

Review Article

Vocational rehabilitation interventions in spinal cord injury: a scoping review

Intervenciones de rehabilitación vocacional en lesión medular: revisión del alcance

Intervenções de reabilitação vocacional na lesão medular: revisão de escopo

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Abstract

Introduction: Spinal cord injury can significantly affect participation in meaningful occupations such as work. Return to work is influenced by physical, emotional, social, and contextual factors, highlighting the need for interdisciplinary interventions. However, there is no consensus on the most effective modalities. **Objective:** This study aims to determine the available evidence on interventions targeting return to work among people with spinal cord injury. **Method:** A scoping review was conducted in February 2025, searching the PubMed, Scopus, and Web of Science databases. Observational and experimental studies, as well as systematic reviews, published between 2010 and 2024 in Spanish, Portuguese, or English were included. A snowball search complemented the process. Intervention strategies, geographic distribution, and study contexts were analyzed, along with methodological limitations and knowledge gaps. **Results:** Ten studies were included: nine observational and one experimental. Various vocational rehabilitation modalities were identified, with diverse approaches depending on the country and healthcare system. Strategies ranged from structured programs to one-off interventions without continuity or standardized follow-up. **Conclusion:** The scarcity of studies on vocational rehabilitation, together with significant methodological limitations, reveals a gap in the literature. These findings underscore the need to develop more robust, comparable, and context-sensitive research to guide the implementation of effective practices promoting return to work.

Keywords: Spinal Cord Injuries, Return to Work, Vocational Rehabilitation.

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Resumen

Introducción: La lesión medular puede afectar significativamente la participación en ocupaciones significativas como el trabajo. La reincorporación laboral de estas está condicionada por factores físicos, emocionales, sociales y contextuales, lo que subraya la necesidad de intervenciones interdisciplinarias. Sin embargo, no existe consenso sobre cuáles son las modalidades más eficaces. **Objetivo:** El objetivo de este estudio es determinar la evidencia disponible sobre las intervenciones dirigidas a la reincorporación laboral. **Método:** Se realizó una revisión de alcance en febrero 2025, llevando a cabo una búsqueda en las bases de datos PubMed, Scopus y Web of Science. Se incluyeron estudios observacionales, experimentales y revisiones sistemáticas publicadas entre 2010 y 2024 en español, portugués o inglés. Se complementó con búsqueda en bola de nieve. Se analizaron las estrategias de intervención, la distribución geográfica y el contexto de los estudios, así como sus limitaciones metodológicas y vacíos de conocimiento. **Resultados:** Se incluyeron diez estudios: 9 observacionales y 1 experimental. Se identificaron diferentes modalidades de rehabilitación vocacional, con enfoques diversos según el país y el sistema sanitario. Las estrategias variaron desde programas estructurados hasta intervenciones puntuales sin continuidad ni seguimiento estandarizado. **Conclusión:** La escasez de estudios en rehabilitación vocacional, junto con limitaciones metodológicas relevantes, pone de manifiesto un vacío de conocimiento en el área. Estos hallazgos refuerzan la necesidad de desarrollar investigaciones más sólidas, comparables y contextualizadas, que orienten la implementación de prácticas eficaces para favorecer la reincorporación laboral.

Palabras clave: Traumatismos de la Médula Espinal, Reinserción al Trabajo, Rehabilitación Vocacional.

Resumo

Introdução: A lesão medular pode afetar significativamente a participação em ocupações significativas, como o trabalho. A reintegração laboral dessas pessoas é condicionada por fatores físicos, emocionais, sociais e contextuais, o que ressalta a necessidade de intervenções interdisciplinares. Contudo, não há consenso sobre quais são as modalidades mais eficazes. **Objetivo:** O objetivo deste estudo é determinar a evidência disponível sobre intervenções dirigidas à reintegração laboral de pessoas com lesão medular. **Método:** Foi realizada uma revisão de escopo em fevereiro de 2025, com busca nas bases de dados PubMed, Scopus e Web of Science. Foram incluídos estudos observacionais, experimentais e revisões sistemáticas publicados entre 2010 e 2024 em espanhol, português ou inglês. A busca foi complementada por meio da técnica bola de neve. Analisaram-se as estratégias de intervenção, a distribuição geográfica e o contexto dos estudos, bem como suas limitações metodológicas e lacunas no conhecimento. **Resultados:** Foram incluídos dez estudos: nove observacionais e um experimental. Identificaram-se diferentes modalidades de reabilitação vocacional, com abordagens variadas conforme o país e o sistema de saúde. As estratégias variaram desde programas estruturados até intervenções pontuais, sem continuidade ou acompanhamento padronizado. **Conclusão:** A escassez de estudos em reabilitação vocacional, juntamente com limitações metodológicas relevantes, evidenciam uma lacuna no conhecimento na área. Esses achados reforçam a necessidade de desenvolver pesquisas mais sólidas, comparáveis e contextualizadas, que orientem a implementação de práticas eficazes para favorecer a reintegração laboral.

Palavras-chave: Lesões da Medula Espinal, Retorno ao Trabalho, Reabilitação Vocacional.

Introduction

Spinal cord injury (SCI) is a complex neurological condition caused by partial or complete damage to the spinal cord, which can lead to alterations in movement, sensation, or control of autonomic functions below the affected level (Bennett et al., 2024; Hu et al., 2023). Its effects may be temporary or permanent and vary depending on the location and severity of the injury.

It is estimated that between 250,000 and 500,000 new cases of SCI occur worldwide each year (Bennett et al., 2024), and the global prevalence reaches 15.4 million people (Organización Mundial de la Salud, 2021).

In addition to its physical and functional consequences, SCI significantly affects the lives of those who experience it, particularly in relation to meaningful activities. One of the most relevant is work, considered a central occupation in adult life. Employment not only represents a source of income but also structures time, facilitates social integration, and supports the development of meaningful roles. For people of working age, it also makes a substantial contribution to health, well-being, and quality of life (Christiansen et al., 2015; Curtin et al., 2017). Although the right to work is protected by the Universal Declaration of Human Rights (Article 23) (Asamblea General de las Naciones Unidas, 1948), many people with spinal cord injury (SCI) and other disabilities are excluded from the workforce and from earning a living (World Health Organization, 2013).

Given the importance of work in people's lives, the objective of this review is to map the available evidence on vocational rehabilitation (VR) interventions aimed at return to work for people with SCI of working age. According to the PCC (Population–Concept–Context) framework, the population consists of people with SCI, the concept corresponds to VR interventions aimed at return to work, and the context includes the different care and work environments in which these interventions are implemented.

Methodology

A scoping review was conducted following PRISMA-ScR (PRISMA Extension for Scoping Reviews: Checklist and Explanation) (Tricco et al., 2018).

For the purposes of this study, vocational rehabilitation (VR) was conceptually defined as systematic strategies that support preparation, access, reintegration, and job retention among people with SCI of working age (Escorpizo et al., 2011; Chamberlain et al., 2009). Operationally, it included any intervention explicitly aimed at facilitating return to work or labor participation, such as IPS, supported employment, workplace adaptations, job training, vocational guidance or counseling, and multidisciplinary programs addressing work-related outcomes. This definition guided the eligibility criteria and data extraction.

- The selection criteria included observational and experimental studies, as well as systematic reviews, published between 2010 and 2024 in Spanish, Portuguese, or English, that evaluated specific interventions aimed at return to work among people of working age with SCI.
- The search was conducted in February 2025 in the Medline (PubMed), Scopus, and Web of Science databases, under the supervision of an expert information specialist, and was complemented by snowball searching. The results were managed in Zotero

- to remove duplicates, yielding a total of 349 articles. The complete bibliographic search strategy is presented in Appendix 1.
- Study selection was carried out in three phases (title, abstract, and full text), with independent review by two evaluators (SRG and BGO) and resolution of discrepancies by consensus.
 - Data extraction was conducted independently by two reviewers (SRG and BGO), with discussion to resolve discrepancies, collecting the following information: (1) study characteristics (design, sample size, country of origin); (2) population characteristics (age, occupational profile, level and severity of injury); (3) intervention characteristics (type, modalities, onset, duration, follow-up, professional team); (4) age of those who returned to work; (5) return to work; and (6) other variables examined.

Results

Of the studies identified, 10 articles met the established selection criteria (Figure 1).

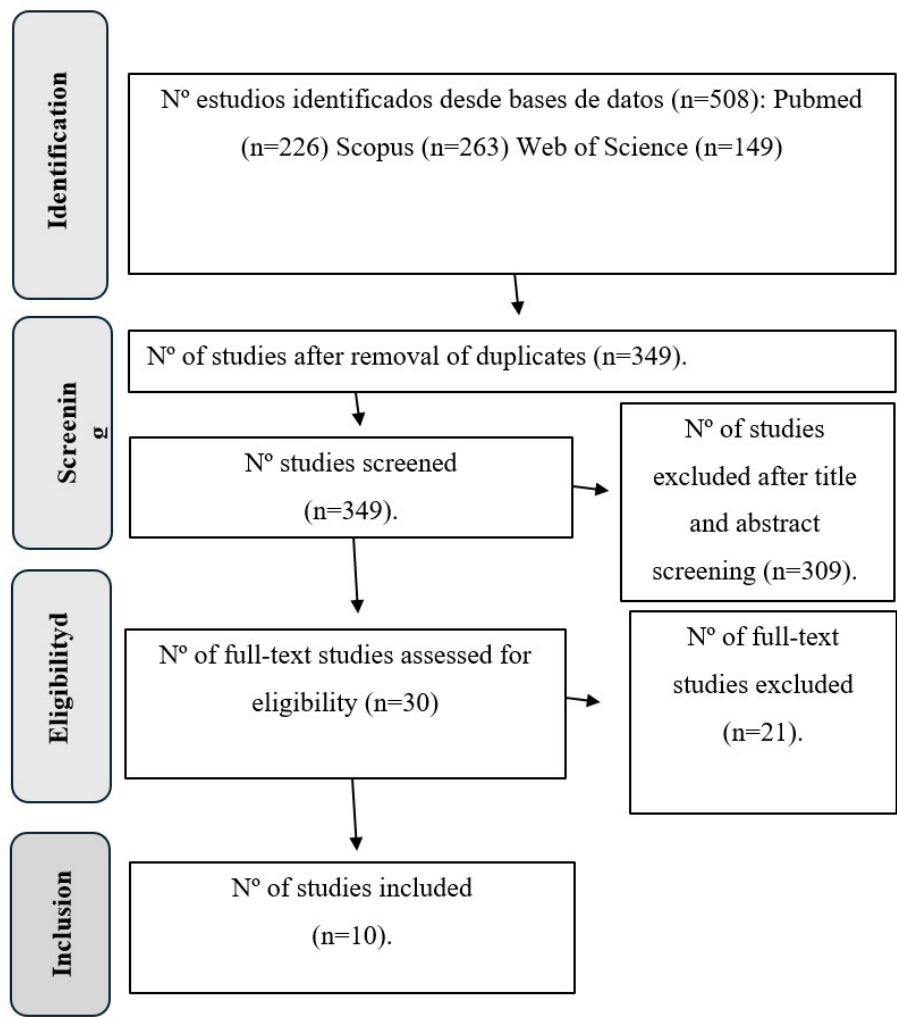


Figure 1. PRISMA flow diagram.

Study characteristics

- The main characteristics of the studies are shown in Table 1.
- **Design.** Ten articles were included: nine observational and one pre–post study (Holmlund et al., 2020). Among the observational studies, three were cross-sectional (Blessyolive et al., 2021; Dunn et al., 2023; Rowell & Connelly, 2010), one was a follow-up to a randomized controlled trial (RCT) (Ottomanelli et al., 2014), two were prospective (Cotner et al., 2018; Shem et al., 2011), one was a retrospective analysis (Kee et al., 2020), one was a case series (Gutierrez et al., 2023), and one was a longitudinal cohort study (Hilton et al., 2017).
 - **Initial sample size.** The initial sample size showed a wide range, with studies including 4 to 213 participants and a median of 68 (interquartile range [IQR]: 144). Three prospective studies (Hilton et al., 2017; Ottomanelli et al., 2014; Shem et al., 2011) experienced sample attrition, with a decrease from 97 to 60 participants in Hilton et al. (2017), from 201 to 103 in Ottomanelli et al. (2014), and from 39 to 10 in Shem et al. (2011).
 - **Country of origin.** The studies were geographically distributed as follows: four in the United States (Cotner et al., 2018; Gutierrez et al., 2023; Ottomanelli et al., 2014; Shem et al., 2011), one in India (Blessyolive et al., 2021), one in New Zealand (Dunn et al., 2023), two in Australia (Hilton et al., 2017; Rowell & Connelly, 2010), one in Singapore (Kee et al., 2020), and one in Sweden (Holmlund et al., 2020).

Table 1. Study characteristics.

Reference	Design	n	Country
(Blessyolive et al., 2021)	Cross-sectional	CG: 86	India
		VT: 23	
		Total: 109	
(Cotner et al., 2018)	Prospective longitudinal study (2 years)	213/213	United States
(Dunn et al., 2023)	Cross-sectional	37	New Zealand
(Gutierrez et al., 2023)	Case series	4/4	United States
(Hilton et al., 2017)	Longitudinal cohort study (2 years)	97/60	Australia
(Holmlund et al., 2020)	Pre-post study	7/7	Sweden
(Kee et al., 2020)	Retrospective study	39/32	Singapore
(Ottomanelli et al., 2014)	Secondary analysis of an RCT	IPS: 81/43	United States
		VR: 76/42	
		OG: 44/18	
		Total: 201/103	
(Rowell & Connelly, 2010)	Cross-sectional	ALSP: 86	Australia
		CG: 95	
		Total: 181	
(Shem et al., 2011)	Prospective longitudinal study	39/10	United States

ALSP: Adult Lifestyle Support Program; CG: control group; IPS: Individual Placement and Support; n: sample size; OG: observational group; RCT: randomized controlled trial; VR: vocational rehabilitation; VT: vocational training. Source: author's own elaboration.

Participant characteristics

- **Age.** This variable is widely reported, although with variability in its presentation. Seven studies (Cotner et al., 2018; Dunn et al., 2023; Gutierrez et al., 2023; Hilton et al., 2017; Ottomanelli et al., 2014; Rowell & Connelly, 2010; Shem et al., 2011) report age as means with standard deviations and/or ranges, while others use only ranges (Holmlund et al., 2020), a median with its IQR (Kee et al., 2020), or classification by age category (Blessyolive et al., 2021). In general, participant ages range from 16 to 71 years, with means varying approximately from 20 to 51 years across the studies.
- **Professional profile.** Half of the studies do not report participants' previous occupations (Dunn et al., 2023; Gutierrez et al., 2023; Kee et al., 2020; Rowell & Connelly, 2010; Shem et al., 2011). Among the remaining studies, two focus on war veterans (Cotner et al., 2018; Ottomanelli et al., 2014), one includes day laborers (Blessyolive et al., 2021), another classifies participants into professional occupations and manual or unskilled labor (Hilton et al., 2017), and one study (Holmlund et al., 2020) distinguishes between sedentary and manual work. No study provides a detailed description of the specific nature of previous jobs.
- **Level and extent of the SCI.** There is considerable heterogeneity in the data. Most studies present this information jointly (Gutierrez et al., 2023; Hilton et al., 2017; Holmlund et al., 2020; Kee et al., 2020; Ottomanelli et al., 2014). The level of injury is classified in various ways, most commonly as paraplegia or tetraplegia (Dunn et al., 2023; Hilton et al., 2017; Kee et al., 2020; Rowell & Connelly, 2010), with some subdivisions within tetraplegia, such as high or low (Ottomanelli et al., 2014), and groupings of levels such as C1–C4, C5–C8, and T1–S5 (Hilton et al., 2017), or C1–C8 and T1–S5 (Holmlund et al., 2020). Classifications based on whether the injury is at or above T6, or below, are also reported (Blessyolive et al., 2021). In the study by Rowell and Connelly (2010), the medical cause of the injury is presented together with the neurological level.

Regarding the extent of the injury, three studies (Gutierrez et al., 2023; Kee et al., 2020; Rowell & Connelly, 2010) distinguish between complete and incomplete injuries, while four use the ASIA scale (Blessyolive et al., 2021; Hilton et al., 2017; Holmlund et al., 2020; Ottomanelli et al., 2014), generally grouping grades A, B, and C on one hand, and D and E on the other.

All studies include cases of tetraplegia and paraplegia, as well as complete and incomplete injuries, except for two (Cotner et al., 2018; Shem et al., 2011), which do not report this information.

The main characteristics of the participants included in the analyzed studies are presented below, including age, professional profile, level of spinal cord injury, and extent of injury (Table 2).

Table 2. Characteristics of the participants.

Reference	Age	Professional profile	Level of SCI	Extent of SCI
(Blessyolive et al., 2021)	<40 y (n=92), >40 y (n=17)	Majority were daily wage workers	T6 or above (n=37), below T6 (n=72).	ASIA A (n=67), ASIA B-D (n=42).
(Cotner et al., 2018)	51 (± 10.1) y	War veterans	-	-
(Dunn et al., 2023)	50 (±15) y; range: 18-71 y	-	Tetraplegia (n=11; 30%), paraplegia (n=23; 63%).	-
(Gutierrez et al., 2023)	38.5 y; range: 26-61 y	-	C4–C5 complete (n=1), T4 complete (n=1), C6–C7 incomplete (n=1), L3–S2 (n=1).	
(Hilton et al., 2017)	35.1 (±14.908) y	Professional occupations (n=27; 27.8%). Manual or unskilled work (n=51; 52.6%).	C1–C4 ASIA A, B, or C (n=10; 10.3%), C5–C8 ASIA A, B, or C (n=23; 23.7%), T1–S5 ASIA A, B, or C (n=45; 46.4%), any level ASIA D (n=19; 19.6%).Tetraplegia (n=43;44.3%), paraplegia (n=54; 55.7%).	
(Holmlund et al., 2020)	Range: 33-62 y	Sedentary work (n=4), manual work (n=3).	C1–C8 ASIA A, B, or C (n=1), T1–S5 ASIA A, B, or C (n=4), any level ASIA D (n=2).	
(Kee et al., 2020)	Median 35 y (IQR = 26–43); range: 21–55 y.	-	Complete paraplegia (n=6; 19%), incomplete paraplegia (n=10; 31%), complete tetraplegia (n=7; 22%), incomplete tetraplegia (n=9; 28%).	
(Ottomanelli et al., 2014)	48.3 (± 9.9) y	War veterans	High tetraplegia (C1–4) ASIA A, B, or C (n=35; 17.3%), low tetraplegia (C5–8) ASIA A, B, or C (n=19; 9.4%), paraplegia ASIA A, B, or C (n=77; 38.1%), any level of injury ASIA D or E (n=68; 34.2%).	
(Rowell & Connolly, 2010)	42.2 (± 13.8) y	-	Paraplegia 47.3% (n=95), high tetraplegia 34.3% (n=69), and low tetraplegia 16.4% (n=33).	
			C2 (2.40%), C3 (5.60%), C4 (16%), C5 (32.80%), C6 (19.60%), C7 (3.60%).	
			Tetraplegia (81.60%); paraplegia (8.80%); medical SCI (9.60%). 47.60% (n=86) complete.	
(Shem et al., 2011)	19.8 (±3) y; range: 16-26 y	-	-	-

ASIA: American Spinal Injury Association Impairment Scale; IQR: interquartile range; n: sample size; SCI: spinal cord injury; y: years. Source: author's own elaboration.

Intervention characteristics

- **Setting.** Seven interventions (Cotner et al., 2018; Gutierrez et al., 2023; Holmlund et al., 2020; Kee et al., 2020; Ottomanelli et al., 2014; Rowell & Connelly, 2010; Shem et al., 2011) took place in outpatient or community settings, one in a combined setting (hospital + community) (Hilton et al., 2017), and one in a residential setting (Blessyolive et al., 2021). In contrast, one study (Dunn et al., 2023) does not specify this information.
- **Intervention modality.** Two studies apply conventional vocational rehabilitation (VR) (Gutierrez et al., 2023; Kee et al., 2020), while others incorporate modalities such as Individual Placement and Support (IPS) (Cotner et al., 2018; Ottomanelli et al., 2014), Early Intervention Vocational Rehabilitation (EIVR) (Dunn et al., 2023; Hilton et al., 2017), and vocational training (VT) (Blessyolive et al., 2021). Other programs identified include ReWork-SCI (Holmlund et al., 2020), Adult Lifestyle Support Program (ALSP) (Rowell & Connelly, 2010), and Back on Track (Shem et al., 2011).
- **Time to onset after SCI.** The time elapsed between SCI and the start of treatment varies considerably across studies. Some studies describe early onset, as soon as 6 weeks (Hilton et al., 2017), while others report 9 months (Kee et al., 2020) or even more than 12 years on average (Ottomanelli et al., 2014). One study (Gutierrez et al., 2023) presents a wide range, from less than 1 year to 14 years after injury. Three studies (Cotner et al., 2018; Dunn et al., 2023; Rowell & Connelly, 2010) do not provide this information.
- **Professional team.** The studies reflect diversity in their multidisciplinary composition; however, three (Blessyolive et al., 2021; Cotner et al., 2018; Rowell & Connelly, 2010) do not provide details on this aspect.

The most common teams include occupational therapists (Gutierrez et al., 2023; Hilton et al., 2017; Holmlund et al., 2020; Kee et al., 2020), vocational counselors (Dunn et al., 2023; Gutierrez et al., 2023; Ottomanelli et al., 2014; Shem et al., 2011), and physical therapists (Gutierrez et al., 2023; Hilton et al., 2017; Kee et al., 2020), among others. Some studies incorporate additional roles, such as psychologists, nurses, and sexual health counselors or peer counselors (Holmlund et al., 2020), community mentors (Gutierrez et al., 2023; Shem et al., 2011), and assistive technology specialists (Gutierrez et al., 2023).

- **Duration of interventions.** The duration varies from 3 months (Gutierrez et al., 2023) to 6 (Blessyolive et al., 2021; Holmlund et al., 2020), 9 (IQR 8–17) (Kee et al., 2020), or 12 months (Hilton et al., 2017; Ottomanelli et al., 2014), with the possibility of extending to 24 months (Ottomanelli et al., 2014). Additionally, one study (Cotner et al., 2018) has a duration of 24 months, while two (Dunn et al., 2023; Rowell & Connelly, 2010) do not provide information on this aspect.
- **Follow-up.** Prospective studies describe different reassessment points. Holmlund et al. (2020) conducts an interim assessment during the intervention and another at its conclusion, while Cotner et al. (2018) and Ottomanelli et al. (2014) carry out quarterly re-evaluations during treatment, extending this to 24 months in the case of Ottomanelli et al. (2014). Gutierrez et al. (2023), on the other hand, limits itself to a single re-evaluation at discharge, while Shem et al. (2011) performs re-evaluations at discharge and 4 months post-discharge. Finally, Hilton et al. (2017) supplements

the end-of-program evaluation with additional follow-ups at 12 and 24 months after discharge.

- **Age of those returning to work.** Several studies provide data on the age of participants returning to work, although the way this variable is reported is heterogeneous. One study (Blessyolive et al., 2021) uses a classification by age categories (<40 or >40 years), where the majority of those returning to work are under 40 years old, while another (Cotner et al., 2018) reports a mean of 50.4 (± 10.6) years. Gutierrez et al. (2023) presents individual data, and Kee et al. (2020) reports a median of 36 years (IQR = 25–46).
- **Return to work.** The rate of return to work varies depending on the intervention modality: vocational training (VT) oriented toward self-employment (100%) (Blessyolive et al., 2021), conventional vocational rehabilitation (VR) up to 84% (Gutierrez et al., 2023; Kee et al., 2020), Individual Placement and Support (IPS) 30.8% and 43.2% (Cotner et al., 2018; Ottomanelli et al., 2014), and Early Intervention Vocational Rehabilitation (EIVR) 33% and 54% (Dunn et al., 2023; Hilton et al., 2017). In the ReWork-SCI program, 57% of participants returned to work or were on a work trial (Holmlund et al., 2020).

In the Back on Track program, 6.9% of participants returned to work (Shem et al., 2011). In this study, 25% of participants completed the program, and among those who finished, there were reports of return to work or education.

In the cross-sectional study that evaluated the Adult Lifestyle Support Program (ALSP) (Rowell & Connelly, 2010), 26% of all participants reported being employed, including both those who received the intervention and the control group. A total of 47.5% of participants had received the intervention.

Table 3 summarizes the main characteristics of the interventions included in the selected studies, as well as the reported return-to-work data.

Other variables examined in the studies

Most studies (Blessyolive et al., 2021; Cotner et al., 2018; Gutierrez et al., 2023; Hilton et al., 2017; Holmlund et al., 2020; Kee et al., 2020; Rowell & Connelly, 2010; Shem et al., 2011) include additional variables related to return to work (Table 4).

Activities of daily living (ADLs) are assessed in four studies (Blessyolive et al., 2021; Hilton et al., 2017; Holmlund et al., 2020; Kee et al., 2020), using different instruments (IPA, COPM, and CIQ) or dichotomous indicators (yes/no).

Functional independence is examined in four studies (Hilton et al., 2017; Holmlund et al., 2020; Kee et al., 2020; Shem et al., 2011). Two (Hilton et al., 2017; Kee et al., 2020) use the SCIM, although with different versions (original and version III).

Variables such as mobility, accessibility, motivation, family support, and social support are included in one study (Blessyolive et al., 2021) through dichotomous indicators (yes/no), without standardized scales.

Social participation is assessed in four studies (Cotner et al., 2018; Hilton et al., 2017; Kee et al., 2020; Shem et al., 2011), with the CHART scale used in two of them (Cotner et al., 2018; Shem et al., 2011).

Health-related quality of life (HRQoL) is assessed in four studies, using the SF-36 (Gutierrez et al., 2023; Rowell & Connelly, 2010), the VR-36 (Cotner et al., 2018), and the EQ-5D-3L (Holmlund et al., 2020).

Table 3. Intervention characteristics.

Reference	O/H/R	Modality	Onset after SCI	Team	Duration	Follow-up	Age of those returning to work	Return to work
(Blessyolive et al., 2021)	R	CG (n=86); VT (n=23)	Minimum 1 y	-	6 mo	-	<40 y (n=79) >40 y (n=10)	CG (66/86; 79%); VT (23/23; 100%)
(Corner et al., 2018)	O	IPS	-	-	24 mo	Quarterly	50.4 (±10.6) y	92/213 (43.2%)
(Dunn et al., 2023)	-	EIVR	-	VC and rehabilitation team	-	-	-	19/37 (54%)
(Gutierrez et al., 2023)	O	VR	<1-14 y	OT, PT, VC, community mentor, and assistive technology specialist	3 mo	At discharge	36 and 61 y	2/4 (50%)
(Hilton et al., 2017)	H+O	EIVR	6 wk	PT, OT, psychologist, nurse, physician, sexual health counselors, program manager, VR professional	12 mo	At discharge, 12 mo and 24 mo	-	33% at the end of the second year
(Holmlund et al., 2020)	O	ReWork-SCI	90-180 d (n=4), 180-364 d (n=2), >365 d (n=1); range: 95-430 d	OT, SW, and peer counselor	6 mo	At 3 mo and at discharge	-	4/7
(Kee et al., 2020)	O	VR	9 mo (IQR= 4-40).	OT, PT, SW, and employment support specialists	Median 9 mo (IQR = 8-17). Maximum 24 mo.	-	Median 36 y (IQR = 25-46)	27/32 (84%)
(Ottomanelli et al., 2014)	O	IPS (n=81); VR (n=76); OG (n=44)	Mean 12.4 ± 11.2 y	VC	12-24 mo	Quarterly for 24 mo	-	IPS 30.8%; VR 10.5%; OG 2.3%
(Rowell & Connelly, 2010)	O	ALSP	18 y	-	-	-	-	26%
(Shem et al., 2011)	O	Back on Track	1 y	Physician, coordinator, assistant, VC, psychologist, and mentors	7-24 mo (mean: 17 ± 5.2)	At discharge and 4 mo after program completion.	-	6.9%

ALSP: Adult Lifestyle Support Program; CG: control group; d: days; EIVR: early intervention vocational rehabilitation; H: hospital-based; IPS: Individual Placement and Support; IQR: interquartile range; mo: months; n: sample size; O: outpatient; OG: observational group; OT: occupational therapist; PT: physical therapist; R: residential; SW: social worker; VC: vocational counselor; VR: vocational rehabilitation; VT: vocational training; wk: week; y: years.

Source: author's own elaboration.

Table 4. Other variables examined in the studies.

ADLs	(Blessyolive et al., 2021)	(Cotner et al., 2018)	(Dunn et al., 2023)	(Gutierrez et al., 2023)	(Hilton et al., 2017)	(Holmlund et al., 2020)	(Kee et al., 2020)	(Ottomanelli et al., 2014)	(Rowell & Connolly, 2010)	(Shem et al., 2011)
Functional independence	Dichotomous				IPA	COPM	CIQ			
Mobility	Dichotomous				SCIM	FIM	SCIM-III			DRS
Accessibility	Dichotomous									
Motivation	Dichotomous									
Hope										
Family support	Dichotomous									
Social support	Dichotomous									
Social participation	CHART				IPA		CIQ			CHART + MPAL-4
HRQoL	VR-36			SF-36		EQ-5D-3L			SF-36	
Well-being					PWI					
Life satisfaction	SWLS			Q-LES-Q-SF		LISAT-11				SWLS
Economy	CHART									CHART
Mental health	PHQ-9				HADS				ASQ	
Productivity					IPA	COPM/WRI	CIQ			
Leisure					IPA	COPM				
Pain					NPRS					
Self-efficacy				CCCS		GSE				

ADLs: activities of daily living; ASQ: Attributional Style Questionnaire; CCCS: Casa Colina Confident Scale; CHART: Craig Handicap Assessment and Reporting Technique; CIQ: Community Integration Questionnaire; COPM: Canadian Occupational Performance Measure; DRS: Disability Rating Scale; EQ-5D-3L: EuroQol five-dimension three-level questionnaire; FIM: Functional Independence Measure; GSE: General Self-Efficacy Scale; HADS: Hospital Anxiety and Depression Scale; HRQoL: health-related quality of life; IPA: Impact on Participation and Autonomy; LISAT-11: Life Satisfaction Questionnaire-11; MPAL-4: Participation Index of the Mayo-Portland Adaptability Inventory-Version 4; NPRS: Numeric Pain Rating Scale; PHQ-9: Patient Health Questionnaire-9; PWI: Personal Well-being Index; Q-LES-Q-SF: Quality of Life Enjoyment and Satisfaction Questionnaire-Short Form; SCIM: Spinal Cord Independence Measure; SCIM-III: Spinal Cord Independence Measure III; SF-36: Short Form-36 Health Survey; SWLS: Satisfaction With Life Scale; VR-36: Veterans RAND-36; WRI: Worker Role Interview.

Source: author's own elaboration.

Life satisfaction is assessed in four studies (Cotner et al., 2018; Gutierrez et al., 2023; Holmlund et al., 2020; Shem et al., 2011), with the SWLS used in two of them (Cotner et al., 2018; Shem et al., 2011).

Other variables considered include well-being (Hilton et al., 2017), mental health (Cotner et al., 2018; Hilton et al., 2017; Rowell & Connelly, 2010), economic factors (Cotner et al., 2018; Shem et al., 2011), productivity (Hilton et al., 2017; Holmlund et al., 2020; Kee et al., 2020), leisure (Hilton et al., 2017; Holmlund et al., 2020), pain (Hilton et al., 2017), and self-efficacy (Gutierrez et al., 2023; Holmlund et al., 2020).

Discussion

Overview and quality of available evidence

Evidence on vocational rehabilitation (VR) in people with spinal cord injury (SCI) is limited, despite the high prevalence of the condition and its socio-health and economic impact. This scarcity may be explained by the complexity of implementing individualized VR interventions, the heterogeneity of users' needs, and the limited availability of specialized teams. Furthermore, the individualized adaptation of interventions hinders the standardization and replicability of studies, thereby limiting external validity.

Most of the included studies are observational (cross-sectional, retrospective, case series, secondary analyses of randomized controlled trials (RCTs), and longitudinal cohorts). Only one pre-post experimental study was identified, with a small sample size and no control group. Although these designs have limitations, they are suitable for exploring preliminary effects and the feasibility of interventions, especially when conducting an RCT is ethically or logistically complex. Sample sizes range from 4 to 213 participants, reflecting recruitment difficulties and resource limitations, which affect representativeness and the detection of significant effects.

Geographically, the evidence is concentrated in the United States, followed by Australia, New Zealand, Sweden, Singapore, and India. In the U.S. context, many studies focus on war veterans, which may limit the generalizability of the results to other groups.

Participant characteristics

Participant age is heterogeneous (16–71 years) and is reported in various formats (ranges, means, medians), making comparisons between studies difficult. Age influences motivation, the ability to reintegrate into the workforce, and contextual factors such as access to benefits.

Previous occupational profiles are described in a limited manner, including war veterans, manual laborers, or sedentary workers, and in some studies, they are not specified. This information is relevant for understanding the meaning of work and for guiding interventions focused on meaningful occupations.

The level and extent of spinal cord injury also show considerable heterogeneity, with variable classifications and a lack of data in some studies. Systematic information on both aspects is essential, as it determines functionality and the adaptations required for return to work.

Characteristics of the interventions

Most interventions take place in outpatient or community settings, although some include early hospital or residential contexts. This diversity underscores the need for flexible pathways adapted to different levels of care and geographical contexts.

Intervention modalities vary widely: conventional vocational rehabilitation (VR), Individual Placement and Support (IPS), Early Intervention Vocational Rehabilitation (EIVR), vocational training (VT), the ReWork-SCI program, the Adult Lifestyle Support Program (ALSP), and the Back on Track program. The lack of a systematic framework for classifying these modalities limits replication and comparative evaluation.

The onset of interventions after SCI ranges from a few weeks to more than 12 years, and duration varies from 3 to 24 months. Heterogeneity in timing and duration may influence return to work and makes comparisons between studies difficult.

Professional teams are mostly interdisciplinary (occupational therapists, physical therapists, psychologists, vocational counselors), although some studies do not detail their composition. The presence of comprehensive teams enables a more integrated approach, while the lack of information limits interpretation of their impact.

Return to work and complementary variables

In all studies, return to work is used as the main indicator of success. While this outcome is fundamental, its isolated interpretation is insufficient. Returning to employment does not, in itself, guarantee an improvement in quality of life if it is not accompanied by stability, psychological well-being, and economic security. Return to work is a complex process that involves physical, emotional, and social factors, as described in other rehabilitation contexts (Pestana et al., 2017). Some studies include additional variables such as functional independence, social participation, family support, or life satisfaction, but their assessment is heterogeneous and unsystematic. The diversity of instruments used to measure activities of daily living, quality of life, mental health, or subjective well-being limits comparability between studies. This reinforces the need for more standardized assessments to improve clinical applicability.

Strengths of the review

This scoping review provides a comprehensive mapping of the available evidence on VR in spinal cord injury (SCI), including different intervention modalities, geographic contexts, and participant profiles. Research gaps were identified, and key information on study designs, populations, interventions, and outcomes was systematized, which may inform future research and clinical practice in occupational therapy.

Limitations of the evidence and of this review

The available evidence exhibits methodological heterogeneity, small sample sizes, a lack of robust experimental designs, and limited standardization in outcome measurement. The geographic concentration of studies and the context-dependent nature of interventions limit generalizability. As a scoping review, this work did not assess the methodological quality of the included studies, and temporal and linguistic restrictions may have excluded relevant research.

Implications for practice and future research

Clear conceptual and operational frameworks for VR in SCI are needed to support the classification and replication of interventions. Future research should employ longitudinal designs with adequate sample sizes and standardized variables, evaluating not only return to work but also its sustainability and impact on quality of life. From an occupational therapy perspective, it is recommended to prioritize interventions focused on meaningful occupation and interdisciplinary teamwork.

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Author's Contributions

Sara Rodríguez-Gomez was responsible for the study design and conceptualization, as well as data selection and extraction. Brais García-Otero participated in data selection and extraction. María Sobrido-Prieto, as an information specialist, managed the literature search and organization. All authors contributed to drafting, revising, and approving the final version of the manuscript.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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Section editor

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Appendix 1. Complete bibliographic search strategy used in the databases.

PubMed

("spinal cord injuries" [Mesh] OR "spinal cord" [TITLE] OR "paraplegia" [Mesh] OR paraplegi* [TITLE] OR "Quadriplegia" [Mesh] OR quadriplegi* [TITLE] OR tetraplegi* [TITLE])

AND

(employment [Mesh] OR employ* [TITLE] OR Job [TITLE] OR work* [TITLE] OR "work" [Mesh] OR "workforce" [Mesh] OR "workforce diversity" [Mesh] OR Profession* [TITLE] OR "labor force" [TITLE] OR career [TITLE] OR "workplace" [Mesh])

AND

("Rehabilitation, Vocational"[Mesh] OR "rehabilitation" [Subheading] OR Rehabilitati* [TITLE] OR educati* [TITLE] OR assist* [TITLE] OR adaptat* [TITLE] OR accessib* [TITLE] OR intervent* [TITLE] OR reintegrat* [TITLE] OR accomodat* [TITLE] OR "barrier removal" [TITLE] OR "employment barriers" [TITLE] OR "barrier management" [TITLE] OR "return to work" [Mesh] OR "return to work" [TITLE] OR "back to work" [TITLE] OR "Individual Placement Support" [TITLE] OR "occupational therapy" [TITLE])

Limit: Last 15 years.

Results: 226

Scopus

TITLE ("Spinal cord" OR quadriplegi* OR paraplegi* OR Tetraplegi*)

AND

TITLE (Employ* OR job* OR profession* OR work* OR "labor force" OR career)

AND

(rehabilitati* OR assistan* OR vocation* OR accessib* OR adaptat* OR accommodat* OR intervent* OR Educat* OR reintegrat* OR "barrier removal" OR "employment barriers" OR "barrier management" OR "return to work" OR "back to work" OR "Individual Placement Support" OR "occupational therapy")

Limit: 2010-2024, Article, Review, Spanish, English, Portuguese.

Results: 263.

Web of Science

TITLE ("Spinal cord" OR quadriplegi* OR paraplegi* OR Tetraplegi*)

AND

TITLE (Employ* OR job* OR profession* OR work* OR "labor force" OR career)

AND

(rehabilitation OR assistan* OR vocation* OR accessib* OR adaptat* OR accommodat* OR intervent* OR reintegrat* OR "barrier removal" OR "employment barriers" OR "barrier management" OR "return to work" OR "back to work" OR "Individual Placement Support" OR "occupational therapy")

Limit: 2010-2024, Article, Review, Spanish, English, Portuguese.

Results: 149.