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Review Article

Barriers to Spinal Cord Injury Rehabilitation in Low-Resource Settings: A Critical Narrative Review and Conceptual Synthesis

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ABSTRACT

Background: Spinal cord injury is associated with long-term disability, secondary complications, reduced participation, and substantial dependence on rehabilitation services. In low- and middle-income countries, rehabilitation access remains constrained by fragmented service delivery, limited workforce capacity, financial barriers, weak referral systems, and poor community-based support. Although previous literature has described individual barriers to rehabilitation, less attention has been given to how these barriers interact across the continuum of care. Objective: To critically synthesize evidence on barriers to spinal cord injury rehabilitation in low-resource settings and develop a conceptual framework explaining how multi-level barriers influence access, continuity, participation, and outcomes. Methods: A structured narrative review was conducted using PubMed/MEDLINE, Scopus, Web of Science, and CINAHL. Literature published between January 2010 and March 2026 was considered. Eligible sources examined spinal cord injury rehabilitation or directly relevant disability rehabilitation services in low- and middle-income countries, with focus on access, service delivery, continuity, barriers, or outcomes. Evidence was synthesized thematically across system-level, service-level, socioeconomic, and patient-level domains, with particular attention to transition points across the rehabilitation pathway. Results: Twenty-two studies/sources were included in the narrative synthesis. The evidence consistently showed that rehabilitation barriers operate cumulatively rather than independently. System-level constraints, including policy gaps, limited financing, and workforce shortages, contributed to restricted service availability and weak referral pathways. Service fragmentation, high out-of-pocket costs, transport barriers, limited community-based rehabilitation, low awareness, stigma, and poor adherence further disrupted continuity of care, especially during transitions from acute care to rehabilitation and from institutional rehabilitation to community reintegration. Conclusion: Spinal cord injury rehabilitation in low-resource settings is best understood as a pathway-level systems challenge. Effective reform requires integrated rehabilitation planning, structured referral and discharge systems, community-based rehabilitation expansion, financial protection, and context-specific strategies to reduce geographic and social inequities. Keywords: Spinal cord injury; rehabilitation; low-resource settings; low- and middle-income countries; access to care; neurorehabilitation; health systems; community reintegration.

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INTRODUCTION

Spinal cord injury (SCI) is among the most devastating neurological conditions, resulting in long-term impairments affecting motor, sensory, autonomic, psychological, and social functioning. Beyond the immediate trauma, SCI frequently leads to permanent disability, reduced participation in societal roles, diminished quality of life, and increased dependence on healthcare and support systems (1,2). Globally, the incidence of traumatic SCI ranges from approximately 10 to 83 cases per million population annually, with a disproportionate burden observed in low- and middle-income countries (LMICs), where road traffic injuries, falls, occupational trauma, interpersonal violence, and inadequate trauma systems

remain major contributors (1-4). Although advances in emergency medicine and acute spinal stabilization have improved survival, long-term outcomes after SCI depend heavily on timely access to comprehensive rehabilitation services that address physical recovery, secondary complication prevention, psychosocial adaptation, and community reintegration (5,6).

Rehabilitation constitutes a central component of SCI management because neurological recovery alone is insufficient to restore functional independence and social participation. Effective rehabilitation pathways typically involve multidisciplinary interventions incorporating physiotherapy, occupational therapy, assistive technologies, psychological support, vocational rehabilitation, caregiver education, and long-term follow-up (7). In high-resource healthcare systems, SCI rehabilitation is commonly integrated into coordinated care continuums extending from acute hospital management to inpatient rehabilitation and community-based support structures. Such integrated models have been associated with improved survival, enhanced functional outcomes, reduced secondary complications, and greater social participation (6,7). In contrast, rehabilitation systems in many LMICs remain fragmented, underfunded, and poorly integrated into national healthcare priorities (8). Patients frequently encounter delayed rehabilitation initiation, inconsistent referral systems, inadequate follow-up, and limited access to specialized services, ultimately contributing to preventable disability and poorer long-term outcomes.

A growing body of literature has explored barriers to rehabilitation in low-resource settings. Previous studies have identified structural limitations including insufficient rehabilitation centers, workforce shortages, lack of trained rehabilitation professionals, inadequate assistive technology availability, and weak policy prioritization of rehabilitation services (5,8-10). Additional socioeconomic constraints such as out-of-pocket healthcare expenditure, inaccessible transportation systems, poverty, and limited insurance coverage further restrict rehabilitation utilization (9,11). At the patient and community level, cultural perceptions of disability, stigma, low awareness regarding rehabilitation benefits, psychological distress, and poor social support systems also influence participation in rehabilitation programs and continuity of care (7,12,13). Evidence from South Asia, particularly Pakistan, highlights substantial urban-rural disparities, inadequate integration of rehabilitation within primary healthcare systems, limited community-based rehabilitation infrastructure, and persistent sociocultural barriers affecting access to care (14-17).

Despite increasing recognition of these challenges, the existing literature remains largely reductionist and descriptive. Most studies focus on isolated domains of barriers such as workforce deficits, financial limitations, or transportation difficulties without adequately examining how these factors interact dynamically across different stages of the rehabilitation continuum (8,18-20). Consequently, the mechanisms through which system-level dysfunction translates into service fragmentation, discontinuity of care, and poor rehabilitation outcomes remain insufficiently understood. Transitional phases of care, including movement from acute hospitalization to rehabilitation services and from institutional rehabilitation to community reintegration, appear particularly vulnerable to breakdowns in continuity; however, these transitions have received comparatively limited analytical attention in prior rehabilitation literature (21,22). This fragmented understanding limits the development of integrated rehabilitation policies and coordinated service delivery strategies capable of addressing the cumulative and interacting nature of barriers in LMIC contexts.

Furthermore, contemporary rehabilitation discourse increasingly emphasizes rehabilitation as a health systems issue rather than solely an individual clinical intervention (8,23). The World Health Organization's Rehabilitation 2030 initiative has highlighted the urgent need for rehabilitation integration into universal health coverage frameworks, especially in resource-constrained settings where rehabilitation services are often marginalized within healthcare planning (23). Nevertheless, SCI rehabilitation in LMICs continues to be characterized by discontinuous pathways, insufficient infrastructure, inequitable service distribution, and weak community reintegration mechanisms. These shortcomings disproportionately affect vulnerable populations residing in rural regions, women with

disabilities, economically disadvantaged groups, and individuals lacking social support networks (14-17,24). Understanding SCI rehabilitation barriers therefore requires a systems-oriented perspective capable of integrating structural, service-related, socioeconomic, and patient-level determinants within a unified conceptual framework.

Given these gaps, there remains a need for a critical synthesis that moves beyond isolated identification of barriers toward a more integrated interpretation of how rehabilitation challenges interact across the continuum of SCI care in low-resource settings. A structured narrative review approach is particularly appropriate because the available evidence is heterogeneous in design, methodology, regional context, and outcome reporting, limiting the feasibility of quantitative synthesis while necessitating interpretive and conceptual integration. Therefore, the present review aims to critically synthesize the existing literature on barriers to spinal cord injury rehabilitation in LMICs, with particular emphasis on South Asia and Pakistan. The review further seeks to examine how system-level, service-level, socioeconomic, and patient-level determinants interact across different stages of the rehabilitation pathway to influence access, continuity of care, utilization, and rehabilitation outcomes. By identifying patterns, interrelationships, and gaps within the current evidence base, this review proposes a conceptual framework to better explain the persistent fragmentation of SCI rehabilitation in low-resource settings and to inform future rehabilitation policy, service planning, and research directions.

MATERIALS AND METHODS

This study was designed as a structured narrative review with conceptual synthesis to examine barriers to spinal cord injury rehabilitation in low-resource settings. A narrative approach was selected because the available literature was methodologically heterogeneous, including reviews, observational studies, qualitative evidence, policy reports, and rehabilitation systems analyses, making quantitative pooling inappropriate. The review followed a transparent, PRISMA-informed search and selection process while using a narrative synthesis framework to identify patterns, contradictions, and conceptual relationships across system-level, service-level, socioeconomic, and patient-level determinants of rehabilitation access and continuity. The scope of the review was defined around the population, concept, and context framework. The population of interest comprised individuals with spinal cord injury or disability populations where findings were directly applicable to SCI rehabilitation. The central concept was access to rehabilitation, including service availability, utilization, continuity of care, referral pathways, follow-up, assistive technology access, community reintegration, and rehabilitation-related outcomes. The context was low-resource healthcare environments, particularly low- and middle-income countries, with specific analytical attention to South Asia and Pakistan. A structured literature search was conducted using PubMed/MEDLINE, Scopus, Web of Science, and CINAHL. The search covered studies published between January 2010 and March 2026 and was limited to English-language publications. Search terms combined controlled vocabulary and free-text keywords related to spinal cord injury, rehabilitation, access, barriers, low-resource settings, LMICs, South Asia, and Pakistan. The core search strategy used combinations of the following terms:

"spinal cord injury" OR "SCI"; "rehabilitation" OR "neurorehabilitation"; "access to care" OR "healthcare access"; "barriers" OR "challenges"; "low-resource settings" OR "low- and middle-income countries" OR "LMICs" OR "developing countries"; and "South Asia" OR "Pakistan." Boolean operators were applied to broaden or refine retrieval, and reference lists of included studies and relevant reviews were screened to identify additional eligible literature.

Studies were eligible for inclusion if they examined SCI rehabilitation or directly relevant disability rehabilitation services; addressed barriers, access, service delivery, continuity, utilization, reintegration, or outcomes; were conducted in LMICs or provided LMIC-specific analysis; used quantitative, qualitative, mixed-methods, review, or policy-oriented designs; were published in peer-reviewed journals or authoritative organizational reports; and were available in English. Studies were excluded if they focused

exclusively on acute surgical or medical management without rehabilitation relevance, were conducted only in high-income settings without transferable implications for low-resource contexts, were case reports or opinion pieces without sufficient analytical content, or lacked adequate methodological clarity for synthesis.

Study selection was performed in sequential stages. Titles and abstracts were first screened for relevance to SCI rehabilitation and low-resource care contexts. Full texts of potentially eligible records were then reviewed against the predefined inclusion and exclusion criteria. Studies addressing broader disability, assistive technology, rehabilitation systems, or community-based rehabilitation were retained only when their findings were directly applicable to SCI rehabilitation pathways. The selection process was iterative, allowing refinement of conceptual relevance while maintaining alignment with the predefined scope.

Data were extracted into a structured matrix to support comparison across studies. Extracted variables included author, year, country or region, study design, target population, rehabilitation setting, type of rehabilitation service or barrier examined, and key findings related to access, utilization, continuity of care, outcomes, and reintegration. Barriers were initially coded inductively and then organized into four higher-order analytical domains: system-level factors, service-level factors, socioeconomic factors, and patient-level factors. System-level factors included policy prioritization, financing, workforce capacity, infrastructure, and governance. Service-level factors included availability of rehabilitation centers, referral coordination, discharge planning, follow-up, and continuity of care. Socioeconomic factors included out-of-pocket costs, transport limitations, poverty, insurance limitations, and social support. Patient-level factors included awareness, beliefs, stigma, adherence, psychological distress, and engagement with rehabilitation.

The synthesis followed an iterative thematic approach. Evidence was first summarized descriptively to identify recurrent rehabilitation barriers across regions and study types. The analysis then moved beyond descriptive aggregation to examine how barriers interacted across the SCI care pathway, including acute care, inpatient rehabilitation, transition to home or community care, and long-term reintegration. Particular attention was given to points of discontinuity where patients were most likely to be lost to follow-up, experience delayed rehabilitation, or discontinue care because of combined structural, financial, geographic, and social constraints. This approach allowed the review to develop a conceptual synthesis explaining how upstream health system weaknesses contribute to downstream service fragmentation, socioeconomic exclusion, and reduced patient participation.

No formal risk-of-bias assessment was conducted because the review was designed as a structured narrative synthesis rather than a systematic review or meta-analysis. However, greater interpretive weight was given to studies with clear objectives, transparent methodology, relevant populations, and direct applicability to SCI rehabilitation or rehabilitation systems in LMICs. Evidence from reviews, observational studies, qualitative research, and global policy reports was triangulated to identify consistent patterns and gaps. The absence of formal quality appraisal was considered during interpretation, and conclusions were framed cautiously to avoid overstating causal relationships.

The final conceptual framework was developed from the thematic synthesis by mapping multi-level barriers onto sequential stages of the SCI rehabilitation pathway. This framework was intended to explain how policy and financing gaps, limited service availability, poor referral coordination, financial hardship, transport barriers, stigma, and reduced awareness interact cumulatively to produce discontinuity of care and poorer rehabilitation outcomes in low-resource settings.

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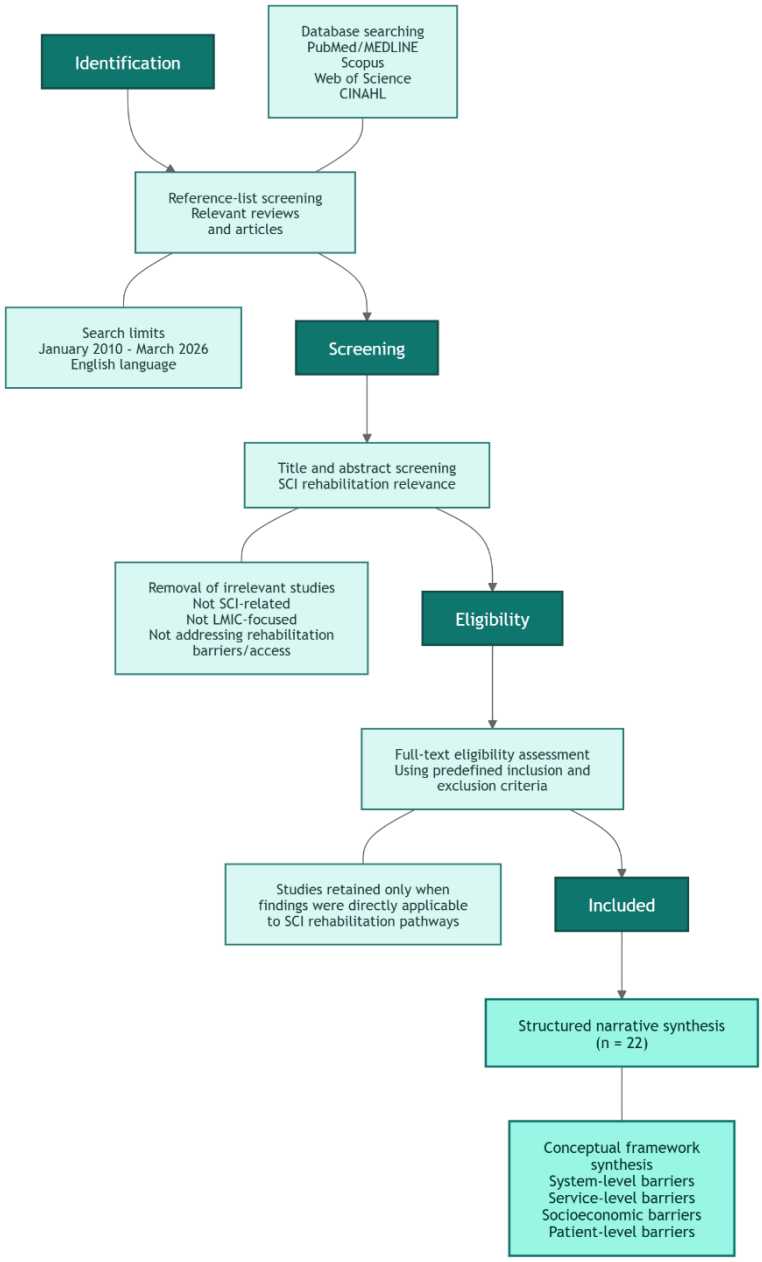

Figure 1 PRISMA Flowchart

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RESULTS

The structured search and reference-screening process identified literature addressing spinal cord injury rehabilitation, disability rehabilitation access, rehabilitation systems, assistive technology, and community reintegration in low-resource settings. After screening for relevance to spinal cord injury rehabilitation, low- and middle-income country contexts, access barriers, service delivery, continuity of care, and rehabilitation outcomes, 22 studies/sources were included in the structured narrative synthesis. The included evidence comprised systematic reviews, observational studies, policy reports, cross-sectional studies, cohort studies, qualitative research, and global rehabilitation strategy papers. The evidence base was geographically diverse, with studies from South Asia, Sub-Saharan Africa, broader LMIC settings, and global rehabilitation systems literature.

Table 1. Characteristics of Included Studies/Sources in the Structured Narrative Review

Author / Source	Year	Country / Region	Design / Source Type	Population / Focus	Main Rehabilitation Focus
Bright et al.	2018	LMICs	Systematic review	People with disabilities	Rehabilitation access
Scovil et al.	2012	Nepal	Observational study	SCI patients	Post-discharge follow-up
Reinhardt et al.	2020	Multicountry / LMIC-relevant	Cross-sectional study	People with SCI	Environmental barriers
Rathore et al.	2016	Pakistan	Review	SCI / neurorehabilitation population	National rehabilitation services
Mlenzana et al.	2013	South Africa / Africa	Systematic review	People with physical disabilities	Rehabilitation access
Borg et al.	2011	LMICs	Review	Assistive technology users	Assistive devices
Kuper et al. / Bright & Kuper	2018	LMICs	Systematic review	People with disabilities	Healthcare access inequity
Islam / Uddin et al.	2019	Bangladesh	Cohort / rehabilitation report	SCI / disability population	Rehabilitation follow-up
Draulans et al.	2011	Sub-Saharan Africa	Observational study	SCI patients	Etiology and reintegration
Tinney et al.	2007	Ghana	Observational study	Rehabilitation patients	Medical rehabilitation barriers
Atijosan et al.	2008	Rwanda	Cross-sectional survey	People with musculoskeletal impairment	Service access
WHO	2017	Global	Policy report	Rehabilitation systems	Health-system rehabilitation integration
Stucki et al.	2018	Global	Review / strategy paper	Rehabilitation systems	Rehabilitation strategy
Shakespeare et al.	2018	Global	Review / policy analysis	Persons with disabilities	Access and stigma
Trani / Mitra et al.	2011	LMICs	Cross-sectional / poverty analysis	Persons with disabilities	Disability and poverty
New et al. / Thietje & Hirschfeld	2017	Global	Review	SCI population	SCI epidemiology
Cripps et al.	2011	Global	Epidemiological review	SCI population	SCI distribution
Middleton et al.	2012	Global	Cohort study	SCI patients	Survival and rehabilitation outcomes
WHO / ISCoS	2013	Global	Report	SCI population	SCI care systems
LaVela et al.	2023	Global / rehabilitation systems	Qualitative study	SCI patients	Rehabilitation experience
Jesus et al.	2017	Global	Workforce review	Rehabilitation workforce	Human resources for rehabilitation
Ranjbar Hameghavandi et al. / Covell et al.	2024	LMICs	Scoping / meta-epidemiological evidence	Traumatic SCI / SCI outcomes	Challenges and social determinants

Table 2. Thematic Classification of Barriers to SCI Rehabilitation in Low-Resource Settings

Barrier Level	Main Barrier Category	Examples Across Literature	Effects on Rehabilitation Access and Outcomes
System-level	Policy and governance	Weak national rehabilitation strategies, poor integration into health systems, limited prioritization of rehabilitation	Limits planning, funding, and development of coordinated SCI rehabilitation pathways
	Financing	Low public investment, limited insurance coverage, dependence on private payments	Shifts rehabilitation costs to patients and families
	Workforce	Shortage of physiotherapists, occupational therapists, rehabilitation physicians, psychologists, and trained community workers	Reduces service capacity, delays rehabilitation initiation, and weakens follow-up

Barrier Level	Main Barrier Category	Examples Across Literature	Effects on Rehabilitation Access and Outcomes
	Infrastructure	Limited specialized SCI units, inadequate rural services, lack of accessible facilities	Concentrates services in urban centers and restricts access for rural populations
Service-level	Availability	Few rehabilitation centers, limited beds, limited assistive technology services	Creates delayed, incomplete, or absent rehabilitation access
	Coordination	Weak referral systems, poor discharge planning, limited acute-to-rehabilitation linkage	Produces discontinuity between acute care and rehabilitation
	Continuity	Limited follow-up, underdeveloped community-based rehabilitation, lack of long-term monitoring	Increases loss to follow-up and risk of secondary complications
Socioeconomic	Cost burdn	Out-of-pocket payments for therapy, transport, devices, and caregiver support	Causes delayed initiation, reduced attendance, or premature discontinuation
	Transport and geography	Long travel distances, inaccessible transport, rural residence	Leads to missed appointments and inequitable access
	Social support	Dependence on family caregivers, limited community support, poverty	Restricts sustained participation in rehabilitation
Patient-level	Awareness	Limited understanding of rehabilitation benefits and long-term SCI management	Delays care-seeking and reduces engagement
	Beliefs and stigma	Fatalism, disability stigma, cultural perceptions of dependency	Reduces participation and community reintegration
	Psychological adjustment	Depression, reduced motivation, social isolation	Weakens adherence and long-term rehabilitation participation

Table 3. Interaction of Multi-Level Barriers Across the SCI Rehabilitation Pathway

Rehabilitation Pathway Stage	System-Level Influence	Service-Level Consequence	Socioeconomic Effect	Patient-Level Outcome
Acute care	Rehabilitation not fully integrated into acute trauma pathways	Limited early referral or rehabilitation planning	Families begin facing direct treatment and transport costs	Low awareness of need for early rehabilitation
Inpatient rehabilitation	Limited workforce, beds, and specialized units	Restricted access or delayed admission to rehabilitation services	High expenditure for therapy, devices, and caregiver support	Reduced engagement due to financial and emotional strain
Discharge / transition phase	Absence of standardized discharge and referral systems	Weak linkage between hospital and community care	Transport barriers and repeat-visit costs increase	Dropout from care and loss to follow-up
Community reintegration	Limited community-based rehabilitation policy and infrastructure	Few accessible local services or follow-up mechanisms	Continued financial pressure and dependence on family support	Poor adherence, isolation, reduced participation, and preventable complications

The included evidence consistently indicates that SCI rehabilitation in low-resource settings is constrained by barriers that operate across multiple levels of the health system rather than by isolated patient or service factors alone. Across the 22 included studies/sources, the most frequently recurring themes were weak rehabilitation governance, insufficient workforce capacity, limited specialized rehabilitation infrastructure, poor referral coordination, high out-of-pocket expenditure, transport difficulty, inadequate community-based rehabilitation, and sociocultural stigma. These barriers were not distributed randomly across the rehabilitation pathway; instead, they accumulated at key transition points, particularly between acute care and rehabilitation admission, and again between institutional rehabilitation and community reintegration.

System-level barriers represented the most upstream constraints. Several sources emphasized that rehabilitation remains insufficiently embedded within national health strategies in many LMICs, resulting in weak planning, poor financing, and limited workforce development. This structural underprioritization reduces the availability of specialized SCI rehabilitation services and contributes to the concentration of care in urban tertiary centers. Workforce shortages further restrict service capacity, particularly where physiotherapists, occupational therapists, rehabilitation physicians, psychologists, and trained community rehabilitation workers are scarce. These system-level weaknesses shape downstream service delivery by limiting the number of rehabilitation centers, reducing inpatient capacity, and weakening coordinated referral pathways.

At the service level, fragmentation and discontinuity emerged as central findings. Even where rehabilitation services exist, patients may not receive timely referral from acute care, structured discharge planning, or sustained follow-up after leaving institutional care. The transition from acute management to rehabilitation was repeatedly identified as a vulnerable point because SCI patients may survive the initial injury but fail to enter a coordinated rehabilitation pathway. The second major failure point occurs during transition from inpatient rehabilitation to home or community settings. In many

LMIC contexts, community-based rehabilitation remains underdeveloped, meaning that patients often experience abrupt discontinuation of therapy, limited monitoring for secondary complications, and reduced opportunities for functional reintegration.

Socioeconomic barriers strongly modified access at every stage of care. Out-of-pocket payment was a recurrent constraint affecting therapy attendance, assistive device acquisition, transport, follow-up visits, and caregiver arrangements. Transport barriers were particularly important for individuals living in rural or geographically remote areas, where rehabilitation facilities are distant, inaccessible, or unaffordable. These financial and geographic constraints help explain why service availability does not automatically translate into actual service utilization. A rehabilitation center may exist at regional level, but for many patients it remains practically inaccessible because of cost, distance, transport limitations, or dependence on family support.

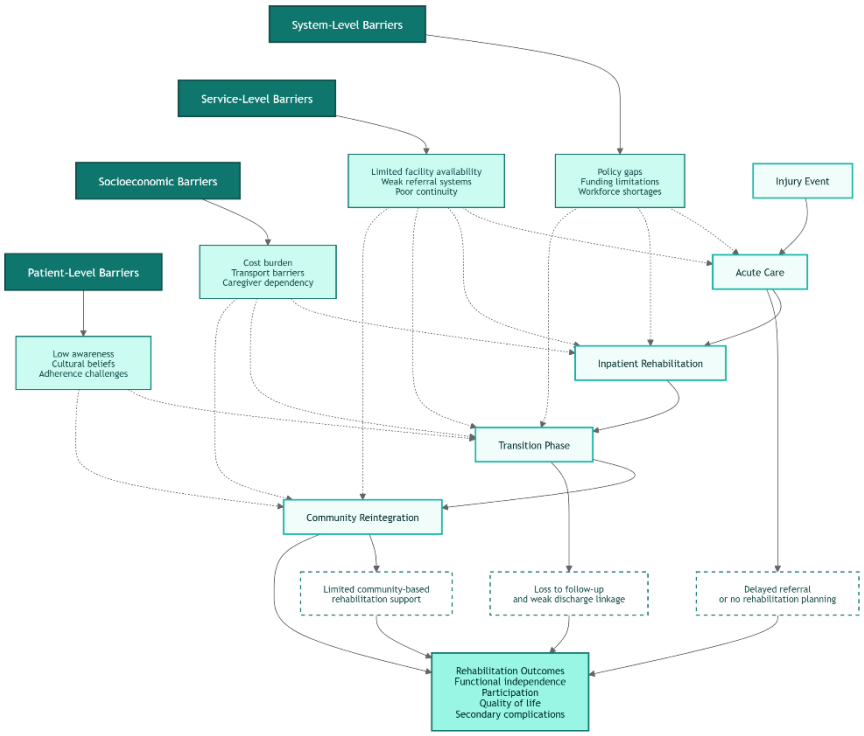

Figure 2 Conceptual pathway framework showing how multi-level barriers interact across the spinal cord injury rehabilitation continuum in low-resource settings. Solid arrows represent the rehabilitation pathway, while dashed arrows indicate the influence of system-level, service-level, socioeconomic, and patient-level barriers on different stages of care.

Patient-level barriers were best interpreted as downstream manifestations of broader structural and socioeconomic conditions. Limited awareness of rehabilitation benefits, poor adherence, stigma, fatalistic beliefs, psychological distress, and reduced motivation were identified across the evidence base; however, these factors should not be viewed as purely individual failings. In low-resource settings, reduced engagement with rehabilitation often reflects accumulated barriers, including inadequate counseling, weak referral systems, financial hardship, social isolation, transport limitations, and absence of local follow-up services. Therefore, patient-level disengagement is more accurately understood as the endpoint of a fragmented rehabilitation system rather than its primary cause.

The synthesis also indicates that South Asian and Pakistani contexts reflect many of the wider LMIC patterns while presenting additional context-specific challenges. Rehabilitation services are commonly concentrated in urban centers, with limited rural outreach and weak integration into primary healthcare systems. Cultural stigma surrounding disability, gender-related constraints, family dependency, and limited community-based support further shape rehabilitation access and participation. These interacting barriers create a layered pattern of exclusion in which SCI rehabilitation may be theoretically available but practically inaccessible for many patients.

DISCUSSION

This structured narrative review synthesized evidence on barriers to spinal cord injury rehabilitation in low-resource settings and found that rehabilitation failure is best understood as a pathway-level systems problem rather than a collection of isolated barriers. Across the included evidence, the most consistent constraints were weak policy integration, inadequate financing, rehabilitation workforce shortages, limited specialized infrastructure, fragmented referral systems, high out-of-pocket costs, transport difficulty, low awareness, stigma, and poor continuity after discharge (5,8,9,17,23,31). These barriers were not confined to a single stage of care; instead, they interacted cumulatively across the rehabilitation continuum, from acute care to inpatient rehabilitation, discharge transition, community reintegration, and long-term participation. The central finding is therefore not merely that SCI rehabilitation is limited in LMICs, but that the pathway itself is structurally discontinuous.

The findings align with global rehabilitation literature showing that rehabilitation remains underprioritized in many health systems despite its central role in long-term disability management and functional recovery (31,32). In high-resource settings, SCI rehabilitation is typically organized through multidisciplinary pathways that link acute management, inpatient rehabilitation, assistive technology provision, psychosocial support, and community follow-up. In contrast, LMIC rehabilitation systems are frequently organized around episodic facility-based care, with weak integration between acute services and long-term rehabilitation support (8,11,38). This creates a critical gap after survival from the initial injury: patients may leave acute care without structured referral, realistic rehabilitation planning, assistive device access, or follow-up mechanisms. The transition from acute care to rehabilitation therefore emerges as one of the most important failure points in the SCI pathway.

Service-level fragmentation further amplifies system-level weaknesses. Even when rehabilitation facilities exist, they are often concentrated in urban tertiary centers, with limited inpatient capacity, inadequate referral coordination, and weak continuity after discharge (14,15,17). Evidence from Nepal and Bangladesh supports this pattern, showing that follow-up and long-term adherence remain difficult after discharge from institutional rehabilitation settings (10,23). These findings indicate that access should not be interpreted simply as the presence of a rehabilitation facility. For SCI patients, meaningful access requires timely referral, affordability, transport feasibility, multidisciplinary input, assistive technology, caregiver education, and continuity into the community. Without these elements, rehabilitation remains technically available but functionally inaccessible.

Socioeconomic barriers were especially important because they converted service gaps into real-world exclusion. Out-of-pocket costs, transport expenses, poverty, and dependence on family caregivers repeatedly limited rehabilitation utilization and follow-up (24,29,34). These constraints are particularly relevant in rural and geographically remote settings, where distance from specialized rehabilitation centers compounds the direct and indirect costs of care. Financial burden also affects patient behavior, making poor adherence appear to be an individual-level problem when it may actually reflect unaffordable therapy, inaccessible transport, and lack of local follow-up. This interpretation is supported by broader disability and rehabilitation literature showing that poverty and disability interact bidirectionally, creating cumulative disadvantage for people requiring long-term care (26,34).

Patient-level factors such as low awareness, stigma, fatalistic beliefs, psychological distress, and reduced motivation were also identified, but these should be interpreted cautiously. In low-resource settings, patient disengagement is often downstream of structural and socioeconomic barriers rather than an independent cause of poor outcomes. For example, lack of rehabilitation knowledge may reflect inadequate discharge counseling, while non-adherence may reflect cost, travel distance, lack of caregiver support, or absence of community-based services. Disability-related stigma and cultural beliefs may further restrict participation, especially in settings where disability is associated with dependency, social exclusion, or gendered barriers to mobility (33). Thus, patient-level barriers should be addressed through

education and psychosocial support, but these interventions are unlikely to succeed unless accompanied by broader system and service reforms.

The South Asian and Pakistani evidence reflects many of the broader LMIC patterns but also highlights region-specific challenges. Rehabilitation services in Pakistan remain concentrated in urban centers, neurorehabilitation capacity is limited, and integration with primary healthcare and community-based rehabilitation remains weak (14,15,17). These structural limitations are intensified by out-of-pocket expenditure, rural-urban inequity, transport barriers, and family-dependent care structures. In such contexts, the development of community-based rehabilitation, structured referral systems, and district-level rehabilitation capacity may be particularly important. Policies that focus only on expanding tertiary rehabilitation units may improve specialized care for a small proportion of patients but will not address the larger continuity gap experienced by rural and socioeconomically disadvantaged populations.

The conceptual framework developed in this review contributes to the literature by mapping barriers across both level and time. System-level barriers shape service availability and coordination; service-level fragmentation increases dependence on private resources and family navigation; socioeconomic hardship restricts rehabilitation utilization; and patient-level disengagement emerges as the downstream consequence of these interacting constraints. This framework shifts interpretation away from isolated barrier lists toward a pathway-based explanation of rehabilitation failure. It also identifies transition points as high-priority intervention targets, particularly discharge from acute care, referral into rehabilitation, and movement from inpatient care to community reintegration.

This review has several limitations. First, as a structured narrative review, it did not include formal risk-of-bias assessment or quantitative pooling, which limits the ability to grade certainty of evidence. Second, included studies varied substantially in design, population, setting, and outcome reporting, restricting direct comparison across sources. Third, English-language restriction may have excluded regionally relevant studies published in local languages. Fourth, because many studies addressed disability or rehabilitation access more broadly, some evidence was included based on applicability to SCI rather than exclusive SCI populations. Despite these limitations, the review provides a coherent synthesis of the available evidence and offers a practical conceptual model for understanding rehabilitation discontinuity in low-resource settings.

Future research should move beyond descriptive identification of barriers and test integrated models of SCI rehabilitation access across different levels of care. Prospective studies are needed to examine patient transitions from acute care to rehabilitation and from rehabilitation to community reintegration, with outcomes including functional independence, secondary complications, participation, quality of life, and service utilization. Implementation research should evaluate low-cost referral pathways, tele-rehabilitation, community-based rehabilitation, caregiver training, and financial protection mechanisms. In South Asia and Pakistan, locally grounded studies are particularly needed to examine rural access, gender-related barriers, district-level rehabilitation capacity, and integration of SCI rehabilitation into primary healthcare systems.

CONCLUSION

Spinal cord injury rehabilitation in low-resource settings is constrained not only by limited service availability but also by discontinuity across the rehabilitation pathway. The evidence indicates that policy gaps, inadequate financing, workforce shortages, fragmented referral systems, out-of-pocket costs, transport barriers, stigma, and low awareness interact across acute care, inpatient rehabilitation, transition phases, and community reintegration. These interacting barriers produce delayed access, loss to follow-up, reduced participation, preventable complications, and poorer quality of life. Improving SCI rehabilitation in LMICs therefore requires a shift from isolated service expansion to coordinated continuum-of-care models that integrate rehabilitation into health systems, strengthen referral and

discharge planning, expand community-based rehabilitation, reduce financial and geographic barriers, and support long-term participation after injury.

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