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Employment, Health Outcomes, and Life Satisfaction after Spinal Cord Injury: Comparison of Veterans and Non-Veterans

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Abstract

Study Design: Retrospective cohort study.

Objective: To explore differences between Veterans and Non-Veterans with spinal cord injury (SCI) for employment, health, and satisfaction with life outcomes after controlling for demographic and injury characteristics.

Setting: Hospitals in the Spinal Cord Injury Model System of care.

Methods: A total of 9,754 (85% Non-Veterans and 15% Veterans) adults with traumatic SCI interviewed from 2000 and 2015 and completed follow-up years 1, 5, and 10 were included in study. Employment status and the Craig Handicap Assessment and Reporting Technique-Short Form (CHART-SF) measured employment. The SF-36 for self-perceived health status, CHART-SF, and rehospitalization determined health outcomes. Satisfaction with life was measured by the Satisfaction with Life Scale (SWLS). Secondary data analysis using chi-squares, t-tests, and

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Authors' Contributions

KWG was responsible for developing the research idea, developing aims and objectives, searching the literature, extracting and analyzing data, interpreting results, creating the reference list, and writing the manuscript.
YC was responsible for extracting and analyzing data and creating tables.
SPB was responsible for interpreting results and providing feedback on manuscript.
SDM was responsible for interpreting results and providing feedback on manuscript.
JSK was responsible for data access and retrieval, developing research idea, developing aims and objectives, interpreting results, and providing feedback on manuscript.

Statement of Ethics

We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers for this database were followed before this information was used as secondary data to conduct this research.

Conflicts of Interests

We confirm the material is original research, has not been previously published and has not been submitted for publication elsewhere at all. There are no conflicts of interests.

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generalized estimating equations (GEE) model to determined group differences with control of demographic and injury characteristics.

Results: There were no significant differences for employment and SWL between Non-Veterans and Veterans. There were some differences in health outcomes; whereas, Veterans had better physical independence and mobility compared to Non-Veterans.

Conclusion: Interventions for both groups should target adults with a disability from SCI, be customized for varying levels of injury that address differences in health care systems, demographic backgrounds, economic resources, disincentives and motivation.

Introduction

Spinal cord injury (SCI) may have a tremendous impact on individuals, family, and society at large. There are approximately 282,000 persons living in the US with SCI [1] that have a myriad of long-term medical complications requiring extensive medical care and rehospitalization [2]. Veterans account for a large proportion of those living with either traumatic SCI or spinal cord disorders (SCI/D) such as spinal stenosis, multiple sclerosis, and transverse myelitis [3]. Difficulties associated with SCI for Non-veterans and Veterans alike involve increased risk for diminished life expectancy [4], secondary health conditions [5], mental health disorders [6], decreased community participation [7], and decreased subjective well-being [8]. However, there are some differences between Veterans and Non-Veterans that may influence adjustment and functional outcomes after SCI. For example, high rates of post-traumatic stress syndrome (PTSD) [9], the need to readjust to civilian life and the burden of not being able to serve [10] increases the risk for poorer health and healthy behaviors [11], mental health problems and substance use [12]. These factors support the examination of various functional outcomes for Veterans compared to Non-veterans with SCI.

There is a paucity of published literature comparing Veterans and Non-Veterans with SCI in employment, health, and satisfaction with life (SWL) outcomes. One study reported Veterans with SCI had more chronic comorbid conditions over the years, lower overall physical health, and were less likely to be employed compared to civilians with SCI [13]. LeVela et al. [14] compared Veterans with SCI with general veteran population and general population for health outcomes and found the odds of having a stroke were higher in Veterans with SCI than both comparison groups and after controlling for demographic and risk factors and SCI was independently associated with stroke. Compared to Non-Veterans with SCI, veteran counterparts reported higher levels of catastrophizing and pain, and lower levels of social integration and productive activity [15]. The SWL outcome studies after SCI examined Veterans and did not have a comparison group but had interesting results for that population. Studies found higher cognitive function, social integration, self-perceived independence, social support, less pain, and fewer secondary impairments were positively associated with SWL after SCI [16–18].

Since very few studies have compared Veterans and Non-Veterans in the US with SCI related to employment, health, and SWL, there is clear justification for examining these outcomes for both groups. Given that SCI has a deleterious effect on both Veterans and Non-

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Veterans that yields significant health and psychosocial outcomes, cross comparison of these two groups is warranted. The few studies that do compare Veterans and Non-Veterans with SCI had either small sample sizes or made comparisons with different data sources. Some studies that examined SWL were conducted outside the US. Moreover, more effort is needed to address needs of Veterans as more have survived once fatal injuries from recent wars as they age with significant impairment [19]. It is possible, that these comparisons will uncover predictors more relevant to Veterans and provide evidence to substantiate differences between Veterans and Non-Veterans being treated in the community by SCI providers.

Our purpose was to utilize a database with large samples to explore differences in outcomes among Veterans and Non-Veterans with SCI. Specifically, we aim to determine what differences exist between adult Veterans and Non-Veterans treated within the Spinal Cord Injury Model System (SCIMS) program in terms of employment, health, and SWL outcomes. We hypothesize Veterans and Non-Veterans treated within the SCIMS will significantly differ for employment, health and SWL variables when simultaneously controlling for demographic and injury characteristics.

Methods

Data Source

The National Spinal Cord Injury Database (NSCID) has captured data on new SCI cases from 1972 to present. The NSCID provided retrospective cross-sectional data of patients who were enrolled in the Spinal Cord Injury Model System (SCIMS) program funded by Health and Human Services' (HHS) National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR). The participants have all received either acute care, inpatient rehabilitation and/or systematic outpatient or day rehabilitation. To be enrolled in SCIMS program and included in NSCID: (1) patients had to be treated at SCIMS facility within 1 year of SCI onset, (2) have clinically discernible degree of neurological impairment after a traumatic event, (3) completed informed consent, and (4) reside in the geographic catchment areas of SCIMS facility at time of injury [20].

Data Collection

From the NSCID, 8,278 Non-Veterans and 1,476 Veterans primarily diagnosed with traumatic SCI and treated at any of the SCIMS centers between October 1, 2000 to September 2015 were compared for differences in employment, health, and SWL outcomes. Participants were categorized as Veterans-those who identified either use of US Veterans Health Administration Healthcare services since SCI onset, or did not receive services but still classified as a Veteran, or those who identified as nonveteran. Of note, individuals who have onset of SCI while active duty service members (injures related or unrelated to combat) typically receive initial SCI rehabilitation at VA hospitals, so Veterans included in this study predominantly had onset of SCI after leaving military service. Inclusion criteria were: (1) had available veteran status data, (2) injured between 2000 and 2015, (3) completed follow-up for years 1, 5, and 10, and (4) between ages of 18 and 70 years old. Participants were excluded if they were lost before year 1 follow-up or had missing Veteran status data. The follow-up data were collected via in person or telephone interviews, and mail surveys. Table

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1, highlights the frequency of unique Veteran and Non-Veteran participants' observations for each follow-up year and by veteran status.

Outcome Measures

Employment status.—Employment was categorized as those currently competitively employed in the labor market versus those who are not competitively employed. Therefore, those who identified as unemployed, homemaker, on-the-job training, sheltered workshop, retired, and other unclassified (i.e., volunteered, medical leave, illegal employment, paid under-the-table) were grouped together. This distinction was made to objectively differentiate between those employed and not employed for any reason) at the time of the study.

Self-perceived Health Status.—Self-perceived health status comes from SF-36 physical and mental health summary scales and is measured by a single item asking "In general, would you say that your health is Excellent, Very Good, Good, Fair or Poor?" [21]. It was rated on an ordinal scale that ranges from 1 (Excellent) to 5 (Poor). Responses that were "Fair" or "Poor" were dichotomized into fair and poor health versus others. The SF-36 scales have strong psychometrics for good interpretation of physical health [22].

Craig Handicap Assessment and Reporting Technique-Short Form.—The CHART has 19 items where highest total score of 100 indicate no handicap for physical independence, cognitive independence, mobility, occupation, social integration, and economic self-sufficiency [23]. These areas are dimensions of handicap at the societal level. The CHART is a psychometrically sound assessment with high reliability and good validity [24].

Rehospitalization.—Rehospitalization numbers represent the mean number of times within 12 months patients were hospitalized.

Life Satisfaction.—The Satisfaction with Life Scale (SWLS) has five items to self-report life satisfaction [25]. The SWLS can either have ordinal measurements that range from 1 (strongly disagree) to 7 (strongly agree) [25]. The SWLS has good psychometrics [26]

Statistical Analyses

First, to compare demographic and injury characteristics of Non-veterans and Veterans, non-parametric Chi-square statistics were used to determine between-group differences for all categorical variables and t-tests were used with continuous variables. An α level of .05 or less determined significance. For the multivariate analyses, the employment was a binary outcome repeatedly measured. We applied the generalized estimating equation (GEE) method for the multivariate longitudinal analyses. The method used quasi-likelihood to estimate the regression coefficients for the longitudinal data [27]. The employment status was a binary outcome and we used GEE with a logit link. For all the other outcomes, we used Gaussian GEE.

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Results

Description of the Sample

Table 1 describes the frequency of unique participants and total follow-up observations. Additionally, it highlights the frequency of unique participants among Veterans and Non-Veterans with SCI. Of the total 9,754 unique participants, there were 15,117 observations. Approximately 15% of those unique participants identified as Veterans. Table 2 describes the demographic and injury characteristics of the sample. Males predominate in this sample (79.7%). The mean age of all participants at time of injury was 36 years old. Most participants were non-Hispanic white (62.2%), had some or completed high school (72%), injured in a vehicular accident (45.3%), and had incomplete tetraplegia (33.2%). There were significant differences between Veterans and Non-Veterans with regards to all demographic and injury characteristics. Veterans were significantly older, more likely to be male, had racial/ethnic status of non-Hispanic White, and had higher levels of education. For injury characteristics, Veterans had more injuries related to falls and flying objects compared to Non-Veterans, who had more injuries from vehicular and violent incidents. Additionally, Veterans presented with more incomplete tetraplegia and significantly less complete paraplegia SCIs compared to Non-Veteran counterparts.

Employment status

Employment status was assessed at 1, 5 and 10 years and controlled for demographic and injury factors using the GEE model to generate odds ratios obtained for the total interviews (see Table 3). There were no significant differences for employment between Non-Veterans and Veterans. Of note, odds of employment significantly increased if participants were male, Non-Hispanic white, had a college education or higher, and interviewed at years 5 and 10. Males had 1.3 greater odds of being employed compared to females. Non-Hispanic whites had 2.1 times greater odds of being employed than other racial/ethnic groups. Those having a college education or higher had 3.93 times greater odds of employment than other lower education groups. Compared to year 1, participants interviewed at year 5 and year 10 had 1.68 and 2.22 greater odds of employment, respectively. In contrast, those who are older age at injury, had injuries caused by violence, and had cervical and complete injuries were less likely to be employed.

Health and SWL outcomes over time

In table 4, the GEE model revealed that Veterans are more likely to be physically independent and have increased mobility compared to Non-Veterans, in general. After controlling for demographic and injury characteristics, Veterans were 3.12 points higher in physical independence score compared to Non-Veterans. For mobility score, Veterans are 1.84 points higher than Non-Veterans. According to the CHART [23], Veterans were more likely to have a routine and live more independently, and to move around in house as well as, use more independently use than Non-Veterans.

No other significant differences were found in occupation, social integration (other subscales of the CHART), self-perceived health, rehospitalization, and SWL outcomes (see Table 5).

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Discussion

This study first compared demographic and injury characteristics between Veterans and Non-Veterans with traumatic SCI from the SCIMS. The main purpose of the study was to examine primary outcomes of employment, health, and SWL outcomes for the sample. We hypothesize Veterans and Non-Veterans treated within the SCIMS will significantly differ for health, employment, and SWL variables when simultaneously controlling for demographic and injury characteristics. The hypothesis was only partially supported. Although, we found differences in demographic and injury characteristics outcomes after controlling for those demographic and injury factors and there were limited differences in primary outcome variables.

Results related to demographic and injury characteristics are consistent with previous studies that compared veterans with SCI to other populations. Veteran groups are significantly older, more likely to be male, and have higher levels of education [11, 13,14]. A different pattern was seen for injury characteristics in relation to previous research, which found Veterans and Non-Veterans to be similar in level of SCI [11,14]. We found that Non-Veterans were less likely to have motor-incomplete tetraplegia than Veterans; however, there are probably selective factors, which make those with more severe injuries more likely to be treated in the SCI model system.

As the primary focus of our study, we described odds of employment status while controlling for demographic and injury factors. The one study, to our knowledge, that compared Veterans and Non-Veterans related to employment noted that Veterans were less likely to be employed at time of interview and 5-years post [13]. Our study did not corroborate Hedricks et al. [13] findings. Although this previous study used assistive technology (AT) as a predictor of employment and Social Security Administration (SSA) benefit data to adjust for potentially confounding factors, it was not clear if the analysis for major sociodemographic data collected and detailed injury characteristics of the study participants with SCI. There could be other reasons why significant differences were not detected between Veterans and Non-Veterans. They both may have disincentives to work following disabilities even though the reasons may be different [28, 29]. There were, however, some notable results with other variables. As conferred by empirical evidence, there is a greater likelihood of employment post-injury for men compared to women [30, 31], those with college education or higher than lower levels [29, 30], and non-Hispanic Whites compared to other racial/ethnic groups [32]. However, Ottomanelli et al. [33] did not corroborate the same findings for educational attainment or race for Veterans with SCI. Additionally, Veterans and Non-Veterans are less likely to be employed due to violence, lesions higher in the spinal cord and complete injuries and these and other critical factors are supported by existing literature [31, 34].

Another part of our study was to describe health outcomes as measured by the CHART, rehospitalization, and SWL scores while controlling for demographic and injury characteristics. There were some notable differences on the CHART; whereas, Veterans had better physical independence and mobility compared to Non-Veterans. Although, to our knowledge, we are the first to compare Veterans and Non-Veterans with SCI on CHART

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outcomes, Hedrick et al. [13] did compare Veterans and civilians' functional limitations and noted that civilians with SCI had slightly lower functioning than Veteran counterparts, but differences were not statistically significant. There are potentially some factors that support enhanced Veterans outcomes. There are some unique programs to optimize function and increase mobility for Veterans with disabilities that are provided by the VA SCI System of Care and associated programs to support community dwelling Veterans [35]. Veterans with SCI that enrolled in NSCID could have access to more services that focus on physical independence and mobility than Non-Veterans with SCI.

Implications

Overall, these findings suggest that there are some differences between Veterans and Non-Veterans, but this was found in a non-VA health care setting. Interventions for both Veterans and Non-Veterans should target adults with a disability from SCI that are customized for varying levels of injury. It is important to consider how healthcare systems affect outcomes, as they will differ in terms of factors such as length of stay. However, because we utilize secondary data from the SCI model systems, we cannot directly compare healthcare systems based on our study. Secondly, it is important to address differences in demographic backgrounds, economic resources, disincentives, and motivation when customizing interventions for Veterans and Non-Veterans with SCI.

Limitations

This study makes an important contribution to the literature comparing veterans and Non-Veterans with SCI. However, there are several limitations. First, the NSCID contains self-report data and there is a possibility of recall errors in the accuracy and completeness of the information gathered. Second, veterans were treated for new injury in a SCI model system may be systematically different than those who are treated in VA hospitals. Therefore, the current findings particularly highlight these types of differences among those treated in SCI model systems and should be verified with additional research. Third, use of any existing data set limits the number of potential outcome variables. Fourth, because of the exploratory nature of the study, we ran numerous statistical tests, which raised the probability of type I error.

Future Research

This study only scratches the surface of potential differences in outcomes between veterans and nonveterans. More research is needed to corroborate the small but significant findings from this study. Studies that rely on other data sets that include different insurance payers and healthcare systems would help to clarify any differences in outcomes and explanatory factors. The examination of other aspects of employment, not included in the SCI model systems data, would be useful (e.g., earnings or other indicators of quality employment). Lastly, intervention studies to promote outcomes for both Veterans and Non-veterans are clearly needed.

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Data Archiving

The datasets generated during and/or analyzed during the current study are available in the National Spinal Cord Injury Statistical Center [https://www.nscisc.uab.edu/Public_Pages/Database].[36]

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Table 1.

Frequency of unique participants and follow-up observations by veteran status

	Number of Nonveteran (Row %)	Number of veteran (Row %)	Total participants (Total follow-up observations)
Participants with one follow-up	4467 (81.3)	1028 (18.7)	5495
Participants with two follow-ups	2810 (89.1)	345 (10.9)	3155
Participants with three follow-ups	1001 (90.7)	103 (9.3)	1104
Total	8278 (84.9)	1476 (15.1)	`9754

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Table 2:

Patient demographic and injury characteristics

DEMOGRAPHIC CHARACTERISTICS	Overall n = 9754	Nonveteran n = 8278	Veterans n = 1476	Statistics*
Mean age at injury ± SD (y)	36.0±13.8	34.8±13.5	42.6±13.8	p <.01
	n	**Col %**	**Col%**	
Sex (%)				
Male	7773	77.7	91.0	p <.01
Female	1979	22.3	9.0	
Unknown, transgender[a]	2			
Race/Ethnicity (%)				
Hispanic	988	10.5	8.1	p <.01
Non-Hispanic White	6075	61.5	66.6	
Non-Hispanic Black	2306	23.9	22.2	
Non-Hispanic Other	385	4.1	3.1	
Highest level of Ed at injury (%)				
Less than High School	392	4.5	2.6	p <.01
Secondary Ed (some or completed)	7027	76.3	75.4	
Post-secondary Ed (some or completed)	1416	15.0	17.3	
Graduate (some or completed)	390	4.1	4.7	
Other/Unknown[a]	529			
INJURY CHARACTERISTICS				
Etiology (%)				
Vehicular accident	4428	45.8	43.3	p <.01
Violence	1554	16.6	12.1	
Sports	898	9.6	7.2	
Falls/Flying Objects	2379	23.1	31.9	
Other (Pedestrian, Med/Surg, Other)	495	4.9	5.5	
Neurological Impairment at D/C (%)				
Paraplegia, incomplete	1790	19.3	18.8	p <.01
Paraplegia, complete	2535	27.7	24.2	
Paraplegia minimal deficit	35	0.3	0.6	
Tetraplegia, incomplete	3237	33.7	40.3	
Tetraplegia, complete	1697	18.7	15.3	
Tetraplegia, minimal deficit	42	0.4	0.9	
Normal (some minimal deficits)[a]	6			
Unknown/Not done[a]	412			

[a]Not included in statistical analyses

*Chi-square test applies to categorical variables, and t-test to continuous variables

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Table 3:

GEE model for Employment Status (Employed vs. Others)

	OR	95% OR		p-value
Veteran (ref=Non-veteran)	0.95	0.81	1.12	0.55
male (ref=female)	1.30	1.13	1.48	<.01
Non-Hispanic white (ref=others)	2.11	1.86	2.40	<.01
college or higher (ref=others)	3.93	3.47	4.46	<.01
Age at injury	0.98	0.97	0.98	<.01
Violence (ref=others)	0.45	0.37	0.56	<.01
Vehicular accident (ref=others)	0.97	0.87	1.09	0.62
c1-4(ref=others)	0.44	0.38	0.50	<.01
c5-8(ref=others)	0.63	0.56	0.72	<.01
complete(ref=incomplete)	0.61	0.55	0.68	<.01
year 5(ref=year 1)	1.68	1.54	1.83	<.01
year 10(ref=year 1)	2.22	2.01	2.45	<.01

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Table 4.

GEE models for continuous outcomes

	Self-perceived health		Physical Independence		Mobility	
	Coefficient	**p-value**	**Coefficient**	**p-value**	**Coefficient**	**p-value**
Intercept	3.59	<.01	92.69	<.01	91.39	<.01
Veteran (ref=nonveteran)	0.03	0.26	3.12	<.01	1.84	0.01
male (ref=female)	0.02	0.45	2.91	<.01	3.38	<.01
Non-Hispanic white (ref=others)	0.16	<.01	4.92	<.01	7.72	<.01
college or higher (ref=others)	0.33	<.01	4.22	<.01	9.66	<.01
Age at injury	−0.02	<.01	−0.25	<.01	−0.47	<.01
Violence (ref=others)	−0.16	<.01	−2.17	0.04	−5.49	<.01
Vehicular accident (ref=others)	−0.01	0.70	1.44	0.04	−0.60	0.26
c1-4(ref=others)	0.00	0.92	−30.59	<.01	−12.48	<.01
c5-8(ref=others)	0.04	0.14	−16.53	<.01	−4.57	<.01
complete(ref=incomplete)	0.07	<.01	−16.70	<.01	−9.88	<.01
year 5(ref=year 1)	0.01	0.47	6.15	<.01	2.42	<.01
year 10(ref=year 1)	−0.03	0.11	7.19	<.01	1.62	<.01

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Table 5.

GEE models for continuous outcomes (cont.)

	Occupation		Social Integration		Rehospitalization Number		Life Satisfaction	
	Coefficient	**p-value**	**Coefficient**	**p-value**	**Coefficient**	**p-value**	**Coefficient**	**p-value**
Intercept	82.37	<.01	93.36	<.01	0.11	<.01	23.13	<.01
Veteran (ref=nonveteran)	0.38	0.71	1.10	0.11	−0.03	0.21	0.40	0.09
male (ref=female)	−3.99	<.01	0.09	0.86	−0.04	0.07	0.03	0.90
Non-Hispanic white (ref=others)	10.64	<.01	5.40	<.01	0.04	0.06	0.10	0.57
college or higher (ref=others)	13.69	<.01	8.46	<.01	−0.09	<.01	1.81	<.01
Age at injury	−0.68	<.01	−0.25	<.01	0.01	<.01	−0.09	<.01
Violence (ref=others)	−8.32	<.01	−7.01	<.01	0.11	<.01	−2.28	<.01
Vehicular accident (ref=others)	0.04	0.95	−0.30	0.54	0.03	0.05	−0.09	0.62
c1-4(ref=others)	−19.71	<.01	−4.10	<.01	0.18	<.01	−1.29	<.01
c5-8(ref=others)	−9.29	<.01	−1.01	0.06	0.06	<.01	−0.79	<.01
complete(ref=incomplete)	−9.31	<.01	−1.21	0.01	0.27	<.01	−1.24	<.01
year 5(ref=year 1)	7.73	<.01	−1.09	<.01	−0.09	<.01	1.72	<.01
year 10(ref=year 1)	6.99	<.01	−1.28	<.01	−0.10	<.01	2.54	<.01