Spinal Cord (2015) 53, 682–686

www.nature.com/sc

ORIGINAL ARTICLE

Factors predicting resilience in people with spinal cord injury during transition from inpatient rehabilitation to the community

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Study Design: This is a longitudinal design study.
Objectives: The objective of this study was to determine factors that predict resilience in people with spinal cord injury (SCI) at discharge from inpatient rehabilitation and after reintegration into the community 6 months post discharge.
Setting: This study was conducted in SCI rehabilitation units and the community in New South Wales, Australia.
Methods: Participants included 88 adults with SCI admitted over almost 3 years into three SCI Units in Sydney. Standardized self-report and clinician-based measures were used. Longitudinal assessment occurred up to 6 months post discharge. Sociodemographic, injury and psychological variables were assessed at admission, before discharge and 6 months post discharge. Standard multiple regression was used to determine factors that predict resilience at discharge from hospital and 6 months post discharge.
Results: Almost 70% of the participants were classified as resilient at discharge and 66% after 6 months of living in the community. Multiple factors significantly predicted resilience at discharge and 6 months post discharge, including self-efficacy, low levels of negative mood and lower functional independence, whereas social support and low severity of secondary conditions trended to significance. Demographic and injury variables did not contribute significantly.
Conclusion: Self-efficacy and low levels of negative mood states strongly contribute to resilience. The determination of these predictors will assist in improving rehabilitation programs to strengthen the resilience of people with SCI. However, given that 40–44% of the variance in resilience was explained by the group of factors entered, future longitudinal research is needed to determine not only whether resilience correlates but also whether these associations change over time.
Spinal Cord (2015) **53,** 682–686; doi:10.1038/sc.2015.32; published online 24 February 2015

INTRODUCTION

Spinal cord injury (SCI) is associated with a life-long physical and psychological burden that can severely challenge well-being.[1,2] Complications include chronic pain, fatigue and psychological morbidity.[3–5] Given the challenging nature of living with such a potentially distressing injury, recent studies have investigated resilience following SCI.[1,6–9] Resilience is a complex process that varies according to context, time, age, sex and cultural origin, and it involves qualities that enable one to adjust to and cope with adversity in an adaptive manner.[1,7] People are believed to demonstrate resilience when they possess protective resources that buffer them against the medical, social and psychological problems associated with SCI and its ongoing daily demands and physical impairments.

Although studies involving mental health, adjustment and coping have been frequently reported in the area of SCI,[2–7] research specifically examining resilience following SCI is less common, and the concept of 'resilience' has been variably defined across studies, making comparisons difficult.[7] Nonetheless, resilience studies are potentially valuable, as they can provide information on factors that can protect a person from maladaptive coping and poor adjustment,[1] potentially adding a rich dimension of data to research that focusses on risks and deficits.[1,3] Cross-sectional research investigated factors associated with resilience in 60 adults with SCI living in the community.[7] Resilience was found to be positively associated with self-efficacy, negatively associated with depressive mood states and not associated with injury characteristics (for example, level of the lesion) or conditions such as neuropathic pain.[7] Qualitative research investigated resilience themes in a convenience sample of persons with SCI.[8] Themes related to resilience included factors such as being optimistic, having access to helpful social support, adaptive coping skills, having a faith and serving as a role model.[8] In cross-sectional research, self-efficacy was shown to be a powerful mediator of pain and depressive mood in adults with SCI.[3] Psychological growth was examined over a 10-year period post discharge from SCI rehabilitation.[9] Findings indicated that a majority of people were being resilient over this time period; however, results suggested that psychological growth was complicated and impeded by factors such as negative mood states.[9] Longitudinal research studied mood trajectories over a period of 2 years following SCI using latent growth mixture modeling analysis.[1] The investigators assumed that poor mood

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Received 4 November 2014; revised 21 January 2015; accepted 22 January 2015; published online 24 February 2015

indicated poor resilience, and findings suggest that several major trajectories of mood exist.[1] Over the 2 years, ~66% were found to maintain acceptable levels of mood and ~13% showed improvement in mood over time, whereas ~20% deteriorated or maintained depressive mood.[1] Factors related to satisfactory mood included acceptance, fighting spirit, a higher quality of life and lower negative appraisals.[1]

Given the potential adverse impact of SCI in the long term, it is critical that factors related to boosting resilience in people with SCI are clarified. Identification of predictive factors will assist in the development of rehabilitation programs designed to boost resilience. The aim of this study was to determine factors that contribute to resilience in adults with an acute SCI. It was hypothesized that resilience, being a complex process, would be influenced by multiple factors. It was also hypothesized that demographic and injury factors would be weak predictors of resilience, whereas psychosocial factors would be strong predictors.

MATERIALS AND METHODS

Participants

Participants included adults with acute SCI who were consecutively admitted to the three adult SCI units in Sydney, Australia, over a period of almost 3 years (March 2010 to January 2013). Inclusion criteria consisted of the following: (a) the presence of an established acute SCI; (b) first time admission to an SCI unit; (c) aged 18–80 years; (d) sufficient cognitive capacity to participate; and (e) able to speak English. Altogether, 91 participants met the inclusion criteria; however, three did not continue to take part in the study, resulting in a total of 88 participants. Demographic and injury characteristics are shown in Table 1. Completeness of the lesion was assessed by a medical specialist based on International Standards for Neurological Classification of SCI (http://ais.emsci.org/).

Table 1 Demographic and injury characteristics of the SCI participants ($N = 88$)

Characteristics	*Participants*
Age: mean years (s.d., min max)	42.6 (17.8, 18–80)
Male: *n* (%)	62 (70.4%)
Education: mean years (s.d.)	12.8 (2.5)
Relationship	
Married or *de facto*: *n* (%)	45 (51.1)
Single: *n* (%)	34 (38.6)
Widowed/separated/divorced: *n* (%)	9 (10.3)
Weeks since accident: mean weeks (s.d.)	7.3 (6.1)
Level and extent of lesion	
Tetraplegia: *n* (%)	34 (39)
Paraplegia: *n* (%)	54 (61)
Complete lesion *n* (%)	41 (46.5)
Cause of SCI	
Road crash: *n* (%)	26 (29.5)
Fall: *n* (%)	27 (30.6)
Sport: *n* (%)	10 (11.4)
Assault/shooting: *n* (%)	2 (2.3)
Nontraumatic (disease): *n* (%)	10 (11.4)
Other: *n* (%)	13 (14.8)
Traumatic brain injury: *n* (%)	19 (21.5)
Compensation: *n* (%)	29 (32.9)
Prior psychiatric/psychological treatment: *n* (%)	28 (31.8)

Abbreviation: SCI, spinal cord injury.

Study design and procedure

A longitudinal design using repeated measures was used. Participants were assessed three times: (i) within 4 weeks of admission to rehabilitation; (ii) within 2 weeks of discharge from hospital; and (iii) 6 months post discharge. The first two assessments were conducted within the SCI unit, whereas the third was conducted face to face, by Skype or by telephone when the participant was in their home.

Assessment

Given that we hypothesized that resilience would be a result of multiple influences, a number of factors were chosen that had a theoretical and clinical foundation for contributing to recovery following SCI.[1–9] Assessment involved 2- to 3-h sessions during which participants were assessed for demographic, injury-related and psychosocial variables. Assessment was conducted by psychologists experienced with the interview and psychometric measurement. Resilience was measured by The Connor-Davidson Resilience Scale, which has acceptable psychometric properties including test–retest reliability and construct validity.[10] The mean resilience score for the general population was shown to be 80 (s.d. = 12.8), and the mean resilience score for an outpatient psychiatric sample was 68 (s.d. = 15.3).[10] Participants rated their perceived resilience over the prior month, where higher scores are indicative of greater resilience.[10]

Independent variables (IVs) included depressive mood and anxiety, assessed by the Hospital Anxiety Depression Scale (HADS), a validated and reliable measure of mood states in people with SCI.[11] Participants were asked to rate the interference of pain in their life over the past week using the six Likert pain interference items from the SCI Pain Basic Data Set, which has acceptable reliability and validity.[12] Cognitive capacity was assessed on admission to the SCI Unit, using the Neuropsychiatry Unit Cognitive Assessment Tool, a valid and reliable measure of cognitive impairment in people with neuropsychiatric disorders.[13] The Neuropsychiatry Unit Cognitive Assessment Tool was administered by the clinical psychologists attached to the SCI Units. The Neuropsychiatry Unit Cognitive Assessment Tool provides a total score of cognitive capacity based on domains including attention, executive, language, memory and visuospatial functions.[13] Self-efficacy was measured by the Moorong Self-Efficacy Scale, which assesses participant's perception of control in functional, social, leisure and vocational contexts, and has demonstrated reliability and validity.[14] Perceived actual social support was assessed by the short-form version of the Social Support Questionnaire, which has demonstrated reliability and validity.[15] Functional capacity measured at discharge was assessed by the Functional Independence Measure (FIM), where low scores indicate low functional capacity.[16] Multidisciplinary health professionals working in the SCI Units performed the FIM measures. The FIM has acceptable reliability and inter-rater agreement.[16] Finally, the SCI Secondary Conditions Scale indicates the severity of SCI in terms of secondary complications.[17] The Secondary Conditions Scale rates the severity of 11 health conditions such as autonomic dysreflexia, bladder/bowel dysfunction, pulmonary complications, spasticity, circulatory problems, pain and diabetes. Higher scores indicate increased secondary complications. The Secondary Conditions Scale has acceptable reliability and validity.[17]

Statistical methods

Descriptive statistical analyses generated central tendency and frequency statistics for the study variables. Standard multiple regression (SMR) analysis was the preferred regression statistic to determine predictors, as well as to determine how much each predictor variable uniquely contributed to the dependent variable (DV). The number of factors hypothesized to contribute to resilience and subsequently entered into the SMR were restricted by the rules governing the sample N versus the number of IVs entered.[18] The DV was resilience assessed by the Connor-Davidson Resilience Scale . A prediction SMR model was used. That is, IVs assessed at admission were regressed onto the DV at discharge, whereas IVs assessed just before discharge were regressed onto the DV at the 6-month post discharge period.

The regression analyses provided the following statistics: correlation coefficient R (the strength of the relationship between DV and IVs); coefficient of determination R^2 (a measure of explained variation or how well the regression

line approximates the real data points); adjusted R^2 (R^2 adjusted for the number of predictors in the model); unstandardized beta coefficients (β; the weight and direction contributed by each of the IVs to the DV); standard error of β; standardized coefficient beta (β standardized for the unit of measurement in the IVs); and semi-partial correlation squared Spc^2 (the estimated amount of unique contribution an IV makes to the DV). Normality and linearity assumptions were met for the regression residuals. All analyses were performed using Statistica Software (Version 12, Statsoft).

Research ethics

All institutional regulations concerning the ethical use of human volunteers were followed during this research. Approval was granted by the local institutional human research ethics committee. Written consent was obtained before participation in the study, and full compliance with the Code of Ethics of the World Medical Association occurred.

RESULTS

Table 2 shows descriptive statistics for the IVs. The mean resilience score for psychiatric outpatients (Connor-Davidson Resilience Scale score of 68)[10] was used to divide the sample into two subgroups, in which ⩽68 indicates poor resilience and >68 indicates acceptable resilience. This resulted in 68.3% ($n=56$) being classified as resilient at discharge, whereas 31.7% ($n=26$) were classified as having poor resilience (six missing cases). After 6 months post discharge, 66.2% ($n=47$) were classified as resilient, whereas 33.8% ($n=24$) had poor resilience (17 missing cases).

Table 3 shows Pearson's correlation coefficients between resilience at discharge and 6 months after discharge. Self-efficacy, low depressive mood and low anxiety assessed at admission correlated significantly to resilience at discharge, whereas self-efficacy, low depressive mood, low anxiety, higher social support, lower pain interference and lower functional independence assessed just before discharge correlated significantly to resilience 6 months post discharge. Resilience at discharge correlated .55 ($P<0.01$) with resilience 6 months post discharge.

Tables 4 and 5 show the regression analyses in which the linear combination of psychosocial variables was significantly related to resilience at discharge and 6 months after discharge ($F_{7,80}=9.1$, $P<0.01$ and $F_{8,79}=6.6$, $P<0.01$, respectively). At discharge, the variables accounted for 44% of the variance (adjusted 39%), with self-efficacy ($P=0.02$) positively contributing to resilience (higher self-efficacy contributing to higher resilience) and depressive mood ($P<0.001$) negatively contributing (lower levels of negative mood, higher resilience). At 6 months post discharge, the IVs accounted for 40% of the variance (adjusted: 34%), with self-efficacy ($P<0.001$) again positively contributing to resilience (higher self-efficacy contributing to higher resilience), anxiety ($P=0.03$) negatively contributing (lower levels of anxiety, higher resilience) and functional independence ($P=0.02$) negatively contributing (lower functional independence contributing to higher resilience). For comparison, sociodemographic and injury variables including age, years of education, sex, presence of TBI, level of injury (paraplegia versus tetraplegia), completeness of lesion (complete versus incomplete), prior psychological treatment (yes or no) and compensation status (received compensation versus not) were entered into an SMR with

Table 2 Descriptive values for the psychosocial factors entered into the standard multiple regression analyses

Psychosocial variables	*Admission* *Mean (s.d.) 95% CI* (n = *88*)	*Discharge* *Mean (s.d.) 95% CI* (n = *83*)	*6 months* *Mean (s.d.) 95% CI* (N = *71*)
CD-RISC	75.6 (14.7) 72–79	75.3 (14.7) 72–78	72.9 (14.6) 69–76
HADS anxiety	5.3 (4.0) 4.4–6.1	4.6 (3.8) 3.8–5.4	5.7 (4.1) 4.7–6.6
HADS mood	5.5 (3.6) 4.7–6.3	4.8 (3.7) 4.0–5.6	5.4 (3.6) 4.6–6.3
MSES	82.7 (14.1) 80–86	90.1 (13.9) 87–93	85.8 (16.7) 82–90
NUCOG total	90.4 (6.7) 89–92	—	—
SF-SSQ	43.2 (15.3) 40–46	44.2 (13.7) 41–47	42.4 (15.4) 39–46
FIM total	—	90.8 (27.1) 85–97	—
Pain interference	11.1 (8.8) 9–13	7.2 (7.4) 6–9	12.5 (8.5) 10–15
SCS	12.3 (6.5) 11–14	11.1 (5.7) 10–12	11.7 (6.7) 10–13

Abbreviations: CD-RISC, Connor-Davidson Resilience Scale; CI, confidence interval; FIM, Functional Independence Measure; HADS, Hospital Anxiety Depression Scale; MSES; Moorong Self-Efficacy Scale; NUCOG, Neuropsychiatry Unit Cognitive Assessment Tool; SCS, Secondary Conditions Scale; SF-SSQ, short-form version of the Social Support Questionnaire.

Table 3 Pearson's correlation coefficients between the IVs entered into the SMR and resilience at discharge and 6 months post discharge

	Resilience at discharge	*Resilience at 6 months*
MSES	0.45**	0.50**
HADS anxiety	−0.40**	−0.47**
HADS mood	−0.65**	−0.44**
SS-SFQ	0.12	0.28*
PI	−0.25	−0.26*
SCS	−0.16	−0.17
NUCOG	−0.11	0.12
FIM	—	−0.18

Abbreviations: FIM, Functional Independence Measure; HADS, Hospital Anxiety Depression Scale; IVs, independent variables; MSES, Moorong Self-efficacy; NUCOG, cognitive capacity; PI, pain interference; SCS, Secondary Conditions Scale; SMR, Standard multiple regression; SS-SFQ, perceived social support. *$P<0.05$; **$P<0.01$.

Table 4 Multiple regression summary for resilience at discharge

Psychosocial	*β*	*SE β*	*beta*	t-*value*	P-*value*	*Spc²*
Anxiety	−0.11	0.1	−0.37	−1.0	0.32	0.6
Mood	−0.49	0.1	−1.9	−4.4	0.00	13.3
Self-efficacy	0.23	0.1	0.24	2.3	0.02	4.0
Social support	0.01	0.1	0.01	0.13	0.89	0.01
Pain interference	−0.01	0.1	−0.03	−0.16	0.87	0.01
Secondary conditions	0.15	0.1	0.33	1.60	0.11	1.8
Cognitive cap	0.02	0.1	0.05	0.27	0.78	0.04

Abbreviation: SE β, standard error of β.
Spc^2 expressed as a percentage.
$R=0.67$, $R^2=0.44$, adjusted $R^2=0.39$, $F_{7,80}=9.1$, $P<0.01$.

Table 5 Multiple regression summary for resilience at 6 months post discharge

Psychosocial	*β*	*SE β*	*beta*	t-*value*	P-*value*	*Spc²*
Anxiety	−0.24	0.1	−0.84	−2.2	0.03	3.6
Mood	−0.01	0.1	−0.00	−0.01	0.99	0.0
Self-efficacy	0.38	0.1	0.37	3.6	0.00	9.7
Social support	0.16	0.1	0.16	1.7	0.09	2.3
Pain interference	−0.08	0.1	−0.15	−0.85	0.40	0.55
Secondary conditions	−0.05	0.1	−0.11	−0.49	0.62	0.18
FIM	−0.22	0.1	−0.11	−2.4	0.02	4.4
Cognitive cap	0.06	0.1	0.11	0.60	0.55	0.25

Abbreviations: FIM, Functional Independence Measure; SE β, standard error of β.
Spc^2 expressed as a percentage; mean substitution for missing values used.
$R=0.63$, $R^2=0.40$, adjusted $R^2=0.34$, $F_{8,79}=6.6$, $P<0.01$.

resilience as the DV at discharge and 6 months post discharge. This linear combination of sociodemographic variables did not significantly contribute to resilience at either time period, explaining $<10\%$ (adjusted R^2) of the variance in resilience.

DISCUSSION

On the basis of the Connor-Davidson Resilience Scale resilience cutoff score for psychiatric outpatients, the majority of the participants had satisfactory levels of resilience at discharge and 6 months after discharge. These results are marginally higher compared with prior research, which found that 58% of people with SCI were resilient (based on that study's sample mean).[7] Although it is an encouraging finding that at least 60–70% of people with SCI report satisfactory levels of resilience, it remains a concern that a large minority of participants (just over 30%) remain highly vulnerable to problems such as maladaptive coping, hopelessness and negativity in the longer term. This rate of vulnerability is similar to rates of depressive mood or probable depression in people with SCI in the long term,[4,5] and it reinforces the need for increased resources to be invested into research that focuses on recovery, such as developing efficacious rehabilitation strategies that boost and sustain resilience in adults with SCI. For example, rehabilitation strategies should (i) strengthen self-efficacy by reinforcing the connection between the person's behavior and intended outcomes using self-management skills such as self-monitoring; (ii) lower negative mood states by teaching fear reduction and anxiety management skills; and (iii) strengthen social and vocational support networks.

Results of the correlation and SMR analyses confirmed prior research in which multiple factors such as self-efficacy and low levels of negative mood states were shown to be significantly related to resilient behavior.[1–4,6–9] Factors close to significance included social support and secondary conditions/complications (at 6 months). The findings in this research support this group of factors (robust self-efficacy, stable mood states, helpful social support and low severity of secondary conditions) to be important, perhaps principal contributors to the development and maintenance of resilient thinking and behavior. This conclusion is further supported by recent longitudinal studies investigating resilience in people with SCI during the inpatient rehabilitation phase.[19,20] Low negative mood states, self-efficacy/optimism, social support and low pain significantly contributed to resilience.[19–20] The relationship between resilience and these factors was clarified in a study that used structural equation modeling analyses to build a model of resilience.[21] Although the study was not prospective in design, it does provide a paradigm for understanding direction of relationships between resilience and contributing bio-psychosocial factors such as depressive mood, attitudes, social support, severity of injury and coping skills.[21]

The finding that lower functional dependence FIM scores predicted higher resilience was unexpected, as one could hypothesize that higher independence scores would predict resilience; however, the reverse was found. Perhaps lower functioning independence results in a stronger fighting spirit, thereby boosting resilience. Alternatively, this unexpected finding may be owing to the ordinal scoring system used by the FIM instrument.[22] Clearly, further research is required to clarify the relationship between the FIM scores and resilience. Further research is also required to determine factors that explain the 50–60% of unaccounted variation in resilience in the present study. As hypothesized, the sociodemographic and injury factors did not significantly predict resilience at discharge or 6 months post discharge. It will therefore be prudent to test the contribution to resilience of other factors such as medications, sleep behavior, caregiver factors, premorbid factors, vocation factors, sexual behavior, fatigue and personality.[5,6,23]

Limitations include lack of testing for factors that contribute to resilience after the 6-month discharge period, such as 24 months post discharge, and the scope of possible predictive factors needs to be widened as suggested above. Future research should also test resilience models articulated by prior research,[21] by generating prospective resilience and health data. It is hoped that the findings of this study can be applied in rehabilitation programs to boost resilience in people with SCI. In summary, the contribution of the biopsychosocial variables to resilience isolated in this study highlights the importance of multidisciplinary approaches in SCI rehabilitation.

DATA ARCHIVING

There were no data to deposit.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGEMENTS

We acknowledge the financial support in the form of a competitive grant from the Lifetime Care Support Authority (NSW, Australia).

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