Research article

Identifying predictors of resilience at inpatient and 3-month post-spinal cord injury

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Objectives: To identify (1) changes in psychosocial factors, (2) relationships between psychosocial factors, and (3) significant predictors of resilience in adults with spinal cord injury (SCI) during inpatient rehabilitation and at 3-month post-discharge.
Design: Cross sectional with convenience sample based on inclusion/exclusion criteria.
Setting: Inpatient rehabilitation hospital and community-based follow-up.
Participants: Individuals with a SCI.
Interventions: Not applicable.
Outcome measures: Demographic, resilience, self-efficacy for managing a chronic health issue, depression, social roles/activity limitations, and pain.
Results: The final sample consisted of 44 respondents (16 women and 28 men). Results of repeated measure analyses of variance indicated no significant changes in variables between inpatient and 3-month follow-up. Bivariate correlations revealed associations between resilience and self-efficacy at inpatient ($r = 0.54$, $P < 0.001$), and resilience and depression ($r = -0.69$, $P < 0.001$) and self-efficacy ($r = 0.67$, $P < 0.001$) at 3-month follow-up. Hierarchical regression analyses a significant model predicting resilience at inpatient stay ($R = 0.61$; adjusted $R^2 = 0.24$, $P = 0.023$), and at 3-month follow-up ($R = 0.83$; adjusted $R^2 = 0.49$, $P = 0.022$). Self-efficacy was the strongest predictor at inpatient stay ($\beta = 0.46$, $P = 0.006$) and depression was strongest at 3-month follow-up ($\beta = -0.80$, $P = 0.007$).
Conclusion: Results suggest that although resilience appears to be stable from inpatient to 3-month follow-up, different factors are stronger predictors of resilience across time. Based on current results, an assessment of self-efficacy during inpatient rehabilitation and an identification of depression at 3-month follow-up may be important factors to help identify those at risk of health issues overtime.

Keywords: Resilience, Self-efficacy, Depression, Activity limitations, Inpatient rehabilitation, Spinal cord injury

Introduction

Sustaining a spinal cord injury (SCI) can be a life-altering event resulting in a complex disability involving an array of potentially long-term and disability-related issues, and specialists are challenged to meet the unique health needs of individuals post-injury. Without the correct care or intervention, individuals may experience secondary (e.g. pressure sores, pain) and chronic conditions (e.g. heart disease, diabetes), placing a greater burden on the healthcare system, emphasized by the fact that SCI costs an estimated $9.3 billion annually.

Over the last several decades, researchers have gained a better understanding of the psychological consequences of SCI, with a particular focus on negative outcomes such as depression[1–4] and anxiety.[5,6] Additionally, physiological factors, such as pain, appear to be co-existing with depression, at rates as high as 60%[7] and the relationship between pain and depression has been demonstrated in the SCI literature.[8] However, in recent years, there has been a growing interest in the inherent strengths of an individual (e.g. positive psychology variables such as hope, spirituality, humor, and resilience) and how these factors influence

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adaptation post-injury.[9,10] Resilience, has been defined as an individual's ability to flourish in the face of adversity or disruptive event, and is being increasingly examined as a protective factor in an individual's ability to overcome adversity and trauma.[11] In recent years, investigators have explored the relationship between resilience and adaptation to traumatic injuries,[12] and specifically SCI.[10,11,13–16]

Qualitative research completed with individuals post-SCI has highlighted that, for inpatients and outpatients, positive thinking (e.g. optimism, hope, and positive attitude), perseverance, determination, and social support from friends and family are important contributors to an individual's ability to adapt.[15] Quantitatively, results indicate that resilience is negatively associated with depression among inpatients[10] and individuals living in the community.[13] In addition, findings suggest that resilient patients have fewer SCI-related quality-of-life problems, greater acceptance, and less behavioral disengagement 2 years post-injury,[11] and that resilience is positively associated with life satisfaction, optimism, and self-efficacy for individuals greater than 1-year post-injury.[14] In a community SCI sample, resilience was shown to possibly reduce the effect of pain and contributed both reduced depression and increased post-traumatic growth.[17] Furthermore, it has been found that resilience predicts psychological distress for individuals with an SCI living in the community.[16]

Collectively, these results are consistent with Richardson's[18] metatheory of resilience and resiliency, which describes different pathways of resilience that individuals can follow after a traumatic event which are associated with certain health outcomes (e.g. depression, quality of life, self-efficacy). Richardson's metatheory begins with an explanation of "biopsychospiritual homeostasis" which is considered as a state of adaptation (e.g. mind, body, and spirit) that can be either positive or negative. This "homeostasis" during daily life is constantly challenged by internal (e.g. thoughts and feelings) and external life prompts (e.g. new information, new experiences, recurring thoughts), stressors, adversity, opportunities, and other forms of change, such as a traumatic injury.[18] Accordingly, resilience is the balance between an individual's life challenges and their own innate qualities (e.g. protective factors or developmental assets) that help them to buffer stress and allow balance (e.g. homeostasis). A traumatic event, such as experiencing a SCI, often marks the beginning of an imbalance in the individual's "biopsychospiritual homeostasis". Richardson suggests that how an individual reacts to a traumatic event is determined by their resilience and results in an individual following one of four pathways during recovery including (a) resilient reintegration (e.g. acknowledge limitations after a traumatic injury, and develop new interests and activities, high self-efficacy and quality of life), (b) reintegration back to homeostasis (e.g. life activities return to homeostasis), (c) reintegration with loss (e.g. inability to return to work, drive), and (d) dysfunctional reintegration (e.g. increased depression, low quality of life, low self-efficacy). Furthermore, the metatheory indicates that individuals are not likely to move from dysfunctional to resilient reintegration without the appropriate intervention to facilitate "growth" and "personal introspection".

In summary, while there is a growing evidence linking resilience to psychosocial factors post-SCI, current efforts have focused on either inpatient or community dwelling samples, with only one study[11] examining resilience in the same patients over time. Thus, examining the association between resilience and psychosocial factors over time may be fruitful based on Richardson's suggestion that individuals will not experience improved reintegration without intervention. Consequently, the purpose of this study was to (1) determine whether resilience and key psychosocial variables (i.e., self-efficacy, depression, pain) changed from inpatient to 3-month follow-up, (2) identify the relationship between resilience and key psychosocial variables at inpatient and 3-month follow-up, and (3) identify the strongest predictors of resilience at inpatient and 3-month follow-up.

Method

Participants

Participants were sampled from an inpatient SCI program at a free-standing rehabilitation hospital in the southwestern USA. Permission to complete the study was received from the hospital's Institutional Review Board to ensure that all procedures were conducted in an ethical manner. A convenience sample was utilized with multiple inclusion and exclusion criteria. Inclusion criteria included (a) female or male, (b) aged 18–65 years, (c) experienced a traumatic SCI, (d) undergoing comprehensive inpatient rehabilitation, and (e) no severe cognitive impairment. Exclusion criteria included (a) younger than 18 or older than 65 years, (b) non-traumatic SCI (e.g. re-occurring injury), and (c) pre-morbid mental illness (i.e. bipolar disorder or manic depression, schizophrenia) and/or pre-morbid developmental disability. Twelve people were excluded based on the exclusion criteria. Each participant was undergoing inpatient rehabilitation at the time of enrollment that included an interdisciplinary approach to treatment (i.e. physical, occupational,

speech therapy, therapeutic recreation, social work, and neuropsychology) based on the participant's level of injury and outcome goal(s) (e.g. return to work, school, or leisure activities).

Due to medical complications requiring re-hospitalization into acute care, early discharge, or missing data, five people were excluded, resulting in an initial sample of 45 participants. However, one was removed from the analysis as their length of stay was a significant outlier (241 days) so the final sample consisted of 44 adults with SCI at inpatient stay. At 3-month follow-up, they included data for 31 participants as individuals removed due to medical complications requiring re-hospitalization into acute care ($n = 7$), early discharge ($n = 6$), or missing values ($n = 1$). For the inpatient sample, there were 16 women and 28 men ($M = 39.84$ years, SD = 13.64). Of the 44 participants at inpatient, 20 (45%) had sustained a cervical injury and 23 (54%) a thoracic injury, and one individual was unclassified. Number of days in rehabilitation ranged from 7 to 104 days ($M = 38.23$ days, SD = 21.46). In addition, the majority of participants were married (48%) or single (41%), Caucasian (66%) or black (18%), had a high school (34%) or some college education (25%), had no history of depressive symptoms (56%), and used a wheelchair (82%) for mobility. Of the 31 participants at 3-month follow-up, there were 11 females and 20 males ($M = 38.96$ years, SD = 12.22). Of the 31 participants at 3-month follow-up, 13 (42%) had sustained a cervical injury and 18 (58%) a thoracic injury. Finally, the majority of participants were married (52%) or single (38%), Caucasian (70%) or black (15%), had a high school (39%) or some college education (32%), had no history of depressive symptoms (66%), and used a wheelchair (85%) for mobility. A comparison between the inpatient scores of participants with and without 3-month follow-up data showed no significant differences in demographic information, injury-related factors, or psychosocial variables.

Procedure

A member of the research team consented participants in their rooms within the first few days after admission, informing them about the purpose of the study and the requirements for participation. Individuals were included in the study if they met the inclusion criteria and provided consent. Data were collected at two time points: (1) during the first 2 weeks of inpatient stay at the rehabilitation hospital, and (2) 3-month follow-up post-discharge. After providing consent, a researcher met with participants individually for approximately 20 minutes to complete the battery of questionnaires.

After discharge from the inpatient program to living in the community, participants were contacted 1 week before their scheduled 3-month follow-up to remind them of the upcoming assessment. The 3-month follow-up was then completed 1 week later via telephone or online survey, according to the preferred method of contact participants had selected during inpatient stay. The same measures were completed at 3-month follow-up, in addition to a questionnaire assessing an individual's social roles/activity limitation.

Measures

Descriptive data were collected at both time points from the participant and hospital's electronic medical records using a two-page questionnaire. In addition, pain was assessed using a one-item visual analog scale with scores ranging from 0 (no pain) to 10 (pain).

The Connor–Davidson Resilience Scale 10 (CD-RISC 10)[19] was used to measure the participant's resilience. The measure consists of 10 items using a 5-point Likert scale ranging from 0 (not true at all) to 4 (true nearly all of the time), with scores ranging between 0 and 40. The scale measures how the participants felt over the past month (e.g. "I am able to adapt when changes occur"). The sum of the 10 items was used to determine participants' total score, with higher scores indicating greater resilience. The CD-RISC 10 has been successfully used with individuals with a SCI in previous studies[10] and has appropriate estimates of reliability and validity.[19,20] Within the current study, the alpha coefficient was 0.80.

The Patient Health Questionnaire 9 (PHQ-9), which is a nine-item self-report form, was used to screen for symptoms of major depressive disorder.[21] The PHQ-9 is considered to be valid measure of depression for population-based studies and clinical populations[22] and a cut-off score of equal or greater than 10 indicates the presence of current depression symptomology. The PHQ-9 includes statements about an individual's affective state over the last 2 weeks (e.g. "little interest or pleasure in doing things"), which are scored using a Likert scale with responses ranging from 0 (not at all) to 3 (nearly every day). Scores range from 0 to 27 with scores of 0–4 indicating no depression, 5–9 mild depression, 10–14 moderate depression, 15–19 moderately severe depression, and 20–27 severe depression. Estimates of reliability and validity for a variety of clinical samples have been provided,[23] and the current alpha coefficient was 0.85.

Self-efficacy to manage a disability was measured using the Self-Efficacy for Managing Chronic Disease/Disability 6-Item Scale.[24] This six-item scale

is an abbreviated version of the Chronic Disease Self-Efficacy Scale. The measure covers several domains that are common across many chronic diseases/disability, including symptom control, role function, emotional functioning, and communicating with physicians. Responses are scored using a 10-point Likert scale, ranging from 1 (not at all confident) to 10 (totally confident) for statements such as "How confident are you that you can keep the fatigue caused by your disease from interfering with the things that you want to do?". The measure is scored by calculating the sum of the six items with lower scores indicating lower self-efficacy and higher scores indicating increased self-efficacy.[24] Evidence of the reliability and validity for this six-item scale has been provided,[25] and the current alpha coefficient was 0.80.

The Social Role/Activities Limitations Scale[24] was used at the 3-month follow-up to determine the participants overall social participation. The scale consists of five items using a 4-point Likert scale ranging from 0 (not at all) to 4 (almost totally).[24] The scale is used to determine how health has affected social or recreational activities over the last month (e.g. "Has your health interfered with your hobbies or recreational activities"). Scores for each item are summed to create a total score, with higher scores indicating a greater limitation in daily activities. The current alpha coefficient was 0.86.

Data analytic approach

Means and standard deviations were calculated for all measures completed at inpatient and 3-month follow-up. Preliminary analyses were first conducted through a series of one-way analyses of variance (ANOVA) using available demographic (i.e. age, sex, marital status, race, education, industry role, income, and history of psychiatric symptoms) and injury-related variables (i.e. Functional Independence Measure (FIM) score, level of injury, complete vs. incomplete, length of stay, mobility level) to identify if any group differences in psychosocial variables (i.e. resilience, depression, self-efficacy, social roles/activity limitations, pain) existed at both inpatient and 3-month follow-up. Demographic variables that were identified as significant covariates were entered into later analyses (i.e. repeated measures model, hierarchical regression analyses). To identify the unique contribution of psychosocial variables in predicting resilience above and beyond the influence of injury, all injury-related variables were included in the subsequent analyses.

First, a series of repeated measures ANOVAs were conducted to determine whether resilience, self-efficacy, and depression changed from inpatient to 3-month follow-up. Second, bivariate zero-order correlations were computed to examine the association between resilience and continuous demographic (i.e. age, income) and injury-specific variables (i.e. FIM score, length of rehabilitation stay), as well as psychosocial variables (i.e. depression, self-efficacy, social roles/activity limitations, pain) assessed at inpatient and at 3-month follow-up (social roles/activity limitations were only assessed at follow-up). Finally, separate hierarchical regression analyses were conducted to determine the unique contribution of significant demographic, injury-related, and psychosocial variables in predicting resilience at inpatient and 3-month follow-up, respectively. Significant demographic and injury-related variables identified in the preliminary analyses were entered first to control for group differences in resilience for both inpatient and 3-month follow-up. Likewise, prediction of resilience at 3-month follow-up controlled for inpatient resilience scores. Before regression analyses, scatter plots and collinearity statistics were inspected and revealed that assumptions of normality, linearity, and homoscedasticity were met, with multicollinearity revealing high levels of tolerance (>0.88 for all measures).

Results

Preliminary analyses

Participants' scores for resilience (CD-RISC), depression (PHQ-9), self-efficacy (SES), social roles/activity limitations (SRAL), and self-reported pain are summarized in Table 1. Results of the preliminary ANOVAs for inpatient data revealed that level of injury (i.e. thoracic or cervical) had a significant effect on depression scores, such that patients who had sustained a cervical-level injury ($M = 3.60$, $SD = 2.52$) reported significantly lower levels of depression than patients with a thoracic-level injury ($M = 5.78$, $SD = 3.51$, $P = 0.026$, $\eta^2 = 0.11$). The extremely small sample of Hispanics ($n = 4$) precluded race-based comparisons. The relationship between psychosocial variables and continuous variables (i.e. age, FIM score, and length of rehabilitation stay) were assessed using bivariate, zero-order correlations. Only age was significantly associated with inpatient resilience ($r = 0.33$, $P = 0.031$). No significant associations were found with outcome variables and FIM score or length of stay, and no other significant effects were observed for remaining demographic or injury-specific variables (Table 2).

The ANOVA at 3-month follow-up indicated that the effect of level of injury on resilience approached significance, such that individuals who sustained a cervical-

Table 1 Descriptive data and change in psychosocial variables

Measure	Inpatient stay ($N = 44$) Scale range	Mean (SD)	3-month follow-up ($n = 31$) Score range	Mean (SD)	Score range	P-value	η^2
Resilience (CD-RISC)	0–40	32.36 (5.29)	17–40	30.71 (7.59)	9–40	0.082	0.10
Depression (PHQ-9)	0–27	4.77 (3.21)	0–13	5.45 (5.46)	0–25	0.949	<0.01
Self-efficacy (SES)	6–60	45.91 (8.18)	32–60	43.71 (13.78)	18–60	0.110	0.09
Social roles/activity limitations (SRAL)	–	–	–	7.34 (5.23)	0–16	–	–
Pain	0–10	5.40 (2.38)	0–10	5.52 (1.83)	1–8	0.894	<0.01

CD-RISC, Connor–David Resilience Score; PHQ-9, Patient Health Questionnaire; SES, Self-Efficacy for Managing Chronic Disease Scale; SRAL, Social Role/Activity Limitations Scale. All significant at $P < 0.05$ entered with covariates as identified in preliminary analysis.

level injury ($M = 33.20$, $SD = 6.06$) reported higher levels of resilience than individuals who had sustained a thoracic-level injury ($M = 27.80$, $SD = 8.26$, $P = 0.051$, $\eta^2 = 0.13$). Additionally, mobility had a significant effect on participant's self-efficacy at 3 months, such that independent walkers ($M = 54.50$, $SD = 6.22$, $n = 6$) had higher self-efficacy than participants in a wheelchair ($M = 40.42$, $SD = 13.74$, $n = 24$, $P = 0.041$, $\eta^2 = 0.20$). However, the disparate sample size cautioned against including mobility in further analysis. Interestingly, there were significant group differences in social roles/activity limitations based on mobility level, such that independent walkers ($M = 2.50$, $SD = 2.81$, $n = 6$) perceived fewer social/activity limitations than participants in a wheelchair ($M = 8.86$, $SD = 1.06$, $n = 22$, $P = 0.015$, $\eta^2 = 0.27$). Similar to inpatient, no other significant effects of demographic or injury-specific variables were observed due to non-significance or inadequate sample size for testing.

Changes in psychosocial variables over time

Results revealed no significant changes in resilience, depression, self-efficacy, or pain across time, indicating that all psychosocial variables remained stable from inpatient to 3-month follow-up (Table 1). Resilience and self-efficacy decreased over time and depression and pain increased.

Relationships between psychosocial variables

Bivariate, zero-order correlations were calculated to examine the cross sectional and prospective associations between psychosocial variables at inpatient and 3-month follow-up (Table 2). Along with age, a significant positive correlation was identified between inpatient resilience and self-efficacy indicating that resilient individuals were older and had greater self-efficacy. A strong, positive association was also found between participants' resilience at inpatient and resilience and self-efficacy at 3-month follow-up. Negative associations were found between inpatient resilience and depression and pain at follow-up. Likewise, a strong, positive correlation was found between resilience and self-efficacy at follow-up. Finally, negative associations at follow-up were found between resilience and depression, and depression, self-efficacy, and social roles/activity limitations, indicating that participants with higher depressive symptomology had lower self-efficacy and more barriers to social and leisure activities.

Table 2 Correlations among predictors to resilience

	1	2	3	4	5	6	7	8	9	10	11
1. Age											
2. Income	−0.02										
3. Length of stay	−0.34*	−0.03									
4. Inpatient CD-RISC	0.33*	0.04	−0.13								
5. Inpatient PHQ-9	−0.21	−0.11	−0.03	−0.26							
6. Inpatient SES	0.06	0.07	−0.04	0.54**	−0.25						
7. Inpatient pain	−0.19	0.23	−0.08	−0.27	0.20	−0.16					
8. 3-month CD-RISC	0.16	0.04	−0.10	0.53**	−0.24	0.20	−0.13				
9. 3-month PHQ-9	−0.12	−0.13	0.18	−0.44*	0.26	−0.39*	0.09	−0.69**			
10. 3-month SES	0.04	0.07	−0.29	0.64**	−0.17	0.47**	−0.08	0.67**	−0.74**		
11. 3-month SRAL	0.09	−0.38	0.19	−0.28	0.40*	−0.37*	−0.02	−0.37	0.61**	−0.61**	
12. 3-month pain	−0.24	0.01	0.19	−0.41*	−0.01	−0.20	0.09	−0.15	0.21	−0.33	−0.30

$N = 44$. CD-RISC, Connor–David Resilience Score; PHQ-9, Patient Health Questionnaire; SES, Self-Efficacy for Managing Chronic Disease Scale; SRAL, Social and Recreational Activities Limitations Scale. *Significant at $P < 0.01$; **significant at $P < 0.05$.

Table 3 Regression analysis to predict resilience at inpatient stay

	β	R^2_{change}	F_{change}
Step 1			
Age	0.29	0.09	0.07
Step 2			
Level of injury	−0.20		
Complete/incomplete	0.09		
Length of stay	−0.01		
Self-rated pain	−0.15	0.10	0.40
Step 3			
PHQ-9	0.03		
SES	0.46**	0.19	0.01

CD-RISC, = Connor–David Resilience Score; PHQ-9, Patient Health Questionnaire; SES, Self-Efficacy for Managing Chronic Disease Scale. **Significant at P < 0.05.

Identifying the strongest predictors of resilience at inpatient

A hierarchical regression analysis was conducted where variables were entered into blocks to identify the unique contribution of psychosocial variables in predicting inpatient resilience. To control for the unique variance of demographic and injury-specific variables, these variables were entered in separate blocks before psychosocial variables (Table 3). As age was the only demographic variable significantly associated with inpatient resilience, it was entered into the first block. All injury-specific variables (i.e. level of injury, injury type, length of rehabilitation stay, and pain) were entered into second block, and self-efficacy and depression were entered into the third block.

The inpatient predictor model was able to account for 24.1% of the variance in resilience, $F(7, 32) = 2.77$, P = 0.023. Both age and injury-specific variables failed to uniquely contribute to the prediction of inpatient resilience, accounting for a total of 18.6% of the variance. The addition of self-efficacy and depression scores into the third block accounted for an additional 19.1% of the variance. However, only self-efficacy was a significant predictor of inpatient resilience, $\beta = 0.46$, P = 0.006.

Identifying the strongest predictors of resilience at 3-month follow-up

A second hierarchical regression analysis was conducted to identify unique predictors of resilience at 3-month follow-up (Table 4). As no demographic variables were significantly associated with resilience at 3-month follow-up, all injury-related variables were entered into the first block. Inpatient resilience was then entered into the second block to control for inpatient resilience levels, and participants' depression, self-efficacy, and social roles/activity limitation scores (all collected at 3 months) were entered into the third block.

Table 4 Regression analysis to predict resilience at 3-month follow-up

	β	R^2_{change}	F_{change}
Step 1			
Level of injury	−0.30	0.13	0.65
Complete/incomplete	0.11		
Length of stay	0.02		
Self-rated pain	−0.10		
Step 2			
Baseline CD-RISC	0.52	0.21	0.04*
Step 3			
PHQ-9	−0.80**		
SES	−0.03		
SRAL	0.31	0.35	0.02*

CD-RISC, Connor–David Resilience Score; PHQ-9, Patient Health Questionnaire; SES, Self-Efficacy for Managing Chronic Disease Scale; SRAL, Social and Recreational Activities Limitations Scale. *Significant at P < 0.01; **significant at P < 0.05.

The 3-month predictor model was able to account for 48.9% of the variance in resilience, $F(8, 13) = 3.51$, P = 0.022. Injury-specific variables failed to uniquely contribute to the prediction of resilience at follow-up, accounting for 12.9% of the variance. The addition of inpatient resilience scores in the second step uniquely accounted for an additional 20.9% of variance (Sig. $F\Delta = 0.04$). Finally, the addition of psychosocial variables in the third step accounted for an additional 34.6% of total variance (Sig. $F\Delta = 0.02$). Overall, only depression at follow-up significantly predicted resilience at follow-up, $\beta = -0.80$, P = 0.007.

Discussion

Results of the study are consistent with previous research in places and offer some interesting implications for clinical practice in the months following a SCI. First, and consistent with recent findings[10,26] and position pieces,[27] resilience appears to function as more of a "trait-like" quality as there was no statistically significant difference from inpatient to 3-month follow-up. In addition, the sample reported levels of resilience that were similar to or higher than other SCI samples.[10,14] Second, the high positive correlation between inpatient and follow-up resilience indicates that individuals who demonstrate high resilience immediately post-injury will continue down a resilient path after discharge from the hospital, which is consistent with Bonanno's work[11] examining trajectories across a 12-month period post-injury. The finding is also consistent with Richardson's metatheory of resilience, which suggests that an individual's resilience can only be modified through intervention and enhanced personal growth. However, due to the slight decrease in resilience (approached significance, P = 0.081) between inpatient ($M = 32.36$) and follow-up ($M = 30.71$)

documented with the current sample, further efforts should determine whether resilience remains stable at later time points post-injury or continues to trend toward lower resilience over time. It is important to note that this finding may be a statistical artifact given the attrition from inpatient ($N = 44$) to follow-up ($N = 31$). Third, results from the regression analyses revealed important predictors of resilience at both inpatient and follow-up that accounted for a significant amount of the variance in resilience. Interestingly, demographic (i.e. age) and injury-specific factors (i.e. level and completeness of injury, length of stay) did not predict an individual's resilience. However, during inpatient stay, self-efficacy uniquely predicted resilience, although this finding did not hold true 3 months post-injury. At 3-month follow-up, only depression emerged as a significant predictor of resilience. Clinically, this is of interest as the focus during inpatient rehabilitation may be on strategies to increase an individual's self-efficacy, whereas intervention for depression may be more salient in the months following injury.

While there was no significant change in participant's self-efficacy or depression overtime, there was another negative trend observed as depression increased and self-efficacy decreased. Collectively, this trend of decreased psychosocial functioning emphasizes the importance of continued efforts to identify individuals that follow a negative health trajectory (e.g. reintegration with loss, dysfunctional reintegration). Recent research suggests that depression in the SCI population is undertreated[4] and a lack of intervention would likely contribute to individual's feeling less able to manage their SCI care over time. For the current sample, it was not surprising that self-efficacy did not increase as participants were not exposed to any type of behavior management therapy intervention. Berkhuysen *et al.*[28] suggest that to see a significant change in self-efficacy, a tailored intervention must be put into place during rehabilitation, and that simply understanding how to manage ones disability will not be enough to change self-efficacy. However, self-efficacy to manage a disability is a key health outcome during rehabilitation and the clinical importance of increasing self-efficacy is recognized as a critical outcome for overall rehabilitation (e.g. return to work, return to community activities).[29]

The results of the bivariate correlation analyses are consistent with recent research demonstrating a strong correlation between resilience and self-efficacy post-injury.[14] However, whereas previous research has largely been cross sectional, the longitudinal nature of the current study sheds light on the consistent relationship between resilience and other psychosocial variables over time in response to the ongoing stressors associated with SCI. Overall, the direction and strength of the associations reported are consistent with previous research,[10–14,16] as well as with Richardson's[18] theoretical framework of resilience.

Interestingly, and of clinical relevance, significant differences in key psychosocial variables were found between individuals with different levels of injury. Specifically, individuals with a cervical injury reported significantly lower levels of depression than those individuals with thoracic level injuries. This is consistent with other findings in the literature[10,11,30] that may appear counterintuitive as clinicians often make the assumption that individuals with a higher level injury, and subsequently less function, will experience increased depression as compared to individuals who have retained more function. As clinicians try to identify which patients may be a risk for depression and poor outcomes post-injury, it is critical not to use level of injury or functional ability to assume degree of depression. Rather, factors such as resilience and self-efficacy may be more important to identify as a potential predictor of depression.

Despite the contributions of this study to the understanding of resilience following traumatic SCI, several limitations deserve mentioning. Primarily, the small sample size is one inherent limitation of this study, which is compounded by the 30% attrition rate between inpatient and 3-month follow-up; however, the small sample size is not dissimilar for other studies in this population[10,14] or clinical environment. A second limitation for this study was the use of self-report measures, thus increasing the risk of bias (e.g. social desirability, misinterpretation). In addition, data collection during inpatient stay was completed in person with a research assistant compared to over the phone or via an electronic survey that was emailed at follow-up, which potentially introduced bias and variability. Finally, only a 3-month follow-up was included, which may not have provided individuals with enough time to fully adjust to living in the community with SCI, thus providing only a snap shot of their psychosocial health. Future efforts should follow patients over greater time (e.g. 6, 12 months) to examine longitudinal changes.

Conclusion

In summary, results provide some support of previous research findings and new insight into the resilience of patients post-SCI. Results confirmed previous efforts identifying resilience as a "trait-like" characteristic and linking resilience to important rehabilitation outcomes across time such as self-efficacy to manage the disability, depressive symptomology, and social roles/activity

limitations. However, findings also indicated that key predictors of resilience change overtime, suggesting that treatment approaches aiming to improve psychosocial outcomes post-injury should focus on specific psychological variables (e.g. depression, self-efficacy) at various time points across the continuum of care.

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Disclaimer statements

Contributors SD and AMW conceived and designed the study, obtained ethics approval, collected the data, analyzed the data, interpreted the data, and wrote the article. MR assisted with data collection, analyzing the data, and revising the article. SA assisted with analyzing the data and revising the article. RH helped with conceiving the study, interpreting the data, and revising the article. ZT helped with analzying the data and revising the article. KM helped with revising the article.

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