SCIRE

SPINAL CORD INJURY REHABILITATION EVIDENCE

Work and Employment Following Spinal Cord Injury

Reuben Escorpizo, PT, DPT, MSc
Emma M Smith, MSc, OT, ATP/SMS
Monika E. Finger, PT, PhD
William C Miller, PhD, FCAOT

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Key Points

Non-modifiable personal characteristics such as: being male and Caucasian, younger at injury; with a longer duration of injury (20-30 years); with higher pre-injury education; being less severely injured; and being employed at injury in a low-intensity job increase the likelihood of employment post-SCI.

Modifiable personal characteristics such as: being highly educated post-SCI; limiting the occurrence of health complications; having a higher level of independence (including wheelchair skills); and having the trait of valuing work can increase the likelihood of employment post-SCI.

Environmental facilitators include having access to various assistive devices, using transportation independently, having social support (including being married), and having the possibilities of job accommodation including reduced work hours.

Environmental barriers to employment are social or physical and include financial disincentives, discrimination associated to negative attitudes toward people with disabilities and difficulties with physical access to workplace.

A single environmental factor can be perceived either as a barrier or a facilitator to employment based on its presence/absence in one's environment and its impact on effective returning to work.

People with SCI may benefit from vocational rehabilitation in the process of job placement and work reintegration.

There is a lack of high quality research in vocational (re) training. Consequently, conclusions are mostly based on evidence from observational studies or case studies.

Continuous support to the employee and employer before and after vocational placement may lead to a successful return to work and job retention.

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Work and Employment Following Spinal Cord Injury

Executive Summary

The consequences of spinal cord injury are profound and extend well beyond the immediate loss of mobility and sensation; employment is a common rehabilitation goal (Rowell and Connelly, 2010). The International Classification of Functioning, Disability and Health (ICF) of the World Health Organization defines employment as "engaging in all aspects of work, as an occupation, trade, profession or other form of employment, for payment or where payment is not provided, as an employee, full or part time, or self-employed" (World Health Organization, 2001). Gainful employment helps to achieve economic self-sufficiency and it is considered a source of personal growth (Ville and Ravaud 1998), disability adjustment (Krause 1992) and is associated with social integration, life and financial satisfaction and better health (Vogel et al, 1998; Anderson et al. 2007).

Many people with SCI can work and maintain employment. Recent data from the U.S. Spinal Cord Injury Model Systems database suggests that 35% of people with SCI are employed 20 years post-injury (https://www.nscisc.uab.edu) compared to an average unemployment rate of the US general population of 6.1% for a 20-year period (1993-2013). Athanasou et al. (1996) on the other hand found that although 61% of Australians with SCI were engaged in employment at some point after injury, problems experienced in sustaining employment led to a decrease in employment rate of 31%. Some factors outside of the health realm, such as societal perceptions and attitudes, can affect whether someone with SCI is employed or not (Conroy and McKenna 1999).
The objective of this chapter is to identify modifiable and non-modifiable factors related to the person and to the environment (like in the International Classification of Disability Framework, or ICF). We can also evaluate the research evidence re: interventions designed to promote return to work post-SCI.

Personal Factors - Non-Modifiable/Modifiable

Non-modifiable personal characteristics (such as being male, Caucasian, younger at injury, with a longer duration of injury (20-30 years), with higher pre-injury education, being less severely injured, and being employed at injury in a low-intensity job) increase the likelihood of employment post-SCI. There is level 5 evidence (Hirsch et al. 2009) that the severity of injury is also a non-modifiable personal factor that negatively influences employment opportunities after SCI. There are multiple studies that show secondary health conditions (e.g., medical complications, bowel incontinence, urinary tract infection, chronic pain, depression, pressure ulcer) are a barrier to employment post-SCI.

Modifiable personal characteristics such as being highly educated post-SCI, limiting the occurrence of health complications, having a higher level of independence (including wheelchair skills), and having the trait of valuing work can increase the likelihood of employment post-SCI. There is a recent RCT showing 3 psychological constructs that led to effects on employment post-SCI: affective experiences, quality of life, and life satisfaction (Kent & Dorstyn et al. 2014).

Environmental Factors

A single environmental factor can be perceived either as a barrier or a facilitator to employment based on its presence/absence in one's environment and its impact on returning to work. Environmental facilitators include: having access to assistive devices, using transportation independently, having social support (including being married), and having the possibilities of job accommodation including reduced work hours. Environmental barriers to employment may be social or physical and include:

financial disincentives, discrimination associated to negative attitudes toward people with disabilities, and difficulties with physical access to workplace.

Interventions to Improve Employment post-SCI

Two systematic reviews and a number of prospective controlled trials show the strongest evidence that Supported Employment programs can improve employment post-SCI (Trenaman et al. 2014; Roels et al. 2015; Ottomanelli et al. 2012; Ottomanelli et al. 2013). There is also one RCT showing that a service dog improves integration and participation in school and work after 1 year of SCI (Allen and Blaskovich, 1996).

There are also a number of lower level studies showing that receiving vocational rehabilitation counselling, even if during inpatient rehabilitation, can increase employment rates post-SCI (Wang et al. 2002; Jang et al. 2005; Jongbloed et al. 2007; Hansen 2007; Marini et al. 2008; Jellinek and Harvey, 1982) and that receiving vocational training increases the likelihood of employment.

1.0 Introduction

Work and employment are terms that are used interchangeably in the literature and in this chapter; both terms include remunerative (paid) and non-remunerative (unpaid) employment regardless of work status, type of industry, and type of occupation. The International Classification of Functioning, Disability and Health (ICF) defines employment as “engaging in all aspects of work, as an occupation, trade, profession or other form of employment, for payment or where payment is not provided, as an employee, full or part time, or self-employed” (World Health Organization, 2001). At the international level, the relationship between employment and health could not be more profound. Article 23 of the Universal Declaration of Human Rights of the United Nations (http://www.un.org/en/universal-declaration-human-rights/) specifies that all people have the right to work. The World Health Organization (WHO) is charged with promoting healthier lives for people around the world (www.who.int) and the International Labor Organization ensures that all people have a decent work (www.ilo.org). These three international bodies have put an emphasis on the value of work and its impact on the individual’s functioning and societal health overall.

Employment remains one the most important topics to have been studied since the early 1950’s when the importance of returning to work after SCI was recognized (Guttmann, 1959). Not only does gainful employment help to achieve economic self-sufficiency but it is considered a source of personal growth (Ville and Ravaud, 1998), disability adjustment (Krause 1992) and is associated with social integration, life and financial satisfaction and better health (Vogel et al, 1998; Anderson et al. 2007).

Exact employment figures in published studies are difficult to capture due to variations in sample characteristics such as the participant’s age, duration of injury, and work experience prior to injury, as well as differences in the definition of the concept of employment (Ottomanelli and Lind 2009). Although variation is observed in reported employment rates (2 – 80%) (Ottomanelli and Lind 2009), it is likely that the most accurate overall figure since the 1970’s is between 30-50%. Rates of employment vary based on the severity of injury in addition to regional disparities. Recent data from the U.S. Spinal Cord Injury Model Systems database suggests that 35% of people with SCI are employed 20 years post-injury (https://www.nscisc.uab.edu) compared to an average unemployment rate in the US general population of 6.1% for a 20-year period (1993-2013).

There is a tangible need to explain why employment is significantly lower in a population with disabilities than in those without disabilities despite a significant proportion of unemployed people with SCI judging themselves able to work (Tomassen et al. 2000). Despite improvements and innovations in technology, robotics, environmental controls, universal design, the attenuation of prejudices and the

opportunity for job accommodation, employment rates for those with SCI have changed very little over the last 30-40 years.

On the other hand, this reveals the complexity of the process of returning to work. Given that work disability results from the interaction of personal and environmental characteristics (Fougeyrollas et al. 2002; Chan and Man, 2005), it remains inappropriate to state that people with SCI experience low employment rate only because of intrinsic or personal characteristics (Fougeyrollas et al., 2002). To ensure a higher likelihood of success in return to work, interventions must target several factors including work retraining and other types of environmental interventions. A major domain to explore is vocational (re)training, which includes vocational rehabilitation, defined as"a multi-professional evidence-based approach through various settings and interventions and is provided to working age individuals with health-related impairments, limitations, or restrictions with work functioning, and whose primary aim is to optimize work participation" (Escorpizo et al. 2011). Another goal of vocational rehabilitation is early and sustained participation in employment; Athanasou et al. (1996) found that although 61% of Australians with SCI were engaged in employment at some point after injury, problems experienced in sustaining employment led to a decrease in employment rate of 31%.

The objective of this chapter is to identify modifiable and non-modifiable factors that influence employment after SCI and to evaluate the evidence of interventions designed to promote return to work post-SCI. Similar to the other SCIRE chapters that have a focus on an area relevant to community reintegration, the methods used for the development of this review expanded upon the traditional SCIRE methods. Specifically, two new databases with a focus on the social sciences were searched (Social Sciences Abstracts and Social Work Abstracts), and the inclusion criteria were broadened to include any relevant qualitative studies.

2.0 Systematic Reviews and Meta-Analysis

Table 1: Systematic Review and Meta-Analysis

Trenaman et al. 2014 Canada Systematic Review AMSTAR= 8 N=14	**Population:** 14 studies were included in the review that investigated interventions among people with SCI and where employment was an outcome. **Methods**: An electronic search of Medline/PubMed, EMBASE, Cochrane database, CINAHL, PsycINFO, Social Science Abstracts and Social Work Abstract databases was performed on 31 December 2013. Exclusion criteria include (i) reviews, (ii) studies not published in English and (iii) non-peer reviewed publications. **Outcome measures**: employment status, workplace support, rate of return to work, labour market outcomes, time to productive activities, time to employment	1. 14 studies met the inclusion criteria: 2 RCTs and 12 observational studies 2. The strongest evidence finds that supported employment can improve employment outcomes among individuals with SCI. 3. The use of service dogs has also been shown to improve employment outcomes. 4. The remaining 12 studies are observational and predominantly focus on vocational rehabilitation programs. 5. There is a lack of high-quality intervention research that targets employment outcomes in individuals with SCI.

Trenaman et al. 2015 Canada/Switzerland Systematic Review AMSTAR=8 N=39	**Population:** 39 studies were included that investigated factors associated with employment outcomes following SCI. **Methods**: Studies published from 1952-2014 were identified through an electronic search of MEDLINE/PubMed, EMBASE, CINAHL, PsycINFO, Social Science Abstracts and Social Work databases. Exclusion criteria included: (1) reviews (2) studies not published in English (3) studies not controlling for potential confounders through a regression analysis, or (4) studies not providing an effect measure in the form of OR, RR, or HR. Data were categorized based on the International Classification of Functioning, Disability and Health framework, with each domain sub-categorized by modifiability. **Outcome measures**: employment, domains: body structures & function, activity & participation, environmental facilitators, barriers, personal factors	1. 39 studies met the inclusion criteria. 2. 20 modifiable and 12 non-modifiable factors have been investigated in the context of employment following SCI. 3. Education, vocational rehabilitation, functional independence, social support, and financial disincentives were modifiable factors that have been consistently and independently associated with employment outcomes. 4. Future research should focus on determining which factors have the greatest effect on employment outcomes, in addition to developing and evaluating interventions targeted at these factors.
Roels et al. 2016 Netherlands Systematic Review AMSTAR= 10 N=15	**Population**: 15 studies were included that studied interventions enhancing employment in people with SCI and reported on effects of interventions on employment rate and duration. Three studies were RCTs. One RCT was of high quality. One RCT was of moderate quality and one was of low quality according to the Grade approach of assessing the quality of evidence. 1 RCT including 201 patients; average years post injury = 12.4y **Methods**: MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials (CENTRAL), CINAHL, PsycINFO and SPORTDISCUS databases were searched. Randomized controlled trials (RCTs) and non-randomized studies (NRSs) describing a hospital- or a community-based intervention aiming at employment in a SCI population were selected. **Outcome Measures**: Employment rate and duration were primary outcomes. Quality appraisal was done using the SIGN methodology, and the quality of	1. The majority of the studies, 11 out of 15 (73%), were case reports or case series. 2. Only 1 RCT was of high quality (Ottomanelli et al. 2012), including 201 patients describing an intervention over 1 and 2 years. In this study, the employment rate was 26% after 1 year and 31% after 2 years for competitive work, compared with 10% in the treatment as usual-intervention site (TAU-IS) control group and 2% in the treatment as usual observational site (TAU-OS) after 1 and 2 years. 3. This RCT showed evidence that a vocational rehabilitation programme based on the principles of supported employment integrated in a multidisciplinary team enhances employment for SCI people. 4. Other studies were of low quality and describe higher employment rates from 36 to 100%.

	evidence was graded using the Grade approach.	
Kent & Dorstyn, 2014 Australia Meta-Analysis AMSTAR = 10 N = 14	**Population:** 9,868 participants with SCI; average age = 38.0 ± 9.4yo; time since injury = 11.7 ± 6.6y **Methods**: A meta-analysis was conducted to examine and quantify differences in psychological functioning and employment status among adults with an acquired SCI. Fourteen observational studies (N=9,868 participants) were identified from an electronic database search. Standardized mean difference scores between employed and unemployed groups were calculated using Cohen's d effect sizes. Additionally, 95% confidence intervals, fail-safe Ns, percentage overlap scores and heterogeneity statistics were used to determine the significance of d. **Outcome measures**: Cohen's d effect sizes tests for psychological measures (feelings, QoL, life satisfaction, thoughts & beliefs)	1. Moderate to large and positive weighted effects were noted across three broad psychological constructs (that could be considered clinically important to employment): affective experience or feelings (d_w=3.16), quality of life (d_w=1.06) and life satisfaction (d_w=0.70). (d=0.2, 0.5 and 0.8 equates to small, medium and large effects, respectively). 2. The psychological domain of life satisfaction had positive effect sizes with employment ranging from 0.37 to 0.85 (a statistically homogeneous finding). 3. Higher effect sizes were associated with studies that comprised a greater proportion of males (*r*=0.56, *P*=0.04); this finding should be interpreted with caution due to the likelihood of a Type I error (false-positive association) due to the relatively small number of mean effect sizes (*n*=14) contributing to this finding.

Discussion

We found three systematic reviews and one meta-analysis looking at employment after SCI. The first of two systematic reviews performed by Trenaman et al. (2014) looked at employment outcomes for people after SCI; the strongest evidence finds that supported employment (Ottomanelli et al. 2012; 2013; 2015) and the use of service dogs (Allen and Blascovich 1996) can improve employment outcomes among people with SCI. The majority of research found in the reviews was observational and predominantly focused on vocational rehabilitation programs. Conclusions drawn from vocational rehabilitation programs may be confounded, as individuals could be self-selecting for these programs (Trenaman et al. 2014). Trenaman et al. (2014) recommend that future studies should aim to identify which components of vocational programs in particular have the greatest influence on employment outcomes.

A systematic review conducted by the same authors (Trenaman et al. 2015) found 20 modifiable and 12 non-modifiable factors that had been investigated in the context of employment following SCI. Education, vocational rehabilitation, functional independence, social support, and financial disincentives were modifiable factors that have been consistently and independently associated with employment outcomes. Researchers recommend that future research should focus on determining which factors have the greatest effect on employment outcomes, so that better intervention research with controls could be conducted (Trenaman et al. 2015).

**Modifiable and Non-modifiable factors for employment after SCI are described in more detail in Tables 2 and 3.*

Kent and Dorstyn (2014) conducted a meta-analysis to determine if any psychological constructs have effects on employment after SCI. They found moderate to large positive effects across three broad psychological constructs (that could be considered clinically important to employment): affective experience or feelings (dw=3.16), quality of life (dw=1.06) and life satisfaction (dw=0.70) (Generally, d=0.2, 0.5 and 0.8 are considered to be small, medium and large effects, respectively).

There is level 1 evidence (Trenaman et al. 2014) suggesting that supported employment shows the strongest evidence that it can improve employment outcomes amongst individuals with SCI. Service dogs have also been shown to increase employment.

There is level 1 evidence (Kent & Dorstyn et al. 2014) that 3 psychological constructs: affective experiences, quality of life, and life satisfaction could be considered clinically important in their effects on employment.

3.0 Personal Factors Associated with Employment Post-SCI

Several personal characteristics have been identified as factors which may interfere with the ability to return to the labor market (Anderson et al. 2007; Lidal et al. 2007; Ottomanelli and Lind 2009). Some of these characteristics cannot be modified (e.g. level of injury) while others such as level of education, health status, and work skills can be modified with appropriate and targeted interventions. Table 2 identifies the non-modifiable personal factors and Table 3 the modifiable personal and activity/participation factors that influence employment after SCI. All of these studies are Level 5 evidence (from cross-sectional studies).

Table 2: Non-Modifiable Personal Factors Influencing Employment after SCI

Personal factors	Impact on employment	Study (N)	Study reference
Sex	Being male tends to favour return to work. **Exceptions:** Anderson and Vogel 2002 (195), Arango-Lasprilla et al. 2009* (11424), Arango-Lasprilla et al. 2010*(11090), Gunduz et al. 2010 (152), Krause and Reed 2011* (781), Ottomanelli et al. 2011 (238)	195 3756 259 615 1397 165 559 5925 82 234 181 2986 183 247	Anderson and Vogel 2002 Krause et al. 1999 Krause 2003 Krause and Terza, 2006 Krause 2010c* Lidal 2009 Marti et al. 2012 Meade et al. 2004 Pell et al 1997 Tomassen et al. 2000 Rowell and Connelly 2010 Tsai et al. 2014 Ullah et al. 2015 Clark et al. 2017
Ethnicity	Being Caucasian tends to favour return to work **Exception**: Ottomanelli et al. 2011 (238)	195 11424 11090 3514 1177 1032 3756 615 1362 1134	Anderson and Vogel 2002 Arango-Lasprilla 2009* Arango-Lasprilla 2010* Arango-Lasprilla 2011 Hess et al. 2000 Krause et al. 1998 Krause et al. 1999* Krause and Terza 2006 Krause and Reed 2009* Krause et al 2010b*

Personal factors	Impact on employment	Study (N)	Study reference
		1397 14454 781 5925 111 118 247	Krause 2010c* Krause et al 2010d* Krause and Reed 2011* Meade et al, 2004 Phillips et al. 2012 Paul et al. 2013 Clark et al. 2017
Age	Employment tends to increase with age up to 30 and remain the same up to middle 40's Employment is lower in individuals aged 55-64 compared to those aged 45-54	195 167 20143 234 181 353 620 149 1323 1159	Anderson and Vogel 2002 Conroy and McKenna 1999 Pflaum et al. 2006 Tomassen et al. 2000 Rowell and Connelly 2010 *(labor market participation may ↓ w/ age)* Huang et al. 2017 Hirsh et al. 2009 Blauwet et al. 2013 Jetha et al. 2014 Marti et al. 2018
Age at time of injury	Younger age at injury tends to increase employment	167 1177 1032 3756 84 2986	Conroy et McKenna 1999 Hess et al. 2000 Krause et al. 1998 Krause et al., 1999* Ramakrishnan et al. 2011 Tsai et al. 2014
Duration of injury	The rate of employment increases with duration of injury (20-30 years)	167 20143 2986 353	Conroy and McKenna 1999 Pflaum et al. 2006 Tsai et al. 2014 Huang et al. 2017
Severity of injury (cervical or tetraplegia)	Higher and more severe injury (i.e., tetraplegia and complete injury) has a negative influence on employment People experiencing fewer functional limitations have a higher likelihood of obtaining employment **Exception:** Botticello 2012 (1013), Gunduz 2010 (152), Marti et al. 2012 (559), Phillips et al. 2012 (111), Ottomanelli et al. 2011 (238)	195 11424 11090 114 167 403 1177 1032 259 1362 1398 1134 781 165 219 91 2986 353 120	Anderson and Vogel 2002 Arango-Lasprilla 2009* Arango-Lasprilla 2010* Castle 1994 Conroy and McKenna 1999 Franceschini 2012 Hess et al. 2000 Krause et al. 1998 Krause 2003 Krause and Reed 2009* Krause et al. 2010* Krause et al. 2010b* Krause and Reed 2011* Lidal 2009 Murphy et al. 1997 Wang et al. 2002 Tsai et al. 2014 Huang et al. 2017 Kader et al. 2018
Education pre-injury	Higher education pre-injury is a key factor in employment. People with tertiary education prior to injury were up to 8 times more likely to be in employment post-SCI. **Exception:** Ottomanelli et al. 2011 (238)	11424 3514 1013 114 169 403 152 60	Arango-Lasprilla 2009* Arango-Lasprilla 2011 Botticello 2012 Castle 1994 Conroy and McKenna 1999 Franceschini 2012 Gunduz 2010 Hilton et al. 2017

Personal factors	Impact on employment	Study (N)	Study reference
		259 615 1362 1398 1134 1397 781 1329 219 559 219 234	Krause 2003 Krause and Terza 2006 Krause and Reed 2009* Krause et al. 2010* Krause et al. 2010b* Krause 2010c* Krause and Reed 2011* Krause et al. 2012* Lin et al. 2009 Marti et al. 2012 Murphy et al. 1997 Tomassen et al. 2000
Pre-injury work	Positive influence on employment: - Being employed at injury - Returning to pre-injury job - Lower physical demands of job pre-injury	11424 167 3756 259 1398 1134 192 72 20143 61 234 192 60 114 183	Arango-Lasprilla 2009* Conroy and McKenna 1999 Krause et al. 1999* Krause 2003 Krause et al. 2010* Krause et al. 2010b* Kurtaran et al. 2009 Murphy et al. 2009 Pflaum et al. 2006 Ramakrishnan et al. 2011b Tomassen et al. 2000 Young et al. 2004 Young et al. 2011 Ferdiana et al. 2014 Ullah et al. 2015
Pre-injury chronic conditions	Negatively impacts post-injury employment	219	Lin et al. 2009
Felony convictions	Negatively impacts ability to find employment regardless of vocation rehabilitation program	157	LePage et al. 2014

* These studies are based on data from the National Spinal Cord Injury Statistical Center (NSCISC) in the United States. In general, two different types of analyses are undertaken (1) retrospective analysis of data in the database (2) a cross-sectional survey that is sent out to individuals identified from the database. Given that the same eligibility criteria are often used for studies relating to work and employment, it is likely that the data from the same individuals are being used for multiple studies.

Discussion

Several personal characteristics cannot be modified but must be taken into consideration in the assessment of potential (re-)employment after SCI as summarized in Table 2. These factors can be divided into 4 categories: 1) demographics, 2) time-related, 3) injury-related and 4) work/education factors (based on observational studies alone). Being Caucasian is a demographic factor that favors employment. Male gender has been a strong demographic predictor of employment, but a number of recent studies have shown no significant difference between males and females. However, 3 of the 6 studies showing no significant difference come from the same data source. The interaction between age, age at injury and the duration of injury is very complex making it difficult to determine their individual influence on employment. Though the proportion of employed people tends to increase with age (increases up to about 30 years of age and is maintained up to 40 years), younger age at injury and longer duration of injury (up to 20 years post-injury) are better predictors of being employed than age alone. Due to a non-linear effect of age on labor market participation, it is likely that work participation may decrease with increasing age at some point after 40. Hirsch et al. (2009) reports that individuals aged 45-54 were significantly more likely to be employed than those aged 55-64. A more

severe injury tends to decrease the probability of employment. A higher level of education seems to be a factor in increasing the probability of employment. Factors related to pre-injury work such as being employed at injury, returning to pre-injury job or holding a job requiring a lower physical intensity tend to positively influence employment.

Conclusions

There is level 5 evidence (see Table 2) that being male, Caucasian, and younger at time of injury; having a longer duration of injury, higher education pre-injury; and having a low-intensity pre-injury job are non-modifiable personal factors that <u>positively</u> influence employment opportunities after SCI.

There is level 5 evidence (Hirsch et al. 2009) that the severity of injury is a non-modifiable personal factor that <u>negatively</u> influences employment opportunities after SCI.

Non-modifiable personal characteristics such as being male and Caucasian, younger at injury, with a longer duration of injury (20-30 years), with higher pre-injury education, being less severely injured, and being employed at injury in a low-intensity job increase the likelihood of employment post-SCI.

Table 3: Modifiable Personal/Activity and Participation Factors Influencing Employment after SCI

Personal	Impact on employment	Study (N)	Study reference
Education / training post-injury	Positive influence on employment: – higher level of education (high school or above) – vocational retraining – attaining post-secondary education	114 167 152 169 259 1362 1398 1329 192 559 5925 459 20143 234 118 181 60 1323 176 353	Castle 1994 Conroy and McKenna 1999 Gunduz 2010 Jang et al. 2005 Krause 2003 Krause and Reed 2009* Krause et al. 2010* Krause et al 2012* Kurtaran et al. 2009 Marti et al. 2012 Meade et al. 2004 Murphy et al. 2003 Pflaum et al. 2006 Tomassen et al. 2000 van Velzen et al. 2009 Rowell and Connelly 2010 Hilton et al. 2017 Jetha et al. 2014 Ferdiana et al. 2014 Huang et al. 2017
Household income	Higher household income group had higher vocational satisfaction. The lower income group had greater improvements in vocational satisfaction over the course of the 10-year study.	434	Cao et al. 2014
Secondary health conditions	In 10 papers, secondary health conditions are a barrier to employment (e.g., medical complications, bowel incontinence, urinary	195 1013 781	Anderson and Vogel 2002 Botticello et al. 2012 Hirsch et al. 2009 (psych functioning)

Personal	Impact on employment	Study (N)	Study reference
	tract infection, chronic pain, depression, pressure ulcer) **Exception:** Hirsch et al. 2009 (N=620; pain, fatigue, sleep) Krause et al. 2011 (N=781; health status) Meade et al. 2011 (N=5925; secondary health conditions) Matthew et al. 2013 (N=108; pressure ulcers) Ramakrishnan et al. 2011 (N=84; medical co-morbidities.)	403 559 103 234 83 219 2986	Franceschini 2012 Marti et al. 2012 (pain) Mann et al. 2013 (pain) Wehman et al. 2000 Burns et al. 2010 (depression) Lin et al. 2009 (depression) Tsai et al. 2014 (catheter indwelling in bladder, pain)
Functional independence	Functional independence increases the likelihood of being employed Independence in bladder emptying is positively associated with return to work Physical function was the most important in relation to return to work in patients with SCI	195 1013 14620 169 72 109 234 2986 192 2986 167	Anderson and Vogel 2002 Botticello et al. 2012 Cohen et al. 2012 Jang et al. 2005 Murphy et al. 2009* Ramakrishnan et al. 2011 (personal care) Tomssen et al. 2000 Tsai et al. 2014 Kurtaran et al. 2009 Tsai et al. 2014 Jeong et al. 2015
Psychological component (locus of control, values placed on work, expectations)	Positive influence on employment: – endorsement of gender norms – internal locus of control – valuing work – positive expectations toward work – positive attributional style (the individual's propensity to "internalize" positive employment outcomes to his/her own attributes, capabilities or functioning – personal sense of motivation – family and rehabilitation professionals serving as extrinsic motivators – social participation is correlated with wellbeing, decreased anxiety and depression – subjective wellbeing – hope and sense of direction – gaining self confidence – self-efficacy and secure attachment	83 459 57 109 181 60 30 60 13 44 190 4 84	Burns et al. 2010 Murphy et al. 2003 Schonherr et al. 2004 Wehman et al. 2000 Rowell and Connelly 2010 Murphy et al. 2011 Boyle et al. 2014 Hilton et al. 2017 Ramakrishnan et al. 2016 Reed et al. 2016 Umucu et al. 2016 Willbanks et al. 2015 Blake et al. 2017
Relationship status	Positive influence on employment – participants in a relationship at the time of injury were 3.5 times	60 461 1323	Hilton et al. 2017 Hwang et al. 2015 Jetha et al. 2014

Personal	Impact on employment	Study (N)	Study reference
	more likely to be employed at 2 years post discharge – married participants		
Social Roles	Participating in more social roles had a positive influence on employment for young/middle aged, and older adults	1323	Jetha et al. 2014
Wheelchair skills	People with better wheelchair skills are more likely to return to work. Manual wheelchair users have higher employment rates than power wheelchair users	118 30 2986	van Velzen et al. 2009 Hastings et al. 2011 Tsai et al. 2014
Activity / participation factor	**Impact on employment**	**Study (N)**	**Study reference**
Sport participation	Participation in organized sports was associated with increased likelihood of employment.	149	Blauwet et al. 2013**
Social Participation	Decreased social participation reduces the odds of being employed	3162	Tsai et al. 2017

* These studies are based on data from the National Spinal Cord Injury Statistical Center (NSCISC) in the United States. Generally speaking, two different types of analyses are undertaken (1) retrospective analysis of data in the database (2) a cross-sectional survey that is sent out to individuals identified from the database. Given that the same eligibility criteria are often used for studies relating to work and employment, it is likely that the data from the same individuals are being used for multiple studies.
**The definition of employment varies among different studies. These studies consider full-time students to be unemployed while others include students within the definition of employment.

Discussion

Several factors can be modified in the post-injury period to prevent deleterious effects or to increase the likelihood of employment after SCI. These factors are categorized as: 1) education / training, 2) health status, 3) functional independence, 4) psychological issues, 5) wheelchair skills and 6) participation. Secondary health conditions such as pain, depression, spasticity, pressure ulcers, severe urinary tract infections and respiratory problems are likely to limit employment opportunities but this finding should be considered in conjunction with the severity of injury. For example having tetraplegia leads to a higher occurrence of secondary health complications due to larger extent of affectation than paraplegia. The level of education or pursuit of training after SCI remains a key factor that can offset other factors such as the severity of injury. Specifically, a professional degree and work that is not physically demanding increases the likelihood of employment. Some psychological attributes such as an internal locus of control, positive values and expectations regarding work including internalization of positive work outcomes are likely to favor employment. Participation in organized sports may facilitate employment through the building of mentorship/relationships, socialization and self-confidence (Blauwet et al. 2013). Reducing environmental barriers may enhance social participation and facilitate employment status.

Conclusion

There is level 5 evidence (see Table 3) that being married, having education post-injury, having fewer secondary health conditions and higher functional independence, having better work

related values and a higher internal locus of control, and better wheelchair skills are modifiable personal factors that <u>positively</u> influence employment opportunities after SCI.

Modifiable personal characteristics such as being highly educated post-SCI, limiting the occurrence of health complications, having a higher level of independence (including wheelchair skills), and having the trait of valuing work can increase the likelihood of employment post-SCI.

4.0 Environmental Factors Associated with Employment Post-SCI

Based on the ICF, the environment includes products and technology (e.g. assistive devices), the natural environment and human-made changes to the environment (e.g. geographic location), support and relationships from others (e.g. support from employer), attitudes (e.g. discrimination due to disability), and services, systems and policies (e.g. healthcare provided) (World Health Organization, 2001). When thinking about the SCI population the most obvious barriers and facilitators are related to the physical environment, particularly for those individuals who have difficulty with mobility. Social, attitudinal, and cultural environment can also been seen to create barriers when one considers the economic disincentives faced, not only by the employers, but also employees with SCI. For instance, the reluctance of an employer to hire an individual with a disability on the belief that they will be less productive or will require costly work accommodations, despite evidence to the contrary is an example of an attitudinal barrier (McFarlin et al. 1991). Moreover the attitudes of other employees can also negatively influence the worksite acceptance of individuals with SCI. In the following section, barriers and facilitators are presented separately. In different contexts a single environmental factor can be perceived to be a barrier and/or a facilitator to employment based on its presence/absence in one's environment and its impact on effective return to work.

The influence of environmental factors associated with employment post-SCI is based on observational studies with level 5 evidence, and are summarized in Tables 4 and 5.

Table 4: Environmental Facilitators Influencing Employment Post-SCI

Environmental Factors	Impact on Employment	Study N	Study reference
Ability to use transportation independently	Those with the ability to independently use transportation are more likely to be employed/return to work. Driving a modified vehicle is associated with increased odds of being employed. **Exception:** Chan and Man 2005 (16)	196 167 403 219 3726 84 2986 461	Jang et al. 2005 Conroy and McKenna 1999 Franceschini 2012 Lin et al. 2009 Norweg et al. 2011 Ramakrishnan et al. 2011 Tsai et al. 2014 Hwang et al. 2015
Assistive technology	Having access to general assistive technology services Ability to use a computer shortens the time to employment post-SCI.	3514 391	Arango-Lasprilla 2011 Kruse et al. 1996
Vocational rehabilitation	Job search assistance, job placement assistance, on-the-job support and training, and maintenance services are associated with successful employment outcomes	3514	Arango-Lasprilla 2011

Environmental Factors	Impact on Employment	Study N	Study reference
Job accommodations and adaptations	Identification of appropriate necessary accommodations alleviates work-related problems and facilitates employment	46	McNeal et al. 1999
	Work modifications including job adaptations and decreased work hours are associated with return to work	12 57	Chapin and Kewman 2001 Schonherr et al., 2004
Social Support	Social support favours employment	83	Burns et al. 2010
	Being married favours employment **Exception:** Franceschini 2012 (403)	11424 1013 196 20143 353	Arango-Lasprilla 2009* Botticello 2012 Jang et al. 2005 Pflaum et al. 2006 Huang et al. 2017
Surrounding Area	Higher socioeconomic status of surrounding area is positively associated with employment; suburban areas were associated with a better employment rate compared with urban areas	1013	Botticello 2012
Area of Residence	Rural residence is associated with lower return to work	120	Kader et al. 2018
Nature of Occupation	Higher odds of return to work is associated with: - high/middle level occupation based on the Dutch Standard Classification of Occupations (NSS) - low physical intensity of pre-injury occupation (NSS)	114	Ferdiana et al. 2014

Discussion

Being an independent driver was positively associated with returning to work post-injury. Reduced dependence on the inflexible, inaccessible, or unreliable options of public transport was likely to be the main reason for this finding (Conroy and McKenna 1999). People with SCI who have computer skills tend to return to work faster after suffering their injury, and to have higher earnings, than otherwise similar workers who lack computer skills (Kruse et al. 1996). Studies specific to persons who experience SCI reported that of those who return to work, the majority were able to do so, in part, because of modifications to the work including job adaptations and decreased work hours. A mentorship or peer support program may also provide a facilitative environment to an individual post-SCI. For example, it was found that those with SCI who completed a mentorship program also improved their functioning, independence, and participation (Shem et al 2010) which may have contributed to their favorable return to work outcomes. However, it was not clear from the study whether or not participation and successful completion of the mentorship program was directly related to employment post-SCI.

Table 5: Environmental Barriers Influencing Employment Post-SCI

Environmental Factors	Impact on Employment	Study (N)	Study reference
Financial disincentives	Decrease in government benefits deter individuals with SCI from returning to work.	16 191 357 143	Chan and Man 2005 Hedrick et al. 2006 Jongbloed et al. 2007 Pflaum et al. 2006

Environmental Factors	Impact on Employment	Study (N)	Study reference
Financial incentives	Those who are entitled to compensation are less likely to be engaged in the labour force.	109 3514 83 403	Wehman et al. 2000 Arango-Lasprilla 2011 Engel et al.1998 Franceschini 2012
	Ottomanelli et al. 2011 (238) (receiving social security benefits was a disincentive for employment but receiving Veterans disability benefits is not)	238	Ottomanelli et al. 2011 (social security disability benefit)
	Those with no fault compensation had lower income and lower return to work (29-39% vs. 42-54% but no significant difference)	118	Paul et al. 2013
Health insurance	Being insured by Medicaid (US) was associated with reduced training and lower employment rates	111	Phillips et al. 2012
`Disability` discrimination (negative attitudes towards those with disabilities)	Companies tend to discriminate against individuals with SCI by offering interviews less frequently when a SCI was disclosed.	2228	Ravaud et al. 1992
	Negative employer attitudes	83	Engel et al. 1998
	Perceived discrimination was associated with current unemployment.	167	Conroy and McKenna 1999
Inaccessibility of the workplace	Physical inaccessibility is a reason for not returning to work.	231	Krause and Anson 1996

Discussion

Financial disincentives are gaining support as having a detrimental effect on return to work post-injury. For example, in British Columbia, Canada, social assistance deters recipients from returning to work because once more than $400/month is earned, benefits received while on social assistance such as dental care and prescription medication, are lost (Jongbloed et al. 2007). This also appears to be the case in Australia as the perceived disadvantages of losing social security benefits (which would lead to exclusion from accessing government funded equipment and medical supplies) seemed to deter people from seeking employment post-SCI (Conroy and McKenna 1999). Health insurance benefits which are considered threatened for abolishment or reduction with an increase in work-related income could be a deterrent for people with SCI considering going back to work.

Workplace discrimination can be further classified into ‘disability discrimination’ and ‘racial discrimination’, the latter being addressed in the personal factor section. Disability discrimination is due largely to negative or naïve employer perceptions about the potential productivity of individuals with SCI. Ravaud et al. (1992) found that companies tend to discriminate against individuals with SCI by offering interviews less frequently when the injury was disclosed. Similarly, 80% of Canadians agreed with the statement that “Canadians with disabilities are less likely to be hired for a job than those without disabilities, even if they are equally qualified” (Social Development Canada 2004). Not surprisingly, Jongbloed et al. (2007) found that individuals with SCI viewed the negative attitudes of employers regarding people with disabilities as a barrier to employment. The lack of physical

accessibility to the workplace has also been found to hinder return to work.

Conclusions

There is level 5 evidence (see Table 5) that financial disincentives has a <u>negative</u> effect on employment post-SCI but financial incentives has a positive effect on employment except for when receiving social security benefits.

There is level 5 evidence (see Table 5) that health insurance, 'disability discrimination' and inaccessibility of the workplace are environmental barriers <u>negatively</u> influencing employment after SCI.

There is level 5 evidence (see Table 4) that ability to use transportation independently, ability to use technological devices, and having access to job accommodations <u>positively</u> influencing employment after SCI.

Environmental facilitators include having access to various assistive devices, using transportation independently, having social support (including being married), and having the possibilities of job accommodation including reduced work hours.

Environmental barriers to employment are social or physical and include financial disincentives, discrimination associated to negative attitudes toward people with disabilities and difficulties with physical access to workplace.

A single environmental factor can be perceived either as a barrier or a facilitator to employment based on its presence/absence in one's environment and its impact on effective returning to work.

5.0 Interventions for Enhancing Employment Post-SCI

Access to vocational counselling, educational or job training has often been mentioned as a key issue in enabling return to work after SCI (Jang et al. 2005; Jongbloed et al. 2007; Lidal et al. 2007). However very few studies have empirically tested strategies to increase job opportunities and most reports we found were either case series or observational studies. Various strategies were described through case studies that had successful return to work and job retention. These individualized strategies addressed activities of daily living and mobility needs, job accommodation including workplace support, and employers' needs and concerns. In this section we reviewed intervention studies examining strategies which lead to return to work.

Table 6: Interventions for Enhancing Employment Post-SCI

Author Year; Country Score Research Design Total Sample Size	Methods	Outcome
Ottomanelli et al. 2013 USA PEDro=5 RCT Level 2 N=157	**Population:** Veterans with SCI between the ages of 18 and 65 who received health care services in the SCI Centers at one of six participating Veterans Affairs Medical Centers. Experimental: n=81 (mean age 48.7) Control: n=76 (mean age 49.8). **Treatment:** Experimental group members received Supported Employment (SE) services by a vocational rehabilitation counsellor who was trained in the Individual Placement and	**Employment:** Among the 157 participants, 33 participants (21.0%) accounted for 88 total jobs. 1. 24 participants in the SE group accounted for 60/88 jobs (68.2%). The rate of employment for SE participants was significantly greater (29.6%) than the control (11.8%). 2. SE participants accounted for 50 of 72 (69.4%) jobs (competitive employment) and

Author Year; Country Score Research Design Total Sample Size	Methods	Outcome
	Support Model, and integrated as provider among the SCI interdisciplinary care team in the SCI Center. Control groups: group members received Treatment as usual and received referrals to vocational rehabilitation services outside the SCI Centre. Data was collected for 12-months. **Outcome measure**: Competitive employment in the community (paying job earning at least minimum wage).	were significantly more likely to achieve employment (25.9%) compared to control (10.5%). 3. SE participants worked significantly more hours per week (22.0 vs. 17.0), averaged significantly fewer wages ($233.9 vs. $267.3), and missed fewer hours per week (0.3 vs. 1.8).
Ottomanelli et al. 2012 USA PEDro=5 RCT Level 2 N=201	**Population:** 201 veterans with SCI (192M 9F) between the ages of 18 and 65 who received medical and/or rehabilitation care at 1 of 6 participating centers. Experimental: n=81 (mean age 48.7) Control: n=76 at intervention site (mean age 49.8); n=44 at observational site (mean age 45.1) **Treatment:** Experimental group members received a supported employment (SE) intervention based on an Individual Placement and Support (IPS) model. There were two control groups: one at the intervention sites through which individuals were randomly assigned to the control group – treatment as usual – intervention site (TAU-IS) and 1 at sites were the SE intervention was not available. All individuals at these observational sites received treatment as usual - TAU (TAU-OS). Data was collected for 12-months. **Outcome measure**: Competitive employment in the community (paying job earning at least minimum wage).	1. Individuals in the SE group were 2.5 times more likely than individuals receiving TAU-IS and 11.4 times more likely than individuals receiving TAU-OS to obtain competitive employment. 2. The rate of employment for SE participants was significantly greater than that of either the TAU-IS group or the TAU-OS group. 3. Intent to treat analysis found that participants in the SE group earned significantly more per week than the TAU-OS group. Participants in the SE group earned significantly more per week than participants in both the TAU-IS and TAU-OS groups.
Allen and Blascovich 1996 USA PEDro=6 RCT Level 1 N=48	**Population:** All individuals were classified as having severe ambulatory disabilities. Experimental: n=24 (SCI: n = 11, 7M 4F) Control n=24 (SCI= 11, 7M 4F) **Treatment**: Experimental group members received trained service dogs 1 month after the study began. Wait-list control group received dogs in month 13. Participants included individuals who had expressed interest in a service dog and who required substantial personal assistance. Data was collected for 2 years **Outcome measure**: Spheres of Control Scale (to assess internal locus of control), Rosenberg Self-esteem Scale, Affect Balance Scale (to assess psychological wellbeing), Community Integration Questionnaire, and data regarding the number of received paid and unpaid assistance.	1. The experimental group had significant improvements on all psychosocial status tests at months 6 and 12 when compared to the control group. 2. The experimental group had a significant decrease in hours of assistance needed at months 6 and 12 when compared to the control group. 3. After receiving a service dog, there were no significant differences between the groups at the same relative data points (months 0, 6 and 12 for the control group, months 12, 18 and 24 for the wait-list control groups. 4. After 12 months, the presence of the service dog was associated with a decrease of 68% of biweekly paid assistance hours. 5. After receiving a service dog, all participants reported substantial increases in terms of school attendance, part time employment, increased levels of social interaction and use of public transportation.

Author Year; Country Score Research Design Total Sample Size	Methods	Outcome
Shem et al. 2011 USA Longitudinal Level 2 N=39	**Population:** 39 participants with SCI (28M 11F); age 16–26 years. Average(SD) age of mentees was 19.8(3.0) years. 17 employed mentors. In total, 29 participants were matched with mentors, and 10 participants (34%) completed the program **Treatment:** Each mentee with SCI was matched with a community-based mentor, with or without a disability. The mentoring relationship was planned for 2 years. Participants were evaluated with standardized questionnaires at intake, 3 months after entry, every 3 months thereafter, at the time of post-secondary education or employment entry and 4 months post entry. **Outcome measures:** return to school, return to work.	1. 7 (24%) participants returned to school; 2. 2 (6.9%) participants returned to work 3. 1 (3.4%) participant returned to school part-time. 4. For mentees who successfully completed the program, there was a trend for improvement in cognitive independence and occupation measures of Craig Handicap Assessment and Reporting Technique, and statistically significant improvements were found with Participation Index of the Mayo-Portland Adaptability Inventory-Version 4, Disability Rating Scale and Supervision Rating Scale, but not with the Satisfaction with Life Scale.
Ottomanelli et al. 2015 USA Case-control Level 3 N=81	**Population:** 81 military veterans with SCI, average age (SD) 48.7 years (9.8), average time since injury (SD) 11.7 years (11.2), AIS Level of injury – A: 32.5%; B: 13.8%; C: 22.5%; D: 31.3%. **Treatment:** This study was part of a larger 3-year randomized control trial comparing EBSE to TAU provided for 12 months each to unemployed Veterans with SCI who were 18 to 65 years of age and receiving medical and/or rehabilitation health care services at 1 of 6 VHA SCI Centers. All participants received standardized evidence-based supported employment (EBSE) with activities including integrated vocational and medical rehabilitation treatment, rapid engagement in job finding, competitive employment, inclusion regardless of severity or type of disability, ongoing job support, and focus on participant preferences. **Outcome measures:** The IPS Fidelity Scale was used to measure the distribution of vocational services and time of those services delivered by vocational counselors. Mean time reflects average time per documented activity. Comparisons were made between groups that gained competitive employment (CE) and those that did not.	1. Competitive employment (CE) rates during 1 year of evidence-based supported employment for persons with spinal cord injury (N = 81) was 25.9%. 2. There was a statistically significant difference observed between groups; participants obtaining CE were more likely to receive job development (26.6% vs 20.7%), job placement (1.3% vs 0.3%), and employment follow-up (8.4% vs. 2.2%) and less likely to receive vocational counseling (15.3% vs 28.4%).
Sinnott et al. 2014 USA Case series Level 4 N=1578	**Population:** 157 participants with SCI; average age = 48.7±9.8yo; time since injury 10.7±11.3y **Treatment/Methods**: A vocational rehabilitation program of Supported Employment (SE) for veterans with SCI; participants were randomly assigned to the intervention of SE (n=81) or treatment as usual	1. Average cost for the SE intervention was $1,821. 2. In 1 year of follow-up, and compared with usual care, the SE group had marginally less total costs ($6369) and produced fewer QALYs (n.s.), suggesting that SCI-VIP was not cost-effective compared with usual care. 3. An intensive program of SE for veterans with SCI was more effective in achieving competitive employment but was not cost effective after 1 year of follow-up.

Author Year; Country Score Research Design Total Sample Size	Methods	Outcome
	TAU (n=76). **Outcome measures**: Costs and quality-adjusted life years were estimated from the Veterans Rand 36-Item Health Survey and extrapolated to Veterans Rand 6 Dimension utilities.	4. Longer follow-up and a larger study sample will be necessary to determine whether SE yields benefits and is cost-effective in the long run for a population with SCI.
Dorstyn et al. 2019 Australia Pre-post Level 4 N=5	**Population**: 5 people with SCI; mean age 46.4 +/-10.2yo; 4 females initially reviewed Work and SCI; Twenty-four with SCI/D subsequently enrolled, of whom 16 (mean age 46.4 years, SD = 11.1; 7 female), completed the intervention. **Intervention**: Intervention participants accessed the email-based information package (Work and SCI) over a 4-week period. **Outcome Measures**: My Vocational Situation Scale, Job Procurement Self-Efficacy Scale, Patient Health Questionnaire-9, and Life Orientation Test-Revised	1. Reliable change in pre-post scores across outcomes were reported by 38% (n = 6) of participants. 2. Favorable comments on the (Work and SCI) resource were provided in addition to suggestions for improvement. 3. Preliminary data suggest that (Work and SCI) may help to establish vocational interests among jobseekers with a SCI/D, however further work is needed to enhance participant compliance. 4. This might include moderator support to promote and maintain participation.
Phillips et al. 2012 United States Case Series Level 4 N=111	**Population:** Newly injured individuals at an Atlanta rehabilitation. Mean(SD) age: 35(11.8) years; 78% male; 76% white. **Treatment**: Video-based telerehabilitation intervention (9 weeks); telephone-based telerehabilitation intervention (9 weeks); standard follow-up care. **Outcome Measures**: Time to productive activities (attending school, VR, working as a homemaker, volunteering) from injury. Time to employment from injury date among individuals employed prior to injury.	1. Being in one of the intervention groups (either phone- or video-based telerehabiiltation) trended towards a longer time to return to productive activities. 2. Being in one of the intervention groups did not have a significant impact on the time to return to employment for individuals that were employed prior to injury.
King et al. 2004 USA Case series Level 4 N = 174	**Population**: 174 participants with SCI up to 12 months post-discharge from inpatient rehabilitation. No other demographics given. **Treatment:** An enhanced case management program (Marcus Community Bridge Program) assisting people to return to the community and to return to work or educational training. **Outcome measure:** Rate of return to work or educational training at 1-year post-discharge.	1. One year after discharge the rate of return to work was 17% (i.e. identical to the rate reported by the U.S. Model Systems) and the rate of return to educational training was 31.6% (compared to 15.3% reported by U.S. Model Systems)
O'Neill et al. 2017 USA	**Population**: 54 participants; 75% males 25% females; mean age = 37±13yo; level of injury 37% tetraplegia, 30% paraplegia, 33% non-traumatic SCI **Intervention**: The intervention consisted of a vocational resource facilitator (VRF) being the single point of contact providing medical/vocational case coordination to	1. At time of discharge, 48% of participants remained interested in pursuing employment. 2. 81% of these outpatient individuals were referred for state vocational rehabilitation services, with 17 actively engaged in the vocational rehabilitation process. 3. Almost half of all eligible inpatients remained actively engaged in pursuing employment after discharge with some returning to work immediately and others actively working with

Author Year; Country Score Research Design Total Sample Size	Methods	Outcome
Prospective Study (without controls) (Conference Abstract) Level 4 N=54	inpatients and outpatients to ensure the continuity of vocational rehabilitation services upon discharge and long-term follow-up in the community. **Outcome Measures**: interest in pursuing employment, return to work	the state vocational rehabilitation agency to secure competitive employment. 4. 23% outpatient individuals returned to work: 15% to same employer-same job and 8% to same employer-different/modified job. 5. None who returned to work received state sponsored vocational rehabilitation services; although two were referred for services, but were denied due to income restrictions. 6. Preliminary findings indicate considerable interest in employment among newly injured persons with SCI.
Rowell and Connelly, 2010 Australia Observational Level 5 N=181 (SCI n=109)	**Population:** 181 respondents; 73.5% male; mean age: 44 years; 61% unmarried; mean time since injury: 18 years; 39% in labour force and 26% employed. **Treatment:** no treatment per se but examines the impact of a publicly funded set of services to enable return to work i.e. Adult Lifestyle Support Packages e.g. support with activities of daily living Spinal Injuries Survey Instrument (SISI) developed and administered, Short Form-36 (SF-36) and modified SF-36 administered. **Outcome Measures:** Labour market outcomes, exposure to the Adult Lifestyle Support Packages (ALSP), clinical and demographic covariates	1. No statistically significant effect of either the ALSP or support packages from private insurance sources (i.e. PPSP) on labour market participation was found. 2. A number of other factors are significantly correlated with labour market participation: 3. individuals who undertook education or training post-SCI were more likely to be labour market participants 4. females were less likely to be labour market participants 5. a positive attributional style is associated with a higher likelihood of labour market participation 6. a weak non-linear age effect was detected, which suggests that the probability of labour market participation is decreasing in age 7. The marginal effects for the ALSP are statistically insignificant. Thus, the hypothesis that the ALSP has a zero effect on labour market participation cannot be rejected. 8. The strongest marginal effect is for post-SCI education, which is statistically significant at the 1% level and for which the 95% confidence interval is 0.108–0.503. This suggests that post-SCI training and education has an important effect on labour market participation. The probability of labour market participation is increasing in the ln (Attributional Style index, positive scenario). The higher the individual's propensity to ''internalize'' positive employment outcomes to his/her own attributes (or ''capabilities and functionings''), the more likely he/she is to be a labour market participant.
Hansen, 2007 India Observational Level 5 N= 46	**Population:** 46 participants with SCI (40M 6F). No other demographics given. **Treatment:** Participation in the work rehabilitation program with the Center for Rehabilitation of the Paralyzed. Program includes physical conditional, vocational training and work placements. **Outcome measure:** Vocational status.	1. 23 individuals returned to work: 18 participants were employed in a job similar to their pre-injury job; 5 were employed in a different occupation than what they were doing pre-injury. 2. Of the 23 individuals that returned to work 4 used a wheelchair, and 5 used crutches.

Author Year; Country Score Research Design Total Sample Size	Methods	Outcome
Jongbloed et al. 2007 Canada Observational Level 5 N=357	**Population:** 357 participants with SCI (243M 114F); 92 with complete tetraplegia, 142 with complete paraplegia, 108 with incomplete SCI, 15 unknown; mean age = 46. **Treatment:** Report on access to vocational counselling and job retraining. **Outcome measure:** Mailed questionnaire inquiring about factors influencing employment.	1. Social, economic and political environmental factors contribute to individuals working less than desired. Personal reasons were the most influential. 2. Vocational counselling and job retraining were the most important factors in obtaining employment. Other factors were access issues, attendant care, willing employers, personal presentation and the chance to prove oneself. 3. The impact of policies of government and third party payers were cited as having both positive and negative effects on reemployment.
Jang et al. 2005 Taiwan Observational Level 5 N=169	**Population:** 169 participants (147M 22F); 32 participants with incomplete paraplegia, 86 with complete paraplegia, 24 with incomplete tetraplegia, 27 with complete tetraplegia; mean age = 39. **Treatment:** Report on access to vocational training. **Outcome measure:** Employment status, vocational training	1. 88% were gainfully employed at time of injury; post-injury 79% were employed full time, 21% part-time, 53% were unemployed, 5% attended school or vocational training 2. 50% of those employed received vocational training compared to only 28% of unemployed. 3. Predictive factors of return to work include greater duration post-injury, higher level of education, being married, independence in use of public and private transportation, higher Barthel Index score, age at injury <25 years, and receiving vocational training after injury.
Wang et al. 2002 Taiwan Observational Level 5 N=91	**Population:** 36 participants with SCI (29M 7F); 13 participants with tetraplegia, 23 with paraplegia; from the Asylum Center Spinal Cord Injury (ACSCI); age range: 18-49; 11 complete, 25 incomplete. 55 participants with SCI (47M 8F); 21 with tetraplegia, 34 with paraplegia; from the Spinal Cord Injury Association of the Republic of China (SCIAROC); age range 18 - >60; 16 complete, 39 incomplete. **Treatment:** ACSCI group: training program with 6 months of training including: psychosocial consulting, functional, strengthening exercises, endurance, and vocational training; SCIAROC: no specific training program. **Outcome measure:** Employment status, self-reported Functional Independence Measure (SRFIM).	1. All participants in the SCIAROC group had no ACSCI training. All participants with tetraplegia were unemployed; 1 subject with paraplegia was a student, 11 were employed, and 22 were unemployed. 2. Employment rates in the SCIAROC group were related to the level of functional independence and injury level. 3. ACSCI group: all 36 participants were unemployed because they were just completing the ACSCI program. 4. Individuals with tetraplegia in the ACSCI group showed significantly better functional independence than those in the SCIAROC group.
Cotner et al. 2018 USA Qualitative	**Population**: 82 service providers in the VA gave 130 interviews over the course of the 24 month vocational program. **Intervention**: Individual placement and Support (IPS).	1. Twelve barriers to IPS implementation were identified including: obtaining resources, caseload size and area, veteran-specific factors (e.g., low motivation, fear, lack of transportation, etc.), provider education, hiring, provider turnover and integration of vocational rehab counselors (VRs) into the

Author Year; Country Score Research Design Total Sample Size	Methods	Outcome
N=82	**Outcome Measures**: Interviews were conducted every 6 months at each site by two or three qualitative researchers using an open-ended, semi-structured interview guide. Interviews were conducted to determine barriers and facilitators to employment and implementation of the IPS program.	SCI clinical care team, time management, and lack of leadership/salesperson type. 2. Facilitators included: integration of vocational and clinical team, engagement of SCI providers, fit of IPS model, audit and feedback, and obtaining resources. 3. Some of the named barriers and facilitators were the same, indicating that they could be key components to a program going well or going poorly, or that different parts of implementation were required at different times.
Note: A 2012 study by Kolakowsky-Hayner et al. was excluded based on the fact that individuals with SCI only constituted 29.8% of the sample population, and there was no specific analysis or coefficients that would enable understanding of the SCI specific subsample. The SCIRE criteria states that over 50% of the sample must be individuals with SCI for inclusion if a subgroup analysis is not performed.		

Discussion

This review suggests that there is a profound lack of high-level evidence studies which have a focus on work and employment-related interventions. Three randomized controlled studies were found, with Allen and Blascovich (1996) examining access to trained service dogs, and suggesting an improvement in psychosocial status including self-esteem, internal locus of control, and overall psychological well-being. Other benefits of having trained service dogs were a decrease in aid time by a professional assistant or family and friends, an increase in school attendance and part-time employment, and an increase in social participation and community (Allen and Blascovich 1996).

The second randomized trial by Ottomanelli et al. (2012) found that a supported employment (SE) intervention was more effective at returning veterans to work than treatment as usual (TAU). Those receiving SE were 2.5 times more likely than those receiving TAU at the intervention sites (offering both SE and TAU) and 11.4 times more likely than those receiving TAU at the observation sites (offering only TAU) to achieve employment over the 12 month follow-up period. However, participants in the SE group earned significantly less per week than those in the TAU intervention site group. This study was followed up by a third randomized trial (Ottomanelli et al. 2013) which reported that the supported employment (SE) intervention participants had a significantly higher rate of employment than the control, worked significantly more hours per week and missed significantly fewer hours of work.

There was one prospective study by Shem et al. (2010) which found that participants who completed a mentorship program improved their functioning, independence, and participation, which may have contributed to their favorable return to work (or return to school) outcomes. However, it was not clear from the study whether or not participation in the mentorship program was directly related to employment post-SCI; hence existence of evidence is uncertain in this case. Other studies included case series and observational studies. These studies examined employment outcomes of people with SCI who received various vocational rehabilitation services. One study (Inge et al. 1998) suggests that people enrolled in a program using person-centered planning tools to identify needs and to direct the job search might gain employment but the workplace support greatly varied- from minor to intensive support. Another study (King et al. 2004) described a modified case management approach to return people with SCI to work. Comparing their preliminary results with those of the U.S. Model Systems, it appears that the program is successful for increasing return to educational training but not

to work. Marini et al. (2007) suggest that people with SCI registered in state vocational rehabilitation agencies and receiving job placement services are likely to have a higher employment rate. Likewise, Jellinek and Harvey (1982) supported the conclusion of higher employment rate in individuals with SCI who had access to on-site professional counsellors for vocational / educational rehabilitation in addition to state vocational rehabilitation agency, compared to the state vocational rehabilitation agency only. They concluded that the vocational or educational placement was as high as 78% among those who had on-site vocational or educational services. In their sample of 169 people (49% engaged in gainful employment), Jang et al. (2005) found that fifty percent of the employed had received vocational training, compared with only 28% of the unemployed. Jongbloed (2007) also found that employment re-training and education were identified as important contributors to success. However, the participants stated that services and information were perceived as difficult to access. Another observational study examined whether a publicly funded set of support services such as help with activities of daily living is associated with labour market participation. The authors found no effect of these services on labour market participation compared to support packages from private insurance sources (Rowell and Connelly 2010). Hence, evidence cannot be ascertained in this case. However, the same study found that an individual's propensity to internalize positive employment outcomes in relation to his or her capabilities may contribute to returning to work.

Two other studies examine vocational interventions. Wang et al. (2002) compared a group of persons with SCI receiving a multimodal 6-month training course to a group without specific training. They found that individuals with paraplegia had higher employment rate which indicated an association between level of injury and employment. Hansen et al. (2007) interviewed male participants with SCI in a work rehabilitation program which included physical conditioning, vocational training, and work placements. Less than half were employed in a similar or identical job as their previous employment and only about a quarter of those who used a wheelchair returned to work. Overall, the studies included in this review investigated different types of interventions and used different measures to assess the interventions. Although this may limit the generalizability of the outcomes, there is evidence in general supporting the use of interventions to enhance employment post-SCI.

One study evaluated a telerehabilitation intervention and included employment as an outcome (Phillips et al. 2012). The intervention arm included a nine week telephone or video-based telerehabilitation intervention (not focused on employment) compared with care as usual. Return to employment was analyzed in those that were employed pre-injury; with those receiving the intervention not returning to work any faster than those receiving standard care.

Conclusions

There is level 1 evidence (Trenaman et al. 2014) suggesting that supported employment shows the strongest evidence that it can improve employment outcomes amongst individuals with SCI. Service dogs have also been shown to increase employment.

There is level 1 evidence (Kent & Dorstyn et al. 2014) that 3 psychological constructs: affective experiences, quality of life, and life satisfaction could be considered clinically important in their effects on employment.

There is level 1b evidence (Allen and Blascovich 1996) that suggests a service dog improves integration and participation in school and employment and decrease the number of hours of paid assistance after the first year.

There is level 2 evidence from three studies (Ottomanelli et al. 2012; Ottomanelli et al. 2013, Ottomanelli et al. 2015) that suggests that a supported employment intervention improves employment rates compared with treatment as usual over a one-year period, increases the

number of hours worked per week, decreases the number of missed hours of work, and improves employment outcomes for veterans with SCI across a 2 year follow-up period.

There is level 5 (Jellinek and Harvey 1982) and level 4 evidence (Marini et al. 2008) that on-site vocational rehabilitation counselling during inpatient rehabilitation can increase employment rates.

There is level 4 evidence (Marini et al. 2008) that use of job placement services may help individuals with SCI find employment.

There is level 4 evidence (Inge et al. 1998) suggesting that person-centred planning tools facilitate employment.

There is level 4 evidence (King et al. 2004) that case management programs increase return to educational training, but not to work.

There is level 4 evidence (Sinnott et al. 2014) that although the supported employment (SE) program for veterans with SCI was more effective in achieving competitive employment than treatment as usual (TAU), it was not cost effective after 1 year of follow-up.

There is level 4 evidence (Dorstyn et al. 2019) that providing structured information on SCI and employment (Work and SCI) over a 4-week period may help to establish vocational interests among job-seeking persons with SCI.

There is level 5 evidence from 4 studies (Wang et al. 2002; Jang et al. 2005; Jongbloed et al. 2007; Hansen 2007) that receiving vocational training increases the likelihood of employment.

There is level 5 evidence (Rowell and Connelly 2010) that an individual's propensity to internalize positive employment outcomes in relation to his or her capabilities may contribute to returning to work.

People with SCI may benefit from vocational rehabilitation in the process of job placement and work reintegration.

There is a lack of high quality research in vocational (re) training. Consequently, conclusions are mostly based on evidence from observational studies or case studies.

Continuous support to the employee and employer before and after vocational placement may lead to a successful return to work and job retention.

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Abbreviations

ACSCI	Asylum Center Spinal Cord Injury
ALSP	adult lifestyle support package
ICF	International Classification of Functioning, Disability and Health
IPS	individual placement and support
SCIAROC	Spinal Cord Injury Association of the Republic of China
SE	supported employment
SF-36	Short Form 36
SISI	Spinal Injuries Survey Instrument
SRFIM	self-reported Functional Independence Measure
TAU	treatment as usual
VR	vocational (re)training