Department of Veterans Affairs

Journal of Rehabilitation Research and Development
Vol. 39 No. 3, May/June 2002
Pages 359–366

Life satisfaction following spinal cord and traumatic brain injury: A comparative study

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Abstract—The current study was designed to examine the predictive validity of several factors that are common to spinal cord injury (SCI) and traumatic brain injury (TBI) populations to overall life satisfaction. We examined several demographic and functional predictors (1) within each group separately and (2) using both groups while controlling for unique predictors within groups. Participants included 190 and 57 individuals with SCI and TBI, respectively. To minimize the influence of injury duration, we assessed life satisfaction at 1-year postinjury in both groups. Functional disability (Functional Impairment Measure [FIM]) was the only common predictor within groups. For the TBI group, marital status was also a significant predictor of life satisfaction. None of the other predictors examined was significant among the SCI group. After functional disability and marital status were controlled, overall life satisfaction did not differ between groups. Total explained variance in life satisfaction was low in both groups, 9% and 25% in the SCI and TBI groups, respectively. Future directions are discussed.

This material is based on work supported by the University of Alabama at Birmingham Model Spinal Cord Injury System of Care grant (H133N50009) from the National Institute on Disability and Rehabilitation Research, Office of Special Education and Rehabilitation Services, Department of Education, Washington, DC; the National Institute of Disability and Rehabilitation Research Traumatic Brain Injury Model System Project at University of Alabama at Birmingham (H133A980010); Mississippi Methodist Rehabilitation Center (H133A980035); National Institutes of Health; National Research Service Award T32 HD07420-10; and National Center for Medical Rehabilitation Research. Data used were derived from the National Spinal Cord Injury Statistical Center.

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Key words: *head injury, life satisfaction, pain, quality of life, spinal cord injury.*

INTRODUCTION

Traumatic brain injury (TBI) and spinal cord injury (SCI) affect over two million people in the United States each year [1,2]. Unfortunately, TBI and SCI may often result in changes in physical, social, cognitive, or emotional functioning, which taken together may significantly impact an individual's self-perception or subjective well-being (SWB).

SWB is receiving increased attention as an important long-term outcome following severe injury. As opposed to objective measures, which often rely on physician- or caregiver-based ratings, SWB attempts to capture the individual's viewpoint. The construct is thought to contain both an emotional (i.e., positive and negative affect), and a cognitive-judgmental component, the latter often referred to as life satisfaction [3]. As described by Diener and associates, judgments of life satisfaction are "dependent upon a comparison of one's circumstances with what is thought to be an appropriate standard" [4, p. 71). The primary advantage of measuring life satisfaction with this approach is that the individual, rather than the researcher, uniquely determines the comparative standard upon which the judgment of life satisfaction is based. While this flexibility may limit a clear understanding of the relative importance of specific life domains across populations, life satisfaction scores do allow for comparisons in overall life satisfaction across different populations by

placing diverse injury or illness groups on a common metric.

Demographic Correlates of Life Satisfaction in SCI Individuals

The association between demographic characteristics and life satisfaction among individuals with SCI has been inconsistent [5–20]. Gender differences in life satisfaction have had relatively little support, whereas age tends to be inversely related to life satisfaction so that younger individuals report higher life satisfaction. One of the few consistent findings is that higher education is associated with increased life satisfaction. Married individuals tend to report higher levels of life satisfaction as compared to single individuals [10,17,21–24], although this is not always supported [14,18,25]. Impairment and disability have been found to be largely unrelated to self-reported life satisfaction [8,9,11,14,18,19,25,26], although decreased life satisfaction has been reported among some with greater impairment and disability [6,27].

Race is largely unrelated to life satisfaction after controlling for demographic differences between racial groups [9,10,18,28]. Krause, in contrast, found lower life satisfaction scores among minority groups as compared to whites [13]. However, the extent to which this difference can be attributed to race is limited, since there was no effort to control for a nearly three to one difference in the employment rate (35 percent versus 13 percent), and education (mean [M] = 13.4 and 11.7 years, standard deviation [SD] = 2.9 and 3.5) between racial groups.

Correlates of Life Satisfaction in TBI Individuals

As compared to individuals with SCI, predictors of life satisfaction among individuals with TBI have not been examined as well. This lack of research may be explained, in part, by a concern that cognitive impairment in areas such as judgment or self-awareness, common among persons with TBI, may result in skewed life satisfaction ratings or in poor understanding of the meaning of life satisfaction questions [2]. It should be noted, however, that Granger et al. found little or no relationship between cognitive status and life satisfaction [29], though this finding is not always supported [29,30]. Moreover, the subjective nature of individual life satisfaction ratings (the advantage to this method of measuring SWB) suggests that the perspective of the TBI patient is, by definition, as valid as that of any other person [2].

Some evidence suggests that older individuals (i.e., both older age and older age at injury onset) report greater life satisfaction [2,31]. Also, Webb et al. found that African Americans with TBI reported greater life satisfaction than Caucasians; however, no relationship was found between income and life satisfaction [32]. Heinemann et al. reported little or no relationship between life satisfaction and education, gender, and marital status [31]. Similar to individuals with SCI, individuals with TBI who are married report greater life satisfaction relative to single individuals with TBI [30]. Finally, the relationship between life satisfaction and disability among individuals with TBI has been mixed, with some evidence for increased life satisfaction with lower disability and some for little or no relationship [29–32].

Despite the many demographic-, disability-, and handicap-related similarities between SCI and TBI populations, only a few studies have attempted to examine predictors of life satisfaction between both SCI and TBI groups. Using the same set of predictor variables for both groups, Warren et al. found some important differences in correlates of life satisfaction between individuals with TBI and SCI [30]. For instance, the strongest predictors of increased life satisfaction among individuals with SCI were lower self-blame for injury, and satisfaction with family support and activities. In contrast, employment, marital status, memory, bowel functioning, family support and activities, and self-blame were associated with life satisfaction among individuals with TBI. Regression analysis indicated that education, age, marital status, and race were not significant unique predictors of life satisfaction for either group. Unfortunately, mean difference in life satisfaction between groups was not examined. In two studies that used a global quality of life (QOL) measure, mean differences in quality of life were not found between individuals with SCI and TBI [33,34]. However, demographic differences between groups were not controlled and the relevance of the global QOL measure used to measure life satisfaction is tenuous.

This study was designed to further examine life satisfaction among individuals with TBI relative to SCI. With the use of the same set of predictor variables, separate regression analyses were performed within an SCI and TBI population to determine unique predictors for each injury group. A follow-up analysis that controlled for significant predictors of life satisfaction for each group was then performed to examine the difference in the overall life satisfaction scores between TBI and SCI groups. So

that the influence of time since injury could be minimized, both studies examined individuals 1-year postinjury.

METHODS

Participants

Participants with TBI

A total of 57 participants with TBI with year-one life satisfaction data were eligible for this study. These subjects were from two TBI centers (University of Alabama-Birmingham and Mississippi Methodist Rehabilitation Center) that are part of the Department of Education-funded Model Traumatic Brain Injury Systems of Care.

Participants with SCI

SCI subjects used in this study have been previously described in detail [35]. Briefly, 940 participants with SCI with year-one life satisfaction data from one of the 18 Department of Education-funded Model Spinal Cord Injury Systems of Care were considered for study. The data were drawn from the National Spinal Cord Injury Statistical Center (NSCISC) database. To ensure a sample that was demographically similar to the TBI sample, we used only data from two Model Systems sites (Birmingham, Alabama, and Atlanta, Georgia), resulting in 190 individuals with SCI being included in the study.

Measures

Outcome

The Satisfaction with Life Scale (SWLS) is a well-validated measure of subjective satisfaction with life that allows respondents to weigh domains of their lives in terms of their own values [4,36]. It consists of five statements measured on a seven-point Likert scale (i.e., completely agree to completely disagree). These items are listed in the **Figure**. Cronbach's alpha (0.80 to 0.89) and test-retest reliability (0.54 to 0.83) have been in the acceptable range [37]. It has been factor analyzed, and all five items load on one general factor of well-being [37]. A total life satisfaction score was obtained by summing the five items (range: 5–35).

1. In most ways, my life is close to my ideal.
2. The conditions in my life are excellent.
3. I am satisfied with my life.
4. So far, I have gotten the important things I want in life.
5. If I could live my life over, I would change almost nothing.

Figure.
Individual items from Satisfaction with Life Scale. All items rated on a 7-point Likert scale (i.e., completely agree to completely disagree).

Predictor

The Functional Impairment Measure (FIM) is a commonly used measure of disability with well-established psychometric characteristics (e.g., interrating reliability = 0.86 to 0.95; [38–41]. The motor component was used after the Rasch analysis with the use of a conversion table from a report by Heinemann et al. (Table 7, Appendix C) [42,43]. The Rasch conversion method was designed to transform the FIM score, which is commonly considered nominal or rank order level data, to interval level data for statistical analysis using parametric tests. The FIM was administered at the year-one follow-up. The cognitive subscale was not included in this study because the SCI Model Systems Database does not include this scale in its routine assessment battery.

Statistical Procedures

We performed between-group analyses on demographic and medical characteristics to determine group equivalence on these factors, Chi-square analyses on categorical data (e.g., cause of injury), and analysis of variance (ANOVA) on interval data (e.g., SWLS score). Preliminary analyses were conducted on predictor variables to check for violations of the major assumptions of regression analysis. To examine unique predictors of life satisfaction within groups, we conducted full model regression analyses (i.e., all variables were entered on the first step) separately for the TBI and SCI groups. The common predictor variables included for both groups included age at one-year follow-up, gender, education (<12 years, high school diploma; or GED, 12+ years), occupational status (employed versus unemployed), race (Caucasian versus non-Caucasian), physical disability (Rasch-adjusted FIM motor score), marital status (married versus not married), and etiology (motor vehicle accident [MVA] versus other). We used analysis of covariance

(ANCOVA) to examine mean between-group differences in life satisfaction while controlling for those factors found to be significantly related to life satisfaction within groups. A 0.05 alpha level was used for significance.

RESULTS

Table 1 presents the demographic and medical characteristics of each group. The groups did not differ ($p > 0.05$) in age, gender, race, occupational status, and marital status. Patients from both groups tended to be unemployed, unmarried, and Caucasian males in their mid-thirties. In contrast, a greater proportion of individuals with TBI (54 percent) reported some education beyond high school as compared to individuals with SCI (15.8 percent), $\chi^2 = 36.93$, $p < 0.001$. Although MVA was the most common cause of injury for both groups, fewer individuals with SCI (50 percent) as compared to TBI (70 percent) reported MVA as the etiology of injury, $\chi^2 = 7.20$, $p < 0.01$. As expected, functional disability, as measured by the FIM, was significantly greater among individuals with SCI, $F(2,208) = 50.36$, $p < 0.001$.

Injury-specific information was also collected. Individuals with TBI experienced between 4 to 106 days of posttraumatic amnesia (PTA) (mean PTA days = 27 days). The median Glasgow Coma Scale at admission was 10, ranging from 3 to 15. For the individuals with SCI, the proportion of individuals with tetraplegia versus paraplegia was similar, as well as complete versus incomplete lesion (about 50 percent).

Preliminary analyses were conducted before regression analyses. Skewness and Kurtosis statistics were well within the normal range (–1.5 to 1.5). A correlation matrix including all predictors (i.e., physical disability, marital status, age, education, etiology, race, gender, and employment) found the highest correlation between predictors to be 0.54, with the average correlation being 0.14. Thus, multicolinearity was not considered a concern. Standardized regression coefficients from both the SCI and TBI regression analyses are reported in **Table 2**. These models, which included all demographic and medical predictors common to both groups, indicated that functional disability (FIM) was the only unique predictor of life satisfaction for both groups ($B = 0.353$, $p < 0.05$; $B = 0.201$, $p < 0.05$, TBI and SCI, respectively). In general, increased physical disability was associated with decreased life satisfaction. The full model accounted for 9 percent ($F(9,144) = 1.589$, $p = 0.124$) and 25 percent ($F(9,46) = 1.739$, $p = 0.107$) of the variance in life satisfaction among individuals with SCI and TBI, respectively.

Table 1.
Demographic and medical variables.

Variable	SCI		TBI	
	M	**SD**	**M**	**SD**
FIM—Motor*	55.4	(21.63)	87.5	(17.60)
Age at Follow-up	36.4	(13.83)	36.2	(15.84)
Glasgow Coma Scale Total	—	—	10.06	(4.29)
Posttraumatic Amnesia (Days)	—	—	27.31	(19.26)
	N	%	N	%
ASIA Impairment				
A	100	52.6	—	—
B	27	14.2	—	—
C	30	15.8	—	—
D	30	15.8	—	—
Unknown	3	1.6	—	—
Category of Neurologic Impairment				
Paraplegia, Incomplete	26	113.7	—	—
Paraplegia, Complete	70	36.8	—	—
Tetraplegia, Incomplete	62	32.6	—	—
Tetraplegia, Complete	30	15.8	—	—
Missing	2	1.1	—	—
Gender				
Male	137	72.1	42	73.7
Female	53	27.9	15	26.3
Education*				
Less than High School (HS)	48	25.3	12	21.0
HS Diploma or GED	112	58.9	14	24.6
Post-HS Education	30	15.8	31	54.4
Race				
Caucasian	133	70.0	34	59.6
Non-Caucasian	57	30.0	23	40.4
Employment				
Employed	54	28.4	22	38.6
Unemployed	136	71.6	34	59.6
Missing	—	—	1	1.8
Etiology†				
Motor Vehicle	95	50.0	40	70.2
Other	95	50.0	17	29.8
Marital Status				
Married	73	38.4	19	33.3
Not Married	117	61.6	38	66.7

*$p < 0.001$
†$p < 0.01$
ASIA = American Spinal Injury Association
SD = standard deviation
M = mean

Table 2.
Standardized coefficients of predictors included in regression analyses.

Variable*	SCI		TBI	
	B	***p***	**B**	***p***
Gender	0.073	0.377	–0.057	0.676
FIM—Motor	0.201	0.016	0.353	0.025
Marital Status	0.146	0.142	0.247	0.110
Education				
High School	0.040	0.686	0.075	0.665
Posthigh School	0.066	0.519	0.031	0.865
Race	0.001	0.993	0.061	0.681
Employment	–0.104	0.217	–0.231	0.179
Etiology	0.050	0.553	0.192	0.173
Age at Anniversary Date	–0.119	0.232	0.222	0.194

*Dummy coding for each variable was as follows:
Gender: 1 = male; 2 = female
Employment: 1 = employed; 2 = unemployed
Etiology: 1 = MVA; 2 = non-MVA
Marital Status: 1 = single; 2 = married
Race: 1 = Caucasian; 2 = non-Caucasian

Individuals with TBI reported higher overall life satisfaction (M = 19.16, SD = 8.53) relative to individuals with SCI (M = 16.84, SD = 7.50). This difference was significant, $F(1,245) = 3.939$, $p < 0.05$. However, when functional disability was controlled for using ANCOVA, the group effect was no longer significant, $F(1,208) = 0.001$, $p = 0.982$.

DISCUSSION

Despite some overlap in injury-related limitations and demographic characteristics associated with the population at increased risk of injury, relatively few comparative studies have examined outcomes following TBI versus SCI. The purpose of this study was to (1) compare and contrast characteristics associated with life satisfaction between two injury populations (i.e., TBI and SCI) and (2) determine whether self-reported life satisfaction had a significant mean difference between individuals with TBI versus SCI. The current study attempted to extend previous research in this area by (1) using a common set of variables across injury groups to predict life satisfaction and (2) controlling for characteristics associated with life satisfaction within each injury group when determining mean group differences.

Demographic variables were unrelated to life satisfaction for both injury groups. In contrast, functional disability, as measured by the motor subscale of FIM, was a common predictor of life satisfaction for both groups. The relationship between disability and life satisfaction reported in the literature among individuals with SCI and TBI has been inconsistent. Among individuals with SCI, disability generally has not been an important predictor of life satisfaction, although decreased life satisfaction has been reported among those with some greater disability [6,8]. Disability is a more consistent predictor of life satisfaction among persons with TBI [30,32,44] although this relationship has not always been supported [29].

The FIM-motor scale attempts to capture an individual's ability to perform basic activities of daily living (ADL) such as toileting, bathing, dressing, feeding, and controlling bowel and bladder. Consequently, the ability to perform basic hygiene-related activities involved in day-to-day living may be a common component of the comparative standard upon which individuals with TBI and SCI base judgments of life satisfaction. It may be reasonable to assume that disabilities in basic hygiene-related activities may be associated with other functional limitations that may prevent or limit an individual's ability to actively engage in other satisfying life events, or may be associated with constructs of independence (e.g., decreased autonomy, self-esteem, self-efficacy, or perceived control). Relatedly, life satisfaction may also be influenced by the extent to which disability influences social, occupational, and/or family roles (e.g., level of handicap).

Note, however, that both regression analyses indicated that the predictors accounted for a small proportion of the variance in life satisfaction for both SCI and TBI groups (i.e., 9 percent and 25 percent, respectively). This finding may be attributed to two factors. First, since a primary interest was placed on examining common predictor variables across injury groups, other variables that may account for additional variance, such as injury-specific factors (e.g., level of injury, cognitive deficits), and other characteristics associated with life satisfaction (e.g., handicap, physical health, and depressive symptoms) were not included. Handicap, for example, has consistently been shown to be an important predictor of life satisfaction [9,31]. In fact, studies of individuals with SCI show that, after the handicap is controlled, the relationship between disability and life satisfaction has a significant attenuation [35]. These other potential predictors

were not included because they were not common data points across both TBI and SCI Model Systems Databases. Second, although the Satisfaction with Life Scale provides a quality of life score comparable across any patient population, the global nature of the SWLS limits the extent of the potential explained variance that may be captured by any set of predictor variables. Future studies that incorporate a more extensive set of common predictor variables between individuals with TBI and SCI will allow for the development of a more comprehensive model of life satisfaction.

Finally, examination of whether there is a mean difference in life satisfaction between individuals with TBI and SCI indicated no difference between groups after controlling for functional disability. This finding is consistent with Brown et al. and Kreuter et al. who also found no difference between individuals with SCI and TBI on global measures of quality of life [33,34]. Thus, there does not appear to be a quantitative difference in life satisfaction, as measured by the SWLS, that can be attributed specifically to injury type.

LIMITATIONS

This study has some important limitations that should be considered. The TBI and SCI samples used in this study were selected from only two sites, both in the southeast United States. Thus, generalization to the overall TBI and SCI populations may be limited. Furthermore, this study focused on life satisfaction 1-year postinjury. Future research would benefit from the examination of life satisfaction across a longer injury duration, on a longitudinal basis, and with the use of a more extensive set of common predictor variables. This broader research will help further characterize the components of life satisfaction among these two injury groups, which may help facilitate targeted intervention efforts.

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Submitted for publication October 23, 2000. Accepted in revised form February 2002.