Review

Modifiable and non-modifiable factors associated with employment outcomes following spinal cord injury: A systematic review

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Context: Employment rates in individuals with spinal cord injury (SCI) are approximately 35%, which is considerably lower than that of the general population. In order to improve employment outcomes a clear understanding of what factors influence employment outcomes is needed.

Objective: To systematically review factors that are consistently and independently associated with employment outcomes in individuals with SCI, and to understand the magnitude of their influence.

Methods: Through an electronic search of MEDLINE/PubMed, EMBASE, CINAHL, PsycINFO, Social Science Abstracts and Social Work databases, we identified studies published between 1952–2014 that investigated factors associated with employment outcomes following SCI. 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. First author, year of publication, sample size, explanatory and outcome variables, and effect measures were extracted.

Results: Thirty-nine studies met the inclusion criteria. Twenty modifiable and twelve non-modifiable factors have 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.

Conclusion: A number of key modifiable factors have been identified and can inform interventions aimed at improving employment outcomes for individuals with SCI. 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.

Keywords: Employment, Spinal Cord Injuries, Systematic Review, Work

Introduction

The importance of employment among individuals with spinal cord injury (SCI) was first raised in 1959,¹ and is regularly identified as an important component of life priorities post injury.² The International Classification

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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’.³ Employment is known to be a critical component of personal identity and personal growth,⁴ disability adjustment,⁵ social integration and life satisfaction,⁶ in addition to economic self-sufficiency. From a societal perspective, engaging individuals in the work force contributes to the social well-being of a country. Employment rates in individuals with SCI are approximately 35%,⁷ which is substantially lower than that of the general population. Research indicates that a considerable number of unemployed individuals with SCI want to work and rate themselves as able to work.⁸

In order to improve employment outcomes among individuals with SCI, a clear understanding of what factors influence employment outcomes is needed. Broadly speaking, factors can be divided into those that are modifiable and those that are not. Non-modifiable factors can be used to determine which individuals are at risk of poor employment outcomes, whereas modifiable factors are those that may be amenable to interventions, either through improvement or preventing deterioration. Commonly cited factors include: education, type of employment, disability severity, age, time since injury, sex, marital status and social support, vocational counselling, medical problems related to the SCI, employer role, environment, and professional interests.⁹ These factors vary and reflect the fact that employment outcomes are the result of a complex interaction between injury-related and contextual (personal/environmental) factors. As such, relying on univariate comparisons between factors and employment outcomes, without controlling for known confounders, may result in unreliable estimates of the true association. Therefore, factors should be investigated in a multivariate manner adjusting for potential confounders. To date, systematic reviews in this area have presented results from both univariate and multivariate analyses, and examining the strength of associations between predictor variables and employment has been limited to a few psychological variables.^{7,8,10,11}

In the current context, reviewing effect sizes is a complex task given the variation in both explanatory (years of education vs. education attainment) and outcome variables (currently employed vs. ever employed post-injury vs. employment income, etc.). Overcoming all of these complexities is challenging, but including them as part of the analysis can begin to elucidate the direction and trends in the magnitude of

their effect. Focusing on the magnitude of effect is particularly important given that program planners are operating within fiscal constraints, and need to ensure that they are allocating resources to the most critical factors to improve employment outcomes.

The current analysis systematically reviewed factors associated with employment outcomes in individuals with SCI. Only factors that were evaluated through multivariate regression analysis and computed effect sizes such as odds ratios, relative risk, or hazard ratios (or reported regression coefficients) were considered. Through this, we addressed two questions: What factors are consistently and individually associated with employment outcomes in individuals with SCI (after adjusting for co-variation)? And, what is the magnitude of the effect of these factors on employment outcomes?

Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed for this review.¹²

Eligibility criteria

In order to be included in the review, studies needed to be investigating factors associated with employment outcomes following SCI. Exclusion criteria include: (1) reviews (2) studies not published in English (3) studies not analyzing the correlation between factors and employment outcomes through a regression analysis, or (4) studies not providing an effect measure in the form of odds ratio, relative risk, or hazard ratio.

Information sources

We conducted a systematic review of MEDLINE/PubMed, EMBASE, CINAHL, PsycINFO, Social Science Abstracts and Social Work Abstract databases, in addition to the Cochrane Database of Systematic Reviews, and included studies published between 1952 and July 18, 2014.

Search strategy

The search was completed by combining terms related to employment, such as ‘employment’, ‘supported employment’ and ‘vocational rehabilitation’, with those related to spinal cord injury, such as ‘spinal cord injury’, ‘paraplegia’ and so forth. A full list of the search terms is available in the supplemental material (available at <http://dx.doi.org/10.1179/2045772315Y.042200000031.S1>). All publications were then entered into an electronic reference manager, where duplicates were removed. Additional papers were identified through hand-searching the reference list of included papers.

Study selection process

Two reviewers independently screened the title of the articles, with relevant studies reviewed at the abstract and full-text levels (LT, WCM). The authors identified papers for inclusion with full agreement (i.e. no discrepancies needed to be resolved through discussion).

Data collection process

Data were extracted independently by two reviewers. Factors were categorized based on the ICF framework where employment falls under participation and can be influenced by other factors such as: activities, body function and structure, environmental factors, personal factors, and health condition. The definitions of the domains were adopted from the World Health Organization.¹³

All studies investigating a correlation between a factor and employment outcomes were extracted into the relevant tables based on the ICF domains. Notably, each domain was sub-categorized based on modifiability. Factors were considered modifiable if they could theoretically be amenable to intervention. Environmental factors were sub-classified as either facilitators or barriers based on how they were investigated in the specific study context.

Data items

For each study, the first author, year of publication, sample size, explanatory variables, and outcome

variables were extracted. Studies reported significance at alpha level of 0.05 and/or 95% confidence intervals (CIs). Effect measures, including odds ratio, relative risk and hazard ratios, were reported and recorded. In order to have greater comparability between studies, effect sizes were converted to a 'standard' direction. For example, in the case of social support, which includes the proxy indicator of marital status, some studies may have reported being 'not married' as the reference group, whereas others may have used being 'married'. Based on the consensus of studies, the direction of the effect was changed to ensure all effect measures were scaled in the same direction.

Results

The search initially resulted in 2,248 papers and after removal of duplicates, a total of 1,448 remained. After full text review, 39 studies were included for review (Fig. 1, Supplemental Table S1). Included studies were published between 1992 and 2014, with only four published prior to 2000. Sample size ranged from 12 to 20,143 participants. Twenty-six studies included participants from the United States, with others being from Australia (4), the Netherlands (4), Taiwan (2), Italy (1), Norway (1) and Switzerland (1). Eighteen (69%) of those studies from the United States used data from the United States Spinal Cord Injury Statistical Center (NSCISC). Employment outcomes

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Search Strategy Diagram. OR = Odds Ratio; RR: Relative Risk; HR: Hazard Ratio.

were primarily related to current employment status (employed vs. not employed, currently employed vs. chronically unemployed), some investigated the timing of return to work (shorter vs. longer time to first full time job, work/school at 1, 5, and 10 years post-injury), and some measured employment along a continuum (eg, proportion of months worked divided by total post-injury).

A total of 32 different factors have been investigated as correlates of employment outcomes (Table 1). We classified the factors into the 5 ICF domains (health condition, body structures and function, activity and participation, environmental and personal) and into 12 different non-modifiable factors and 20 different modifiable factors in an effort to describe and understand what factors contribute to employment outcomes in those with SCI. Of the non-modifiable factors, five are related to the health condition, including etiology of injury, time since injury, time period of injury, severity of injury, and pre-injury chronic conditions. Five factors fell in the personal domain, including sex,

race/ethnicity, age, age at injury, and pre-injury education. Associated injury was the sole factor classified in the body structures and function domain. Lastly, pre-injury employment was the sole factor under the activity and participation domain, with no non-modifiable factors in the environmental domains.

Non-modifiable factors

In 15 studies, age was investigated as a correlate of employment status (Supplemental Tables S2–S5). Twelve investigated age as a continuous correlate, with 8 of these studies^{14–21} finding a one-year increase in age was associated with a 2–4% decrease in odds of employment. Three studies^{22–24} found no significant difference in odds of employment based on age. Three studies^{8,25,26} investigated age as a dichotomous correlate, with two studies finding no significant difference in odds of employment between age groups and one finding a significant decrease in the likelihood of employment for those older than 55 years.

Twenty-one studies investigated sex as a correlate of employment, with ten^{15,19,23,24,26–31} finding no significant difference between males and females. Eleven studies^{8,17,18,21,25,32–36,42} found a significant difference in odds of employment based on sex, with eight finding higher odds in males. Among those studies with a higher proportion of males being employed, the OR ranged from 1.15³³ to 3.70 (95% CI, 1.54–8.92).⁸ The lone study where females had an OR of 0.59 (9% CI, 0.42–0.77)⁴² corresponded to a 41% decrease in odds of employment among males.

With respect to race/ethnicity, studies performed a number of subgroup analyses, including whites vs. non-whites, non-minority vs. minority, Caucasian vs. Hispanic, Hispanic/other vs. African American, and Whites vs. African American. The results from six^{15,16,20,21,23,37} out of seven²⁹ studies indicate that odds of employment are greater among whites compared to non-whites. Three^{17,18,29} out of four³⁰ studies found that odds of employment are greater among non-minorities compared to minorities. Three^{27,38,39} out of four²² studies found greater odds of employment among Caucasians compared to Hispanics. Three^{20,32,39} studies found greater odds of employment among Hispanics compared to African Americans; in one study this effect was only significant at 10 years, but not 1- and 5-years post-injury.³⁹ Six^{25,29,32,39,40,42} out of seven²² studies found greater odds of employment among whites compared to African Americans.

Eight studies investigated the influence of pre-injury education attainment on post-injury employment outcomes. Krause *et al.* completed two studies^{17,42} focusing

Table 1 Factors identified in the systematic review: Classified by ICF domain and modifiability

ICF Domain	Modifiable	Non-modifiable
Health condition		Etiology Pre-injury chronic conditions Time since injury Severity of Injury Time period of injury Associated injuries
Body structures and function	Motor Status Secondary health conditions	
Activity and Participation	Use transportation independently Able to drive Able to live alone Functional independence Wheelchair Skills Mobility Community Integration Post-injury employment [GOAL]	Pre-injury employment
Environmental		
Facilitators	Area environmental factors Assistive technology Social support Vocational Rehabilitation	
Barriers	Accessibility Disability discrimination Financial disincentives Insurance	
Personal	Personal Attitude Post-injury education	Age Age at Injury Sex Race Pre-injury education

on education attainment, and in all but one sub-analysis, higher degree attainment was associated with an increased odds of post-injury employment. The effect of the association ranged from OR = 1.60 (95% CI, 1.02–2.52) for technical training before injury compared to less than high school, to OR = 20.80 (95% CI, 15.40–28.10) for a masters/PhD degree compared to <11 years of school. One researcher found in two separate studies^{36,49} that higher pre-injury education was associated with a significantly higher odds of having worked a greater proportion of time post-injury; however pre-injury education was not correlated with employment status at one year post injury (OR = 1.45 [95% CI, 0.67–3.15]). Both^{40,41} studies comparing college degrees to less than 12 years of education were significantly related to an approximately 3 times greater likelihood of being employed post-injury.

Five^{18,20,32,42,45} out of seven^{19,27} studies indicate that non-violent etiology of injury is associated with increased odds of post-injury employment. Younger age at injury is associated with increased odds of employment in three^{22,40,42} of four¹⁶ studies that investigated it as a dichotomous correlate. There was mixed evidence when age at injury was investigated as a continuous correlate. Odds of employment appear to improve as time post-injury increases, though there is evidence that this effect may plateau around 5-years post-injury and begin to slowly decrease thereafter.³¹ The severity of injury is also a significant predictor of employment status post-injury. A more severe injury (tetraplegia vs. paraplegia) associated with decreased odds of employment in eleven^{14,20,27–29,33,34,36,37,40,41} of fourteen studies. Complete compared to incomplete injury was associated with decreased odds in three^{27–29} studies except when comparing complete to incomplete paraplegia where no difference was found. One study³⁴ found that those injured at a later time period (1976–1982 vs. 1961–1975) experienced a greater odds of employment HR = 2.09 (95% CI, 1.09–4.00), and that pre-injury medical complications were associated with an increased odds of post-injury employment HR = 4.38 (95% CI, 1.51–12.71) whereas pre-injury chronic conditions were associated with decreased odds HR = 0.20 (95% CI, 0.06–0.64). Lastly, one study reported that if alcohol was involved with the injury that it is significantly less likely that the person will have work or school at 1 year post-injury.⁴⁰

Modifiable factors

Body structures and functions

Secondary health conditions were investigated in 8 studies, including both general and condition specific

measures (Supplemental Table S6). Anderson and Vogel found that a higher total number of medical complications was associated with a 19% decrease in odds of being employed (OR = 0.81 [95% CI, 0.69–0.96]).⁴⁴ Other significant results included the finding that being in poor health was associated with a 59% (OR = 0.41 [95% CI, 0.22–0.76]) reduction in having paid employment,²² and having been hospitalized (compared to not) was associated with a 36% decrease in odds of being employed (OR = 0.64 [95% CI, 0.48–0.85]).²⁹ Two studies found that a greater number of depressive symptoms were correlated with a modest, but statistically significant, decrease of 7–12% in odds of being employed,^{45,46} in addition to a longer time to employment post-injury (HR = 0.38 [95% CI, 0.21–0.69]).⁴⁶ One study¹⁹ found that pain was associated with a 15% decrease in odds of being employed, whereas another¹⁶ found that a one-unit increase on a sleep scale (indicating poorer sleep) was associated with an increased odds of employment (OR = 1.04 [95% CI, 1.01–1.06]); this association was not significant in a secondary analysis (OR = 1.01 [95% CI, 1.00–1.03]). Greater motor status, as measured by the motor index, was associated with increased odds of employment in year one post-injury, OR = 1.25 (95% CI, 1.15–1.33).¹⁵

Some non-significant results were also present, including whether an individual was re-hospitalized (vs. not)²² and current health status.²³ Meade *et al.*²⁹ evaluated a considerable number of secondary health conditions including pressure ulcers (stage vs. none), deep vein thrombosis, pneumonia, kidney stones, and nursing home stays, with only the aforementioned hospitalization showing a significant difference. Lastly, Blauwet *et al.*²⁶ found no significant association between Body Mass Index (BMI) and being employed and Hirsch *et al.*¹⁶ found no significant difference in odds of employment based on pain severity or fatigue.

Activity and participation

The modifiable factors under the ICF domain of activity included using transportation independently, ability to drive and to live alone, functional independence, wheelchair skills, mobility, community integration, and our end-point post-injury employment (Supplemental Table S7).

Three studies evaluated independent transportation as a correlate of employment, with two finding a significant difference; one found that lack of independent transportation was associated with lower odds of employment, OR = 3.82,⁴³ and one found that autonomy in transportation was positively correlated with

employment HR = 5.13 (95% CI, 2.72, 9.68).⁴⁶ Similarly, two studies^{14,37} found that the ability to drive was associated with an increased odds of employment, OR = 1.85 (95% CI, 1.50–2.27) and OR = 2.59 (95% CI, 1.19, 5.63). One study⁴⁴ investigated mobility (using the Craig Handicap Assessment and Recording Technique, or CHART) and found that a greater CHART score was associated with increased odds of employment OR = 1.07 (1.03–1.10).

Ability to live alone was also associated with an increased odds of employment, OR = 2.89 (95% CI, 1.38, 6.05).¹⁴ Seven studies^{8,31,41,44,47–49} evaluated measures of functional independence and the association with employment. Five evaluated the Functional Independence Measure (FIM) finding that a one-unit increase was associated with 2% (OR = 1.02 (95% CI, 1.00–1.04) to 7% (OR = 1.07 (95% CI, 1.01–1.13) increase in odds of employment.^{31,41,44,47,49} Jang *et al.*⁴⁸ found that those displaying independence and scoring greater than 10 on the Barthel index had a 170% increase in odds of employment, while those displaying independence with a Barthel index of 10 or less did not have significantly different odds of employment. Tomassen *et al.*⁸ found that a Barthel index score of >15 was associated with a 176% increase in odds of employment compared with those with a score of <15. One study⁴⁹ focused on a participation factor, finding that a one point greater score on the Community Integration Measure (CIM) was associated with an increased odds of employment of 1.26 (95% CI, 1.06–1.49). Two publications^{50,51} looked at components of wheelchair skills and the resulting odds of employment. In both, wheelchair ability score was associated with an increased odds of employment (OR = 2.22; OR = 1.63), but taking one-second longer to perform an exercise was associated with a decreased odds of employment (OR = 0.88; OR = 0.87). High peak oxygen uptake and a lower physical strain score were associated with increased odds of employment in both studies.^{50,51}

Environmental facilitators

Four environmental facilitators were identified, including area environmental factors (rural vs. urban; higher socioeconomic status vs. lower; area employment rate), assistive technology, social support (including marital status), and vocational rehabilitation interventions (Supplemental Table S8). Botticello *et al.*²² found that higher socioeconomic status of the surrounding area, and living in an suburban (compared to urban) area was correlated with an increased odds of employment, OR = 1.09 (95% CI, 1.04–1.14) and OR = 2.17 (95%

CI, 1.08–4.35), respectively. No significant difference was observed between rural and suburban areas. Pflaum *et al.*²⁰ found that a greater population employment rate was associated with an increased odds of employment, OR = 2.08 (95% CI, 1.74–2.48). Results from multivariate studies including assistive technology on employment were mixed; one study³⁸ found that assistive technology was associated with increased odds of employment, one²⁴ found no significant difference, and another⁴⁶ found that it was associated with a longer time to employment, HR = 0.31 (95% CI, 0.12–0.82).

Burns *et al.*⁴⁵ found that social support was associated with a slightly increased odds of employment, OR = 1.14 (95% CI, 1.01–1.30). Five studies investigated marital status, with four^{15,20,22,27} of these finding that being married is associated with a 54–126% increase in odds of employment; the remaining study¹⁹ found a non-significant result. Arango-Lasprilla *et al.*³⁸ found that a variety of vocational rehabilitation related factors, including on the job training (OR = 2.97 [95% CI, 1.55–5.69]), job search assistance (OR = 1.35 [95% CI, 1.10–1.67]), on the job support (OR = 1.65 [95% CI, 1.25–2.17]), maintenance services (OR = 1.60 [95% CI, 1.32–1.94]), and other services (OR = 1.51 [95% CI, 1.29–1.78]) were associated with increased odds of employment, while miscellaneous training (OR = 0.74 [95% CI, 0.62–0.92]) and attendant services (OR = 0.56 [95% CI, 0.35–0.89]) were associated with decreased odds of employment. Marti *et al.*¹⁹ found that vocational counselling was associated with increased odds of employment, but Pell *et al.*²⁴ found neither computer skills nor training in computers was correlated with employment outcomes. Lastly, Tomassen⁸ found that retraining post-injury was associated with an increased odds of employment (OR = 2.14 [95% CI, 1.08–4.26]) and Heinemann *et al.*⁴⁰ found that those involved in psychological treatment that focused on rapport building were less likely to have work/school at the 1 year anniversary post-injury (OR = 0.84, P = 0.01).

Environmental barriers

Four modifiable environmental barriers were identified, including financial disincentives (e.g. welfare subsidy, disability benefit), insurance status, disability discrimination, and inaccessibility (Supplemental Table S8). Five studies found that disincentives were associated with a decreased odds of employment,^{14,30,36,38,43} the odds were smallest for an individual receiving welfare subsidy, OR = 0.07 (95% CI, 0.03–0.20).¹⁴ Four studies^{21,23,30,49} found that financial disincentives were

not associated with odds of employment. One study investigated insurance status²¹ finding no significant difference in employment outcomes but two studies^{40,41} found that those on Medicaid or Worker's Compensation were significantly less likely to have work/school 1 year post-injury than those with private insurance. Two studies^{43,45} found that perceived discrimination was associated with increased odds of employment. Pflaum *et al.*²⁰ found that an indicator of the Americans with Disabilities Act was correlated with an increased odds of employment, OR = 1.24 (95% CI, 1.01–6.23). Lastly, perceived access-related barriers were associated with decreased odds of employment in one study (OR = 0.30 [95% CI, 0.12–0.80])⁴⁵ but perceived environmental barriers were associated with increased odds in another⁴³ (OR = 6.62, P = 0.02).

Personal factors

Two modifiable personal factors were investigated: education (attainment and years of education) and personal attitude (Supplemental Table S9). Four studies^{8,17,36,42} investigated the influence of post-injury education attainment on employment. All found that higher educational attainment, from high school graduation to masters/PhD, was associated with increased odds of employment relative to attaining less than a high school education. There appears to be a 'dose-response' as high school graduation (compared to less than high school education) was associated with an OR = 2.90 (95% CI, 2.40–3.60) compared with an OR = 28.60 (95% CI, 21.90–37.20) for a post-injury masters/PhD⁴²; a similar trend was observed elsewhere.¹⁷ With respect to number of years of education, each additional year of education is associated with a 12–54% increase in the odds of employment following SCI.^{19,44} Notably whether or not the education was gained pre- or post-injury was not specified.

A variety of personal attitudes were investigated in the context of employment outcomes. Primacy of work, self-reliance, motivation, resources, higher thrill and adventure seeking behaviour, and viewing work as more important were associated with an increased odds of employment^{19,23,44,45} but emotional control, a perceived lack of skills, and not considering work important were associated with a decreased odds of employment.^{43,45}

Discussion

This paper systematically reviewed factors associated with employment outcomes in individuals with SCI. Factors were categorized based on the domains of the

ICF of the WHO to use a universal framework on functioning based on an integrative biopsychosocial approach to understanding disability. Factors were also framed around their modifiability to acknowledge the fact that modifiable and non-modifiable factors can be used to accomplish different goals. For example, non-modifiable factors can be used by program planners as a means to reduce disparities by focusing on individuals that will have the most difficult time gaining employment. Alternatively, planners in a low-resource setting may choose to direct their limited resources towards those that are the easiest to employ. Modifiable factors, on the other hand, serve as the foundation or guide to inform further decision-making for interventions aimed at improving employment outcomes, and may be of interest to program planners, rehabilitation professionals, and affected individuals and their families. Thus non-modifiable factors identify 'who' to target; modifiable factors indicate 'how' employment outcomes can be improved.

To our knowledge, this is the first time that a systematic review in this area has explicitly controlled for numerous confounding factors, and attempted to systematically quantify the magnitude of the association by reporting effect sizes. The knowledge of a significant relationship between a factor and employment outcome is valuable, but the magnitude and direction of association is of particular importance. Suppose we know that an additional year of education is associated with increased odds of employment; how one might act upon this information is dependent upon the size of the effect based on current evidence. A 0.1% increase in odds may be statistically significant, but may not justify the time and energy involved in completing an additional year of education. Conversely, if one additional year was associated with a 100-fold increase in odds of employment, individuals are likely to be compelled to act on this finding.

A number of systematic reviews have previously been completed in this area. A 2007 systematic review found a number of key factors associated with employment including: education, type of employment, disability severity, age, time since injury, sex, marital status and social support, vocational counselling, medical problems related to the SCI, employer role, environment, and professional interests.⁹ A review in 2009 reported a number factors associated with returning to work post SCI, including age at time of injury/study, education level, employment status at injury, being able to drive, sex, physical health, functional ability, severity/level of injury, life satisfaction, locus of control, motivation level/expectation to work, race, paraplegia vs.

tetraplegia, being married, time since injury, and social support.⁷

The current review has corroborated many findings from past reviews, such as identifying education as the most important modifiable correlate of employment outcomes. Importantly, we introduced a greater level of rigor to the inclusion process that has not been used in past reviews, excluding studies that inadequately control for confounding factors, while beginning to shift the focus from factors that are associated with employment outcomes to those that can be modified and may provide the greatest impact on employment outcomes.

Even though a factor may be modifiable, it may not represent a logical intervention target if improving employment outcomes is the goal. For instance, it is unlikely that rehabilitation professionals would recommend individuals get married because of a correlation with favourable employment outcomes. Similarly, reducing medical complications is a laudable goal in and of itself without the associated employment benefits. An additional example is motor status, as it is challenging to discern if improvements in motor status are due to spontaneous recovery or motor rehearsal. If the latter is true, the factor would be considered modifiable and thus amenable to intervention. We have included these factors that are modifiable in theory. In the case of motor status specifically, using workplace accommodations and assistive technologies as a means of supplementing motor status may be the best avenue for intervention. Thus not all factors will be the target of employment interventions, but in such cases the information presented may justify including employment as a secondary outcome.

ICF framework

We found the utility of the ICF in this review to be valuable. Employment outcomes are just as complex and multifactorial as the consequences of SCI. We were able to disentangle the different factors according to the ICF model of functioning and disability. This allows the readers and users of this review to decide which aspects of disability to target and which modifiable and non-modifiable factors within each aspect that they need to consider or address in order to optimize employment outcomes in SCI.

Implications for practice

The ultimate goal of reviews in this area is to provide evidence that can inform practice, thereby improving employment outcomes for individuals with SCI. How the information presented here is used depends on the audience, as different individuals will have different perspectives and experiences that will dictate how this

knowledge can translate into action. We will now explore how a number of different groups, including policy makers, rehabilitation professionals, and affected individuals and their families or caregivers could leverage the findings of this review.

Policy-makers

From a policy perspective, financial disincentives were significantly correlated with employment outcomes in 5 of 8 studies that reported values. In these five,^{14,30,36,38,43} receiving compensation in the form of welfare subsidies or other payments resulted in a 14–93% decrease in odds of employment. Disability discrimination was also a significant correlate of employment status. One study found that the implementation of the American Disability Act resulted in a 20% increase in odds of employment.²⁰ This Act was developed with the explicit purpose of guaranteeing equal opportunities for individuals with disabilities by removing barriers in public accommodations, employment and transportation.⁵² This is an important example of policy translating into real changes in the population. There is reason to evaluate the policies around financial benefits such as welfare subsidies and disability benefits to ensure that the loss of benefit does not outweigh the benefits for an individual to return to work. A study of employment following SCI in Canada found that policies of third party payers and government, including financial disincentives, were among the most important factors that influence employment outcomes.⁵³

Rehabilitation professionals

Not surprisingly, vocational rehabilitation interventions appear to play a significant role in the odds of gaining employment. The evidence is persuasive, with one study finding that individuals receiving job placement assistance have an 81% increase in odds of competitive employment than those who do not.³⁸ Other targets identified in this review include functional independence, wheelchair skills, and independence in driving or transportation. Given that employment outcomes are not maximized until 5–10 years post-injury,^{32,42} there is a crucial need to better integrate rehabilitation professions into tertiary care to ensure ongoing rehabilitation continues after individuals are discharged into the community.

Affected individuals and their families

One additional year of education is associated with a 12–54% increase in odds of employment. However it should be stressed that, even amongst those with post-secondary education, there are unique benefits to be gained by additional education post-injury. Two

publications^{17,42} that investigated pre- and post-injury education attainment found that post-injury education was more highly correlated with odds of employment than pre-injury education. The authors attribute this to individuals being able to tailor their education to their post-injury abilities.

Limitations

Our search criteria excluded non-English publications and studies that did not perform regression analysis or report effect measures other than OR, RR, and HR. We acknowledge that these criteria may have limited the number of factors found in this review, but we believe this is an important step in delineating the most important factors that influence employment outcomes in the population.

Eighteen of the thirty-nine studies included in this review used data from the US based National Spinal Cord Injury Statistical Center (NSCISC). Research using the NSCISC database is performed by using available data to perform a retrospective analysis, or to identify eligible patients who are then contacted to participate in a cross-sectional survey. It is possible that a number of individuals appeared in multiple studies we reviewed.

For the education factor, we have included publications regardless of whether they specified if the education was undertaken pre- or post-injury. Undoubtedly some individuals would have undertaken education pre-injury, and this would bias the effect size in a conservative manner given that post-injury education has a greater effect on employment than pre-injury.

Admittedly in the current context, comparisons are fraught with complexities given the variance observed between studies. There is considerable variation in the methods used to build the regression models (statistical vs. a priori knowledge) that results in variation in the factors that are controlled for. Additional complexities arise as a result of different employment end-points, such as current employment status, time to employment post injury, and hours worked per week. This makes comparisons challenging, and undoubtedly results in increased variation in the effect sizes. The same is true for explanatory variables; some domains such as education, sex, and age are relatively homogeneous, but others such as secondary health conditions and financial disincentives are heterogeneous.

Conclusion

There are a considerable number of modifiable factors that have been correlated with employment outcomes following SCI. We have taken the first step in attempting to delineate the relative importance of these factors in

influencing employment outcomes, but additional research is needed. Future studies should focus on evaluating the strength of association between individual factors and employment outcomes. Education is one factor that is sufficiently homogeneous to be considered for meta-analysis if the employment outcomes could be more uniformly defined. Beyond this, a greater understanding of interventions that can be deployed to improve employment outcomes in individuals with SCI is needed.

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