Heterogeneity and Its Impact on Rehabilitation Outcomes and Interventions for Community Reintegration in People With Spinal Cord Injuries: An Integrative Review

Shikha Gupta, PhD (cand.), MHA, BOTH,¹ Atul Jaiswal, PhD (cand.), MA (Disability Studies), BOTH,¹ Kathleen Norman, PhD, BScPT,¹ and Vincent DePaul, PhD, BScPT¹

¹School of Rehabilitation Therapy, Queen's University, Kingston, Ontario, Canada

Background: Various injury characteristics such as cause, level, severity, and time since injury divide individuals with spinal cord injury (SCI) into many subgroups. The heterogeneity among individuals' injuries and personal characteristics has significant implications for SCI rehabilitation practice, specifically directed toward community reintegration, which is a key goal of rehabilitation interventions for people with disabilities. **Purpose:** This study aims to summarize the evidence on attributes that make the SCI population heterogeneous, the impact of these attributes on community reintegration, and the implications of heterogeneity for rehabilitation interventions directed toward optimizing community reintegration. **Methods:** We used an integrative review approach to conduct this study. MEDLINE, PubMed, CINAHL, EMBASE, Google Scholar, and PsycINFO were searched from inception until May 2017. Out of 670 articles retrieved, 49 provided evidence on the impact of various attributes that make SCI heterogeneous on rehabilitation outcomes related to community reintegration. **Results:** An array of injury-related, personal, social, and environmental factors are associated with various rehabilitation outcomes that affect community reintegration of people with SCI. There is level 1 evidence that social support, self-efficacy, and self-esteem facilitate community reintegration among people with SCI while there is level 5 evidence that presence of psychological or medical complications decreases it. There is lack of clarity on the impact of injury-related factors on community reintegration. **Conclusion:** This integrative review found that social support and individuals' self-efficacy can improve community reintegration of people with SCI. However, evidence regarding the impact of injury characteristics on community reintegration is still underdeveloped. Approaches directed at community reintegration should involve components of psychosocial, physical, and vocational rehabilitation while considering personal and societal aspects of an individual's life. **Key words:** community reintegration, integrative review, rehabilitation interventions, spinal cord injury

Spinal cord injury (SCI), a life-changing event, is medically defined as a traumatic or non-traumatic lesion of the spinal cord causing any degree of neurological impairment and affecting motor, sensory, and/or autonomic functions.^{1,2} The American Spinal Injury Association Impairment Scale (AIS) is a commonly used tool to describe the level of injury. Based on the neurological responses and degree of preservation of motor and sensory functions, the extent of injury impairment is categorized from A to E, where A indicates a state of complete motor-sensory loss in the sacral segments and E indicates normal motor and sensory functions.^{3,4}

Various injury characteristics such as cause, level, severity, and time since injury divide

individuals with SCI into many subgroups, such as traumatic versus nontraumatic, paraplegic versus tetraplegic, complete (impairment A) versus incomplete (impairment B through D), and acute versus chronic. These injury characteristics in turn determine the trajectory of neurological recovery, extent of secondary health conditions, and overall prognosis of the disease.⁵ Hence, individuals belonging to these various SCI subgroups have different rehabilitation needs and outcomes. However, the impact of SCI on one's life is multifaceted and does not solely depend on injury characteristics of an individual.⁶

The aftermath of SCI ranges from premature mortality, morbidity, social exclusion, and loss of independence to full reintegration into previously

Corresponding author: Shikha Gupta, PhD (cand.), MHA, BOTH, School of Rehabilitation Therapy, Queen's University, Kingston, Ontario, K7L 3N6 Canada; email: shikha.gupta@queensu.ca

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enjoyed activities and roles within the family and community. These consequences depend on many factors such as social and community support systems available to an individual and an individual's personal attributes such as self-perception or acceptance of one's disability.^{7,8} Moreover, SCI is not a static condition but rather a process of continuous adaptation where various factors interact with the person's injury to make it a complex phenomenon.⁹ All these aspects have significant implications for SCI rehabilitation practice, specifically directed toward optimizing community reintegration.^{10,11}

Community reintegration, as described by various researchers and the International Classification of Functioning, Disability and Health (ICF) research branch (2015), is a broad term that involves "the assumption or resumption of culturally and developmentally appropriate social roles" and "full inclusion and participation... in the physical and psychosocial environment" or returning to "pre-injury roles and activities."^{10,12(p8),13} Therefore, for the purpose of our study, we adopted a multidimensional definition of community reintegration as described in the seminal literature.¹⁴⁻¹⁶ These dimensions include personal care, physical independence and mobility, exchange of information, social relationships, home life, acceptance and assimilation, education, work, economic life, community and civic life, occupation, residential environment, social support, participation, and overall satisfaction.¹⁷

The importance of community reintegration for people with disabilities has been recognized for many years.^{6-8,10} The purpose of rehabilitation is to ensure that an individual with SCI is empowered to participate in the life situations they consider important and to facilitate an adjustment and return to life within the society after acquisition of a disabling condition.¹⁸ However, evidence is lacking about the most effective approaches to optimize community reintegration of people having SCI. Heterogeneity among those with SCI is one of the various reasons for the limited evidence on effective interventions for community reintegration.¹⁸ Hence, we require a comprehensive understanding of the attributes that affect successful community reintegration of people with SCI in order to design appropriate rehabilitation interventions. In this study, our goal is to describe how people

with SCI may differ with respect to their various injury-related, personal, social, and environmental characteristics and present evidence about the relationship of these characteristics to various rehabilitation outcomes that are related with community reintegration (such as independent living, social adjustment, life satisfaction, or participation).¹³ We then discuss the relevance of this heterogeneity to rehabilitation approaches directed at optimizing community reintegration.

Methods

Study design

We used an integrative review approach to conduct this study, which allowed us to present a comprehensive understanding of the problem to inform evidence-based practice for rehabilitation professionals working for people with SCIs.¹⁹ The steps followed for this integrative review are presented here:

1. *Purpose identification.* The purpose of this study was to find out how various attributes that make SCI population heterogeneous affect successful community reintegration of people with SCI in order to design appropriate rehabilitation interventions.
2. *Literature search.* We systematically searched MEDLINE, PubMed, CINAHL, EMBASE, Google Scholar, and PsycINFO to find pertinent studies that were published until May 2017. The search was updated on August 1, 2018. The terms used for literature search were a combination of medical subject headings and free text terms that included [*spinal cord injur** OR *quadriplegia* OR *paraplegia* OR *tetraplegia*], AND [*community reintegration* OR *participation* OR *social adjustment* OR *independent living*] AND [*rehabilitation*]. These key words varied to some extent depending on the different indexing schemes of included bibliographic databases. We also searched reference lists of the key articles to identify articles that did not emerge in the initial database search. To be included in this study, studies had to focus on the impact of one or more of personal, injury-related, or socio-environmental attributes on

outcomes related to community reintegration among the SCI population. Articles were included if they were empirical studies (ie, involving primary data and directly measuring the outcome of interest within the population of interest), secondary studies involving the analysis of primary research (ie, systematic or literature reviews), or discussion papers. The included studies could have a quantitative, qualitative, or mixed-method design. Apart from published research articles, we also included relevant books, book chapters, or research reports. Commentaries, letters to the editor, opinions, or media articles were excluded. Resources available in languages other than English were also excluded. The study selection process is shown in **Figure 1**. The first author (S.G.) performed the search and reviewed the titles and abstracts of the articles retrieved from the initial database

search. Then, using the inclusion and exclusion criteria, full text of potentially relevant retrieved resources was reviewed by first and second authors (S.G., A.J.) to create the final pool of the articles. Any discrepancies were resolved by the senior authors (K.N., V.D.P.).

3. *Data extraction and evaluation.* The information extracted for data charting included author(s), year of publication, location, study design, study setting, sample size, population characteristics, level of evidence, factors looked at for their impact on community reintegration, and key outcomes or results. Data extraction was performed by two authors (S.G., A.J.).
4. *Data analysis.* Each of the included articles was reviewed according to the criteria for evidence-based medicine by Sackett and colleagues.²⁰ Results were organized according to three categories of factors that have been shown to differentiate persons with SCI from

Figure 1. Study selection process.

one another: (1) injury-related, (2) personal, and (3) socio-environmental factors. For each of the factors, we identified subcategories of characteristics and the relationship of these characteristics to successful community reintegration. We also analyzed relevance of these findings to rehabilitation approaches directed at optimizing community reintegration of people with SCI.

5. *Presentation.* Data were organized under relevant themes and categories and presented in the form of tables and figures. **Table 1** summarizes the characteristics and findings from the 49 individual studies. These studies are organized as per the level of evidence and then organized alphabetically. **Table 2** summarizes the evidence on the relationship of various attributes that make the SCI population heterogeneous with rehabilitation outcomes related to community reintegration. **Figure 2** depicts the synthesis in the form of a model that was developed to comprehensively portray the factors leading to heterogeneity in SCI and approaches to community reintegration.

Results

A total of 670 resources were retrieved, out of which 49 articles presented evidence on impact of various attributes that make the SCI population heterogeneous on outcomes related to community reintegration. Of the 49 individual studies, 27 studies were quantitative, four were qualitative, six were mixed-method, and 12 were review articles (including systematic, scoping, critical, and clinical reviews). Of 27 quantitative studies, 11 were cross-sectional, 10 had prospective or longitudinal research designs, and six collected data retrospectively. The sample mostly included individuals with traumatic SCI, and sample size ranged from 1 to 2,839 participants. There were four studies that offered level 1 evidence (ie, systematic reviews), although no randomized controlled designs were found. Ten studies offered level 2 evidence (ie, longitudinal or prospective cohort studies), five studies provided level 3 evidence (retrospective studies), one study provided level 4 evidence (ie, retrospective chart review), and 14 provided level 5 evidence (ie,

cross-sectional or observational studies and surveys). The rest of the included studies ($n = 15$) were qualitative or descriptive studies and were categorized under level 6 evidence.

Thematic analysis

1. *Heterogeneity due to injury-related factors and its relevance to community reintegration*

- a) *Cause.* Cause of injury divides people with SCI into two groups: traumatic versus nontraumatic. Traumatic causes of injury commonly include motor vehicle accidents, falls, acts of violence, and sports-related activities. The most common nontraumatic causes include spinal degenerative disorders, spinal tumors, stenosis, infections, or other metastatic disorders.^{21,22} Injuries due to nontraumatic causes often lead to incomplete and thoracic level injuries whereas traumatic events lead to more severe injuries or multiple injuries.^{23,24} Whereas motor vehicle accidents remain the main cause of injury worldwide, the number of SCIs due to falls, spinal degenerative diseases, and infections is increasing.^{22,25}

A large number of studies have examined the relationship between cause of injury and rehabilitation outcomes. A majority of the longitudinal studies found that among clinically similar patients matched for demographics, AIS, and level of injury, no significant differences were detected in the rehabilitation functional outcomes between persons with traumatic versus nontraumatic causes of injury, however long-term survival was significantly lower in persons having nontraumatic SCI.²⁶⁻³¹ The occurrence of secondary health conditions that significantly affect quality of life and participation was also not different between persons with traumatic and persons with nontraumatic SCI.³² Within people affected by nontraumatic SCI, Kennedy and Hasson found in their retrospective study that people with an SCI caused by infection had the highest rehabilitation needs and poorer rehabilitation outcomes, particularly in physical health, activities of daily living, and

Table 1. Data charting

Author, country, study design, setting, and level of evidence	Sample size and participants' characteristics	Factors looked at and relevant results and outcomes
<i>Studies with level 1 evidence</i>		
Hitzig et al, 2011 ⁵³ • Canada • Systematic review	<ul style="list-style-type: none"> • $N = 74$ • Electronic databases: MEDLINE/PubMed, CINAHL, EMBASE, and PsycINFO • Time line: 1980 and 2009 • Levels of evidence were assigned using a modified Sackett scale. 	<i>Injury-related, and personal</i> <ul style="list-style-type: none"> • There is lack of clarity on how chronological age (including age of SCI onset) and years post injury affect (individually and in combination) the individual living with SCI over time.
Koh et al, 2013 ⁵⁸ • Singapore and Canada • Systematic review	<ul style="list-style-type: none"> • Databases: PubMed and references in primary article • Criteria: Limited to articles in English and up to December 31, 2011, including case-control and cohort studies and controlled interventional trial 	<i>Injury-related and personal</i> <ul style="list-style-type: none"> • Older age, lower pre-rehabilitation functional status, and cognitive impairment are predictive of poorer functional gains.
Muller et al, 2012 ⁵⁹ • Switzerland • Systematic review (1990-2010)	<ul style="list-style-type: none"> • $N = 69$ • Database: PubMed, EMBASE, PsycINFO, ERIC, CINAHL, and SSCI • Studies in English and on individuals with SCI >13 years of age 	<i>Socio-environmental</i> <ul style="list-style-type: none"> • Social support was positively related to physical and mental health, pain, coping, adjustment, and life satisfaction.
Peter et al, 2012 ⁶¹ • Switzerland • Systematic review (1990-2010)	<ul style="list-style-type: none"> • $N = 83$ cross-sectional studies • Databases: PubMed, EMBASE, PsycINFO, ERIC, CINAHL, and SSCI • Studies in English and on individuals with SCI >13 years of age 	<i>Personal</i> <ul style="list-style-type: none"> • Self-efficacy and self-esteem were consistently associated with positive adjustment indicators such as high well-being and better mental health.
<i>Studies with level 2 evidence</i>		
Adriaansens et al, 2013 ³² • Netherlands • Multicenter longitudinal study • Hospital and community	<ul style="list-style-type: none"> • $N = 224$ who were followed 1 year, 2 years, and 5 years after discharge from inpatient rehabilitation • Mean age: 40 years • 72% males • 77% traumatic SCI • 33% tetraplegia • 53% complete injuries 	<i>Injury-related and personal</i> <ul style="list-style-type: none"> • Occurrence of several secondary health conditions was higher among women and individuals with a complete lesion, tetraplegia, and with a higher body mass index.
Beedie & Kennedy, 2002 ⁷¹ • United Kingdom • Longitudinal study • In-patient national rehabilitation center	<ul style="list-style-type: none"> • $N = 53$ followed until 6 weeks post injury and 42 completed follow-up to 18 weeks • Males: 80% (6 wk) and 86% (18 wk) • Mean age (at injury): 30 years (6 wk, 18 wk) • Level of injury <ul style="list-style-type: none"> • Paraplegia: 60.3% (6 wk), 62.5% (18 wk) • Tetraplegia: 39.7 (6 wk), 37.5% (18 wk) 	<i>Socio-environmental</i> <ul style="list-style-type: none"> • High quality of social support was associated with low hopelessness and depression scores, being more pronounced at week 18 post injury. • Quality of social support was consistently related to depression and to an even greater extent hopelessness.
Charlifue & Gerhart, 2004 ⁶ • UK • Longitudinal study • Community	<ul style="list-style-type: none"> • $N = 178$ • Mean age: 60 years • Male sex: 85% • Mean time since injury: 36 years • Neurological level: <ul style="list-style-type: none"> • Tetraplegia ABC: 33% • Paraplegia ABC: 46% • All D: 21% • Outcome measure used for community reintegration: Craig Handicap Assessment and Reporting Technique (CHART) 	<i>Personal</i> <ul style="list-style-type: none"> • Although there were concurrent relationships between demographic variables of age and neurologic group, neither these factors nor duration of injury appeared to impact change in community reintegration.
Hitzig et al, 2010 ⁹ • Canada • Longitudinal cohort study • Rehabilitation institute	<ul style="list-style-type: none"> • $N = 344$ • Mean age (range): 42.9 (16-80) • 85% male sex • 92% traumatic SCI • Mean years post injury: 12.2 • 64% tetraplegia • 65% incomplete injuries 	<i>Injury-related and personal</i> <ul style="list-style-type: none"> • Aging with an SCI, even across a relatively short period of time, is associated with significant decreases in self-reported health status. • Regardless of years post injury or age, the risk for these secondary health conditions increased over time.

Table 1. Data charting (CONT.)

Author, country, study design, setting, and level of evidence	Sample size and participants' characteristics	Factors looked at and relevant results and outcomes
McKinley et al, 2001 ²⁸ • USA • Longitudinal study with matched block design • Spinal cord injury rehabilitation unit and centers	<ul style="list-style-type: none"> • $N = 86$ nontraumatic SCI matched with 86 traumatic SCI • 68% paraplegia • Avg age of patients, mean (SD): 40 (16.7) • Patients with AIS "C" and "D" accounted for 36% and 41% of the sample. 	<i>Injury-related</i> <ul style="list-style-type: none"> • Patients with nontraumatic SCI can achieve rates of functional gains and community discharge comparable with traumatic SCI.
McKinley et al, 2002 ²⁹ • USA • 7-year prospective review • Spinal cord injury rehabilitation unit	<ul style="list-style-type: none"> • $N = 81$ patients with spinal stenosis induced SCI and 102 patients with traumatic SCI • Mean age: 64.1 vs 44.4 years • Female: 39% vs 20% • Paraplegia vs tetraplegia: 69% vs 46% • Motor incomplete SCI vs incomplete SCI: 100% vs 49% 	<i>Injury-related</i> <ul style="list-style-type: none"> • Patients with clinically similar spinal stenosis induced SCI were noted to achieve rates of functional gain and community discharge comparable with traumatic SCI patients.
McKinley et al, 2011 ³⁰ • USA • 10-year prospective study • Level 1 tertiary university trauma center	<ul style="list-style-type: none"> • $N = 30$ vascular-related SCI compared with 573 traumatic SCI. • Mean age: 57.2 vs 40.0 years • Paraplegia: 87% vs 48% • Incomplete SCI: 70% vs 58% 	<i>Injury-related</i> <ul style="list-style-type: none"> • When matched on age, neurological level, and completeness of injury, rehabilitation functional outcomes were not significantly different between the two groups.
Mingaila & Krisciunas, 2005 ³⁶ • Lithuania • Longitudinal study • Hospital-based rehabilitation setting	<ul style="list-style-type: none"> • $N = 136$ • Mean age: NA • 71% male sex • 15.4% complete tetraplegia • 30.2% complete paraplegia • 25.7% incomplete tetraplegia • 28.7% incomplete paraplegia • Avg. duration of rehab: 68.3 ± 22.5 days 	<i>Injury-related</i> <ul style="list-style-type: none"> • The level of SCI had greater influence on the level of independence of patients with injury in cervical level rather than in thoracic-lumbar level.
Phillips et al, 2012 ⁵⁶ • USA • Longitudinal study • Tele-rehabilitation setting	<ul style="list-style-type: none"> • $N = 111$ • Mean age: 35 years • 78% male • 80% employed • 16% high tetraplegia • Mean FIM score: 84 	<i>Injury-related, personal, and socio-environmental</i> <ul style="list-style-type: none"> • Increasing age and being on Medicaid significantly decreased the likelihood of returning to productive activities while being white and having a higher median income significantly increased this probability.
Scivoletto et al, 2003 ⁴⁷ • Italy • Matched cohort study • Spinal unit of rehab hospital	<ul style="list-style-type: none"> • $N = 284$, divided into Group 1 (<50 years) and Group 2 (>50 years) • Mean age ($\pm SD$): 50.47 ± 19.3 years • 65% male sex • 63% traumatic lesions • 28.5% cervical lesions • 72% thoracic or lumbar lesions • AIS impairment at admission: A: 84; B: 19; C: 129; D: 52 	<i>Injury-related, and personal</i> <ul style="list-style-type: none"> • There is a significant difference in neurologic recovery, function, and specific activities such as walking between younger and older subjects, irrespective of the cause.
<i>Studies with level 3 evidence</i>		
Cosar et al, 2010 ³¹ • Turkey • 12 years retrospective study • In-patient rehabilitation unit of a tertiary research hospital	<ul style="list-style-type: none"> • $N = 165$ in total • Traumatic SCI: 127 <ul style="list-style-type: none"> • Mean age: 37.8 years • M/F: 86/41 • Paraplegia/tetraplegia: 67.9%/32.1% • Nontraumatic SCI: 38 <ul style="list-style-type: none"> • Mean age: 53.9 years • M/F: 21/17 • Paraplegia/tetraplegia: 74.1%/25.9% 	<i>Injury-related</i> <ul style="list-style-type: none"> • There was no significant difference in functional outcomes between traumatic and nontraumatic SCI patients.

Table 1. Data charting (CONT.)

Author, country, study design, setting, and level of evidence	Sample size and participants' characteristics	Factors looked at and relevant results and outcomes
Furlan & Fehlings, 2009 ⁴⁵ <ul style="list-style-type: none"> Canada Cohort study Sample accrued from clinical database 	<ul style="list-style-type: none"> N = 499 (455 younger and 44 older) Mean age (young/old): 32/74 years Male sex (young/old): 83%/93% Major cause of injury (young): Motor vehicle accident (53%) Major cause of injury (old): Falls (57%) % Tetraplegia (young/old): 66%/89% % Complete injuries (young/old): 52%/30% 	<i>Personal</i> <ul style="list-style-type: none"> Mortality rates among older people (>65 years) were significantly greater than those of younger individuals at 6 weeks, at 6 months, and at 1 year following SCI. Older individuals experienced greater functional deficit (based on FIM scores) than younger individuals, despite experiencing similar rates of sensorimotor recovery.
Gupta et al, 2008 ²⁷ <ul style="list-style-type: none"> India Retrospective study Neurological rehabilitation department of a tertiary research center 	<ul style="list-style-type: none"> N = 76 Traumatic: 38 patients <ul style="list-style-type: none"> Mean age: 32.8 years M/F: 34/4 Nontraumatic: 38 patients <ul style="list-style-type: none"> Mean age: 31.1 years M/F: 16/22 	<i>Injury-related</i> <ul style="list-style-type: none"> There was statistically no significant difference in the length of stay and the functional outcome between persons with traumatic and nontraumatic spinal cord lesion after in-patient rehabilitation.
Hatch et al, 2017 ²⁶ <ul style="list-style-type: none"> USA Retrospective chart review Tertiary care institution 	<ul style="list-style-type: none"> N = 759 patients with SCI (535 nontraumatic and 221 traumatic) Mean age: 58 years 64% male sex 58% paraplegia 11% with complete injury 	<i>Injury-related</i> <ul style="list-style-type: none"> Survival after SCI varies depending on SCI cause, with survival better after traumatic SCI than after nontraumatic SCI.
Kennedy & Hasson, 2016 ³³ <ul style="list-style-type: none"> UK Repeated measures, retrospective cohort study Tertiary care, SCI rehabilitation unit 	<ul style="list-style-type: none"> N = 265 patients with nontraumatic SCI Mean age: 53 years 56% male sex 71% paraplegia 72% incomplete injury 	<i>Injury-related</i> <ul style="list-style-type: none"> Individuals with infection-related nontraumatic SCI present with more significant rehab needs and lower rehabilitation outcomes particularly in physical health, activities of daily living, and bowel management domains.
<i>Studies with level 4 evidence</i>		
Krassioukov et al, 2003 ⁵⁵ <ul style="list-style-type: none"> Canada Retrospective chart review Acute care unit at a university hospital 	<ul style="list-style-type: none"> N = 58 (28 elderly, age 60-89 years, and 30 younger, age 17-56 years) Mean age (young/old): 39/73 years Male sex (young/old): 86%/61% Major cause of injury (young): Motor vehicle accident (36%) Major cause of injury (old): Falls (64%) The severity and level of SCI were similar in both groups. 	<i>Injury-related and personal</i> <ul style="list-style-type: none"> Increased incidence of secondary complications (infections, psychiatric disorders, pressure sores, and cardiovascular complications) in the elderly. Mortality rates in elderly and younger individuals with acute SCI were not significantly different.
<i>Studies with level 5 evidence</i>		
Anderson et al, 2003 ⁴¹ <ul style="list-style-type: none"> USA and Canada Cross-sectional study; interviews Hospital and community 	<ul style="list-style-type: none"> N = 216 adults (150 males and 66 females) Mean age at interview: 29 years (range, 24-27 years) Mean age at injury: 14 years (range, 0-18 years) 57% tetraplegia Duration of SCI: 14 years Outcome measure used for community reintegration: Craig Handicap Assessment and Reporting Technique (CHART) 	<i>Injury-related and personal</i> <ul style="list-style-type: none"> Five factors most strongly associated with community integration were education level, employment, income, functional independence, and health status. Factors that were not associated with community integration included sex, age at injury, duration, and level of injury.
Beauregard et al, 2012 ⁶⁷ <ul style="list-style-type: none"> Quebec, Canada Cross-sectional survey Intensive rehab unit 	<ul style="list-style-type: none"> N = 35 Men 80% Average age: 47.6 years (± 17.8 years) Main causes of trauma were motorized vehicle and being hit by an object or falling (40%). AIS: A (23%); B (11%); C (14%); D (52%) 	<i>Socio-environmental</i> <ul style="list-style-type: none"> The most frequently mentioned needs for participants with SCI are SCI specialized health care, income support, equipment and technical aids, general health care, adapted transport, home support, and adapted housing.

Table 1. Data charting (CONT.)

Author, country, study design, setting, and level of evidence	Sample size and participants' characteristics	Factors looked at and relevant results and outcomes
Boschen et al, 2003 ¹⁶ <ul style="list-style-type: none"> Canada Mixed-methods design Community 	<ul style="list-style-type: none"> $N = 134$ community-residing adults with SCI, between 1 year and 5 years post-discharge and not involved in inpatient rehabilitation Quantitative <ul style="list-style-type: none"> $n = 100$ patients Mean age: 40 years M/F: 75%/25% Paraplegia/tetraplegia: 42%/58% Complete/incomplete: 39%/61% Qualitative <ul style="list-style-type: none"> $n = 34$ patients Mean age: 37 years M/F: 71/29% Paraplegia/tetraplegia: 35/65% Complete/incomplete: 41/59% Outcome measure used for community reintegration: Reintegration to Normal Living Index 	<i>Personal</i> <ul style="list-style-type: none"> Locus of control is crucial to subjective quality of life, productivity status, satisfaction with performance of daily activities, and satisfaction with community integration. Social support and peer mentoring were invaluable. Stable health and appropriate pain management were crucial to subjective satisfaction with community integration.
Carpenter et al, 2007 ⁷³ <ul style="list-style-type: none"> Canada Community survey Sample through an SCI-specific service and advocacy organization 	<ul style="list-style-type: none"> $N = 357$ Mean age: 46 years Mean time since SCI: 13 years 68% male Outcome measure used for participation: Open-ended questions to measure participation domains that included social involvement, physical activity, relationships with others, transportation, and community access. 	<i>Socio-environmental</i> <ul style="list-style-type: none"> Respondents identified help and support from family members and friends, availability of publicly funded transportation, advocacy organizations, and special equipment as important factors that contributed in participation in their preferred activities.
Carr et al, 2017 ⁴⁰ <ul style="list-style-type: none"> Australia Mixed-method Community 	<ul style="list-style-type: none"> $N = 270$ for quantitative phase and $N = 8$ for qualitative phase Mean age: 43 years Mean time since injury: 15 years Mean age at injury: 25 Male sex: 81% Paraplegic: 47% Incomplete: 46% Outcome measure used for community integration: Community integration measure (CIM) 	<i>Injury-related, personal, and socio-environmental</i> <ul style="list-style-type: none"> Employment, paid or unpaid, was the strongest independent factor associated with community participation. Time since injury, completeness of injury, secondary conditions, and functional independence were also independently associated.
Geyh et al, 2012 ⁴² <ul style="list-style-type: none"> Switzerland A multi-center cross-sectional study Community 	<ul style="list-style-type: none"> $N = 102$ Mean age: 56.5 years M/F: 74.5%/25.5% Paraplegia/tetraplegia: 61.8%/38.2% Complete/incomplete: 26.5%/73.5% Traumatic/nontraumatic: 86.3%/13.7% Outcome measure used: Reintegration to Normal Living Index (RNL) 	<i>Personal and socio-environmental</i> <ul style="list-style-type: none"> Self-esteem and self-efficacy correlated highly with participation and were the strongest correlates of participation. Participation seemed to be independent of gender, age, level or completeness of injury.
Hampton, 2000 ⁶⁴ <ul style="list-style-type: none"> China Cross-sectional survey Rehabilitation hospital 	<ul style="list-style-type: none"> $N = 100$ in total; participants with traumatic SCI were included Mean age: 34.4 years M/F: 78%/22% Complete/incomplete: 60%/40% 	<i>Personal and socio-environmental</i> <ul style="list-style-type: none"> Self-efficacy beliefs, health status, income, educational level, and time spent on voluntary work were correlated with the quality of life in this population.
Hampton, 2004 ⁶³ <ul style="list-style-type: none"> USA Cross-sectional survey Community based organization 	<ul style="list-style-type: none"> $N = 127$ in total; participants with traumatic SCI were included Mean age: 43 years M/F: 69%/31% Complete/incomplete: 58%/42% 	<i>Personal</i> <ul style="list-style-type: none"> Self-efficacy, perceived social support, perceived health, and age at injury were the major contributors to the prediction of the affective aspect of social well-being of the participants. Gender, ethnicity, and educational level were not significantly correlated with social well-being.

Table 1. Data charting (CONT.)

Author, country, study design, setting, and level of evidence	Sample size and participants' characteristics	Factors looked at and relevant results and outcomes
Hitzig et al, 2008 ⁴⁶ <ul style="list-style-type: none"> Canada Cross-sectional telephone survey Community 	<ul style="list-style-type: none"> $N = 785$, >1 year post injury living in Ontario Mean age: 52 years 76% male sex Years since injury: 13.9 (range, 1-60) 66% incomplete injury 55% paraplegia 81% traumatic cause 	<i>Injury-related and personal</i> <ul style="list-style-type: none"> The odds ratios for cardiac complications, high blood pressure (HBP), and respiratory complications increased per year with age. Complete injuries were associated with bladder infections, pressure ulcers, and AD.
Jørgensen et al, 2017 ³⁵ <ul style="list-style-type: none"> Sweden Cross-sectional study Home and community setting 	<ul style="list-style-type: none"> $N = 123$ individuals Mean age: 63 years 71% male sex Injury levels: C1-L5 AIS: A-D Mean time since injury: 24 years 	<i>Injury-related and personal</i> <ul style="list-style-type: none"> Higher level and more severe SCI exhibited the strongest association with more activity limitations. Activity limitations and life satisfaction were not associated with gender, age, and time since injury.
Lundstrom et al, 2017 ⁵⁰ <ul style="list-style-type: none"> Sweden Cross-sectional telephone survey Regional SCI outpatient center 	<ul style="list-style-type: none"> $N = 73$ 55 men and 18 women Mean age: 63.7 ± 9.4 years Mean time since injury: 36.3 ± 9.2 years Level of injury <ul style="list-style-type: none"> Cervical: 37% Upper thoracic: 19% Lower thoracic: 33% Lumbar: 11% Outcome measure used: PARTS/M-v3 (PARTicipation Survey/Mobility version-3) 	<i>Injury-related and personal</i> <ul style="list-style-type: none"> For those who lived 36-55 years after injury increasing pain, fatigue, spasticity, and decreased muscle strength were negatively affecting participation in activities, especially exercise and active recreation. There were no statistically significant relations between participation in activities and age or time since injury.
Lysack et al, 2007 ⁷⁷ <ul style="list-style-type: none"> USA Cross-sectional survey Community 	<ul style="list-style-type: none"> $N = 136$ individuals with traumatic SCI Females: 38% African American: 41% Mean age: 37 years (range, 18-68 years). Average length of time since injury: 11 years (range, 2 months-45 years). Level of injury <ul style="list-style-type: none"> Tetraplegia: ($n = 62$, 46%) Paraplegia: ($n = 74$, 54%) Outcome measure used: Community Integration Measure (CIM) 	<i>Injury-related, personal, and socio-environmental</i> <ul style="list-style-type: none"> Data suggest a significant relationship ($p < .01$) between perceived environmental barriers and community integration for adults with SCI. Fewer barriers were associated with greater integration. None of the sociodemographic variables (age, gender, ethnicity, marital status, education, current work status, residential locale) or injury variables (injury type, time since injury, injury cause) were significantly associated with the perceived environmental barriers in this sample.
Tonack et al, 2008 ⁵⁷ <ul style="list-style-type: none"> Canada Cross-sectional telephone survey SCI rehabilitation hospital 	<ul style="list-style-type: none"> $N = 2,839$ 76% male sex Mean age at the time of injury: 37.42 Mean duration of injury: 13.9 years Traumatic injury: 630 (80.7%) Nontraumatic injury: 148 (19.7%) Level of injury <ul style="list-style-type: none"> Complete quadriplegia: 13.2% Incomplete quadriplegia: 33% Complete paraplegia: 21.4% Incomplete paraplegia: 33% Secondary health complications: cardiovascular (25.6%), psychological (45%), genitourinary (60%), musculoskeletal (73%) Outcome measure used: Reintegration to Normal Living Index (RNL) 	<i>Injury-related and personal</i> <ul style="list-style-type: none"> With regard to community participation, the presence of psychological complications and number of medical complications were associated with decreased reintegration. Increased time since injury onset, higher health ratings, and being employed were positively related to reintegration to normal living.

Table 1. Data charting (CONT.)

Author, country, study design, setting, and level of evidence	Sample size and participants' characteristics	Factors looked at and relevant results and outcomes
Whiteneck et al, 2004 ⁷⁶ • USA • Cross-sectional and follow-up survey • National SCI Database	• $N = 2726$ • Mean age at injury: 35 years • Male sex: 78%	<i>Socio-environmental</i> • The top 5 environmental barriers to participation and life satisfaction reported by subjects with SCI, in descending order of importance, were the natural environment, transportation, need for help in the home, availability of health care, and governmental policies. • Environmental factors, participation, years post-injury, and gender were the only significant predictors of life satisfaction.
<i>Studies with level 6 evidence</i>		
Barclay et al 2016 ³⁷ • Australia • Qualitative study • Community	• $N = 17$ adults with SCI in the community • Age range: 15-60 years • Time since injury: 5-29 years • Level of injury: Incomplete paraplegia to complete tetraplegia	<i>Injury-related, personal, and socio-environmental</i> • Those with more severe injuries or higher level of impairment were considerably more dependent on others. • Those without compensation had more limited access to paid care and assistance. • Strong social support was identified as important to facilitate reconnection with the community. • Mental health issues significantly impacted on community participation.
Barclay et al, 2014 ⁶⁸ • Australia • Critical review	• $N = 23$ studies • Databases: Ovid Medline, AMED, CINAHL Plus, PsychInfo • Timeline: 2001 to 2013 • Aim: To examine the available evidence on social and community participation following SCI and to examine the factors that influence that participation	<i>Socio-environmental</i> • Adequate personal care assistance, appropriate social support, having adequate specialized equipment, and appropriate occupational therapy input were found to facilitate social and community participation. • Problems with transport, inaccessibility of the natural and built environment, issues with health care services and rehabilitation providers, and pain were identified as barriers.
Burns & Connell, 2012 ⁷⁰ • Canada • Invited review	• Aim: To discuss the challenges of SCI in developing and resource-poor environments • Database or timeline: Not specified	<i>Socio-environmental</i> • Significant disparities persist, with life expectancies of 2 years or less not uncommon for persons living with paraplegia in many developing countries.
Chevalier et al, 2009 ⁶⁰ • UK • Literature review (2001-2009)	• No. of studies included = Not specified • Databases: PubMed, MEDLINE, and EMBASE • Studies in English and on adults with SCI included.	<i>Personal and socio-environmental</i> • Significant predictors of social reintegration were family and informational support, perceived stress, and presence of social barriers.
Dwyer & Mulligan, 2015 ¹⁰ • New Zealand • Review article	• $N = 7$ articles • Databases: Ovid MEDLINE, CINAHL, the Allied and Complementary Medicine Database (AMED), Cochrane Database of Systematic Reviews and PEDro • Timeline: Articles published until 2000	<i>Socio-environmental</i> • Accessibility of the environment, re-establishing self, support, and connections were strong themes for reintegration. • Restricted mobility due to lack of suitable wheelchairs, dependence with transfers, and lack of aids or independence with daily activities such as dressing and eating were barriers to community reintegration.
El-Masry & Haboubi, 2001 ⁴⁹ • UK • Clinical review	• No. of studies: Not specified • Database: Not specified • Timeline: Not specified	<i>Injury-related and personal</i> • Social functioning is significantly better in those <50 years old at onset of injury compared with those ≥50 years old. • Life satisfaction and quality of life are better for those <30 years of age and <30 years post-injury.

Table 1. Data charting (CONT.)

Author, country, study design, setting, and level of evidence	Sample size and participants' characteristics	Factors looked at and relevant results and outcomes
Fritz et al, 2015 ⁶² <ul style="list-style-type: none"> USA In-depth anthropological study 	<ul style="list-style-type: none"> N = 1 Interview with a 28-year-old marine with a service-related C5/C6 SCI 	<i>Personal and socio-environmental</i> <ul style="list-style-type: none"> Management of the social self in interpersonal interactions and public spaces is critical to gaining broader societal acceptance. Meaningful age normative relationships and activities are essential to establish lasting inclusive social connections.
Goodridge et al, 2014 ⁷⁴ <ul style="list-style-type: none"> Canada Qualitative study Community 	<ul style="list-style-type: none"> N = 23 individuals living with traumatic SCI Paraplegia: 13 Male sex: 16 Rural residence: 10 	<i>Socio-environmental</i> <ul style="list-style-type: none"> Availability and accessibility of services was limited in some cases for rural participants. Opportunities to engage in health-promoting activities through a broad range of health and support services were at times limited, particularly by issues of affordability.
Guilcher et al, 2012 ⁷² <ul style="list-style-type: none"> Canada Mixed-method study: measurement tools and key informant interviews Community 	<ul style="list-style-type: none"> N = 14 Median age: 47.5 years (range, 31–75) Median number of years post injury: 18 (range, 4–49 years) Injury at the level of the cervical spine: 8 	<i>Socio-environmental</i> <ul style="list-style-type: none"> Social capital, characterized by intimate relationships in which social and psychological support are provided to help with day to day care needs, was prominent among participants.
Jensen et al, 2013 ⁵⁴ <ul style="list-style-type: none"> USA Scoping review 	<ul style="list-style-type: none"> N = 92 Database: PubMed, CINAHL, and PsycINFO Timeline: Studies published from 1986–2011 	<i>Injury-related and personal</i> <ul style="list-style-type: none"> Many of the secondary conditions identified such as pain, bowel and bladder regulation problems, muscle spasms, fatigue, heart burn, and osteoporosis occur at a higher rate in older than in younger individuals with SCI.
Knox et al, 2014 ⁷⁵ <ul style="list-style-type: none"> Canada Qualitative study Rehabilitation unit 	<ul style="list-style-type: none"> N = 23 health care providers Sample included therapists, physicians, nurses, home care workers and managers working with traumatic SCI clients. 	<i>Socio-environmental</i> <ul style="list-style-type: none"> Health care providers felt restricted in their ability to ensure availability of services. In rural areas, therapy and counseling services were often not available. Parking and transportation barriers severely impacted the accessibility of services.
Lidal et al, 2007 ³⁸ <ul style="list-style-type: none"> Norway & Denmark Literature review 	<ul style="list-style-type: none"> N = 123 A systematic review of literature published from 2000–2006 Databases: PubMed/MEDLINE, AMED, (ISI) Web of Science, EMBASE, CINAHL, PsycINFO and Sociological abstracts database 	<i>Injury-related, personal, and socio-environmental</i> <ul style="list-style-type: none"> Return to work was higher in persons who were injured at a younger age, had less severe injuries, and had higher functional independence.
Øderud, 2014 ⁶⁹ <ul style="list-style-type: none"> Zimbabwe Literature review and qualitative interviews Sample recruited through disabled people's organization in the community 	<ul style="list-style-type: none"> N = 23 Participants: Individuals with SCI living in Zimbabwe, their relatives, and rehabilitation professionals. Database for literature review: PubMed Timeline: 1992 to 2010 	<i>Socio-environmental</i> <ul style="list-style-type: none"> Lack of appropriate wheelchairs and services, limited knowledge about SCI amongst health care staff, limited access to health care and rehabilitation services, loss of employment, and lack of financial resources worsen the daily challenges for individuals living with SCI in low-income countries.
Riis & Verrier, 2007 ⁶⁵ <ul style="list-style-type: none"> Canada Literature review 	<ul style="list-style-type: none"> Databases: MEDLINE, EMBASE, CINAHL, Healthstar Timeline: 1985 to Dec 2005 Aim: To examine the literature describing the cost of outpatient rehabilitation for patients with SCI as well as the effect of funding type on cost and outcome. 	<i>Socio-environmental</i> <ul style="list-style-type: none"> The literature shows a relationship between the availability and type of financial support for outpatient rehabilitation and better outcomes. Insufficient funding may inhibit access to sufficient levels of attendant care to successfully reintegrate into society and the labor market.

Table 1. Data charting (CONT.)

Author, country, study design, setting, and level of evidence	Sample size and participants' characteristics	Factors looked at and relevant results and outcomes
Wee & Lysaght, 2009 ³⁹ • Canada • Mixed-method study • Tertiary referral center	• $N = 24$ • Sex: 9 males and 15 females • Mean age: 63.5 years (range, 20-93 years) • Cause of mobility impairment: SCI, myelopathy such as multiple sclerosis, brain injury, muscular dystrophy, and polio • Outcome measurement used: Participation scale	<i>Socio-environmental</i> • Participants identified adaptive equipment, gait aids, wheelchairs, scooters, and home modifications were most influential for their activities of daily living. • Personality, community and home accessibility, level of impairment, mobility aids, and transportation were among the most influential for their community participation.

Note: AIS = American Spinal Injury Association Impairment scale; NA = not applicable

Table 2. Factors leading to heterogeneity and their impact on rehabilitation outcomes related to community reintegration in people with SCI

Factors leading to heterogeneity	Impact on community reintegration	References (sample size)
<i>Injury-related factors</i>		
<i>Cause of injury</i> • Traumatic versus nontraumatic causes	Long-term survival found to be significantly lower in persons having nontraumatic SCI. No other difference reported in the rehabilitation functional outcomes between those with traumatic vs nontraumatic causes of injury.	26-33 ($N = 8$)
<i>Level and severity of injury</i> • Neurological level of injury (ie, higher tetraplegia, lower tetraplegia, and paraplegia) • Completeness of injury (ie, complete versus incomplete)	Evidence regarding the impact of level and severity of injury on community integration has been mixed. In some studies, higher level and more severe injuries were related with more activity limitations and dependency. However, level or completeness of injury was not directly related to community reintegration or participation.	35-42 ($N = 8$)
<i>Age at injury and duration of injury</i> • Younger with acute injury • Younger with chronic injury • Older with acute injury • Older with chronic injury	Younger age at onset of injury and longer time since injury appeared to be positively correlated with health and activity level, life adjustment, securing employment post injury, and overall social functioning. Health and activity level correlated negatively with increasing age at onset of injury. However, life satisfaction seems to remain unaffected or rather improve as one grows or lives longer with the injury.	9, 35, 41, 42, 45-50 ($N = 10$)
<i>Personal factors</i>		
<i>Demography</i> • Heterogeneity based on age, gender, race, ethnicity, education, marital status, employment, and income	Neither gender nor race were found to be significantly affecting rehabilitation outcomes. Having higher income, employment, and insurance coverage before injury and better education were reported having positive effects on vocational gains after SCI. However, none of the studies reported that these factors were significantly related to rehabilitation outcomes.	9, 32, 38, 41, 45, 46, 48, 53-56 ($N = 11$)
<i>Physical or mental illness and other comorbidities</i> • Presence or absence of physical or psychological comorbidities or secondary health conditions along with SCI.	Presence of psychological and medical complications was related to decreased community participation and reintegration; cognitive impairment significantly predictive of poorer rehabilitation gains.	32, 40, 50, 57, 58 ($N = 5$)
<i>Personal skills and attitude toward disability</i> • Positive attitude and sense of self-efficacy versus low self-efficacy and negative attitude	Self-efficacy and self-esteem are associated with higher well-being and better mental health. Spirituality and purpose in life were found to be the potential determinants of adjustment outcomes in long-term SCI.	16, 41, 42, 59-64 ($N = 9$)

Table 2. Factors leading to heterogeneity and their impact on rehabilitation outcomes related to community reintegration in people with SCI (CONT.)

Factors leading to heterogeneity	Impact on community reintegration	References (sample size)
Environmental factors		
<i>Formal support</i>	Access and availability of formal support or resources such as work benefits or insurance benefits to fund skilled rehabilitation services, assistive devices, and supported employment can facilitate long-term community reintegration after an SCI.	8, 37, 65-70 (N = 8)
<i>Informal support</i>	Social relationships and availability of informal social networks found as one of the most significant factors that improved participation, helped dealing with secondary health conditions, and improved overall management of life with SCI.	16, 59, 63, 64, 71-73 (N = 7)
<i>Geographical variation</i>	Individuals living in rural areas were significantly worse-off with respect to the availability of rehabilitation services and other resources related to accessible housing or transportation than those living in urban areas.	5, 74, 75 (N = 3)
<i>Environmental barriers</i>	Mobility aids, accessible transportation, community access, and home accessibility are identified as significant factors to improve participation in physical and social activities after SCI.	10, 37, 39, 73, 76, 77 (N = 6)

Figure 2. Factors leading to heterogeneity in SCI and approaches to community reintegration.

bowel management, as compared to people with an SCI caused by spinal degenerative disorders.³³

- b) *Level and severity of injury.* The involvement and completeness of neurological level of injury divide people with SCI into many diverse groups. For example, injuries involving high-cervical segments (C1-C4) are the most severe, if neurologically complete, leading to the paralysis of limbs and trunk where breathing is severely affected (ie, higher tetraplegia). In neurologically complete injuries at the thoracic, lumbar, or sacral regions, the muscles of the upper chest, abdomen, trunk, and legs are involved to varying degrees based on the nerve involvement, whereas upper limb and hand functions are usually preserved (ie, paraplegia). Distinct from the matter of neurological level, there is also the extent of neurological completeness to consider. Individuals may have complete injuries (loss of motor, sensory, and autonomic functions below the level of injury) or incomplete injuries (either or both motor and sensory functions are preserved below the neurological level of injury) to varying degrees.³⁴

Evidence regarding the impact of level and severity of injury on community integration has been mixed. In a recent cross-sectional study, a higher level and more severe injury along with spasticity was related with more limitations on activity.³⁵ These injury characteristics in turn were strongly related to the extent of medical complications associated with SCI.³⁵ Mingaila and Krisciunas in their longitudinal study also found that during early phases of rehabilitation, the level of independence achieved for daily activities was much lower in patients with cervical level or complete injuries than in the patients having injury at thoracic-lumbar level or incomplete injuries.³⁶ Barclay and associates found in their qualitative study that individuals with more severe or higher injuries were more reliant on others to assist them to get out of the house and to complete household

tasks for them.³⁷ A literature review also reported better outcomes related to return to work post SCI in those who had less severe injuries.³⁸ Two other mixed-method studies also concluded that level of impairment or completeness of injury were most influential for community participation.^{39,40} However, a cross-sectional survey conducted with 216 adults found that level of injury was not associated with community integration,⁴¹ which was concurrent with another study that found that participation among adults with SCI was independent of level or completeness of injury.⁴²

- c) *Age at injury and duration of injury.* Based on the heterogeneity in age at injury and duration or time since injury, individuals with SCI can be broadly classified into four categories: (a) younger with acute injury (ie, injured at a young age with a recent injury), (b) younger with chronic injury (ie, injured at a young age but sustaining SCI for a long duration), (c) older with acute injury (ie, incurred a recent SCI at an old age), and (iv) older with chronic injury (ie, incurred SCI at an old age and living with it for a long duration).⁴³ However, it must be noted that these are arbitrary distinctions as literature does not provide a clear classification of the acute versus chronic injuries among younger and older adults. In a Canadian study, the age of people living with SCI varied between 18 to 90 years (mean age, 50 years), with duration of injury ranging between 1 to 81 years (mean duration, >18 years).⁴⁴

Although the four subgroups based on age and duration are somewhat arbitrary, there is evidence that these subgroups have different rehabilitation needs and outcomes.^{9,45,46} Examining the effects of age at injury on rehabilitation outcomes related to independence, Scivoletto and colleagues in their matched cohort study found that younger patients showed better neurological recovery and hence a higher level of independence in bowel and bladder management and independent walking.⁴⁷ Another quantitative study suggested that elderly patients with paraplegia were more

likely to have a longer length of stay and lesser functional and neurological status gains than younger individuals with paraplegia and tetraplegia.⁴⁸ El-Masry and Haboubi also reported in their clinical review that younger age at onset of injury and longer time since injury both appeared to be positively correlated with life adjustment, securing employment post injury, and overall social functioning.⁴⁹ However, a cross-sectional study looking at life satisfaction among older adults with long-term SCI concluded that overall life satisfaction improves as one grows or lives longer with the injury.³⁵ A few other cross-sectional studies also found no statistically significant positive relationship between age and time since injury with participation in activities^{42,50} or community reintegration.⁴¹

2. Heterogeneity due to personal characteristics and its relevance to community reintegration

- a) *Demography.* Age, gender, race, ethnicity, education, marital status, employment status, and income divide individuals with SCI into many subgroups. Large international epidemiological studies report that there is a bimodal distribution in the age of onset of SCI with a peak at ages 15 to 29, a relatively low distribution through middle age, and another peak at ages >65 years.^{5,25} The average age of SCI onset is increasing as the incidence of nontraumatic SCI increases with age.^{21,22,51,52} A study from the United States looking at the epidemiological trends of SCI over the last four decades reported that the incidence of SCI is higher for males than females regardless of age, although it reports an overall increasing trend of injury in females.⁵¹

A large number of studies have examined the effects of age on rehabilitation needs and outcomes for people with SCI.^{9,45,46,53} Some investigators suggest that a person with SCI experiences functional declines from aging that are superimposed on their disability.^{32,54} Krassioukov et al in their retrospective chart review ($N = 58$) found that older adults had more

susceptibility toward having comorbidities, which also had an impact on their rehabilitation care pathways.⁵⁵ Having higher income, employment and insurance coverage at the time of injury, and better education were reported as having positive effects on reintegration, especially on vocational gains after SCI.^{38,41,56} However, neither gender nor race were found to be significantly affecting rehabilitation outcomes such as discharge destination, rehabilitation length of stay, or functional status gains.⁴⁸

- b) *Physical or mental illness and other comorbidities.* The presence or absence of physical or psychological comorbidities or secondary health conditions along with SCI make individuals with SCI diverse in terms of their overall health status, and hence this factor has a substantial effect on the rehabilitation gains or outcomes. For example, in their survey of persons with SCI ($N = 2,839$), Tonack et al reported that the presence of psychological and medical complications was related to decreased community participation and reintegration.⁵⁷ Another systematic review reported that cognitive impairment was significantly predictive of poorer rehabilitation gains.⁵⁸ Likewise, patients who experienced complications such as neuropathic and musculoskeletal pain, pressure ulcers, urinary tract infections, bowel problems, autonomic dysreflexia, and depression had higher rehabilitation needs.³² In a survey study ($N = 73$), Lundström et al reported that physical limitations such as pain, fatigue, and spasticity were the major reasons cited by the participants with SCI for not participating in active recreation.⁵⁰ A mixed-method study also found that secondary health conditions and functional independence were independently associated with community participation.⁴⁰
- c) *Personal skills and attitude toward disability.* As with any other group, people with SCI can vary in terms of their personal skills and perceptions and attitudes toward their disability.⁵⁹ These differences may affect their overall adjustment with the

injury and disability.⁶⁰ A systematic review found that higher levels of self-efficacy and self-esteem were associated with higher well-being and better mental health, and spirituality and purpose in life were the potential determinants of adjustment outcomes in long-term SCI.⁶¹ Similarly, a cross-sectional study found that self-efficacy and self-esteem were significant predictors of participation of people living with SCI.⁴² Many other studies involving a diverse group of individuals (such as children, adolescents, veterans with SCI) identified self-efficacy beliefs, locus of control, and self-rated health as significant predictors of life satisfaction, community integration, and quality of life among people with SCI.^{16,41,62-64}

3. *Heterogeneity due to socio-environmental factors and its relevance to community reintegration*

a) *Access to formal support.* Among people with SCI, there is a spectrum with regard to access to resources and social support. At one end of the spectrum, a few have good access to resources and social support; at the other end, some have very limited access to income resources and have little or no social support at all. Based on the social welfare policies, the available funding or community resources vary from individual to individual and affect their access to rehabilitation and subsequently influence life-long outcomes.⁶⁵ For instance, studies from Canada report that individuals who incur SCI at a workplace or as a result of motor vehicle accident often have work benefits or insurance benefits to fund the services of a physical therapist, occupational therapist, a nurse and/or counselor, a psychologist, or a social worker. However, individuals without these benefits have to rely on federal disability support and may face long waiting lists for provincially funded services; many times they are turned away from tertiary outpatient therapy services, with no financially feasible therapy alternative.^{66,67} Similarly, Australian studies found that participants who were in receipt

of compensation were able to get the paid services or care they needed, whereas those without compensation had more limited access to care and assistance and were forced to rationalize how they used their limited resources.^{37,68} It is noteworthy that both of these countries (Canada and Australia) have universal health insurance for patients within hospitals so the challenges in access to resources occur during the post-hospitalization period. However, individuals living in less-developed or low-income countries face more barriers in terms of accessing skilled rehabilitation services, assistive devices, supported employment, education, or health care services that can facilitate long-term community reintegration after an SCI.^{8,69,70}

b) *Availability of informal support.* Evidence on the role of informal social support has been well-established in the successful rehabilitation and community reintegration of people with SCI.^{71,72} A systematic review found social support to have a positive relationship with both physical and mental health such as dealing with depression or pain, adjustment with injury, and overall life satisfaction after having an SCI.⁵⁹ Having positive social relationships also led to reduced likelihood of experiences related to depression, suicidal ideation, psychosocial disability, and posttraumatic stress disorder in people with SCI.⁵⁹ In a number of studies, social relationships and availability of informal social networks were found to be one of the most significant factors that improved participation and helped patients to deal with secondary health conditions and overall management of life with SCI.^{16,63,64,73}

c) *Geographical variation.* The etiology, incidence, prevalence, and demographics of SCI change with respect to the countries and geographical regions within countries. These geographical differences affect the availability of general level of health and social care, which in turn affect the rehabilitation service delivery.⁵ Furthermore, urban-rural differences also affect the availability and

accessibility of rehabilitation services.⁷⁴ For example, a qualitative study of health professionals working with individuals with SCI highlighted that individuals living in rural areas were significantly worse-off with respect to the availability of rehabilitation services and other resources related to accessible housing or transportation than those living in urban areas.⁷⁵

- d) *Other aspects of environment (such as technology access, policy, community characteristics).* People with SCI are also diverse based on the frequency and magnitude of environmental barriers that they do (or do not) face in the community. For example, in a study by Whiteneck and associates, around 80% of participants reported confronting barriers, ranging from minor or infrequent problems to major problems encountered on the daily basis.⁷⁶ Several studies report the influence of environmental factors on the experiences of community reintegration and participation of people with SCI.^{10,37} A qualitative study exploring the factors affecting participation among people with SCI revealed that mobility aids, transportation, and home accessibility were identified as most influential factors.³⁹ In one study, 136 people with traumatic SCI, 41% of whom were African American, were interviewed regarding the relationship between environmental barriers and community reintegration.⁷⁷ The authors found that after natural environment, the topmost barriers perceived by the participants affecting their community reintegration were government policies, transportation, and availability of health care services. In a Canadian survey study ($N = 357$), accessible transportation, community access, and adapted and special equipment were found to be the most significant factors to improve participation in physical and social activities after SCI.⁷³

Discussion

In this study, we examined an array of 10 common factors within three categories that make the population with SCI heterogeneous

and pose significant implications on their rehabilitation needs and outcomes related to community reintegration (Table 2). The available literature on SCI rehabilitation suggests that all these factors affect rehabilitation outcomes to varying extent. There is level 1 evidence that social support, self-efficacy, and self-esteem facilitate community reintegration among people with SCI, whereas there is level 5 evidence that presence of psychological or medical complications decreases it. There is lack of clarity on the impact of injury-related factors on community reintegration. However, it is well established that none of these factors predict community reintegration independently, rather a combination of these factors interact with each other and predict the community reintegration and participation, life satisfaction, and overall quality of life of people with SCI. Therefore, rehabilitation approaches directed at optimizing community reintegration may involve components of physical, psychosocial, and vocational rehabilitation while considering injury-related, personal, and societal aspects of an individual's life.

Implications for rehabilitation service delivery and practice

Overall, literature indicates that community integration of individuals with SCI is a function of their injury as well as their personal and social factors. Consequently, rehabilitation interventions directed toward community reintegration should involve a multidisciplinary approach that may include components of physical, psychosocial, and vocational rehabilitation directed at personal and environment levels.⁷⁸ All three types of rehabilitation approaches are interrelated and have their direct or indirect impact on community reintegration of individuals with SCI⁶⁶ (see Figure 2).

Physical rehabilitation

The heterogeneity manifested through individuals' injury-related and personal characteristics determine the approaches to physical rehabilitation. Depending on these factors, the goals for rehabilitation may be varied and can be achieved through the outpatient or community-based physiotherapy, occupational

therapy services, a fitness center, assistive technology support, and other health services related to urology, obstetrics, gynecology, and sexual health.⁶⁶

For example, in people with less severe injuries or paraplegia, rehabilitation goals can range from maintaining or improving walking, regaining motor control, and facilitating performance in the tasks such as transfers or pushing a wheelchair.⁸ In people with moderate level of injuries such as at the higher thoracic regions, maintaining or improving reach, grasp, and manipulation and ameliorating neuropathic pain can be of importance. Whereas in people with more severe injuries such as higher tetraplegia, attaining independence in breathing and optimizing the management of spasticity would be priorities,^{66,79} in addition to other goals, such as bowel and bladder management, skin care, and pain management, which are common across all groups. Likewise, individuals who are older at the time of injury and have complete or more severe injuries will have different (and probably more) rehabilitation needs than those who are younger and have less severe injuries.

The interventions for improving functioning in important areas such as mobility or bladder functions will also depend on personal and other lifestyle factors. For example, individuals with paraplegia will most likely need to use a manual wheelchair. Attaining independence in breathing, learning to use assistive technologies, and gaining skill in direction of care would be priorities. Across the population of people with SCI, management of spasticity, bowel and bladder management, skin care, and pain management are common goals.⁸

Psychosocial rehabilitation

As discussed earlier, the impact of SCI on a person's life has positive to negative effect that depend partly on the individual and partly on the psychosocial support an individual receives. Therefore, the psychosocial rehabilitation of an individual with SCI often involves a comprehensive approach of building a supportive environment involving family members. It also involves helping patients access and navigate legal, federal, or provincial resources or services available to them, such as those related to accommodation, housing, insurance, health, or other disability benefits.^{80,81}

The extent, nature, and frequency of these interventions will depend on the availability of formal and informal social support such as family or other caregivers and eligibility for funding or other resources (eg, attendant care services).⁷⁸ In cases where family support is available, a comprehensive evaluation is required in which the family's understanding of the injury, expectations for the future, and capacity to provide support and assistance are assessed. Potential caregivers are identified and educated about rehabilitation needs of an individual with SCI and resources available in the community.⁸⁰ In case of individuals living alone, special attention should be given to improve their social participation (eg, health promotion activities in the community) to the maximum extent possible and provide appropriate information to improve their access to various community resources.^{74,82} Social skills and recreational training can be of particular importance to promote physical and psychological health and provide avenues for reintegration into the society.⁸³ Likewise, depending on the individual's mental health needs, rehabilitation interventions may include individualized or group-based programs involving education and counselling, cognitive behavior therapy (CBT), psychotherapy, or a coping effectiveness training (CET) by a psychologist or psychiatrist if needed.⁸⁴

Vocational rehabilitation

Return to work including both vocational and avocational activities has been the key to independent living and has a significant impact on life satisfaction, quality of life, psychological adjustment, and overall community reintegration of people with SCI.^{40,85} Evidence suggests that in addition to health-related issues, various personal, environmental, and policy-related factors affect return to work or initiating employment after incurring SCI.⁸⁶ Therefore, keeping these factors in consideration, several approaches to vocational rehabilitation can be considered for a person for whom return to work is an important goal. Some of these approaches include program-based, supported employment and case-coordinated approaches.⁸⁷ The critical components within each of these approaches will vary according

to individual needs and may include any of the following: job readiness assessments and work preparedness programs to evaluate and improve person's ability to perform the job demands; evaluation of environmental factors such as transportation, accessibility of the work premises, or availability of an attendant; knowing employer's expectations and addressing concerns related to worksite modifications, equipment, or flexible work schedule; and providing ongoing support to both the individual and the employer.^{86,88,89} In situations where return to work or school is not a primary or feasible goal for an individual, efforts can be geared toward improving meaningful engagement in self-directed activities, such as resuming hobbies and home-making activities and exploring options for volunteer work, adapted sporting, or continuing education to improve the feelings of self-worth and increase avenues for social interaction and involvement.^{90,91}

Limitations of the study

One major limitation of this study was that we only included studies that were available in English. Inclusion of studies in languages other than English might have given us more comprehensive results. Another limitation of this study might be related to the generalizability of its findings. Because most of the cited literature came from developed countries, the results might not be completely applicable to the context of less developed or developing

countries. In addition, we conducted our search from six major databases using key words based on our operational definition of community reintegration. Therefore, results we obtained are limited to the articles based on our search strategy.

Conclusion

The available literature on SCI rehabilitation suggests that an array of personal, injury-related, and environmental factors create significant heterogeneity in rehabilitation needs and outcomes among people with SCI that further affect their community reintegration. Understanding the heterogeneity posed by these aspects will help rehabilitation professionals to address the needs and concerns of people with SCI in a holistic but unique way and help them achieve a satisfying life that they desire. This integrative review found that social support and individuals' self-efficacy can improve community reintegration of people with SCI. However, evidence regarding the impact of injury characteristics on community reintegration is still underdeveloped. Therefore, approaches directed at community reintegration should involve components of psychosocial, physical, and vocational rehabilitation while considering personal and societal aspects of an individual's life.

Conflicts of Interest

The authors declare no conflicts of interest.

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