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ORIGINAL ARTICLE

Health-related quality of life for veterans with spinal cord injury

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Study design: Cross-sectional.
Objectives: The objective of this study was to examine the association between the characteristics of individuals with spinal cord injury (SCI) and self-reported health-related quality of life (HRQoL).
Setting: The United States.
Methods: Questions from the Behavioral Risk Factor Surveillance System (BRFSS) survey were sent to veterans with SCI. The analyses included 2302 respondents. Logistic regression analysis was used to examine the association between subject characteristics and the following four measures of HRQoL: frequent physical distress (FPD), frequent mental distress (FMD), frequent depressive symptoms (FDS) and poor or fair self-reported health.
Results: Approximately 19% of the respondents reported FMD, 27% reported FPD, 17% reported FDS and 29% reported poor or fair health. Veterans who self-reported chronic illnesses, had higher odds of reporting FPD, FMD, FDS and poor or fair health than veterans who did not report chronic illnesses. Smoking was significantly associated with decreased HRQoL. Older veterans had higher odds of reporting poor or fair health and FPD than younger veterans. Higher levels of education were associated with lower odds of FMD, FDS and poor or fair health.
Conclusions: Chronic illnesses and smoking have a substantial effect on HRQoL for persons with SCI, suggesting the importance of continued efforts to improve smoking cessation methods and to treat and prevent chronic conditions.
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Keywords: spinal cord injury; health-related quality of life; chronic illness

Introduction

Health-related quality of life (HRQoL) is defined by the Centers for Disease Control and Prevention (CDC) as an individual's 'perceived physical and mental health over time.'[1] HRQoL is being used to track population health, identify health disparities and evaluate health-care policies.[2] The CDC HRQoL measures were developed as part of the Behavioral Risk Surveillance System (BRFSS) survey. The BRFSS survey is a standardized instrument that is used in US to collect information about health behaviors, preventive health and chronic illness.[1] A core module, CDC HRQOL-4, which consists of four questions, focuses on the perception of general health, physical health and mental health.[2]

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The measurement of HRQoL is particularly important for persons with spinal cord injuries (SCI), because such persons often experience complications as a result of their impairment, in addition to the chronic diseases that often accompany aging. A limited number of studies have examined HRQoL in persons with SCI, and most have used measures such as the Short Form 36 (SF-36).[3,4] Only one study used the CDC HRQoL measures in the SCI population, and it focused on comparing the reliability, validity and acceptance of several QoL instruments.[5]

The CDC HRQoL measures are brief, and norms have been published from representative population samples.[2] Additionally, the questions about physically and mentally unhealthy days (see Figure 1) are less focused on physical functioning than other HRQoL measures. The purpose of this study was to examine the association between subject demographics, chronic illness and risky health behaviors and the following four HRQoL measures: frequent physically unhealthy days (FPD), frequent mentally unhealthy days (FMD), frequent days with depressive symptoms (FDS) and

CDC Question	Measure
Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?	Frequent Physical Distress (FPD) *FPD=1 if respondent indicated 14 or more days*
Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?	Frequent Mental Distress (FMD) *FMD=1 if respondent indicated 14 or more days*
During the past 30 days, for about how many days have you felt sad, blue, or depressed?	Frequent Depressive Symptoms (FDS) *FDS=1 if respondent indicated 14 or more days*
Would you say that in general your health is *a. Excellent* *b. Very good* *c. Good* *d. Fair* *e. Poor*	Fair or Poor Self-rated Health *Poor health=1 if respondent chose fair or poor*

Figure 1 CDC HRQoL measures. CDC, Centers for Disease Control and Prevention; HRQoL, health-related quality of life.

poor self-rated health. This study is unique in that it describes the results of several measures of HRQoL in a large sample of persons with SCI, and examines the association between the several patient characteristics and HRQoL in this population.

Methods

Design

This was a cross-sectional observational study using a mailed survey. Approval for human studies was obtained from the Institutional Review Board at Edward Hines Jr VA Hospital.

Subjects

In October 2003, surveys were mailed to 18 372 members of the Paralyzed Veterans of America, a population that included veterans with SCI, other spinal cord disease and multiple sclerosis. A total of 5690 veterans responded to the survey. We excluded 1875 respondents who indicated that they had conditions other than SCI. An additional 1513 respondents were excluded because they had missing data for one or more of the characteristics examined in the models. Respondents who had incomplete data were more likely to have a chronic illness, to be older, to be unemployed, to not have a college education and to have longer durations of injury. The final analyses included 2302 veterans with SCI.

Instrument

For this study, select questions from the 2002/2003 CDC BRFSS questionnaire, and additional questions designed to assess demographic and SCI characteristics, were used to develop the Spinal Cord Dysfunction Health Care Questionnaire. Several studies have documented the validity and reliability of the CDC HRQoL measures.[6,7] Andresen *et al*.[5] concluded that for persons with SCI, the BRFSS survey's physical HRQoL questions were highly correlated with SF-36.

Measures

HRQoL. Four dichotomous measures of HRQoL were created: FPD, FMD, FDS and fair or poor self-rated health. The measures are described in Figure 1. The first three measures indicate whether a respondent had $\geqslant$14 days of physical distress, mental distress and/or depressive symptoms. This definition has been used in several studies,[8,9] because a 14-day history of symptoms within a 30-day period is considered to be clinically significant.[10] The fourth measure of self-rated health indicates whether the individual described their health as fair or poor vs excellent, very good or good on the original polytomous survey question.

Sociodemographic characteristics. Race was divided into three categories: white, black and Hispanic/other. Age was measured as a categorical variable in years: $<$40, 40–49, 50–59, 60–69 and $\geqslant$70. Other demographic variables included indicators of whether or not the subject was married, a college graduate and employed at the time of the survey.

SCI characteristics. The level of injury was defined as either tetraplegia or paraplegia, according to the subject's self-report. Duration of the injury was measured as the number of years between the date of injury indicated by the respondent and the survey date, and was divided into four categories: $<$10, 10–19, 20–29 and $\geqslant$30 years.

Health conditions. Variables that indicated a veteran's self-report of chronic diseases, including asthma, diabetes, stroke, hypertension and hepatitis C, were included in the analyses. To examine the association between heart disease and HRQoL, we created a variable to indicate report of myocardial infarction, angina or coronary heart disease.

Additionally, veterans with SCI reported alcohol consumption and tobacco use behaviors. Binge drinking was defined as having at least one occasion in which $\geqslant 5$ drinks were consumed during the previous 30 days. Smoking was measured by a dichotomous variable that indicated whether the respondent was a smoker at the time of the survey.

Analyses

The demographic characteristics of the veterans are presented using frequencies. To examine the association between subject characteristics and HRQoL, we estimated four separate multivariable logistic regression models with each of the four measures as the dependent variable. The four models include the veteran's age, race, education level, employment status, marital status, level of injury, duration of injury, presence of chronic health conditions, smoking status and report of binge drinking during the previous 30 days.

Results

Characteristics of the veterans are presented in Table 1. Approximately 19% of veterans reported to have experienced FMD, whereas 27% reported FPD and 17% reported FDS. When asked about general health status, 9% of veterans

Table 1 Demographic and health characteristics of veterans ($N = 2302$)

Characteristic	*Overall, %*	*Duration of injury, 0–9 years,* N = *446 (19.4%)*	*Duration of injury, 10–19 years,* N = *515 (22.4%)*	*Duration of injury, 20–29 years,* N = *517 (22.5%)*	*Duration of injury, 30+ years,* N = *824 (35.8%)*
Male	97.8	96.0	97.1	97.1	99.8
Race					
Black	9.9	14.1	12.6	10.4	5.5
Hispanic and other	7.1	9.4	8.7	5.8	5.6
White	83.1	76.5	78.6	83.8	88.9
Age group (years)					
<40	6.5	18.8	12.6	0.0	0.0
40–49	15.9	18.8	26.6	27.5	0.4
50–59	34.0	27.1	27.9	41.9	36.5
60–69	22.8	17.7	17.3	18.4	31.8
>70	20.8	17.5	15.5	12.2	31.3
College education	27.9	23.9	28.2	27.1	30.5
Married	54.4	53.6	53.8	46.8	59.9
Employed	10.6	10.1	13.2	11.8	8.6
Level of injury					
Tetraplegia	38.5	44.2	42.1	38.9	30.7
Health conditions					
Asthma	7.4	8.5	8.2	7.4	6.4
Diabetes	15.3	17.9	15.5	11.8	15.9
High blood pressure	40.7	38.3	35.5	35.0	48.2
Coronary heart disease/MI	11.0	13.0	8.9	8.3	12.9
Stroke	3.5	3.4	4.9	2.1	3.6
Hepatitis C	4.9	4.5	4.5	7.7	3.6
Health behaviors					
Binge drinking in previous 30 days	10.7	11.2	12.6	12.8	8.0
Current smoker	19.5	21.3	22.5	23.2	14.3
HRQoL measures					
Frequent physical distress	27.0	32.3	27.9	24.5	25.1
Frequent mental distress	18.9	22.4	19.8	18.4	16.3
Frequent depressive symptoms	17.2	20.9	19.0	16.3	14.6
Poor or fair self-reported health	28.9	35.2	26.6	25.7	29.00

Abbreviations: HRQoL, Health-related quality of life; MI, myocardial infarction.

Table 2 Correlation of HRQoL measures

	Frequent physical distress	*Frequent mental distress*	*Frequent depressive symptoms*
Frequent physical distress	1.00	0.49 ($P=0.000$)	0.45 ($P=0.000$)
Frequent mental distress	0.49 ($P=0.000$)	1.00	0.71 ($P=0.000$)
Frequent depressive symptoms	0.45 ($P=0.000$)	0.71 ($P=0.000$)	1.00
Self-rated health, poor or fair	0.57 ($P=0.000$)	0.40 ($P=0.000$)	0.39 ($P=0.000$)

Table 3 Characteristics associated with HRQoL measures (adjusted odds ratios and 95% confidence intervals)

Variable	*Frequent physical distress*	*Frequent mental distress*	*Frequent depressive symptoms*	*Self-rated health, poor or fair*
Duration of injury, 10–19 years	0.85 (0.63–1.14)	0.89 (0.64–1.23)	0.91 (0.65–1.27)	0.68* (0.50–0.92)
Duration of injury, 20–29 years	0.68* (0.50–0.93)	0.80 (0.57–1.12)	0.72 (0.51–1.03)	0.65** (0.47–0.88)
Duration of injury, >30 years	0.60** (0.46–0.81)	0.66* (0.48–0.92)	0.66* (0.47–0.92)	0.61** (0.46–0.80)
Age, 40–49 years	1.21 (0.72–2.05)	1.08 (0.61–1.90)	1.38 (0.78–2.46	1.38 (0.79–2.41)
Age, 50–59 years	1.98** (1.21–3.24)	1.39 (0.81–2.36)	1.40 (0.81– 2.42	2.44** (1.44–4.12)
Age, 60–69 years	1.70* (1.02–2.84)	1.22 (0.70–2.13)	1.28 (0.72–2.27)	2.16** (1.26–3.71)
Age, >70 years	1.75* (1.04–2.94)	1.02 (0.58–1.81)	0.80 (0.44–1.46)	2.65** (1.53–4.58)
Black race	0.80 (0.57–1.12)	0.48** (0.31–0.73)	0.73 (0.50–1.07)	0.96 (0.70– 1.34)
Hispanic/other race	1.40 (0.96–2.02)	1.40 (0.94–2.08)	1.40 (0.95–2.06)	1.56* (1.07–2.26)
College graduate	0.80 (0.63–1.01)	0.76* (0.56–0.95)	0.76* (0.59–0.99)	0.72** (0.57–0.91)
Married	0.99 (0.80–1.21)	1.00 (0.80–1.27)	0.81 (0.64–1.00)	1.06 (0.86–1.30)
Employed	0.46** (0.31–0.70)	0.50** (0.31–0.80)	0.58* (0.38–0.91)	0.36** (0.23–0.56)
Tetraplegia	1.18 (0.95–1.45)	1.15 (0.91–1.46)	0.98 (0.77–1.23)	1.14 (0.93–1.40)
Asthma	2.56** (1.82–3.59)	2.18** (1.52–3.11)	1.95** (1.33–2.86)	2.28** (1.61–3.23)
Diabetes	1.46** (1.13–1.89)	1.63** (1.23–2.17)	1.89** (1.35–2.64)	1.64** (1.27–2.12)
High blood pressure	1.57** (1.27–1.94)	1.49** (1.17–1.90)	1.63** (1.23–2.15)	1.76** (1.42–2.17)
Coronary heart disease/MI	2.08** (1.55–2.80)	1.70** (1.23–2.36)	1.58** (1.09–2.29)	2.23** (1.66–3.00)
Stroke	2.44** (1.48–4.02)	2.58** (1.56–4.26)	2.06** (1.29–3.31)	2.41** (1.45–4.02)
Hepatitis C	1.39 (0.90–2.13)	1.55 (0.98–2.44)	1.29 (0.80–2.08)	1.03 (0.66–1.61)
Binge drinking	0.97 (0.70–1.34)	1.27 (0.90–1.79)	1.20 (0.85–1.68)	0.95 (0.68–1.32)
Current smoker	1.60** (1.25–2.05)	1.61** (1.23–2.11)	1.54** (1.18–2.01)	1.65** (1.29–2.12)

Abbreviations: HRQoL, Health-related quality of life; MI, myocardial infarction.
Reference categories: Duration of injury <10 years, Age <40 years, white, education level below college graduate, unmarried, unemployed, level of injury: paraplegia, no report of chronic illness (asthma, diabetes, high blood pressure, coronary heart disease, stroke, hepatitis C), no binge drinking in past month, and current nonsmoker.
*$P<0.05$.
**$P<0.01$.

rated it as excellent, 27% as very good, 36% as good, 21% as fair and 8% as poor. FMD, FPD, FDS and self-reported health status were all significantly correlated (see Table 2). Veterans reported a mean of 8.6 days with poor physical health, 6.0 days with poor mental health and 5.9 sad, blue or depressed days during the past month. These categories are not mutually exclusive, and so an individual could have experienced more than one kind of distress on the same day.

Several characteristics were significantly associated with the HRQoL indicators (Table 3). Veterans who were older (>50 years of age) had higher odds of having FPD and of reporting poor self-rated health than were younger veterans, but there was no significant relationship between age and FDS or FMD. Black veterans had higher odds of reporting FMD than white veterans, whereas veterans who were Hispanic or who indicated another race had higher odds of reporting poor or fair health. Veterans who were employed had lower odds of reporting FPD, FMD, FDS and of rating their health as fair or poor than unemployed veterans. Veterans with a college education had lower odds of reporting FMD, FDS and poor or fair health than other veterans. Marital status was not associated with any of the HRQoL indicators.

Some SCI characteristics also were significantly associated with HRQoL measures. Compared with veterans with an injury duration less than 10 years, veterans injured for longer periods of time (⩾10 years) had lower odds of rating their health as poor or fair. Veterans with an injury duration greater than 30 years had lower odds of reporting FDS, FMD and FPD. Veterans who sustained an injury between 20 and 30 years ago also had lower odds of reporting FPD than veterans who were injured more recently. The level of injury was not significantly associated with any of the HRQoL measures.

The presence of asthma, diabetes, high blood pressure, heart disease or stroke was all significantly associated with higher odds of having FPD, FMD or FDS, or a self-rating of fair to poor health (see Table 3). Self-reporting of hepatitis C was not significantly associated with HRQoL in this study. Veterans who were current smokers had higher odds of reporting FPD, FMD, FDS and fair to poor health than nonsmokers. There was no statistically significant

association between binge drinking and any of the quality of life measures assessed.

Discussion

The percentage of veterans with SCI who reported poor or fair general health (31%) was much higher than the 13% reported for the general population.[8] The general population, however, had a lower mean age.[8] In addition, a higher percentage of veterans with SCI reported FPD (27 vs 9.7%), FMD (19 vs 9.5%) and FDS (17 vs 8%) than the general population. Similarly, a sample of Texas residents were less likely to report frequent mental distress than that reported by the veterans with SCI in this study (9.8 vs 19%).[11] The mean number of physical 'not good' days for this SCI sample (8.6 days) was comparable to that found in a study of older adults with arthritis who reported an average of 10.3 physically unhealthy days for respondents with osteoarthritis and 12.3 days for respondents with rheumatoid arthritis. However, veterans with SCI reported more 'not good' mental health days (6.1) on average than either the rheumatoid (5.2) or osteoarthritis samples (4.8).[12] The average number of sad, blue and depressed days reported by veterans with SCI was approximately twice the mean number of days reported in a large study of the US population.[13] These findings are consistent with other research that suggests that persons with SCI may be at a higher risk of depression than the general population.[14]

Our finding that older veterans with SCI were more likely to report poor or fair health than younger veterans consistent with previous studies of older adults.[12] Although these findings might be expected because age and chronic illnesses are strongly related, we found a significant association between age and FPD after controlling for several chronic conditions in the analyses. It is likely that there are other chronic conditions that affect HRQoL that we did not include in the analyses, such as arthritis. The result that veterans of Hispanic or another non-white race were more likely to report poor or fair general health than white veterans consistent with previous research conducted using the BRFSS survey.[8] Jiang and Hesser[8], however, reported conflicting findings for different HRQoL measures and suggested that race may influence the manner in which questions about health status are interpreted. This could account for our finding that black veterans had lower odds of reporting FMD than white veterans, although there was no significant difference with respect to reporting depressive symptoms. Dominick *et al*.[12] also found a relationship between race and HRQoL.

Employment was a significant predictor for all four measures of HRQoL. Studies of state populations have also found a strong association between unemployment, FPD and poor health.[8] In studies of the SCI population, employment has been associated with better SF-36 scores.[4] Employment has many benefits that could increase HRQoL, and veterans who are less healthy may be unable to work.

In this study, marital status was not significantly related to HRQoL, but previous studies of the general population have found that unmarried adults were more likely to report FMD[11] and less likely to report poor health.[12] The different results in this study might be due to differences in the characteristics of the populations studied. Our finding that a lower education level was associated with higher odds of reporting FMD, FDS and poor or fair health is consistent with the results of previous research of the general population that has found a relationship between lower education levels and FMD.[11]

Overall, the results of the analyses examining the association between demographic characteristics and HRQoL were mostly consistent with those of studies involving other populations. Conflicting results from studies of demographic characteristics and the CDC measures can probably be accounted for by differences in the populations studied and the confounding variables in the analyses.

Veterans with a longer duration of injury had lower odds of reporting FPD, FDS or poor health. A longer duration of injury appears to be protective against poor HRQoL, perhaps because of a healthy survivor effect. Our findings are consistent with studies that found longer durations of injury to be associated with higher QoL using the SF-36.[3] One study of persons with SCI and HRQoL using the SF-36, however, found no association between injury duration and HRQoL.[4] Possible explanations for the different results include the use of different measures for QoL, the existence of cultural or other differences between the populations studied and differences in sample sizes that affected statistical power. Level of injury and the HRQoL measures were not related in this study. Other studies have found that persons with tetraplegia have scores on some QoL measures that are lower than those of persons with paraplegia.[4,5]

With the exception of hepatitis, all chronic diseases included in these analyses had strong associations with each of the HRQoL measures. Studies of other populations also have reported relationships between the presence of chronic illness and HRQoL, including asthma,[8,15] diabetes[8,9] and heart disease.[16] These results demonstrate the substantial effect that chronic diseases have on physical and mental aspects of HRQoL in the SCI population, and they highlight the importance of strategies to prevent and manage these diseases.

The strong negative associations between current smoking and HRQoL measures in this study are expected because of the negative effects smoking has on health. These findings were consistent with studies that have found a relationship between smoking and poor mental health,[8] and between smoking and poor HRQoL.[17] The association between depression, FMD and smoking is consistent with research suggesting that smokers have higher rates of depressive symptoms.[17]

Binge drinking was not significantly associated with any HRQoL measures. A previous study of the US population found an association between binge drinking and several of the CDC HRQoL measures.[18] Binge drinking may not have the same effects on QoL for persons with SCI. We also estimated the models using a variable measuring chronic drinking (average number of drinks per day >2), and the results were similar.

Limitations

There were limitations to this study. As the surveys were anonymous, we could not compare respondents with nonrespondents. There were, however, significant differences for many of the independent variables between veterans who had complete and incomplete study data. Also, our sample included an overwhelming number of male respondents. Past research examining HRQoL measures in persons with SCI found significant differences between male and female respondents.[3] Additionally, in this study the chronic illnesses were self-reported, which may have resulted in errors. This study, however, describes HRQoL for a large sample of persons with SCI using a validated instrument. Results are comparable to that of other populations assessed using the BRFSS.

Conclusion

Veterans with SCI were much more likely to experience frequent FPD, FMD and FDS than what has been reported for the general population. The strong association between the presence of chronic conditions such as diabetes and asthma with both physical and mental quality of life suggests the importance of efforts to prevent and treat these conditions in the SCI population. Additionally, use of smoking cessation programs may increase HRQoL for veterans with SCI who are current smokers.

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