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ORIGINAL RESEARCH

Rehabilitation Priorities and Employment Reintegration Among Individuals with Spinal Cord Injury Receiving Home-Based Care: A National Cross-Sectional Survey of Functional and Social Determinants

Hongxia Pan[1,2], Mingfu Ding[1,2], Yue Yang[1,2], Jianmei Zhang[1,2], Liang Zhu[1,2], Quan Wei[1,2]

[1]Rehabilitation Medicine Center and Institute of Rehabilitation Medicine, West China Hospital, Sichuan University, Chengdu, Sichuan, People's Republic of China; [2]Key Laboratory of Rehabilitation Medicine in Sichuan Province, Chengdu, Sichuan, People's Republic of China

Correspondence: Quan Wei, Rehabilitation Medicine Center and Institute of Rehabilitation Medicine, West China Hospital, Sichuan University, Chengdu, Sichuan, People's Republic of China, Email weibuyi98@163.com

Introduction: Spinal cord injury (SCI) individuals undergoing home-based rehabilitation face multiple challenges, including functional impairments, bladder dysfunction, and employment barriers. Poor bladder management impacts autonomy, health, and quality of life, while limited mobility and environmental inaccessibility hinder return-to-work.

Objective: To assess rehabilitation priorities and unmet needs among home-based individuals with SCI, focusing on bladder management, functional limitations, and employment reintegration. The study aims to identify personal, medical, and environmental factors affecting rehabilitation outcomes.

Methods: A cross-sectional survey was conducted from May to September 2023 by West China Hospital, Sichuan University. A total of 3,055 SCI individuals across mainland China completed an online questionnaire assessing demographics, functional status, rehabilitation goals, and employment challenges. Descriptive statistics, t-tests, ANOVA, Chi-square, and multivariate regression were used for data analysis.

Results: Challenges: Most participants (80.88%) had traumatic SCI. Significant daily life barriers included financial burden (46.0%), unemployment (44.1%), accessibility issues (34.3%), health concerns (29.5% frequent medical visits; 25.7% persistent issues), and stigma (26.8%). Only 2.7% could walk ≥1 km independently. Rehabilitation Goals: Bladder function improvement (49%) was the top priority, followed by restoring mobility (standing 17%; walking 16%) and preventing complications (10%). Notably, 63.3% did not define specific bladder management targets. Predictors: Multivariate analysis showed that thoracic/cervical injury, complete paralysis, and limited mobility were predictors of prioritizing bladder management ($p<0.001$). Employment reintegration was significantly influenced by mobility level, environmental accessibility, and social factors such as stigma and recurrent illness.

Conclusion: SCI individuals face intertwined challenges that impact rehabilitation and social participation. Bladder care, mobility, psychosocial stressors, and environmental access are key factors shaping rehabilitation priorities and employment outcomes. Individualized, biopsychosocial approaches are essential to promote recovery and community reintegration.

Keywords: spinal cord injury, home-based rehabilitation, neurogenic bladder, functional impairment, employment reintegration, environmental barriers, multivariate analysis

Introduction

Spinal cord injury (SCI) is a debilitating neurological condition that leads to partial or complete loss of sensory and motor functions below the level of injury, as well as disruptions in autonomic nervous system regulation.[1] Beyond the profound physical impairments, SCI leads to substantial psychological distress, social isolation, and long-term declines in

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quality of life,[2] imposing a heavy burden on individuals, families, and healthcare systems.[3,4] Among these, bladder dysfunction stands out as a particularly disruptive complication,[5] affecting personal dignity, autonomy, and daily routines, while also increasing the risk of complications and limiting social participation.[6]

Although prior studies have primarily focused on acute care and inpatient rehabilitation settings based on early patient hospital data,[1,6] with insufficient attention given to the rehabilitation needs and challenges faced by patients during the home-based rehabilitation phase. There is a growing recognition that individuals with SCI—especially those of working age—continue to face persistent challenges during the home-based rehabilitation phase, facing greater long-term rehabilitation needs and multifaceted challenges. These include limited mobility, environmental inaccessibility, inadequate bladder management, recurrent health issues, and psychosocial barriers such as stigma and financial strain, all of which can hinder rehabilitation progress and delay or prevent return-to-work and community reintegration. However, there remains a notable gap in understanding how individuals with SCI define and prioritize their own rehabilitation goals during the home-based phase, particularly in large-scale, community-based settings. Most prior studies have focused on clinician-defined outcomes or small-scale interviews, rather than systematically capturing patient-defined needs and goals that could inform patient-centered care and policy.

Young and middle-aged adults constitute a major demographic affected by SCI,[7] with a substantial proportion expressing strong intentions to return to the workforce.[8,9] However, employment reintegration remains difficult due to enduring functional impairments and a lack of systemic support. Understanding their rehabilitation priorities—particularly in domains such as functional independence, bladder management, and employment needs—is essential for tailoring interventions that promote long-term recovery and social participation. Effective rehabilitation strategies can help alleviate the socioeconomic burden on both their families and the broader healthcare system.

This study aims to assess rehabilitation priorities and unmet needs among individuals with SCI during home-based recovery. Using a large-scale national survey and multivariate analysis, we examine the functional, psychosocial, and environmental factors associated with bladder management and employment reintegration. The findings aim to inform patient-centered rehabilitation strategies and policy initiatives to support quality of life and community participation.

Methods

Study Design and Questionnaire Formation

This study employed a national, cross-sectional, multicenter survey targeting home-based recovery phase SCI individuals. The survey was conducted by the Rehabilitation Department of West China Hospital, Sichuan University, in collaboration with the China Association of Persons with Physical Disabilities. Questionnaires were distributed to confirmed SCI patients or their caregivers. Before the official launch, standardized training was provided to ensure accurate questionnaire completion. Trained personnel were available to assist participants as needed. The sample size was determined to ensure broad regional representation rather than for statistical hypothesis testing.

The questionnaire was initially developed by the China Association of Persons with Physical Disabilities and the Spinal Cord Injury Team at the Rehabilitation Medicine Center of West China Hospital, Sichuan University. Feedback from 16 experts in SCI rehabilitation and disability services was incorporated to refine the first draft. Subsequently, 30 SCI volunteer were invited to complete initial version of the questionnaire and provide feedback. Their responses were used to revise and finalize the questionnaire. Internal consistency was evaluated during the pilot test using Cronbach's alpha, yielding an overall value of 0.81, indicating good reliability. Content validity was supported through expert consensus from 16 specialists in SCI rehabilitation and disability services.

Participant Population

Participants were included based on the following criteria: 1) a confirmed medical history of SCI, verified through the local association of persons with physical disabilities using unique disability certificate IDs, in accordance with ISNCSCI diagnostic standards[10] without any restrictions on age or gender; 2) Participants with ability to complete the questionnaire independently or with assistance from caregiver was well-acquainted with their health condition; 3) willingness to take

part in the survey and 4) Participants who have the ability to complete the survey online by smartphone or computer. Incomplete or incorrect records were excluded.

Procedures and Data Collection

This cross-sectional study was conducted from May to September 2023. Trained personnel from the China Association of Persons with Physical Disabilities distributed the questionnaire across 31 provinces, municipalities, and autonomous regions. They provided guidance to ensure participants accurately completed the survey using online survey software.

Questionnaire Contents

Section 1: Demographic Information, SCI Characteristics, and Environmental Accessibility

This section collected demographic, clinical, and environmental accessibility data, including:

1. Demographic and SCI Characteristics:
   (1) Age, gender, and marital status.
   (2) Etiology of SCI, classified as traumatic or non-traumatic.
   (3) SCI characteristics, including lesion location (cervical, thoracic, lumbar, sacral) and severity (complete or incomplete), further categorized into parapleg ia, quadriplegia, monoplegia, or hemiplegia.
   (4) Overall functional status and hand function, as detailed in Table 1.

Table 1 Characters of SCI Disease

Various	Number (%)
Injury location	
Cervical	463(15.16%)
Thoracic	1348(44.12%)
Lumbar	804(26.32%)
Sacral	311(10.18%)
Unclear	129(4.22%)
SCI classification	
Completed paraplegia	2050(67.10%)
Incompleted paraplegia	331(10.83%)
Completed quadriplegia	182(5.96%)
Incomplete quadriplegia	143(4.68%)
Neurogenic bladder	61(2.00%)
Monoplegia	202(6.61%)
Hemiplegia	86(2.82%)
Optimal activity status	
Primarily bedbound; no physical activity tolerance	278(9.10%)
Wheelchair-dependent (assisted transfers)	728(23.83%)
Independent wheelchair-bed transfers	1207(39.51%)
Standing >30min with assistive devices	202(6.61%)
Independent ambulation with assistive devices	269(8.81%)
Independent ambulation >500m with abnormal gait	115(3.76%)
Independent ambulation >1km	84(2.75%)
Independent driving capacity	172(5.63%)
Hand Function Status	
Normal	2040(66.78%)
Mild impairment	456(14.93%)
Moderate impairment	255(8.35%)
Severe impairment	304(9.95%)

2. Environmental Accessibility:
   (1) Presence of barrier-free facilities in the residential area (eg, ramps, accessible pathways, designated parking spaces).
   (2) Availability of elevators in residential buildings.
   (3) Distance from the residence to the nearest major roadway or public transportation access points.

Section 2: Patient-Reported Challenges in Daily Life

This section investigated the challenges individuals with SCI face in their daily lives through a structured questionnaire. Participants were presented with a predefined list of common difficulties and asked to indicate which challenges they experienced. They were then instructed to rank these difficulties based on their personal experience and perceived impact on daily living.

The challenges assessed included:

1. Employment Limitations – Inability to work or reduced job opportunities due to physical or functional impairments.
2. Frequent Medical Visits – Repeated healthcare appointments resulting from recurrent illnesses or complications.
3. Social and Family Strain – Difficulties in maintaining social relationships and increased burden on family members.
4. Financial Burden – Economic strain caused by treatment costs and the need for long-term caregiving.
5. Persistent Health Concerns – Ongoing medical conditions affecting general health and well-being.
6. Illness-Related Stigma – Negative societal attitudes and discrimination related to SCI.
7. Psychological Distress – Emotional and mental health issues, including anxiety and depression.
8. Insufficient Accessibility – Lack of adequate barrier-free facilities in both living environments and public spaces.

Section 3: Rehabilitation Goals and Priorities

To further assess the rehabilitation needs of individuals with SCI, participants were asked to identify and rank their rehabilitation goals based on their personal priorities. The options included:

1. Regaining the ability to stand.
2. Regaining the ability to walk.
3. Improving bladder management, including achieving continence, reducing urinary complications, and protecting upper urinary tract function.
4. Restoring the ability to eat independently.
5. Improving sleep quality.
6. Managing complications such as urinary tract infections, spasticity, and pressure ulcers.
7. Relieving back pain.
8. Alleviating lower limb pain and numbness.
9. Addressing emotional distress.
10. Restoring confidence in life.
11. Addressing concerns related to fertility and childbirth.
12. Improving marital relationships and sexual function.
13. Facilitating return to employment.

Each participant selected their most desired rehabilitation targets. The researchers then established cumulative rankings based on the frequency of these selections.The inclusion of a specific item on bladder management allowed for a more accurate understanding of patient priorities regarding urinary health and independence.

Statistical Analysis

This exploratory, descriptive national survey aimed to capture the diverse rehabilitation experiences of individuals with SCI across mainland China. Rather than conducting an a priori power calculation, we sought to recruit the largest feasible sample to maximize geographical representation and generalizability. The final sample included 3,055 respondents from 31 provinces, providing a robust dataset suitable for subgroup comparisons and multivariate analyses.

All statistical analyses were performed using SPSS® for Windows, version 25.0 (IBM Corporation, Armonk, NY, USA). Continuous data were assessed for normality using the Shapiro–Wilk test and summarized as mean ± standard deviation; categorical data were presented as frequencies and percentages. Group comparisons for categorical variables were conducted using Chi-square tests, while continuous variables were analyzed using t-tests or one-way ANOVA, as appropriate. Logistic regression was used to identify predictors of employment outcomes, and multivariate regression was applied to examine factors associated with rehabilitation priorities. A two-sided $p < 0.05$ was considered statistically significant. The sample size exceeded the commonly recommended threshold of 10–15 observations per variable in multivariate models, ensuring analytical validity.

Data preprocessing was conducted in Excel by a team of three trained researchers, including duplicate removal, verification, and preliminary analysis. Questionnaires with major logical inconsistencies or >20% missing data were excluded after group consensus. For valid questionnaires, pairwise deletion was used in descriptive analysis, and listwise deletion was applied in regression models.

Ethics of Approval and Participation Consent Statement

The study was approved by the Clinical Research and Biomedical Ethics Committee of West China Hospital, Sichuan University (Approval No. 2023NO1105) and was conducted in line with the ethical standards set forth in the Declaration of Helsinki and its amendments. Informed consent was obtained from all participants or their legal guardians. All procedures followed the relevant ethical guidelines and regulations.

Results

Sociodemographic and Functional Characteristics of Participants

A total of 3,055 individuals with SCI were included in the study, with a mean age of 45.86 ± 11.45 years. The majority were male (69.69%, n = 2,129), while the remaining 30.31% were female (n = 926). In terms of marital status, over half of the participants were married (51.55%, n = 1,575), followed by unmarried adults (26.06%, n = 796), divorced individuals (17.02%, n = 520), adolescents (3.04%, n = 93), and remarried individuals (2.32%, n = 71) (Table 2).

Traumatic SCI accounted for the majority of cases, with falls being the leading cause (34.32%, n = 846), followed closely by traffic accidents (33.47%, n = 825) and injuries caused by falling heavy objects (17.44%, n = 430). Less common causes included sports-related injuries (5.40%, n = 133) and stab wounds (0.97%, n = 24). In 7.22% (n = 178) of traumatic cases, the specific etiology was undocumented. Non-traumatic etiologies represented 19.12% (n = 590) of all cases, among which myelitis or neuromyelitis optica was the most frequently reported diagnosis (33.39%, n = 197) (Table 2).

Thoracic SCI was the most frequently reported injury level (44.12%, n = 1,348), followed by lumbar (26.32%, n = 804), cervical (15.16%, n = 463), and sacral (10.18%, n = 311) levels. Injury location was unspecified in 4.22% (n = 129) of cases (Table 1).

Regarding neurological impairment classification, complete paraplegia was the most prevalent (67.10%, n = 2,050), followed by incomplete paraplegia (10.83%, n = 331), monoplegia (6.61%, n = 202), complete quadriplegia (5.96%, n = 182), incomplete quadriplegia (4.68%, n = 143), hemiplegia (2.82%, n = 86), and isolated neurogenic bladder dysfunction (2.00%, n = 61) (Table 1).

Optimal Activity Status

Most participants exhibited varying levels of physical dependence. A total of 39.51% (n = 1,207) were able to transfer independently between bed and wheelchair, while 23.83% (n = 728) required assistance for such transfers. Additionally, 9.10% (n = 278) were fully bedridden and unable to move independently.

Table 2 General Sociology-Demographic Data

Variable	Number (%)
Age (years)	45.86±11.45
Sexual (M/F)	2129 (69.69%)/ 926 (30.31%)
Marriage status, n (%)	
Adolescent	93 (3.04%)
Adult unmarried	796 (25.8%)
Married	1575 (51.55%)
Divorced	520 (17.02%)
Remarried	71 (2.32%)
Etiology	
Traumatic	2465 (80.69%)
Traffic-related injury	825 (33.47%)
Falls	846 (34.32%)
Crush injury by heavy object	430 (17.44%)
Sports-related injury	133 (5.40%)
Knife injury	24 (0.97%)
Gunshot wound	11 (0.45%)
Blunt trauma	18 (0.73%)
Unclear	178 (7.22%)
Non-traumatic	590 (19.12%)
Spina bifida	72 (12.20%)
Intraspinal vascular malformation	64 (10.85%)
Spinal canal tumor	84 (14.24%)
Malignant tumor metastases	37 (6.27%)
Myelitis or neuromyelitis optic	197 (33.39%)
Multiple sclerosis	29 (4.92%)
Unclear	107 (18.14%)

Among those with partial mobility, 8.81% (n = 269) could walk using assistive devices, 6.61% (n = 202) were able to stand with support, and 3.76% (n = 115) could ambulate more than 500 meters unaided but presented with abnormal gait patterns.

A small proportion of participants achieved higher levels of functional independence: 5.63% (n = 172) were able to drive independently, and only 2.75% (n = 84) could walk unaided for distances ≥1 km.

Hand Function Status

In terms of hand function, 66.78% (n=2040) of participants had normal hand function. Mild impairment, defined as the ability to hold and control a pencil or paper, was observed in 14.93% (n=456), while 8.35% (n=255) had moderate impairment, characterized by limited control of a pencil or paper. Severe impairment, where participants were unable to hold objects, was present in 9.95% (n=304) (Table 1).

Patient-Reported Barrier in Daily Life

Individuals with SCI reported a range of barriers that significantly impact their daily lives (as Figure 1). The most prevalent challenges were financial burden (46.0%) and unemployment due to disability (44.1%), reflecting considerable socioeconomic constraints. Accessibility-related barriers were also common, with 34.3% citing inadequate barrier-free facilities and 32.4% experiencing mobility and travel difficulties.

Health-related concerns were frequently noted. Approximately 29.5% of participants required frequent medical visits due to recurrent complications, while 25.7% reported persistent health concerns. Additionally, 26.8% of respondents experienced illness-related stigma, potentially contributing to psychological distress, which was reported by 12.3%. Social and family-related challenges were less frequently mentioned but still notable, with 9.8% of individuals reporting social disruption or increased family burden.

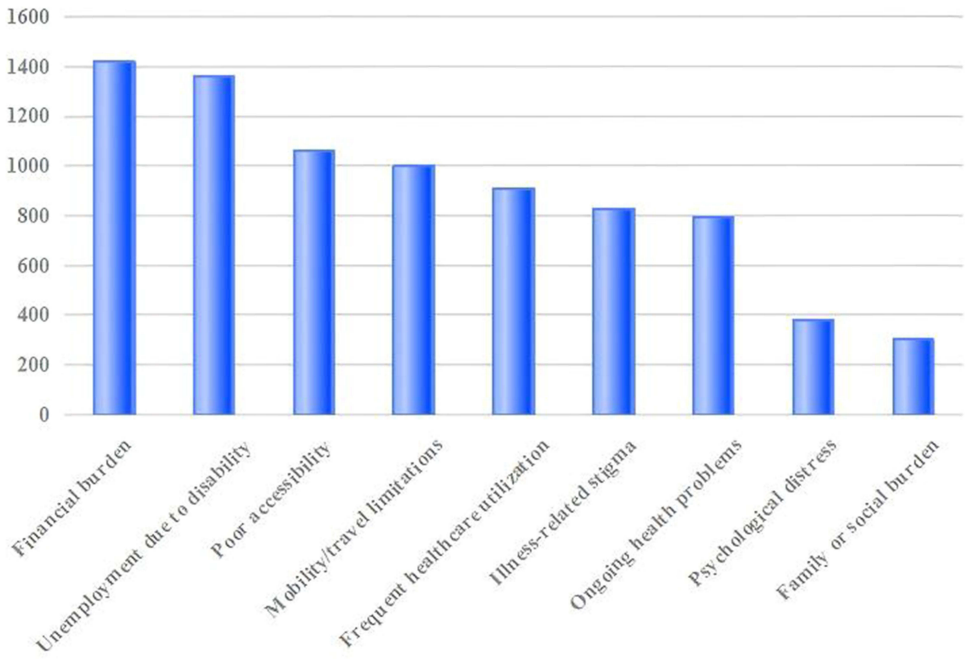

Figure 1 Patient-reported barrier in daily living.

These findings emphasize the urgent need for multidimensional interventions, including financial assistance programs, vocational rehabilitation, improved accessibility infrastructure, and integrated medical and psychosocial services to address these challenges faced by SCI individuals.

Prioritized Rehabilitation Goals Among Individuals with SCI

Overall Priority Distribution of Rehabilitation Goals

Figure 2 illustrates the distribution of rehabilitation goals among individuals with SCI, ranked by priority as first, second, and third choices. The most frequently cited primary goal is improving bladder function, reflecting its critical role in daily life and overall well-being. Similarly, restoring walking and standing ability ranks highly, underscoring the strong desire for mobility recovery.

Pain management is another significant concern, with back pain and lower limb pain relief frequently prioritized, indicating its substantial impact on quality of life. Additionally, preventing complications and improving dietary intake emerge as important rehabilitation goals, likely due to their role in maintaining overall health and reducing the risk of secondary conditions.

While physical recovery remains the dominant focus, psychosocial aspects such as emotional well-being, regaining confidence, reproductive health, and sexual health are also considered, albeit with lower prioritization. Notably, returning to work appears to be a less immediate concern, suggesting that individuals prioritize fundamental physiological functions and mobility before addressing vocational and social reintegration.

Overall, the findings highlight the need for a patient-centered rehabilitation approach that not only targets functional recovery but also incorporates pain management, complication prevention, and psychosocial support to optimize outcomes for individuals with SCI.

Stratified Analysis of Rehabilitation Priorities (by Priority Level)

Figure 3 highlights the top five primary rehabilitation goals identified by individuals with SCI. The most frequently reported primary goal is improving bladder function (49%), reinforcing its critical impact on daily life and independence. Standing and walking recovery are also major priorities, accounting for 17% and 16%, respectively, further emphasizing the importance of regaining mobility.

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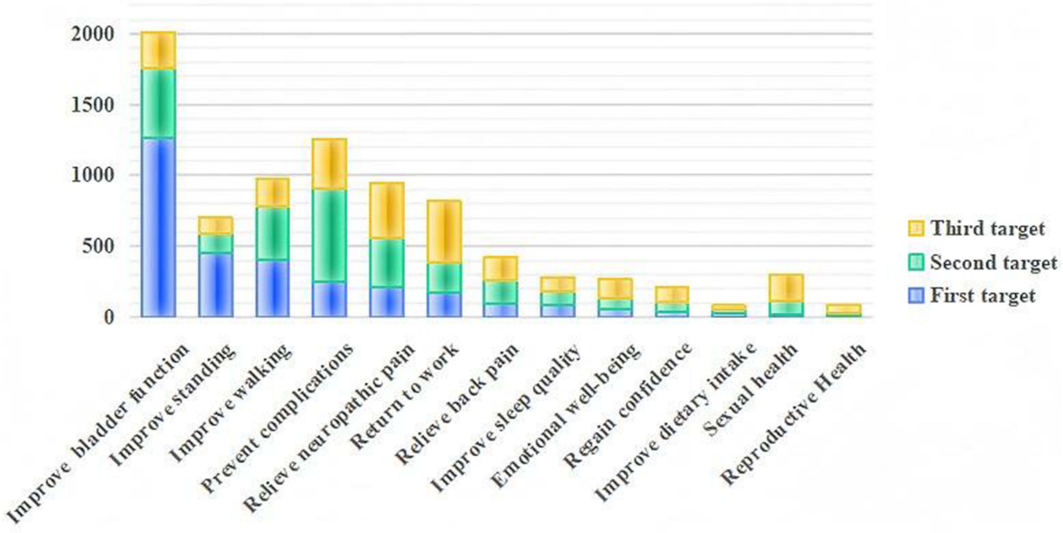

Figure 2 Patient-reported rehabilitation targets.

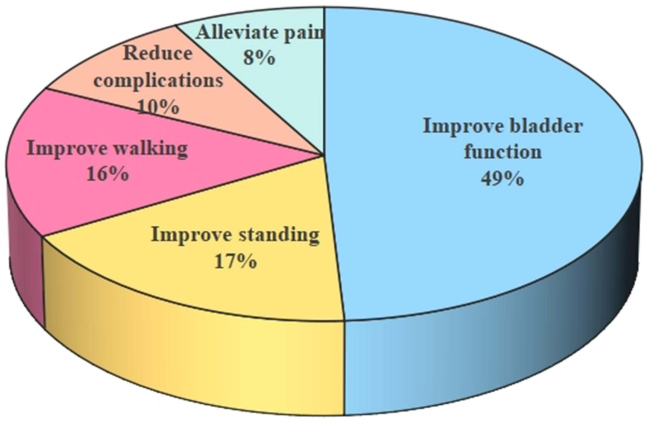

Figure 3 Most Common Primary Priority Rehabilitation Goals Among SCI Individuals.

Additionally, preventing complications (10%) is a key concern, likely reflecting the need to mitigate secondary health issues commonly associated with SCI. Alleviate pain management (8%) is also reported as a primary goal, highlighting the significant burden of chronic pain in this population.

These results align with previous findings, suggesting that SCI rehabilitation priorities are primarily centered on restoring fundamental physiological functions and mobility, while pain management and complication prevention remain essential aspects of care. A comprehensive rehabilitation strategy addressing these core concerns is crucial for optimizing patient outcomes.

Expanding upon the primary rehabilitation goals, Figures 4 and 5 illustrate the most cited second and third rehabilitation priorities among SCI individuals, reflecting variations in how patients rank the importance of different functional outcomes.

In Figure 4, the top-ranked second rehabilitation priority is preventing complications (31.8%), indicating that many individuals with SCI place high value on avoiding secondary health issues. This is followed by improving bladder function (23.5%),which remains a key concern for a significant proportion of respondents. Improving walking ability (18.0%) also ranks prominently, underscoring its continued relevance. Additionally, pain management (16.7%) and returning to work (10.1%) appear as relatively lower priorities at this level, though still important to a subset of participants.

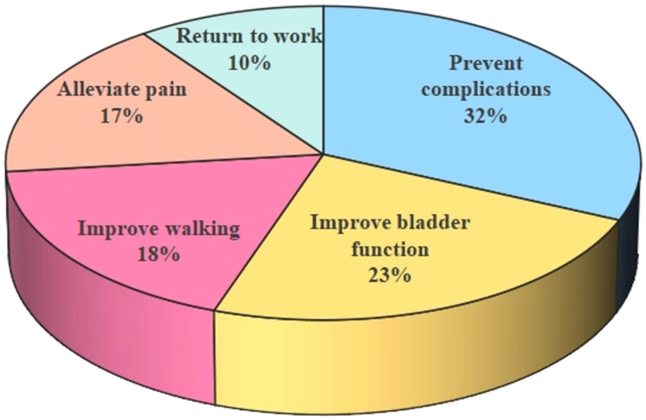

Figure 4 Most Common Second Priority Rehabilitation Goals Among SCI Individuals.

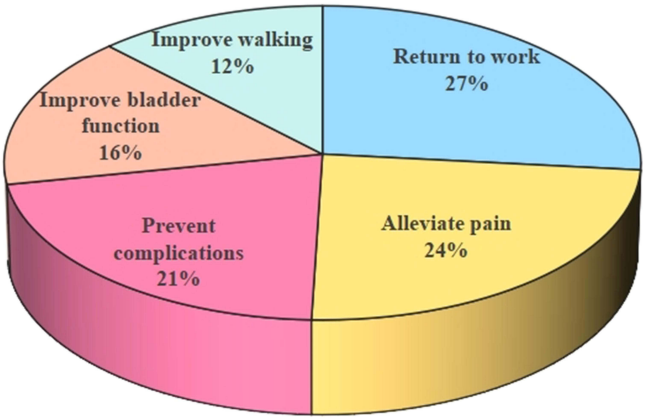

Figure 5 Most Common Third Priority Rehabilitation Goals Among SCI Individuals.

Figure 5 presents the third rehabilitation priorities, demonstrating a reordering of goals compared to the second priority selections. Returning to work rises to the top prominent objective (26.6%), suggesting that vocational and social reintegration are particularly valued among participants once more immediate concerns are addressed. Pain management follows closely (23.9%), while preventing complications remains important (21.4%), albeit slightly less emphasized than in the second priority ranking. Improving bladder function (15.8%) and improving walking ability (12.3%) are relatively lower in this ranking, though they continue to represent meaningful goals for some individuals.

Overall, these findings highlight differences in the prioritization of rehabilitation goals among individuals with SCI. While basic functional restoration and complication prevention are often emphasized as secondary goals, areas such as vocational reintegration and pain management gain prominence when individuals consider their third most important objectives. These patterns suggest that SCI rehabilitation planning should be responsive to the nuanced and individualized preferences of patients, rather than assuming a uniform hierarchy of needs.

Awareness and Expectations for Bladder Management Goals

Given the prominent emphasis on bladder function improvement in rehabilitation priorities, further investigation into bladder management goals was conducted. The results (Figure 6) reveal distinct patterns in patient preferences regarding bladder-related rehabilitation objectives.

A significant portion of respondents (63.3%) did not specify a bladder management goal, which may reflect a lack of awareness or insufficient guidance on bladder care strategies. Among those who set goals, the most commonly prioritized objective was achieving continence and independent urination, with 35.5% selecting it as their primary goal, and 13.1%

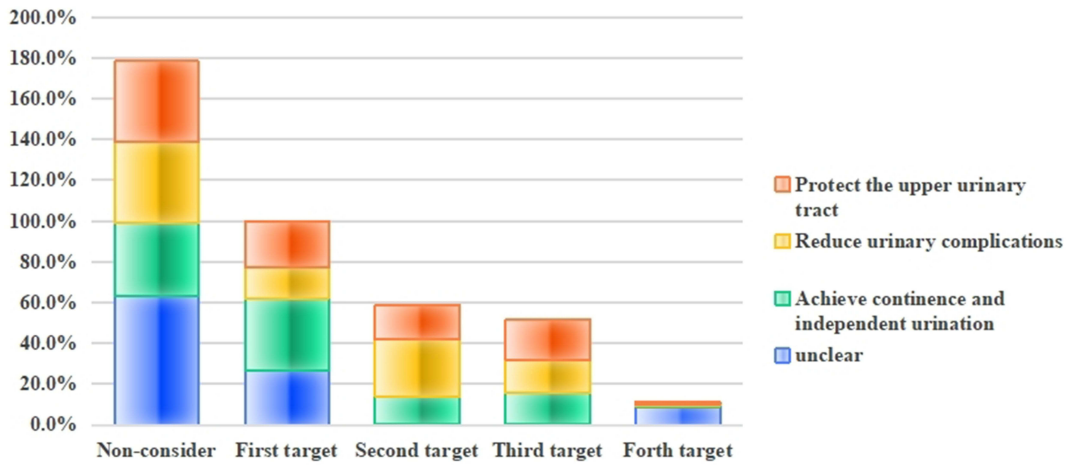

Figure 6 Ranking of patient-identified bladder management goals.

and 15.1% ranking it second and third, respectively. This underscores the critical role of urinary autonomy in rehabilitation outcomes and patient quality of life.

The reduction of urinary complications was also a notable concern, with 15.0% selecting it as their first priority, while 28.1% and 16.3% ranked it as their second and third priorities, respectively. This underscores the ongoing burden of recurrent urinary tract infections and related issues in SCI populations. Similarly, protection of the upper urinary tract emerged as a significant objective, with 22.7% prioritizing it first, and a notable 16.8% and 19.8% selecting it as their second and third priorities, respectively. This indicates an awareness of long-term renal health risks associated with bladder dysfunction post-SCI.

Overall, these findings emphasize the multifaceted nature of bladder management priorities among individuals with SCI. While achieving continence and independent urination remains the primary goal for most, concerns regarding urinary complications and upper urinary tract health are also significant. These results highlight the need for personalized bladder management strategies, which should integrate patient education, medical interventions, and long-term urological care, to address the diverse needs and optimize outcomes in SCI rehabilitation.

Multivariate Analysis of Factors Influencing the Prioritization of Bladder Function in SCI Rehabilitation

The Table 3 presents the results of a multivariate logistic regression analysis revealed several significant factors associated with the prioritization of bladder dysfunction as rehabilitation goals in individuals with SCI. Injury location, type of paralysis, optimal activity status, hand function and psychosocial factors were identified as key determinants.

Injury Level and Bladder Goal Prioritization

Individuals with cervical, thoracic, and lumbar injuries were significantly more likely to prioritize bladder function, with the highest odds observed for thoracic injuries (OR = 60.819, $p < 0.001$) as the primary goal. This association persisted for secondary (cervical OR = 20.728, $p = 0.004$; thoracic OR = 40.310, $p < 0.001$) and tertiary goals (cervical OR = 20.739, $p = 0.019$; thoracic OR = 40.422, $p < 0.001$), although the odds ratios slightly decreased across the goals. Sacral injuries, however, showed no significant association with prioritizing bladder dysfunction at any stage ($p > 0.05$), indicating that these patients are less likely to emphasize bladder issues compared to those with higher-level injuries.

Paralysis Type and Goal Prioritization

Individuals with isolated bladder dysfunction (OR = 120.012, $p < 0.001$), as well as those with complete quadriplegia (OR = 90.802, $p < 0.001$) and complete paraplegia (OR = 90.050, $p < 0.001$), were significantly more likely to prioritize bladder function as a primary rehabilitation goal, regardless of injury duration. However, in the context of secondary and tertiary goals, the influence of paralysis type became less pronounced. Only complete paraplegia remained significantly

Table 3 Factors Associated with Bladder Dysfunction as the Primary, Secondary, and Tertiary Rehabilitation Goals in SCI

Various		Primary Rehabilitation goal		Second Rehabilitation Goal		Third Rehabilitation Goal	
		P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)
Injury location	Cervical SCI	<0.001**	40.746 (20.772, 80.124)	0.004*	20.728 (10.387, 50.366)	0.019*	20.739 (10.182, 60.345)
	Thoracic SCI	<0.001**	60.819 (40.125, 110.271)	<0.001**	40.310 (20.299, 80.083)	<0.001**	40.422 (10.987, 90.839)
	Lumbar SCI	<0.001**	20.603 (10.575, 40.302)	0.008*	20.338 (10.247, 40.386)	0.017*	20.642 (10.186, 50.885)
	Sacral SCI	0.008	20.292 (10.246, 40.219)	0.164	0.461 (0.155, 10.372)	0.698	0.779 (0.221, 20.749)
	Unclear	Ref					
Types of SCI	Complete paraplegia	<0.001**	90.050 (30.820, 210.442)	0.034*	20.732 (10.078, 60.925)	0.113	20.478 (0.807, 70.612)
	Incomplete paraplegia	<0.001**	50.874 (20.458, 140.039)	0.441	10.466 (0.554, 30.879)	0.613	10.356 (0.416, 40.418)
	Complete quadriplegia	<0.001**	90.802 (30.834, 250.059)	0.217	10.928 (0.680, 50.465)	0.128	20.605 (0.760, 80.928)
	Incomplete quadriplegia	<0.001**	50.827 (20.280, 140.890)	0.189	20.014 (0.708, 50.730)	0.271	20.032 (0.574, 70.192)
	Neurogenic bladder	<0.001**	120.012 (40.316, 330.431)	0.051	30.717 (0.997, 130.865)	0.557	20.478 (0.807, 70.612)
	Monoplegia	0.076	20.348 (0.915, 60.026)	0.188	0.426 (0.120, 10.516)	0.273	10.356 (0.416, 40.418)
	Hemiplegia	Ref					
Optimal activity	Primarily bedbound; no physical activity tolerance	0.509	10.196 (0.703, 20.035)	0.049*	10.885 (10.003, 30.542)	0.035*	20.161 (10.055, 40.427)
	Wheelchair-dependent (assisted transfers)	0.002*	10.997 (10.276, 30.125)	0.004*	20.236 (10.286, 30.885)	0.099	10.716 (0.904, 30.258)
	Independent wheelchair-bed transfers	0.001*	10.957 (10.296, 20.954)	0.106	10.535 (0.913, 20.582)	0.578	10.185 (0.282, 100.464)
	Standing >30min with assistive devices	0.018*	10.880 (10.115, 30.171)	0.162	10.596 (0.829, 30.072)	0.381	0.676 (0.281, 10.624)
	Independent ambulation with assistive devices	0.123	10.480 (0.899, 20.439)	0.830	10.075 (0.557, 20.072)	0.285	0.632 (0.272, 10.466)
	Independent ambulation >500m with abnormal gait/muscle weakness	0.242	10.502 (0.760, 20.969)	<0.001**	<0.001 (<0.001, <0.001)	0.099	0.172 (0.021, 10.393)
	Independent ambulation >1km	0.462	0.712 (0.288, 10.758)	<0.001**	<0.001 (<0.001, <0.001)	0.227	0.274 (0.033, 20.241)
	Independent driving capacity	Ref					
Hand Function	Normal	0.613	10.128 (0.707, 10.801)	0.859	10.053 (0.595, 10.864)	0.743	10.124 (0.559, 20.260)
	Mild Impairment	0.428	0.826 (0.514, 10.326)	0.645	0.872 (0.488, 10.559)	0.801	0.913 (0.449, 10.855)
	Moderate Impairment	0.027*	0.588 (0.367, 0.943)	0.070	0.580 (0.322, 10.046)	0.410	0.746 (0.371, 10.499)
	Severe Impairment	Ref					
Employment		0.692	0.956 (0.766, 10.194)	0.369	0.881 (0.667, 10.162)	0.307	0.837 (0.594, 10.178)
Frequent medical visits due to recurrent disease		<0.001**	0.535 (0.421, 0.680)	<0.001**	0.519 (0.388, 0.693)	0.246	0.802 (0.552, 10.165)
Family relationship issues or social barriers		0.763	0.951 (0.685, 10.319)	0.965	10.009 (0.665, 10.531)	0.252	10.406 (0.785, 20.519)
Economic burden due to treatment or care		<0.001**	0.624 (0.507, 0.770)	0.024*	0.743 (0.574, 0.962)	0.006*	0.642 (0.468, 0.882)
Concerns on physical health status		0.071	0.803 (0.633, 10.019)	0.035*	0.728 (0.542, 0.978)	0.520	0.885 (0.594, 10.178)
Stigma		<0.001**	0.138 (0.105, 0.182)	<0.001**	0.226 (0.163, 0.313)	<0.001**	0.287 (0.194, 0.426)
Feel depressed		0.619	0.923 (0.674, 10.265)	0.724	0.931 (0.626, 10.385)	0.053	0.642 (0.409, 10.007)
Lack of accessible facilities		0.001*	0.672 (0.529, 0.853)	0.696	0.942 (0.700, 10.269)	0.056	0.703 (0.490, 10.009)

Notes: *$p<0.05$, **$p<0.001$.

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associated with prioritizing bladder dysfunction as the second goal (OR = 20.732, p = 0.034). Other types of paralysis did not show significant associations with prioritization in the secondary or tertiary goals (p > 0.05).

Functional Activity Status and Goal Prioritization

Individuals who were wheelchair-dependent but capable of assisted transfers (OR = 10.997, p = 0.002), those able to transfer independently (OR = 10.957, p = 0.001), and those with standing tolerance exceeding 30 minutes using assistive devices (OR = 10.880, p = 0.018) were significantly more likely to prioritize bladder management as their primary rehabilitation goal.

By contrast, participants with higher mobility levels—specifically, those capable of ambulating >500 meters with abnormal gait or >1 km independently—were less likely to prioritize these functions as a primary goal (p = 0.242 and p = 0.462, respectively), but were significantly more likely to identify them as secondary rehabilitation goals (p < 0.001 for both).

Notably, individuals who were primarily bedridden showed a stronger association with prioritizing bladder function as a secondary (OR = 10.885, p = 0.049) and tertiary goal (OR = 20.161, p = 0.035), rather than a primary one. Those requiring transfer assistance also showed significant associations with both first- (OR = 10.997) and second-level (OR = 20.236, p = 0.004) prioritization.

Hand Function Status and Goal Prioritization

In terms of hand function, individuals with moderate impairment (OR = 0.588, p = 0.027) were less likely to prioritize bladder function as their primary rehabilitation goal. This association was significant for the primary goal but weaker for secondary and tertiary goals, where no significant associations were found for individuals with mild or moderate hand impairments (p > 0.05). Those with normal hand function did not show any significant association with prioritizing bladder dysfunction across all goal categories (p > 0.05).

Psychosocial and Environmental Factors Associated with Goal Prioritization

Psychosocial and environmental factors played a significant role in the prioritization of bladder function as rehabilitation goals. Individuals who reported no perceived stigma (OR = 0.138, p < 0.001) and no recurrent illness (OR = 0.535, p < 0.001) were significantly less likely to prioritize bladder management as their primary goal.

Conversely, those experiencing stigma (p < 0.001) or frequent medical visits due to recurrent disease (p < 0.001) showed a marked tendency to prioritize these functions as both primary and secondary goals. The economic burden due to treatment or caregiving responsibilities also remained significantly associated with prioritization at all three goal levels (p < 0.001).

In addition, the lack of accessible facilities within the environment was strongly associated with prioritizing bladder function as the primary goal (p = 0.001). Concerns regarding physical health status were notably associated with prioritization of bladder function as a secondary goal (p = 0.035). However, factors such as family relationship issues and social barriers were not significantly related to goal prioritization at any level (p > 0.05).

These findings underscore the importance of psychosocial and environmental support in shaping rehabilitation priorities, particularly for individuals facing additional burdens from health concerns and social factors.

Multivariate Logistic Regression Analysis of Determinants of Employment Reintegration

The multivariate logistic regression analysis further delineated the independent predictors associated with employment status in individuals with SCI, as follows.

Impact of Injury Location on Employment

Injury location did not show a statistically significant association with employment outcomes. None of the SCI levels—cervical, thoracic, lumbar, or sacral—demonstrated a significant impact on employment status (all p > 0.05), suggesting that employment likelihood may not be primarily determined by the anatomical location of the injury when other factors are accounted for.

Impactof Paralysis Type on Employment

Complete paraplegia was significantly associated with lower employment odds (OR = 0.481, 95% CI: 0.293–0.791, p = 0.004), whereas neither incomplete paraplegia nor quadriplegia showed a statistically significant association with employment status (p > 0.05). These findings suggest that individuals with complete paraplegia face more substantial employment challenges.

Impact of Functional Mobility Status on Employment

Greater mobility capacity was associated with increased employment likelihood. Participants who were predominantly bedridden had significantly lower employment odds (OR = 0.615, 95% CI: 0.400–0.944, p = 0.026), as did those requiring assistance for wheelchair transfers (OR = 0.629, 95% CI: 0.435–0.911, p = 0.014) and those able to independently transfer but still reliant on a wheelchair (OR = 0.572, 95% CI: 0.406–0.808, p = 0.001). Conversely, individuals who could walk independently for at least 500 meters, even walk with abnormal gait, were significantly more likely to be employed (OR = 1.800, 95% CI: 1.017–3.185, p = 0.044). These findings highlight the importance of mobility in vocational reintegration.

Impact of Hand Function on Employment

Hand function impairment was not a significant predictor of employment status, as neither mild (OR = 1.296, p = 0.195) nor moderate (OR = 1.442, p = 0.071) dysfunction reached statistical significance compared to severe dysfunction.

Impact of Health-Related and Social Barriers on Employment

Several factors related to health and social barriers were strongly associated with reduced employment probability: Frequent hospital visits due to recurrent health issues (OR = 0.294, 95% CI: 0.243–0.357, p < 0.001). Family relationship strain or social difficulties (OR = 0.526, 95% CI: 0.402–0.687, p < 0.001). Travel difficulties (OR = 0.365, 95% CI: 0.305–0.436, p < 0.001). Stigma related to disability (OR = 0.271, 95% CI: 0.224–0.329, p < 0.001). Lack of accessible facilities (OR = 0.287, 95% CI: 0.238–0.346, p < 0.001).

These factors indicate that beyond physical impairment, social and environmental elements play a crucial role in employment status.

Impact of Environmental Accessibility on Employment

Better environmental accessibility (eg, accessible home facilities, elevators) was significantly associated with greater employment likelihood among individuals with SCI. The availability of home-based accessibility features was a significant predictor (OR = 1.247, 95% CI: 1.053–1.476, p = 0.011), and the presence of an in-building elevator further increased the odds of employment (OR = 1.405, 95% CI: 1.177–1.677, p < 0.001). Proximity to a vehicle-accessible road (<100 meters) showed a trend toward significance (OR = 1.572, p = 0.071), whereas other environmental distance variables were not significant.

In conclusion, the findings suggest that employment status among individuals with SCI is influenced by multiple factors, with mobility and accessibility playing key roles. While injury level alone was not a determinant, complete paraplegia, severe mobility limitations, and recurrent medical visits were significant barriers to employment. Conversely, greater ambulatory capacity and living in an accessible environment facilitated employment. These results underscore the need for targeted rehabilitation, social support systems, and urban planning initiatives to enhance employment opportunities for individuals with SCI. As Table 4.

Discussion

SCI is a profoundly life-altering condition that affects not only physical function but also the psychological well-being and social participation. Effective rehabilitation must therefore address a broad range of needs—including medical, functional, and psychosocial aspects,[11,12] especially for individuals receiving home-based care. This study provides a national perspective on the rehabilitation priorities, unmet needs, and reintegration challenges faced by individuals with SCI living at home. Our findings emphasize the need for tailored, stage-specific strategies that go beyond physical recovery to support long-term functional independence and societal reintegration.

Table 4 Factors Influencing Employment Among Individuals with SCI: Multivariate Logistic Regression Analysis

Various	B	SE	Wald χ^2	P	Exp(B)	95% CI	
Injury location							
Cervical SCI	−0.252	0.200	1.585	0.208	0.777	0.525	1.150
Thoracic SCI	−0.038	0.182	0.044	0.834	0.963	0.674	1.375
Lumbar SCI	−0.025	0.180	0.019	0.890	0.975	0.685	1.389
Sacral SCI	−0.292	0.238	1.497	0.221	0.747	0.468	1.192
Unclear	Ref						
Types of SCI							
Complete paraplegia	−0.732	0.253	8.331	0.004*	0.481	0.293	0.791
Incomplete paraplegia	−0.488	0.261	3.496	0.062	0.614	0.368	1.024
Complete quadriplegia	−0.304	0.301	1.021	0.312	0.738	0.409	1.331
Incomplete quadriplegia	−0.328	0.300	1.195	0.274	0.721	0.400	1.297
Neurogenic bladder	−0.175	0.366	0.228	0.633	0.840	0.410	1.720
Monoplegia	0.138	0.271	0.259	0.611	1.148	0.675	1.951
Hemiplegia	Ref						
Optimal activity status							
Primarily bedbound	−0.487	0.219	4.951	0.026*	0.615	0.400	0.944
Wheelchair-dependent (assisted transfers)	−0.463	0.189	6.034	0.014*	0.629	0.435	0.911
Independent wheelchair-bed transfers	−0.558	0.176	10.085	00.001*	0.572	0.406	0.808
Standing tolerance >30min with assistive devices	−0.428	0.222	3.717	0.054	0.652	0.422	1.007
Independent ambulation with assistive devices	−0.482	0.211	5.231	0.022*	0.618	0.409	0.933
Independent ambulation >500m with abnormal gait	0.588	0.291	4.074	0.044*	1.800	1.017	3.185
Independent ambulation >1km	0.346	0.311	1.241	0.265	1.414	0.769	2.599
Independent driving capacity	Ref						
Hand Function Classification							
Normal	−0.038	0.196	0.037	0.847	0.963	0.656	1.415
Mild Impairment	0.259	0.200	1.676	0.195	1.296	0.875	1.919
Moderate Impairment	0.366	0.203	3.258	0.071	1.442	0.969	2.145
Severe Impairment	Ref						
Frequent medical visits due to recurrent disease	−1.223	0.098	154.909	<0.001**	0.294	0.243	0.357
Family relationship issues or social barriers	−0.643	0.137	22.188	<0.001**	0.526	0.402	0.687
Difficulty with travel/mobility	−1.009	0.091	122.607	<0.001**	0.365	0.305	0.436
Stigma	−1.304	0.099	174.352	<0.001**	0.271	0.224	0.329
Lack of accessible facilities	−1.249	0.096	169.913	<0.001**	0.287	0.238	0.346
Residence equipped with accessible facilities	0.220	0.086	6.534	0.011*	1.247	1.053	1.476
Residence equipped with an elevator	0.340	0.090	14.214	<0.001**	1.405	1.177	1.677
Distance to nearest accessible roadway							
Within 100 meters	0.452	0.251	3.251	0.071	1.572	0.961	2.569
100-500 meters	0.396	0.251	2.494	0.114	1.486	0.909	2.429
500-1000 meters	0.322	0.260	1.525	0.217	1.379	0.828	2.298
1000-3000 meters	0.278	0.286	0.943	0.331	1.321	0.753	2.316
3000-5000 meters	0.565	0.388	2.120	0.145	1.760	0.822	3.767
Beyond 5000 meters	Ref						

Notes: *p<0.05, **p<0.001.

Overview of Key Findings

This study reveals the complex and interconnected priorities in SCI rehabilitation. While bladder management and mobility remain central goals, successful return to work depends not a broader set of factors, Specifically, walking ability plays a pivotal role, but psychosocial and environmental barriers are equally influential. The interplay of these determinants calls for comprehensive rehabilitation models that align medical goals with social reintegration pathways.

Challenges in Daily Living and Barriers to Community Reintegration

Beyond clinical rehabilitation, individuals with SCI encounter substantial challenges in daily life that hinder their reintegration into the community. Environmental barriers such as inaccessible infrastructure, remote service locations, and lack of assistive devices—were commonly reported and severely limited participation in work, social life, and essential activities like transportation and personal care. These findings align with previous research highlighting how structural inaccessibility undermines autonomy and social participation among people with SCI.[13,14]

Psychosocial factors, particularly stigma and negative societal perceptions of disability, also emerged as major obstacles. Internalized stigma and perceived discrimination were closely linked to reduced social engagement and increased emotional distress.[15–18] Notably, participants frequently cited these attitudinal barriers, along with inaccessible workplaces and inadequate accommodations, as key reasons for limited employment opportunities and loss of economic independence.

Peer support appeared to buffer some of these negative effects, with higher satisfaction associated with better psychosocial adjustment.[19] This highlights the importance of social connectedness in recovery and reintegration.

Collectively, these findings point to the need for a comprehensive rehabilitation approach that integrates physical, psychological, and social components. Enhancing mobility alone is insufficient—addressing stigma, improving accessibility, and fostering supportive environments are equally essential for meaningful community participation and vocational reintegration. A biopsychosocial model should guide post-discharge care to better support individuals with SCI in rebuilding independent and fulfilling lives.

Rehabilitation Goals and Priorities

This study highlights the multifaceted nature of rehabilitation goals among individuals with SCI, with bladder management emerging as the most frequently prioritized domain. This finding is consistent with previous research indicating that bladder dysfunction significantly affects autonomy, self-esteem, and daily life quality in individuals with SCI.[5] However, priorities extended well beyond bladder control to include mobility—particularly the ability to stand and walk—which reflects a broader aspiration for independence and community participation. The emphasis on mobility aligns with existing literature demonstrating that ambulatory capacity is closely linked to higher rates of employment and improved quality of life.[20] In turn, employment plays a mediating role in social reintegration, offering individuals a sense of purpose and societal belonging. Structural modeling studies have further supported this relationship, identifying functional independence, vocational engagement, and social participation as key determinants of quality of life among individuals with SCI.[21]

Participants also identified goals such as pain management, prevention of secondary complications, and overall health maintenance. These findings support a holistic rehabilitation model that addresses physical recovery alongside psychological and social well-being. Although goals related to emotional resilience and confidence-building were less frequently prioritized, they remain relevant—especially as individuals transition into later stages of recovery. Prior studies suggest that psychosocial concerns, including emotional distress, social isolation, and financial strain, often become more prominent over time as physical function stabilizes.[22]

Return-to-work and community participation were additional goals reported by participants, though often ranked lower in priority. This may reflect the ongoing reality that employment remains difficult to achieve for many individuals with SCI. International data suggest that employment rates among this population remain low—approximately 38%—due to persistent structural and systemic barriers.[23–25] Furthermore, vocational rehabilitation services vary widely across countries and health systems, with challenges such as poor intersectoral coordination, lack of individualized job matching, and limited long-term support.[8,9,26,27]

Therefore, rehabilitation programs should be flexible and responsive to individual recovery trajectories. While early rehabilitation must focus on physical function and basic self-care, vocational goals and psychosocial support should become central components in later stages. A patient-centered, stage-specific approach is essential to support individuals across the full continuum of recovery—from clinical stabilization to meaningful reintegration into work and society.[28]

Awareness and Knowledge Gaps in Bladder Management

Although bladder management is widely recognized as a critical priority in SCI rehabilitation. Our findings reveal a persistent disconnect between its clinical importance and patients' understanding of how to address it. While most individuals with SCI acknowledged the desire to improve bladder function, over 60% reported uncertainty about specific bladder management goals—particularly regarding long-term protection of upper urinary tract function. Many SCI individuals focused on reducing incontinence or achieving voluntary urination, often overlooking critical issues such as infection prevention, pressure regulation, and renal preservation. This knowledge gap reflects insufficient patient education and inconsistent goal-setting support, especially during early rehabilitation. Previous multi-center research has similarly identified inadequate bladder-related knowledge as a major barrier to effective rehabilitation planning and long-term follow-up adherence in SCI populations,[29] Without a clear understanding of priorities, patients are less likely to engage meaningfully in bladder care strategies, delaying critical interventions and compromising functional outcomes.

Moreover, when benchmarked against international guidelines, our results suggest inconsistent implementation of evidence-based bladder management practices across rehabilitation programs. Global recommendations emphasize early and proactive bladder care to reduce incontinence, prevent complications, and safeguard renal function—ultimately improving quality of life.[30–32] However, many individuals with SCI are not adequately supported in setting realistic and comprehensive bladder management goals.

These findings highlight the urgent need for structured, patient-centered education as part of routine rehabilitation. Incorporating individualized bladder care plans from the outset can empower patients to make informed decisions, enhance adherence, and improve both functional independence and health outcomes. Bridging this knowledge gap is essential to delivering high-quality, goal-directed rehabilitation for people living with SCI.

Multivariate Analysis: Determinants of Bladder Management Goals

Multivariate analysis revealed that several key factors associated with whether individuals with SCI actively set bladder management goals. Greater functional independence and improved access to healthcare services were positively linked to proactive goal-setting—findings that align with earlier studies underscoring the role of health system accessibility and patient capacity in achieving effective bladder control and higher satisfaction after SCI.[33,34]

Access to assistive technologies—including catheters, anticholinergic medications, and advanced management tools—also facilitated goal-setting behavior. These resources not only improve symptom control but also enhance patients' confidence and autonomy. However, disparities in resource availability and insufficient user training can lead to suboptimal management and diminished quality of life, emphasizing the need for individualized instruction and continued support.

Psychosocial factors further shaped patients' engagement. Those with higher perceived self-efficacy and lower internalized stigma were more likely to set and pursue bladder-related goals. This highlights the importance of psychological readiness, in addition to physical and environmental factors, in driving rehabilitation involvement.

Together, these findings support a comprehensive, patient-centered rehabilitation approach—one that integrates physical capacity, equitable access to care, and psychosocial empowerment. Addressing these interrelated determinants is essential for improving bladder outcomes and promoting meaningful engagement in rehabilitation among individuals living with SCI.

Factors Influencing Employment Outcomes: Functional and Environmental Barriers

Employment represents a core component of long-term rehabilitation for individuals with SCI, yet remains challenging to achieve. Consistent with previous studies, individuals with higher-level injuries (eg, thoracic or cervical) tend to have lower employment rates.[35,36] However, our findings suggest that functional capacity, particularly patient-reported mobility and daily activity performance, may offer a more practical and person-centered predictor of vocational reintegration than anatomical classification alone.

Notably, independent ambulation of ≥1 km was significantly associated with higher employment rates, whereas shorter or unstable ambulation (eg, ≥500 meters with gait abnormalities) conferred limited vocational advantage. This

indicates the existence of a functional threshold, where long-distance and stable ambulation becomes essential for sustaining employment. These insights support stage-specific rehabilitation planning—initial targets like walking 500 meters may enable basic participation, but further gains in endurance and gait quality are likely necessary for meaningful vocational reintegration.

For individuals with limited walking potential, assistive strategies such as powered mobility devices or accessible transportation should be integrated into employment planning. These findings reinforce the need to align functional goals with real-world occupational demands.

Importantly, functional ability alone does not fully account for employment outcomes. Our analysis revealed that frequent healthcare needs and experienced stigma significantly hindered workforce participation, even among physically capable individuals—echoing prior findings that emphasize the role of medical and societal barriers.[37] Psychosocial factors, including internalized stigma, low self-efficacy, and fear of rejection, further discouraged reentry into the workforce, consistent with previous reports.[38] These psychological dimensions highlight the importance of incorporating mental health support, peer mentorship, and vocational counseling into rehabilitation programs.

Environmental factors also played a substantial role. Participants frequently cited inaccessible transport, workplaces, and housing as major barriers to employment. These results align with earlier research demonstrating that environmental accessibility is a strong predictor of community reintegration.[39] Addressing such barriers requires not only individual-level interventions but also systemic change—through universal design, inclusive hiring policies, and supportive workplace accommodations.

In summary, while physical function is foundational, it is not sufficient to ensure successful vocational reintegration. A truly effective rehabilitation strategy must adopt a biopsychosocial model, integrating physical rehabilitation, psychological empowerment, and environmental accessibility. Future programs should be flexible and adaptive, responding to the evolving needs of individuals with SCI as they progress toward meaningful employment and social participation.

Implications for Rehabilitation and Community Reintegration

This study underscores the urgent need to adopt a holistic, biopsychosocial approach to SCI, rehabilitation that integrates physical, psychological, and social dimensions. While bladder management and mobility are critical components of early functional recovery, long-term outcomes such as employment and community participation are shaped by a broader set of interrelated factors.

For clinicians and rehabilitation teams, the development of individualized, goal-oriented care plans is essential. These plans should incorporate structured education on bladder management from the outset, with attention to both continence and upper urinary tract protection. Furthermore, mobility training should be aligned with real-world demands, gradually progressing toward functional thresholds associated with vocational engagement.

Psychological readiness and self-efficacy play a pivotal role in rehabilitation engagement and reintegration outcomes. As prior studies have shown, individuals with SCI often face significant internalized stigma during the early post-discharge period, which is closely associated with reduced confidence and lower rates of social participation.[40] Given that perceived stigma within the first three months post-injury can negatively predict long-term reintegration—independently of physical impairment—rehabilitation programs should include early-stage psychosocial interventions, such as cognitive-behavioral therapy, peer mentoring, and structured self-efficacy enhancement.

For policymakers, the results emphasize the importance of removing structural and environmental barriers. Interventions should include improving accessibility in transport and workplaces, promoting universal design, and incentivizing inclusive hiring practices. Additionally, expanding equitable access to long-term rehabilitation services—including in underserved and rural regions—can help address disparities in outcomes.

Beyond the clinical setting, environmental and occupational factors remain central to successful reintegration. Our findings reinforce evidence that functional status—particularly mobility and hand function—is more predictive of employment than neurological injury level alone. This aligns with existing literature highlighting the influence of pre-injury occupation, educational background, and participation in vocational rehabilitation programs on post-injury employment outcomes.[41] As such, rehabilitation teams should integrate vocational assessment and support services into routine care, particularly in the later stages of recovery.

From a policy perspective, efforts to improve transportation access, workplace accommodations, and inclusive hiring practices are necessary to mitigate the structural barriers that persistently hinder workforce re-entry. These actions should be guided by principles of universal design and supported by cross-sector collaboration among health, labor, and social service systems.

Although this study contributes important insights, it has several limitations. The use of self-reported online questionnaires may have excluded individuals without access to digital resources, introducing potential selection bias. Additionally, functional assessments were based on participant or caregiver reports rather than standardized clinical instruments, limiting diagnostic precision. The simplified classification of motor function and injury level, while suitable for community-based surveys, does not align fully with ISNCSCI criteria.[42]

Future research should expand the psychosocial dimension of SCI rehabilitation, including the role of social support networks, coping strategies, and community integration resources. Moreover, studies evaluating interdisciplinary care models—combining physical, psychological, and environmental interventions—are warranted to determine their effectiveness in promoting sustainable employment and social inclusion.

In conclusion, effective SCI rehabilitation must move beyond traditional biomedical targets to address the broader context of patients' lives. Translating these findings into clinical and policy action requires coordinated, stage-specific strategies that promote not only physical recovery but also psychological empowerment and structural inclusion, ultimately supporting individuals with SCI in achieving meaningful and sustained reintegration into society.

Conclusions

This study highlights the complex, interrelated barriers faced by individuals with spinal cord injury (SCI) during home-based rehabilitation, emphasizing the critical role of a comprehensive biopsychosocial approach. To enhance reintegration outcomes, clinicians and rehabilitation teams should prioritize personalized functional training, particularly bladder management education, and integrate psychosocial support to address stigma and mental health challenges.

Policy makers and healthcare planners are encouraged to invest in inclusive infrastructure, such as accessible transportation and barrier-free environments, to reduce environmental constraints that limit employment opportunities. Additionally, developing multidisciplinary rehabilitation programs that coordinate medical, psychological, and vocational services will be vital to support sustained functional independence and workforce participation.

The findings also reveal a significant gap in bladder management goal-setting, underscoring the need for improved patient education and clinical guidance in this area. Targeted interventions that align with patients' injury characteristics and psychosocial context can optimize rehabilitation efficacy.

By translating these insights into coordinated clinical practices and policy initiatives, we can promote meaningful long-term recovery, empower individuals with SCI, and facilitate their successful return to work and community life.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors have no conflicts of interest to declare in this work.

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