

ORIGINAL ARTICLE

Predictors of marital longevity after new spinal cord injury

D Karana-Zebari, MB de Leon and CZ Kalpakjian

Department of Physical Medicine and Rehabilitation, University of Michigan, Ann Arbor, MI, USA

Study design: Prospective cohort design of married persons with new spinal cord injury (SCI).

Objectives: To examine the relationship of demographic and injury characteristics, self-rated health, physical functioning, and life satisfaction to the duration of marriage 1 to 15 years after SCI among individuals who were married at the time of injury.

Setting: United States.

Methods: Survival analysis was chosen to determine the predictors related to marital longevity, which is defined as non-occurrence of divorce after injury. In all, 2327 subjects were included in the analyses. Predictors were demographics and injury characteristics, level of handicap, self-perceived health, and functional independence.

Results: Age at injury, being Caucasian vs African American, having a college education vs high school, having 'other' employment status vs being unemployed, having higher social integration and improved or stable self-rated health vs poor health were all significant factors that delayed the time of divorce after injury. Contrary to expectations, level of injury, function, mobility and independence were not significant predictors of marriage longevity.

Conclusion: Social integration and health perception, the most powerful indicators of marriage longevity, can be addressed and facilitated by health care providers and rehabilitation programs.

Spinal Cord (2011) 49, 120–124; doi:10.1038/sc.2010.63; published online 1 June 2010

Keywords: spinal cord injuries; divorce; marriage

Introduction

Spinal cord injury (SCI) results in many challenges that often lead to changes in personal relationships. Marriage duration after SCI can be indirectly ascertained from divorce rates, which have been estimated at various post-injury intervals. Divorce rates for couples married at the time of injury are estimated to be 1.5–2.5 times higher than that of the general population,^{1,2} with increased odds of divorcing rising over time, though this is not consistently found. Higher divorce rates have been shown to occur most frequently in the first 3 years after injury, and follow-up studies of >5 years after injury show divorce rates approximating that of general population base rates.³

Studies of marital relationships and SCI have focused on marital dissolution and its associated factors. Demographic characteristics of persons with SCI who divorce after injury include young age at marriage, being female, lower education, and a previous divorce.^{1,4} Injury characteristics indicative of more severe injuries have likewise been associated with higher rates of divorce.^{2,4} Difficulty in simultaneously attaining new physical functioning, trouble maintaining a

partner relationship,⁵ reduced labor force participation and decreased income⁶ are some of the cited reasons for divorce after injury.

In summary, the current SCI literature has identified multiple factors associated with divorce after injury. However, the use of cross-sectional designs and the variability in time frames in longitudinal studies have limited the ability to examine those factors that contribute or detract from the duration of marriage after injury. In addition, the finding of the leveling off of divorce rates after initial high rates after injury point to the need to further investigate what factors contribute to marital longevity after SCI. None have examined marital longevity after new injury using longitudinal data. Thus, the purpose of this study was to examine the relationship of demographic and injury characteristics, self-rated health, physical functioning and life satisfaction to the duration of marriage 1 to 15 years after injury among individuals who were married at the time of injury.

Materials and methods

Participants

Data from women and men who sustained traumatic SCI and were enrolled in the National SCI Model System database were examined in this study. Follow-up interviews were completed at 1 year after injury and every 5 years thereafter.

Correspondence: Dr D Karana-Zebari, Department of Physical Medicine and Rehabilitation, University of Michigan, 325 East Eisenhower, Suite 300, Ann Arbor, MI 48108, USA.

E-mail: dunia@med.umich.edu

Received 18 March 2010; revised 23 April 2010; accepted 25 April 2010; published online 1 June 2010

Inclusion criteria included: 18 years of age and older, married at the time of injury, and completed at least the first year follow-up interview. Individuals who had minimal deficits, recovered or were deceased (by year 1 follow-up) or were missing marital status were excluded. In addition, because most of the outcomes used in this study were introduced into the database in November 1995, individuals who completed year 1 follow-up after January 1996 were included. This date was selected to allow for a transitional period at each data collection site for the integration of the new items in their interviews. From a pool of $N = 6141$, there were 2327 individuals who met inclusion criteria.

Measures

Outcome variable. The outcome of this study is marital longevity, which is defined by non-occurrence of divorce after SCI. The occurrence of divorce is assessed at an interval; that is, whether it occurred in the time between the last and current interview. The interviews are typically at 1, 5, 10, and 15 years after injury. As such, the exact time of divorce is unknown but estimated within an interval. Marriage longevity or duration estimation is based on the divorce estimate (for example the longer the time to divorce, the longer the marriage duration after the injury.) Individuals who were separated were combined with the divorce category.

Predictor variables

The Craig Handicap Assessment and Reporting Technique-Short Form (CHART-SF). The CHART-SF is a 19-item measure assessing six dimensions of handicap among persons with disabilities living in the community; however, we only included the following four subscales: physical independence, mobility, occupation, and social integration.⁷ Test-retest reliability has ranged from 0.80 to 0.95 for individual dimensions and 0.93 for the overall score among individuals with SCI; validity of the instrument also has been supported.⁷

Self-Perceived Health Status (SF-1 and SF-2). The SF-1 is a single item that measures general health perception from the Health Status Questionnaire Short Form (SF-36).⁸ The SF-1 refers to a general rating of health on Likert scales of 1 (excellent) to 5 (poor). The next item (SF-2) refers to a comparison of current health to a year ago rated on Likert scales of 1 (much better now than 1 year ago) to 5 (much worse now than 1 year ago).

Satisfaction with Life Scale. The satisfaction with life scale is a 5-item self-report measure of life satisfaction.⁹ Items are rated on Likert scales of 1 (strongly disagree) to 7 (strongly agree), with total scores ranging from 0 to 35, with higher scores reflecting higher levels of satisfaction with life. The satisfaction with life scale has been shown to have strong internal consistency (Cronbach's $\alpha = 0.80-0.87$) and good test-retest reliability (ranging from 0.50 at 10 weeks to 0.83 at 2 weeks) in persons with SCI.¹⁰

Functional Independence Measure (FIM). The FIM assesses an individual's ability to perform functional daily living tasks.¹¹ These tasks include self-care, sphincter control, mobility, locomotion, communication, and social cognition. Functional independence measure item scores range from 1 (total assist) to 7 (complete independence). The functional independence measure has been shown to have interrater reliability of 0.95 and test-retest reliability of 0.95.¹²

Demographic and injury characteristics. Level of neurological impairment was based on status at discharge from inpatient rehabilitation and classified as incomplete paraplegia, complete paraplegia, incomplete tetraplegia, and complete tetraplegia. Demographic characteristics include age, race, occupational status and education. Categories for the latter three characteristics are specified in Table 1.

Statistical analysis

Interval-censored survival analysis was chosen to determine the predictors that significantly contribute to marital longevity after new SCI. This method handles interval-censored data, where an event is known to occur between two potentially large and irregularly spaced dates, but the actual date of the event is unknown, which is the case in the SCI Model System database. All predictor variables were measured at year 1 follow-up.

We tested the fit of three commonly used parametric distributions (that is Log-Normal, Weibull, and Generalized γ)

Table 1 Demographic and injury characteristics of participants ($N = 2327$)

Characteristics	N	%
Gender		
Male	1837	78.9
Female	490	21.1
Race		
Caucasian	1781	76.5
African American	352	15.1
Native American, Aleutian, or Eskimo	14	0.6
Asian or Pacific Islander	65	2.8
Other	66	2.8
Unknown or missing	49	2.1
Employment status		
Employed	1716	73.7
Not employed	154	6.5
Other (students, homemaker, retired, and 'other')	432	18.6
Unknown or missing	25	1.1
Education		
Less than high school	384	16.5
High school graduate or GED	1231	52.9
College graduate (Associate's or Bachelor's)	393	16.9
Graduate degree	124	5.3
Unknown or missing	195	8.4
Level of neurological impairment		
Incomplete paraplegia	445	19.1
Complete paraplegia	527	22.6
Incomplete tetraplegia	949	40.8
Complete tetraplegia	406	17.4

and selected the distribution with a maximum log-likelihood; the analysis showed Weibull to have the maximum log-likelihood. SAS PROC LIFEREG generates a table of regression coefficient estimates and χ^2 distribution P -values for each factor in the model. For this study, variables with $P \leq 0.05$ are considered to have significant influence on and are predictive of marriage duration. A positive estimate means a longer time to event (that is divorce) and a negative estimate means a shorter time to event. Taking the exponent of the regression coefficients provides the ratio of a mean survival time for the two groups (that is those who did and did not divorce). Descriptive statistics and univariate analyses were used to describe demographic and injury characteristics. Statistical analyses were performed using SPSS 17.0 and SAS 9.2.

Results

Representativeness of the sample

The study sample was compared with those who did not complete their year 1 follow-up ($N = 305$) with respect to acute care days, rehabilitation days, gender, education, work status at the time of injury, and injury level. There were no statistically significant differences with respect to any of these variables. The results suggest that the subjects included in the study represent the National SCI Model System database.

Participant characteristics

Table 1 summarizes the distribution of participants by demographic characteristics of gender, race, employment status, education, and level of neurological impairment. The average age at the time of injury was 46.6 ± 14.1 years and ranged from 18 to 86 years.

Predictors of marriage longevity after SCI

Age at injury, being Caucasian vs African American, having a college education vs high school, having 'other' employment status vs being unemployed, having higher social integration and improved or stable self-rated health vs poor health were all significant factors that delayed the time of divorce after injury (Table 2). The strongest predictor was *improved or stable* self-rated health compared with a year ago; those with improved or stable health had a 23–32% longer time to divorce than those with poor self-rated health. The next strongest predictor was social integration, where for every 1 s.d. increase in social integration, time to divorce increased two times. Having a college education significantly contributed to marital longevity, increasing time to divorce almost two times longer than having a high school education. Time to divorce was two times longer for individuals whose occupational status was retired, student, homemaker or other than an unemployed person. For every year increase in age, the time to divorce increased by 11%. African Americans had almost half the time to divorce than Caucasians. Both gender and life satisfaction had no significant effect on marriage longevity. Contrary to expectations, level of injury, function, mobility and

independence did not have a significant effect on marriage longevity.

Discussion

The results of this study suggest that factors that have a function in marriage longevity in the general population are also true for persons with SCI. These factors include having a higher education, being Caucasian, having improved or stable health, and greater social engagement. Similar to our results, research in the general population indicate that divorce is less likely with older age at marriage,¹³ being Caucasian,¹⁴ and having higher education.¹³ It has been argued that individuals marrying at a young age are perhaps less compatible, less prepared for marriage, and lack economic resources.¹³ Age at injury may also be an indirect indicator of length of marriage; that is, an older married person compared with a younger one is more likely to have been married for a longer time when the injury occurred. Both older age and longer pre-injury marriages may be protective against marital dissolution because of a variety of factors, including greater maturity, better economic situation, and perhaps a more established marital relationship.

It is interesting to note that rather than current self-perceived health, an *improvement* or *stability* in self-perceived health compared with the previous year was significantly associated with marriage longevity. As self-perceived health was measured rather than a clinical assessment of health, the findings suggest that the actual *personal experience* of physical health is an important predictor of marriage longevity. Those who perceive their health to be 'much worse' may be dealing with additional adjustment issues, possibly increasing spousal caregiver burden, and greater perceived stress. It has been suggested that SCI is a severe stressor that is associated with limiting opportunities for social integration, forced changes in household responsibilities, and financial decline.¹⁵ Hence, individuals with SCI whose health has deteriorated are likely to be experiencing more stress that may possibly affect the longevity of their marriages.

Social integration was also a strong predictor of marriage longevity after SCI. Our findings may suggest the benefit of maintaining social connections as a safeguard against marital dissolution. However, this association may be partly due to the nature of the social integration Craig handicap assessment and reporting technique subscale itself, with higher scores obtained for living with a spouse or significant other. Social integration has shown its benefits in all areas of functioning, including mental and physical health. It has been found that greater social integration is associated with survival from heart attacks, reduced risk for cancer recurrence, decreased depression and anxiety, and less severe cognitive decline with aging.¹⁶ Social integration may be particularly important to the SCI population in that there are fewer burdens on the non-injured spouse because the spouse with SCI has other outlets and a greater number of resources. This greater social support might mean that both the person with SCI and the spouse are better adjusted and are experiencing less emotional distress. It may be that social

Table 2 Estimates for predictors of marriage longevity

Variable	Coefficient estimate	Survival time ratio (<i>exp</i>)	95% CI (<i>exp</i>)	P-value
Age at the time of injury	0.10	1.11	1.08, 1.14	<0.0001
<i>Gender</i>				
Female	0.20	1.22	0.70, 2.10	0.48
Male	—	—	—	—
<i>Neurological impairment</i>				
Paraplegia, complete	-0.06	0.94	0.52, 1.70	0.84
Paraplegia, incomplete	-0.19	0.83	0.43, 1.59	0.57
Tetraplegia, complete	-0.34	0.71	0.36, 1.41	0.33
Tetraplegia, incomplete (referent)	—	—	—	—
<i>Education</i>				
Less than HS	0.55	1.74	0.89, 3.40	0.11
College	0.61	1.84	1.00, 3.40	0.05
Graduate	0.27	1.31	0.40, 4.32	0.66
HS (referent)	—	—	—	—
<i>Race</i>				
African American	-0.55	0.57	0.33, 1.00	0.05
Native American/Eskimo/Aleut	1.15	3.17	0.15, 66.59	0.46
Asian/Pacific Islander	2.03	7.60	0.37, 154.97	0.19
Other	0.55	1.72	0.51, 5.84	0.38
Caucasian (referent)	—	—	—	—
<i>Employment</i>				
Employed	0.41	1.51	0.75, 3.02	0.25
Other	0.60	1.82	1.73, 3.15	0.03
Unemployed (referent)	—	—	—	—
<i>Self-perceived health (SF-1)</i>				
Excellent health	-0.21	0.81	0.24, 2.80	0.74
Very good health	-0.37	0.69	0.24, 2.01	0.50
Good health	-0.82	0.44	0.16, 1.22	0.11
Fair health	-0.44	0.64	0.23, 1.80	0.40
Poor health (referent)	—	—	—	—
<i>Self-perceived health (SF-2)</i>				
Much better now than 1 year ago	0.86	2.35	1.00, 5.54	0.05
Somewhat better now than 1 year ago	0.90	2.45	1.01, 5.92	0.05
About the same as 1 year ago	1.18	3.25	1.26, 8.34	0.01
Somewhat worse now than 1 year ago	0.47	1.60	0.57, 4.50	0.38
Much worse now than 1 year ago (ref)	—	—	—	—
Satisfaction w/life	0.20	1.22	0.96, 1.57	0.11
Functional independence measure (FIM)	-0.20	0.82	0.61, 1.10	0.18
<i>CHART</i>				
Physical independence	-0.39	0.67	0.25, 1.84	0.44
Occupation	0.50	1.65	0.92, 2.96	0.09
Mobility	-0.01	0.99	0.55, 1.79	0.98
Social integration	0.72	2.05	1.67, 2.53	<0.001

Abbreviations: CHART, Craig Handicap Assessment and Reporting Technique; CI, confidence interval; HS, high school. Dependent variable: time to divorce.

isolation as a result of injury and disability increases stress on the marriage, or conversely, the already problematic marriage is resulting in increased isolation for the person with SCI.

Research has shown that less socially integrated individuals are less healthy, both psychologically and physically.¹⁶ Although we did not test the interaction between social integration and perceived health on marital longevity, it is plausible that these factors are interrelated. Individuals who perceive their health to be deteriorating and who have low social integration are potentially adding greater stress on the

marriage. Individuals with poor social integration are likely to have limited social outlets and resources, thus may experience overall more stress including physical health stress, which in turn may negatively affect the marriage. Future research should explore the relationships between social integration, perceived health, and marriage and marital well-being.

Contrary to expectation, 'other' occupational status (that is being a student, retired, homemaker, or other), rather than being unemployed predicted marriage longevity. This finding perhaps suggests that having a societal role,

such as homemaker or student, may serve as protection against marital discord and add to the years of marriage.

Injury-related factors associated with higher divorce in other studies such as severity and level of injury² did not have a significant function in time to divorce in this sample. However, it is important to note that our study examined *time to divorce* in contrast to the focus on *divorce rates* in earlier studies.

Limitations

There are several limitations that should be considered when interpreting these results. It has been reported that neurologically complete injuries, males, injuries caused by violence, and non-white men are slightly overrepresented in the SCI Model System database,² therefore the generalizability of the results is limited. We also did not have information on the quality of the marriage, which have an important function in the longevity of marriage, such as interpersonal interactions between husband and wife and their overall marital satisfaction. Furthermore, we did not know the length of the marriage at the time of injury or prior divorce, which they could be confounding factors as previous research has shown that older marriages show less risk for divorce whereas previous divorce increase risk for later divorce.^{1,13} Employment categories were also a limitation in this study. The 'other' category captured students, homemakers, retirees, and 'other'. It is difficult to interpret these findings due to difficulties assessing what 'other' constitutes. It is important for future studies to clearly define this category to make more meaningful interpretations.

Conclusions

Although many factors found to contribute to marital longevity after a new SCI are immutable, social integration and health perception, the most powerful among these, are those that can be addressed and facilitated by health care providers and rehabilitation programs. Strategies to protect against marital dissolution can be used by first assessing perceived health and social support, and then individual counseling with an educational component should be implemented with a focus on developing positive coping, challenging distortions of perceived health, and identifying barriers to social integration. To allow for communication and understanding, spousal involvement should be considered. The evidence for the benefits of social support is vast therefore it behooves health care providers to educate patients on these benefits as well as encourage social support.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgements

Drs Karana-Zebari and de Leon are supported by a T-32 Training Grant in the University of Michigan Department of Physical Medicine and Rehabilitation from the National Center for Medical and Rehabilitation Research, National Institute for Child and Human Development, National Institutes of Health, Bethesda, MD (5-T32-HD007422-17). The National Institute for Disability and Rehabilitation Research, Office of Special Education and Rehabilitative Services, US. Department of Education, Washington, DC funds the University of Michigan Model SCI Model System (H133N060032). We thank Ms Kathleen Welch for her assistance with statistical analysis.

References

- 1 Dawodu ST. Spinal cord injury: definition, epidemiology, pathophysiology. *Emed J* 2001; 2: 8.
- 2 DeVivo MJ, Hawkins LN, Richards JS, Go BK. Outcomes of post-spinal cord injury marriages. *Arch Phys Med Rehabil* 1995; 76: 130–138.
- 3 Kreuter M. Spinal cord injury and partner relationships. *Spinal Cord* 2000; 38: 2–6.
- 4 Arango-Lasprilla JC, Ketchum JM, Francis K, Premuda P, Stejskal T, Kreutzer J. Influence of race/ethnicity on divorce/separation 1, 2, and 5 years post spinal cord injury. *Arch Phys Med Rehabil* 2009; 90: 1371–1378.
- 5 Kreuter M, Sullivan M, Dahllorf AG, Siosteen A. Partner relationships, functioning, mood and global quality of life in persons with spinal cord injury and traumatic brain injury. *Spinal Cord* 1998; 36: 252–261.
- 6 Chan RC. How does spinal cord injury affect marital relationship? A story from both sides of the couple. *Disabil Rehabil* 2000; 22: 764–775.
- 7 Whiteneck GG, Charlifue SW, Gerhart KA, Overholser JD, Richardson GN. Quantifying handicap—a new measure of long-term rehabilitation outcomes. *Arch Phys Med Rehabil* 1992; 73: 519–526.
- 8 Ware JE, Snow KK, Kosinski M, Gandek B. *SF-36 Health Survey: Manual and Interpretation Guide*. Quality Metric Inc: Lincoln, RI, 1993.
- 9 Diener E, Emmons RA, Larsen RJ, Griffin S. The satisfaction with life scale. *J Pers Assess* 1985; 49: 71–75.
- 10 Pavot W, Diener E. Review of the satisfaction with life scale. *Psychol Assess* 1993; 5: 164–172.
- 11 Hamilton B, Granger C. *Guide for the Use of Uniform Data Set for Medical Rehabilitation*. Research Foundation of the State University of New York: Buffalo, NY, 1990.
- 12 Ottenbacher KJ, Hsu Y, Granger CV, Fiedler RC. The reliability of the functional independence measure: a quantitative review. *Arch Phys Med Rehabil* 1996; 77: 1226–1232.
- 13 Booth A, Edwards JN. Age at marriage and marital instability. *J Marriage Family* 1985; 47: 67–75.
- 14 Orbuch TL, Veroff J, Hassan H, Horrocks J. Who will divorce: a 14-year longitudinal study of black couples and white couples. *J Soc Pers Relat* 2002; 19: 179–202.
- 15 Brown JS, Giesy B. Marital-status of persons with spinal-cord injury. *Soc Sci Med* 1986; 23: 313–322.
- 16 Cohen S. Social relationships and health. *Am Psychol* 2004; 59: 676–684.