

ORIGINAL RESEARCH

Longitudinal Prediction of Quality-of-Life Scores and Locomotion in Individuals With Traumatic Spinal Cord Injury



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Abstract

Objectives: To examine (1) differences in quality-of-life scores for groups based on transitions in locomotion status at 1, 5, and 10 years postdischarge in a sample of people with spinal cord injury (SCI); and (2) whether demographic factors and transitions in locomotion status can predict quality-of-life measures at these time points.

Design: Retrospective case study of the National SCI Database.

Setting: Model SCI Systems Centers.

Participants: Individuals with SCI (N=10,190) from 21 SCI Model Systems Centers, identified through the National SCI Model Systems Centers database between the years 1985 and 2012. Subjects had FIM (locomotion mode) data at discharge and at least 1 of the following: 1, 5, or 10 years postdischarge.

Interventions: Not applicable.

Main Outcome Measures: FIM—locomotion mode; Severity of Depression Scale; Satisfaction With Life Scale; and Craig Handicap Assessment and Reporting Technique.

Results: Participants who transitioned from ambulation to wheelchair use reported lower participation and life satisfaction, and higher depression levels ($P<.05$) than those who maintained their ambulatory status. Participants who transitioned from ambulation to wheelchair use reported higher depression levels ($P<.05$) and no difference for participation ($P>.05$) or life satisfaction ($P>.05$) compared with those who transitioned from wheelchair to ambulation. Demographic factors and locomotion transitions predicted quality-of-life scores at all time points ($P<.05$).

Conclusions: The results of this study indicate that transitioning from ambulation to wheelchair use can negatively impact psychosocial health 10 years after SCI. Clinicians should be aware of this when deciding on ambulation training. Further work to characterize who may be at risk for these transitions is needed.

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The number of individuals with spinal cord injuries (SCIs) living in the United States is estimated to be 273,000, with 12,000 new

cases annually.¹ Mobility outcomes after SCI vary because of the unique characteristics of each individual and injury. In a survey-based study, Krause et al² found mobility independence was associated with a higher quality of life (QOL) regardless of the actual mode of locomotion (ie, ambulation, wheelchair). Indeed, ambulation in the face of partial paralysis can require greater visual dependence,³ attention demand,⁴ energy expenditure,⁵ and reliance on orthoses or assistive technologies.^{6,7} Individuals with SCI who ambulate may be at a higher risk of

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injury from falling,^{8,9} and walking velocities can be less than those required to cross the street safely.¹⁰

The focus on ambulation training has increased in recent years in both hospital and outpatient settings^{11,12} as well as through fee-based locomotor training programs.^{13,14} However, ambulation training may not be appropriate for everyone who sustains an SCI. Riggins et al¹⁵ found that persons with SCI who transitioned from walking to wheelchair use within 1 year of discharge reported more pain and depression than those who transitioned from wheelchair use to ambulation. Individuals who transitioned from walking to wheelchair also reported worse life satisfaction, self-perceived health, and societal participation.¹⁵ Results of this study suggest that marginal ambulators may be at risk of having a worse QOL if they transition to wheelchair use after discharge; marginal ambulators are individuals who “can walk short distances; may need wheelchair at times, particularly outside the home.”^{16(p.232)} As lengths of stay at inpatient rehabilitation facilities in the United States are decreasing, it is important to focus rehabilitation efforts on optimizing and functional mobility. Furthermore, since an SCI is a lifelong injury, it is important to understand the transitions of individuals between modes of locomotion (ambulation and wheelchair use) and how those transitions affect QOL.

This study examined differences in QOL scores for locomotion groups at 1, 5, and 10 years postdischarge in a sample of people with SCI. The QOL outcomes assessment was influenced by the *International Classification of Functioning, Disability and Health*.¹⁷ Within the *International Classification of Functioning, Disability and Health* framework, changes in mobility—defined as mobility limitation or use of assistive technology to participate in the society—can affect the QOL.¹⁷ We hypothesized that individuals transitioning from ambulation to wheelchair use would have lower QOL scores compared with those who remained in the wheelchair user group or transitioned from the wheelchair to ambulation group over time. We also investigated whether demographic factors and locomotion groups predict QOL measures such as Satisfaction With Life Scale (SWLS), Severity of Depression Scale (SDS), and Craig Handicap Assessment and Reporting Technique (CHART) at all time points.

Methods

National Spinal Cord Injury Database

Data were collected through SCI Model Systems Centers and entered into the National SCI Database. The National SCI Database collects data on approximately 13% to 15% of new SCI cases

that occur annually in the United States. To be included in the database, individuals must (1) be admitted to a model system of care within 1 year of injury, (2) be injured and live within the geographic area of a model system, and (3) exhibit spinal cord neurologic impairment upon admission.¹⁸ The time frame for the data included in this analysis was from February 1985 to November 2012. The National SCI Database more clearly defines an SCI as an acute traumatic lesion of neural elements in the spinal canal resulting in temporary or permanent sensory deficit, motor deficit, or both.¹⁹ Individuals are followed up at year 1 and every 5 years after that until they are lost to follow-up or die. Participant informed consent was obtained before data collection.

Data collection

The National SCI Database was filtered to include only individuals who had FIM data for the mode of locomotion at discharge and at least 1 of 3 time points: 1, 5, and 10 years postdischarge. Change in mode of locomotion was determined using the FIM mode of locomotion at discharge compared with self-reported FIM mode of locomotion at each of 3 time points: 1, 5, and 10 years.²⁰ The FIM mode of locomotion scores for walking, wheelchair use, and equal use of both are 0, 1, and 2, respectively.²⁰ Based on locomotion change or no change, individuals were categorized at each follow-up time point into 1 of 4 groups: AA (ambulation to ambulation), WW (wheelchair to wheelchair), WA (wheelchair to ambulation or wheelchair to both), and AW (ambulation to wheelchair or ambulation to both). WA was considered an improvement in locomotion or a positive transition. AW was considered a decline in locomotion. Locomotion status was maintained if individuals continued to use a wheelchair or ambulate (WW and AA, respectively). We treated each time point as an individual group to identify whether transitions had long-term implications and to see how many individuals with SCI transition at various time points after discharge. Baseline demographic data for this study included age at injury, sex, and race. Additionally, education, employment, and marital status at discharge and each follow-up time point were included.

The CHART,²¹ SWLS,²² Patient Health Questionnaire,²³ and a pain severity scale were used to assess QOL. The CHART is designed to quantify the level of social participation experienced by people with disabilities, with higher values indicating better participation. Four subscales of the CHART were analyzed: physical independence, occupation, mobility, and social integration. These aspects represent the ability of individuals to independently function and exist, effectively move in their surroundings, occupy their time with activities common to their demographics, and participate in social relationships, respectively.²¹ Scores of each subscale, ranging from 0 to 100, were summed to yield a total CHART score. The CHART had test-retest reliability of .80 to .95 for subscale measures²⁴ and had a high value of internal reliability for this study (Cronbach α = .72). The SWLS is a reliable measure of life satisfaction based on 5 subjective questions ranked on a scale of 1 (strongly disagree) to 7 (strongly agree), with higher values indicating better life satisfaction.²² The SWLS had high internal reliability with coefficients ranging from .79 to .87.²² SDS scores were calculated as the sum of individuals' responses to questions 1 through 9 for the highly reliable Patient Health Questionnaire.²³ Lower SDS scores indicate a reduced severity of depression. The Patient Health Questionnaire had high internal consistency of .89 and test-retest reliability of .84.²⁵ SDS had a high value of internal reliability for this study (Cronbach α = .77). The pain severity scale, a reliable

List of abbreviations:

AA	ambulation to ambulation
AW	ambulation to wheelchair or ambulation to both
CHART	Craig Handicap Assessment and Reporting Technique
QOL	quality of life
SCI	spinal cord injury
SDS	Severity of Depression Scale
SWLS	Satisfaction With Life Scale
WA	wheelchair to ambulation or wheelchair to both
WW	wheelchair to wheelchair

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