Longitudinal Analysis of the Associations Between Depression and Employment After Traumatic Spinal Cord Injury

Ted Allaire

Department of Psychology, Eastern Michigan University
Department of Physical Medicine & Rehabilitation, University of Michigan

The research reported herein was performed pursuant to a grant from Policy Research, Inc. as part of the U.S. Social Security Administration's (SSA's) Analyzing Relationships Between Disability, Rehabilitation and Work. The opinions and conclusions expressed are solely those of the author(s) and do not represent the opinions or policy of Policy Research, Inc., SSA or any other agency of the Federal Government.

Abstract

Problem: Adults with traumatic spinal cord injury (TSCI) experience high rates of both depression and unemployment, and these two adverse outcomes are known to correspond with one another. However, it remains unclear if the strength of the association between depression and unemployment remains constant as time since injury increases, or if this relationship changes with time. Similarly, it also remains unclear if there are distinct employment trajectories that adults with TSCI follow over the first decade following injury, which, if identified, may facilitate earlier identification of individuals at-risk for suboptimal workforce participation after TSCI.

Purpose/Objective: There were two objectives of this study. First, I sought to examine the moderating effect of time since injury on the strength of the association between depression and unemployment among adults with TSCI. I also sought to clarify whether the larger population of adults with TSCI could be split into meaningfully different subgroups on the basis of their longitudinal employment data.

Research Method/Design: This was an archival study of data stored within the National SCI Database. To address Aim 1, I used a generalized estimating equation approach to analyze data that had been previously collected from 14,539 participants at various post-injury intervals to clarify whether time moderated the association between depression and employment. For Aim 2, I identified a subsample of 1,127 adults with TSCI, for whom employment data were available at 1-, 5-, and 10-years post-TSCI. Then, using structural equation modeling, I imputed participants' employment (employed vs. unemployed) slope and intercept data and subjected those data to two-step cluster analysis to identify longitudinal trajectories of employment.

Results: With regard to Aim 1, greater depression severity predicts a significantly lower likelihood of participating in paid employment, post-TSCI ($Exp(B) = 0.83$, $p < .001$), and the strength of this association remained consistent even as time since injury increased ($Exp(B) = 1.00$, $p > .05$). Results of Aim 2 analyses indicated that adults with TSCI tend to follow one of four distinct employment trajectories: [1] Stable Unemployment (68.50%; $n = 772$); [2] Stable Employment (11.45%; $n = 129$); [3] Deteriorating Employment (5.24%; $n = 59$); and [4] Improving Employment (14.82%; $n = 167$). Participant education, premorbid employment status, age, race, injury completeness, and experiences of depression all impacted trajectory membership (*p*s < .001), while participant sex and level of injury did not (*p*s > .05).

Conclusion: Greater depression severity yields a significantly (and consistently) lower likelihood of employment following incidence of TSCI. Furthermore, over the first decade following injury, adults with TSCI appear to generally follow one of four distinct employment trajectories, with the majority of participants following a trajectory characterized by consistent unemployment. Importantly, it appears that a number of demographic, injury-related, and psychosocial factors impact the probability of trajectory membership. This finding may be particularly useful in informing future intervention studies designed to identify methods of maximizing employment after SCI through policy change, rehabilitation programming, and psychosocial interventions.

.

Longitudinal Analysis of the Associations Between Depression and Return-to-Work After Traumatic Spinal Cord Injury

Review of Relevant Literature

Traumatic spinal cord injury (TSCI) is a significant medical condition that often yields a variety of adverse outcomes, including higher incidence of both depression (Lim et al., 2017; Pollard & Kennedy, 2007; Radnitz et al., 1996; Williams & Murray, 2015) and unemployment (Ottomanelli & Lind, 2009; Yasuda et al., 2002). Alternatively, and of particular relevance to this project, employment after TSCI has been linked with a number of other positive personal and societal outcomes, including enhanced quality of life (Franceschini et al., 2012) and decreased reliance on federal benefits for disabled people, including those provided by the Social Security Administration (Feldstein, 1977).

Regarding prevalence of TSCI, review of data collapsed across regions suggests a global incidence rate of approximately one case of TSCI per 43,000 people, with an average of 179,312 new cases of TSCI per year. However, by region, stark differences emerge in terms of TSCI incidence, with approximately one case of TSCI occurring per 25,000 people in North America relative to one case per 63,000 people in Western Europe and Australia. Differential rates of TSCI by region likely reflect increased access to firearms and increased rates of violent crimes and other firearm-related injuries (e.g., self-harm, incomplete suicide) within the United States of America (U.S.A or U.S.) relative to most other industrialized nations (Fowler et al., 2015).

Furthermore, despite its relatively low incidence, the National SCI Model Systems (SCIMS; 2018) estimate that individuals in the U.S.A., who sustain TSCI at age 25 will likely incur associated lifetime expenses ranging from approximately $1.5 to $4.5 million U.S. dollars. Similarly, it is estimated that adults who sustain TSCI at age 50 will incur approximately $1.1 to $2.6 million dollars in associated expenses. Together, alongside data indicating higher rates of TSCI within the U.S.A, this evidence underscores the relevance of research on how best to maximize functional and financial independence in the years following TSCI to organizations responsible for providing disability benefits, including the U.S. Social Security Administration.

With regard to this project, experiences of depression have been linked with lower rates of employment following TSCI. For example, Chapin and Holbert (2009) reported that individuals living with TSCI who had been employed following participation in a vocational rehabilitation program endorsed fewer symptoms of depression than those who did not secure employment following participation in the same rehabilitation program. Similarly, Burns, Boyd, Hill, and Hough (2010) observed an association between higher levels of depressive symptoms among men living with TSCI and lower levels of employment. Within the context of traumatic injury more broadly, depression at 1-year post injury has been similarly associated lower rates of employment (Zatzick et al., 2008). While findings from these and other studies underscore the link between depression and employment after TSCI, the interaction of depression and time since injury on employment status remains understudied. **That is, over time, does the salience of depression as a predictor of employment after TSCI fluctuate or remain static?**

In addition to this question regarding the differential impact of depression on employment contingent on time since TSCI, there are some other, more general questions regarding employment after TSCI that also remain unanswered. For example, it remains unclear, at least within the U.S., if there exist consistent patterns, or trajectories, of employment in the years following TSCI. **That is, are there some individuals who more reliably engage in**

employment in the years following TSCI and some others who remain either under- or unemployed after TSCI? To this last point, Ferdiana and colleagues (2014) used growth mixture modeling (GMM) to address this research question within a study of Dutch adults living with TSCI. Findings from that study revealed the presence of three distinct patterns of employment among Dutch adults with TSCI (see Figure 1): no employment, low employment, and steady employment. While GMM has been used to better understand employment after TSCI in the Netherlands, it has not yet been used to classify the employment trajectories of Americans living with TSCI. Replicating aspects of Ferdiana and colleagues (2014) within this proposed study may yield meaningful insights into patterns and trajectories of employment among Americans living with TSCI, which may inform future research focused on identifying ways to influence these post-injury employment trajectories.

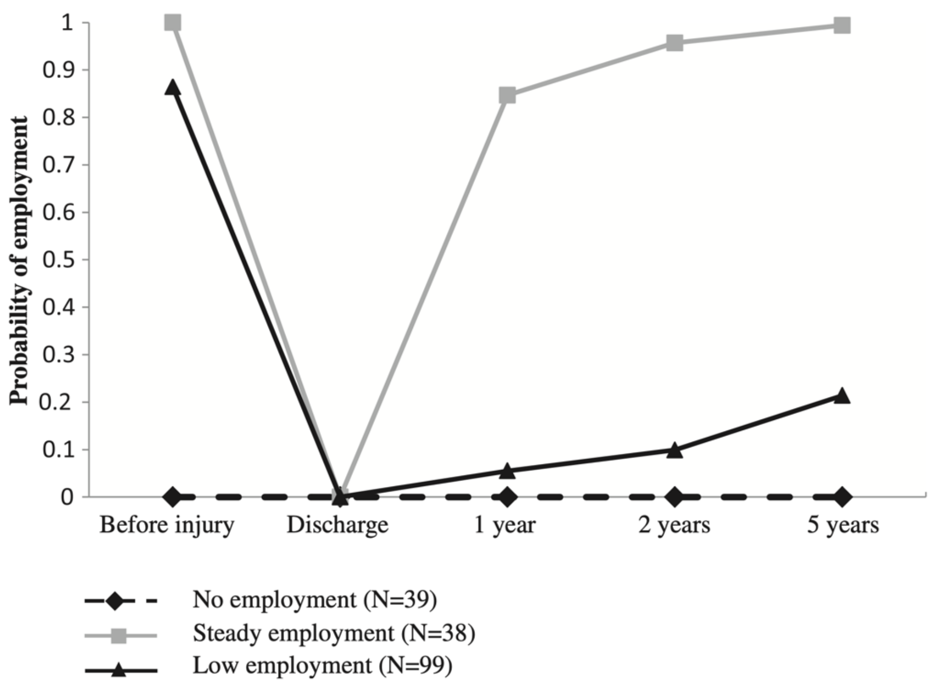

Figure 1. Graphic Used by Ferdiana et al. (2014; p. 2043) to Describe Dutch Post-TSCI Employment Trajectories

Summary and Rationale

Because TSCI disproportionately impacts the U.S.A. and is associated with both diminished workforce participation and high lifetime costs, organizations like the U.S. Social Security Administration have a vested interest in identifying factors that influence employment and financial independence after TSCI. To this point, by clarifying the stability (or fluctuation) of the association between depression and employment over the years following TSCI, professionals from across disciplines may be better resourced in their efforts to maximize workforce participation and financial independence after TSCI. That is, is it justifiable to assert that an evidence-based depression intervention might differentially impact employment after TSCI contingent on when that intervention is implemented? Relatedly, findings from this project will also provide more general information regarding the presence or absence of subgroups within the larger TSCI population that are homogenous with regard to their employment trajectories, which will likely be of particular interest to the U.S. Social Security Administration. These findings may inform other, future studies seeking to identify ways to directly influence these trajectories in the years following TSCI.

To address these empirical questions, I conducted a retrospective study of longitudinal data derived from the National SCIMS Database. In this study, I longitudinally examined the effects of depression, as measured by the Patient Health Questionnaire-2 (PHQ-2), and time since injury on employment, while controlling for salient covariates (e.g., demographics, injury characteristics, education, premorbid employment status, premorbid history of depression). Regarding use of the PHQ-2 in this study, Zakaria et al. (2019) observed that higher scores on PHQ-2 predicted a significantly lower likelihood of having returned to work within a medically complex population also characterized by spinal involvement. Similar to Ferdiana and colleagues' (2014) data analytic approach, I used cluster analysis to identify longitudinal trajectories of employment over the first 10 years following incidence of TSCI.

Aims and Hypotheses

The aims of this study were two-fold. First, I examined the association between depression and employment among adults with TSCI, including whether time since injury moderated the relationship. Second, I sought to clarify whether there were general patterns, or trajectories, of employment that adults with TSCI followed over the first 10 years after sustaining their injuries. Specific directional hypotheses are listed below:

Aim 1: Depression as a Predictor of Employment Status

Hypothesis 1. Greater depression severity will predict a significantly lower likelihood of employment across time points following TSCI.

Hypothesis 2. As time since injury increases, so will participants' likelihood of employment.

Hypothesis 3. Time since injury will moderate the strength of the association between depression and employment among adults with TSCI – That is, the impact of depression on employment will significantly increase as time since injury increases.

Aim 2: Longitudinal Trajectories of Employment

Hypothesis 4. There will exists subgroups within the larger sample of adults with TSCI that exhibit employment trajectories similar to those observed by Ferdiana et al. (2014).

Method

This study relied on secondary analysis of data contained within the National SCIMS Database, which is one of the largest longitudinal datasets with individuals with disability in the world. This database is publicly available and contains data collected from member SCIMS institutions, which are located across the U.S.A and funded by grants provided by the National Institute on Disability, Independent Living, and Rehabilitation. Notably, only data collected through 2016 had been made publicly available at the time of this project, so therefore only data collected from SCIMS institutions through 2016 were analyzed as part of this study.

Participants

As of 2016, the National SCIMS Database contains data derived from 32,159 individuals living with TSCI. Individuals are typically approached by SCIMS-associated staff during their initial hospitalization, post-TSCI. Attempts are then made to collect baseline data during participants' inpatient hospitalization. Subsequent attempts are later made to longitudinally collect data from each of these SCIMS enrollees starting 1 year after their TSCI, then 4 years after that initial follow-up (i.e., 5 years post-TSCI), and every 5 years after that (e.g., 10 years post-TSCI). SCIMS data collection commenced in 1973, so, as of 2016, there are some SCIMS participants for whom data have been collected longitudinally for 40 years. For Aim 1, data were analyzed from large pool of 14,539 participants, for whom at least partial depression and employment data were both available. For Aim 2, data were analyzed from 1,127 individuals for whom complete depression and employment data were available over the first 10 years following their injuries. These participants included in Aim 2 analyses were a subset of individuals from the larger Aim 1 participant pool.

Primary Measures

Patient Health Questionnaire-2. The Patient Health Questionnaire-2 (PHQ-2) is a brief, two-item depression screener that is commonly used across medical settings (Kroenke et al., 2001). As cited previously, there exist some data to support its sensitivity to employment in other medically complex populations also characterized by spinal involvement (Zakaria et al., 2019). The PHQ-2 has been administered to SCIMS participants since 2000, meaning that, at most, PHQ-2 data have been collected at four time points for some participants (e.g., 2000, 2005, 2010, 2015).

Time since injury. Data regarding time since injury exist within the SCIMS dataset. Baseline data will be coded zero, indicating that 0 years have elapsed since participant injury. All other data will be annotated with the number of years that have elapsed since participant injury. Data pertaining to time since injury are available for all SCIMS participants.

Post-TSCI employment. Data regarding participants' employment status have also been collected since the beginning of the SCIMS, meaning that these data are available for a large number of participants. For the purposes of this project, data pertaining to participant employment will be dichotomized (i.e., working vs. not working). These data have been collected at each follow-up interval since creation of the SCIMS in 1973.

Secondary Measures

Other data were also extracted from the SCIMS database, including: (1.) participant demographics, (2.) injury characteristics, (3.) educational attainment, and (4.) premorbid work status. These data were examined across hypothesis-driven statistical analyses as possible covariates.

Procedures

Archival data analysis. Data derived from the SCIMS were requested and downloaded. These data were analyzed using both IBM SPSS and IBM Amos. Data derived from the SCIMS are maintained within two separate data files (i.e., baseline data, follow-up data) but are linked by participants' unique ID numbers. After downloading these files, I first merged these databases, thus allowing for longitudinal analyses to be performed using the complete SCIMS dataset.

Data Analytic Strategy

Generalized estimating equation. A generalized estimating equation (GEE) is a statistical technique that allows researchers to analyze longitudinal data. Unlike other repeated measures techniques (e.g., repeated measures ANOVA), GEE is compatible with dichotomous outcomes (e.g., working vs. not-working) and allows for the correlation between time points to be directly manipulated (e.g., autoregressive), rather than assumed to be equivalent as time progresses (i.e., compound symmetric). GEE is also unique in that it allows researchers to measure the impact of a predictor that has been measured at multiple time points (e.g., PHQ-2) on an outcome that has also been measured at multiple time points (e.g., employment status); this is not possible using other, simpler repeated-measures analyses (e.g., ANOVA).

In this study, I used GEE to examine the main effects of PHQ-2 score and time since injury, as well as the interaction effect of these two variables, on employment status. Within this model, I also controlled for theoretically salient factors, including participant demographics, injury characteristics, educational attainment, and premorbid employment status (see *p.* 3 for aim-specific hypotheses).

Structural equation modeling. Employment slope and intercept data were imputed via structural equation modeling (SEM), using the growth curve plugin within IBM Essentially, this procedure provided the necessary information to graph each individual participant's linear employment trajectory. Each participant's intercept was their employment status at 1-year post injury, and each individual's slope reflected the line of best fit for their employment status at 1-, 5-, and 10-years post injury. I then imputed these data from IBM Amos into IBM SPSS, and each participant received their own unique employment slope and intercept value. The slope and intercept data imputed via this technique are the same slope and intercept data described in basic linear algebra (i.e., $y = mx + b$), where m represents each participant's slope, and b represents each participant's intercept. Using linear algebra, with these data, it is possible to graph each individual participant's change in employment over the first 10 years following their injuries.

Two-step cluster analysis. While the SEM approach described above provided a means of identifying each participant's unique employment trajectory, two-step cluster analysis provides a method of segmenting participants into subgroups based on those trajectories. Specifically, two-step cluster analysis applies an algorithmic approach to segmenting a larger group into smaller subgroups by attempting to maximize intra-cluster homogeneity and inter-cluster heterogeneity. There are many indices that can be used to assess the fit of a cluster analytic solution, but in this study I specifically examined the silhouette coefficient, which is a value that ranges from -1 to +1, with higher values reflecting better fit. Typically, silhouette coefficients that exceed a minimum threshold of 0.5 are considered indicative of good fit.

Chi squared tests of independence. Two-step clustering assigns each participant to one cluster. Therefore, I performed chi squared tests of independence to determine whether participants differed significantly across a range of dichotomous and nominal variables on the basis of cluster membership.

Analysis of variance. In addition to chi squared tests of independence, I also performed analyses of variance (ANOVA) to determine whether participants differed significantly across a range of continuous variables on the basis of cluster membership.

Results

Sample characteristics split by Aim 1 and Aim 2 participants can be seen in Table 1. Per this information, the majority of participants in both study phases were male, which is consistent with epidemiological data on incidence of TSCI (Lee et al., 2014). The majority of participants were White, and most were also employed at the time of their injury. Participants were split approximately in half on the basis of both neurologic level of injury (NLI) injury completeness (i.e., AIS A vs. AIS-B, C, or D). Most participants had earned at least a high school diploma, and most participants sustained their injuries during either late adolescence or early adulthood (i.e., 15-to-44 years of age).

Table 1. Frequency counts for demographic, injury-, and employment-related data

	Aim 2 (*n* = 1,127) *N (%)*	**Aim 1 (*n* = 14,539)** *N (%)*		**Aim 2 (*n* = 1,127)** *N (%)*	**Aim 1 (*n* = 14,539)** *N (%)*
Sex			**Completeness**		
Female	271 (24.0%)	3,111 (21.4%)	*Motor Incomplete*	412 (36.6%)	5,320 (36.6%)
Male	856 (76.0%)	11,428 (78.6%)	*Sensory Incomplete*	159 (14.1%)	1,890 (13.0%)
			Complete	520 (46.1%)	6,848 (47.1%)
Race					
Non-White	267 (23.7%)	3,416 (23.5%)	**Premorbid Education**		
White	857 (76.0%)	10,686 (73.5%)	*< 12 years*	198 (17.6%)	3,765 (25.9%)
			12 years	666 (59.1%)	7,793 (53.6%)
Premorbid Employment Status			*14-16 years*	180 (16.0%)	1,846 (12.7%)
Not Working	343 (30.4%)	5,292 (36.4%)	*18+ years*	45 (4.0%)	509 (3.5%)
Working	784 (69.6%)	9,116 (62.7%)			
			Age at Injury		
NLI			*< 14 years old*	0 (0.0%)	218 (1.5%)
Paraplegia	506 (44.9%)	6,746 (46.4%)	*15 to 29 years old*	443 (39.3)	7,458 (51.3%)

Tetraplegia	586 (52.0%)	7,400 (50.9%)	*30 to 44 years old*	347 (30.8)	3,678 (25.3%)
			45 to 59 years old	251 (22.3)	2,181 (15.0%)
			60 to 74 years old	77 (6.8)	858 (5.9%)
			75+ years old	9 (0.8)	145 (1.0%)

Aim 1: Associations Between Depression and Employment

As described above, I used a GEE approach to examine the association between depression and employment over the first 10 years following SCI. My initial attempt to perform this GEE analysis yielded a model that failed to converge, and it appeared that this failure was caused by including data regarding participant sex in the model. I confirmed this hypothesis by attempting to perform GEE with participant sex as the only predictor, which again generated the same error message. In an attempt to examine the association between sex and post-injury employment in any capacity, I next performed a simple chi squared test of independence. Results of that latter analysis indicated the presence of a significant difference between male and female participant post-injury employment across all time points ($\chi^2[1] = 19.39$, $p < .001$). Post-hoc review of the standardized residuals generated from that chi squared test of independence indicated that the significance of that analysis was driven by the presence of significantly fewer employed, female participants than male participants ($z = -3.49$).

As a subsequent step, to test the hypotheses presented above, I opted to perform two separate GEE analyses, with the first leveraging data derived from all male participants (11,428; 78.6%) and the second utilizing data derived from all female participants (3,111; 23.5%). Accordingly, I have provided a by-sex breakdown of Aim 1 sample characteristics in Table 2.

Table 2. Frequency counts for demographic, injury-, and employment-related data broken down by sex for Aim 1 participants

	Female	**Male**		**Female**	**Male**
	%	*%*		*%*	*%*
Race			**Completeness**		
Non-White	21.0%	24.2%	*Motor Incomplete*	41.1%	35.4%
White	76.7%	72.7%	*Sensory Incomplete*	12.9%	13.0%
			Complete	42.8%	48.3%
Premorbid Employment Status					
Not Working	46.3%	33.7%	**Premorbid Education**		
Working	52.8%	65.4%	*< 12 years*	23.4%	26.6%
			12 years	52.2%	54.0%
NLI			*14-16 years*	15.8%	11.9%
Paraplegia	48.7%	45.8%	*18+ years*	3.8%	3.4%
Tetraplegia	48.4%	51.5%			
			Age at Injury		
			< 14 years old	2.4%	1.2%
			15 to 29 years old	47.8%	52.3%
			30 to 44 years old	25.4%	25.3%
			45 to 59 years old	15.4%	14.9%
			60 to 74 years old	7.2%	5.5%
			75+ years old	1.7%	0.8%

Review of the data presented in Table 3 indicate that, among male participants, younger age at injury corresponded significantly with increased likelihood of employment. A significant association emerged between time since injury and likelihood of employment; however, the magnitude of this effect was small. White male participants were significantly more likely to be employed than male participants of color, as were male participants with paraplegia relative to those with tetraplegia. With regard to the association between injury severity (i.e., completeness) and employment, male participants with complete injuries (AIS-A) were significantly less likely to be employed than participants with incomplete injuries (AIS-D, C, or B). Of note, premorbid education did not correspond significantly with post-injury employment; however, a quasi-linear association emerged between post-injury educational attainment and post-injury employment, with higher levels of post-injury education corresponding significantly with a higher likelihood of employment. Of particular relevance to this study, greater depression severity (PHQ-2 Total Score) predicted a significantly lower likelihood of employment among male participants; however, the interaction of depression severity and time since injury was non-significant.

Table 3. Results of GEE predicting change in employment over time since injury among male participants with TSCI

	B	SE	Wald X2	DF	Sig.	Exp(B)
Continuous Variables						
Age @ Injury	-0.61	0.03	502.41	1	0.00	*** 0.55
Time Since Injury	-0.01	0.00	4.51	1	0.03	* 1.00
PHQ-2 Total Score	-0.20	0.02	123.15	1	0.00	*** 0.82
*Time * PHQ-2 Total Score*	0.00	0.00	2.93	1	0.09	1.00
Race						
Non-White (0)	-0.68	0.14	24.93	1	0.00	*** 0.51
White (1)	0.24	0.13	3.59	1	0.06	*** 1.27
NLI						
Paraplegia (1)	0.64	0.30	4.63	1	0.03	* 1.90
Tetraplegia (2)	0.19	0.30	0.41	1	0.52	1.21
AIS						
AIS-D (Motor Incomplete; 1)	0.34	0.27	1.66	1	0.20	1.41
AIS-C (Motor Incomplete; 2)	-0.45	0.27	2.85	1	0.09	0.64
AIS-B (Sensory Incomplete; 3)	-0.48	0.27	3.19	1	0.07	0.62
AIS-A (Complete; 4)	-0.61	0.26	5.29	1	0.02	* 0.55
Premorbid Employment						
Unemployed (0)	-0.38	0.26	2.12	1	0.15	0.68
Employed (1)	-0.04	0.26	0.03	1	0.87	0.96
Premorbid Education						
< 12 years (1)	0.20	0.13	2.27	1	0.13	1.22
12 years (2)	0.17	0.12	1.82	1	0.18	1.18
14-16 years (3)	0.12	0.13	0.77	1	0.38	1.12
18+ years (4)	0.03	0.17	0.03	1	0.86	1.03
Post-injury Education						
< 12 years (1)	-1.64	0.15	114.18	1	0.00	*** 0.19
12 years (2)	-0.62	0.11	30.72	1	0.00	*** 0.54
14-16 years (3)	0.64	0.12	29.80	1	0.00	*** 1.89

18+ years (4)	1.55	0.14	118.30	1	0.00	*** 4.70

Note. *** *p* < .001, * *p* < .05

Subsequent review of the complementary data presented in Table 4 provides an overview of the associations between study variables and employment among female participants. Consistent with male participants, younger age at injury significantly corresponded with a higher likelihood of employment among female participants. Unlike male participants, there was a null correspondence between female participant race, NLI, and injury completeness on post-injury employment outcomes. Also unlike male participants, female participants with fewer than 12 years of premorbid education were significantly more likely to be employed at post-injury than participants with higher levels of premorbid education. Like male participants, a quasi-linear association emerged between post-injury education and post-injury employment outcomes, with higher levels of post-injury education corresponding significantly with a higher likelihood of employment, and vice-versa for lower levels of post-injury education. Congruent with the results initial all-male analysis, greater depression severity corresponded with a significantly lower likelihood of employment among female participants, but the interaction of depression severity and time since injury on employment outcomes was non-significant.

Table 4. Results of GEE predicting change in employment over time since injury among female participants with TSCI

	B	SE	Wald X2	DF	Sig.	Exp(B)
Continuous Variables						
Age @ Injury	-0.55	0.05	121.05	1	< .001	*** 0.58
Time Since Injury	-0.01	0.00	1.33	1	0.25	1.00
PHQ-2 Total Score	-0.13	0.03	17.30	1	< .001	*** 0.87
*Time * PHQ-2 Total Score*	0.00	0.00	0.77	1	0.38	1.00
Race						
Non-White (0)	-0.50	0.29	3.07	1	0.08	0.60
White (1)	-0.04	0.27	0.03	1	0.87	0.96
NLI						
Paraplegia (1)	-0.27	0.87	0.10	1	0.76	0.76
Tetraplegia (2)	-0.78	0.88	0.79	1	0.37	0.46
AIS						
AIS-D (Motor Incomplete; 1)	1.24	0.83	2.23	1	0.14	3.46
AIS-C (Motor Incomplete; 2)	0.45	0.84	0.29	1	0.59	1.57
AIS-B (Sensory Incomplete; 3)	0.45	0.84	0.29	1	0.59	1.57
AIS-A (Complete; 4)	0.50	0.83	0.36	1	0.55	1.64
Premorbid Employment						
Unemployed (0)	0.03	0.46	0.00	1	0.95	1.03
Employed (1)	0.61	0.46	1.78	1	0.18	1.85
Premorbid Education						
< 12 years (1)	0.62	0.25	6.01	1	0.01	* 1.87
12 years (2)	0.31	0.23	1.79	1	0.18	1.37
14-16 years (3)	0.02	0.24	0.01	1	0.93	1.02
18+ years (4)	-0.30	0.31	0.93	1	0.33	0.74

Post-injury Education						
< 12 years (1)	-2.35	0.34	47.60	1	< .001	*** 0.10
12 years (2)	-0.45	0.20	4.94	1	0.03	* 0.64
14-16 years (3)	0.65	0.21	9.94	1	< .001	*** 1.91
18+ years (4)	1.53	0.24	39.28	1	< .001	*** 4.62

Note. *** $p < .001$, * $p < .05$

Aim 2: Longitudinal Trajectories of Employment After TSCI

As noted earlier, I performed growth curve modeling within an SEM framework to compute employment slope and intercept data for a subsample of 1,127 participants, whose data had also been included in Aim 1 analyses. A graphical representation of the model used to compute these data can be seen in Figure 2.

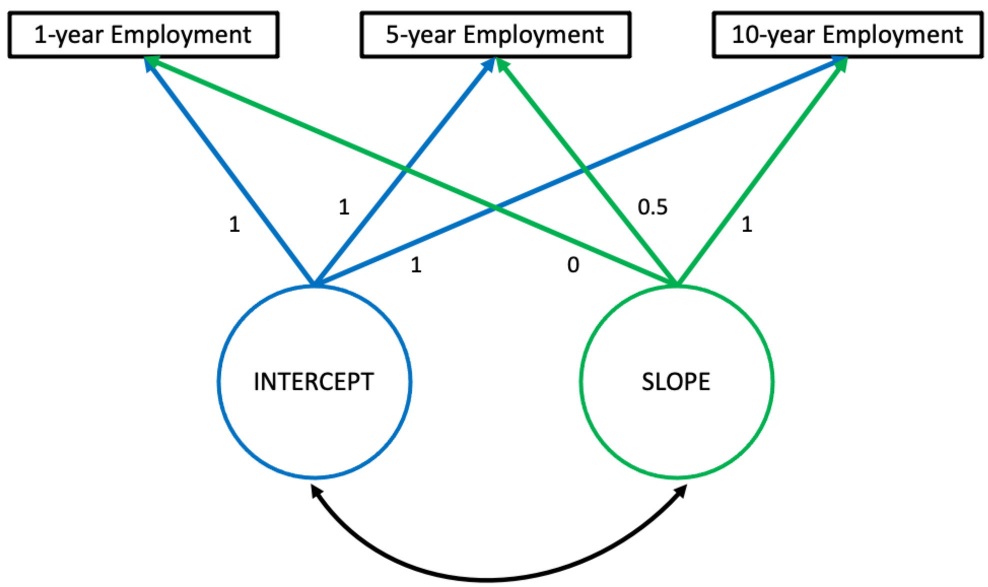

Figure 2. Graphical depiction of the factor analytic model used to generate employment slope and intercept data for the participants included in Aim 2 analyses

As is standard in SEM notation, the rectangular variables included in Figure 2 represent observed variables, while the circular variables represent latent (or unobserved) variables. After testing this model, I then imputed the data for these unobserved variables into SPSS, which then allowed me to perform further analyses with these latent variables. In SPSS, I computed standard descriptive statistics to clarify the distribution of employment slope and intercept data within this subsample of participants. Results of these analyses are included in Table 5.

Table 5. Descriptive data regarding employment intercept and slope data

	N	*M*	*SD*	*Min.*	*Max.*
Employment Intercept	1,127	.09	.13	-.14	.78
Employment Slope	1,127	.05	.27	-.23	.38

Review of slope data, which have a possible range of -1 to +1, indicate considerable variability in the trajectories of employment following incidence of TSCI (*SD* = .27), with the average participant following. A relatively shallow slope in employment change over time (*M* = .05). Review of participants' intercept data, which reflect average likelihood of employment at 1-year post injury, indicate that the average participant had a low likelihood of being employed at this time interval (*M* = .09; *SD* = .13).

While the data presented in Table 5 provide a means of grossly conceptualizing the general trends in employment followed by adults with TSCI, they inadequately capture the nuanced differences that may exist within this large and diverse population of adults with TSCI. Accordingly, I next used two-step cluster analysis to further segment the 1,127 participants for whom these employment slope and intercept data were available into employment-based subgroups. As indicated in Figure 2, slope and intercept data were generated using participant employment status at 1-, 5-, and 10-years post injury. Results of this data analytic procedure indicated that a four-cluster solution best fit the intercept and slope data derived from participants in this study. A description of these "employment trajectories" can be found in Table 6.

Table 6. Characteristics of the longitudinal trajectories of employment followed by 1,127 adults with TSCI over the first decade following their injury

	N	*M*	*SD*	*Min.*	*Max.*
Stable Unemployment					
Employment Intercept	772 (68.50%)	-.09	.07	-.14	.13
Employment Slope		.05	.01	.03	.07
Stable Employment					
Employment Intercept	129 (11.45%)	.65	.05	.51	.78
Employment Slope		.11	< .01	.08	.12
Deteriorating Employment					
Employment Intercept	59 (5.24%)	.52	.08	.45	.71
Employment Slope		-.20	.01	-.23	-.19
Improving Employment					
Employment Intercept	167 (14.82%)	.05	.09	-.07	.19
Employment Slope		.36	.01	.34	.38

Review of the data included in Table 6 indicates that the vast majority of participants (68.50%) included in this analysis demonstrated a pattern of stable unemployment (SU), which was characterized by a low likelihood of employment at 1-year post injury (*M* = -.09; *SD* = .07) and a generally shallow change in employment status over time (*M* = .05; *SD* = .01). A much smaller group of participants (11.45%) demonstrated an inverse pattern of stable employment (SE), characterized by a relatively high likelihood of employment at 1-year post injury (*M* = .65; *SD* = .05), and a relatively shallow (*M* = .11) but highly consistent (*SD* < .01) trajectory of employment over time. The third cluster, characterized by a pattern of deteriorating employment (DE), demonstrated a relatively high likelihood of employment at 1-year post injury (*M* = .52; *SD* = .08), followed by a considerable (*M* = -.20) and consistent (*SD* = .01) drop in employment over time. The last cluster, labeled the improving employment (IE) cluster, demonstrated a pattern of low employment at 1-year post injury (*M* = .05; *SD* = .09), followed by a considerable (*M* = .36) and consistent (*SD* = .01) improvement in employment over time. A graphical representation of these four trajectories can be found in Figure 3.

Of note, I have included participants' employment status at time of injury in Figure 3; however, participant slope and intercept data (see Table 6) were computed using participants' employment status at only 1-, 5-, and 10-years post injury (see Figure 2). I opted to exclude these data given that the model I used to compute participant slope and intercept data assumed a linear change in employment status, which is inconsistent with the anticipated change in employment that occur for many adults immediately after sustaining a TSCI.

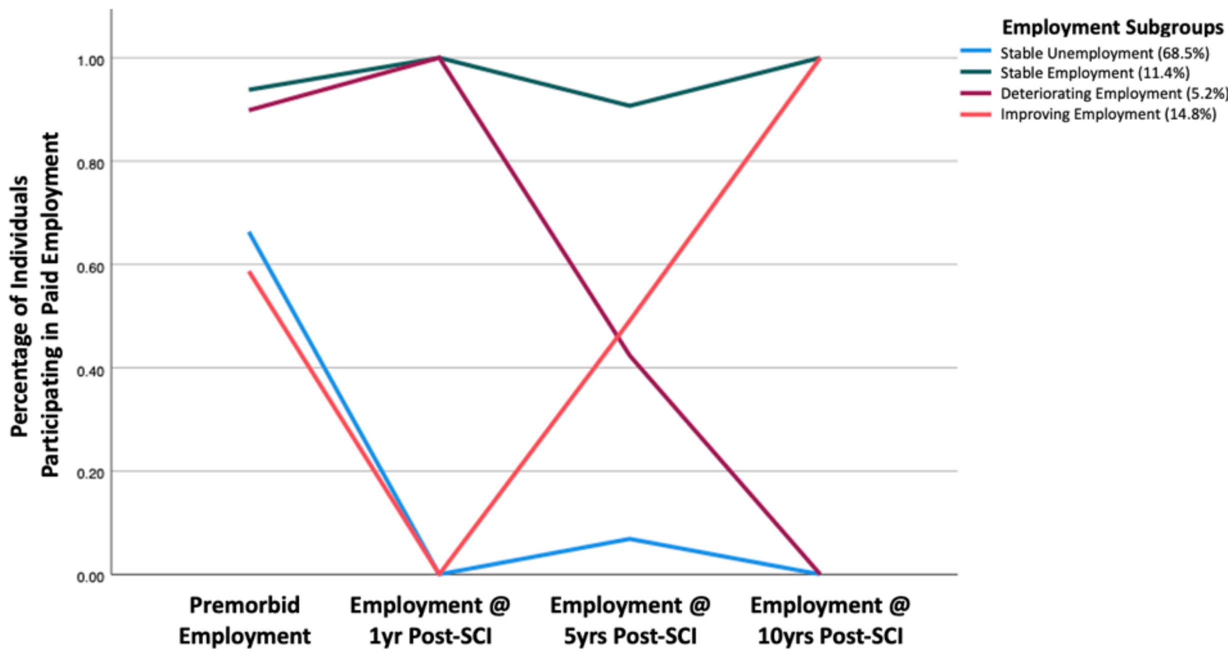

Figure 3. Graphical depiction of the four trajectories of employment identified for the participants included in Aim 2 analyses

As a last step, I also performed a series of chi squared tests of independence to determine which factors, if any, predicted which employment trajectory a participant would follow. To address the inflated risk of Type I error associated with performing multiple comparisons, I utilized a Bonferroni correction to generate a corrected alpha level. Results of this Bonferroni correction yielded a corrected 0.05 alpha level of 0.006.

Results of these multiple chi squared tests of independence indicated that employment at time of injury (which was not used to compute employment slope and intercept data; $\chi^2 = 60.40$; $p < .001$), premorbid level of education ($\chi^2 = 114.19$; $p < .001$), age ($\chi^2 = 113.46$; $p < .001$), race ($\chi^2 = 25.17$; $p < .001$), injury completeness ($\chi^2 = 32.52$; $p < .001$), and depression ($\chi^2 = 40.41$; $p < .001$) all impacted trajectory membership. Neither participant sex ($\chi^2 = 5.49$; $p > .05$) nor NLI ($\chi2 = 6.99$; $p > .05$) significantly impacted employment trajectory. Details regarding the specificity and directionality of these differences can be found in Table 7.

Table 7 . Differences between trajectory subgroups across salient demographic, injury related, and psychosocial factors

Employment Trajectory x Pre-SCI Employment (X2 = 60.40; p < .001)
** There is no evidence to indicate a sig. difference in SU trajectory membership on the basis of pre-SCI employment
** Individuals who were unemployed prior to their injuries have a sig. lower likelihood of following the SE trajectory
** Individuals who were employed prior to their injuries have a sig. higher likelihood of following the SE trajectory
** Individuals who were unemployed prior to their injuries have a sig. lower likelihood of following the DE trajectory
** Individuals who were employed prior to their injuries have a nearly sig. higher likelihood of following the DE trajectory
** Individuals who were unemployed prior to their injuries have a sig. higher likelihood of following the IE trajectory
Employment Trajectory x Pre-SCI Education (X2 = 114.19; p < .001)
** Individuals with less than a HS diploma are at sig. higher risk of following the SU trajectory
** Individuals with at least some college have a sig. lower risk of following the SU trajectory
** Individuals without any college have a sig. lower likelihood of following the SE trajectory
** Individuals with at least some college have a sig. higher likelihood of following the SE trajectory
** There is no evidence to indicate a difference in IE or DE trajectory membership on the basis of pre-SCI education
Employment Trajectory x Sex (X2 = 5.49; p > .05)
** There is no evidence to indicate a sig. difference in employment trajectory membership on the basis of participant sex
Employment Trajectory x Race (X2 = 25.17; p < .001)
** People of color are at a sig. higher risk of following the SU trajectory
** People of color have a sig. lower likelihood of following the SE trajectory
** People of color have a sig. lower likelihood of following the IE trajectory
** There is no evidence to indicate a sig. difference in DE trajectory membership on the basis of participant race
Employment Trajectory x NLI (X2 = 6.99; p > .05)
** There is no evidence to indicate a sig. difference in employment trajectory membership on the basis of participant NLI
Employment Trajectory x AIS (X2 = 32.52; p < .001)
** There is no evidence to indicate a sig. difference in SU trajectory membership on the basis of AIS
** Individuals with AIS D injuries have a sig. higher likelihood of following the SE trajectory
** Individuals with AIS D injuries have a sig. higher likelihood of following the DE trajectory
** Individuals with AIS C injuries have a sig. lower likelihood of following the DE trajectory
** Individuals with AIS B injuries have a nearly sig. higher likelihood of following the IE trajectory
Employment Trajectory x Depression (X2 = 40.41; p < .001)
** Individuals with Low and Stable Depression have a sig. lower likelihood of following the SU trajectory
** Individuals with Moderate and Improving Depression have a sig. higher likelihood of following the SU trajectory
** Individuals with Low and Stable Depression have a sig. higher likelihood of following the SE trajectory
** Individuals with Moderate and Improving Depression have a sig. lower likelihood of following the SE trajectory
** Individuals with Moderate and Worsening Depression have a sig. lower likelihood of following the SE trajectory
** There is no evidence to indicate a sig. difference in DE or iE trajectory membership on the basis of depression trajectories
Employment Trajectory x Age (X2 = 113.46; p < .001)
** Individuals who sustain their injuries between the ages of 60 and 74 years of age have a sig. higher likelihood of following the SU trajectory
** Individuals who sustain their injuries between the ages of 30 and 44 years of age have a sig. higher likelihood of following the SE trajectory
** Individuals who sustain their injuries between the ages of 60 and 74 years of age have a sig. lower likelihood of following the SE trajectory
** Individuals who sustain their injuries between the ages of 15 and 29 years of age have a sig. lower likelihood of following the DE trajectory
** Individuals who sustain their injuries between the ages of 45 and 59 years of age have a sig. higher likelihood of following the DE trajectory
** Individuals who sustain their injuries between the ages of 15 and 29 years of age have a sig. higher likelihood of following the IE trajectory
** Individuals from all other age groups (excluding 75+) have a sig. lower likelihood of following the IE trajectory

Note . sig. = standardized residuals $\geq |1.5|$

Discussion

In this study, I sought to clarify how a range of demographic, injury-related, and psychosocial factors impact the employment trajectories of adults with TSCI (Aim 1). I also sought to clarify the longitudinal trajectories of employment followed by adults with TSCI (Aim 2).

Aim 1

When I sought to address Aim 1 of this project, I encountered an error, which appeared to be caused by inclusion of data pertaining to participant sex in the initial GEE model. Accordingly, I opted to perform two separate analyses, with the first including data derived from all male participants, and the second including data derived from all female participants. Results of these concurrent analyses indicated that, for both male and female participants, younger age, less severe experiences of depression, and higher post-injury educational attainment each corresponded significantly with a higher likelihood of post-injury employment.

Among male participants, White participants were significantly more likely to be employed post-injury than participants of color; however, there was a null effect of race on employment outcomes among female participants. Similarly, male participants with complete injuries and male participants with tetraplegia were less likely to be employed than male participants with incomplete injuries and paraplegia, respectively, and this pattern was not observed among female participants. As time since injury increased, male, but not female, participants' likelihood of employment increased; however, the strength of this association was weak.

Interestingly, and paradoxically, female participants with fewer than 12 years of premorbid education were significantly more likely to be employed than women with other, higher levels of premorbid education. In reconciling that counterintuitive observation, this pattern may reflect the natural correlation between age and education and mirror the previously described association between younger age and higher likelihood of employment. That is, among female participants, perhaps individuals with fewer than 12 years of education were disproportionately young, which, as described above, appears to function as a protective factor for employment. This explanation is speculative and warrants future, more targeted examination in subsequent studies.

Together, these findings underscore a number of potential intervention targets for maximizing employment after TSCI that each warrant further examination. For example, evidence of a disparity in workforce participation on the basis of race among males with TSCI, most likely underscores the impact of systemic factors, like institutionalized racism on functional outcomes for this population. Given its systemic nature, any intervention designed to address this disparity would likely need to occur at a policy level. The Social Security Administration's Ticket to Work program is an example of one existing policy-level intervention designed to segue people with disabilities into the workforce. In a May 2021 interview about this program, Dr. Kilolo Kijakazi, Deputy Commissioner for Retirement and Disability Policy at the SSA, highlighted the challenge of ensuring that the Ticket to Work program is adequately publicized and facilitated in underserved communities, including communities of color.

Consistent with Dr. Kijakazi's interview, it seems likely that continuing to prioritize implementation of return-to-work programs, like Ticket to Work, in underserved communities, including communities of color, may help to address this disparity in workforce participation among people of color. Of note, there may been need for other, parallel programs designed to address subtle (and overt) racism performed by employers when interviewing and considering disabled people of color for open positions.

As a clinician-scientist, making specific recommendations of how best to address the impact of racism on workforce participation among disabled people of color falls outside of my expertise. However, I am hopeful that the stark evidence yielded from this study will be of use to researchers conducting future studies and policymakers interested in addressing inequities in our society through various policy-level interventions, and I welcome opportunities to collaborate with policy experts and discuss ways that this finding could be translated into impactful and decisive action. It is worth examining why this association between participant race and workforce participation emerged only among male participants in this study and not female participants. Understanding why the impact of institutionalized racism on workforce participation may be more acutely experienced by men with TSCI than women may impact the kinds of systems-level interventions that are most appropriate for maximizing workforce participation among this clinical population.

As noted above, I was unable to include data pertaining to participant sex in my Aim 1 GEE model; however, I did perform a simple, chi squared test of independence, which allowed me to examine the association between participant sex and post-injury employment across all time points. While lacking in certain nuance and complexity, in broad strokes, this finding appears to be consistent with results of other studies, which have indicated that disabled women are at particularly high risk of unemployment (Hanson, 2002). Similar to the impact of racism on the employment outcomes of disabled people of color, experiences of sexism likely impact and impede the employment outcomes of disabled women. To this point, in Spain, policymakers trialed an intervention program, in which employers were incentivized to hire disabled women (Vall Castello, 2012). Results of that 2012 study revealed that an estimated 7,100 women secured employment as a result of the intervention program, with an estimated cost savings of approximately €11million for the Spanish government. As a non-expert on policy development, and based on the results of my study, it seems plausible that an intervention implemented in this country may yield similar results; however, I welcome the opportunity to discuss this hypothesis with an expert on policy development and policy-level interventions.

Furthermore, education appears to be another important contributor to employment among individuals with TSCI. That is, a quasi-linear association between participant, both male and female, post-injury educational attainment and likelihood of employment emerged in this study. This is contrasted by a generally, with one exception, null association between premorbid education and post-injury employment. This indicates that the act of securing higher education after sustaining TSCI may be uniquely useful in facilitating post-injury entry (or re-entry) to the workforce. From a policy perspective, this finding appears to underscore the importance of continuing to provide opportunities for people with disabilities to receive education and training through Ticket to Work and related programs, and this may be a particularly important intervention for individuals with lower levels of premorbid employment.

Evidence that lower levels of depression correspond with a significantly higher likelihood of employment after TSCI among both men and women is generally consistent with results from previous studies (Lin et al., 2009). A novel contribution made by this study is that the effect of depression on employment after TSCI remains relatively constant, even as time since injury increases. This indicates that the effect of depression on employment remains relatively consistent over the first decade following incidence of TSCI. From an intervention perspective, this underscores the potential utility of evidence-based depression interventions (e.g., behavioral activation; Cuijpers et al., 2007) in maximizing workforce participation throughout the first decade following incidence of TSCI. Alternatively, this also underscores the consistent buffering effect of employment against depression throughout the first decade following incidence of TSCI. As a clinician-scientist myself, who has experience providing evidence-based intervention to people with a wide range of disabilities, I am not surprised by this finding and can speak to the importance of early identification and treatment of psychological distress among people with disabilities. To this point, through most evidence-based depression interventions, psychologists and other mental healthcare providers seek to specifically facilitate patient engagement in pleasant and meaningful activities, which often includes employment (Jacobson et al., 1996).

Given the overlap between depression symptomatology and sequelae of TSCI, it is not uncommon for instances of depression to go unnoticed among individuals with TSCI, which can delay (if not entirely prevent) initiation of treatment. Accordingly, it is crucial that psychologists and other mental healthcare professionals, whose expertise in depression diagnosis and treatment, continue to be included in the interdisciplinary rehabilitation team, and, perhaps more importantly, be adequately compensated for providing services. To this last point, earlier this year, the Centers for Medicare and Medicaid Services projected a 7% cut in reimbursement for mental health billing codes, which will likely further limit the opportunities for disabled people, including people with TSCI, to receive evidence-based mental healthcare. On a tentative note, findings from this study indicate that, if implemented, this reduction in healthcare access may ultimately yield an even higher rate of unemployment and increased reliance on federal benefits among individuals with TSCI.

Aim 2

While Ferdiana and colleagues (2014) reported that a three-class solution best the 5-year employment trajectories of Dutch adults with TSCI, our findings indicate that a four-cluster solution best fit the employment trajectories of American adults with TSCI over the first 10 years following incidence of TSCI. These results are important, because they provide a heuristic with which healthcare providers, policy makers, and all individuals and organizations tasked with facilitating recovery of functional independence after TSCI can conceptualize the long-term employment trajectories of individuals with TSCI. These findings also shed further light on factors that may predict employment outcomes for people with TSCI, as well as which factors may serve as either risk or protective factors against unemployment after TSCI. To this point, Table 7 provides a concise, tabular overview of factors found to correspond significantly with each of these trajectories, and these findings may inform future studies designed to clarify how specific interventions programs (e.g., an evidence-based depression program) impact the employment outcomes of individuals with TSCI.

Limitations

Findings from this project are limited by a number of factors. For example, only individuals with traumatic SCI are eligible for participation in the SCIMS research project. This means that, while the data generated by this study likely generalize to the experiences of individuals living with TSCI, they may not fully map onto the experiences of individuals living with non-traumatic SCI. This has the potential to be particularly problematic given that women and older adults are more likely to experience non-traumatic SCI than TSCI.

While the large number of individuals for whom longitudinal data are stored within the National SCIMS Database allows for a wide range of robust analyses to be performed, the data included in this report are limited by their depth and nuance. That is, the findings generated from this project provide a broad framework of factors that likely impact the employment outcomes of individuals with TSCI; however, it will be important to replicate these results in future projects designed to generate more intricate and complex models of factors that impact employment for adults with TSCI.

Furthermore, the depression measure used in this study (i.e., PHQ-2) is a shorter, two-item version of a more comprehensive, nine-item measure (i.e., PHQ-9; Kroenke et al., 2001). Accordingly, while the PHQ-2 has demonstrated adequacy as a depression measure, it is possible that use of a more comprehensive measure of depression severity would have yielded meaningfully different results. To the extent possible, replicating this study with other, more comprehensive measures of depression may yield results that complement (or refute) those generated from this project.

Conclusions

Greater depression severity yields a significantly (and consistently) lower likelihood of employment following incidence of TSCI. Furthermore, over the first decade following injury, adults with TSCI appear to generally follow one of four distinct employment trajectories, with the majority of participants following a trajectory characterized by consistent unemployment. Importantly, it appears that a number of demographic, injury-related, and psychosocial factors impact the probability of trajectory membership. Findings from this study may inform future intervention studies designed to identify methods of maximizing employment after SCI through policy change, rehabilitation programming, and psychosocial interventions.

References

Alkhalaf, A., & Zumbo, B. D. (2017). The impact of predictor variable(s) with skewed cell probabilities on wald tests in binary logistic regression. *Journal of Modern Applied Statistical Methods*, *16*(2), 40–80. https://doi.org/10.22237/jmasm/1509494640

Burns, S. M., Boyd, B. L., Hill, J., & Hough, S. (2010). Psychosocial Predictors of Employment Status Among Men Living With Spinal Cord Injury. *Rehabilitation Psychology*, *55*(1), 81–90. https://doi.org/10.1037/a0018583

Chapin, M. H., & Holbert, D. (2009). Differences in affect, life satisfaction, and depression between successfully and unsuccessfully rehabilitated persons with spinal cord injuries. *Rehabilitation Counseling Bulletin*, *53*(1), 6–15. https://doi.org/10.1177/0034355209331403

Cuijpers, P., van Straten, A., & Warmerdam, L. (2007). Behavioral activation treatments of depression: A meta-analysis. *Clinical Psychology Review*, *27*(3), 318–326. https://doi.org/10.1016/j.cpr.2006.11.001

Feldstein, M. (1977). *The Private and Social Costs of Unemployment* (Vol. 68, Issue 2). https://doi.org/10.3386/w0223

Ferdiana, A., Post, M. W., Hoekstra, T., Van Der Woude, L. H., Van Der Klink, J. J., & Bültmann, U. (2014). Employment trajectories after spinal cord injury: Results from a 5-year prospective cohort study. *Archives of Physical Medicine and Rehabilitation*, *95*(11), 2040–2046. https://doi.org/10.1016/j.apmr.2014.04.021

Fowler, K. A., Dahlberg, L. L., Haileyesus, T., Annest, J. L., States, U., Integration, P., & States, U. (2015). Firearm injuries in the United States. *Preventive Medicine*, *79*(2), 5–14. https://doi.org/10.1016/j.ypmed.2015.06.002

Franceschini, M., Pagliacci, M. C., Russo, T., Felzani, G., Aito, S., & Marini, C. (2012). Occurrence and predictors of employment after traumatic spinal cord injury: The GISEM Study. *Spinal Cord*, *50*(3), 238–242. https://doi.org/10.1038/sc.2011.131

Gehring, K., Aaronson, N. K., Gundy, C. M., Taphoorn, M. J. B., & Sitskoorn, M. M. (2011). Predictors of neuropsychological improvement following cognitive rehabilitation in patients with gliomas. *Journal of the International Neuropsychological Society*, *17*(2), 256–266. https://doi.org/10.1017/S1355617710001530

Hanson, N. (2002). *Nancy Hanson On Approval: The Geography of Disabled Women and Work Paper given at the*.

Jacobson, N. S., Dobson, K. S., Truax, P. A., Addis, M. E., Koerner, K., Gollan, J. K., Gortner, E., & Prince, S. E. (1996). A component analysis of cognitive-behavioral treatment for depression. *Journal of Consulting and Clinical Psychology*, *64*(2), 295–304. https://doi.org/10.1037//0022-006X.64.2.295

Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9. *Journal of General Internal Medicine*, *16*(9), 606–613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Lee, B., Cripps, R. A., Fitzharris, M., & Wing, P. C. (2014). The global map for traumatic spinal cord injury epidemiology: update 2011, global incidence rate. *Spinal Cord*, *52*(2), 110–116. https://doi.org/10.1038/sc.2012.158

Lim, S. W., Shiue, Y. L., Ho, C. H., Yu, S. C., Kao, P. H., Wang, J. J., & Kuo, J. R. (2017). Anxiety and depression in patients with traumatic spinal cord injury: A nationwide population-based cohort study. *PLoS ONE*, *12*(1), 1–14. https://doi.org/10.1371/journal.pone.0169623

Lin, M. R., Hwang, H. F., Yu, W. Y., & Chen, C. Y. (2009). A Prospective Study of Factors Influencing Return to Work After Traumatic Spinal Cord Injury in Taiwan. *Archives of Physical Medicine and Rehabilitation*, *90*(10), 1716–1722. https://doi.org/10.1016/j.apmr.2009.04.006

Ottomanelli, L., & Lind, L. (2009). Review of critical factors related to employment after spinal cord injury: Implications for research and vocational services. *Journal of Spinal Cord Medicine*, *32*(5), 503–531. https://doi.org/10.1080/10790268.2009.11754553

Pollard, C., & Kennedy, P. (2007). A longitudinal analysis of emotional impact, coping strategies and post-traumatic psychological growth following spinal cord injury: A 10-year review. *British Journal of Health Psychology*, *12*(3), 347–362. https://doi.org/10.1348/135910707X197046

Radnitz, C. L., Broderick, C. ., Perez-Strumolo, L., Tirch, D. D., Festa, J., Schlein, I. S., Walczak, S., Willard, J., Lillian, L. B., & Binks, M. (1996). The prevalence of psychiatric disorders in veterans with spinal cord injury. *The Journal of Nervous and Mental Disease*, *184*(7), 431–432. https://doi.org/10.1097/00005053-199607000-00006

Reilly, D. (2019). Gender can be a continuous variable, not just a categorical one: Comment on Hyde, Bigler, Joel, Tate, and van Anders (2019). *The American Psychologist*, *74*(7), 840–841. https://doi.org/10.1037/amp0000505

Summers, G. F., & Hammonds, A. D. (1969). Toward a Paradigm for Respondent Bias in Survey Research. *Sociological Quarterly*, *10*(1), 113–121. https://doi.org/10.1111/j.1533-8525.1969.tb02066.x

Tueller, S. J., Deboeck, P. R., & Van Dorn, R. A. (2016). Getting less of what you want: reductions in statistical power and increased bias when categorizing medication adherence data. *Journal of Behavioral Medicine*, *39*(6), 969–980. https://doi.org/10.1007/s10865-016-9727-9

University of Alabama at Birmingham. (2018). *National Spinal Cord Injury Statistical Center, Facts and Figures at a Glance.*

Vall Castello, J. (2012). Promoting employment of disabled women in Spain; Evaluating a policy. *Labour Economics*, *19*(1), 82–91. https://doi.org/10.1016/j.labeco.2011.08.003

Williams, R., & Murray, A. (2015). Prevalence of depression after spinal cord injury: A meta-analysis. *Archives of Physical Medicine and Rehabilitation*, *96*(1), 133–140. https://doi.org/10.1016/j.apmr.2014.08.016

Yasuda, S., Wehman, P., Targett, P., Cifu, D. X., & West, M. (2002). Return to work after spinal cord injury: A review of recent research. *Neurorehabilitation*, *17*(3), 177–186.

Zakaria, H. M., Mansour, T. R., Telemi, E., Asmaro, K., MacKi, M., Bazydlo, M., Schultz, L., Nerenz, D. R., Abdulhak, M., Schwalb, J. M., Park, P., & Chang, V. (2019). Use of patient health questionnaire-2 scoring to predict patient satisfaction and return to work up to 1 year after lumbar fusion: A 2-year analysis from the Michigan Spine Surgery Improvement Collaborative. *Journal of Neurosurgery: Spine*, *31*(6), 794–801. https://doi.org/10.3171/2019.6.SPINE1963

Zatzick, D., Jurkovich, G. J., Rivara, F. P., Wang, J., Fan, M. Y., Joesch, J., & MacKenzie, E. (2008). A national US study of posttraumatic stress disorder, depression, and work and functional outcomes after hospitalization for traumatic injury. *Annals of Surgery*, *248*(3), 429–435. https://doi.org/10.1097/SLA.0b013e318185a6b8