485 (44.8)	
≥76	135 (8.6)	5 (1.1)	125 (11.5)	
Aboriginal and torres strait islander	37 (2.4)	24 (2.4)	8 (1.8)	0.45
LOTE at home	157 (10.1)	41 (9.1)	110 (10.2)	0.52
Lesion severity				0.30
Paraplegia, incomplete	542 (36.6)	141 (33.3)	392 (38.3)	
Paraplegia, complete	362 (24.4)	107 (25.2)	244 (23.8)	
Tetraplegia, incomplete	449 (30.3)	139 (32.8)	298 (29.1)	
Tetraplegia, complete	128 (8.6)	37 (8.7)	90 (8.8)	
Injury type				<0.001
Traumatic	1306 (82.7)	399 (89.1)	897 (81.5)	
Non-traumatic	257 (16.3)	49 (10.9)	200 (18.5)	
Time since injury (years)				0.02
≤5	348 (22.6)	89 (19.9)	247 (23.3)	
6–10	307 (19.9)	87 (19.4)	213 (20.1)	
11–20	385 (25.0)	123 (27.5)	259 (24.4)	
21–30	187 (12.1)	70 (15.6)	112 (10.6)	
≥31	315 (20.4)	79 (17.6)	229 (21.6)	
Marital status				<0.001
Single	386 (24.5)	92 (20.4)	281 (25.9)	
Married	791 (50.3)	240 (53.3)	531 (49.0)	
Cohabitating/partnership	140 (8.9)	69 (15.3)	69 (6.4)	
Divorced/ separated	195 (12.4)	42 (9.3)	148 (13.7)	
Widowed	62 (3.9)	7 (1.6)	55 (5.1)	
Education				<0.001
Primary	61 (3.9)	8 (1.8)	52 (4.9)	
Lower secondary	434 (28.0)	77 (17.2)	343 (32.3)	
Higher secondary	207 (13.3)	39 (8.7)	164 (15.5)	
Post-secondary[a]	292 (18.8)	93 (20.8)	193 (18.2)	
Short tertiary	179 (11.5)	64 (14.3)	110 (10.4)	
Bachelor, or equivalent	239 (15.4)	100 (22.3)	134 (12.6)	
Master, or higher	137 (8.8)	67 (15.0)	65 (6.1)	
Weekly household income (AUD)				<0.001
≤$455	356 (25.9)	24 (5.6)	321 (35.2)	
$456–$686	194 (14.1)	34 (7.9)	157 (17.2)	
$687–$909	164 (11.9)	37 (8.6)	121 (13.3)	
$910–$1203	146 (10.6)	50 (11.7)	92 (10.1)	
$1204–$1548	146 (10.6)	59 (13.8)	85 (9.3)	
$1549–$1931	121 (8.8)	60 (14.0)	57 (6.2)	
$1932–$2374	86 (6.3)	56 (13.1)	27 (3.0)	

Table 2 (continued)

Characteristic, *n* (%)	Total sample $N = 1579$	Engaged in paid work		*p* value
		In paid work $n = 450$	Not in paid work $n = 1085$	
$2375–$2969	51 (3.7)	30 (7.0)	21 (2.3)	
$2970–$3979	62 (4.5)	49 (11.4)	12 (1.3)	
≥$3980	50 (3.6)	30 (7.0)	20 (2.2)	

Engaged in paid work variable includes data for $n = 1535$, sums will not match *n* from Total column.

LOTE Language other than English.

[a]Includes vocational education and training; certificates; and tertiary preparation.

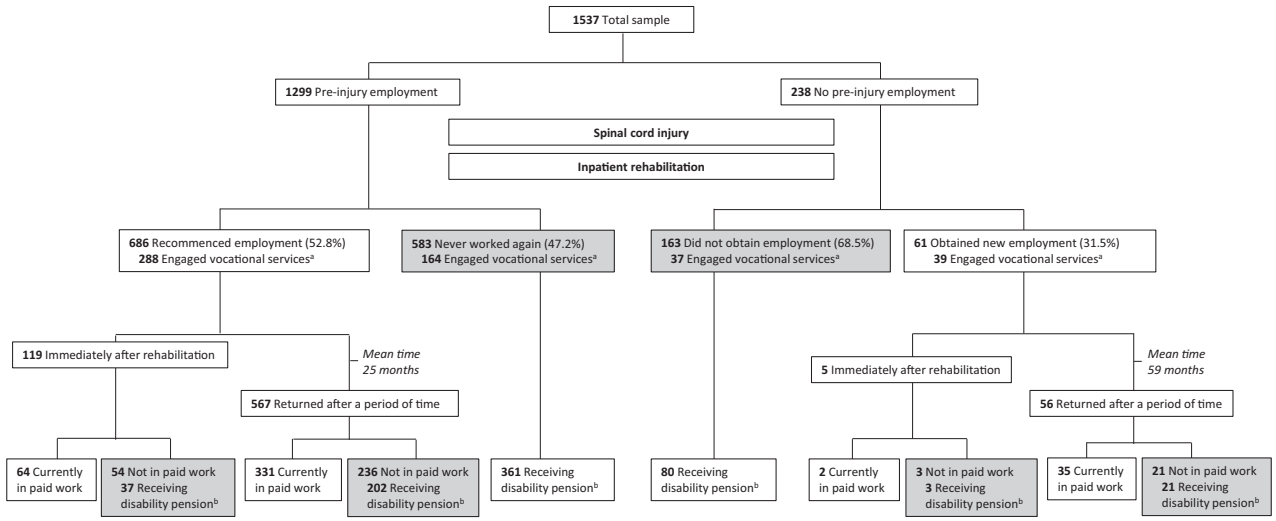

Fig. 1 Employment outcome flow from pre- to post-injury. SCI spinal cord injury. Flow chart relies on individual responses for preceding variables and does not specify missing responses. As such, numbers may differ to where variable information appears elsewhere. [a]Vocational services engaged by a subset of group, the point at which services were engaged is not known. [b]Or similar disability benefit.

most frequently reported reason (63.7%) for unemployment, followed by inability to find suitable work. Of those not working, nearly half felt they were unable to perform paid work, with a quarter (25.2%) identifying their ability to perform a smaller number of weekly hours.

Discussion

The process of recommencing work and the employment landscape for people with SCI is complex and heavily influenced by a range of individual and systemic factors. This study provides a broad snapshot to contextualise employment for individuals with long-term SCI in the community. One-third of the study population indicated they were currently engaged in paid work. While this is a little lower than employment rates commonly reported for high-income countries (35–40%) [7] and other Australian populations [8], it should be noted that this study's cohort was generally older with a long duration following SCI, whereby nearly half were retired, either due to age or health condition. The absolute post-injury employment rate (50%) provides a more accurate comparison, and is more in line with previously stated employment rates for Australia of 31–47% [8].

Incomes for those who returned to work were more evenly spread across the range of weekly household incomes than those not working, who were much more likely to fall in the lowest weekly income brackets. This is not surprising given that nearly half of individuals indicated they are receiving a disability, or similar pension, where incomes are AUD944.30 for singles and AUD711.80 each for couples [23]. Median weekly gross household income in Australia for 2017–18 was AUD1701 [24]. Only 8.8% of the study population fall within this range (i.e. AUD1549 - AUD1931), with three-quarters (47.6% for those working; 85.1% for those not currently working) below the median Australian household income. It is unsurprising that 85.1% of those not working fell below the Australian median household income given the weekly pension figures described above, yet nearly half (47.1%) of those engaged in paid work fell

Table 3 Pre- and post-injury employment and disability pension status for the total sample and by state.

	Total $N = 1579$	Lesion severity				p value
		Paraplegia, complete $n = 362$	Paraplegia, incomplete $n = 542$	Tetraplegia, complete $n = 128$	Tetraplegia, incomplete $n = 449$	
Pre-injury employment, *n* (%)	1299 (84.5)	353 (89.8)[e]	532 (81.2)[d]	127 (85.8)	437 (84.0)	0.006
Worked following initial rehabilitation, *n* (%)	747 (49.9)	197 (57.3)[e,g]	247 (47.6)[d]	65 (52.0)	201 (47.2)[d]	0.02
Resumed immediately following rehabilitation, *n* (%)	124 (8.3)	44 (12.8)[g]	47 (9.1)[g]	10 (8.0)	19 (4.5)[d,e]	0.001
Time to employment (months)[a], mean ± SD (range)	28.3 ± 35.9 (1–336)	33.9 ± 39.1 (1–192)	20.9 ± 27.5 (1–241)	46.7 ± 40.5 (2–156)	28.5 ± 39.4 (1–336)	<0.001[†]
Receiving disability pension, *n* (%)	722 (47.3)	175 (49.9)	246 (46.7)	76 (59.8)	193 (44.4)	0.02
Currently engaged in paid work, *n* (%)	450 (29.3)	107 (30.5)	141 (26.5)	37 (29.1)	139 (31.8)	0.30
Current work situation[b], *n* (%)						
Retired						
Due to health condition	406 (25.7)	87 (24.0)	151 (27.9)	22 (17.2)	126 (28.1)	0.05
Due to age	388 (24.6)	75 (20.7)[e]	175 (32.3)[d,f,g]	18 (14.1)[e]	90 (20.0)[e]	<0.001
Working, paid	326 (20.6)	79 (21.8)	107 (19.7)	21 (16.4)	102 (22.7)	0.38
Working, on sick leave ≥3months	313 (19.8)	76 (21.0)	102 (18.8)	20 (15.6)	98 (21.8)	0.37
Unemployed, not looking for work	188 (11.9)	53 (14.6)	53 (9.8)[f]	24 (18.8)[e]	53 (11.8)	0.02
Self-employed	157 (9.9)	34 (9.4)	44 (8.1)[f]	22 (17.2)[e]	46 (10.2)	0.02
Housewife or househusband	113 (7.2)	30 (8.3)	46 (8.5)	8 (6.3)	22 (4.9)	0.13
Student	50 (3.2)	13 (3.6)	10 (1.8)[f]	8 (6.3)[e]	19 (4.2)	0.04
Unpaid family member	43 (2.7)	15 (4.1)[e]	7 (1.3)[d,f]	11 (8.6)[e,g]	7 (1.6)[f]	<0.001
Unemployed, actively looking for work	29 (1.8)	7 (1.9)	11 (2.0)	2 (1.6)	6 (1.3)	0.85
Hours worked per week[c], mean ± SD (range)	30.1 ± 15.1 (0–90)	26.7 ± 14.2 (2–60)	31.7 ± 14.4 (0–90)	27.1 ± 13.9 (2–80)	32.0 ± 16.4 (0–87.5)	<0.001[†]
Paid work	30.7 ± 14.2 (0–90)	26.3 ± 13.2 (2–50)	33.4 ± 13.9 (0–90)	23.8 ± 10.9 (8–40)	32.1 ± 15.4 (0–87.5)	<0.001[†]
Self-employed	27.1 ± 16.1 (0–84)	27.7 ± 16.8 (4–60)	23.2 ± 14.3 (0–60)	27.7 ± 11.2 (2–40)	30.7 ± 18.6 (0–84)	<0.001[†]

SD standard deviation.

Hours worked per week provided by $n = 438$ (Paid work: $n = 308$; Self-employed: $n = 135$).

† Based on negative binomial regression, adjusted for age, sex, injury type, completeness of injury and years with SCI.

Based on contingency tables, unless otherwise specified.

[a]Excludes those who resumed work immediately following rehabilitation, based on $n = 623$.

[b]Multiple categories able to be selected ('no' responses not shown).

[c]Based on hours for those engaged in paid work, paid and on sick leave ≥3 months, or self-employed.

[d]Different to Paraplegia, complete at Bonferroni corrected significance ($p = 0.0083$).

[e]Different to Paraplegia, incomplete at Bonferroni corrected significance ($p = 0.0083$).

[f]Different to Tetraplegia, complete at Bonferroni corrected significance ($p = 0.0083$).

[g]Different to Tetraplegia, incomplete at Bonferroni corrected significance ($p = 0.0083$).

below this median weekly income which further highlights the challenges around employment faced by persons with disability.

Time to resume work in the current study is less than half (28 months following discharge) the average time of 5 years reported in other long-term SCI populations [11], with around 8% returning immediately post discharge. This is likely due to a combination of high pre-injury employment rates and job types that facilitate employment much earlier, nearly 3 years ahead of those without a pre-injury job. Nearly 85% of the current sample were employed pre-injury, well above rates identified by AIHW reporting, where only half were employed at the time of their injury [25].

Table 4 Major work category for pre- and post-injury employment and by lesion severity.

ISCO-08 major categories, *n* (%)	Pre-injury *n* = 1240	Post-injury					*p* value
			Lesion severity				
		All post-injury *n* = 442	Paraplegia, complete *n* = 105	Paraplegia, incomplete *n* = 136	Tetraplegia, complete *n* = 128	Tetraplegia, incomplete *n* = 139	
1 Managers	169 (13.6)	93 (21.0)	19 (18.1)	27 (19.9)	6 (16.2)	36 (25.9)	0.37
2 Professionals	206 (16.6)	96 (21.7)	22 (21.0)	8 (25.7)	14 (37.8)[a]	22 (15.8)[b]	0.02
3 Technicians and associate professionals	130 (10.5)	101 (22.9)	27 (25.7)	16 (21.3)	9 (24.3)	31 (22.3)	0.87
4 Clerical support workers	75 (6.0)	30 (6.8)	13 (12.4)	3 (5.9)	0 (-)	7 (5.0)	0.03
5 Service and sales workers	105 (8.5)	56 (12.7)	11 (10.5)	0 (-)	5 (13.5)	23 (16.5)	0.52
6 Skilled agriculture, forestry and fishery workers	89 (7.2)	11 (2.5)	2 (1.9)	0 (-)	2 (5.4)	3 (2.2)	0.66
7 Craft and related trades workers	271 (21.9)	24 (5.4)	5 (4.8)	9 (11.8)	1 (2.7)	6 (4.3)	0.73
8 Plant and machines operators and assemblers	95 (7.7)	18 (4.1)	2 (1.9)	7 (5.1)	0 (-)	6 (4.3)	0.34
9 Elementary occupations	88 (7.1)	12 (2.7)	4 (3.8)	2 (1.5)	0 (-)	4 (2.9)	0.49
0 Armed forces occupations	12 (1.0)	1 (0.2)	0 (-)	0 (-)	0 (-)	1 (0.7)	0.57
- Unidentifiable[a]	7 (0.4)	–	0 (-)	0 (-)	0 (-)	0 (-)	–

Fishers Exact Test used for Clerical Support Workers comparisons including Tetraplegia, complete group.

All post-injury column includes $n = 25$ with unknown lesion severity.

[a]Different to Tetraplegia, incomplete at Bonferroni corrected significance ($p = 0.0083$).

[b]Different to Tetraplegia, complete at Bonferroni corrected significance ($p = 0.0083$).

The one-third of the current population who engaged with VR services had significantly higher rates of employment post-injury than those not engaging with VR. However, only one survey question related to engagement with VR services. This limits further understanding of how and when individuals established connections with such services, and what types of VR were utilised, which can have important implications on work participation [26]. There are also multiple factors that influence engagement with VR services. At the individual level, these include patient education, work self-efficacy, transportation and accessibility, readiness to return to work and motivation [26]. The impact of such factors has not been assessed for the current sample and further statistical modelling is required to develop sound conclusions about the impact of VR engagement on employment outcomes for the study population. However, VR services are clearly important with emerging research supporting the increased effectiveness of early intervention models for employment and as a means for promoting psychological adjustment and wellbeing [13, 14]. Whilst it is clear that access to earlier interventions should be widely available, comprehensive VR models should also integrate effective multifaceted employment strategies and evidence-based employment services with SCI rehabilitation programmes across the continuum of care. Ottomanelli et al. [27] showed that it is possible to improve employment outcomes (43% overall) even for those individuals who have significant levels of physical disability, high medical complexity and co-existing mental health or cognitive impairments by incorporating use of the Individualised Placement and Support model of supported employment into SCI care programme over 24 months.

There is little published work utilising the ISCO-08 job classification for individuals with SCI. Schwegler and colleagues' recent study comparing pre- and post-injury jobs for a Swiss population against the labour force changes using the ISCO-08 categories is the most relevant [28]. Pre-injury work was comparative across most categories, with Craft and Related Workers also representing the most common pre-injury workgroup (26.5% [28] vs. 21.9% in the current study) and decreasing post-injury to around 5% for both populations. When matched for pre- and post-injury roles, transition patterns were also similar. Higher proportions in non-manual labour roles (i.e. Managers, Clerical Support Workers) resumed employment within the same, or similar non-manual work category, while those in manual roles (e.g. Plant and Machine Operators and Assemblers) transitioned away from their labour-intensive pre-injury roles. There have been mixed findings relating to the impact of lesion severity has on employment [1, 29].

Table 5 Work category transition patterns for individuals with a pre- and post-injury job ($n = 390$).

Pre-injury ISCO-08 work category, n	Post-injury ISCO-08 work category, n								
	1 Managers $n = 81$	2 Professionals $n = 84$	3 Technicians and associate professionals $n = 91$	4 Clerical support workers $n = 28$	5 Service and sales workers $n = 45$	6 Skilled agriculture, forestry and fishery workers $n = 10$	7 Craft and related trades workers $n = 23$	8 Plant and machine operators and assemblers $n = 18$	9 Elementary occupations $n = 10$
1 Managers, $n = 65$	31	7	17	1	6	–	1	1	1
2 Professionals, $n = 81$	7	51	15	2	4	–	2	–	–
3 Technicians and associate professionals, $n = 37$	4	6	20	3	2	–	–	1	1
4 Clerical support workers, $n = 25$	1	3	5	14	2	–	–	–	–
5 Service and sales workers, $n = 37$	8	5	5	2	14	–	2	1	–
6 Skilled agriculture, forestry and fishery workers, $n = 23$	6	3	2	1	2	7	1	–	1
7 Craft and related trades workers, $n = 70$	15	3	14	2	9	–	16	7	4
8 Plant and machines operators and assemblers, $n = 24$	6	–	4	3	3	–	–	7	1
9 Elementary occupations, $n = 24$	3	4	8	–	3	3	-	1	2
0 Armed forces occupations, $n = 4$	–	2	1	–	–	–	1	–	–

ISCO-08 International Standard Classification of Occupations 10 category major classification.

Table 6 Reasons for not working, work preference and ability to perform work.

		Lesion severity				*p* value
	Total $n = 1010$	Paraplegia, complete $n = 228$	Paraplegia, incomplete $n = 368$	Tetraplegia, complete $n = 89$	Tetraplegia, incomplete $n = 276$	
Reasons for not working						
Health condition/disability	652 (63.7)	146 (59.8)[c]	235 (59.9)	75 (80.0)[a]	199 (66.8)	0.001
Unable to find suitable work	183 (17.9)	47 (19.3)	64 (16.3)	20 (22.2)	52 (17.4)	0.54
Do not want to work	147 (14.4)	36 (14.8)	61 (15.6)	7 (7.8)	43 (14.4)	0.30
Did not have the financial need	117 (11.4)	24 (9.8)	40 (10.2)	14 (15.6)	39 (13.1)	0.32
Lack of accessibility to potential workplaces	95 (9.3)	26 (10.7)	30 (7.7)	12 (13.3)	27 (9.1)	0.31
Fear of losing disability benefits	91 (8.9)	23 (9.4)	38 (9.7)	7 (7.8)	23 (7.7)	0.79
Family responsibilities	69 (4.7)	17 (4.7)	28 (5.2)	6 (4.7)	18 (4.0)	0.86
Insufficient transport services	65 (4.4)	16 (6.6)	22 (5.6)	9 (10.0)	18 (6.0)	0.49
Other	63 (6.2)	17 (7.0)	16 (4.1)	4 (4.4)	26 (8.7)	0.07
Unsure how or where to seek work	58 (5.7)	8 (3.3)	25 (6.4)	3 (3.3)	22 (7.4)	0.14
Engaged in educational or vocational training	35 (3.4)	9 (3.7)	9 (2.3)	6 (6.7)	11 (3.7)	0.21
Lack of assistive devices	34 (3.3)	3 (1.2)[c]	8 (2.0)[c]	10 (11.1)[a,b]	13 (4.4)	<0.001
Parents/spouse did not permit work	7 (0.7)	4 (1.6)	2 (0.5)	0 (-)	1 (0.3)	0.20
Would like to have paid work	419 (41.7)	97 (42.5)	143 (39.2)	43 (48.3)	118 (42.9)	0.43
Able to perform paid work						0.04
Not at all	484 (49.4)	101 (45.7)	180 (50.8)	34 (39.1)	141 (53.2)	
1–11 h per week	247 (25.2)	45 (20.4)	93 (26.3)	29 (33.3)	65 (24.5)	
12–20 h per week	158 (16.1)	49 (22.2)[d]	55 (15.5)	15 (17.2)	34 (12.8)[a]	
20+ h per week	90 (9.2)	26 (11.8)	26 (7.3)	9 (10.3)	25 (9.4)	

Responses are for those who indicated they are not currently in paid work

[a]Different to Paraplegia, complete at Bonferroni corrected significance ($p = 0.0083$).

[b]Different to Paraplegia, incomplete at Bonferroni corrected significance ($p = 0.0083$).

[c]Different to Tetraplegia, complete at Bonferroni corrected significance ($p = 0.0083$).

[d]Different to Tetraplegia, incomplete at Bonferroni corrected significance ($p = 0.0083$).

While post-injury employment differed by lesion severity for the current sample, with complete tetraplegia resulting in the lowest employment rate, it was less impactful on post-injury type of work. Despite smaller numbers for post-injury manual work categories (i.e. ISCO-08 categories 6–9 and 0), there were few differences for work category by lesion severity. Such findings highlight need for broadening the retraining and educational opportunities, focusing in particular on those with greater injury severity and those required to transition out of labour intensive or manual types of work.

There is a large focus on measuring employment outcomes following SCI [12, 30]. Yet, narrow reporting can limit understanding of the context of employment. For example, labour force statistics report engagement in work regardless of the level of participation. This can detract from other important issues, including underemployment and reemployment sustainability, both of which are more prevalent among disability populations [12, 31] and can have a negative impact on mental health [32]. Although pre-injury weekly working hours were not obtained in this study, post-injury average of 30 h/week is 8-h below the Australian standard of 38 h/week for full-time work. Underemployment for this population was slightly higher than the current rate for people with disability in Australia (17% vs 11% [31], respectively). Given the second type of underemployment, invisible underemployment (whereby an individuals' skills and abilities are not fully utilised) is more difficult to measure and was not addressed in this survey, the full extent of underemployment in the study population may not be realised. Despite the increased risk for underemployment in disabled populations and its negative implications for mental health [32], there is a lack of research exploring underemployment specifically in SCI, warranting further exploration into rates and causes in SCI populations. Although the majority of those working were

satisfied with their current hours, further advocacy and support could be offered to employers to assist in addressing misperceptions about work ability where underemployment is present.

The study had several limitations. Survey responders largely represented two of the four participating states within Australia. The overall response rate of 27% is below the rates seen in other SCI populations [33]; however, the total survey responses were well in excess of the minimum sample size of 200 calculated for the wider InSCI community survey [17]. Representativeness of the results may be affected by recruitment of relatively fewer people with SCI under the age of 40 years and more with incomplete than complete lesions. Multiple statistical testing was performed to determine paired differences for states and lesion severity; however, a corrected p value was used to preserve the Type I error rate of 5%.

This study demonstrated moderate post-injury employment rates, often with lengthy periods until work resumption requiring shifts away from previous employment for those in manual-intensive pre-injury jobs. Pre-injury employment and engagement with vocational rehabilitation resulted in higher employment rates. Findings support the need for more comprehensive employment services with better integration into SCI programmes at every stage post-injury, targeted at systemic, workplace and individual levels. The paper provides a brief snapshot of employment post SCI in Australia, but deeper understanding of how other factors impact employment and measures of satisfaction and access for those who are working will provide further insight into the work landscape for people with SCI in Australia. Future research should focus on such areas to provide a more comprehensive understanding of employment following SCI.

Data archiving

De-identified data is available upon request and with permission gained from the Aus-InSCI Community Survey National Scientific Committee.

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Author contributions JWM is a member of the International Scientific Committee and National leader of the Australian arm of the InSCI Community Survey. JWM, TG, AN, RM and MA developed the Aus-InSCI study concept, survey design and Australian protocol. MA managed the project, provided training and support to all Australian sites with data collection, data entry, risk mitigation and quality checking. SJB contributed to data collection for the QLD site. SJB, TG and MF contributed to the papers' concept development, data interpretation and wrote the first draft of the manuscript. SJB is the guarantor of this work, had full access to all the data in the study and takes responsibility for the integrity and accuracy of the data. All authors contributed to the revision of the paper and approved the final submitted version.

Compliance with ethical standards

Conflict of interest The authors declare no competing interests.

Ethics statement We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research.

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