

ARTICLE



# Does severity of spinal cord injury predict likelihood of suffering chronically from severe depression and anxiety?

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**STUDY DESIGN:** Qualitative Survey study.

**OBJECTIVE:** One might assume that those with higher and more complete spinal cord injuries are at higher risk of depression and anxiety. The objective of this study was to assess the association between level and severity of injury with the degree of anxiety and depression in chronic spinal cord injury.

**SETTING:** Spinal Cord Injury Rehabilitation outpatient clinic.

**METHODS:** 49 subjects were recruited from our research database. Time from injury ranged from 6 months to 20+ years. Sample included 23 motor complete and 26 motor incomplete participants; of these 24 were people with paraplegia, 25 were people with tetraplegia. They answered HADS, BDI-FS and PHQ-9 questionnaires. Participants were grouped based on time post injury and then were further divided by motor complete (AIS A/B) and incomplete (AIS C/D) and level (tetraplegia cf. paraplegia). Two-sample t-tests were conducted to evaluate the differences in depression and anxiety scores, between individuals with different completeness and injury type.

**RESULTS:** There were no significant differences amongst the groups tested regarding severity of depression and anxiety, however, those with paraplegia or incomplete injuries had higher but not significantly higher average scores for depression and anxiety.

**CONCLUSION:** We found there were no statistically significant differences in depression and anxiety scores among the groups. These results suggest that all people with SCI may be at similar risk of depression and anxiety, regardless of SCI severity and level.

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## INTRODUCTION

Quality of life can be significantly impacted by depression and anxiety. It can impact multiple facets of life such as daily functioning abilities, coping abilities, relationships, independence and overall life satisfaction. The effects of depression and anxiety can be detrimental to a person's life. Furthermore, individuals with spinal cord injury (SCI) have additional stressors and limitations that leave them particularly vulnerable to the battle against depression and anxiety.

It can generally be assumed that a higher degree of disability or severity of SCI would correlate with higher levels of depression and anxiety and would therefore lead to greater difficulty of coping for these individuals. However, through clinical observations and previous research there is evidence to suggest that this is not the case [1], especially for individuals with long term SCI, and therefore we believe that it would be beneficial to identify the levels of depression and anxiety for this population in sub-acute (< 2 years after injury) and chronic (2+ years after injury) phases. This information will aid in further understanding the complex relationship between SCI and non-physical variables such as depression and anxiety. Because depression and anxiety influence coping abilities, this information may ultimately help to target appropriate resources to improve coping abilities among people living with SCI.

In current literature some studies have found that individuals with paraplegia have higher levels of depression and anxiety [1, 2], while other studies have found that people with tetraplegia show more depression [3, 4]. When relating completeness of injury to depression and anxiety, some studies have found that complete injuries relate to higher rates of depression [1, 3], conversely, other research has found that individuals with incomplete injuries have higher rates of depression [4]. A study which explored the relationship between pain and depression, found that there were no significant differences between the type of injuries regardless of the completeness of injury and furthermore found that depression scores between admission and discharge had increased for individuals whom had complete tetraplegia [3]. Some research suggests that SCI patients have greater rates of depression and anxiety than the general population and these rates were comparable to several years after injury [1, 5]. Studies have also looked at the prevalence of depression at 1 year and 5 years after initial SCI show a significant decrease in depression across these two time periods [3, 6], whereas another study found that there were no significant differences between a control group and SCI group within 1 year [1].

Other research which followed levels of depression and anxiety over a course of 10 years found that pain was associated with

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depressive symptoms and quality of life for individuals with tetraplegia/complete injuries and paraplegia/incomplete injuries for 10 years or less since injury [7]. A research study that followed emotional impact and psychological growth from 12 weeks – 10 years post discharge found that the majority of their sample size showed no symptoms of depression 10 years post injury, but also stated that individuals who showed clinically significant symptoms for emotional distress at week 12 were more likely to show emotional distress at year 10 post injury [8]. A longitudinal study examining coping strategies suggests that depression, other psychological factors and poor coping strategy may result in premature death which emphasizes the necessity to develop strong interventions that focus on protective psychological factors to decrease risk of mortality in SCI individuals [9].

As most literature focuses on SCI in the short term, and current literature is lacking in information assessing effects of depression and anxiety past 10 years post injury, our aim was to evaluate the effect of severity and level of SCI on depression and anxiety rates, both relatively early after SCI and in chronic SCI up to 40 years post injury. Greater understanding of the variability in psychological impacts among people with SCI can allow for better targeting of resources to increase the quality of life and satisfaction for these individuals.

## METHODS

### Participants

Participants were selected from a research database of people with SCI who had previously agreed to be contacted for research studies as appropriate. Participants were chosen based on when their injury had occurred and the type of injury they had. The inclusion criteria included: (1) age of 18 or older for enrollment; (2) had SCI for more than 6 months; (3) lived in Manitoba. Exclusion criteria included: (1) diagnosed personality disorder; (2) diagnosed schizophrenia; (3) individuals with American Spinal Injury Association Impairment Scale (AIS) E SCI, suggesting normal motor ability.

### Measures of depression and anxiety

Once consented and agreeable to participate, three questionnaires were used to evaluate depression and anxiety. The Hospital Anxiety and Depression Scale (HADS) [10], was used to evaluate both anxiety and depression. Scores of 11 or higher on a theoretical HADS range of 0–21 indicated severe depression and anxiety. The Beck Depression Inventory Fast Screen (BDI-FS) [11] was used to determine the severity of depression. Scores of 13 or higher on a theoretical BDI-FS range of 0–21 indicated severe depression. Lastly, the Patient Health Questionnaire (PHQ-9) [12] was used to consider factors beyond physical functioning, and scores 15 or higher on a theoretical range of 0–27 showed severe depression. BDI-FS included questions regarding suicidal ideation, and PHQ-9 included questions regarding the frequency of suicidal ideation. Participants who showed suicidal ideation were flagged and sent additional support material and were contacted.

### Injury characteristics

Differences in psycho-social scores were summarized across five time-frames with respect to years since injury. These were: 6 months–2 years, 2–5 years, 5–10 years, 10–20 years, and 20+ years. As individuals with AIS Class A and B injuries are both motor complete SCI, they were grouped together, and AIS Class C and D were grouped together as motor incomplete SCI. Those with neurological level of injury C2–8 were grouped together as people with tetraplegia, and T1-distal were grouped as people with paraplegia.

Packages with questionnaires were mailed to the participants homes, where they were completed and mailed back. The response rate was 77.8%, with a total of 63 packages sent out, of which 49 packages were returned. Their scores were recorded and tabulated. We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research.

### Statistical analysis

Means and frequencies were used to describe the population. T tests for differences in mean depression and anxiety between groups were

conducted. In order to assess whether the association between psychosocial scores (HADS, BDI-FS, and PHQ-9) and completeness/injury type differed by time since initial SCI, stratified Fisher's exact tests were conducted within each of three time-frames. The five time-frames were collapsed to three for this analysis in order to retain a large enough sample in each group. The three-time frames were: <2 years, 2–10 years, > 10 years. The Fisher's exact tests assessed whether motor completeness or injury type were associated with severe depression or anxiety on any of the three measures (HADS, BDI-FS, or PHQ-9). This is a hypothesis generating study. As such, any statistically significant findings need to be interpreted with the same caution one would accord all studies that may have elevated type I error because of more than one assessment being conducted.

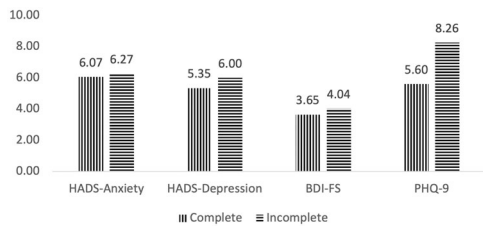
## RESULTS

The sample size included 49 participants in total, among whom the mean age was 54.1 (range 19–89), and the majority were men (87.8%) (Table 1). While the mean age at the time of the survey was 54.1, the mean age at the time of injury was just 40.1 and ranged from 12 to 89. In the subacute post injury category (6 months–2 years) there were 12 participants, for 2–5 years there were 7 participants, 5–10 years had 5 participants, 10–20 years had 11 participants, and 20+ years had 14 participants. There were 26 participants that were motor incomplete, while 23 participants were motor complete. Furthermore, the sample contained 24 people with paraplegia and 25 with tetraplegia.

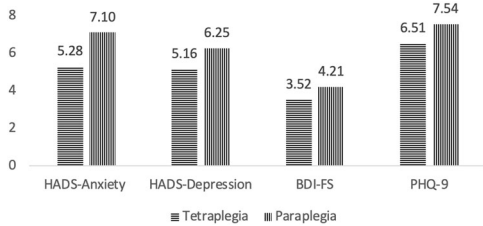
The HADS questionnaire was divided into two parts, anxiety and depression. The difference between the anxiety scores by complete (mean score 6.07) versus incomplete (mean score 6.27) (Fig. 1) was not statistically significant ( $p = 0.440$ ,  $t$ -test, results not shown).

**Table 1.** Background characteristics of study sample.

Background	N (%)
Demographics	
Age (mean, range)	54.1 (19.7–89.8)
19–34	8 (16.3%)
35–59	19 (38.8%)
60–69	13 (26.5%)
70–89	9 (18.4%)
Gender	
Female	6 (12.2%)
Male	43 (87.8%)
Spinal cord injury related background	
Age at time of injury (mean, range)	40.1 (12.8–89.2)
12–19	7 (14.3%)
20–29	15 (30.6%)
30–59	17 (34.7%)
60–89	10 (20.4%)
Years since injury (mean, range)	14.0 (0.6–43.4)
0.5–2 years (sub-acute)	12 (24.5%)
2–5 years	7 (14.3%)
5–10 years	5 (10.2%)
10–20 years	11 (22.5%)
20+ years	14 (28.6%)
Motor completeness	
Incomplete	26 (53.1%)
Complete	23 (46.9%)
Injury type	
Paraplegia	24 (49.0%)
Tetraplegia	25 (51.0%)



**Fig. 1 Mean scores for complete and incomplete injuries.** Compared participants with complete vs. incomplete injuries and their scores on each questionnaire.



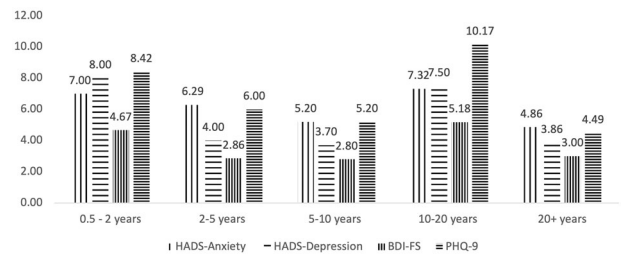
**Fig. 2 Mean scores for people with tetraplegia and paraplegia.** Compared participants with tetraplegia vs. paraplegia and their scores on each questionnaire.

Those with paraplegia had a higher mean anxiety score on HADS (7.10) than those with tetraplegia (5.28) (Fig. 2), but this was also not statistically significant ( $p = 0.086$ , *t*-test, results not shown). For HADS Depression, participants with incomplete injuries again had a higher mean score of 6.0 while those with complete injuries with mean score of 5.35 (Fig. 1), but this difference was not statistically significant ( $p = 0.305$ , *t*-test, results not shown). Those with paraplegia showed a higher mean score of 6.25 compared to those with tetraplegia of 5.16 (Fig. 2), but not statistically significant ( $p = 0.196$ , *t*-test, results not shown). For HADS Anxiety, it was found that individuals with subacute injuries and individual who sustained injuries for the past 10–20 years had the highest mean values of 7 and 7.32 respectively (Fig. 3), compared to other groups. For HADS Depression, the results were similar, with individuals scoring an average of 8 for subacute injuries and 7.50 for those in the 10–20 category.

The difference in mean BDI-FS scores for completeness ( $p = 0.350$ , *t*-test, results not shown) and injury type ( $p = 0.246$ , *t*-test, results not shown) was not statistically significant. Those with motor incomplete and who had paraplegia had higher mean BDI-FS scores, but not substantially higher (Figs. 1 and 2). Time since injury did not impact the BDI-FS score (Fig. 3).

The difference in mean scores in PHQ-9 for completeness ( $p = 0.091$ , *t*-test, results not shown) and injury type ( $p = 0.304$ , *t*-test, results not shown) was not statistically different. Again, a similar trend to the other two questionnaires was observed. Those with incomplete injuries had a higher mean score of 8.26, compared to individuals with complete injuries with an average score of 5.60 (Fig. 1). Similarly, people with paraplegia had a higher average score of 7.54, while participants with tetraplegia had lower average scores of 6.51 (Fig. 2). The 10–20 year since injury group had the highest average of depression (10.17), but after 20 years this significantly dropped (Fig. 3).

In Table 2, we used the standard score cut-offs found in literature to explore associations between severe anxiety or depression and both motor completeness and injury type. Although those with incomplete injuries may be more likely than those with complete injuries to experience severe depression or anxiety, and those with paraplegia may also be more likely than those with tetraplegia to experience severe depression or anxiety, the differences were not statistically significant.



**Fig. 3 Mean scores for subacute and long-term phases.** Compared five different time frames since injury occurred and participant scores on each questionnaire.

We also found no strong evidence that the associations between severe anxiety or depression and motor completeness or injury type may differ for people in the sub-acute (< 2 years) injury phase compared to those who have lived with the injury longer (Table 2). Nobody in our cohort was classified as having severe depression on the BSI-SF measurement so *p*-values were not calculated for this measure.

The trend found throughout the study showed that those with incomplete injuries (Fig. 1) and those that had paraplegia had higher scores of depression and anxiety (Fig. 2). However, there were no statistically significant differences observed.

Suicidal ideation was also assessed in the questionnaires. Out of the forty-nine participants, thirteen (26.5%) showed suicidal ideation. Eight (61.5%) of these participants had paraplegia and five (38.5%) had tetraplegia. Six of the thirteen participants were classified as AIS A and therefore had a motor complete injury. Seven of the participants with suicidal ideation were classified as AIS C or D and had an incomplete injury.

## DISCUSSION

The objective of this study was to assess the level of depression and anxiety related to level, severity and time since injury occurred. It seems intuitive to believe that individuals with tetraplegia and those with motor complete injuries would be more depressed and anxious due to their higher mobility restrictions, however, this was not observed in this study. The results showed that there were no statistically significant differences across any of the groups. Additionally, it was observed that individuals with paraplegia or that have motor incomplete injuries had higher average scores in depression and anxiety compared to those with tetraplegia or complete injuries. Past research also supports these findings [1, 2].

When looking at short timelines post SCI, a study which compared SCI in their first year of injury vs. controlled able-bodied individuals found that across time there were no significant differences in these psychological factors between these groups [1]. Previous studies provide additional support to the results of this study, showing that rates of depression and anxiety can be high in the first year, but then decrease in the fifth-year post injury [3, 5].

Time did not significantly impact depression and anxiety. However, across all three assessments, the results show a downward trend for mean depression and anxiety scores as time goes on, but depression and anxiety was shown to increase in 10–20 years, and then decrease again. The average age of this group is 53 years old. This finding may be due to an emotional transitional period where individuals commonly experience additional stressors due to new challenges that arise with aging, family and work problems. Those in the 20+ years post injury, scored lower compared to the 10–20-year group and this could be due to the healthy survivor effect [13]. Previous research has found that there is stability in psychological factors like depression and anxiety with some subtle differences across time [14].

**Table 2.** Associations between motor completeness, injury type and severe depression or anxiety, stratified by duration since injury.

	HADS-severe depression <sup>a</sup>		HADS-severe anxiety <sup>b</sup>		BDI-FS – Severe Depression <sup>c</sup>		PHQ-9 – severe depression <sup>d</sup>	
	Percent	P-value <sup>e</sup>	Percent	P-value <sup>e</sup>	Percent	P-value <sup>e</sup>	Percent	P-value <sup>e</sup>
Overall (N = 49)								
Motor Completeness								
Complete	9%	0.263	22%	0.592	0%	–	9%	0.100
Incomplete	19%		23%		0%		27%	
Injury type								
Paraplegia	17%	0.476	25%	0.469	0%	–	21%	0.473
Tetraplegia	12%		20%		0%		16%	
Among people with 0.5–2 years since injury (N = 12)								
Motor Completeness								
Complete	0%	0.091	17%	0.500	0%	–	0%	0.227
Incomplete	50%		33%		0%		33%	
Injury type								
Paraplegia	0%	0.255	0%	0.255	0%	–	0%	0.424
Tetraplegia	38%		38%		0%		25%	
Among people with 2–10 years since injury (N = 12)								
Motor Completeness								
Complete	0%	0.667	25%	0.745	0%	–	25%	0.745
Incomplete	13%		25%		0%		25%	
Injury type								
Paraplegia	20%	0.417	40%	0.364	0%	–	40%	0.364
Tetraplegia	0%		14%		0%		14%	
Among people with 10+ years since injury (N = 25)								
Motor Completeness								
Complete	15%	0.531	23%	0.541	0%	–	8%	0.265
Incomplete	8%		17%		0%		25%	
Injury type								
Paraplegia	20%	0.198	27%	0.313	0%	–	20%	0.468
Tetraplegia	0%		10%		0%		10%	

<sup>a</sup>Score 11 or higher <sup>b</sup>Score 11 or higher <sup>c</sup>Score 13 or higher <sup>d</sup>Score 15 or higher.

<sup>e</sup>Fisher's exact tests.

A limitation in this study was the small sub-sample sizes for each category which may have impacted the statistical results by yielding non-significant results. For future research this issue can be addressed having a larger sample size which should provide more precise results. There is a need to research these variables in long term injuries as current literature is lacking in this. Additionally, some participants may have had a history of depression and anxiety before injury, and it would be interesting to see future research in assessing how much a spinal cord injury influences these factors before and after injury.

It is important to find that depression and anxiety was not significantly influenced by time, level, and severity of injury. While initially depression and anxiety may be high post injury due to adjustments to new circumstances and changing ways of living, these psychological factors are seen to decrease overtime and stay stable. This study addresses the assumption that individuals with less mobility and other physical restrictions have increased rates of depression and anxiety, but through this study has shown to be false. There is a great paucity of literature that examines this issue beyond 5–10 years post injury, however this study looks at 20+ years. The 20+ years since injury group overall showed the lowest average depression and anxiety scores, which shows that people with long term injuries are psychologically healthy and are living

satisfied lives. This study also reduces the stigma and perception that individuals with spinal cord injuries are unhappy or unable to emotionally cope with their injuries. Furthermore, this study shows that counseling efforts should particularly be focused to help people with paraplegia and incomplete injuries.

## CONCLUSION

This study assessed whether there was an association between depression and anxiety with level, severity and time. Overall, there were no significant findings found among any of the groups, however those with paraplegia or incomplete injuries had non-significant higher average scores for depression and anxiety. These results show that those with higher levels and more complete injury are coping at least as well, and perhaps even better than those with lower levels of injury. Lastly, as this study shows there needs to be more attention on counseling towards all people with SCI, not just those with more severe injuries.

## DATA AVAILABILITY

The datasets generated during the current study are available from the corresponding author upon reasonable request.

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## COMPETING INTERESTS

The authors declare no competing interests.

## ADDITIONAL INFORMATION

**Correspondence** and requests for materials should be addressed to Karen Ethans.

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