Factors Associated with Return to Work after a Spinal Cord Injury: a Systematic Review and Meta-analysis

by

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Abstract

Background: Individuals with a Spinal Cord Injury (SCI) experience challenges in obtaining and maintaining employment. The overall Return-To-Work (RTW) rate after SCI is lower than the employment rate of the general population. Some factors have been reported in the literature as being associated with RTW after SCI, but there is a need to synthesize results to estimate the strength of association of each significant factor.

Objectives: 1) To identify factors associated with RTW after a SCI, 2) To assess the strength of each factor's association with RTW, and 3) To explore how factors associated with RTW after a SCI vary among High Income Countries (HIC) and Low/Middle Income Countries (LMIC).

Methods: Systematic review and meta-analysis. A comprehensive literature search was conducted in MEDLINE, Embase, CINAHL, PsycINFO and Scopus databases. Search terms included two constructs, 1) "spinal cord injury" and 2) "return to work". All articles discussing RTW after SCI as a key concept were included. Articles were then excluded if the descriptive data were not disaggregated in "employed" and "unemployed" categories or if data were not presented for SCI-only groups. Factors that were reported in three or more articles were included in meta-analyses and subgroup analysis were completed by country's economic status, as determined by the World Bank Classification (i.e. HIC vs. LMIC). A random effect model was used to estimate: 1) Odd ratios for nominal/ordinal factors, and 2) Mean differences for continuous factors with respective corresponding 95% confidence intervals (CI).

Results: We screened 3,834 articles and 52 were included for analysis. Forty-seven studies were from HIC and five from LMIC. We identified 12 factors significantly associated with RTW: A) "body structures and functions" - 1) Being paraplegic (OR: 0.73, 95 % CI: 0.63 to 0.85, medium

quality of evidence), B) “activity limitations”- 2) Ability to live alone (OR: 2.59, 95 % CI: 1.30 to 5.10, low quality of evidence), 3) Ability to drive (OR: 4.76, 95 % CI: 2.94 to 7.61, low quality of evidence), 4) No wheelchair use (OR: 0.44, 95 % CI: 0.20 to 0.96, low quality of evidence), and 5) Higher Functional Independence Measure scores (Mean difference: 0.67, 95 % CI: 0.49 to 0.85, medium quality of evidence) , and C) “personal factors”- 6) Being married (OR: 1.54, 95 % CI: 1.06 to 2.23, medium quality of evidence), 7) Being white (OR: 2.16, 95 % CI: 1.54 to 3.03, low quality of evidence), 8) Being younger at the time of data collection (mean difference: -0.24, 95 % CI: -0.38 to -0.11, low quality of evidence), 9) Being younger at the time of injury (mean difference: -0.30, 95 % CI: -0.46 to -0.14, low quality of evidence), 10) More time since injury (mean difference: 0.31, 95 % CI: 0.12 to 0.49, low quality of evidence), 11) ≥ high school education (OR: 0.45, 95 % CI: 0.36 to 0.57, low quality of evidence), and 12) ≥ $20,000 annual income (OR: 0.15, 95 % CI: 0.06 to 0.34, low quality of evidence). No “environmental” factors qualified for meta-analysis. Five factors were included in the subgroup analyses and the following 3 factors were significantly associated with RTW only in HIC: 1) Being paraplegic, 2) Being able to live alone, and 3) Being married.

Conclusions: Being able to drive, Being able to live alone, Being White, Being paraplegic, Having ≥ high school education, Having ≥$20,000 annual income were the most important factors associated with RTW after SCI. All factors identified as significantly associated with RTW were explored in HIC. There is a paucity of evidence on factors associated with RTW in LMIC so more research is needed in this area. Personal, impairment and activity limitation factors appear to be emphasized over environmental factors in the available literature, and there is a lack of high quality prospective studies in this area.

Keywords: Meta-analysis, return to work, spinal cord injury, systematic review

Preface

This thesis is an original work by Bina Gyawali. This research project does not involve any human or animal participants; therefore ethics approval was not required. A part of this thesis was registered in the PROSPERO database (registration number CRD42022325836).

Dedication

To my parents.

Acknowledgements

I am grateful to my M.Sc. supervisor Dr. Adalberto Loyola-Sanchez for providing me with the opportunity to pursue graduate studies along with numerous personal and professional development opportunities. He has demonstrated leadership along with patience, support, and encouragement. Not only did I benefit from his scientific integrity, but I also learned a lot from his academic character.

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Background

Spinal Cord Injury (SCI) is a complex condition resulting in motor, sensory, and autonomic dysfunction leading to devastating impacts on the individual, both socially and economically. The incidence rate of SCI in HIC and LMIC has been reported from 13.1 to 163.4 per million and 13.0 to 220.0 per million people respectively, while the prevalence rates vary from 490 to 526 per million and 440.0 per million people, respectively [1]. A systematic review by Kumar et. al. found that globally, the average age of patients with traumatic SCI is 39.8 (SD ± 12.2) and the most common mechanism of injury is road traffic accidents followed by falls [2]. These patients typically fall within the working age group (15 to 64 years, inclusive) as defined by global demographics [3]. Participation in productive work is considered as one of the most important factors affected by SCI.

According to the International Classification of Functioning, Disability, and Health (ICF) framework, participation in any area of life, like occupation, is the interaction between the environment and the person who has specific impairments and activity limitations. Therefore, it is important to consider these factors while exploring the phenomenon of return to work (RTW). The ICF is the World Health Organization's (WHO) framework to measure health and disability at individual and population levels [4]. The components of ICF are: Body structure and function, Activity, and Participation, Environmental and Personal factors [5]. The activity and participation components deal with the concept of capacity and performance of a person with a certain health condition [5]. SCI leads to the impairment of motor and sensory function which causes mobility and hand activity limitations, giving rise to participation restrictions by affecting activities of daily life which in turn affects major areas of life, including employment.

Individuals with physical disabilities like SCI experience challenges in obtaining and maintaining employment [6]. RTW following SCI can be of two types: 1) continuing the same job as before injury and 2) starting a new job. RTW rates of people with SCI vary widely across countries, and depend on geographical location, opportunity, and expectation. Outcomes also vary due to discrepancies in the definition of employment, type of sample and the time of measurement (time since injury). A Swiss community-based observational study reported that 45.7% of people experiencing SCI returned to pre-injury employment, 32.9% changed employers, and 21.4% never

returned to work (paid employment) after SCI with an overall paid employment rate of 78.6% [7]. Whereas, the paid employment rate after SCI has been reported as 35% in the USA [8], 49.9% in Australia [9], and 82% in South India [10]. A cross-sectional survey in 22 countries across the world reported a 38% of paid employment rate after SCI with a wide variation across countries, ranging from 10.3% to 61.4% [11]. Sturm et. al. reported that out of 623 persons unemployed after SCI, 319 (51.2%) wished to work, among which 220 (35.3%) subjectively perceived they were able to work [12]. The mean duration of time to RTW after SCI was reported as 4.9 years [13]. RTW is positively associated with better quality of life as well as higher psychological, financial, and social wellbeing in people with SCI [14]. The benefits of employment after SCI go beyond financial compensation, as it provides a sense of identity, social connections, a reason to start a day, [15] and higher life expectancy [16].

The overall RTW rate after SCI is lower than the employment rate of the general population. Therefore, it is important to find better ways to support RTW because this is not only associated with improved finances, but also with improving physical, emotional, and psychosocial wellbeing after a SCI. Getting back to work and sustaining employment is undeniably challenging for a person with SCI because of the physical, emotional, and psychological body functions, activities and environmental factors required to be successful in any remunerative employment.

Previous systematic and scoping reviews have consolidated different barriers and facilitators related to RTW following SCI [17, 18, 19, 20]. However, the strength of the association of these barriers and facilitators with the RTW outcome has not been clearly defined. A systematic review categorized employment definition into three themes: a) salary dependent (i.e., working for pay, gainfully employed, competitive employment, or earning minimum wage), b) employed vs unemployed (i.e., volunteer, retired and homemaker were combined with the "employed" category in some studies while others have categorized students, homemakers and volunteers as "unemployed"), and c) hours-dependent work (e.g., working at least 12 hours per week) [22].

The diversity in definition of RTW after SCI in available literature makes it challenging to interpret rates of employment and factors associated with them. Bloom et. al. reported that most of the literature on RTW after SCI come from North America (59%), followed by Europe (22%), Asia (10%), Australia (10%), Africa (1%), with no reports from South America [22]. In addition

most of the literature in these regions come from High Income Countries (HIC), as defined by the "World Bank Country Classification by Income 2021-2022" [23]. The paucity of evidence on RTW following SCI in Low and Middle Income Countries (LMIC) makes it difficult to understand which factors are most likely to influence RTW in countries with low per capita income. Consequently, it is important to identify factors related to RTW after a SCI considering the socio-economic status of the counties where research was conducted. There is evidence supporting that higher individual socioeconomic status is positively associated with success in RTW in SCI; however, it is unknown whether this situation applies to LMIC [24].

Problem statement

There is a need to better understand the strength of association between body structures and functions, activities, and environmental factors with the outcome of RTW after SCI. In addition, considering how these factors could have a different impact depending on countries' socioeconomic status will help understand how the association between these factors and RTW varies between HIC and LMIC.

Purpose

This systematic review aimed to identify the significant factors associated with RTW for people with SCI, the strength of their association with RTW and their variation among HIC and LMIC. This will provide a direction for future research aimed at improving successful RTW following SCI in different countries and inform healthcare policy makers for potential improvements.

Objectives

1. To identify factors associated with RTW after SCI in the available literature.
2. To perform a meta-analysis to identify factors associated with RTW after SCI, estimating the strength of associations.
3. To explore how the identified factors associated with RTW after a SCI vary between HIC and LMIC.

Method

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were followed to conduct and report this review [25]. The study was registered in the PROSPERO database (registration number CRD42022325836).

Eligibility criteria

Inclusion criteria:

- Articles that described the RTW process after SCI.
- Articles that discussed the factors associated with RTW after SCI.
- Articles that were published in the English language.
- Employment/RTW after SCI was a key concept of the study, not just a part of a questionnaire.
- Full-text articles.

Exclusion criteria:

- Descriptive data was not disaggregated as employed and unemployed.
- Outcomes of employed versus unemployed expressed only in inferential estimates (e.g., as odds ratios, rate ratios or risk ratios).
- SCI data was not disaggregated from other injuries. For instance, if the study compares RTW after SCI and multiple sclerosis, descriptive data for SCI and multiple sclerosis should be disaggregated as employed and unemployed separately.
- Policy reports, analysis, dissertations, editorials, opinion pieces, scoping and systematic reviews were excluded.

Search strategy

A comprehensive literature search of MEDLINE, Embase, CINAHL, PsycINFO and Scopus databases was conducted and included all the relevant articles from inception to April 26, 2022. To ensure all expectations of comprehensiveness were addressed, a health sciences research librarian at the University of Alberta was consulted to define the search strategy. Search terms

included the two key concepts of the review: ***Return to Work*** and ***Patients with Spinal Cord Injury***. The full search strategy implemented is available as supplementary material (Appendix C). All retrieved articles were imported to COVIDENCE, a web-based software platform that streamlines the production of systematic reviews.

Study selection process

Two independent reviewers conducted the title and abstract screening, and full-text review. Inter-Rater Reliability (IRR) was estimated using Cohen's Kappa test for two raters i.e. Bina and Rija (once for the abstract screening and once for full text selection). Cohen's Kappa was 0.66 for the title and abstract screening stage, indicating substantial agreement, while it was 0.98 for the full text review stage, indicating almost perfect agreement [26]. All disagreements between the two reviewers were resolved by discussion with a third reviewer until a perfect agreement was achieved.

Data collection process

A standardized data extraction spreadsheet was developed by the author upon considering feedback from all review team members. Data extracted from included articles were: 1) first author name, year of publication and country of research conducted, 2) sample size, 3) research design, 4) data collection method, 5) definition of employment including total of participants employed and unemployed, and 6) factors studied. The author filled the spreadsheet after going through full-texts of the included articles. The second reviewer checked the correctness of data filled in the spreadsheet upon reading the full-texts of the included articles and left a comment wherever there was disagreement. Any discrepancies in data extraction were resolved first by consensus between the two reviewers and if required, through discussion with the third reviewer. For meta-analysis, separate spreadsheets were made for each factor, including: 1) study ID (serial number provided by COVIDENCE), 2) total employed and unemployed, 3) segregated data of the factor to be studied (for example: for a factor ethnicity; Employed-White, Employed-Others, Unemployed-White, and Unemployed-Others), and 4) the socio-economic status of the country where research was conducted. All these data were taken from the main data extraction spreadsheet.

Quality assessment

We assessed the quality of evidence behind each factor identified using a modification of the GRADE methodology [27, 28]. We only considered the assessment of "risk of bias" and "inconsistency" because the concepts of "indirectness" and "imprecision" could not be applied consistently due to variations in studies' methodological designs. As for publication bias we assumed this existed because we only used studies published in English language so this factor couldn't be utilized as a criterion to differentiate quality among the meta-analyses conducted.

Risk of bias was examined using the Newcastle-Ottawa Scale (NOS) and its extension for cross-sectional studies [29]. The NOS appraises studies in three different domains: Selection, Comparability, and Outcome. It contains 8 items within the 3 domains and the total maximum score is 9. A study with a score from 7-9 is considered low risk, 4-6 is high risk, and 0-3 is very high risk of bias.

To identify the overall risk of bias of a factor, we categorized it into three different groups: low risk, moderate risk, and high risk. For each of the factors, if all (100%) of the articles included had low risk of bias, it was considered as low risk, if 50% or more of the articles included had low risk of bias, it was considered as moderate risk, and if less than 50% of the articles included had low risk of bias, it was considered as high risk.

For inconsistency the criteria utilized was: if the test of heterogeneity (I^2) was less than or equal to 30%, then no inconsistency was assumed, if I^2 was between 31% - 60%, we judged moderate inconsistency, I^2 between 61% - 75% was judged as substantial inconsistency, and if I^2 was between 76% - 100%, then inconsistency was judged as considerable. For overall quality of evidence for each factor, I^2 up to 60% was not penalized and I^2 between 61% - 100% was penalized; however, if the heterogeneity was explained by subgroup analysis (i.e. if I^2 dropped during subgroup analysis) it was considered as no inconsistency and was not penalized. For example: for a particular factor, if the risk of bias was low; however, the inconsistency was between 61% - 100% and the I^2 did not drop while doing subgroup analysis, then the overall quality of evidence was decreased to the level immediately below its initial level of quality (i.e., dropping down from high quality to moderate quality or from moderate quality to low quality).

Statistical analysis

Meta-analyses were conducted using statistical software (i.e., Stata BE 17). Only factors that were reported on three or more articles qualified for meta-analysis. A random-effects model was used. Nominal and continuous data were analyzed estimating log odd ratios and mean differences (Hedge's g), respectively. 95% CI and p values were estimated considering a $p<.05$ as statistically significant. The I^2 statistic was used to evaluate heterogeneity among the included articles.

RTW factors categorization

The identified factors associated with RTW were classified according to the ICF domains. Subgroup analysis of factors were done on the basis of economic status of the countries where research was conducted, when possible. Countries were categorized as HIC and LMIC according to the World Bank classification [23].

Results:

A total of 7,341 articles were identified from five different databases, 3,834 included after removing duplicates (refer to Figure 1). A full text review of 130 articles was done after abstract screening. After screening full texts, 52 studies were eligible and included in the systematic review (refer to Table 1). Of these, 47 were from HIC [7, 9, 12, 14, 15, 30-72], 4 from upper middle income countries [73-76], 1 from lower middle income countries[10], and none were from low income countries. Among the articles included, 33 were cross-sectional studies [9, 10, 12, 24, 30, 35, 36, 38, 40-42, 46, 48-50, 52, 54, 57, 59-64, 67-69, 72-75, 78], 18 were longitudinal studies [7, 31-34, 37, 39, 43-45, 51, 53, 55, 58, 65, 66, 70, 76] and 1 was a pilot study [59].

Nineteen factors qualified for the meta-analysis. Following is the description of results organized by the factors explored during the meta-analyses.

1. Functional Independence Measure (FIM)

Five studies (n=1,976) identified an association between FIM and RTW after SCI (refer Table SOF). Our meta-analysis showed a significant association, meaning that the average FIM score of people employed was higher than those unemployed (Hedges's g = 0.67) [refer to Figure 2.1] with

a medium quality of evidence, meaning further research could change the conclusion. No subgroup analysis was possible as there were no studies from LMIC.

2. Age at injury

Fifteen studies (n=3,673) identified an association between age at injury and RTW after SCI (refer to Table SOF). Our meta-analysis showed a significant association, meaning that on average, people employed after SCI were younger than those who were unemployed (Hedges's g = -0.30) [refer to Figure 2.2] with low quality of evidence, meaning further research could change the conclusion. No subgroup analysis was possible as there were no enough studies from LMIC.

3. Age at data collection

Twenty studies (n=7,683) identified an association between age at data collection and RTW after SCI (refer table SOF). Our meta-analysis showed a significant association, meaning that the average age of people employed were younger than those unemployed (Hedges's g = -0.24) [refer to Figure 2.3] with low quality of evidence, meaning further research could change the conclusion. No subgroup analysis was possible as there were no enough studies from LMIC.

4. Time since injury

Thirteen studies (n=4,437) identified an association between time since injury and RTW after SCI (refer to Table SOF). Our meta-analysis showed a significant association, meaning that the average time since injury of employed people was higher than people who were unemployed (Hedges's g = 0.31) [refer to Figure 2.4] with low quality of evidence, meaning further research could change the conclusion. No subgroup analysis was possible as there were no studies from LMIC.

5. Ability to live alone

Nine studies (n=3,120) identified an association between the ability to live alone and RTW after SCI (refer to Table 2a). Our meta-analysis showed a significant association, meaning that a person who is able to live alone has higher chances of being employed (OR= 2.59) [refer to Figure 2.5a] with a low quality of evidence, meaning further research could change this conclusion. A subgroup analysis by country's level of income showed this significant association held for HICs but not for

LMICs; however, the country category could not explain the high heterogeneity observed (refer Figure 2.5b).

6. Annual income

Three studies (n=1,491) identified an association between annual income and RTW after SCI (refer table SOF). Our meta-analysis showed a significant association, meaning that there are higher chances of being employed if a person's annual income is ≥$20,000 compared to <$20,000 (OR= 0.15) [refer to Figure 2.6] with low quality of evidence, meaning further research could change the conclusion. No subgroup analysis was possible as there were no studies from LMIC.

7. Ability to drive

Three studies (n=664) identified an association between ability to drive and RTW after SCI (refer table SOF). Our meta-analysis showed a significant association, meaning that a person who is able to drive has higher chances of being employed after a SCI (OR= 4.76) [refer to Figure 2.7] with low quality of evidence, meaning further research could change the conclusion. No subgroup analysis was possible as there were no enough studies from LMIC.

8. Employment at the time of injury

Three studies (n=386) identified an association between employment at the time of injury and RTW after SCI (refer table SOF). Our meta-analysis did not show a significant association [refer to Figure 2.8] with a low quality of evidence, meaning further research could change the observed results. No subgroup analysis was possible as there were no studies from LMIC.

9. Gender

Thirty-six studies (n=31,080) identified an association between gender and RTW after SCI (refer Table SOF). Our meta-analysis did not show a significant association (refer to Figure 2.9a) with low quality of evidence, meaning further research could change the results observed. A subgroup analysis by the country's income level did not show a significant association and could not explain the high heterogeneity observed (refer to Figure 2.9b).

10. Education level

Twenty studies (n=20,343) identified an association between education level and RTW after SCI (refer table SOF). Our meta-analysis showed a significant association, meaning that there are higher chances of being employed if a person had a degree of high school or more (OR= 0.45) [refer to Figure 2.10] with low quality of evidence, meaning further research could change the conclusion. No subgroup analysis was possible as there were no studies from LMIC.

11. Pre-injury employment

Ten studies (n=2,936) identified an association between being employed pre-injury (anytime) and RTW after SCI (refer Table SOF). Our meta-analysis did not show a significant association for this factor [refer to Figure 2.11] with low quality of evidence, meaning further research could change the observed results. No subgroup analysis was possible as there were no studies from LMIC.

12. Ethnicity

Nine studies (n=23,192) identified an association between ethnicity and RTW after SCI (refer table SOF). Our meta-analysis showed a significant association, meaning that there are higher chances of being employed if a person is white compared to other races (OR= 2.16) [refer to Figure 2.12] with low quality of evidence, meaning further research could change the conclusion. No subgroup analysis was possible as there were no studies from LMIC.

13. Level of injury

Twenty-seven studies (n=9,376) identified an association between level of injury and RTW after SCI (refer Table SOF). Our meta-analysis showed a significant association, meaning that a paraplegic person has higher chances of being employed compared to a tetraplegic person (OR = 0.73) [refer to Figure 2.13a] with a medium quality of evidence, meaning further research could change the conclusion. A subgroup analysis by the country's income level showed significant association for the HICs and not for the LMICs, also explaining the high heterogeneity observed (refer to Figure 2.13b).

14. Medical comorbidities

Four studies (n=22,491) identified an association between medical comorbidities and RTW after SCI (refer Table SOF). Our meta-analysis did not show a significant association [refer to Figure 2.14] with low quality of evidence, meaning further research could change the results observed. No subgroup analysis was possible as there were no studies from LMIC.

15. Pre-injury work intensity

Three studies (n=839) identified an association between pre-injury work intensity (low vs moderate/high) and RTW after SCI (refer table SOF). Our meta-analysis did not show a significant association [refer to Figure 2.15] with low quality of evidence, meaning further research could change the conclusion. No subgroup analysis was possible as there were no studies from LMIC.

16. Marital status

Twenty-three studies (n=20,367) identified an association between marital status (married vs others) and RTW after SCI (refer Table SOF). Our meta-analysis showed a significant association, meaning that a person who is married has higher chances of being employed (OR= 1.54) [refer to Figure 2.16a] with medium quality of evidence, meaning further research could change the conclusion. A subgroup analysis by the country's income level showed significant association for the HICs but not for the LMICs and explained the high heterogeneity observed (refer to Figure 2.16b).

17. Wheelchair use

Four studies (n=925) identified an association between wheelchair use and RTW after SCI (refer to Table SOF). Our meta-analysis showed a significant association, meaning that there are higher chances of being employed if a person does not use a wheelchair (OR= 0.44) [refer to Figure 2.17] with low quality of evidence, meaning further research could change the conclusion. No subgroup analysis was possible as there were no studies from LMIC.

18. Vocational training

Three studies (n=437) identified an association between vocational training and RTW after SCI (refer to Table SOF). Our meta-analysis did not show a significant association [refer to Figure 2.18] with high quality of evidence, meaning further research is unlikely to change this conclusion. No subgroup analysis was possible as there were no studies from LMIC.

19. Type of injury

Fourteen studies (n=3,919) identified an association between the type of injury (i.e., complete vs incomplete) and RTW after SCI (refer table SOF). Our meta-analysis did not show a significant association [refer to Figure 2.19a] with a medium quality of evidence, meaning further research could change the conclusion. A subgroup analysis by the country's income level did not show a significant association and did not explain the high heterogeneity observed (refer to Figure 2.19b).

Discussion:

This systematic review identified that personal, impairment and activity limitation factors are emphasized over environmental factors in available literature on RTW after SCI. There is a lack of high quality prospective studies, cross-sectional studies dominating the literature of this area. There is paucity of evidence on factors associated with RTW after SCI in LMIC. Nineteen factors qualified for meta-analysis and twelve factors: Being younger at the time of injury, Being younger at the time of data collection, More time since injury, Having higher FIM score, Being able to live alone, Being able to drive, ≥ high school education, ≥$20,000 annual income, Being White, Paraplegia, Being married, and being able to use a wheelchair were found significantly associated with RTW after SCI.

Mapping of identified factors according to the WHO ICF framework

All the components of the ICF model (i.e., body structure and function, activity, participation, personal, and environmental factors) were represented in the factors reported as associated with RTW after SCI in the literature (refer to Table 3.1); however, none of the environmental factors qualified to be included in the meta-analysis as they were not explored in three or more articles. In addition, the majority of factors included in the meta-analysis were personal factors (refer to Table

3.2). This suggests that the main focus of the research in this area is on personal, impairment and activity limitation factors, lacking scientific evidence on the effect of the environment on RTW after SCI. The increased focus on personal factors explored in the studies suggests that successful RTW after SCI is mainly attributed to the individual characteristics of a person and not so much on the employment environmental demands. Alternatively, our findings could reflect the fact that personal factors are easier to study, as it is easier to collect them from medical charts. In contrast, exploring environmental factors is more time, energy, and financially consuming as they require visiting working environment.

Considering that RTW is the result of the capacity of an individual, including personal factors and health conditions, to effectively address the environmental work demands, then our review demonstrates the literature mostly focuses only on one aspect of the RTW process. This is important to recognize as environmental factors are more susceptible to be modified than personal factors when considering interventions to increase the rate of RTW after SCI. Therefore, future research should equally prioritize environmental factors to understand and overcome low rates of RTW after SCI.

Vocational training was not a significant factor in the meta-analysis, and this is supported by high quality of evidence. This finding contradicts the existing literature, and this could be explained by the variety of the components that vocational rehabilitation programs can have. As vocational rehabilitation is a complex intervention with so many variations, our results suggest we need to understand better which are the components of vocational training that are more effective and how they interact with each other to promote a successful RTW after SCI.

Comparison of factors between HIC and LMIC

Out of fifty-two articles included in the study, only five articles were from LMIC and forty-seven articles were from HIC. This reveals a need to increase high quality scientific production from LMIC on RTW after SCI. All nineteen factors that qualified for meta-analysis were explored in HIC and six factors were not explored in LMIC (i.e., vocational training, pre-injury work intensity, time since injury, annual income, FIM and ethnicity). Occupations that demand the use of analytical and interpersonal skills, the skills that cannot be substituted away by technology/machinery (e.g., researchers, artists, managers, etc), are more common in HIC. This

suggests that occupations that involve more physical intensity (e.g., heavy machine operators, manufacturing and agricultural laborers, etc) are more common in LMIC [76]. Pre-injury work intensity has not been explored in LMIC, when it is of particular importance to know how work's physical demands are related to RTW after SCI in LMIC. Therefore, there is a dire need to explore pre-injury work intensity in LMIC.

Only five factors qualified for subgroup analysis because of the lesser number of articles being included from LMIC. In a subgroup analysis of five factors, three were significant (i.e., level of injury, ability to live alone, and being married) and two (i.e., type of injury and gender) were not significant overall. All the three factors that were significant overall, were significant in HIC; however, none were significant in LMIC. This result might have been influenced by a small sample size and lesser number of articles being included from LMIC compared to HIC.

Comparison of RTW rate between HIC and LMIC

Literature from India and Malaysia showed RTW rates after SCI as 82% and 76.2%, respectively [10,74]; whereas RTW rates after SCI were 49.9% in Australia, 26.5% in Finland, 29.8% in the USA, and 32% in Canada [9,57,72,77]. The RTW rate after SCI appears higher in LMIC as compared to HIC. This is likely because most LMIC do not provide disability benefits and if the patient is the primary income generator of the family, they are left with no option other than RTW in some capacity.

Factors associated with RTW after SCI

Being able to drive, Being able to live alone, Being White, Being paraplegic, Having ≥ high school education, Having ≥$20,000 annual income were the most important factors associated with RTW after a SCI.

Limitations

This review included literature only available in the English language. If any relevant articles were found in non-English language, we tried to locate its English version; however, this was not always successful. Thus, some of the factors could have been systematically excluded, especially from Asia, Africa and South America. Having the majority of included articles from HIC (i.e., North

America, Australia and Europe) could restrict the ecological validity of our findings to LMIC. The Inter-Rater Reliability (IRR) of abstract screening, which was estimated by Cohen's Kappa test for two raters, was 0.66, meaning substantial agreement; however, all disagreements between two reviewers were solved by discussion with a third reviewer until a perfect agreement was achieved. For quality assessment, we modified the GRADE methodology to account for variations in the methodological designs of the included studies. We only considered "risk of bias"- assessed using Newcastle-Ottawa Scale and "inconsistency" of the original GRADE approach. This approach has not been validated and could have limited our interpretations on the quality of the evidence assessed.

Future research

Cross sectional studies dominate the literature available to date on RTW after SCI, which makes it hard to understand the cause and effect relationship within this phenomenon. Therefore, high quality longitudinal studies should be conducted. The majority of studies exploring RTW after SCI were conducted in HIC, which impacts the generalizability of the findings considering geographical, economical, and cultural aspects. More research exploring factors associated with RTW after SCI in LMIC is warranted. Future research should focus on different types of work people with SCI are returning to. All of this will inform the decisions of rehabilitation professionals, who can help to guide the RTW process after SCI in a timely manner. Lastly, future research should focus on which components of vocational rehabilitation are more effective and how they interact with each other to optimize the rate of RTW after SCI.

Conclusion

All factors identified as significantly associated with RTW were explored in HIC. There is a paucity of evidence on factors associated with RTW in LMIC so more research is needed in this area. Personal, impairment and activity limitation factors appear to be emphasized over environmental factors in the available literature, and there is a lack of high quality prospective studies in this area.

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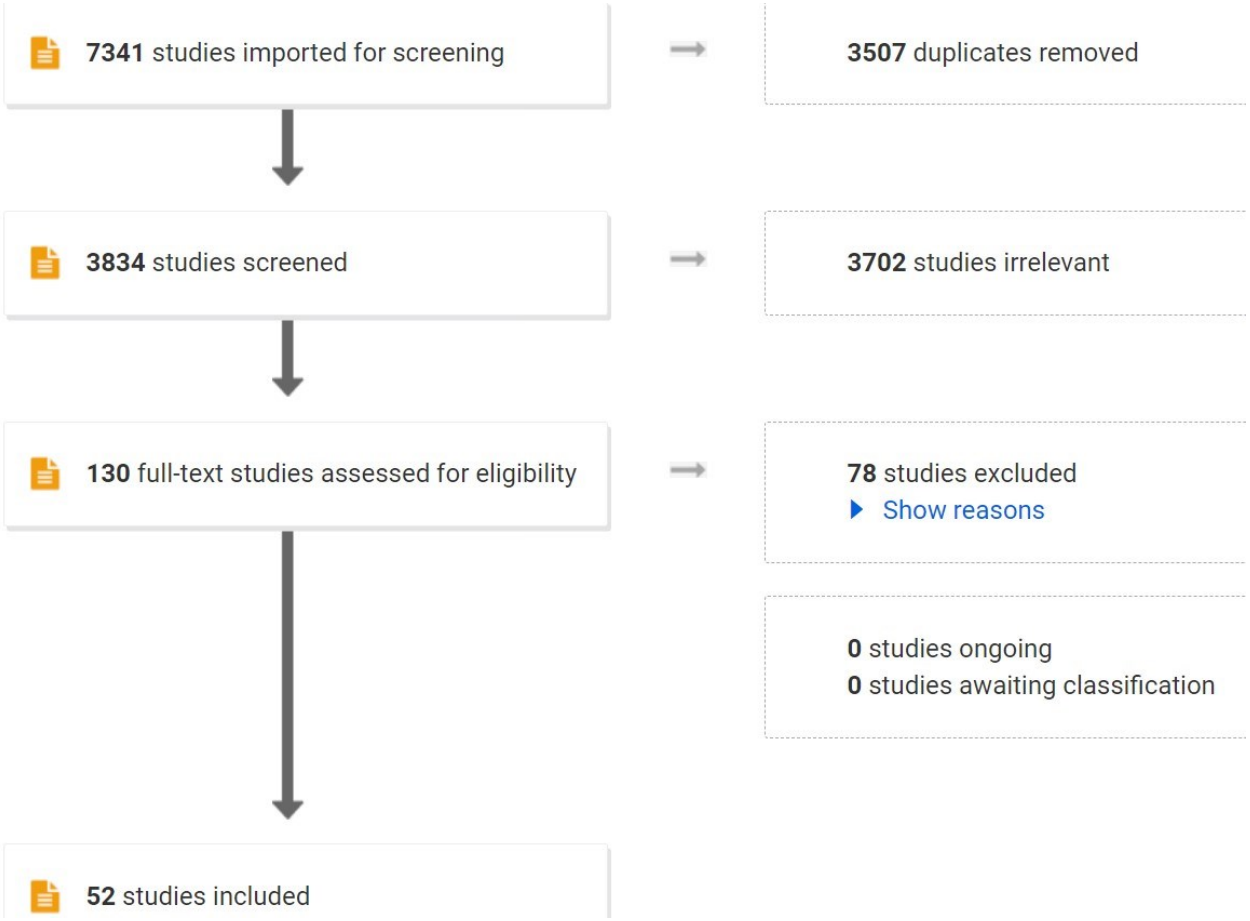
Appendix A: List of Figures



78 studies excluded

Hide reasons

40 Employed and unemployed data not disaggregated.
18 Unable to locate full text
8 Policy reports, analysis, dissertations, editorials, opinion pieces, scoping and systematic reviews
6 Descriptive study
3 SCI data not disaggregated from other injuries.
2 Not in English
1 Case studies

Figure 1. PRISMA diagram of the inclusion process

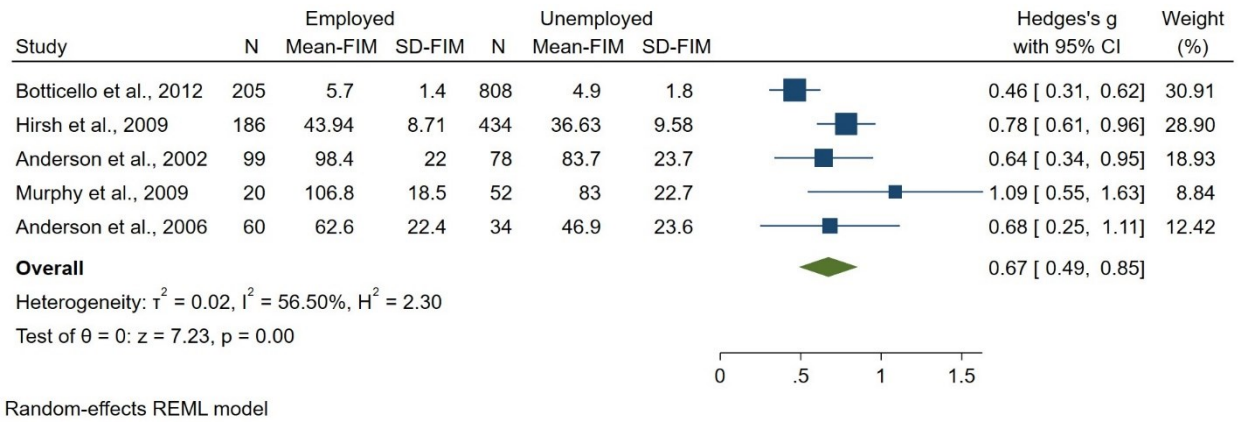


Figure 2.1: Forest plot- FIM score

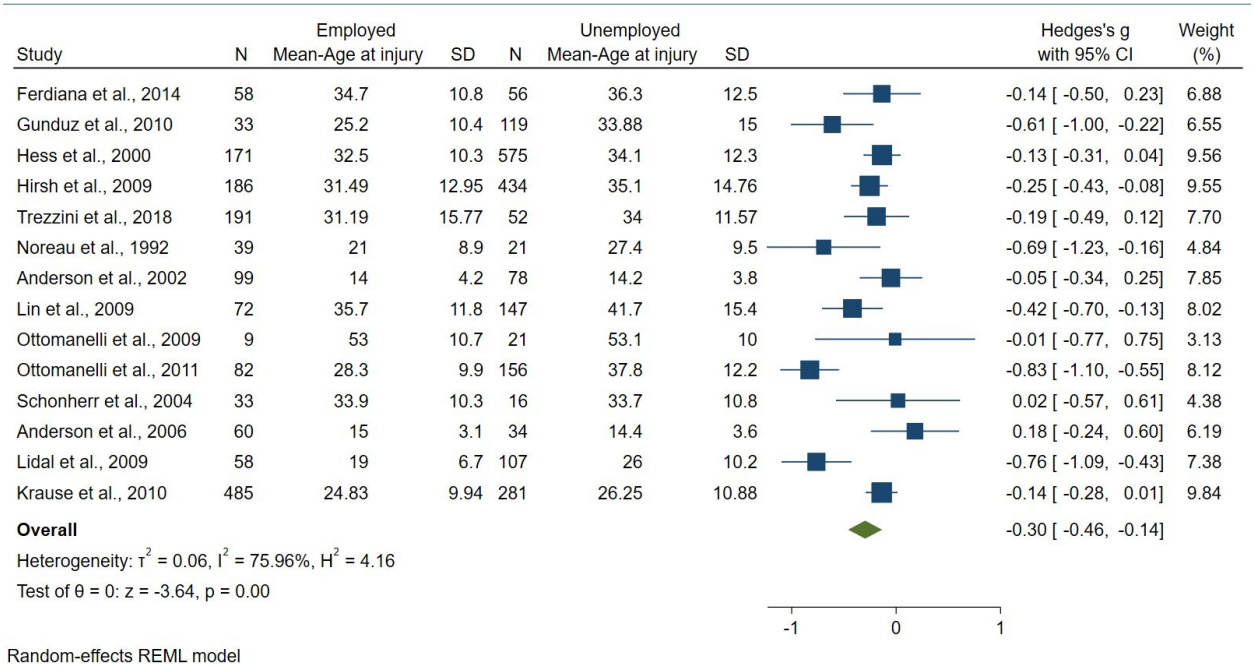


Figure 2.2: Forest plot- Age at injury

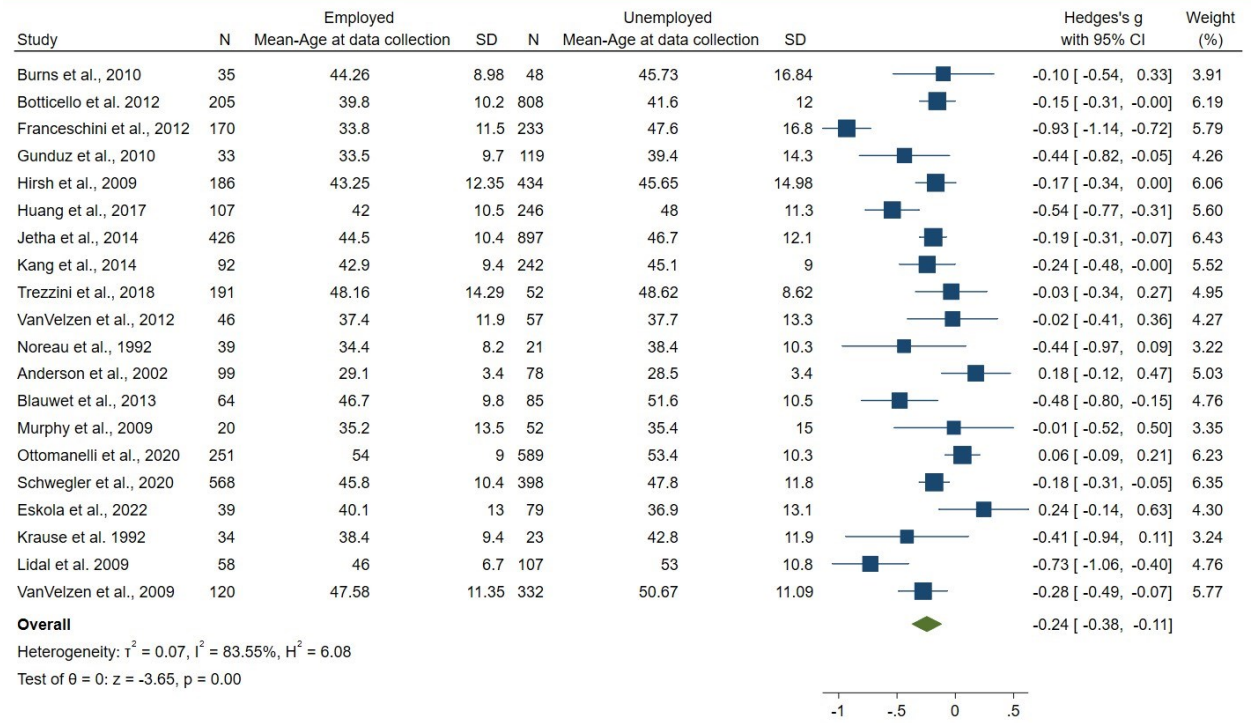


Figure 2.3: Forest plot- Age at data collection

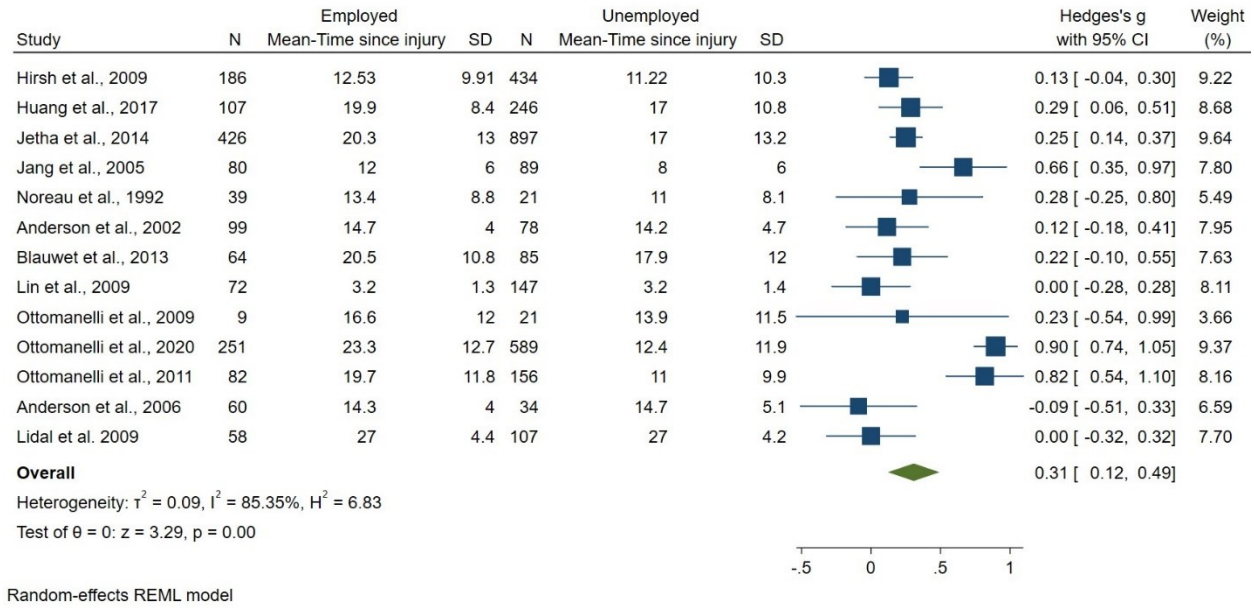


Figure 2.4: Forest plot- Time since injury

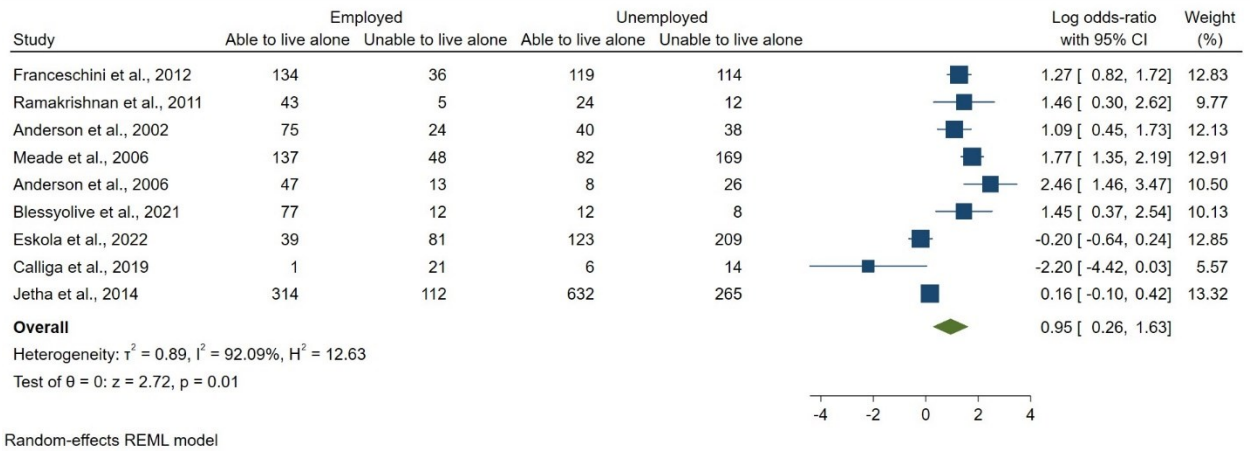


Figure 2.5a: Forest plot- Ability to live alone

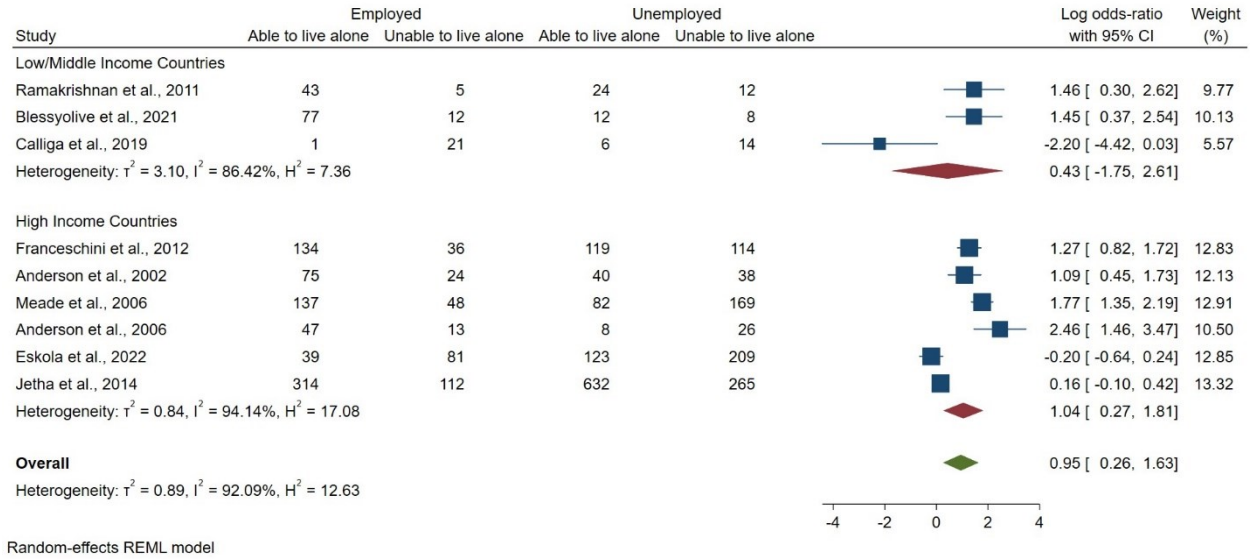


Figure 2.5b: Forest plot- Sub-group meta-analysis of ability to live alone

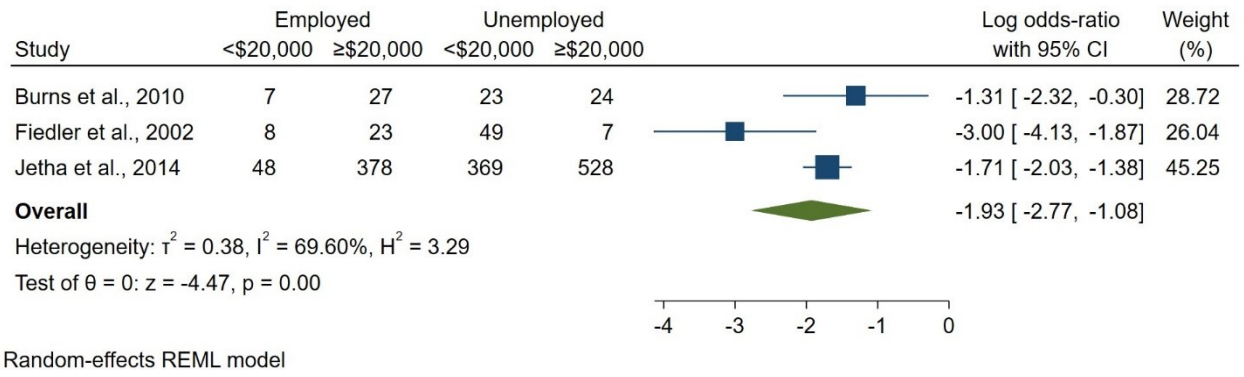


Figure 2.6: Forest plot- Annual income

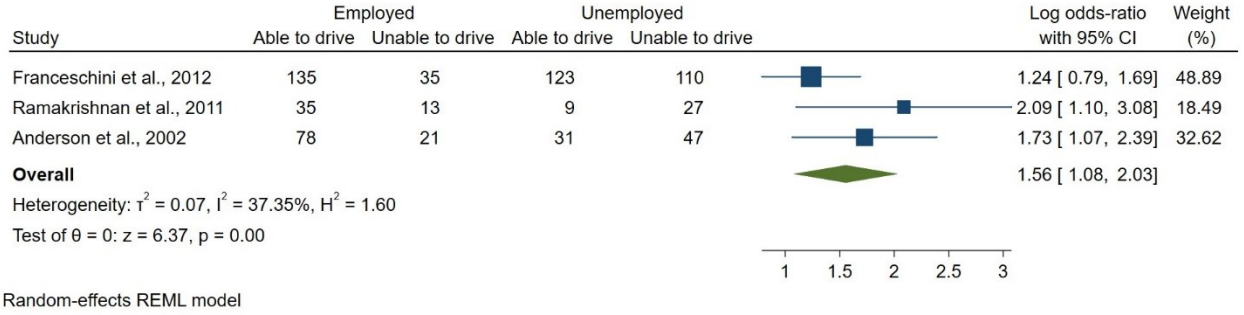


Figure 2.7: Forest plot- Ability to drive

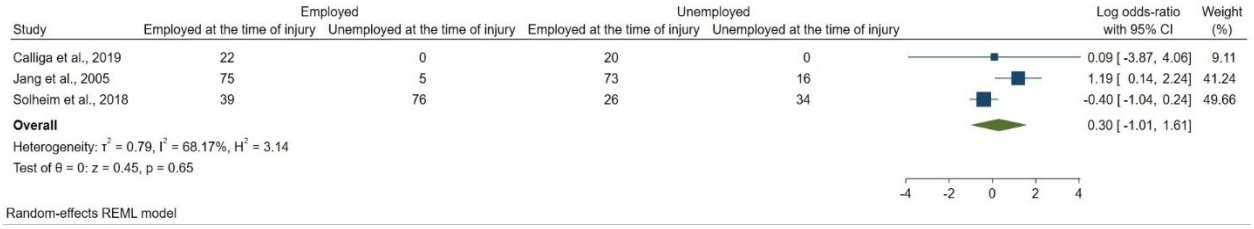


Figure 2.8: Forest plot- Employment at the time of injury

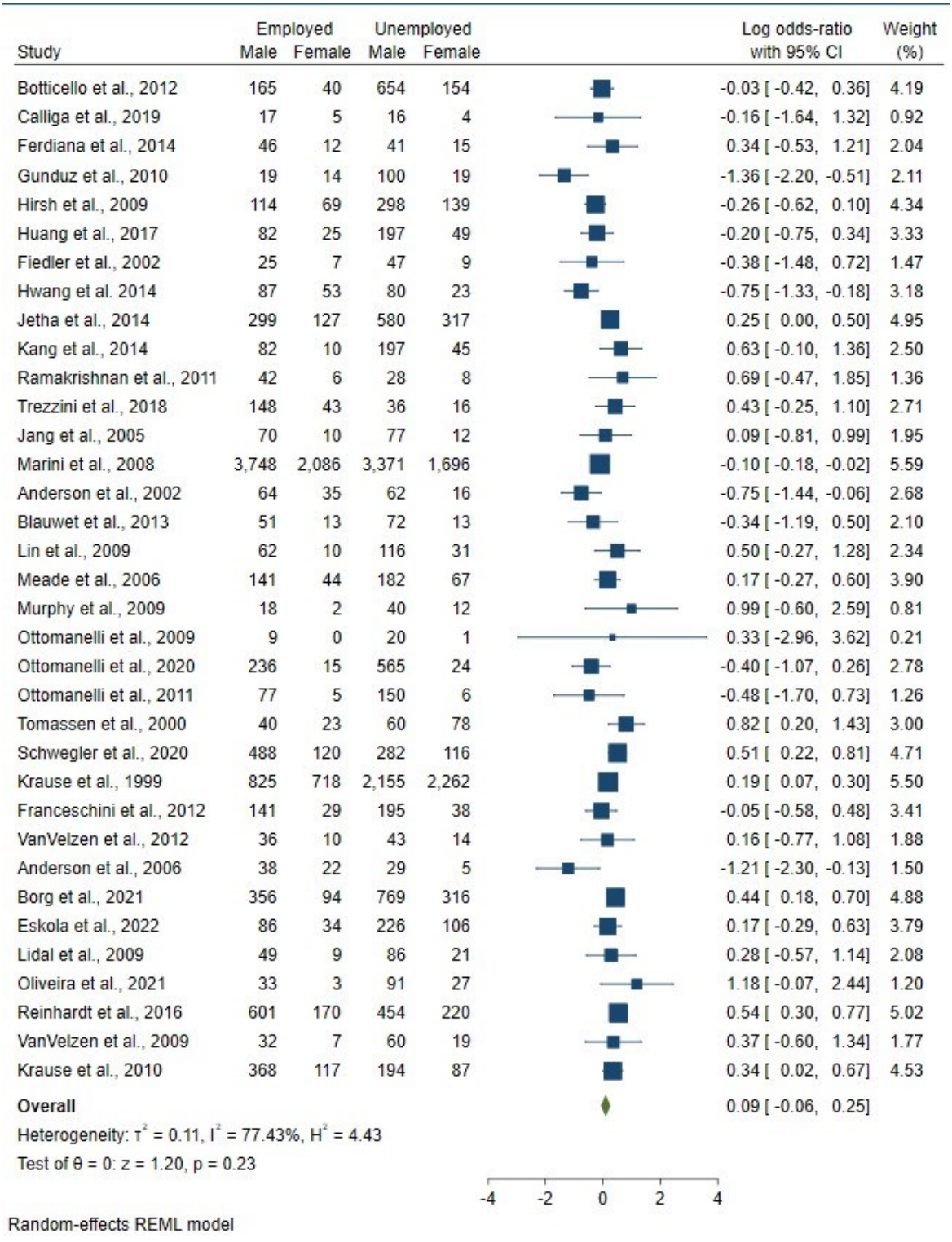


Figure 2.9a: Forest plot- Gender

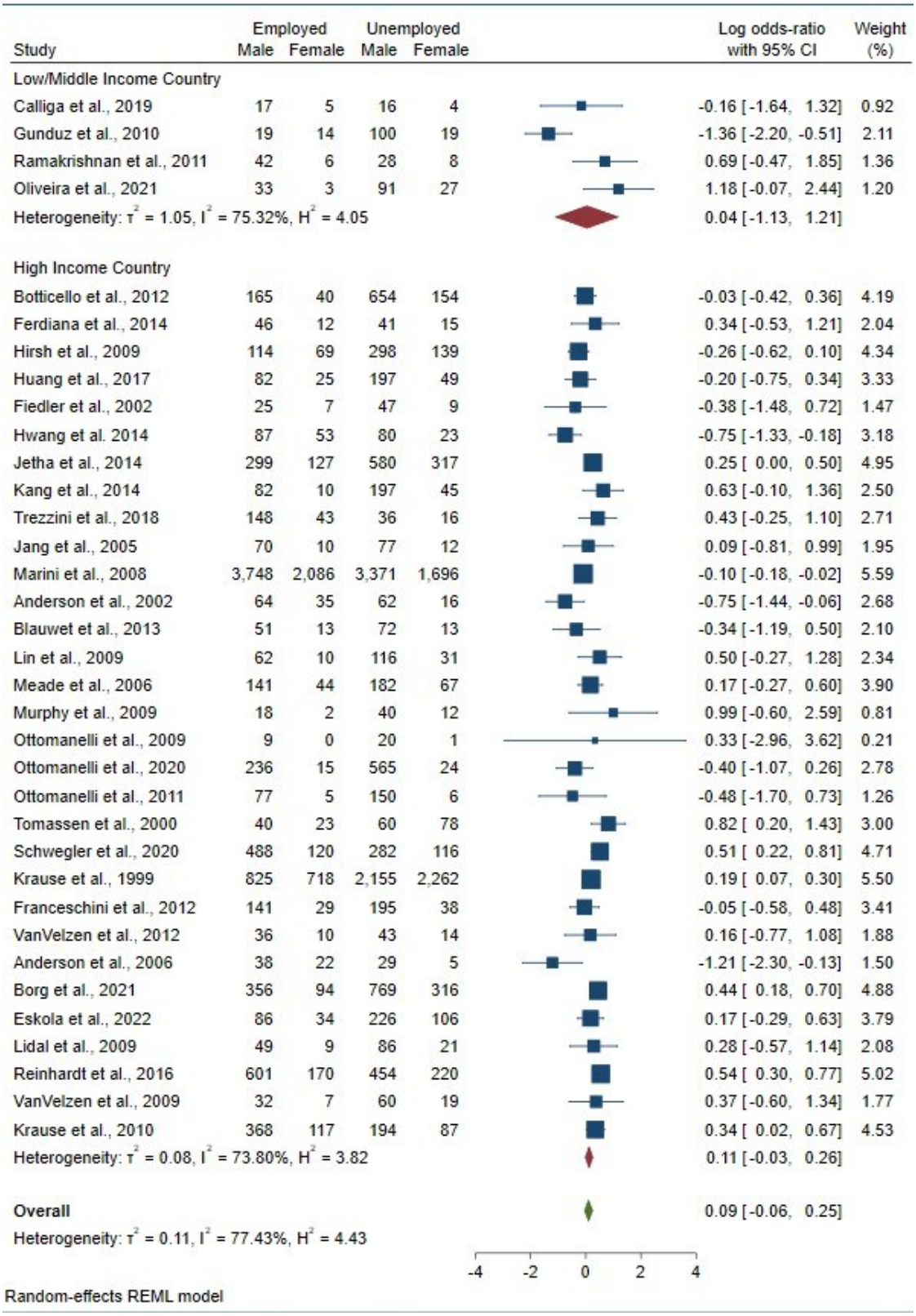


Figure 2.9b: Forest plot- Sub-group meta-analysis of gender

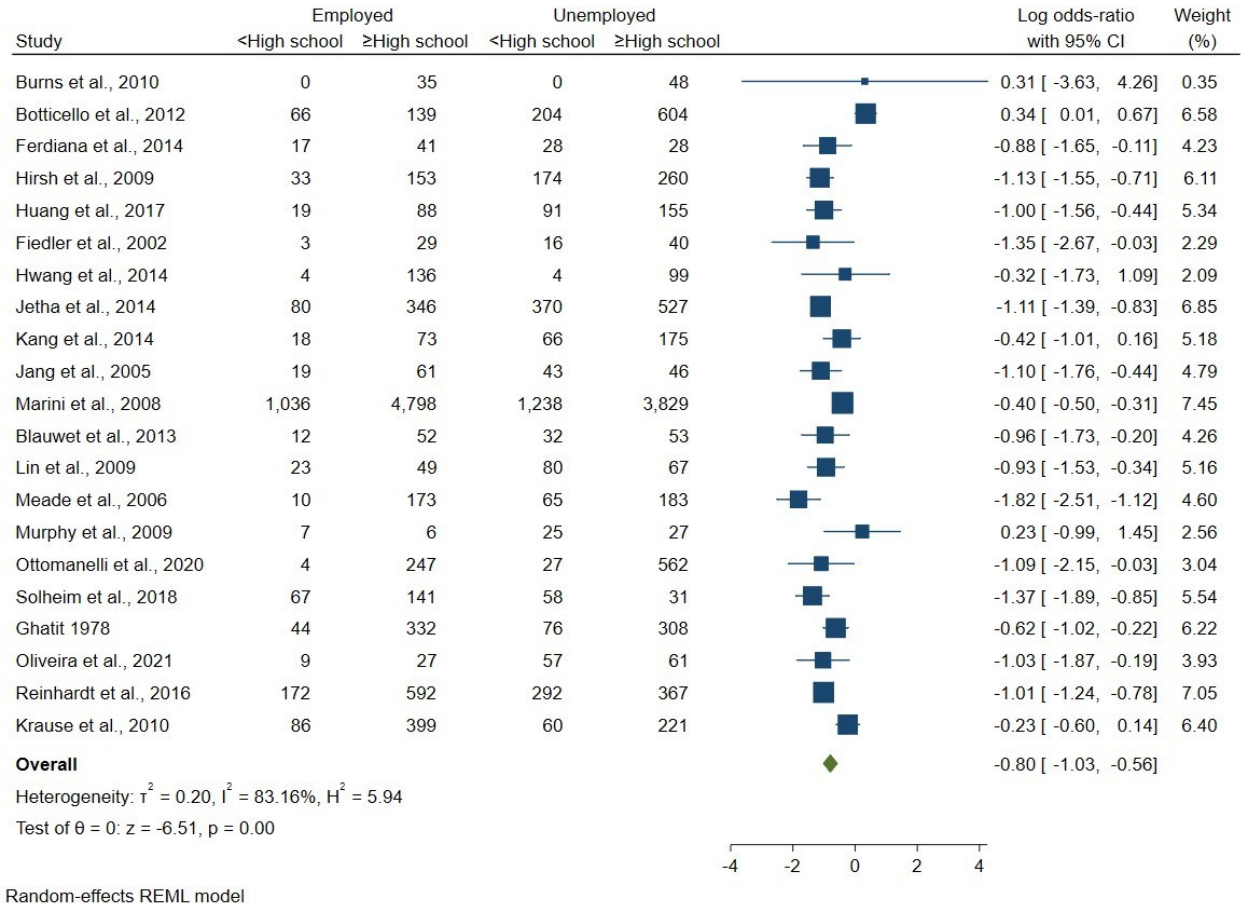


Figure 2.10: Forest plot- Education level

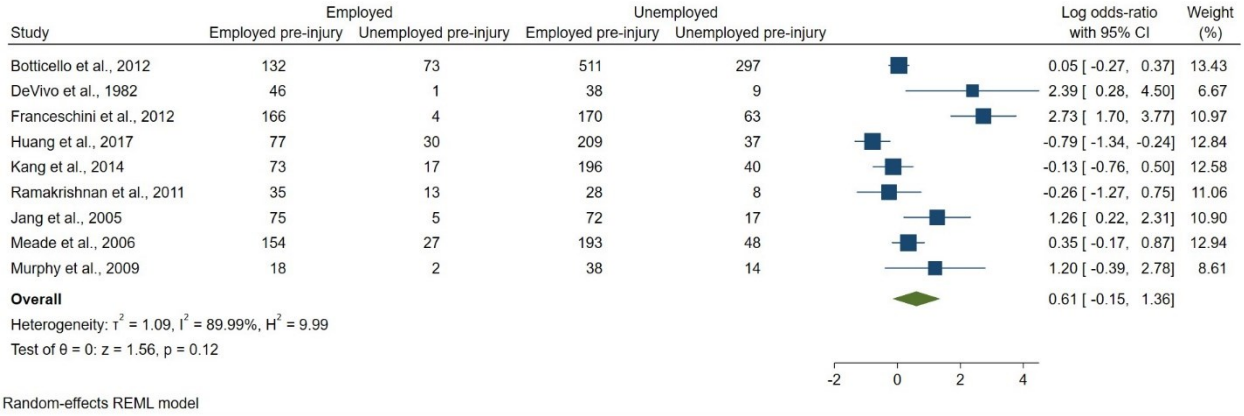


Figure 2.11: Forest plot- Employment pre-injury

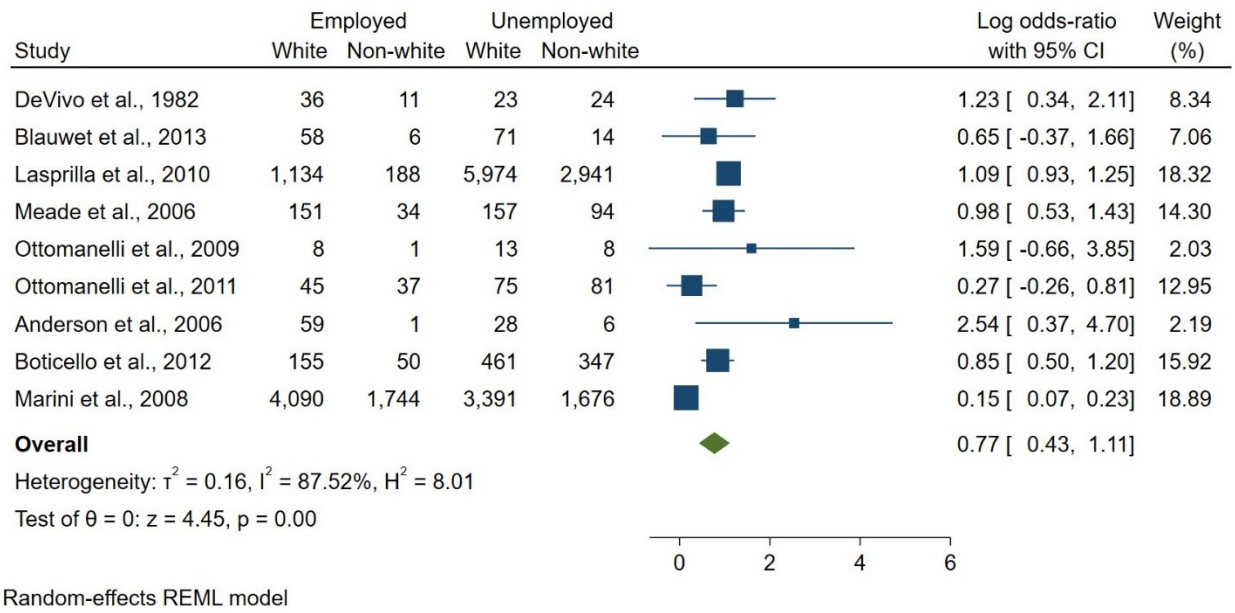


Figure 2.12: Forest plot- Ethnicity

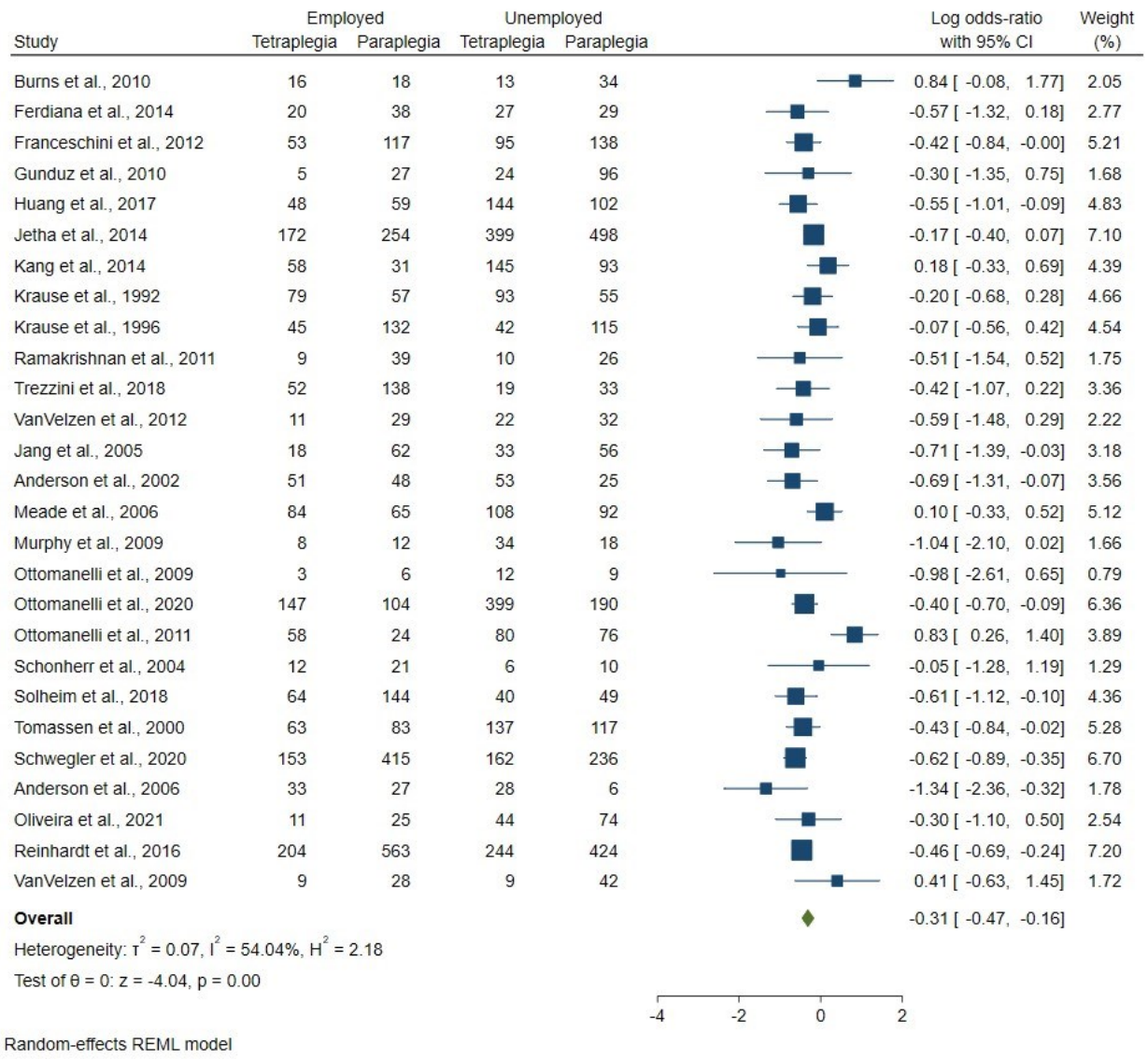


Figure 2.13a: Forest plot- Level of injury

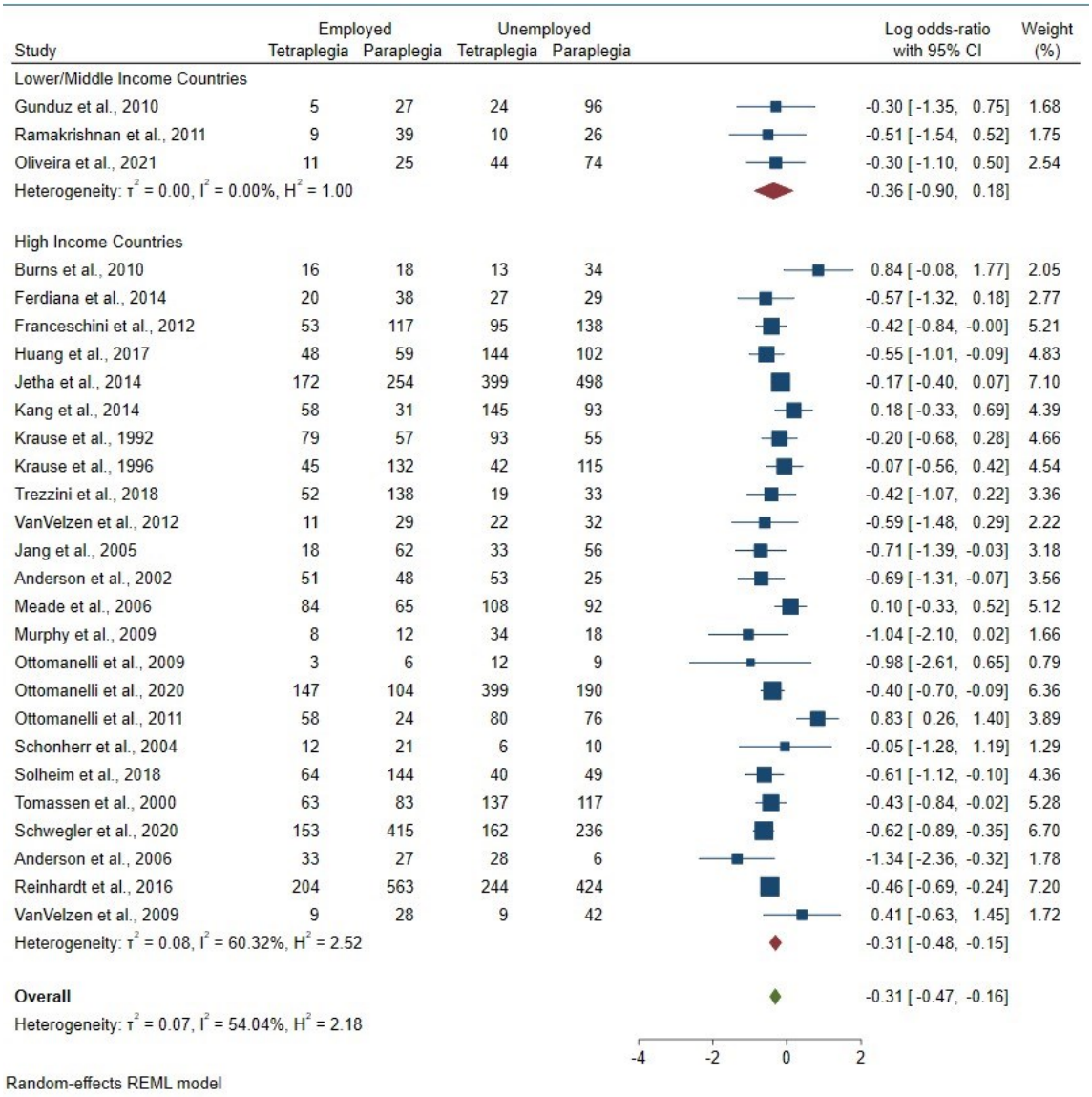


Figure 2.13b: Forest plot- Sub-group meta-analysis of level of injury

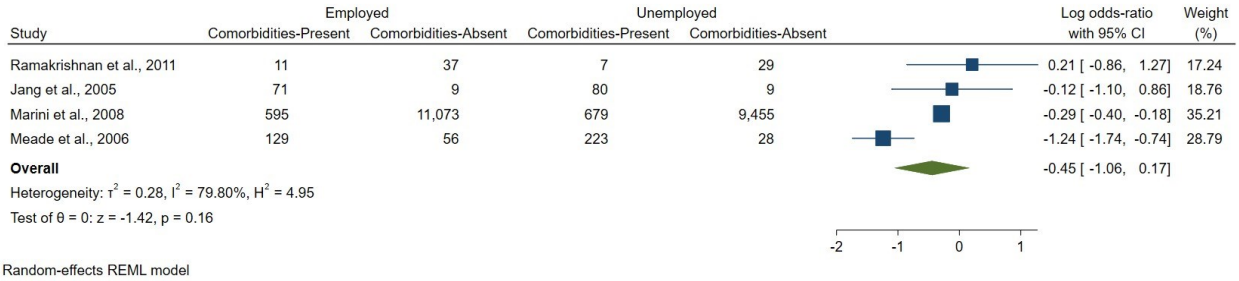


Figure 2.14: Forest plot- Medical co-morbidities

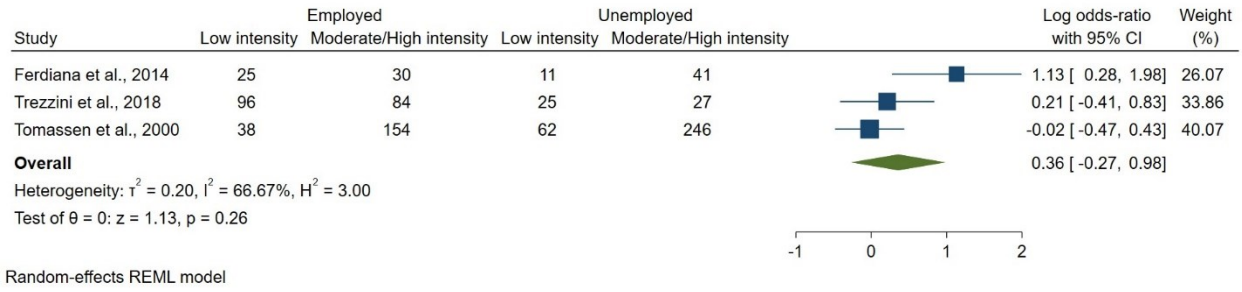


Figure 2.15: Forest plot- Pre-injury work intensity

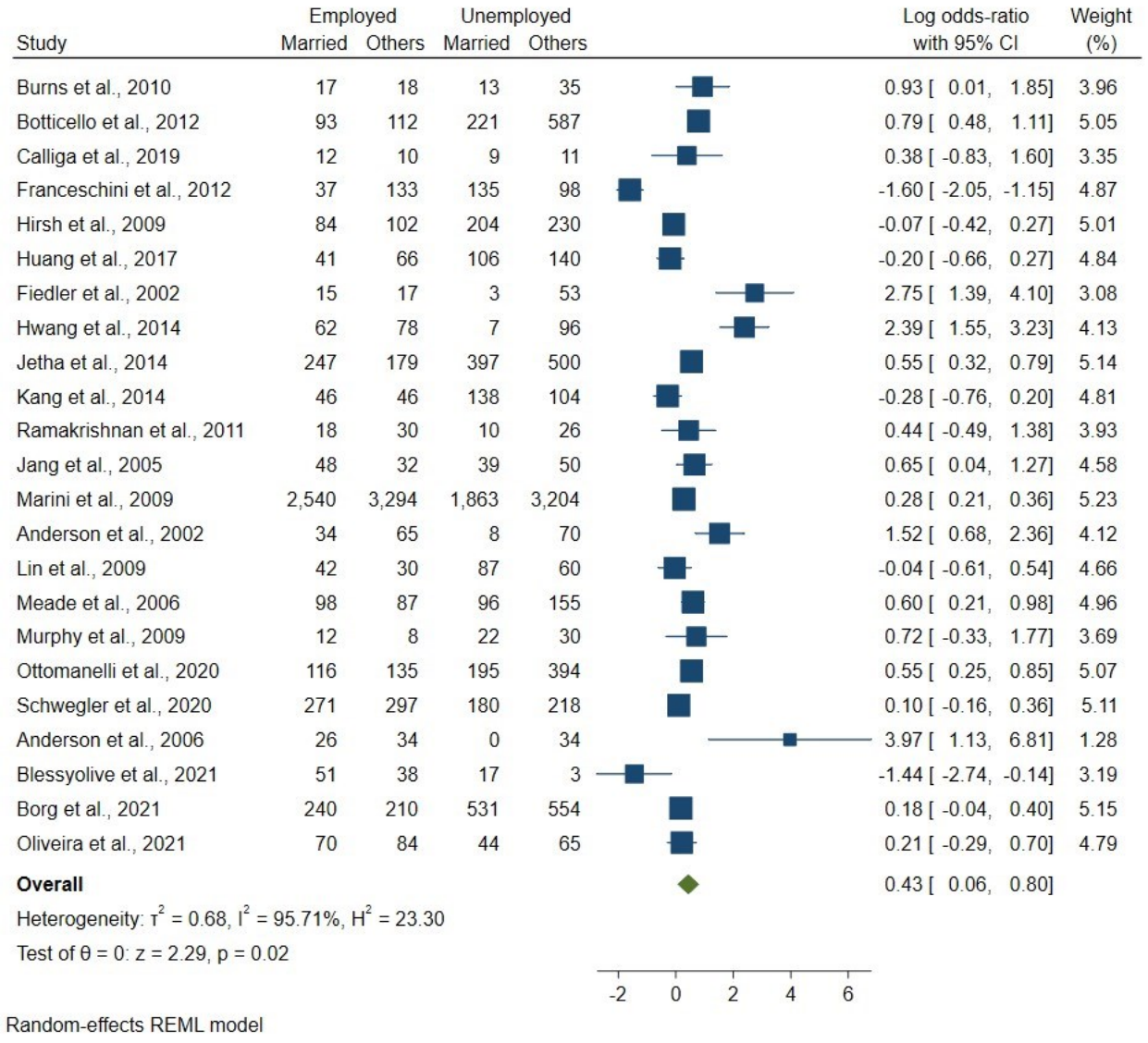


Figure 2.16a: Forest plot- Marital status

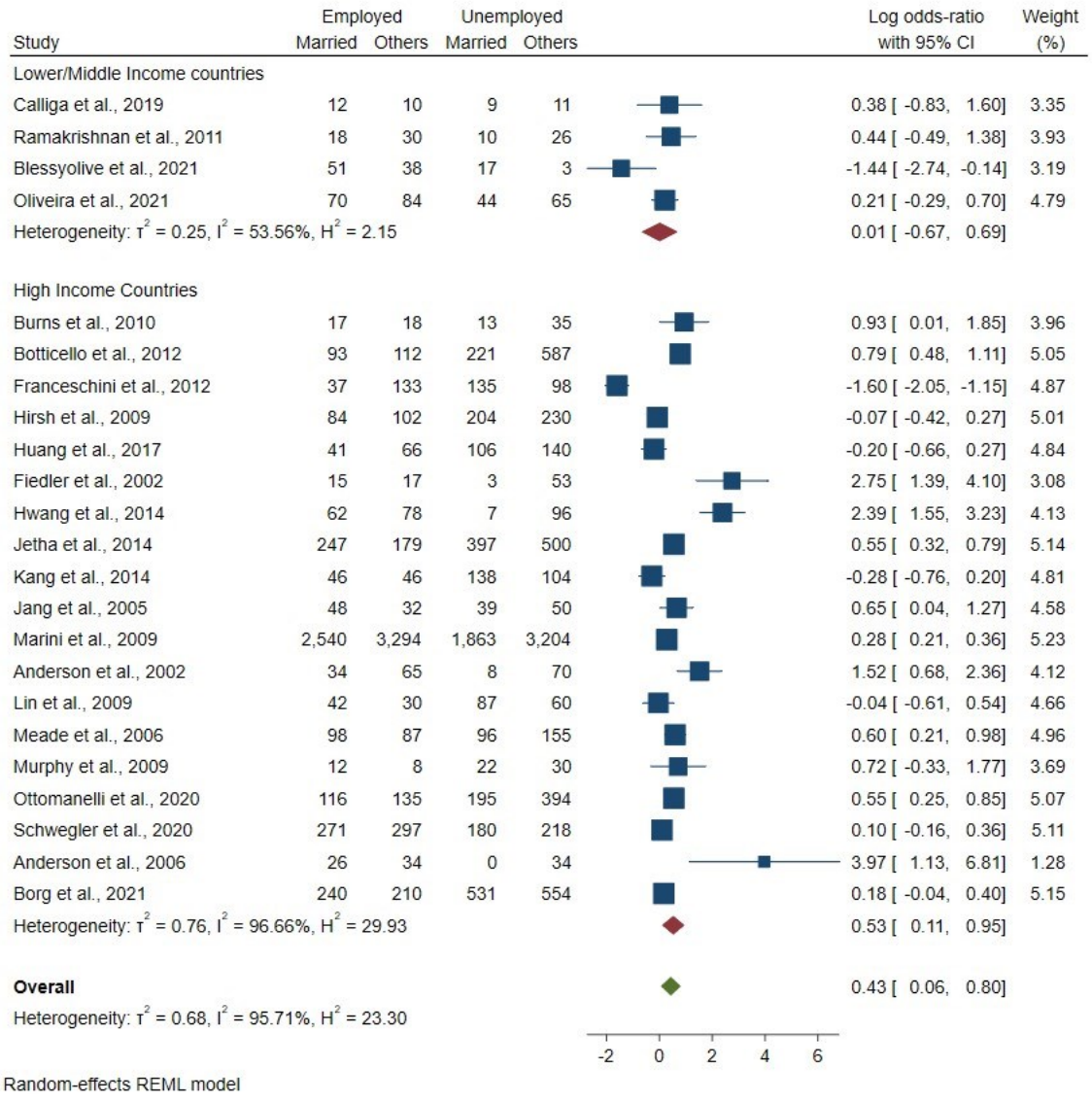


Figure 2.16b: Forest plot- Sub-group meta-analysis of marital status

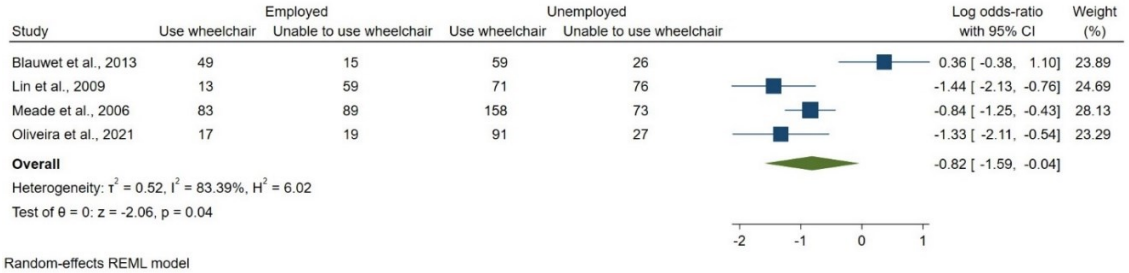


Figure 2.17: Forest plot- Wheelchair use

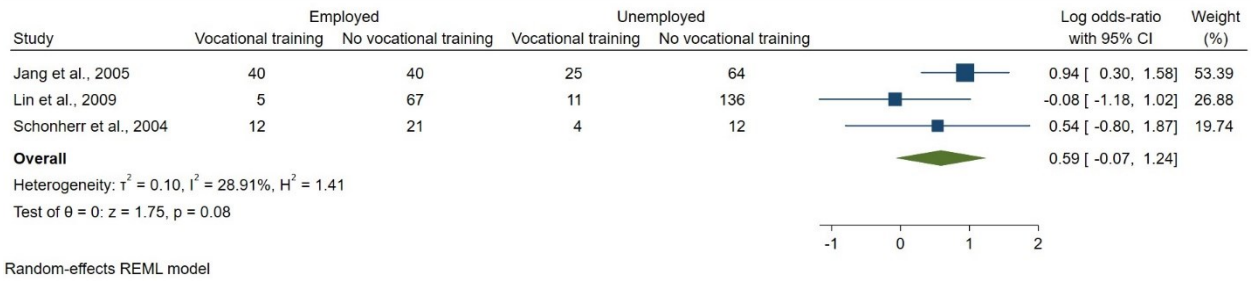


Figure 2.18: Forest plot- Vocational training

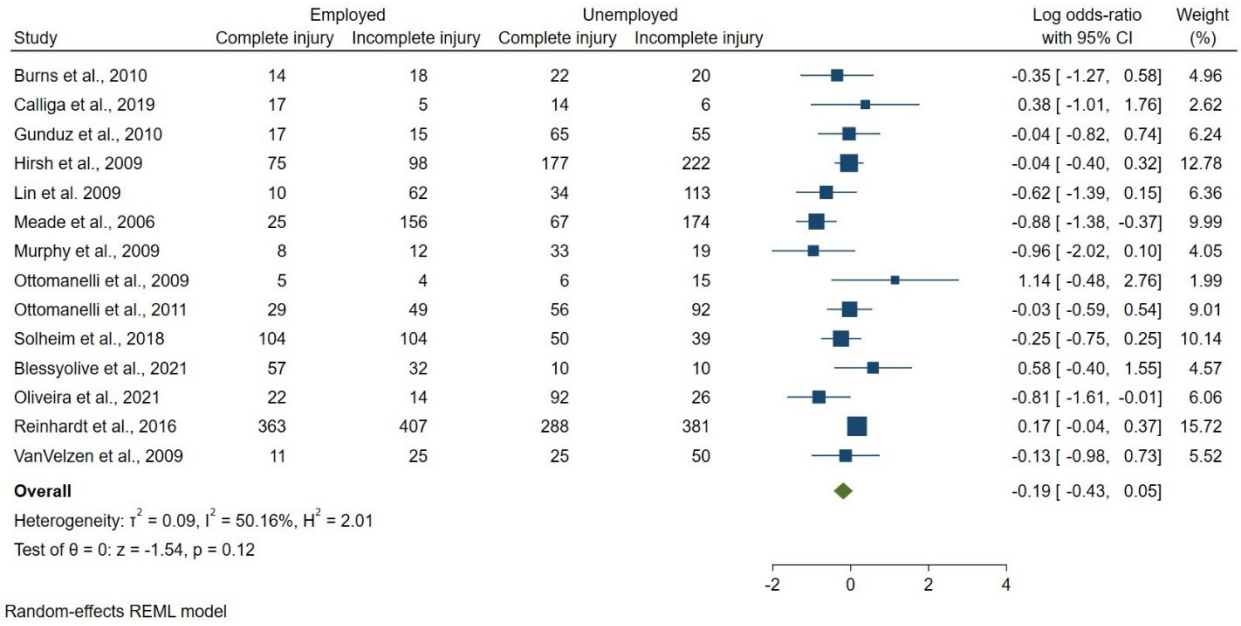


Figure 2.19a: Forest plot- Type of injury

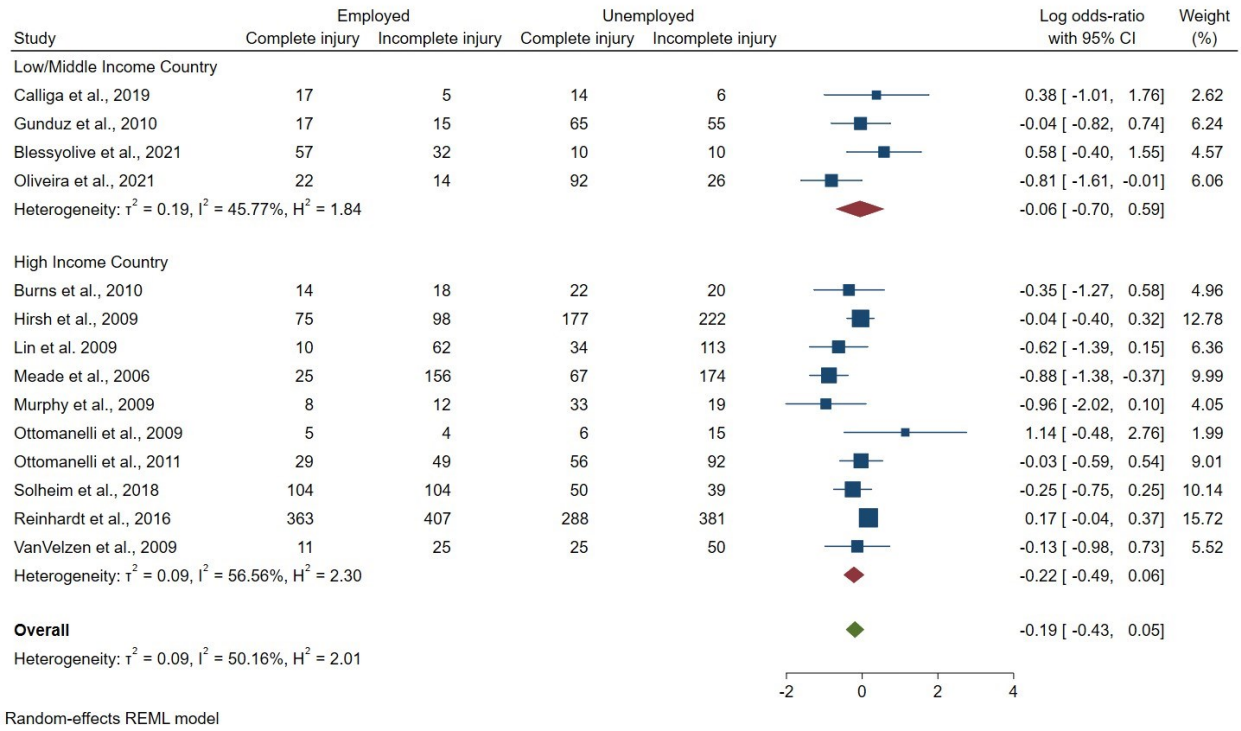


Figure 2.19b: Forest plot- Sub-group meta-analysis of type of injury

Appendix B: List of Tables

Table 1: List of included articles

Article	Country of research	Definition of employment	Objectives	Factors explored	Conclusion
Burns et.al., 2010 [30]	USA (HIC)	Working full or part-time	"To explore the relationship between employment status and community access, perceived community discrimination, social support from significant others, depressive symptoms, and gender related variables for 83 men living with spinal cord injury."	Age at the time of data collection, Age at injury, Time since injury, Ethnicity, Being married, Sexual orientation, Education, Annual income, Means of injury, Type of injury, Level of injury, Extent of disability.	"Psychosocial variables such as community access, perceived discrimination, social support from significant others, depressive symptoms, and gender identity represent important and understudied predictors of employment status among men living with spinal cord injury."

Botticello et.al, 2012 [24]	USA (HIC)	Paid employment	"This study investigates the role of area economic characteristics in predicting employment a key aspect of social participation for adults with physical disabilities using data from a national registry of persons with spinal cord injury (SCI)."	Gender, Age at the time of data collection, Age at injury, Time since injury, Ethnicity, Being married, Employed pre-injury, Education, FIM score, Self-rated poor health, Re-hospitalized in past year, Area level characteristic.	"Variation in area economic conditions may affect the feasibility of employment for persons who experience chronic physical disability during adulthood, thus limiting full participation in society."
Calliga et. al., 2019 [73]	Brazil (LMIC)	Participant returned to work	"To investigate the factors that affect the return to work of individuals with traumatic paraplegia and	Gender, Being married, Living alone, Having children, Employmen	"The study reveals the need to improve the return to work process, in particular regarding the qualification of

			to characterize post-injury work."	t at the time of injury, Education, Current income, Economic class, Means of injury, Type of injury, Industrial accident, Current work capacity, BDI, WHOQOL-Brief.	adults with spinal cord injury and the adaptation of transportation and working spaces and conditions so that such individuals can effectively return to work and sustain their activities with quality."
DeVivo et. al., 1982 [31]	USA (HIC)	Gainfully employed (working in competitive labour market, self-employed, participating in on-the-job training program, participating	"To examine the influence of medical, demographic, and epidemiologic variables on the spinal cord injury patient's return to gainful	Age at injury, Ethnicity, Employed pre-injury.	"The vocational rehabilitation potential of individual SCI patients is measureable using a relatively small number of sensitive predictor variable."

		in sheltered workshop activities, a homemaker, or a student) 3 years post-injury.	employment 3 years post-injury."		
Ferdiana et. al., 2014 [32]	Netherland (HIC)	Paid work of ≥ 1hour/week at 5 years post-discharge.	"To examine the employment situation and predictors of return to work for individuals with spinal cord injury 5 years after discharge from inpatient rehabilitation. "	Gender, Age at injury, Pre-injury occupation level, Physical intensity pre-injury work, RTW support, Education, Monthly income, Means of injury, Type of injury, Level of injury, FIM score, Self-efficacy.	"Rehabilitation interventions should enhance the skills and qualifications of individuals with physically-demanding pre-injury work in order to improve access to suitable jobs after spinal cord injury. Interventions should focus not only on return to work, but also on the quality of employment, including opportunities to

					pursue full-time work."
Franceschini et.al., 2012 [33]	Italy (HIC)	Formally involved in any regular job, either self-employed or employed in any public or private organization, and involved in any formal study course.	"To assess the occurrence and predictors of return to work after traumatic spinal cord injury."	Gender, Age at the time of data collection, Being married, Employed pre-injury, Education, Welfare subsidy, Type of injury, Level of injury, Bladder continence, Bowel continence, Independent in mobility, Ability to drive, Participatio n in community, Ability to live alone,	"Employment after SCI was rather frequent and was related to several patient characteristics and social factors. Specific interventions on the patient and on the social environment may favor employment after SCI and improve quality of life."

				Architectural barriers, Re-hospitalization in past years, medical problem in last 6 months.	
Gunduz et. al., 2010 [74]	Turkey (LMIC)	Working for salaries.	"To determine the rate of employment and to establish the factors affecting vocational status in spinal cord injured patients living in Turkey."	Gender, Age at the time of data collection, Age at injury, Time since injury, Education before and after injury, Being a member of social association, Type of injury, Level of injury.	"The employment rates after spinal cord injury are low in Turkey. There is a need to maximize the employment capacity. Social and educational activities after injury should be encouraged during rehabilitation."

Hess et. al., 2000 [34]	USA (HIC)	Legally and gainfully working in the competitive labour market.	"To examine the ability of the Motor Index Score (MIS), in combination with demographic variables, to predict return to work during a 3-year period for individuals with spinal cord injury (SCI)."	Age at injury, Education, Motor Index Score.	"The ability to predict return to work after SCI was shown utilizing MIS and demographic variables, with nearly 80% accuracy. This suggests that return to work after SCI is a dynamic process, with the level of importance of each variable changing with time post-injury."
Hirsh et. al., 2009 [35]	USA (HIC)	Working full-time or part-time	"To examine the associations between chronological age, duration of SCI, and age at SCI onset variables	Gender, Age at the time of data collection, Age at injury, Time since injury, Ethnicity, Being	"Continued research in this area is needed to better understand age-related effects on employment status, which could be used to

			and employment status in individuals with SCI through a series of regression analyses."	married, Education, Means of injury, Type of injury, Physical functioning, Psychological functioning, Sleep, Fatigue, Pain severity.	help maximize the quality of life in individuals with SCI."
Huang et. al., 2017 [36]	Taiwan (HIC)	Paid work either full-time or part-time	"To examine the employment status and determinants of employability for individuals with spinal cord injury in Taiwan."	Gender, Age at the time of data collection, Time since injury, Being married, Employed pre-injury, Education, Means of injury, Extent of disability, Depressive	"Vocational rehabilitation services can use the results to target efforts toward those at risk of unemployment. "

				symptoms, Functional limitation, Core self-evaluation, Perceived social support.	
Ferdiana et. al., 2014 [37]	Netherland (HIC)	Paid work of ≥ 12hour/week.	"To identify different employment trajectories in individuals with spinal cord injury (SCI) after discharge from initial rehabilitation and to determine predictors of different trajectories from demographic, injury, functional, and psychological	Gender, Age at injury, Employed pre-injury, Education, Type of injury, Level of injury, FIM score, Self-efficacy.	"Distinct employment trajectories after SCI were identified. More than half of the individuals with SCI had a low employment trajectory, and only one-fifth of the individuals with SCI had a steady employment trajectory. Secondary education and higher functional independence level predicted

			characteristics.”		steady employment.”
Fiedler et. al., 2002 [38]	USA (HIC)	Pay for profit.	“To assess the factors influencing employment for individuals with spinal cord injury.”	Gender, Ethnicity, Being married, Education, Annual income.	“The fact that financial disincentives and transportation barriers, as well as helpful factors, are perceived so differently by individuals with SCI, depending on their employment status, should mandate additional research in this area.”
Hwang et. al., 2014 [39]	USA (HIC)	Paid work including full-time or part-time, including self-employment.	“To determine in adults with pediatric-onset spinal cord injury (SCI) employment outcomes, longitudinal changes in	Gender, Age at the time of data collection, Being married, Education,	“Employment status remained relatively stable in adults with pediatric-onset SCI; however, changes in employment were associated

			employment over time and changes in psychosocial outcomes associated with employment status."	Type of injury.	with education, secondary health conditions and psychosocial well-being."
Jetha et. al., 2014 [40]	Canada (HIC)	Paid employment	"To compare employment participation of young/middle-aged and older adults with SCI and to examine the association between employment and demographic and health factors, SCI-related needs, and social role participation at the 2 life phases."	Gender, Age at the time of data collection, Time since injury, Being married, Living with another person, Education, Annual income, Social role participation, Means of injury, Type of injury, Level of injury, Self-	"A life course perspective is important to understanding similarities and differences between young/middle-aged and older adults with SCI in their employment participation. Tailored programs and policies should be designed to promote labor force involvement at different phases

				reported health, SCI related unmet needs, SF-12 (physical and mental score).	of the working life course."
Kang et. al., 2014 [41]	South Korea (HIC)	Paid work > 1 hour/week or unpaid family work for > 18 hours/week	"To investigate employment status after spinal cord injury (SCI) and identify personal, family, and injury characteristics those affect their employment in South Korea."	Gender, Age at the time of data collection, Age at injury, Time since injury, Being married, Employed pre-injury, Education, Monthly income, Extent of disability, Industrial accident.	"Injury characteristics are the most important predictors of employment in persons with SCI. For persons with lower employment rate, individualized vocational rehabilitation and employment-support systems are required."
Krause et. al., 2020 [42]	USA (HIC)	Paid employment	"To identify demographic, educational,	Gender, Age at injury, Time since	"There is importance of policies

			and injury-related characteristics associated with odds of employment and estimates of differential earnings among participants with spinal cord injury."	injury, Ethnicity, Being married, Education, Type of injury.	maximizing employment opportunities for people with SCI to promote the optimal outcomes."
Krause et. al., 1992 [43]	USA (HIC)	Not defined	"To compare preinjury and post-injury employment rates in a diverse sample of persons with spinal cord injuries."	Age at the time of data collection, Age at injury, Time since injury, Education, Level of injury.	"The study results reaffirmed the need for comprehensive rehabilitation, identified the need for retraining several years after injury, and pointed to the role of higher education in producing high employment rates."

Krause et. al., 1996 [44]	USA (HIC)	Self-employment or work for pay	"To investigate the relation between selected participant characteristics and employment outcomes after spinal cord injury."	Age at the time of data collection, Age at injury, Ethnicity, Education, Extent of disability.	"Results point to the need for rehabilitation professionals to make special efforts to maximize employability after SC1 among people with biographic characteristics that place them at greatest risk for unemployment. "
Ramakrishnan et. al., 2011 [75]	Malaysia (LMIC)	Self-employment and paid employment	"To determine the employment outcomes of persons with spinal cord injury (SCI) and to investigate the impact of various demographic, injury-related	Gender, Age at the time of data collection, Age at injury, Time since injury, Ethnicity, Being married, Employed pre-injury, Education,	"Functional independence, especially ability to drive, was strongly associated with return to work and should be one of the priority goals of comprehensive rehabilitation of persons with

			and work-related variables on these outcomes."	Financial incentives, Level of injury, Medical co-morbidities, Independent in mobility, Ability to drive, Ability to live alone, Re-hospitalized in past years.	SCI. The negative impact of recent hospitalization as well as financial compensation needs to be probed further."
Trezzini et. al., 2018 [7]	Switzerland (HIC)	Paid work (any remunerative employment, including self-employed work and work as an apprentice and in sheltered workshops.)	"To investigate work and wellbeing-related consequences of different return-to-work (RTW) pathways after SCI."	Gender, Age at the time of data collection, Age at injury, Time since injury, Physical intensity of pre-injury job, Education, Means of injury,	"Although the two pathways seem equally viable, longitudinal data are required to corroborate the present findings, and future research needs to clarify the role of the client triage

				Level of injury, Extent of disability, Quality of life, Life satisfaction.	system and of vocational rehabilitation practices with regard to person–job match and its impact on job satisfaction and job performance.”
VanVelzen et. al., 2012 [45]	Netherland (HIC)	Paid work of atleast 1 hour or more per week.	“To describe the proportion of people with spinal cord injury who returned to work 5 years after discharge from inpatient rehabilitation, and to investigate whether return to work is related to wheelchair capacity at discharge from inpatient	Gender, Age at the time of data collection, Education, Type of injury, Level of injury.	“Return to work was related to wheelchair capacity at discharge. It is recommended to train wheelchair capacity during rehabilitation in the context of return to work, since the association with return to work is another benefit of the training of wheelchair capacity in

			rehabilitation. ”		addition to the improvement of mobility and functional independency.”
Jang et. al., 2005 [46]	Taiwan (HIC)	Full-time, part-time, student, homemaker	“To study the employment rate and determinants of return to work for persons with traumatic spinal cord injury (SCI) in Taiwan.”	Gender, Age at the time of data collection, Age at injury, Time since injury, Being married, Employed pre-injury, Employed at the time of injury, Vocational training, Education, Extent of disability, Medical co-morbidities, Independent transport, Barthel Index.	“Functional independence was a strong factor predicting return to work. Rehabilitation focused on education, vocational training, self-care ability, community mobility, and environmental modifications could improve employability after SCI.”

Marini et. al., 2008 [47]	USA (HIC)	Employed in integrated competitive employment setting.	"To examine the effect of demographic, work disincentives, and service variables on employment outcomes of persons with spinal cord injury in state vocational rehabilitation agencies."	Gender, Ethnicity, Being married, Education, Work disincentives, Co-occuring disability as Alcohol and other drug abuse, Co-occuring disability as Psychiatric disability.	"The results confirmed substantial counseling, assistive technology, and job placement and support services are important to the return-to-work success of persons with SCI."
Noreau et. al., 1992 [48]	Canada (HIC)	Gainful employment	"To examine whether there is any associations between the levels of aerobic and muscular fitness and the employment status following SCI."	Age at the time of data collection, Age at injury, Time since injury, Education, Body mass, BMI, Body fat, Peak power output.	"The results verified the positive relationship between physical fitness (body composition, aerobic power, muscular endurance) and the gainful employment of

					paraplegics, but failed to show any significant relationship between physical fitness and the acceptance of physically demanding work by such individuals."
Anderson et. al., 2002 [49]	USA (HIC)	Employed ≥ 1 hour/week	"To determine employment outcomes of adults with pediatric-onset spinal cord injury (SCI) and factors associated with those outcomes."	Gender, Age at the time of data collection, Age at injury, Time since injury, Ethnicity, Being married, Education, Annual income, Means of injury, Type of injury, Level of injury,	"Compared with the general population, the high rate of unemployment among adults with pediatric-onset SCI is a cause for concern. Risk factors associated with adult unemployment provide guidelines for targeting rehabilitation

				Independent driving, Independent living, Physical functioning, SF-12 (physical and mental score), CHART score, SWLS score.	resources and strategies.”
Blauwet et. al., 2013 [50]	USA (HIC)	Full or part time job, or regularly volunteering	“To determine the association between participation in organized sports programs and employment in adults with chronic spinal cord injury.”	Gender, Age at the time of data collection, Time since injury, Ethnicity, Education, Extent of disability, Wheelchair use, Participation in organized sports,	“In the adults with chronic spinal cord injury, participation in organized sports was positively associated with employment. Further studies are necessary to determine the causative nature of this association and how various

				Exercise time textiles, BMI.	factors related to sports participation may contribute."
Sturm et. al., 2020 [12]	Germany (HIC)	Gainful employment	"1) To describe the prevalence of labour market participation in the German study population and 2) To analyse determinants of labour market participation across relevant subpopulation s based on demographic data, social and health related factors, and SCI characteristics. "	Education	"Education and pain belong to the most critical factors and thereby possible approaches to increase the level of employment, which is essential and highly relevant not only for earning money but also for self-confidence and social integration. SCI has many dimensions in itself; support also should be multidimension al. Study results might help to

					improve participation.”
Lasprilla et. al., 2010 [51]	USA (HIC)	Competitive employment	“To compare the odds of competitive employment versus not competitive employment among a group of white, African American, and Hispanic persons with spinal cord injury (SCI) at 1, 5, and 10 years after injury.”	Ethnicity	“Regardless of race, short- and long-term employment outcomes were not favorable for persons with SCI; however, African Americans and Hispanics fared worse in employment outcomes compared with whites. Rehabilitation professionals should work to improve employment outcomes for all individuals with SCI, with special emphasis on addressing specific needs

					of African Americans and Hispanics."
Krause et. al., 1999 [52]	USA (HIC)	Gainful employment	"To describe the relationship of multiple biographic, injury-related, and educational factors with employment outcomes after spinal cord injury."	Gender, Age at the time of data collection, Age at injury, Time since injury, Ethnicity, Employed pre-injury, Education, Type of injury.	"Interventions to improve employability should focus on education and the needs of individuals from minority backgrounds."
Lin et. al., 2009 [53]	Taiwan (HIC)	Working in a competitive labor market, self-employed, homemaker, or a student.	"To examine comprehensively the effects of physical, psychologic, and sociologic characteristics on employment among persons after a traumatic spinal cord	Gender, Age at injury, Time since injury, Being married, Vocational training, Education, Type of injury, Bladder incontinence, Use of	"In addition to education level and traditional physical factors, overall injury severity and psychologic factors such as thrill and adventure seeking and depression can also influence the return to

			injury (SCI) in Taiwan."	assistive devices for ambulation, Wheelchair use, Strong social support, Barthel Index Score.	work after an SCI."
Meade et. al., 2006 [54]	USA (HIC)	Working full or part time	"To describe the relationship between work intensity, personal and injury-related factors and the resources typically associated with employment, including insurance, access to health care, and salary."	Gender, Age at the time of data collection, Time since injury, Ethnicity, Being married, Having children, Employed pre-injury, Education, Compensation status, Type of injury, Level of injury, Extent of	"Secondary conditions may influence the level/intensity of employment for individuals with SCI and that working part-time still provides advantages over unemployment."

				disability, Medical co-morbidities, Uncontrolled spasticity within past 12 months, UTI within past 12 months, Chronic pain within past 12 months, Unable to access medical care within past 12 months, Need of help in daily activities, Wheelchair use, Perceived health.	
Murphy et. al., 2009 [55]	Australia (HIC)	Paid employment	"To identify the extent to which early participation	Gender, Age at the time of data collection,	"To assist in raising employment achievements

			and environmental variables, when assessed at discharge from hospital, add to injury and demographic variables in the prediction of employment following traumatic spinal cord injury."	Being married, Employed pre-injury, Employed at the time of injury, Education, Compensation status, Type of injury, Level of injury, Community Integration Measure, FIM, Discharge area, CHART score.	post-injury, attention should be given during rehabilitation to factors beyond the traditional patient injury and demographic variables, as well as considering community integration support services when developing vocational rehabilitation service plans."
Ottomanelli et. al., 2009 [56]	USA (HIC)	Competitive employment	"To investigate the extent to which veterans are able to obtain competitive employment	Gender, Age at injury, Time since injury, Ethnicity, Type of injury, Level of	"The findings of this study emphasize the need to educate veterans, especially those with more severe injuries,

			after a spinal cord injury and to explore veterans' use of existing vocational rehabilitation services."	injury, Extent of injury.	about vocational rehabilitation services as a possible means of improving employment outcomes in this special population."
Ottomanelli et. al., 2020 [57]	USA (HIC)	Paid employment	"To examine variables predictive of post-SCI return to employment and current employment among a large cohort of veterans with Spinal Cord Injury (SCI) treated within the Veterans Health Administratio n (VHA) SCI System of Care."	Gender, Age at the time of data collection, Time since injury, Ethnicity, Being married, Education, Means of injury, Type of injury, Level of injury, Extent of disability.	"The baseline employment rate following SCI of a large, representative sample, was 29.8%. Greater duration of SCI predicted unemployment, likely due to the older age of this population. Additional years of education promoted current and post-SCI employment, while a history of legal

					problems was a barrier to employment."
Ottomanelli et. al., 2011 [58]	USA (HIC)	Competitive employment	"To investigate predictors of competitive employment after a spinal cord injury (SCI) among veterans."	Gender, Age at injury, Time since injury, Ethnicity, Education, Type of injury, Level of injury, Extent of disability.	"Vocational rehabilitation interventions that focus on rapid re-entry to the workforce using existing skill sets may maximize post-SCI employment."
Schonherr et. al., 2004 [59]	Netherland (HIC)	Reintegration in paid work	"To explore the process of reintegration in paid work following a traumatic spinal cord injury (SCI), including the role of early expectations of individual patients regarding return to work,	Age at injury, Vocational training, Education, Extent of disability, Job expectation.	"Positive expectations regarding resumption of work after a SCI are an important indicator of successful reintegration in work. An active role of the rehabilitation team is recommended in drawing up a

			indicators of success of job reintegration and a description of reintegration interventions and barriers."		vocational reintegration plan to prepare the patient, the employer and professionals involved in the reintegration process."
Solheim et. al., 2018 [60]	Norway (HIC)	Continue the same job as of before injury	"To address: 1) What predicts employment among persons with spinal cord injury (SCI) in Norway? 2) How do the employed compare with the non-employed in their job motivation, labour discrimination, quality of life, everyday coping, health	Gender, Age at the time of data collection, Age at injury, Employed at the time of injury, Education, Type of injury, Level of injury.	"Job motivation and work ability could have affected past employment, and both the employed and non-employed supported the statement that employers discriminate against wheelchair users."

			and pain suffering?"		
Tomassen et. al., 2000 [61]	Netherland (HIC)	Gainful employment	"To describe predictors of return to work after spinal cord injury (SCI), in particular the physical intensity of the pre-injury job."	Gender, Age at the time of data collection, Time since injury, Physical intensity pre-injury job, Extent of disability, Barthel Index Score.	"Only a minority returned to gainful employment after SCI even to a physically less demanding job. In addition to intensive inpatient re-education, long-term support in job seeking is very important, including switching to a less demanding job."
Schwegler et.al., 2020 [62]	Switzerland (HIC)	Paid work	"To identify associations between selected factors related to the social background, health, functional	Gender, Age at the time of data collection, Being married, Education,	"Beyond previously established sociodemographic and injury-related risk factors such as female gender, low education,

			independence, and the environment of persons with spinal cord injury (SCI) and their labor market participation."	Extent of disability.	and high lesion severity, functional independence, chronic pain, and nationality proved crucial for labor market participation. These factors should receive particular attention in medical and vocational strategies striving for a sustainable work integration of persons with SCI."
Anderson et. al., 2006 [63]	USA (HIC)	Working full or part time	"To assess the stability of independent living, employment, and life satisfaction and to determine	Gender, Age at the time of data collection, Age at injury, Time since injury, Ethnicity, Being	"Many individuals with pediatric-onset SCI achieve successful, stable adult outcomes. The factors associated with

			factors associated with stable, successful outcomes.”	married, Independent living, Education, Type of injury, Level of injury, Uncontrolled spasticity within past 12 months, UTI within past 12 months, Chronic pain within past 12 months, Co-occuring disability as drug abuse, Bowel incontinence, Life satisfaction, FIM, Re-hospitalized in past year, SF-12,	that success can help us improve rehabilitation for future patients.”

				CHART score.	
Blessyolive et. al., 2021 [10]	India (LMIC)	Being employed or self-employed, either full-time or part-time (excluding students and homemakers)	"To find the factors influencing the return to work status (RTW) in persons with spinal cord injury (SCI)."	Being married, Vocational training, Type of injury, Ability to live alone, Self-motivation, Family support, Social support.	"Motivation and social support are critical to successful return to work following SCI. Comprehensive multidisciplinary rehabilitation, which targets vocational goals, improvements in individual functioning and mobility, and community access are important for successful employment outcomes."
Borg et. al., 2021 [9]	Australia (HIC)	Paid work	"To contextualise post-injury employment for people with spinal	Gender, Being married, Means of injury.	"While there are current services and programmes in place in Australia that

			cord injury (SCI) in Australia, including work participation rates, time to resuming work, underemployment and pre- and post-SCI employment changes."		support post-injury employment, findings indicate a need for more comprehensive early intervention focused services targeted towards employers and individuals."
Ghatit et. al., 1978 [64]	USA (HIC)	Part-time or full-time	"To distinguish between merely obtaining employment and whether the individual had sustained employment as reflected by his current status."	Being married, Education.	"It was found that respondents regarded private employers as being more helpful than public agencies in both obtaining and sustaining employment."
Eskola et. al., 2022 [72]	Finland (HIC)	worked for at least 1 h to earn a salary	"To explore work participation	Gender, Age at the time of data	"The first national survey among people

		or entrepreneurial income during the survey week	and the health-related factors affecting work participation among the Finnish Spinal Cord injury (FinSCI) study population."	collection, Living alone, Having children, Means of injury.	with spinal cord injury in Finland shows low level of employment. The results suggest that pain, physical function, and ability to participate in social roles should be monitored by health and vocational professionals when assessing a person's likelihood of being in work."
Goetz et. al., 2018 [65]	USA (HIC)	Competitive employment	"To determine the relationship between medical and mental health comorbidities in a large cohort of	Spasticity and UTI	"Further investigation is needed to clarify whether comorbidity severity or combinations of specific comorbidities

			veterans with spinal cord injury."		predict rehabilitation outcome, including employment."
Krause et. al., 1992 [66]	USA (HIC)	Not defined	"To investigate the relationship between work history, biographical status, and adjustment after SCI."	Age at the time of data collection, Age at injury, Time since injury.	"Either current employment or productivity status is of central importance to adjustment."
Lidal et. al., 2009 [67]	Norway (HIC)	Paid work	"The primary objective was to study factors influencing post-injury employment and withdrawal from work in persons who sustained traumatic spinal cord injury (SCI) more than 20	Gender, Age at the time of data collection, Age at injury, Time since injury, Means of injury, Chronic pain.	"The study indicates a low employment-rate in persons with SCI, even several years after injury. From the results, we suggest more support, especially to persons of older age at injury and/or with a history of pre-

			years ago. A secondary objective was to study life satisfaction in the same patients."		injury medical condition(s), to help them to obtain work and sustain employed for more years after injury."
Oliveira et. al., 2021 [76]	Brazil (LMIC)	Paid work	"To investigate paid work status and return to work (RTW) pathways after spinal cord injury."	Gender, Being married, Education before and after injury, Means of injury, Type of injury, Level of injury, Ability to drive, Powered/manual wheelchair.	"Working-age people with SCI who underwent rehabilitation in Brazil had a low rate of paid work. Fewer complications at the time of the injury, returning to study, good ability to work and greater satisfaction with the work status increased the likelihood of being engaged in paid work."
Reinhardt et. al., 2016 [68]	Switzerland (HIC)	Employment or self-employment	"To describe labor market participation	Gender, Education, Means of	"LMP of persons with SCI is

		at the time of the survey for at least one hour/week, included competitive, sheltered and supported employment	(LMP) of persons with spinal cord injury (SCI) in Switzerland, to examine potential determinants of LMP, and to compare LMP between SCI and the general population."	injury, Type of injury, Level of injury.	comparatively high in Switzerland. LMP after SCI is, however, considerably lower than in the general population. Future research needs to show whether the reduced LMP in SCI reflects individual capacity adjustment, contextual constraints on higher LMP or both."
Schonherr et. al., 2005 [69]	Netherland (HIC)	Work gainfully for at least 4 hours a week.	"To give insight into the vocational situation several years after a traumatic spinal cord injury (SCI)	Age at the time of data collection.	"Despite a high participation in paid work following SCI, the effort of the disabled worker to have and keep a job should not be

			and describe the personal experiences and unmet needs; to give an overview of health and functional status per type of SCI and their relationship with employment status."		underestimated. "
VanVelzen et. al., 2009 [70]	Netherland (HIC)	Worked at least 1 hr/wk in paid employment	"To describe the number of people with spinal cord injury who returned to work (RTW) 1 year after discharge from inpatient rehabilitation and to investigate whether RTW can be	Gender, Age at the time of data collection, Type of injury, Level of injury.	"RTW was successful in 33% of the subjects. Wheelchair capacity was independently related to RTW. Therefore, it is recommended to train wheelchair capacity in the context of RTW."

			predicted from wheelchair capacity at discharge from inpatient rehabilitation, after correction for confounders."		
Krause et. al., 2010 [78]	USA (HIC)	Gainfully employed	"To identify demographic, injury, educational, and vocational predictors of labor force participation (LFP) after spinal cord injury (SCI) performing secondary analysis of existing data."	Gender, Age at injury, Education.	"Counselors can use the results to help understand the extent to which characteristics are associated with the probability of successfully participating in the labor force."

Table 2.1: Summary of Findings (SOF) for continuous factors

Factor	No. of Participants		Mean difference	95% CI	P-value	Quality of evidence
	Employed	Unemployed				
FIM Score	570	1406	0.67	0.49 to 0.85	<0.01	Medium
Being young at the time of injury	1576	2097	-0.30	-0.46 to -0.14	<0.01	Low
Being young at the time of data collection	2783	4900	-0.24	-0.38 to -0.11	<0.01	Low
More time since injury	1533	2904	0.31	0.12 to 0.49	<0.01	Low

Table 2.2: Summary of findings (SOF) for Nominal factors

Factor	No. of Participants		OR (95% CI)	P-value	Quality of evidence
	Employed	Unemployed			
Being able to live alone	1219	1901	2.59 (1.29 to 5.10)	0.01	Low
Ability to drive	317	347	4.76 (2.94 to 7.61)	<0.01	Low
Having annual income of ≥$20,000	491	1000	0.15 (0.06 to 0.34)	<0.01	Low
Having education of ≥High school	9646	10697	0.45 (0.36 to 0.57)	<0.01	Low
Being White	7808	15384	2.16 (1.54 to 3.03)	<0.01	Low
Being Male	12933	18147	1.09 (0.94 to 1.28)	0.23	Low
Being married	9325	11042	1.54 (1.06 to 2.23)	0.02	Medium

Being paraplegic	4279	5097	0.73 (0.63 to 0.85)	<0.01	Medium
Having complete injury	1758	2161	0.83 (0.65 to 1.05)	0.12	Medium
Being employed pre-injury	948	1988	1.84 (0.86 to 3.90)	0.12	Low
Being employed at the time of injury	217	169	1.35 (0.36 to 5.00)	0.65	Low
Having low pre-injury work intensity	427	412	1.43 (0.76 to 2.66)	0.26	Low
Medical co-morbidities Present	11981	10510	0.64 (0.35 to 1.19)	0.16	Low
Being able to use Wheelchair	344	581	0.44 (0.20 to 0.96)	0.04	Low
Received vocational training	185	252	1.80 (0.93 to 3.46)	0.08	High

Table 3.1: ICF structure of factors that were explored

Body structure and function	**Activity**	**Participation**	**Personal factors**	**Environmental factors**
Types of injury Level of injury Beck Depression Inventory (BDI) Body Mass Index (BMI) Medical comorbidities Pain/spasticity/UTI/sleep/fatigue/ Bowel-bladder incontinence	Ability to live alone Ability to drive Wheelchair use Mobility Functional Independen	Education after injury Participation in community Being member of social association	Gender Marital status Ethnicity Age at the time of data collection Age at injury	Unable to access medical care Architectural barrier Insurance Welfare subsidy

Co-occurring disability: Alcohol/drug abuse and Psychiatric disability	ce Measure (FIM)	Participation in organized sports Vocational training	Time since injury Education level before injury Employment pre-injury Employment at the time of injury Pre-injury work intensity Annual income Economic class Self-motivation/ self-efficacy Perceived health Life satisfaction Job expectation Means of injury	RTW support Financial incentives Work disincentives Family/social support Area level characteristics

			Industrial accident Re-hospitalization	

Table 3.2: ICF structure of factors that qualified for meta-analysis

Body structure and function	**Activity**	**Participation**	**Personal factors**
Types of injury Level of injury Medical comorbidities	Ability to live alone Ability to drive Wheelchair use Functional Independence Measure (FIM)	Vocational training	Gender Marital status Ethnicity Current age Age at injury Education level Annual income Employment pre-injury Employment at the time of injury

			Pre-injury work intensity Time since injury

Appendix C

Search Strategy:

Ovid MEDLINE(R) ALL 1946 to April 25, 2022

Date searched April 26, 2022

Results: 1345

1. exp Spinal Cord Injuries/

2. hemiplegia/ or exp paraplegia/ or quadriplegia/

3. (Spinal cord injur* or (paraplegi* not spastic paraplegi*) or (quadraplegi* not spastic quadriplegi*) or (hemiplegi* not spastic hemiplegi*) or spinal paralys* or spinal cord paralys*).mp.

4. 1 or 2 or 3

5. work/ or exp return to work/

6. employment/ or employment, supported/ or workplace/ or occupations/

7. ("Return* to work" or work re-entry or work reentry or community integration or community reintegration or vocational or labor market or labour market or job market or workplace* or "place of work" or job accommodation* or work accommodation* or supported employment or work* capacity or job characteristics or reasonable accommodation* or job modification* or work modification* or employment status or occupational status or employment rate* or re-employ* or reemploy*).mp.

8. ((back or return* or resum* or reentry or re-entry or re-enter) adj3 (work* or employ* or vocation*)).mp.

9. (job or jobs or work or (worker* not worker* compensation) or workplace or (working not working memory) or (occupation* not (occupational therap* or occupational performance*)) or vocation* or employ*).ti,kf.

10. 5 or 6 or 7 or 8 or 9

11. 4 and 10

EMBASE

Embase 1974 to 2022 April 25

Date searched: April 26, 2022

Results: 2389

1. exp spinal cord injury/

2. hemiparesis/ or hemiplegia/ or paraplegia/ or quadriplegia/ or spinal paralysis/

3. (Spinal cord injur* or (paraplegi* not spastic paraplegi*) or (quadraplegi* not spastic quadriplegi*) or (hemiplegi* not spastic hemiplegi*) or spinal paralys* or spinal cord paralys*).mp.

4. 1 or 2 or 3

5. return to work/ or work/

6. employment/ or occupation/ or full time employment/ or parttime employment/ or self employment/ or sheltered employment/ or supported employment/

7. ("Return* to work" or work re-entry or work reentry or community integration or community reintegration or vocational or labor market or labour market or job market or workplace* or "place of work" or job accommodation* or work accommodation* or supported employment or work* capacity or job characteristics or reasonable accommodation* or job modification* or work modification* or employment status or occupational status or employment rate* or re-employ* or reemploy*).mp.

8. ((back or return* or resum* or reentry or re-entry or re-enter) adj3 (work* or employ* or vocation*)).mp.

9. (job or jobs or work or (worker* not worker* compensation) or workplace or (working not working memory) or (occupation* not (occupational therap* or occupational performance*)) or vocation* or employ*).ti,kf.

10. 5 or 6 or 7 or 8 or 9

11. 4 and 10

APA PsycInfo 1806 to April Week 3 2022

Date searched: April 26, 2022

Results: 428

1. exp spinal cord injuries/

2. hemiplegia/ or hemiparesis/ or paraplegia/ or quadriplegia/

3. (Spinal cord injur* or (paraplegi* not spastic paraplegi*) or (quadraplegi* not spastic quadriplegi*) or (hemiplegi* not spastic hemiplegi*) or spinal paralys* or spinal cord paralys*).mp.

4. 1 or 2 or 3

5. reemployment/

6. employment status/ or self-employment/ or supported employment/

7. ("Return* to work" or work re-entry or work reentry or community integration or community reintegration or vocational or labor market or labour market or job market or workplace* or "place of work" or job accommodation* or work accommodation* or supported employment or work* capacity or job characteristics or reasonable accommodation* or job modification* or work modification* or employment status or occupational status or employment rate* or re-employ* or reemploy*).mp.

8. ((back or return* or resum* or reentry or re-entry or re-enter) adj3 (work* or employ* or vocation*)).mp.

9. (job or jobs or work or (worker* not worker* compensation) or workplace or (working not working memory) or (occupation* not (occupational therap* or occupational performance*)) or vocation* or employ*).ti.

10. 5 or 6 or 7 or 8 or 9

11. 4 and 10

Scopus

Date searched: April 26, 2022

Results 1824

TITLE-ABS-KEY (spinal-cord-injur* OR (paraplegi* AND NOT spastic-paraplegi*) OR (quadraplegi* AND NOT spastic-quadriplegi*) OR (hemiplegi* AND NOT spastic-hemiplegi*) OR spinal-paralys* OR spinal-cord-paralys*) AND (TITLE-ABS-KEY ("Return* to work" OR work-re-entry OR work-reentry OR community-integration OR community-reintegration OR vocational OR labor-market OR labour-market OR job-market OR workplace* OR "place of work" OR job-accommodation* OR work-accommodation* OR supported-employment OR work*-capacity OR job-characteristics OR reasonable-accommodation* OR job-modification* OR work-modification* OR employment-status OR occupational-status OR employment-rate* OR re-employ* OR reemploy*) OR TITLE-ABS-KEY ((back OR return* OR resum* OR re-entry OR reentry OR re-enter) W/3 (work* OR employ* OR vocation*)) OR TITLE (job OR jobs OR work OR (worker* AND NOT worker*-compensation) OR workplace OR (working AND NOT working-memory) OR (occupation* AND NOT (occupational-therap* OR occupational-performance*)) OR vocation* OR employ*))

CINAHL Plus with Full text

Date searched: April 26, 2022

Results: 1355

S1. (MH "Spinal Cord Injuries+")

S2. (MH "Paraplegia+") OR (MH "Hemiplegia") OR (MH "Quadriplegia")

S3. (Spinal-cord-injur* or (paraplegi* not spastic-paraplegi*) or (quadraplegi* not spastic-quadriplegi*) or (hemiplegi* not spastic-hemiplegi*) or spinal-paralys* or spinal-cord-paralys*)

S4. S1 OR S2 OR S3

S5. (MH "Job Characteristics") OR (MH "Job Re-Entry")

S6. (MH "Job Accommodation") OR (MH "Employment, Supported") OR (MH "Employment") OR (MH "Employment of Persons with Disabilities")

S7. (MH "Occupation (Human)")

S8. ("Return* to work" or work-re-entry or work-reentry or community-integration or community-reintegration or vocational or labor-market or labour-market or job-market or workplace* or "place of work" or job-accommodation* or work-accommodation* or supported-employment or work* capacity or job-characteristics or reasonable-accommodation* or job-modification* or work-modification* or employment-status or occupational-status or employment-rate* or re-employ* or reemploy*)

S9. ((back or return* or resum* or re-enter or re-entry or reentry) N3 (work* or employ* or vocation*))

S10. TI(job or jobs or work or (worker* not worker*-compensation) or workplace or (working not working-memory) or (occupation* not (occupational-therap* or occupational-performance*)) or vocation* or employ*)

S11. S5 OR S6 OR S7 OR S8 OR S9 OR S10

S12. S4 AND S11