Special issue article

Relationship of therapeutic recreation inpatient rehabilitation interventions and patient characteristics to outcomes following spinal cord injury: The SCIR rehab project

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Objective: To investigate associations of therapeutic recreation (TR) interventions during inpatient rehabilitation for patients with traumatic spinal cord injury (SCI) with functional, participation, and quality of life outcomes.

Methods: In this prospective observational study, data were obtained from systematic recording of TR services by certified TR specialists, chart review, and patient interview.

Results: TR interventions, including exposure to community settings and leisure activities, add to the variance explained (in addition to the strong predictors of injury classification, admission motor Functional Independence Measure (FIM), and other patient characteristics) in outcomes at the time of rehabilitation discharge (FIM, discharge to home) and at the 1-year injury anniversary (FIM, working or being in school, residing at home, and societal participation as measured by the Craig Handicap Assessment and Reporting Technique (CHART)). They also are associated with less rehospitalization and less pressure development after discharge. In addition, more time spent in specific TR activities during rehabilitation is associated with more participation in the same type of activities at the 1-year injury anniversary.

Conclusion(s): Greater participation in TR-led leisure skill and community activities during rehabilitation is a positive predictor of multiple outcomes at rehabilitation discharge and the 1-year injury anniversary demonstrating that TR activities are associated with a return to a productive and healthy life after SCI. Further research should focus on the impact of TR on longer-term outcomes to determine whether relationships continue or change as persons continue to adapt to their life after SCI.

Note: This is the fourth of nine articles in the SCIR rehab series.

Keywords: Spinal cord injuries, Rehabilitation, Therapeutic recreation, Outcomes, Practice-based evidence, Tetraplegia, Paraplegia

Introduction

World War II left memories of thousands of victims. It is those who survived but sustained a spinal cord injury (SCI), who were the pioneers of organized programs of rehabilitation. Nearly 70 years later, rehabilitation professionals continue to refine approaches to treatment in order to maximize independence of those who sustain an SCI. It is now recognized that comprehensive rehabilitation services yield great benefits. Treatment modalities have advanced beyond early approaches

that first focused on physical therapy (PT) to help individuals learn mobility skills and then occupational therapy (OT), which focused on essential activities of daily living to further independence. Therapeutic recreation (TR) provides activities and experiences that assist individuals in achieving a connection to their former lifestyles. TR promotes a more successful return to school, work, and personal relationships, and helps to minimize dependency on the medical community. The inclusion of TR services in a comprehensive rehabilitation program for persons with SCI advances training beyond basic functional skills to learn how to enjoy life after injury.¹

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TR offers interventions and modalities that include educational sessions, community outings, leisure skill-based activities, and diversional activities, etc.² Physical activity has an effect on functional independence, and involvement in leisure and physical pursuits has been associated with feeling less disabled.^{3–5} The key to successful delivery of TR service is to find recreational pursuits that help individuals incorporate the SCI into their personal and professional worlds. It has been demonstrated that the happy, well-adjusted survivor of SCI is much more apt to be healthy and productive.^{6,7}

Planning and anticipation are a large part of a recreational experience for all individuals; persons with SCI need to learn how to revive successful recreation experiences. As Kleiber and Block⁸ report “Not being able to hunt, to play with one’s children, and to help with cooking during social events were examples of experiences that seemed to threaten the personal identity of our informants” (p. 296). TR professionals assist individuals and their families to acquire necessary skills and resources that enable safe and rewarding leisure experiences. For example, participating in a river rafting trip can be pleasurable, but learning to interact safely with the environment as independently as possible aids in reconnecting with one’s sense of self after SCI.

Evidence that associates TR intervention, including the acquisition of skills and resources that enable a safe and rewarding leisure experience, with outcomes is needed. Health care organizations such as Centers for Medicare and Medicaid Services and the Joint Commission on the Accreditation of Healthcare Organizations have not established standards for TR; the lack of mandate drives individual TR programs within rehabilitation facilities to define their own standard for tracking patient progress and provide justification of their value. A recent review by Stumbo and Pegg⁹ noted “Results of client involvement in TR programs produce the outcome data that is accumulated and is used to demonstrate program effectiveness. The relationship between research and practice, when working well, is symbiotic and improvement oriented” (p. 15).

The SCIREhab project, a multi-center investigation based in the United States, is examining relationships of treatment by multiple rehabilitation specialties, including TR, with outcomes at the time of rehabilitation discharge and the 1-year injury anniversary. In the project’s first stage, Certified Therapeutic Recreation Specialist (CTRS) developed a taxonomy of TR interventions to classify treatment provided during SCI rehabilitation. This taxonomy formed the foundation of an electronic documentation system in which clinicians recorded details of treatment provided

during each TR session. It included six major activities delivered during individual or group sessions, as well as time that patients spent in classes or clinics led by a CTRS and time that CTRSs spent in interdisciplinary conferences on patient’s behalf.¹⁰ Gassaway *et al.*¹¹ used TR taxonomy data to describe treatment during inpatient rehabilitation and the relationships of patient characteristics with treatment time. The investigators found a significant difference in time spent in each TR intervention among four neurologic injury groups. Patients with Association Impairment Scale (AIS) D, regardless of neurological level of injury, were grouped together; patients with AIS A, B, and C were assigned to one of three groups: high tetraplegia (C1–4), low tetraplegia (C5–8), or paraplegia (T1 and below). Patients with AIS D injuries spent significantly less time in leisure skill work in the rehabilitation center and on outings than patients with AIS A, B, and C injuries. Patients with tetraplegia A, B, C spent more time than patients with paraplegia A, B, C in community event outings.¹¹ These findings suggest that level and completeness of injury influence the selection of TR interventions and the frequency of participation. There is, however, a paucity of evidence regarding relationships of TR interventions with outcomes.

The large sample size in the SCIREhab study provides a unique opportunity for a comprehensive examination of factors associated with functional, participation, recreation, and quality of life outcomes for people with SCI. More overall time spent in TR, as quantified by total hours over the rehabilitation stay, is significantly associated with many outcomes: higher scores on the CHART social integration, occupation and mobility dimensions, higher life satisfaction, and at the time of the 1-year injury anniversary: more residing at home, more likely to be working or in school, less rehospitalization, and less development of pressure ulcers after rehabilitation discharge. These findings are presented in the Whiteneck¹² (first article) in this series.

The current paper has three purposes. The first is to examine associations of patient characteristics (demographic and injury-related) with functional, residential, participation, quality of life, utilization, and secondary complication outcomes achieved at discharge from inpatient rehabilitation and at 1-year post-injury. The second purpose is to examine the added contribution of type and quantity of TR interventions to the variance in outcomes explained by patient characteristics. The third purpose is to explore how focusing on specific types of activities, e.g. sports, horticulture, etc. during rehabilitation is associated with participation in these activities at 1-year post-SCI.

Methods

The practice-based evidence research methodology^{13,14} used in the SCIREhab study has been described previously and is summarized in the first article of this SCIREhab series.¹²

Study sample and facilities

The SCIREhab project enrolled patients who were 12 years of age or older, gave (or whose parent/guardian gave) informed consent. Each patient was admitted to one of six facilities (Craig Hospital, Englewood, CO; Shepherd Center, Atlanta, GA; Rehabilitation Institute of Chicago, Chicago, IL; Carolinas Rehabilitation, Charlotte, NC; The Mount Sinai Medical Center, New York, NY; and MedStar National Rehabilitation Hospital, Washington, DC) SCI unit for initial rehabilitation following traumatic SCI from the fall of 2007 through December 31, 2009.

Patient data

Patient demographic and injury information were abstracted from the medical record for 1376 patients in two ways. The first was as part of the National Institute on Disability and Rehabilitation Research SCI Model Systems Form I, which contains information on injury through community discharge; the second from a database designed specifically for the SCIREhab study. The International Standards of Neurological Classification of SCI (ISNCSCI) and its American Spinal Injury Association Impairment Scale (AIS)¹⁵ were used to describe the neurologic level and completeness of injury. The Functional Independence Measure (FIM®) served to describe a patient's functional independence in motor and cognitive tasks at admission.¹⁶ The Comprehensive Severity Index (CSI®), which is a disease-specific measure to quantify how severely ill the patient was throughout the rehabilitation stay, was used as the measure of medical severity.¹⁷⁻¹⁹ All patient characteristics are listed in the Introductory paper in this series¹² (Table 1) and include, in addition to the FIM and CSI scores, age, gender, marital status, race, occupation status at injury, payer, primary language, body mass index (BMI) categorized as overweight (BMI ≥30) and not overweight, ventilator use at the time of rehabilitation admission, etiology of injury, whether the injury was work related, and the number of days that elapsed from date of spinal injury to rehabilitation admission.

TR treatment data

CTRSs documented detailed information about treatment provided during each TR session beyond what

Table 1 Treatment variables: rehabilitation LOS, time spent in TR activities, and number of session of activity types

	SCIREhab study sample <i>n</i> = 1032, Mean (SD)
Length of rehabilitation stay – days	55.7 (36.6)
TR hours of specific treatments	
Initial assessment	0.4 (0.5)
Leisure education and counseling	2.5 (2.0)
Leisure skills in center	4.8 (4.8)
Outing – leisure skills	1.5 (3.9)
Outing – community	6.2 (7.3)
Outing – camping/hunting	0.8 (6.3)
Interdisciplinary conference	1.3 (1.7)
# Sessions of TR activity types	
Sports/aquatics	2.0 (2.4)
Outdoors (other than sports)	0.7 (1.2)
Creative expression	1.4 (2.4)
Horticulture	0.6 (1.3)
Indoor/other	1.4 (2.1)

was documented in traditional medical record by inputting information into handheld personal digital assistants (PDAs) after each patient encounter. This process has been described previously.^{10,11} After each TR session, CTRSs input the date/time, type(s) of intervention activity/treatment and activity-specific details, including number of minutes spent in each TR activity. Hours spent in each activity were included as independent variables in regression models predicting outcome; in addition, for select outcomes the number of TR treatment sessions that included sports or aquatics, outdoor activities, gardening, and creative expression activities were included. The TR interventions collected are categorized in Table 1.

Outcomes

Outcome measures were obtained at the time of rehabilitation discharge and at the 1-year injury anniversary. These outcomes and the processes to obtain them are described in detail in the first article in this SCIREhab series.¹² The SCIREhab study utilized standardized information collected by SCI Model Systems, Form I (during rehabilitation) and Form II (1-year anniversary).^{15,20} An additional, project-specific interview was conducted to supplement the Form II information. All interviewers were trained in the interview process and had experience conducting telephone interviews with persons with SCI. Outcomes at the time of rehabilitation discharge include discharge location (home or elsewhere) and the discharge FIM motor score. All FIM data were Rasch-transformed as described in the first article in this series.¹² Outcome measures derived

primarily from the Form II interview conducted at the 1-year injury anniversary included: the FIM motor score, Diener Satisfaction With Life Scale (SWLS),²¹ mood state as measured by the Patient Health Questionnaire – brief (9-question) version (PHQ-9),²² place of residence, whether the person was working or in school, and selected subscales from the Craig Handicap Assessment and Reporting Technique (CHART)^{23–25} including Physical Independence, Social Integration, Occupation, and Mobility. The occupation subscale includes a component for estimated amount of time spent in recreation; this component was used as an additional separate outcome. The presence of a pressure ulcer at the time of the 1-year interview and rehospitalization between rehabilitation discharge and the interview date were included from the project-specific interview. Also taken from that interview was information on participation in any competitive or recreational sports, creative expression activities such as music or art, outdoor recreational activities, or in gardening.

The Form II interview was completed with 85% of persons enrolled; the project-specific interview was conducted with 91%. Interview questions were asked in a sequential manner; however, some respondents may not have had an answer for each question or may have fatigued prior to the end of the interview. In addition, when a proxy completed the interview the satisfaction with life questions were not asked. Therefore, there is variation in sample sizes for specific outcomes based on interview responses, from 1032 to 745.

Data analysis

Regression analysis was used to predict outcomes at discharge and 1-year post-injury. Ordinary least-squares linear regression²⁶ was used for outcomes that are continuous in nature and logistic regression for dichotomous (yes/no) outcomes (discharge location – home, and at the time of injury anniversary: work/school, rehospitalization, pressure ulcer, and participation in leisure activities).²⁷ A stepwise selection procedure was used to identify the significant predictors for the model; independent variables with $P < 0.05$ are considered significant predictors. Three groups of independent variables were allowed to enter regressions, in three steps: (1) all patient demographic and injury characteristics, (2) treatment variables that included time spent in TR activities and rehabilitation length of stay (LOS) (Table 1), and (3) rehabilitation center where treatment took place (represented by a series of dummy variables). For linear regressions, the R^2 parameter expresses the amount of variation in the

outcome (dependent variable) that is explained by the independent variables jointly, and thus the strength of the model; the adjusted R^2 reduces the unadjusted R^2 , penalizing models that have a greater number of predictors. R^2 values range from 0.00 (no prediction) to 1.00 (perfect prediction); values that are closer to 1.00 indicate better fitting models. For logistic regression, the Maximum Re-scaled R^2 (Max R^2), also known as the Nagelkerke Pseudo R^2 or Cragg and Uhler's R^2 , is reported as a measure of the strength of the model.²⁸ This value is scaled the same as the R^2 (0.00–1.00) and reflects the relative strength of the predictive logistic model. In addition for logistic regression, discrimination was assessed by using the area under the receiver operator characteristic curve (c) to evaluate how well the model distinguished persons who did not achieve an outcome from those who did. Values of c that are closer to 1.00 indicate better discrimination.

For each equation, the adjusted R^2 (linear regression) or the c statistic and the Max R^2 (logistic regression) are reported, first for the prediction of the outcome with only significant patient characteristics included as independent variables (Step 1). Next, the same statistics are reported for the combination of significant treatment variables and patient characteristics (Step 2). Finally, to determine the added impact of rehabilitation center, in Step 3 the dummy variables indicating the center where the person was rehabilitated were added to the model (in addition to the significant treatment and patient variables) and the adjusted R^2 or c statistic/Max R^2 reported. The change in the adjusted R^2 or c statistic/Max R^2 as the treatment variables and then the center variables were added indicates the additional explanation contributed by these components. For all outcome models, parameter estimates based on the regressions, including significant patient and treatment variables, but not center are reported, indicating the direction and magnitude of the association between each independent variable and the outcome. In the linear regression models, semi-partial Omega²s are reported, which indicate the portion of the variance in the dependent variable that is associated uniquely with the predictor variable. For the logistic regressions, odds ratios (OR) are reported to indicate the magnitude of the association of the predictor variable with the outcome. For continuous predictor variables, an OR of 2 indicates that for each unit increase in the independent variable, the odds of the outcome occurring doubles, and an OR of 0.5 indicates the odds of the outcome occurring is cut in half. In all regression models, the P value associated with each significant predictor also is reported.

Results reported here are for the 1032 individuals in the “primary analysis” subset – a randomly selected 75% of the 1376 enrolled in the SCIREhab study; the regression models developed for this subgroup were tested using the validation subgroup, which contained the remaining 25% of individuals. For linear outcomes the relative shrinkage of the original model's R^2 that included all patient and treatment variables as the independent variables was compared to the R^2 for the same outcome using the 25% sample and *only* the significant variables from the original model.²⁹ A relative shrinkage (difference in R^2) of <0.1 was considered to be a well-validated model. (For instance, an original adjusted R^2 of 0.71 is reduced to 0.68; $(0.71-0.69)/0.71 = 0.04$; $0.04 < 0.10$.) Validation was considered to be moderate when the relative shrinkage was between 0.1 and 0.2 and models were considered to be validated poorly if the relative shrinkage was >0.2 . For dichotomous outcomes the P -value for the Hosmer–Lemeshow (HL) goodness of fit test for the original model was calculated both for the original model and for its replication in the validation sample. Models validated well if the HL P -value was >0.1 for both, which indicates no evidence of lack of fit in either model. Models were considered to validate moderately well if the HL P value was 0.05–0.1 for one or both models, indicating some evidence of lack of fit, and to validate poorly if the HL P value was <0.05 for one or both models (lack of fit in one or both of the models).

Results

Patient characteristics

The SCIREhab sample (1376) was divided into two parts using random selection: 1032 (75%) into a primary analysis subset and 344 (25%) into a validation subset. There was equal representation by level and completeness of injury, treatment center, and availability of follow-up interview data and no significant differences on any dependent or independent variables used in the regression models. The first paper in this SCIREhab series describes patient demographic and injury characteristics¹² (Table 1). The sample was 81% male and the average age was 38 years (SD) 17. The majority of subjects were White (71%), 38% were married, most were not obese (82% had a BMI of <30) and 66% were employed at the time of injury. The causes of injury included vehicular crashes (49%), falls (25%), sports and violence (11% each), and others (15%). The motor FIM score at admission was 24 (SD 11) and the cognitive score was 29 (SD 6). These raw FIM scores were Rasch-transformed; the mean transformed motor FIM

score at admission was 18 (SD 13) and the cognitive score was 74 (SD 18).

Treatment time

CTRSs documented treatment provided to 967 of the 1032 SCIREhab patients (94%) within the five TR activities (including three types of outings), during 14 391 sessions. Patients received 18 hours (mean) of TR (range, 0–125, SD 16, median 15 hours). Below we discuss associations with each outcome using time spent in specific TR activities as the predictor variables.

Associations of TR activities with outcomes at rehabilitation discharge and the 1-year injury anniversary

FIM motor score at rehabilitation discharge

Patient characteristics predict 65% ($R^2 = 0.65$) of the variation in discharge motor FIM score (see Table 2). Injury grouping (patients with AIS A, B, or C injuries have lower motor FIM scores than patients with AIS D) and the admission motor FIM score are the strongest predictors. Older age, higher medical severity (as measured by the CSI), longer time from injury to rehabilitation, and BMI ≥ 30 are associated with lower discharge motor FIM scores. The addition of TR treatment variables increases the R^2 only slightly (to 0.67). More time spent on leisure skill outings and attending classes led by CTRSs is associated with higher scores as is more time that CTRSs spend in patient assessment. Adding rehabilitation center to the model only increases the R^2 to 0.70.

FIM motor score at anniversary

Patient characteristics, TR treatment variables, and rehabilitation center explain about half of the variation in the motor FIM score 1 year after injury ($R^2 = 0.53$) (see Table 2). Again, injury group and the admission motor FIM score explain most of this variation; the only significant TR intervention is time spent in assessment.

Discharge location

Most patients (90%) were discharged to home (see Table 3). Patient and treatment predictors of likelihood of discharge to home (c statistic = 0.77, Max $R^2 = 0.20$) include higher admission motor FIM, more time spent in TR-led community outings, and assessment. Older age, Black or Hispanic race, and higher admission cognitive FIM scores are associated with greater likelihood of discharge to locations other than home. The addition of rehabilitation center to the model increases the c statistic from 0.77 to 0.81 and the Max R^2 to 0.25.

Table 2 Prediction of motor FIM* at discharge and 1-year post-injury

Outcome	Motor FIM* at discharge			Motor FIM* at 1 year		
Observations used		826			796	
Step 1: Pt characteristics: adj. R^2		0.65			0.51	
Step 2: Pt characteristics + treatments: adj. R^2		0.67			0.52	
Step 3: Pt characteristics + treatments + center identity: adj. R^2		0.70			0.53	
Independent variables**	Parameter estimate	P value	Semi-partial Omega ²	Parameter estimate	P value	Semi-partial Omega ²
Neurological group	–	<0.001	0.046	–	<0.001	0.072
C1–4 ABC	–12.748	<0.001	–	–27.871	<0.001	–
C5–8 ABC	–9.529	<0.001	–	–21.530	<0.001	–
Para ABC	–3.790	<0.001	–	–17.565	<0.001	–
All Ds (Reference)	0.000	–	–	0.000	–	–
Admission FIM motor**	0.449	<0.001	0.075	0.573	<0.001	0.037
Comprehensive Severity Index	–0.046	<0.001	0.006	–0.095	<0.001	0.012
Days from trauma to rehabilitation admission	–0.060	<0.001	0.016	–0.137	<0.001	0.023
Age at injury	–0.057	0.003	0.003	–0.186	<0.001	0.013
Highest education achieved	–	0.006	0.003	–	0.024	0.003
High school	2.081	0.001	–	3.918	0.009	–
College	1.573	0.042	–	4.119	0.019	–
<12 years/other/unknown (reference)	0.000	–	–	0.000	–	–
BMI ≥30	–2.305	<0.001	–	–	–	–
Primary payer	–	0.023	0.003	–	–	–
Medicare	–1.832	0.110	–	–	–	–
Medicaid	–1.611	0.018	–	–	–	–
Worker's compensation	0.666	0.430	–	–	–	–
Private insurance/pay (reference)	0.000	–	–	–	–	–
Rehabilitation length of stay	0.036	0.001	0.004	–	–	–
TR hours of specific treatments	–	–	–	–	–	–
Classes provided by CTRSS	0.933	0.010	0.002	–	–	–
Initial assessment	2.360	<0.001	0.007	4.212	0.001	0.007
Outing – leisure skills	0.134	0.037	0.001	–	–	–
Interdisciplinary conference	–0.313	0.033	0.001	–	–	–

*Motor FIM was Rasch-transformed.

**All patient variables listed in Methods and treatment variables listed in Table 1 except # sessions of TR activity types were allowed to enter the models. Only statistically significant predictors are reported here; a missing variable name means that the variable did not predict any of the outcomes in this table; a blank cell means that the variable was not a significant predictor for the outcome examined.

Table 3 Prediction of discharge location, place of residence at 1-year anniversary, and working or being in school at 1-year anniversary

Outcome	Discharged to home			Reside at home at 1 year			Work/school at 1 year		
Observations used	826: Yes = 742, No = 84			812: Yes = 768, No = 44			791: Yes = 228, No = 563		
Step 1: Pt characteristics: $c/\text{Max } R^2$	0.75/0.17			na			0.81/0.32		
Step 2: Pt characteristics + treatments: $c/\text{Max } R^2$	0.77/0.20			0.69/0.06			0.81/0.33		
Step 3: Pt characteristics + treatments + center identity: $c/\text{Max } R^2$	0.81/0.25			0.70/0.08			0.82/0.34		
Independent variables*	Parameter estimate	Odds ratio	<i>P</i> value	Parameter estimate	Odds ratio	<i>P</i> value	Parameter estimate	Odds ratio	<i>P</i> value
Neurological group									
C1–4 ABC							–	–	<0.001
C5–8 ABC							–2.092	0.123	<0.001
Para ABC							–1.246	0.288	<0.001
All Ds (reference)							–0.483	0.617	0.083
Admission FIM motor-Rasch transformed	0.053	1.054	<0.001				0.000	–	–
Admission FIM cognitive-Rasch transformed	–0.015	0.985	0.037						
Age at injury	–0.028	0.973	<0.001				–0.025	0.975	0.004
Race	–	–	0.004				–	–	0.039
All other minorities	–0.539	0.584	0.318				–0.572	0.564	0.145
Black	–0.889	0.411	0.001				–0.567	0.567	0.023
Hispanic	–1.352	0.259	0.015				**	**	**
White (reference)	0.000	–	–				0.000	–	–
Occupational status at injury									<0.001
Unemployed/other							–0.887	0.412	0.025
Student							1.533	4.630	<0.001
Retired							–0.389	0.678	0.508
Working (reference)							0.000	–	–
Highest education achieved							–	–	<0.001
High school							0.169	1.184	0.550
College							0.961	2.613	0.003
<12 years/other/unknown (reference)							0.000	–	–
Primary payer							–	–	0.002
Medicare							–0.925	0.396	0.146
Medicaid							–0.728	0.483	0.009
Worker's compensation							–0.956	0.384	0.006
Private insurance/pay (reference)							0.000	–	–

Continued

Table 3 Continued

Outcome	Discharged to home			Reside at home at 1 year			Work/school at 1 year		
	Parameter estimate	Odds ratio	P value	Parameter estimate	Odds ratio	P value	Parameter estimate	Odds ratio	P value
Independent variables*									
Rehabilitation length of stay									
TR hours of specific treatments:									
Initial assessment	0.776	2.174	0.031			0.001			
Leisure education and counseling				0.286	1.330	0.002			
Outing – community	0.047	1.048	0.038				0.033	1.033	0.011

*All patient variables listed in Methods and treatment variables listed in Table 1 except # sessions of TR activity types were allowed to enter the models. Only statistically significant predictors are reported here; a missing variable name means that the variable did not predict any of the outcomes in this table; a blank cell means that the variable was not a significant predictor for the outcome examined.

**Hispanic was combined with "all other minorities".

Residential location at anniversary

Patient variables are not significant in this model. Two treatment variables explain a very moderate amount of variation (c statistic = 0.69, Max R^2 = 0.06). More time spent in TR leisure education and counseling is associated with greater likelihood of residing at home, and longer rehabilitation LOS is associated with less. Adding rehabilitation center to the model increases the c statistic slightly (to 0.70) (see Table 3).

Work/school at anniversary

Most of the variation seen in the work/school outcome is explained by patient characteristics (c statistic = 0.81); TR treatments and rehabilitation center add little (c statistic increases to 0.82) (see Table 3). Persons who are older, black, unemployed prior to injury, and have tetraplegia are less likely to be working or in school, as are persons with Medicaid or worker's compensation as their primary payer. Individuals who have a college education or were students before injury are more likely to be working or in school after injury. The only significant treatment variable was more time spent in community outings, which was positive.

Societal participation (CHART)

Tables 4A and 4B contain regression models that include patient characteristics and TR treatments as the independent variables to predict the four dimensions of the CHART and the recreation subscore of the Occupation dimension. The R^2 for the model predicting Physical Independence is 0.43; models for Social Integration (R^2 = 0.12) and Mobility (R^2 = 0.29) are less predictive (Table 4A). Younger age and higher admission motor FIM, education (college) are significant positive predictors of all three dimensions. AIS D injury type is associated with higher Physical Independence and Mobility scores than are AIS A, B, or C injuries, regardless of motor level. Black race (compared to White as the reference group) is associated with lower Physical Independence, Social Integration, and Mobility scores. Payer is a significant predictor in all models: workers compensation is associated with lower Physical Independence scores and Medicaid with lower Social Integration and Mobility scores (compared to private insurance as the reference group). Higher cognitive FIM score on admission is associated with higher Social Integration and Mobility scores. The explained variance increases only slightly with the addition of treatment variables. More time in TR-led community outings is associated with higher Social Integration and Mobility scores and more time in leisure education and counseling is associated with higher Physical

Table 4A Prediction of social participation

Outcome:	CHART: Physical Independence			CHART: Social Integration			CHART: Mobility		
Observations used			792			771			781
Step 1: Pt characteristics: adj. R^2			0.41			0.12			0.28
Step 2: Pt characteristics + treatments: adj. R^2			0.43			0.12			0.29
Step 3: Pt characteristics + treatments + center identity: adj. R^2			0.44			0.14			0.29
Independent variables*	Parameter estimate	P value	Semi-partial Omega ²	Parameter estimate	P value	Semi-partial Omega ²	Parameter estimate	P value	Semi-partial Omega ²
Neurological group	–	<0.001	0.030				–	<0.001	0.015
C1–4 ABC	–28.115	<0.001	–				–13.300	<0.001	–
C5–8 ABC	–14.035	0.001	–				–7.066	0.015	–
Para ABC	–6.693	0.055	–				–6.331	0.008	–
All Ds (reference)	0.000	–	–				0.000	–	–
Admission FIM motor - Rasch transformed	0.900	<0.001	0.031	0.175	0.003	0.009	0.310	0.001	0.010
Admission FIM cognitive - Rasch transformed				0.091	0.027	0.004	0.102	0.020	0.004
Comprehensive Severity Index	–0.117	0.003	0.006						
Days from trauma to rehabilitation admission	–0.275	<0.001	0.035				–0.159	<0.001	0.031
Traumatic etiology	–	0.007	0.007						
Medical/surgical/other	–7.573	0.183	–						
Violence	–3.323	0.409	–						
Sports	–12.514	0.001	–						
Fall	–0.330	0.907	–						
Vehicular (reference)	0.000	–	–						
Age at injury	–0.316	<0.001	0.009	–0.271	<0.001	0.019	–0.472	<0.001	0.051
Marital status is married				7.515	<0.001	0.021	3.667	0.041	0.003
Race	–	0.013	0.006	–	0.040	0.006	–	0.001	0.012
All other minorities	–9.833	0.047	–	1.729	0.592	–	–2.259	0.524	–
Black	–6.983	0.016	–	–4.855	0.006	–	–7.538	<0.001	–
Hispanic	7.755	0.261	–	–2.761	0.563	–	–3.289	0.527	–
White (reference)	0.000	–	–	0.000	–	–	0.000	–	–
Occupational status at injury				–	0.001	0.016			
Unemployed/other				–4.638	0.062	–			
Student				1.265	0.603	–			
Retired				11.095	0.002	–			
Working (reference)				0.000	–	–			
Highest education achieved	–	0.002	0.008	–	0.004	0.011	–	<0.001	0.012
High school	7.661	0.008	–	1.553	0.434	–	2.840	0.164	–
College	11.905	<0.001	–	6.714	0.004	–	8.808	<0.001	–
< 12 years/other/unknown (reference)	0.000	–	–	0.000	–	–	0.000	–	–
Primary language is English							12.493	0.001	0.009

Continued

Table 4A Continued

Outcome:	CHART: Physical Independence			CHART: Social Integration			CHART: Mobility		
	Parameter estimate	P value	Semi-partial Omega ²	Parameter estimate	P value	Semi-partial Omega ²	Parameter estimate	P value	Semi-partial Omega ²
Independent variables*									
Primary payer	-6.463	0.019	0.005	-4.955	0.025	0.007	2.100	0.002	0.011
Medicare	-0.717	0.180	-	-5.760	0.162	-	-7.570	0.539	-
Medicaid	-10.873	0.808	-	-1.039	0.005	-	0.661	<0.001	-
Worker's compensation	0.000	0.003	-	0.000	0.661	-	0.000	0.793	-
Private insurance/ pay (reference)		-	-		-	-		-	-
TR hours of specific treatments	4.994	0.001	0.007						
Classes provided by CTRs	6.051	0.011	0.004						
Initial assessment	1.446	0.008	0.004						
Leisure education and counseling									
Outing – community				0.262	0.007	0.007	0.447	<0.001	0.016

*All patient variables listed in Methods and treatment variables listed in Table 1 except # sessions of TR activity types were allowed to enter the models. Only statistically significant predictors are reported here; a missing variable name means that the variable did not predict any of the outcomes in this table; a blank cell means that the variable was not a significant predictor for the outcome examined.

Independence scores. The addition of rehabilitation center also adds little to the model.

The regression models to predict the Occupation scale and its recreation component are presented in Table 4B. Patient characteristics predict 23% of the variation in the Occupation model and only 10% for the recreation component (the strongest predictor is the individual's estimate of time spent in recreation prior to injury). The addition of TR treatment variables increases the R^2 's slightly. More time spent in leisure skill work in the rehabilitation center is predictive of higher scores in both models.

Mood state and life satisfaction

Patient characteristics, TR treatments, and rehabilitation center are weak predictors of depressive symptoms as measured by the PHQ-9 ($R^2 = 0.07$) or of life satisfaction (measured with the SWLS) ($R^2 = 0.12$) (data not shown). No TR treatment is a significant predictor.

Rehospitalization

Higher medical severity during rehabilitation, longer time from trauma to rehabilitation admission, and primary payer of Medicaid are associated with greater likelihood of at least one rehospitalization; higher admission motor and cognitive FIM, male gender, and student status prior to injury are associated with lesser likelihood (c statistic = 0.67, max rescaled $R^2 = 0.12$) (see Table 5). When TR treatments are added, the c statistic increases to 0.71 (Max R^2 to 0.17). Longer rehabilitation LOS and more time spent on leisure skill outings are associated with less rehospitalization. Adding rehabilitation center as a predictor variable increases the predictability only minimally (c statistic = 0.72, Max $R^2 = 0.19$).

Pressure sore at anniversary

Patient characteristics, TR treatments, and rehabilitation center show some correlation with reporting a pressure sore at the time of the 1-year injury anniversary (c statistic = 0.69, Max $R^2 = 0.10$) (see Table 5). More time spent on community outings during rehabilitation is associated with less reporting of pressure ulcers.

Participation in sports after injury

The strongest predictor of participation in sports as reported during the 1-year post-injury interview is a greater number of TR sessions during rehabilitation that involve sports or aquatic activities (OR = 1.2) (see Table 6). More time spent in community outings during rehabilitation also is a positive predictor. Injury group (those with high tetraplegia participate less and those with paraplegia participate more than persons

Table 4B Prediction of social participation, part 2

Outcome	CHART: Occupation			CHART: Recreation subscore		
Observations used		783			786	
Step 1: Pt characteristics: adj. R^2		0.23			0.10	
Step 2: Pt characteristics + treatments: adj. R^2		0.24			0.11	
Step 3: Pt characteristics + treatments + center identity: adj. R^2		0.26			0.14	
Independent variables*	Parameter estimate	P value	Semi-partial Omega ²	Parameter estimate	P value	Semi-partial Omega ²
Neurological group	–	0.010	0.008			
C1–4 ABC	–16.150	0.001	–			
C5–8 ABC	–7.681	0.107	–			
Para ABC	–6.591	0.089	–			
All Ds (reference)	0.000	–	–			
Admission FIM motor-Rasch transformed	0.813	<0.001	0.028	0.153	<0.001	0.023
Days from trauma to rehabilitation admission	–0.139	0.002	0.008			
Traumatic etiology	–	0.033	0.006			
Medical/surgical/other	–11.888	0.068	–			
Violence	–8.953	0.039	–			
Sports	2.462	0.547	–			
Fall	–6.429	0.046	–			
Vehicular (reference)	0.000	–	–			
Age at injury	–0.466	<0.001	0.017			
Gender is male	–8.423	0.008	0.006			
Marital status is married	6.857	0.019	0.004			
Highest education achieved	–	<0.001	0.015			
High school	2.718	0.408	–			
College	13.686	<0.001	–			
<12 years/other/unknown (reference)	0.000	–	–			
Primary payer	–	0.042	0.005			
Medicare	–6.640	0.229	–			
Medicaid	–8.110	0.017	–			
Worker’s compensation	–7.134	0.085	–			
Private insurance/pay (reference)	0.000	–	–			
Hours of recreation pre-injury	0.173	0.033	0.003	0.225	<0.001	0.076
TR hours of specific treatments						
Leisure skills in center hours	0.802	0.002	0.008	0.319	<0.001	0.015

*All patient variables listed in Methods and treatment variables listed in Table 1 except # sessions of TR activity types were allowed to enter the models. Only statistically significant predictors are reported here; a missing variable name means that the variable did not predict any of the outcomes in this table; a blank cell means that the variable was not a significant predictor for the outcome examined.

Table 5 Prediction of re-hospitalization between discharge and 1-year anniversary and pressure sore(s) at 1-year anniversary

Outcome	Re-hospitalized			Pressure sore(s)		
Observations used	826: Yes = 297, No = 529			824: Yes = 101, No = 723		
Step 1: Pt characteristics: $c/\text{Max } R^2$	0.67/0.12			0.65/0.05		
Step 2: Pt characteristics + treatments: $c/\text{Max } R^2$	0.71/0.17			0.67/0.07		
Step 3: Pt characteristics + treatments + center identity: $c/\text{Max } R^2$	0.72/0.19			0.69/0.10		
Independent variables*	Parameter estimate	Odds ratio	P Value	Parameter estimate	Odds ratio	P Value
Admission FIM motor score – Rasch transformed	–0.028	0.973	<0.001			
Admission FIM cognitive score – Rasch transformed	–0.010	0.990	0.033			
Comprehensive Severity Index	0.014	1.014	<0.001	0.011	1.011	<0.001
Days from trauma to rehabilitation admission	0.007	1.007	0.012	0.010	1.010	0.001
Gender is male	–0.539	0.583	0.007			
Occupational status at injury	–	–	0.009			
Unemployed/other	–0.050	0.952	0.851			
Student	–0.845	0.430	<0.001			
Retired	–0.267	0.766	0.472			
Working (Reference)	0.000	–	–			
Primary payer	–	–	0.006			
Medicare	0.632	1.881	0.091			
Medicaid	0.667	1.949	0.002			
Worker's compensation	0.402	1.494	0.133			
Private insurance/pay (reference)	0.000	–	–			
Rehabilitation length of stay	–0.014	0.986	<0.001			
Outing – leisure skills hours	–0.077	0.926	0.003			
Outing – community hours				–0.052	0.949	0.003

*All patient variables listed in Methods and treatment variables listed in Table 1 except # sessions of TR activity types were allowed to enter the models. Only statistically significant predictors are reported here; a missing variable name means that the variable did not predict any of the outcomes in this table; a blank cell means that the variable was not a significant predictor for the outcome examined.

Table 6 Prediction of activity participation at 1-year anniversary

Outcome	Sports			Outdoor (other than sports)			Creative expression			Gardening		
Observations used	813: Yes = 175, No = 638			811: Yes = 359, No = 452			814: Yes = 289, No = 525			814: Yes = 148, No = 666		
Step 1: Pt characteristics: $c/\text{Max } R^2$	0.74/0.19			0.69/0.15			0.70/0.14			0.72/0.14		
Step 2: Pt characteristics + treatments: $c/\text{Max } R^2$	0.78/0.25			0.73/0.20			0.72/0.17			0.76/0.20		
Step 3: Pt characteristics + treatments + center identity: $c/\text{Max } R^2$	0.80/0.29			0.75/0.25			0.73/0.20			0.76/0.20		
Independent variables*	Parameter estimate	Odds Ratio	P Value	Parameter estimate	Odds Ratio	P Value	Parameter estimate	Odds Ratio	P Value	Parameter estimate	Odds Ratio	P Value
Neurological group	–	–	<0.001				–	–	<0.001			
C1–4 ABC	–1.150	0.152	<0.001				–0.467	0.400	0.001			
C5–8 ABC	–0.066	0.448	0.716				–0.367	0.442	0.016			
Para ABC	0.480	0.773	0.002				0.385	0.937	0.002			
All Ds (reference)	0.000	–	–				0.000	–	–			
Admission FIM motor – Rasch transformed				0.029	1.029	<0.001				0.026	1.026	0.011
Admission FIM cognitive – Rasch transformed	0.013	1.013	0.021							–0.013	0.987	0.031
Days from trauma to rehabilitation admission	–0.010	0.990	0.028	–0.014	0.986	<0.001				–0.016	0.984	0.002
Traumatic etiology				–	–	0.029						
Medical/surgical/other				0.334	1.447	0.311						
Violence				–0.795	0.468	0.002						
Sports				0.389	1.529	0.078						
Fall				0.108	1.154	0.528						
Vehicular (reference)				0.000	–	–						
Age at injury	–0.027	0.973	<0.001	–0.020	0.981	0.001				0.017	1.017	0.006
Gender is male	0.904	2.470	0.002	0.439	1.551	0.037						
Race	–	–	0.047	–	–	<0.001	–	–	<0.001	–	–	<0.001
All other minorities	–0.441	0.643	0.047	–0.317	0.728	0.308	0.224	1.251	0.560	–1.332	0.264	<0.001
Black	**			–0.824	0.439	<0.001	0.745	2.106	<0.001	**		
Hispanic	**			***			1.070	2.916	0.034	**		
White (reference)	0.000	–	–	0.000	–	–	0.000	–	–	0.000	–	–
Highest education achieved							–	–	0.004			
High school							–0.293	0.774	0.006			
College							0.330	1.444	0.007			
<12 years/other/unknown (reference)							0.000	–	–			
Injury is work related							–0.718	0.488	0.006			
BMI ≥ 30										0.560	1.750	0.018
Rehabilitation length of stay										–0.013	0.988	0.003
Hours of recreation pre-injury							0.031	1.031	<0.001			
TR hours of specific treatments:												
Leisure education and counseling										0.115	1.121	0.019
Outing – leisure skills				0.055	1.057	0.015						

Continued

Table 6 Continued

Outcome	Sports		Outdoor (other than sports)		Creative expression		Gardening	
Outing – community	0.044	1.045	0.002					
# Sessions of TR activity types:								
Sports/aquatics	0.150	1.161	<0.001	–0.098	0.907	0.008		
Outdoor activities				0.172	1.188	0.021		
Creative expression								
Horticulture				0.186	1.204	0.005	0.247	1.280
								<0.001

*All patient variables listed in Methods and treatment variables listed in Table 1 were allowed to enter the models. Only statistically significant predictors are reported here; a missing variable name means that the variable did not predict any of the outcomes in this table; a blank cell means that the variable was not a significant predictor for the outcome examined.

**Black and Hispanic were combined with “all other minorities.”

***Hispanic was combined with “all other minorities.”

with AIS D injuries), age (older persons participate less), race (minorities participate less than Whites), and gender (males participate more) also are significant. Inclusion of patient and treatment variables result in a *c* statistic of 0.78 (Max $R^2 = 0.25$); the addition of rehabilitation center as a predictor increases the *c* statistic by 0.02 and the Max R^2 by 0.04 (to 0.29).

Participation in outdoor activities

More TR sessions that involve outdoor activities (other than sports) and more time in leisure skills outings during rehabilitation are associated with more participation in outdoor activities after injury; more sessions of TR horticultural activities also is a positive predictor, while more TR sessions involving sports is associated with less outdoor activities. Injury group is not predictive of greater participation in outdoor activities at the anniversary, but the FIM motor score at rehabilitation admission is. Males are more likely to participate; older age, longer time from injury to rehabilitation admission, injury etiology of violence, and Black race (White is the reference group) are associated with a smaller likelihood (see Table 6).

Participation in creative expression

Similar to participation in sports, the strongest predictor of participation in creative expression is the intensity of work in creative expression activities during rehabilitation (Table 6). Also predictive are: race (blacks and Hispanic are more likely than Whites to occupy their time this way), injury group (those with tetraplegia participate less and those with paraplegia participate more than persons with AIS D injuries), and education level (persons with a college education participate more). Interview respondents who report more hours spent in recreation pre-injury are more likely and those who were injured in a work-related accident are less likely to participate in creative expression activities after injury. The *c* statistic increases from 0.70 (Max $R^2 = 0.14$) for patient characteristics alone to 0.72 (Max $R^2 = 0.17$) with the addition of TR treatments and to 0.73 (Max $R^2 = 0.20$) with the addition of center variables.

Participation in gardening

Older persons who are obese and have higher rehabilitation admission motor FIM scores are more likely to participate in gardening after injury. More frequent participation in horticultural activities during rehabilitation and more time spent in TR leisure education and counseling activities are associated with a greater likelihood of participation in gardening after discharge (Table 6). The *c* statistic for the combination of patient

and treatment variables is 0.76 (Max $R^2 = 0.20$); the addition of the rehabilitation center does not add explanatory power.

Model validation

Linear regression models that validated well (relative shrinkage <0.1) include those for: motor FIM at discharge and the 1-year anniversary, and CHART Social Integration. The CHART Physical Independence and Occupation models validated moderately well (relative shrinkage $0.1-0.2$). Three models validated poorly (relative shrinkage >0.2): CHART Mobility, PHQ-9, and life satisfaction. For dichotomous outcomes almost all models validated well (HL P value >0.1 for both); the only exception was rehospitalization, which validated moderately well (HL P value was 0.05 to 0.1 for one or both models).

Discussion

Anecdotal evidence has long supported the value of TR in the rehabilitation process for persons with SCI; however, there is little empirical evidence. Perhaps for the first time, we demonstrate significant positive associations of total time spent in TR (as described in the first paper in this series¹²) and more clinically meaningful associations with functional, recreational, participation, and quality of life outcomes when examining time spent in specific TR interventions.

Neurological injury groupings and motor FIM scores are known to be associated strongly with functional capacity in persons with SCI. In addition, for participation in recreational activities after injury, this study demonstrates that the amount of time (respondent estimates) spent in recreational pursuits prior to injury also is related to outcomes, particularly the CHART Occupation score and its recreation component. Individuals who are more active prior to injury may be more likely to recognize and appreciate the values that are inherent in participating in leisure activities. Individuals often pursue leisure activities to help meet personal goals related to physical health and wellness, socialization with family or peers, relaxation and stress relief, or simply to alleviate boredom and prevent falling into bad habits. Leisure time exercise benefits cardio-respiratory function, muscular strength, and greater mobility.³⁰

Patient demographic and injury characteristics explain a large amount of the variance in the likelihood of participating in specific types of leisure activities (e.g. sports, outdoor activities, creative expression, and gardening) after discharge. These associations are so strong (69–74%) that they may overshadow the

contribution of TR interventions; explained variance increases from 2 to 4% with the addition of treatment variables to the regression models. However, we do see significant and strong associations of greater exposure to specific activities during rehabilitation with more likelihood of participating in that activity at 1-year post-injury. Individuals who participated in more TR sessions involving sports and aquatics during rehabilitation are more likely to participate in these activities after discharge. The same pattern is seen for intensity of outdoor, creative expression, and gardening activities – more sessions during rehabilitation is associated with more likelihood of participation at the time of the 1-year anniversary. There may be several explanations for this. People may learn to like what they are exposed to during rehabilitation, and continue to be active in that domain after discharge to home. Alternatively, those who had a strong interest in a particular leisure activity before injury may ask for instruction in how they can continue to engage in their sport, hobby, or leisure activity in spite of the injury. In the scenario of the first explanation, TR is a driver of new patterns; in the second scenario, it is a facilitator. In the absence of information on pre-injury leisure patterns, we do not know which of these, individually or in combination, is most likely.

The negative association of increased time in sports activities during rehabilitation with less participation in outdoor activities post discharge is puzzling. Individuals may choose to participate in adapted sports to find activities for increased physical fitness or that they can do with their children and families. With increased participation in sports and athletic training (which were recorded as sports, regardless of whether performed indoors or outdoors), less time may be available for outdoor activities (other than sports). Or perhaps, they discovered sports activities like cycling or skiing, which are performed outdoors (but were recorded in sports activities in the TR taxonomy), involve more physical challenge and offer more social and family interaction opportunities than traditional outdoor activities like hunting or fishing.

The positive associations of participation in community outings during rehabilitation with multiple outcomes (higher CHART Social Integration and Mobility scores, discharging to a home environment, and greater likelihood of being employed or in school and less likelihood of reporting a pressure ulcer by the time of the 1-year anniversary) speak to the value of community exposure in the rehabilitation process. These outings provide rehabilitation patients the opportunity to experience accessibility issues such as difficulty

(or ease) of navigating challenges in community environments and practice-associated problem-solving techniques learned in the hospital setting. As individuals are exposed to community activities such as shopping, eating out, or going to the movies or a ball game, they may become better prepared to overcome stigma issues (e.g. anxieties associated with their new identity that incorporates the SCI) and practice interacting with members of the community in a public setting. This allows the individual to become more comfortable with interactions and to feel less isolated. Community outings also provide the opportunity to practice wheelchair mobility and self-care skills that patients spend much of their rehabilitation time during physical and occupational therapy sessions developing and practicing. The opportunity to practice these skills in environments similar to those found in working or academic settings promotes the building of self-confidence with a new body image that incorporates the SCI and increases the likelihood of returning to community life, including employment of educational endeavors, soon after discharge. Families are encouraged to participate in community outings, and thus have the opportunity to practice care-giver skills and become confident in their ability to assist, or to refrain from assisting, the person with needs outside of the hospital. These skills promote independence and may make individuals and families feel more comfortable moving forward with a home discharge.

More time spent in leisure education and counseling sessions with the CTRS was associated with higher CHART Physical Independence scores and more residing at home at the 1-year anniversary of injury. Receipt of leisure skill education and practice of these skills in the rehabilitation center aids in using these skills in community settings, which may be linked to more successful living in a home environment. CTRSs identify adaptive equipment that promotes optimal performance of specific skills and provide instruction on how best to use the equipment. Practicing in the “safe” environment of the rehabilitation center allows the patient to develop the confidence to participate in skill-based activities in the community; first on outings with therapists and, more importantly, after discharge with family and friends. While the skill approach may be different from the approach used prior to injury, the person renews participation. Riding a handcycle, for example, around a gym or up and down the hallways of the hospital prepares the person to ride in community settings with other cyclists. Community exposure promotes confidence and motivation for people to focus efforts on activities beyond personal care independence and

prepares them for successful life in a home environment. In addition, this education and practice helps to promote a healthy physical lifestyle and provides the opportunity to spend time during rehabilitation in active and therapeutic pursuits that support therapy goals but go beyond the Medicare-mandated 3 hours of therapy per day (combination of physical, occupational, and speech).

The finding that CTRS time spent assessing patient status correlates with more home discharge, higher motor FIM at rehabilitation discharge and at the 1-year anniversary, CHART Physical Independence, and higher life satisfaction is curious; we hypothesize that it may be related to local practice patterns of when assessment occurs. Often, screening by CTRSs (and other rehabilitation therapists) is done prior to rehabilitation admission while the patient is still in acute care; this time is not recorded as assessment time for this study. However, when the acute care LOS is short, which is often the case with less severe injuries, initial TR assessment is done in the rehabilitation center. Indeed, we find that time CTRSs spent in assessment is greater for persons with AIS D injuries (who also have shorter acute care LOS) than for other injury groups.

Limitations

The participating rehabilitation centers include some of the largest SCI rehabilitation programs in the United States; however, some had larger and more active TR departments than others. Some SCIREhab centers were more urban than others, and thus access to outdoor recreational pursuits may have been more limited. Thus, the time reported by CTRSs may not generalize to all rehabilitation centers. There may also be bias resulting from unique referral patterns to specialty centers.

Use of the FIM has advantages in rehabilitation research: it is used widely among rehabilitation units in the United States, it has a standard certification process for clinicians of multiple disciplines using the measure, and it provides a means of comparing functional status at admission and discharge. The FIM, however, has been criticized on multiple grounds including susceptibility to bias,³¹ and significant ceiling and floor effects.³² A more appropriate tool from a TR perspective may have been the Leisure Competence Measure (LCM),^{33,34} which has a similar measurement paradigm as the FIM but assists TR in advancing leisure-oriented goals and tracking patient progress with their independence. However, the LCM is not a mandated tool, and thus, is not used consistently. Several SCIREhab centers did not use it and others

modified the tool to serve as a documentation guideline, in combination with the FIM, to meet individual needs of the center and promote easier interdisciplinary communications with other clinicians who use the FIM.

On the 1-year post-injury interview, respondents were asked to estimate the amount of time spent on leisure activities prior to injury; however, no information was gathered about types of leisure pursuits, preferences, or previous experiences. Hence, we were not able to compare reporting of leisure activities at the injury anniversary with those performed prior to injury.

Outcomes for this study were collected at the 1-year injury anniversary and thus may be considered intermediate and not reflect the full impact of TR interventions on the lives of individuals with SCI, the majority of whom are still adjusting to their injury and making life-style changes throughout the first year. Outcomes measured later in the recovery process may be more relevant to determine associations of TR interventions provided during rehabilitation with productive lifestyles long after injury.

Clinicians documented treatment on a PDA, which was a new documentation process and supplemental to traditional documentation. Data collection methods were standard across the six facilities; however, time of documentation (end of session, end of day, end of week) varied depending on clinician workload and time constraints. Therefore, it is possible that some treatment information may have been omitted or not documented in its entirety.

Conclusion

Greater participation in TR-led leisure skill and community activities during rehabilitation is predictive of higher motor FIM, more participation in active leisure activities, more participation in community-based activities such as working or attending school, and less rehospitalization and pressure ulcer development following discharge. As part of a comprehensive SCI treatment team, TR plays a vital role in the return to a productive and healthy life. Findings from the SCIR rehab study offer promising results that validate the importance of TR and demonstrate its effectiveness in improving the quality of the rehabilitation experience.

This unique and precedent-setting study in which practicing clinicians played an active role has yielded good news for those who provide care and for the persons they serve. The demonstration of associations among TR activities with outcomes at the time of the 1-year anniversary is encouraging. Further research needs to focus on the impact of TR on longer-term outcomes to determine if initial associations hold true and

whether additional associations are seen. In the meantime, CTRs may be better equipped to tailor TR interventions to meet each individual's long-term goals. Persons who enjoy components of their rehabilitation and learn that their lives can continue to be active and enjoyable may be more motivated to participate actively in the rehabilitation process and to emerge from rehabilitation ready to engage in productive and more fully engaged lives.

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