IDENTIFYING CHANGES IN RESILIENCE DURING REHABILITATION
FROM A SPINAL CORD INJURY

Brian Dale White, BA

Thesis Prepared for the Degree of

MASTER OF SCIENCE

UNIVERSITY OF NORTH TEXAS

May 2008

APPROVED:

Simon Driver, Major Professor
Christy Greenleaf, Committee Member
Jordan Hamson, Committee Member
Jeff Goodwin, Chair of the Department of
Kinesiology, Health Promotion and
Recreation
M. Jean Keller, Dean of the College of Education
Sandra L. Terrell, Dean of the Robert B. Toulouse
School of Graduate Studies

The study purposes were to identify changes in resilience, satisfaction with life (SWL), depression, spirituality, and functional independence (FI) and to examine the relationship between these variables, during the inpatient rehabilitation for a spinal cord injury (SCI). The sample included 42 individuals with a SCI, 33 males and 9 females, who were inpatients with a mean stay of 52 days ($SD = 15.78$). A repeated measures design was employed with questionnaires completed at three times during rehabilitation. Results indicated that there were significant changes in depression, satisfaction with life, spirituality, and FI during inpatient rehabilitation. Findings also indicated significant correlations between resilience, SWL, spirituality, and depression. Future studies developing interventions, and examining factors that predict resilience could help build resilience and may improve rehabilitation outcomes.
Copyright 2008

by

Brian Dale White
IDENTIFYING CHANGES IN RESILIENCE DURING REHABILITATION FROM A SPINAL CORD INJURY

Resilience refers to an individual’s personal qualities and skills that enable them to flourish in the face of adversity or a disruptive event (Connor & Davidson, 2003; Richardson, 2002). Findings from previous resilience literature indicated that resilience is constructed from skills ordinary in nature, which involve behaviors, thoughts, and actions, that can be learned and developed by almost anyone (APA Help Center, 2006; Newman, 2005). Other resilience literature considers this construct to be a multidimensional variable that consists of psychological and dispositional attributes, such as competence, external support systems, and personal structure (Campbell-Sills, Cohan, & Stein, 2006; Connor & Davidson, 2003; Masten, 2001). Consequently, individuals who possess a greater number of attributes associated with resilience are more likely to successfully adapt to a disruptive event (e.g., traumatic injury, loss of job, death of spouse). However, recent research found that resilience was best identified by a single factor rather than multiple variables, questioning the multidimensional nature of resilience (Campbell-Sills & Stein, 2007). Nevertheless, rebuilding and adapting after a disruptive event is an exigent process, which may or may not result in positive adaptation. Important factors associated with resilience and the rebuilding process include (a) locus of control, (b) coping strategies, (c) personality traits, (d) social support, (e) attribution of responsibility, and (f) purpose in life (White, Driver, & Warren, 2008). Research has emphasized the importance of these skills in the rebuilding process by showing that people who have a cohesive support network (e.g., family, friends) during a
disruptive event tend to have fewer health-related issues than individuals without a support network (Berkman & Syme, 1979). Likewise, individuals who possess and maintain a positive disposition of the world tend to recover faster from health-related issues (e.g., cancer, depression, heart-disease) than those with a negative view (Anderson & Anderson, 2003). Anderson and Anderson have shown that behaviors associated with resilience such as good relationships, optimism, and the ability to find meaning after a disruptive event are associated with greater life expectancy. Based on these findings, a challenge is presented to specialists to increase resilience early and throughout rehabilitation programming in an attempt to enhance outcomes (White et al., 2008).

The study of resilience stems from the positive psychology research paradigm, which investigates the positive characteristics of an individual, such as personal competence and social cohesiveness, rather than the pathology or deficits they demonstrate (e.g., depression, post traumatic stress disorder; Masten, 2001; Seligman & Csikszentmihalyi, 2000). Research that has used ability-focused models has predominantly studied children of low socioeconomic background, children with abusive or divorced parents, and adults dealing with bereavement (Masten, 2001). However, even though resilience is recognized as an important variable in determining the physical and psychosocial health of an individual, it has been vastly understudied compared to deficit-focused studies (Campbell-Sills et al., 2006). Connor and Davidson (2003) reiterate this point by stating that there is a paucity of literature regarding resilience and its importance in clinical settings. Thus, there is a need for research into the resilience of understudied populations who experience disruptive events, such as individuals with a spinal cord...
injury (SCI). This is especially pertinent due to the increased incidence of SCI and the impairments caused by damage to the spinal cord (National Spinal Cord Injury Statistical Center [NSCISC], 2006).

A SCI is a disruption of the spinal cord that results in loss of sensation and mobility (American Medical Association, 2005). The two common types of SCI are traumatic (e.g., automobile accidents, gunshots, falls) and non-traumatic (e.g., polio, spina bifida, Friedreich's ataxia). The annual incidence of SCI is approximately 11,000 new cases each year with an estimated 225,000 to 296,000 people living with a SCI within the United States (NSCISC, 2006). Due to the high incidence of SCI it is critical that researchers examine ways to positively influence the rehabilitation process. Therefore, using a positive psychology paradigm to examine the rehabilitation process of people with a SCI may prove to be a fruitful line of research, primarily because this paradigm has not been widely used when studying this population. The discussion will now examine one construct of positive psychology by reviewing previous resilience research.

Connor and Davidson (2003) administered the CD-RISC to 828 participants, who were in 1 of 6 groups based upon health status. The six groups included (1) individuals not seeking help ($n = 577$), (2) outpatients with their primary care provider ($n = 139$), (3) private practice outpatients ($n = 43$), (4) individuals with generalized anxiety disorder ($n = 25$), and (5, 6) participants with Post Traumatic Stress Disorder (PTSD; $n = 22$ and $n = 22$). Regardless of grouping and history of pre-existing psychosocial disturbance results indicated that individuals with higher resilience reported greater hardiness and lower
perceived stress and vulnerability. Conversely, individuals with lower resilience reported lower hardiness and higher perceived stress and vulnerability. These results suggest that individuals with a psychosocial disorder can still demonstrate qualities of resilience. Campbell-Sills et al. (2006) expanded on these findings by examining the relationship between resilience, personality traits, coping, and psychiatric symptoms in adults. Results showed a strong negative relationship between resilience and neuroticism, a construct that encompasses proneness to negative emotions, poor coping, and difficulty controlling impulses. Luthar and Cicchetti (2000) indicated that the implementation of resilience interventions early following a disruptive event could enhance the probability of positive adaptation. For example, Newman (2005) identified that individuals undergoing rehabilitation in a clinical environment could benefit from increased resilience due to the associated mental health benefits like reduced stress and anxiety. Newman suggested that individuals with greater resilience possess characteristics associated with stronger mental health and are able to adapt to a traumatic event more effectively than individuals with lower levels of resilience.

In summary, each of these findings has implications for clinical psychologists by supporting the need to increase resilience in individuals after a traumatic event. Also, with the recent finding that perhaps resilience is a unidimensional construct, rather than multidimensional, it is important to continue to study the variables related to resilience (Campbell-Sills et al., 2006; Connor & Davidson, 2003; Masten, 2001). The review of literature will now shift to examine research on depression, satisfaction with life (SWL),
functional independence (FI), and spirituality, which are variables relevant to resilience and the rehabilitation of people with SCI.

A key variable related to the rehabilitation of individuals after a SCI is depression, which has consistently been associated with an array of psychosocial and medical complications (Bombardier, Richards, Krause, & Tulsky, 2004; Dreer, Elliott, Shewchuck, Berry & Rivera, 2007; Elliott & Kennedy, 2004). One measure of depression is the Patient Health Questionnaire-9 (PHQ-9; Kroenke, Spitzer, & Williams, 2001) which has been used to examine depression at different stages post-injury including (a) inpatient rehabilitation, (b) 1-6 months after rehabilitation discharge, and (c) 6, 8, 10, and 12 months following injury (Fann et al., 2005). Results indicated that individuals experienced depressive symptoms or depression at each stage post injury, and a significant negative correlation was found between depression level and the FI of an individual, which is the ability of an individual to complete activities of daily living without assistance, indicating that higher FI scores were related to lower levels of depression. Thus, individuals who had a more severe injury experienced greater levels of depression as they struggled to terms with their new abilities. In contrast, Bombardier et al. (2004) found that depression did not differ based on severity of injury and functional status, but that increased depression was associated with negative mental and physical health behaviors (e.g., isolation, substance abuse). This research further suggested that diagnosis and treatment of depression during rehabilitation is important to the recovery process, and understanding changes to depression and its relationships to other variables, such as resilience, during rehabilitation could help to reduce negative mental and physical
health behaviors and improve rehabilitation outcomes. Collectively, this research considered it pertinent to examine depression and its relationship to other variables during rehabilitation. As a result, depression was considered a critical variable in this study.

Existing literature indicates SWL is an important variable to examine in individuals with a SCI (Kennedy & Rogers, 2000; Matheis, Tulsky, & Matheis, 2006; Sherman, DeVinney, & Sperling, 2004). Although, limited research exists examining the relationship between SWL and resilience, research does exist examining the relationship between SWL and social support, a key factor of resilience. For example, individuals with a SCI who reported receiving greater social support indicated that they (a) identified themselves as being better adjusted to their injury and experienced less emotional anguish, which is a characteristic of resilience, (b) reported higher overall SWL, and (c) had significantly smaller number of health problems, less hospitalization time, and decreased mortality (Matheis et al., 2006). Results also showed that SWL changed based on a number of factors including level of injury, functional status, and social support. For example, individuals reporting high social support reported higher SWL than those reporting low social support. In addition, research has shown that physical ability and factors of resilience such as family and social support were important determinates of SWL following a SCI (Kennedy & Rogers, 2000). Results from a sample of 24 individuals with SCI indicated that family support, social support, as well as physical and material wellbeing each enhanced SWL. Consequently, the current study examined the
relationship between SWL and resilience due to the commonalities on factors that may impact each variable.

The FI of an individual undergoing rehabilitation is an important outcome measure of the rehabilitation process (Dixon & Caradoc-Davies, 2005). FI refers to the both physical (e.g. toileting, bathing) and cognitive (e.g. verbal and analytical) abilities in individuals (Hamilton, Granger, Sherwin, Zielezny, & Tashman, 1987). One of the primary measures of FI in a rehabilitation setting is the Functional Independence Measure (FIM) which consists of two subscales including (1) motor functioning (e.g., bathing, grooming, toileting, etc), and (2) cognitive functioning (Burnett, Kolakowsky-Hayner, White, & Cifu, 2002). FIM scores have shown to accurately measure clinical changes in motor and cognitive functioning during rehabilitation (Dixon & Caradoc-Davies, 2005). Although no research was found that examined the relationship between FIM and resilience, research has shown a negative correlation between FIM and depression. Burnett et al. (2002) collected FIM score data three times during inpatient rehabilitation including (1) admission to acute medical care, (2) admission to inpatient rehabilitation, and (3) discharge. This study showed an improvement in FIM scores at all measurement times for the SCI participants. Results were attributed to physical and occupational therapy, and according to the authors may be related to levels of the participants’ hopes for the future. Fann et al. (2005) also investigated the relationship between depression and FIM scores by examining longitudinal data during and after rehabilitation. Results showed a significant negative correlation between FIM scores and depression at each time period, indicating that individuals with greater functioning had lower levels of
depression and visa versa. Therefore, with FIM scores being the standard outcome measurement of FI during rehabilitation it was important to include the motor subscale as a dependent variable. Also, it was the authors intent to including FIM scores to establish whether they were related to the resilience, depression, SWL, and spirituality.

One key factor associated with resilience is spirituality, which has been shown to help some individuals deal with adversity (Connor & Davidson, 2003; Connor, Davidson, & Lee, 2003; Hodge, 2003; Richardson, 2002). Spirituality refers to an individual’s belief in a universal power, believed transcendence, or omnipotent intervention in one’s life (Connor & Davidson, 2003), and “spiritual well-being” is recognized as an intrinsic value structure that shapes the foundation of an individual’s behaviors (Hodges, 2002). Spirituality has been shown to change after a significant event in an individual’s life (Hodge, 2003). According to Hodges (2002) when individuals exhibited spirituality (e.g. prayer, meditation, faith) they also demonstrated “emotional well-being” (e.g., social support, family support), which could be interpreted as resilience. Consequently, examining the relationship between spirituality and resilience is critical because increased spirituality may result in enhanced resilience and SWL.

In summary, the purposes of this study were to (1) identify changes in resilience, SWL, depression, FI, and spirituality, and (2) examine the relationship between these variables during the inpatient rehabilitation of individuals with a SCI. It was hypothesized that there would be a significant increase in resilience, SWL, FI, and spirituality during rehabilitation and a significant decrease in depression. It was also hypothesized that there would be significant positive correlation between resilience,
SWL, FI, and spirituality, and significant negative correlation between depression and resilience, SWL, spirituality, and FI. Each of these variables have been shown to have a positive or negative relationship with resilience or its related factors, but they have not been examined together (Bombardier et al., 2004; Campbell-Sills et al., 2006; Connor & Davidson, 2003; Elliott & Frank, 1996; Fann et al., 2005; Frank, Elliot, Corcoran, & Wonderlich, 1987; Hodge, 2003; Kennedy & Rogers, 2000; Kroenke et al., 2001; Martin, Rief, Klaiberg, & Braehler, 2006). Results will provide a better understanding of resilience in patients with a SCI and how resilience is related to other key variables relevant to rehabilitation.

Method

Participants

Participants were sampled from the inpatient program of a local rehabilitation center. Purposive sampling was used to select participants based on four criteria to increase the homogeneity of the sample. Participants were between 16-60 years old, classified as chronic non-ambulatory, excluding scoliosis, which is representative of people in inpatient rehabilitation, and were all inpatients at the local rehabilitation center that had been stabilized after undergoing acute-care. Individuals with severe cognitive impairments as a result of multiple injuries (e.g., spinal cord, brain injuries) were not included in the study as these impairments could have interfered or confounded the changes. The final sample consisted of 42 adults with SCI, including 33 male and 9 female participants \(M \text{ age} = 37.1, SD = 14.01\). Number of days in rehabilitation (DIR) ranged from 29 to 107 days \(M = 52.24, SD = 15.78, \text{see Table 1}\). Based on age and
etiology (see Table 2), the current sample appeared to be representative of the general population of individuals with a SCI. Each participant was undergoing an individualized rehabilitation program based on the level and completeness of their injury. The individualized program included a variety of therapeutic treatments like physical and occupational therapy, individual and group psychological therapy, and aquatics.

Procedure

The researcher contacted the Clinical Research Director at the rehabilitation center to present information about the study protocol. Permission to complete the research study was received from the Institutional Review Board at the rehabilitation center and University of North Texas. A resident osteopathic doctor from the hospital completed the informed consent with participants in their rooms within the first few days after admission, informing them of the nature of the study, the requirements (e.g., completing questionnaires), and the selection criteria. Individuals were included in the study if they met the purposive sampling criteria and gave informed consent. When new participants consented to participate in the study, the primary investigator (PI) was contacted by the study coordinator to schedule all sessions required for data gathering. The PI then met with each participant individually, in their room at the scheduled time, to complete the measures of resilience, depression, SWL, and spirituality. The order that measures were presented to participants was determined by selecting numbers on index cards in a file folder that corresponded to each measure. A pen was supplied to each participant if they did not have one available. Each measure was completed in its entirety before moving to the next measure. It took approximately 20 minutes total time for all
measures to be completed. The PI was available to assist all participants during this time. For example, if they were unable to complete the questionnaires independently the PI read and/or marked the answers that participants specified. This protocol was followed for the participant’s privacy concerns and to comply with the Health Insurance Portability and Accountability Act of 1996 (HIPAA) regulations. Data was collected at three intervals during rehabilitation including (a) first week of admission (T1), (b) third week after admission (T2) and (c) the week of discharge (T3). A repeated measures design was utilized to examine when changes occur in the dependent variables throughout the inpatient rehabilitation program. All data was stored on-site at the rehabilitation center under double-lock conditions. When all data had been gathered for the study, the completed questionnaires were collected and taken off-site for analysis. After analysis was completed, all measures were returned to the rehabilitation center for long-term storage according to the policies and procedures of the hospital.

**Measures**

All descriptive data for participants were collected from the rehabilitation center’s records using a one-page questionnaire. This data consisted of age, gender, etiology and description of their injury, number of days prior to rehabilitation, admission and discharge dates, and hours of different therapies.

The CD-RISC (Connor & Davidson, 2003), Satisfaction With Life Scale (SWLS) (Diener, Emmons, Larsen, & Griffin, 1985), and Intrinsic Spirituality Scale (ISS) (Hodge, 2003), used in this study were sent to six experts (e.g., clinical psychologists, exercise psychologists) in an attempt to provide evidence of their face validity for use
with individuals with a SCI. Modifications were made to the measures if a majority of experts recommended a specific change (e.g., > 50%). Based on feedback from the experts two changes were made including (1) font size enlarged to 14pt, and (2) the page was formatted from portrait to landscape to allow for greater accessibility for participants who were confined to a bed during administration. This was particularly important as it was anticipated that several participants would be tetraplegic (i.e., loss of function in all four limbs) and on a ventilator ensuring that they would not be able to complete the questionnaires independently. Next, discussion will examine the details of each measure used in this study (i.e., CD-RISC, PHQ-9, SWLS, FIM, ISS).

The CD-RISC measures the total resilience of an individual which comprises of five factors including (a) Personal Competence, High Standards, and Tenacity; (b) Trust in One’s Instincts, Tolerance of Negative Affect, and Strengthening Effects of Stress; (c) Positive Acceptance of Change, and Secure Relationships; (d) Control, and (e) Spiritual Influences (Connor & Davidson, 2003). Evidence of the reliability and validity of the CD-RISC has been provided for adults (Campbell-Sills et al., 2006; Connor & Davidson, 2003). The measure consists of 25 items using a 5-point Likert scale ranging from 0 (not true at all) to 4 (true nearly all of the time). The scale examines how the participant felt over the past month (e.g., “I like challenges.”). A total resilience value is obtained by summing each item, thus scores can range from 0-100, with higher scores representing higher resilience. The total resilience score was used within this study. The internal consistency of the measure was calculated and an acceptable alpha coefficient was reported (.73). An intraclass correlation was computed to determine the stability of the
CD-RISC by administering the questionnaires to 42 individuals with SCI 3 weeks apart. The intraclass correlation for the CD-RISC was significant ($r = .72$), indicating that scores remained stable from time one to time two.

Depression was measured using the PHQ-9 and evidence supports the usefulness of this tool to identify and diagnose DSM-IV Major Depressive Disorder (Bombardier et al., 2004; Spitzer, Williams, & Kroenke, 1999). The PHQ-9 is a self-report measure, which is used during inpatient rehabilitation evaluation for people with a SCI (Burnett, et al., 2002). Estimates of the reliability and validity have been demonstrated for a variety of clinical samples (Bombardier et al., 2004; Fann et al., 2005). The PHQ-9 consists of a nine-item Likert scale with statements (e.g., “Little interest or pleasure in doing things”) and responses ranging from 0 (not at all) to 3 (nearly everyday). Scores range from 0-27, with higher scores representing higher depression. For the current sample the alpha coefficient (.77) and intraclass correlation ($r = .67$) were both acceptable providing evidence of the internal consistency and stability of the PHQ-9 for individuals with a SCI.

The SWLS is a five-item measure of the cognitive, judgmental component of subjective well-being that evaluates SWL overall (Sherman et al., 2004). It was selected because of its frequent use with participants with traumatic injuries (Matheis et al., 2006; Scherer & Cushman, 2001; Sherman et al., 2004). Participants indicate their degree of agreement with each item (e.g., “I am satisfied with my life”) using a 7-point Likert scale, with scores ranging from 1 (strongly disagree) to 7 (strongly agree). Total scores range from 5-35, with a score of 5 representing dissatisfied, and 35 representing completely satisfied. A total score of 20 reflects the neutral point on the scale. The alpha
coefficient (.79) and intraclass correlation ($r = .75$) were both acceptable providing evidence of the internal consistency and stability of the SWLS for individuals with a SCI.

The FIM is the most widely accepted functional assessment measure in inpatient rehabilitation centers (Center for Outcome Measurement in Brain Injury, 2006; Hamilton et al., 1987). Evidence of reliability and validity has been provided for use of the FIM with inpatients with SCI (Hamilton et al., 1987), and several studies have used the FIM in studying populations undergoing rehabilitation (Burnett et al., 2002; Dixon & Caradoc-Davies, 2005) The FIM is an 18-item ordinal scale used to assess functional ability in individuals with a variety of medical diagnoses requiring inpatient rehabilitation (e.g., traumatic brain injury, SCI, stroke). FIM scores range from 1 (total assist; performs less than 25% of task) to 7 (complete independence). The FIM has both motor and cognitive subscales but this study only utilized the motor component of the FIM which assesses four areas of function including (1) self-care, (2) bladder and sphincter control, (3) mobility, and (4) locomotion. By summing the points for each item in the motor component section, the possible total score ranges from 13 (lowest) to 91 (highest) level of independence. During inpatient rehabilitation clinicians observing patient function recorded FIM scores daily, which was usual practice at the local rehabilitation center where the study was conducted.

The ISS was used to measure intrinsic spirituality. Evidence of the validity and reliability of this measure indicate its appropriateness as a measure of intrinsic spirituality. The ISS is a six-item measure that uses a sentence completion format. An incomplete sentence fragment was provided, followed by two phrases anchoring each end
of the scale (e.g., “My spiritual beliefs affect: 10 - absolutely every aspect of my life, 0 - no aspect of my life”). An individual’s level of intrinsic spirituality is scored by summing the six subscales and dividing by six. Scores range from 0-10, with higher scores denoting a person who possesses greater spiritual motivation, and a score of 0 representing an individual for whom spirituality is not a part of their life. The alpha coefficient (.87) and intraclass correlation ($r = .62$) were both acceptable providing evidence of the internal consistency and stability of the ISS for individuals with a SCI.

**Data Analysis**

First, a repeated measures multivariate analysis of covariance (MANCOVA) was conducted to determine if there were differences between the participants’ resilience, depression, SWL, FI, and spirituality (dependent variables) at different times during their rehabilitation program. A MANCOVA was used as (1) each of the dependent variables were correlated, and (2) it decreased the chance of a type 1 error caused by computing multiple univariate tests (Norusis, 1988). Number of days in rehabilitation was used as a covariate during each analysis (except effect sizes). Huynh-Feldt adjusted univariate follow up tests, and univariate tests of within-subjects contrasts with effect sizes were also calculated to examine the linear or quadratic changes in variables. To examine the relationship between the dependent variables at T1, T2, and T3, three correlation matrices were generated.

**Results**

Preliminary data analyses were first completed and involved screening for outliers or missing values. No data were removed or missing from the sample. Analysis of the
distribution of the data revealed that values for skewness and kurtosis were not significantly different from zero ($p > 0.05$) with skewness values ranging between -0.35 to 0.71 ($M = 0.45$), and kurtosis between -0.19 to 0.51 ($M = 0.22$).

The final sample consisted of 42 participants (33 males and 9 females) with a mean age of 37.1 years ($SD = 14.01$). A summary of the samples demographic information is included (see Table 1 and 2). Descriptive statistics for each of the dependent variables across time are available in Table 3 (i.e., resilience, depression, SWL, FI, spirituality). Due to the large difference in the number of males ($n = 33$) and females ($n = 9$) in the study, gender differences in dependent variables could not be calculated. However, from examining the descriptive statistics females reported higher levels of depression (T1, $M = 11.56$; T2, $M = 7.22$; T3, $M = 6.44$) at each measurement time when compared to males (T1, $M = 5.51$; T2, $M = 5.55$; T3, $M = 4.30$). This gender difference is supported by previous research, which indicates that females consistently reported higher levels of depression compared to males (Munce & Stewart, 2007).

The initial repeated measures MANCOVA used two covariates including (1) number of days in rehabilitation and (2) ASIA rating ($ASIA = American Spinal Cord Injury Association$). ASIA ratings range from A (complete injury – low functioning) through E (normal) indicating the completeness of the SCI. A value was assigned to each ASIA rating (e.g., A = 1) to conduct the calculation. These were considered important covariates that could influence a change in the dependent variables overtime (e.g., greater time in rehab = greater physical/psychosocial functioning; more severe injury = lower physical/psychosocial functioning). Results indicated a significant within-subjects effect
$\Lambda = .718, \ F(8, 150) = 3.38 \ p < .05, \ ES = .15$ indicating that there was a significant
difference in the dependent variables across time, and the covariate of Time * DIR was
significant, $\Lambda = .775, \ F(8, 150) = 2.55, \ p < .05, \ ES = .12$. However, the covariate of Time
* ASIA rating was not significant, $\Lambda = .876, \ F(8, 150) = 1.28, \ p > .05, \ ES = .06$,
indicating that level of injury was not a significant covariate and influence on change in
the dependent variables across time. Consequently, the ASIA rating was removed as a
covariate from the repeated measures MANCOVA.

A second repeated measures MANCOVA was conducted using only DIR as a
covariate. Results indicated a significant within-subjects effect $\Lambda = .62, \ F(8, 154) = 5.14,
\ p < .05, \ ES = .21$. The covariate DIR had a significant within-subjects effect $\Lambda = .60, \ F(8,
154) = 5.53, \ p < .05, \ ES = .22$. Huynh-Feldt adjusted univariate follow-up tests revealed
significant differences within the dependent variables of depression, $F(1, 90) = 9.20, \ p < .05, \ ES = .19$; SWL, $F(1, 88) = 5.20, \ p < .05, \ ES = .16$; and spirituality, $F(1, 57) = 4.31, \ p < .05, \ ES = .10$. Univariate tests of within-subject contrasts with DIR used as a covariate
were calculated as well as effect sizes to determine whether differences between T1, T2,
and T3 were linear or quadratic. Significant differences were found for depression $F(1) = 16.31, \ p < .05, \ ES = .23$, (quadratic), SWL $F(1) = 12.42, \ p < .05, \ ES = .24$, (linear), and
spirituality $F(1) = 12.16, \ p < .05, \ ES = .23$, (quadratic). Also, a post hoc contrast showed
a significant difference was for FIM scores between T1 and T3 $F(1) = 19.94, \ p < .05, \ ES
= 2.75$.

The correlation matrices between dependent variables for the three measurement
times are displayed in Table 4. All correlations were considered significant at $p < .05$. At
T1 there were significant positive correlations between resilience and SWL (.54), resilience and spirituality (.35), and SWL and spirituality (.48). Significant negative correlations were found between depression and resilience (-.35), SWL (-.52), and spirituality (-.34). At T2 significant positive correlations were reported between resilience and SWL (.45) and SWL and spirituality (.60). Significant negative correlations were found between depression and resilience (-.33) and SWL (-.42). At T3, all of the correlations between the dependent variables were significant, except FIM. Positive correlations were reported between resilience and SWL (.69), and spirituality (.56) as well as SWL and spirituality (.56). Significant negative correlations were found between depression and resilience (-.48), SWL (-.45), and spirituality (-.42). Neither the T1 nor T3 FIM scores were significantly correlated to the other dependent variables across time.

Discussion

The purposes of this study were to identify changes in resilience, SWL, depression, spirituality, and FI, and examine the relationship between these variables during the inpatient rehabilitation of individuals with a SCI. Results indicated that participants experienced improved depression, SWL, FI and spirituality scores during inpatient rehabilitation, partially supporting the first hypothesis of the study as there was no change in resilience. Results also indicated relationships between resilience, depression, SWL, and spirituality at all three measurement times partially supporting the second hypothesis of the study. Discussion will focus on interpreting the changes in the dependent variables overtime and applying findings to the rehabilitation of inpatients post SCI.
Depression showed a small but significant improvement during rehabilitation as there was a significant decrease in depression from T1 to T2 and from T2 to T3. At each measurement time the sample’s mean scores for depressive symptoms using the PHQ-9 was classified as ‘mild’ depression. The mean scores moved from the mid-range of ‘mild’ depression downward toward ‘no depressive symptoms’. This finding was consistent with national data for individuals with a SCI (NSCISC, 2006) and typical of other findings that indicated some depression existed in individuals with a SCI during and after rehabilitation, but that major depression was not universal for this population (Frank et al., 1987; Woolrich, Kennedy, & Tasiemski, 2006). As the participants were known to have undergone pharmaceutical and therapeutic treatments for depression during this study, the decrease in depression found in the current study supported previous research that indicated individuals with depression undergoing treatments (e.g. cognitive-behavioral therapy, medication) reported significant decreases in depression (Dimidjian et al., 2006). Another study that examined SWL in individuals with a SCI found that levels of depression were a strong predictor of the individuals’ SWL, indicating that decreased depression is associated with increased SWL and visa versa (Budh & Osteraker, 2007).

The second variable to show a change was SWL as there was a significant improvement in SWL during time spent in rehabilitation. The mean scores for all measurement times were at or slightly above the neutral point of the SWLS, indicating that individuals were neither satisfied nor dissatisfied with their life. These findings supported previous research that indicated SWL was relatively stable during the first 6
months post SCI (Kennedy & Rogers, 2000). Other research on individuals with a SCI indicated that SWL was positively related to spirituality, general health, and social interactions, and changes in SWL occurred based on a number of factors including level of injury, functional status, and social support (Matheis et al., 2006). Changes in SWL have important implications for rehabilitation practitioners as findings from a longitudinal study of individuals with a SCI indicated that improved SWL was a predictor of higher levels of job productivity, social interaction, and physical activity participation (Charlifue & Gerhart, 2004).

FIM scores improved significantly indicating that physical functioning for individuals in this rehabilitation program increased substantially from the beginning to end of the program. However, according to the NSCISC (2006) the mean value for physical FIM scores at discharge of the current sample was slightly lower than the national average (i.e., study discharge [$M = 48$], national discharge [$M = 57$]) as well as the mean gain in FIM scores (i.e., study gain [$M = 28$], national gain [$M = 31$]). Improving FIM scores is an essential outcome of rehabilitation and is one of the goals of physical and occupational therapy (Dixon & Caradoc-Davies, 2005). A study of a variety of acquired traumatic injuries (e.g., traumatic brain injury, SCI, amputees) showed that physical and occupational therapies as well as other rehabilitation activities (e.g., aquatics, weight lifting) improved FIM scores across time (Burnett, et al., 2002). Also, improved physical functioning post-rehabilitation has been shown longitudinally to correlate with long-term improvements in activities of daily living, such as wheelchair transfers, in individuals with a SCI (Nyland et al., 2000). Accordingly, rehabilitation
specialists should continue to implement strategies to improve physical functioning as well as pursuing new methods to enhance FI (e.g., Lokomat, central pattern generator therapy).

The final variable that had a small significant quadratic change was spirituality as there was an increase from T1 to T2, then a decrease from T2 to T3 as scores returned close to their starting point. This pattern of an increase followed by a decrease is perhaps supported by the supposition that after a substantial disruption in someone’s life, spirituality tends to increase, but often returns to previous levels after a period of time (Hodge, 2003). By developing spirituality an individual may see improvements in other areas of their lives. For example, a study that examined inpatients in rehabilitation for a SCI found that perceived levels of general health, and social quality of life were highest among individuals with spiritual beliefs (Matheis et al., 2006). Therefore, rehabilitation specialists could implement strategies to enhance spirituality, which may have a positive impact on rehabilitation outcomes (e.g., greater SWL, social interactions, community integration).

While the current study examined if changes occurred in the dependent variables during rehabilitation, it was not identified why these changes occurred. Thus, no definitive answer can be made although we can speculate. For example, participants in this sample were known to have undergone a variety of therapies (e.g., pharmacological, individual psychological, group, physical, occupational) which previous research has indicated can influence particular dependent variables (e.g. medication impact depression, physical therapy impact FIM scores) (Dimidjian et al., 2006; Dixon &
Caradoc-Davies, 2005). Previous research has also shown other variables that were not measured in this study such as social support can influence depression and SWL (Froehlich, Fialkowski, Scheers, Wilcox & Lawrence, 2006; Malec, Testa, Rush, Brown & Moessner, 2007). In Malec et al. (2007), individuals with higher perceived social support showed less depression than individuals with low social support. In addition, Froehlich et al. (2007) found that individuals who received greater social support also reported improved SWL. In summary, future research should focus on identifying why these variables change over time so interventions can be developed to enhance rehabilitation outcomes.

Resilience showed no significant change over time, possibly due to the fact that there was not an intervention in place to influence resilience during rehabilitation. Consequently, for changes in resilience to be observed a specific intervention may be required. Another possibility was the instructions of the CD-RISC asked participants to respond based on the way they had felt over the last month. Given that the study measurement interval was 3-weeks it may not have been sensitive enough to identify change during this interval, which may have confounded the results. Thus, the wording of the measure may need to be modified to identify more acute (e.g., daily, weekly) changes in resilience. Further research is needed to identify if an intervention could lead to significant improvements in resilience. The following discussion will focus on the relationships found between the dependent variables over time.

There was a moderate significant negative correlation between resilience and depression at all three measurement times. This indicated that individuals who reported
greater resilience also reported decreased depression while individuals experiencing lower resilience had higher depression. No specific previous research on this relationship was found for individuals with a SCI. However, these results were supported by previous research with adults with brain injuries which indicated that post injury individuals with high resilience showed almost no depression while those with low resilience showed higher levels of depression (Bonanno, Galea, Bucciarelli & Vlahov, 2007).

A moderate significant positive correlation was found between resilience and SWL at each measurement time. This indicated that individuals who reported higher resilience also reported higher SWL while lower resilience was associated with lower SWL. Although no previous research on the relationship between resilience and SWL was found, perhaps the resilience-SWL relationship highlights the fact that resilience is an indicator of subjective well-being.

The results of the relationship between resilience and spirituality were not consistent across time as there was a moderate significant positive correlation between resilience and spirituality at T1 and T3, and non-significant correlation at T2. The significant relationship found during the first and last measurement time indicated that individuals reporting higher resilience also reported higher spirituality while lower resilience were associated with lower levels of spirituality. These results partially supported previous research that indicated a key variable related to resilience is spirituality (Connor & Davidson, 2003; Connor, Davidson, & Lee, 2003; Richardson, 2002). However, the inconsistencies in these results may be related to the measure of spirituality used during this study, as the range of scores for the ISS were narrow (i.e. 1-
which can create a lack of sensitivity to change and can impact results. Also, spirituality fluctuates in individuals according to their circumstances (Hodge, 2003). For example, the changes that occurred during the rehabilitation process (e.g. adjustment to loss of function, or improvement in function across time) may have contributed to this fluctuation. Additional research is needed to clarify the relationship between these two variables to see if these results can be replicated, and also to identify what if any effects these variables have on one another.

Depression showed a moderate significant negative correlation to SWL at each measurement time. This indicated that individuals who reported lower levels of depression reported higher levels of SWL while individuals reporting higher depression reported lower SWL. This result supported previous research that found a moderate significant negative relationship between depression and SWL in SCI participants (Scherer & Cushman, 2001). These results are also supported by Budh and Osteraker (2007) who found that higher levels of depression in individuals with an SCI were associated with decreased SWL and that depression was a strong predictor of SWL scores.

The relationship between depression and spirituality was not consistent across time as there was a moderate significant negative correlation at T1 and T3, but only close to significance at T2. The significant relationship found during the first and last measurement time indicated that individuals who reported lower depression also reported higher spirituality while higher reported depression were associated with lower levels of spirituality. These results partially supported previous research that individuals who
reported low levels of depression also reported higher levels of spirituality (Maddi, Brow, Khoshaba & Vaitkus, 2006). Again, the inconsistencies in these results may be related to the measure of spirituality used during this study. However, as stated earlier spirituality levels fluctuate in individuals across time, which could contribute to the inconsistency in the relationship between spirituality and other dependent variables in the study.

The last relationship to be discussed was between SWL and spirituality, which showed a moderate positive correlation at all measurement times throughout rehabilitation. This result indicated that individuals who reported high levels of SWL also reported high levels of spirituality while those who reported lower SWL reported lower levels of spirituality. These results supported previous research suggesting that individuals with high SWL also had high spirituality while lower SWL was associated with lower spirituality (Froehlich et al., 2006).

In contrast, no significant relationships were identified between FI and the other dependent variables in this study. Thus, as FI improved during the course of the rehabilitation program there were no significantly related changes in resilience, depression, SWL, or spirituality. These results were largely different from previous research, which had reported that FIM scores were significantly related to other psychosocial variables (e.g., depression, perceived quality of life, joy) (Burnett et al., 2002). However, the lack of a significant relationship between FI and depression supported Bombardier et al. (2004) who found that FIM scores were not significantly related to depression. However, further research on the relationships between FI and
other psychosocial variables is needed due to the inconsistencies in the literature on these relationships.

One limitation of the current study was related to the collection of FIM scores. Within the inpatient center where participants were sampled, FIM scores were completed by different therapists at different times and then input into the center’s MEDLINKS program. Thus, there may have been inconsistencies in the reporting of scores as one therapist may report FIM scores slightly differently from another for the same participant. The scores may also have been affected by the timing of the assessment (e.g. before or after aquatic therapy vs. after psychotherapy). The use of this measure as described here is common in rehabilitation environment (Burnett et al., 2002; Dixon & Caradoc-Davies, 2005), consequently the results should not be considered dramatically inaccurate. However, without a specific therapist recording FIM scores for all participants across time there may have been some variation in study scores, which could have impacted the validity of results.

A second limitation was the ISS that was used to measure spirituality, and was selected in the current study due to its brevity. However, due to the narrow scale used to score the ISS, changes in spirituality may have been difficult to accurately identify due to the measure’s sensitivity to change. Also, the measure of spirituality is inherently difficult due to the lack of a clear definition of the construct and its confusion for some individuals with religious behaviors (Hodge, 2002). As a result using a different measure such as the Multidimensional Measure of Religion/Spirituality (Idler et al., 2003) could yield different results.
There are many opportunities for future research on resilience. Based on the findings of this study, resilience is related to a variety of variables. Identifying which variables have the strongest relationships to resilience is important as this could lead to a clear and consistent definition of the construct. Furthermore, examining the relationships between variables related to resilience may prove productive, as almost no research has examined the interactions between these variables. This could lead to identifying the source of change for resilience and its related variables during rehabilitation. Another area for future research is developing resilience interventions that could be implemented as early as possible after a traumatic event has occurred (Amatea, Smith-Adcock, & Villares 2006; LaFromboise, Hoyt, Oliver, & Whitbeck 2006; Luthar & McMahon, 1996; Vera & Shin, 2006; Weed, Keogh, & Bordowski 2006). An intervention could include identifying what areas are important to a person, and then focus on expanding the skills in those areas such as spiritual practices, social support, or organization to maximize resilience and lead to an optimum rehabilitation outcome as defined by the highest possible psychosocial and physical functioning an individual can achieve. The completion of this type of intervention could be done in individual or group settings depending on the needs of the person. Interventions like this may increase the likelihood of an individual successfully reintegrating posttraumatic event.

Additionally, research could be conducted that monitors the use of medications and hours of psychological therapy completed. These variables could be used as covariates when observing changes in depression, and could identify a source for change in depression. Findings from Friedman, Wright, Jarrett, and Thase (2006) showed the
effect of combined treatments (e.g., medication and cognitive behavioral therapy), had a significantly stronger effect on depression than only using one treatment by itself.

Depression in individuals with a SCI has been associated with increased healthcare expenditures, longer rehabilitation stays, and a decrease in SWL (Elliot & Frank, 1996). A decrease of depression can be quantified economically as the costs of depression are high due to the prevalence of the condition and the impact the illness has on functioning (Donohue & Pincus, 2007). These authors’ review on the costs of depression highlighted the economic impact of depression indicating that it had the same healthcare costs as diabetes, heart disease, hypertension, and back problems. In 2000 estimated annual costs for depression treatment, suicide, and workplace losses in the United States were approximately $83 billion dollars. Therefore, clinicians and service providers for rehabilitation should continue to focus on developing and delivering intervention that can reduce depression. One way is to further research on resilience to identify any impact it may have on depression. Also, developing a better understanding of the changes in depression could prove productive if there were resulting reductions in cost associated with depression for the rehabilitation population.

In conclusion, results indicated significant improvements in depression, SWL, FI, and spirituality. Also, significant correlations were found between resilience, depression, SWL, and spirituality. Future resilience research could develop a clear consistent definition of resilience, identify the source of change for resilience and related variables during rehabilitation, and develop effective resilience interventions to implement in the rehabilitation environment. Any new resilience interventions could give rehabilitation
service providers additional tools to improve rehabilitation outcomes, decrease ongoing adverse health issues for individuals with SCI, and aid in the successful reintegration of individuals into their lives after a traumatic event. However, resilience intervention development and implementation will only be helpful if researchers and therapeutic communities consider resilience an important part of rehabilitation and recovery from traumatic events (White et al., 2008). Consequently, it is imperative that researchers continue to examine the construct of resilience, its role in the rehabilitation process, and develop practical interventions that are implemented as early as possible after a traumatic event.
Table 1

*Descriptive Data of Sample Means, Standard Deviations, Ranges*

<table>
<thead>
<tr>
<th></th>
<th>$M$</th>
<th>$SD$</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age$^a$</td>
<td>37.1</td>
<td>14.01</td>
<td>16-60</td>
</tr>
<tr>
<td>Days in Rehabilitation$^a$</td>
<td>52.24</td>
<td>15.78</td>
<td>29-107</td>
</tr>
<tr>
<td>Number of days prior to Rehabilitation$^a$</td>
<td>26.02</td>
<td>17.00</td>
<td>7-85</td>
</tr>
<tr>
<td>Hours of Physical Therapy$^b$</td>
<td>51.44</td>
<td>13.80</td>
<td>19-69</td>
</tr>
<tr>
<td>Hours of Occupational Therapy$^b$</td>
<td>37.38</td>
<td>10.62</td>
<td>23-53</td>
</tr>
<tr>
<td>Hours of Therapy$^b$</td>
<td>115.23</td>
<td>27.15</td>
<td>64-179.75</td>
</tr>
</tbody>
</table>

$^a n = 42, ^b n = 32.$
Table 2

*Etiology of Sample compared to the General Population*

<table>
<thead>
<tr>
<th></th>
<th>Sample</th>
<th>General Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Age</td>
<td>37.1</td>
<td>38</td>
</tr>
<tr>
<td>Percent Males</td>
<td>78.6</td>
<td>81</td>
</tr>
<tr>
<td>Motor Vehicle Accidents</td>
<td>52.4</td>
<td>43.4</td>
</tr>
<tr>
<td>Motor Cycle Collision</td>
<td>9.5</td>
<td>5.9</td>
</tr>
<tr>
<td>Fall</td>
<td>23.8</td>
<td>19.9</td>
</tr>
<tr>
<td>Gun Shot Wound</td>
<td>4.8</td>
<td>16.1</td>
</tr>
<tr>
<td>Medical</td>
<td>9.5</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Note: General population data from 2006 Annual Report for the Model Spinal Cord Injury Care Systems, National Spinal Cord Injury Statistics Center, University of Birmingham
Table 3

*Dependent Variable Means, Standard Deviations, by Time*

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Resilience</td>
<td>82.19</td>
<td>9.37</td>
<td>81.90</td>
</tr>
<tr>
<td>Depression</td>
<td>6.81</td>
<td>5.24</td>
<td>5.90</td>
</tr>
<tr>
<td>SWL</td>
<td>19.90</td>
<td>7.28</td>
<td>20.43</td>
</tr>
<tr>
<td>Spirituality</td>
<td>7.56</td>
<td>1.70</td>
<td>7.80</td>
</tr>
<tr>
<td>FIM</td>
<td>19.81</td>
<td>10.24</td>
<td></td>
</tr>
</tbody>
</table>
Table 4

_Correlation Matrix Between Dependent Variables_

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Resilience</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Depression</td>
<td>-.35*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Satisfaction With Life</td>
<td>.54*</td>
<td>-.52*</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Spirituality</td>
<td>.35*</td>
<td>-.34*</td>
<td>.48*</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>5. FIM&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.08</td>
<td>-.03</td>
<td>.28</td>
<td>.07</td>
<td>-</td>
</tr>
<tr>
<td><strong>Time 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Resilience</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Depression</td>
<td>-.33*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Satisfaction With Life</td>
<td>.45*</td>
<td>-.42*</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Spirituality</td>
<td>.29</td>
<td>-.27</td>
<td>.60*</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>5. FIM&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Time 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Resilience</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Depression</td>
<td>-.48*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Satisfaction With Life</td>
<td>.69*</td>
<td>-.45*</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Spirituality</td>
<td>.56*</td>
<td>-.42*</td>
<td>.56*</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>5. FIM&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-.03</td>
<td>-.08</td>
<td>-.11</td>
<td>-.16</td>
<td>-</td>
</tr>
</tbody>
</table>

<sup>a</sup>Admit FIM. <sup>b</sup>No FIM data collected during this time. <sup>c</sup>Discharge FIM.

*<sup>p</sup> < .05.
REFERENCES


