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Original Research

Association Between Anxiety Symptoms, Depression Symptoms, and Life Satisfaction Among Individuals 1 Year After Spinal Cord Injury: Findings From the SCIRehab Project

Maria A. Parker, PhD, MS, MPH [a], Jodi K. Ichikawa, BS [a], Charles H. Bombardier, MD [b], Flora M. Hammond, MD [c]

[a] *School of Public Health, Department of Epidemiology and Biostatistics, Indiana University, Bloomington, IN*
[b] *Department of Rehabilitation Medicine, University of Washington, Seattle, WA*
[c] *Department of Physical Medicine and Rehabilitation, Indiana University School of Medicine, Indianapolis, IN*

KEYWORDS
Anxiety;
Depression;
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Abstract *Objective:* To examine the association between anxiety symptoms, depression symptoms, and life satisfaction 1 year after SCI.
Design: Cross-sectional analysis of data from the SCIRehab Project. A linear regression model estimated the association between anxiety symptoms and life satisfaction and tested the moderating effect of depression symptoms on the association between anxiety symptoms and depression symptoms with an interaction term.
Setting: Six rehabilitation facilities across the United States.
Participants: A total to 940 persons older than 12 years who received inpatient spinal cord injury (SCI) rehabilitation between 2007 and 2009 were followed up 1 year post injury (n=940).
Interventions: None
Main Outcome Measures: Life satisfaction 1 year after SCI measured via the Satisfaction With Life Scale.
Results: Unadjusted analyses showed anxiety symptoms were associated with decreased life satisfaction for individuals with SCI. In adjusted analyses, anxiety symptoms were not associated with life satisfaction. In adding an interaction term, anxiety symptoms were associated with 2 points lower life satisfaction holding the other variables constant (*P*=.02). There was a moderating effect

List of abbreviations: AIS, American Spinal Injury Association Impairment Scale; GAD, Generalized Anxiety Disorder; PHQ, Patient Health Questionnaire; SCI, spinal cord injury.

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of depression symptoms on the association between anxiety symptoms and life satisfaction. Persons with anxiety symptoms had lower life satisfaction scores at lower levels of depression symptoms but higher life satisfaction scores at higher levels of depression symptoms than persons with no anxiety.
Conclusions: In clinical settings, both anxiety and depression symptoms should be monitored, measured, and treated together to optimally improve life satisfaction for persons with SCI. Prioritizing interventions known to have transdiagnostic effects may achieve the best results.
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While spinal cord injury (SCI) has negatively affected life satisfaction largely because of decreased community participation,[1-4] it also results in reduced psychological well-being, including elevated anxiety and depression.[5] Studies suggest that 22% of persons with SCI experience symptoms of depression and almost 30% experience symptoms of anxiety,[4,6-8] which is much higher than the general population. At 1 year post SCI, approximately 30% have clinical anxiety and depression without significant improvement 2 years post injury.[6] This lack of improvement in psychological distress for persons with SCI can contribute to long-term poor quality of life and/or chronic psychological dysfunction.[9,10]

Compared with persons without SCI, persons with SCI have higher levels of both anxiety and depression as well as more anxiety than depression[4,6,7]; anxiety is understudied relative to depression among persons with SCI.[11] In a nationally representative survey of persons *without* SCI, researchers examined the relationship between anxiety and life satisfaction and found a moderately negative correlation between anxiety and life satisfaction, a negative correlation between depression and life satisfaction, and a very strong positive correlation between anxiety and depression.[12]

Life satisfaction and the prevalence and severity of anxiety and/or depression have been explored separately in the population with SCI.[6,9,11,13-19] While life satisfaction has been associated with mental health concerns,[20] prior research on depression and/or anxiety generally has not considered life satisfaction.[13,21,22] However, 1 study in Sweden found higher levels of anxiety and depression associated with decreased life satisfaction in a mailed survey of this population (n=191).[22]

This study builds on cross-sectional findings[22] by examining the association of anxiety symptoms, depression symptoms, and life satisfaction together 1 year after SCI using data from the SCIRehab Project. We hypothesized a moderate positive association (eg, Headey et al.[12]) between anxiety symptoms and life satisfaction scores 1 year after SCI. Our secondary hypothesis was that depression symptoms would moderate the association between anxiety symptoms and life satisfaction. The interaction between anxiety and depression symptoms was tested because of the strong relationship between anxiety and depression.[12]

Methods

Data source and sample

This study included data from the SCIRehab Project on individuals older than 12 years consecutively admitted for inpatient SCI rehabilitation at 6 facilities across the United States between 2007 and 2009 and followed up 1 year post injury (n=1376).[23] At 1 year post injury, 58 had died and 147 were lost-to-follow-up. Individuals missing data for life satisfaction (n=186), anxiety (an additional n=30), and depression (n=15) were excluded, yielding an effective sample of 940 participants with complete data. The SCIRehab Project received Institutional Review Board approval at each site and all participants provided consent. This study using deidentified data was deemed Institutional Review Board exempt.

Measures

Outcome: life satisfaction

The outcome variable was life satisfaction 1 year after SCI. It was measured via the Satisfaction With Life Scale, a 5-question instrument using a 7-point Likert scale, ranging from 1=strongly disagree to 7=strongly agree.[20] Values were summed for a range from 5-35.[20] A score of 20 represents the neutral point, 5-9 indicates extreme dissatisfaction with life, 10-14 indicates dissatisfaction with life, 15-19 indicates slight dissatisfaction with life, 21-25 indicates slight life satisfaction, 26-30 indicates satisfaction with life, and 31-35 indicates extreme satisfaction with life.[20] The reliability of this scale has been adequate for persons with SCI.[24]

Exposure: anxiety

The exposure of interest was anxiety symptoms 1 year after SCI. It was measured via the Generalized Anxiety Disorder (GAD)-2 assessment,[25] an ordinal scale with 4 categories: "not at all," "several days," "more than half the days," and "nearly every day." Participants answered about the past 2 weeks, ". . . how often have you been bothered by feeling nervous, anxious or on edge?" and ". . . how often have you been bothered by not being able to stop or control worrying?" A conservative combined score of ≥2 indicated clinically significant anxiety.[25,26] The GAD-7 is commonly used in research for persons with SCI,[27] but the GAD-2 has not been validated in the population with SCI. Both the GAD-7 and GAD-2 have acceptable reliability and validity in the primary care setting.[25, 28]

Moderator: depression

Depression symptoms, measured by the Patient Health Questionnaire (PHQ-9) 1 year after SCI, was considered as a moderator because of its strong association with anxiety.[6,11-14] The PHQ-9 is a 9-item self-report measure with scores from 0=not at all to 3=nearly every day (total range, 0-27).[29] Levels of depression severity are categorized as Minimal (0-4),

Mild (5-9), Moderate (10-14), Moderately Severe (15-19), or Severe (20-27).[23,] Psychometric properties of the PHQ-9 were acceptable for persons with SCI.[29]

Covariates

Covariates included sex (male, female), age at injury (12-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79, ≥80 years), race/ethnicity (White, Black, Hispanic, Asian/Pacific Islander, Other), highest education level completed at injury (<high school, high school, >high school, other), neurologic impairment at rehabilitation admission measured by the American Spinal Injury Association Impairment Scale (AIS) grades A-E,[30] and Rasch transformed Motor and Cognitive FIMs at rehabilitation admission (18-item total clinician rating of care burden).[31]

Statistical analyses

Background characteristics of the population were compared between participants with and without 1 year follow-up data. For the sample with data, life satisfaction scores were examined by anxiety and by depression symptoms separately. Then, a 1-way analysis of variance estimated the association between life satisfaction by anxiety level to examine if anxiety should be treated as a dichotomous or categorical variable. Next, linear regression models estimated the association between anxiety symptoms (yes/no) and life satisfaction (continuous).[12] These analyses began with unadjusted models followed by models adjusting for sex, age, race/ethnicity, education, and depression (continuous). Then, models added AIS and FIM. Finally, to test the moderating effect of depression on the association between anxiety and depression symptoms, an interaction term was added between anxiety and depression symptoms to explore whether life satisfaction scores varied at differing levels of anxiety and/or depression. A sensitivity analysis was performed to examine levels of low anxiety vs high anxiety symptoms by conducting a final model with a revised measure of anxiety (ie, low anxiety GAD-2 score=2-3, high anxiety GAD-2 score=4-6). Analyses were conducted in Stata version 16.[32] Values of $P \leq .05$ were considered statistically significant.

Results

Participant characteristics of those with and without 1-year follow-up data are summarized in table 1. The sample was primarily male, White, with high school education, and more than half the sample was younger than 29 years old. There were significant differences between persons with and without 1 year follow-up data for age, education, and motor/cognitive FIM. Persons with 1-year follow-up data tended to be slightly older and more educated with higher motor/cognitive scores vs those with no follow-up data. Twenty-four percent of the sample experienced elevated symptoms of anxiety. Average ± SD depression score was 4.5±4.9. The average life satisfaction score was neutral (20.8) (see table 1).

Life satisfaction scores were lower for persons with anxiety symptoms (vs none) and decreased as levels of depression symptoms increased (table 2). The unadjusted linear regression model established having anxiety symptoms was related to lower life satisfaction compared with persons with no anxiety symptoms (β=−4.4; P<.001). In a linear regression model adjusting for sex, age, race/ethnicity, education, and depression, anxiety symptom level was not significantly associated with life satisfaction (β=−0.1; P=.86), while depression symptoms were significantly associated with life satisfaction (β=−0.7; $P \leq .001$). In adding AIS and FIM, anxiety remained nonsignificant, and depression remained significant (β=−1.5; P=.53; β=−0.7; $P \leq .001$, respectively) (appendix 1).

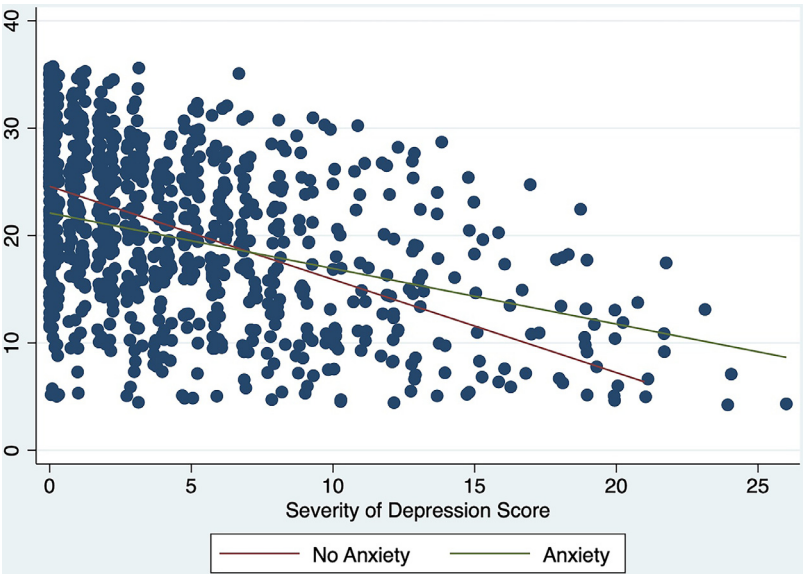

Fig 1 Unadjusted association between severity of depression and anxiety level for life satisfaction scores among persons with SCI. Data from the SCIRehab Project (n=940).

Table 1 Characteristics of participants with SCI in the SCIRehab Project and those without 1-year follow-up data

Characteristic	Those With Data (N=940) n (%)	Those With Incomplete Data/Lost to Follow-up (n=436) n (%)	*P* Value
Age (y)			<.001
12-19	106 (11.28)	94 (21.56)	
20-29	263 (27.98)	115 (26.38)	
30-39	163 (17.34)	53 (12.16)	
40-49	162 (17.23)	63 (14.45)	
50-59	137 (14.57)	46 (10.55)	
60-69	76 (8.09)	40 (9.17)	
70-79	27 (2.87)	18 (4.13)	
80+	6 (0.64)	7 (1.61)	
Sex			.591
Female	184 (19.57)	80 (18.35)	
Male	757 (80.43)	356 (81.65)	
Race and ethnicity			.138
White	672 (71.49)	308 (70.64)	
Black	203 (21.60)	88 (20.18)	
Hispanic	20 (2.13)	20 (4.59)	
Asian/Pacific Islander	23 (2.34)	8 (1.83)	
Other	23 (2.45)	12 (2.75)	
Highest level of education completed at injury*			<.001
<High school	147 (15.64)	120 (27.52)	
High school	469 (49.89)	178 (40.83)	
College	252 (26.81)	75 (17.20)	
Other	72 (7.66)	63 (14.45)	
Neurologic impairment at rehabilitation admission†			.065
A	444 (47.23)	237 (54.36)	
B	156 (16.60)	71 (16.28)	
C	183 (19.47)	71 (16.28)	
D	157 (16.70)	57 (13.07)	
FIMs at rehabilitation admission‡			
Motor	23.59 (0.53)	21.42 (0.79)	.011
Cognitive	69.34 (0.64)	67.06 (0.98)	.021
Anxiety 1 y after SCI§			
No anxiety	713 (75.85)	—	
Anxiety	227 (24.15)	—	
Life satisfaction 1 year after SCI‡			
	20.81 (0.25)	—	
Depression 1 y after SCI			.394
Minimal	582 (61.85)	84 (64.84)	
Mild	223 (23.70)	24 (18.75)	
Moderate	83 (8.82)	10 (7.81)	
Moderately severe	37 (3.93)	9 (7.03)	
Severe	16 (1.70)	2 (1.56)	

* College includes associate, bachelor's, master's, doctorate. Other includes other and unknown.
† No participants presented with neurologic impairment E.
‡ Mean (SE) presented.
§ Scores of ≥2 on the GAD-2. Scores of 3=131 (13.94%), scores of 4=83 (8.83%), scores of 5=47 (5.00%), scores of 6=33 (3.51%).

Then, in adding an interaction term to the model between anxiety and depression symptoms, having anxiety symptoms became significantly associated with lower life satisfaction scores (β=−1.9; *P*=.02), as were depression symptoms (β=−0.8; *P*≤.001) and the interaction between the 2 (β=0.3; *P*=.01). Persons with no anxiety symptoms had higher levels of life satisfaction at low levels of depression symptoms. Around a depression score of 7, indicating mild depression,[33] persons with anxiety symptoms had higher life satisfaction scores despite higher scores for depression vs persons with no anxiety at the same level of depression (fig 1). This model explained 29% of the variance in life satisfaction. The final model comparing low with high levels of anxiety symptoms showed that there were significantly lower life satisfaction scores for persons with low levels of anxiety (β=−2.0; *P*=.04) but not for those with high levels of anxiety (β=−1.9; *P* =.24; interaction term (β=0.3; *P*=.02). There was not collinearity with symptoms of depression and anxiety;

Table 2 Life satisfaction scores by anxiety and depression symptoms for participants with SCI in the SCIRehab Project (n=940)

	Mean (SE)
Anxiety 1 y after SCI	
No anxiety	21.87 (0.28)
Anxiety	17.46 (0.49)
Depression 1 y after SCI	
Minimal	23.05 (0.29)
Mild	19.02 (0.47)
Moderate	15.64 (0.78)
Moderately severe	13.11 (1.02)
Severe	8.94 (0.99)

the correlation between anxiety and depression symptoms was 0.6.

Discussion

Data from the SCIRehab Project, including persons who received inpatient rehabilitation for SCI between 2007 and 2009, showed that anxiety symptoms were significantly associated with lower life satisfaction when considering its interaction with depression, particularly for those with low levels of anxiety symptoms. In the literature, a higher level of anxiety was associated with lower levels of life satisfaction.[12,19] Anxiety and depression are highly interrelated.[6,11-14] We found about a quarter of persons had elevated levels of anxiety 1 year after SCI, and 14% had levels of moderate depression symptoms or more. While the proportion of persons with elevated anxiety symptoms was similar to the literature,[6] levels of depression symptoms were lower.

This study indicated that depression symptoms moderated the association between anxiety symptoms and life satisfaction. This phenomenon was echoed in the literature, with chronic high depression emerging as a pattern but not chronic high anxiety, showing that resilient persons with SCI had fewer quality of life issues, greater acceptance and fighting spirit, and less coping through behavioral disengagement.[9] Our findings highlight the importance of anxiety and depression, the 2 most common psychological pathologies after SCI,[6,16,17,34] in relation to life satisfaction. Persons with SCI have higher levels of both anxiety and depression than able-bodied controls without SCI.[11] Life satisfaction scores have been correlated with other mental health issues and found to predict of future behaviors such as suicide attempts.[20]

The research literature demonstrates that depression and anxiety are highly comorbid conditions,[35] although research in persons with SCI tends to focus on depression rather than anxiety. Yet, anxiety is prevalent, maybe even more so than major depression.[36] Our results suggest that in persons with SCI, depression and anxiety interact in ways that influence life satisfaction. One implication is that clinicians caring for persons with SCI should measure both anxiety and depression to capture psychological distress. Moreover, when treating people with anxiety or depression, using principles of measurement-based care,[37] both anxiety and depression should be monitored because it may be important to reduce both anxiety and depression to optimally improve satisfaction with life. Fortunately, both medical and psychosocial treatments for depression also tend to have antianxiety effects.[38] For example, selective serotonergic reuptake inhibitor medications are effective for both anxiety and depression. Similarly, cognitive behavior therapy and behavioral activation for depression include strategies that also reduce anxiety and avoidance. Given these conditions frequently co-occur, it may be prudent to prioritize interventions that are known to have transdiagnostic effects[39,40] and to measure response to treatment in both symptom domains, anxiety and depression, to achieve the greatest effects on life satisfaction.

Study strengths and limitations

While the SCIRehab data are a longitudinal and comprehensive cohort containing detailed information regarding postacute rehabilitation services and follow-up data collected via patient interview, it was collected between 2007 and 2009. Therefore, the participants who received inpatient rehabilitation may not represent all persons with SCI today. There may be differences in historical context (eg, changes in rehabilitation treatment, awareness of ableism, COVID-19, suicidal norms). Those persons lost to follow-up included those who were younger, had less education, and had lower motor/cognitive FIM scores. These persons might have had more difficulties with anxiety and depression and, therefore, elevated anxiety and depression scores. Further, we did not have information about preinjury psychiatric history. The SCIRehab Project questionnaire only measured 2 of the 7 GAD questions over 2 weeks and may over/underestimate anxiety presence.[25] We acknowledge that this study did not use diagnostic criteria for anxiety or depression; it has only measured the symptoms of the disorders. Additionally, statistical significance does not always translate to clinical significance. For example, a 2-point difference on the life satisfaction scale may only be important clinically for some individuals. While several key demographic data were included, there may be other factors important for the association between anxiety and life satisfaction such as preinjury substance use.[41]

Conclusions

In conclusion, this study found that level of anxiety symptoms was a significant predictor of life satisfaction level when considering the interaction between anxiety symptoms and depression symptoms using a well-established cohort of persons with SCI. In other words, depression and anxiety symptoms interact in ways that can adversely influence life satisfaction for persons with SCI, which may be especially important for persons experiencing low levels of anxiety symptoms. These findings are consistent with studies conducted with persons without SCI.[12] Among persons with SCI, depression may be more debilitating than anxiety.[9] Future research should continue to examine the complex relationship between anxiety, depression, and life satisfaction in the population with SCI. When addressing life satisfaction among persons with SCI in clinical settings, both anxiety and depression should be monitored, measured, and treated because it may be important to reduce both anxiety and depression to optimally improve satisfaction with life.[35–37]

Corresponding author

Maria A. Parker, PhD, MS, MPH, Indiana University School of Public Health, 809 East 9th St, Bloomington, IN 47405.
E-mail address: map2@iu.edu.

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