Mental Health and Risk of Secondary Medical Complications in Adults With Pediatric-Onset Spinal Cord Injury

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Objective: To investigate mental health problems in adults with pediatric-onset spinal cord injury (SCI) and explore how these problems relate to the risk of negative outcomes over time. **Method:** The study included 466 adults who sustained an SCI prior to age 19 years and had been injured for at least 1 year. Participants were interviewed on an approximately annual basis using a study-specific questionnaire and standardized measures of depression, anxiety, substance use, and community involvement. Generalized estimating equations were used to assess the risk of negative outcomes across time as a function of depression, anxiety, and substance misuse. **Results:** Of the participants who reported on each domain of mental health, 26% reported misuse of alcohol or drugs (122/466), 21% reported problems with depression (78/360), and 29% reported problems with anxiety (49/168). Depression was associated with increased odds of pressure ulcers, urinary tract infections, hospitalizations, pain, and smoking and lower levels of economic independence and mobility. Anxiety was associated with increased odds of hospitalization, pain, and smoking. Substance misuse predicted an increased risk of pressure ulcers, pain, and smoking and decreased odds of occupational involvement. When examining the effect of mental health with time, results showed that depression accelerated the risk of urinary tract infections, respiratory complications, and hospitalizations and anxiety and depression accelerated risk for lower occupational independence. **Conclusions:** The added burden that mental health difficulties pose for medical and psychosocial outcomes highlight the importance of monitoring and treating mental health symptoms in pediatric-onset SCI. **Key words:** anxiety, depression, mental health, pediatric onset, spinal cord injury, substance use

Individuals with a spinal cord injury (SCI) face lifelong stressors, physical limitations, and medical complications that can be devastating at any age. Although many individuals adjust well to the challenges of an SCI and enjoy satisfying and meaningful lives after injury,^{1,2} a significant minority are at heightened risks for developing mental health disorders such as anxiety, depressed mood, and substance abuse problems.³ Consequently, there is a real need to devote scientific attention to understanding the psychological impact of SCI and identifying indicators of risks related to the development of significant emotional distress.

Rates of depression, in particular, tend to be higher for individuals with adult-onset SCI than is typically found in the general population. Estimates of depression range from 20% to 37%

in the more acute stages of injury⁴⁻¹⁰ and 11% to 48% at least 1 year post injury.⁹⁻¹⁵ The course of anxiety symptoms following SCI has been studied less, but the prevalence of clinically significant anxiety symptoms for adult-onset SCI is estimated to be between 13% and 41%.^{8,9,12,16} Compared to the adult-onset SCI population, individuals with pediatric-onset injury may adjust better than those injured as adults.^{17,18} Estimates suggest that as many as 17% children will report elevated anxiety symptoms and 9% of children will report elevated symptoms of depression at least a year after injury.¹⁸ In a sample of adults with pediatric-onset SCI, only 3% reported symptoms consistent with probable major depressive disorder (MDD), but as many as 27% reported at least mild symptoms of depressed mood.¹⁷

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Alcohol and drug use are frequent contributors to injury onset, are highly comorbid with depression and anxiety, and are also utilized as a coping mechanism to deal with SCI-related stressors.¹⁹ Several studies have highlighted the importance of attending to substance use in the treatment of SCI due to the higher rates of problematic alcohol and drug use than in the general population.^{19,20} Consequently, substance abuse is an important aspect of psychosocial adjustment to consider when looking at mental health symptoms for SCI survivors. Prevalence rates of substance use tend to vary widely depending on age and how it is defined (abuse/misuse vs use). In studies examining substance use in persons with SCI, rates vary from as high as 55% to 90% for alcohol use in young adults^{21,22} and 60% for adults over 25²¹ to as low as 13% to 14% when distinguishing alcohol misuse from use.^{20,23} Prevalence rates for illicit drug use, including marijuana, suggest a lower frequency of drug use among individuals with SCI compared to alcohol use, with an estimated 11% to 26% endorsing use of illegal drugs.^{20,22-24}

An SCI, independent of any other factors, leads to a high degree of unique medical considerations and physical limitations, but the presence of mental health symptoms is typically associated with an increased incidence of secondary medical complications. Although highly comorbid with depression symptoms, less is known about specific risks associated with anxiety.²⁵ Elevated depression symptoms have been linked to several SCI-related health concerns, including increased pain and deterioration in health,^{12,13,26} pressure ulcers,^{17,27} longer rehabilitation,²⁸ and greater risk of mortality,²⁹ whereas anxiety has been associated with significant pain elevations.³⁰ Substance misuse in individuals with SCI has been associated with pressure ulcers,^{20,31} pain,²⁰ urinary tract infections,³¹ lower overall perceived health,²⁴ and decreased life satisfaction.²⁰

Taken together, these studies highlight the substantial psychological and emotional impact of SCI, as well as the potential physical and health consequences of emotional distress. Furthermore, it is important to consider that individuals who are injured at a young age may face challenges that those with adult-onset injuries may not. Unlike

injuries that occur in adulthood, children with SCI must navigate the normal complexities of youth and identity development, while adjusting to a chronic health condition and physical disability. Additionally, as is the case with adult-onset injury, individuals with pediatric-onset SCI are susceptible to a number of secondary conditions; however, they have the added burden of spending their adult life vulnerable to these conditions. Consequently, the previously discussed cross-sectional designs may not account for the ways that mental health might relate to medical complications and adjustment over time.

Given concerns noted in the literature regarding the ability of cross-sectional analyses to adequately capture changes in SCI-related complications,³² the purpose of this study was to (a) examine the presence of mental health problems in individuals with pediatric-onset SCI, (b) examine whether demographics or injury characteristics relate to mental health problems, and (c) explore longitudinal changes in the occurrence of medical complications and social adjustment as a function of mental health presentation.

Based on the literature reviewed, we hypothesized that cross-sectional analyses may have underestimated previous estimates of mental health conditions in pediatric-onset SCI and that, when assessed longitudinally, rates of depression, anxiety, and substance misuse would be comparable to available estimates in the adult-onset SCI population as well as the general population. We also hypothesized that the prevalence of secondary health conditions would differ as a function of mental health difficulties and that individuals with mental health concerns would be at greater risk for increased SCI-associated medical complications and decreased participation and involvement.

Method

Participants and data collection

This study included participants drawn from an ongoing longitudinal study of individuals who sustained an SCI prior to age 19 years. The study included individuals who were at least 19 years of age, did not have a significant brain injury, and

were English-speaking. All participants received care at 1 of 3 geographically diverse SCI programs housed within the same specialty hospital system. This study was approved by the institutional review board, and informed consent was obtained prior to participation.

Participants were interviewed on an approximately annual basis between 1996 and 2013 and completed an average of 4.32 interviews ($SD = 3.20$; range, 1-14) for a total of 2,011 interviews. Of the 466 participants who consented to participate in the study, 356 had completed more than 2 follow-up interviews and provided data on at least one area of mental health. After completing several waves of study interviews, a number of measures, including depression and anxiety, were added to data collection, which resulted in uneven available data in these areas. All participants provided data on substance use, 360 completed a measure of depression and provided personal history on treatment for depression, and 160 completed a measure of anxiety and provided history on treatment for anxiety disorders.

Measures

Demographic data, injury-related factors, secondary health conditions, and history of treatment for psychiatric diagnoses were collected via a structured questionnaire designed for this study. Impairment was measured using neurological level and the American Spinal Injury Association Impairment Scale (AIS) that was obtained from the medical records and SCI database of the Shriners Hospitals for Children.³³

Community participation and independence

The Craig Handicap Assessment and Recording Technique (CHART) was used to assess community participation, independence, and activity level.³⁴ Responses to the CHART are used to calculate 6 separate subscales, including Physical Independence, Cognitive Independence, Mobility, Occupation, Social Integration, and Economic Self-Sufficiency, and an overall total score. Each subscale is scored on a 100-point scale, with higher scores indicating greater integration

and participation in the community. For analyses, each CHART subscale was dichotomized into some evidence of impairment (<100) versus fully independent (100).

Depression

Depression was determined using the Patient Health Questionnaire-9 (PHQ-9)³⁵ and self-report of treatment for a depressive disorder. The PHQ-9 is composed of 9 statements that align with the diagnostic criteria for MDD.³⁶ Participants respond to each question on a scale of 0 (*not at all*) to 3 (*nearly every day*) indicating how much they are bothered by each symptom over the last 2 weeks. In the current study, PHQ-9 scores were used to assess the presence of probable MDD. If at least 5 symptoms were endorsed “more than half the days” (suicidal thoughts could be “several days”), with at least one being “presence of a depressed mood” or “loss of pleasure or interest,” a diagnosis of probable MDD was indicated.

Substance misuse

We were interested in the potential adverse consequences associated with problematic substance use. Consequently, we use the term “misuse” to apply to the improper use of illegal drugs and alcohol, and we distinguish this from “use,” which is defined as the quantity and frequency of substance consumption and might involve “normal” drinking. Substance misuse was determined utilizing the Alcohol Use Disorders Identification Test (AUDIT-C)³⁷ and self-report of treatment history for substance abuse. The AUDIT-C is a brief screener to identify excessive and hazardous drinking, with the total score reflecting overall risk related to alcohol consumption. A score of 4 or greater in males or 3 or greater in females along with endorsement of at least one risky drinking behavior (having 6 or more drinks on one occasion or consistent heavy drinking on days when drinking) suggested alcohol misuse. Frequency of marijuana and illicit drug use were also assessed, with at least weekly use of marijuana or other illegal drug use considered drug misuse.

Anxiety

Anxiety was determined utilizing the Beck Anxiety Inventory (BAI)³⁸ and self-reported treatment history for an anxiety-related disorder. The BAI consists of 21 common symptoms of anxiety, and participants indicate how much they have been bothered by each symptom on a scale of 0 (*not at all*) to 3 (*severely*). The BAI has a maximum score of 63, however many of the symptoms are physiological in nature and overlap with common SCI-related complications, such as autonomic dysreflexia. Given this potential overlap, scores were recalculated based on a 4-factor solution described in the literature for neurophysiological, subjective, autonomic, and panic factors.^{39,40} This factor structure has been utilized in other medical populations, including older medical patients,⁴¹ patients with chronic obstructive pulmonary disease,⁴² and patients with Parkinson's disease.⁴³ Following a similar method utilized for Parkinson's disease, the neurophysiological and autonomic factors were removed from anxiety calculations to address the possibility that symptoms of SCI might be misinterpreted as anxiety. Thus, probable anxiety problems were considered if participants endorsed symptoms greater than cutoffs for panic and subjective symptoms.⁴⁴

Data analysis

To determine prevalence of mental health diagnoses during the course of this study, an aggregated count was conducted of individuals who either (a) endorsed being diagnosed or treated for an anxiety disorder, depression, or substance use disorder or (b) reported symptoms at any study assessment consistent with cutoffs for possible anxiety, depression, or substance abuse disorder. Demographic and injury-related data for all participants at initial interview were summarized using descriptive statistics. *T* test and chi-square analyses were used to compare demographic and injury-related data between the individuals within each mental health diagnostic group and peers who did not meet cutoffs in that category. For these analyses, we adopted a more conservative alpha level of .01 for determination of significance to correct for multiple comparisons. Finally, to

better understand the medical and social health burden for those with mental health problems, we used generalized estimating equations (GEEs), with a logit link function and an autoregressive AR(1) correlation structure, in a 2-stage process to calculate odds of complication occurrence in relation to mental health. Time was represented in the models by age. In the first set of GEE analyses, the odds of each dichotomously coded secondary condition were calculated by modeling the effects of mental health condition while controlling for the effects of time. The next series of GEE analyses was conducted to explore the longitudinal effects of mental health on each outcome and included only those participants who had participated in at least 2 annual interviews. In these analyses, the interaction term with time was explicitly modeled to evaluate the longitudinal effects of mental health condition on secondary complications. IBM SPSS Statistics for Windows Version 2.0 (IBM Corp., Armonk, NY) was used for all analyses.

Table 1. Characteristics of the overall study sample at baseline

Demographic and participant characteristics	Mean (SD) or <i>n</i> (%)
Age, years (range, 19-39)	26.99 (3.67)
Age at injury, years (range, 0-18)	14.27 (4.40)
Duration of injury, years (range, 1-31)	12.72 (5.32)
Caucasian	398 (86.5%)
Male	295 (63.3%)
Etiology	
Vehicular/pedestrian	229 (50%)
Violence	41 (9%)
Fall/flying object	31 (6.8%)
Sports	115 (25.1%)
Medical/surgical	42 (9.2%)
Tetraplegia	255 (54.8%)
Complete	319 (69.8%)
College degree or higher (yes)	150 (32.2%)
Work status	
Unemployed	174 (37.3%)
Employed	202 (43.3%)
Student	90 (19.3%)
Married (yes)	88 (18.9%)

Note: Unknown/missing date: race, *n* = 6; etiology, *n* = 8; complete/incomplete, *n* = 9; paraplegia/tetraplegia, *n* = 1.

Results

Demographic and injury characteristics for all 466 participants at initial interview are shown in **Table 1**. Of the 466 participants, 173 (37%) had difficulties or symptom elevations in at least one area of mental health and several reported problems in multiple domains. Although not all mental health areas were assessed for every participant, anxiety was the most prevalent (29.2%; 49 of 168), followed by substance misuse (26.2%; 122 of 466) and depression (21.7%; 78 of 360). A closer examination of the substance misuse category suggested that drug misuse was more common (15.9%; 74 of 466) than alcohol misuse (11.2%; 55 of 466). Compared to published norms in the general population, the current sample of individuals with pediatric-onset SCI appear to be experiencing similar rates of depression (reported at 21%)⁴⁵ and anxiety (reported at 29%),⁴⁵ decreased rates of alcohol misuse (reported at 23%),⁴⁶ and increased rates of drug misuse (reported at 9%).⁴⁶ Compared to prevalence rates reported in the literature for adult-onset SCI population, the rate of depression in our participants was either comparable (21%–24%)^{13,25} or lower (35%–38%)^{9,47} than published estimates. The rates of anxiety and substance misuse in our participants were also similar to findings in the adult SCI literature.^{8,9,20}

Cross-sectional analyses of demographic and injury characteristics at initial interview were completed to compare participants in each mental health diagnostic group to those without such a history (see **Table 2**). Individuals tended to be similar on age variables, ethnicity, injury level and severity, employment, and marital status. However, males were significantly more likely than females to report substance misuse.

Longitudinal analyses were used to (a) estimate the risk of mental health difficulties on secondary complications and (b) ascertain whether mental health problems might pose an added burden over time. The first set of analyses included all participants with available mental health data. To accomplish the second task, we included only the participants who had completed at least 2 annual interviews in data analysis. Of the original pool of

466 participants, a total of 1,901 interviews came from the 356 participants who completed at least 2 waves of substance abuse data, 1,682 interviews came from 280 participants who completed at least 2 waves of depression data, and 967 interviews came from 130 participants who completed at least 2 waves of anxiety data.

The odds ratios (ORs) for occurrence of secondary medical complications and psychosocial outcomes as a function of depression and depression over time are presented in **Table 3**, as a function of anxiety and anxiety over time are presented in **Table 4**, and as a function of substance misuse and substance misuse over time are presented in **Table 5**. Individuals with depression seemed to have particularly increased risk of health problems, with increased odds of urinary tract infections, hospitalizations, pain that interfered with activity, muscle spasms, neck or back pain that limited activity, and shoulder pain that limited activity. Individuals with anxiety also had increased risk of hospitalization, pain that interfered with activity, neck or back pain that limited activity, and shoulder pain that limited activity. Substance misuse was associated with increased odds of pressure ulcer occurrence and neck or back pain that limited activity. In terms of psychosocial outcomes, individuals with depression are at increased risk for smoking and have decreased odds of community independence, as evidenced by greater risk for impairment in economic self-sufficiency, occupational independence, and mobility. The anxiety and substance misuse groups were both at risk for smoking, whereas the substance misuse group was at significant risk for impaired occupational independence. When looking at the added burden that mental health morbidity may add for risk of developing secondary complications as a function of time, depression added to the risk of developing a urinary tract infection, respiratory complications (such as pneumonia), hospitalizations, and impaired occupational independence. Anxiety also increased the risk for impaired occupational independence. Paradoxically, the risk of both bladder accidents and arm/elbow pain decelerated with time for the substance misuse group relative to individuals without a history or current substance misuse problems.

Table 2. Demographic data at baseline by aggregated mental health groupings

	Depression (n = 360)			Anxiety (n = 168)			Substance misuse (n = 466)		
	No M (SD)	Yes M (SD)	t (P)	No M (SD)	Yes M (SD)	t (P)	No M (SD)	Yes M (SD)	t (P)
Age, years	27.1 (3.8)	26.3 (3.4)	1.81 (.07)	26.7 (3.3)	25.4 (4.0)	2.13 (.04)	26.9 (3.7)	27.1 (3.7)	0.47 (.64)
Age at injury, years	14.5 (4.3)	14.0 (4.8)	0.82 (.41)	13.8 (4.9)	14.6 (3.7)	1.02 (.31)	14.3 (4.3)	14.2 (4.7)	0.18 (.86)
Injury duration, years	12.7 (5.4)	12.3 (5.7)	0.56 (.58)	12.9 (5.7)	10.8 (5.2)	2.18 (.03)	12.7 (5.3)	12.9 (5.5)	0.47 (.64)
Sex	%	%	$\chi^2(P)$	%	%	$\chi^2(P)$	%	%	$\chi^2(P)$
Male	77.9%	22.1%	0.06 (.81)	72.6%	27.4%	0.46 (.50)	68.5%	31.5%	11.89 (.001*)
Female	79.0%	21.0%		67.7%	32.3%		83.0%	17.0%	
Race/ethnicity									
Caucasian	76.6%	23.4%	4.66 (.03)	71.5%	28.5%	0.04 (.85)	73.6%	26.4%	0.03 (.86)
Other	90.9%	9.1%		69.6%	30.4%		72.6%	27.4%	
Paraplegia/tetraplegia									
Paraplegia	81.6%	18.4%	1.89 (.17)	71.8%	28.2%	0.06 (.81)	74.3%	25.7%	0.05 (.82)
Tetraplegia	75.6%	24.4%		70.1%	29.9%		73.3%	26.7%	
Complete/ incomplete injury									
Complete	78.6%	21.4%	0.01 (.99)	72.3%	27.7%	0.61 (.44)	72.4%	27.6%	1.72 (.19)
Incomplete	78.6%	21.4%		65.9%	34.1%		78.3%	21.7%	
College degree or higher									
No	78.2%	21.8%	0.01 (.95)	64.7%	35.3%	4.72 (.03)	72.2%	27.8%	1.41 (.24)
Yes	78.5%	21.5%		80.3%	19.7%		77.3%	22.7%	
Work status									
Unemployed	72.8%	27.2%	5.52 (.02)	64.3%	35.7%	6.25 (.01)	69.5%	30.5%	1.82 (.18)
Employed	84.3%	15.7%		83.8%	16.2%		75.7%	24.3%	
Married									
No	76.1%	23.9%	5.01 (.03)	67.9%	32.1%	2.74 (.10)	72.5%	27.5%	1.84 (.18)
Yes	88.9%	11.1%		82.4%	17.6%		79.5%	20.5%	

Note: Individuals included in each analysis may have met criteria for more than one mental health classification.

* $P \leq .01$.

Table 3. Odds of secondary complications as a function of depression and depression over time

Outcome	Predictor			
	Depression (<i>n</i> = 360)		Depression over time (<i>n</i> = 280)	
	OR (95% CI)	<i>P</i>	OR (95% CI)	<i>P</i>
Chronic medical condition	1.27 (0.77-2.10)	.35	1.00 (0.93-1.07)	.96
Pressure ulcer	1.54 (1.01-2.35)	.05*	1.02 (0.96-1.08)	.56
UTI	1.77 (1.12-2.81)	.02*	1.07 (1.01-1.13)	.01*
Pneumonia/respiratory failure	1.90 (0.89-4.06)	.10	1.17 (1.04-1.32)	<.01**
Bladder accidents	1.07 (0.71-1.63)	.74	0.96 (0.90-1.02)	.20
Bowel accidents	1.14 (0.68-1.90)	.63	1.02 (0.94-1.10)	.70
Hospitalization	1.67 (1.15-2.42)	<.01**	1.08 (1.02-1.13)	<.01**
Pain	2.45 (1.66-3.64)	<.01**	1.04 (0.98-1.10)	.23
Muscle spasms	1.84 (1.15-2.95)	.01*	1.05 (0.99-1.11)	.11
Neck or back pain	4.33 (2.52-7.44)	<.01**	1.02 (0.93-1.12)	.65
Shoulder pain	1.81 (1.19-2.74)	<.01**	1.02 (0.96-1.08)	.60
Arm or elbow pain	1.30 (0.77-2.17)	.33	1.03 (0.95-1.11)	.49
Wrist or hand pain	1.14 (0.67-1.95)	.62	0.98 (0.91-1.06)	.65
CHART subscales				
Economic Self-sufficiency	0.54 (0.33-0.89)	.02*	0.98 (0.92-1.06)	.65
Physical Independence	0.69 (0.41-1.18)	.18	1.00 (0.94-1.06)	.92
Cognitive Independence	0.85 (0.57-1.26)	.41	0.96 (0.90-1.02)	.20
Mobility	0.63 (0.40-0.98)	.04*	1.03 (0.98-1.09)	.22
Occupation	0.44 (0.29-0.67)	<.01**	0.92 (0.87-0.97)	<.01**
Social Integration	0.70 (0.47-1.05)	.08	0.96 (0.91-1.01)	.14
Smoke	1.70 (1.09-2.67)	.02*	0.98 (0.92-1.05)	.60

Note: Reference group for all calculations were individuals who did not meet stated criteria for depression. CHART = Craig Handicap Assessment and Reporting Technique; OR = odds ratio; UTI = urinary tract infection.

P* ≤ .05, *P* ≤ .01.

Discussion

The results of the study underscore the importance of attending to psychological distress and morbidity in the treatment of SCI. Our results suggest that a significant percentage of individuals with pediatric-onset SCI will experience some evidence of mental health problems, with more than a third of the individuals in this study reporting either treatment history or current symptoms of anxiety, depression, or substance misuse. A number of clinical and medical implications are indicated by these results.

The finding that approximately 21% of individuals assessed in this study reported either current probable major depression or treatment history of depression is particularly meaningful in light of considerably lower prevalence rates observed in cross-sectional analyses¹⁷ and

longitudinal studies that did not account for prior treatment history.⁴⁸ This finding suggests possible differences in the scope and breadth of mental health outcomes that can be ascertained from the data depending on the nature of the analysis. The prevalence rate for depression observed in this study is consistent with the 21% lifetime prevalence estimates for mood disorders (which accounts for the prevalence of both MDD and dysthymia, a more pervasive form of depression) in the general population.⁴⁵ However, the observed rate in the current study is still comparable or in some cases lower than longitudinal estimates of clinically significant depression found for people with adult-onset SCI who are living in the community.^{9,49,50} This may indicate that the risk of significant depressive problems among people with SCI may be greater for those injured as adults than those injured as children and adolescents.

Table 4. Odds of secondary complications as a function of anxiety and anxiety over time

Outcome	Predictor			
	Anxiety (<i>n</i> = 168)		Anxiety over time (<i>n</i> = 130)	
	OR (95% CI)	<i>P</i>	OR (95% CI)	<i>P</i>
Chronic medical condition	1.47 (0.79-2.75)	.22	1.00 (0.92-1.08)	.98
Pressure ulcer	1.27 (0.72-2.26)	.41	1.01 (0.94-1.09)	.78
UTI	1.46 (0.80-2.67)	.22	1.03 (0.96-1.11)	.39
Pneumonia/respiratory failure	1.74 (0.63-4.80)	.28	1.02 (0.85-1.23)	.84
Bladder accidents	1.41 (0.79-2.52)	.25	0.98 (0.91-1.06)	.57
Bowel accidents	1.26 (0.67-2.39)	.48	1.05 (0.93-1.17)	.45
Hospitalization	1.88 (1.09-3.23)	.02*	1.05 (0.98-1.14)	.19
Pain	1.91 (1.13-3.25)	.02*	1.06 (0.98-1.15)	.12
Muscle spasms	1.75 (0.94-3.28)	.08	1.06 (0.99-1.14)	.09
Neck or back pain	2.86 (1.53-5.33)	<.01**	1.03 (0.94-1.14)	.52
Shoulder pain	1.97 (1.16-3.36)	.01*	1.01 (0.94-1.09)	.71
Arm or elbow pain	1.62 (0.84-3.11)	.15	0.99 (0.90-1.07)	.72
Wrist or hand pain	1.32 (0.66-2.66)	.44	1.00 (0.90-1.11)	.92
CHART subscales				
Economic Self-sufficiency	0.73 (0.36-1.50)	.40	0.98 (0.89-1.07)	.61
Physical Independence	0.79 (0.41-1.54)	.49	0.95 (0.89-1.01)	.12
Cognitive Independence	0.73 (0.44-1.21)	.22	1.03 (0.94-1.14)	.51
Mobility	0.64 (0.35-1.19)	.16	1.02 (0.96-1.09)	.46
Occupation	0.78 (0.45-1.34)	.36	0.92 (0.86-0.99)	.03*
Social Integration	0.85 (0.49-1.45)	.54	1.03 (0.96-1.10)	.43
Smoke	2.41 (1.28-4.52)	<.01**	1.01 (0.92-1.10)	.87

Note: Reference group for all calculations were individuals who did not meet stated criteria for anxiety. CHART = Craig Handicap Assessment and Reporting Technique; OR = odds ratio; UTI = urinary tract infection.

P* ≤ .05. *P* ≤ .01.

The results also indicate that individuals with depression were at greater risk for a number of medical complications compared to those without any indicators of depression. Specifically, those with depression were at increased risk for pressure ulcers, urinary tract infections, hospitalizations, and pain. This is not surprising given the number of studies that have previously indicated the increased risk of secondary medical complications and depression.^{12,13,17,27} There are a number of potential explanations for this finding; in particular, it seems that the very symptoms of depression, such as social withdrawal, feelings of hopelessness, and increased fatigue, may adversely affect medical compliance and self-care and thus increase vulnerability to poor medical outcomes.^{3,51}

Consistent with previous findings, depression was associated with decreased odds on several

indicators of economic well-being, including higher rates of unemployment, and decreased odds of occupational involvement and economic self-sufficiency, as measured by the CHART subscales.¹⁷ It is also worth noting that the odds ratios for all of the CHART subscales were below 1 for those with depression. Although not all achieved statistical significance, this is an important consideration given the high degree of association that exists between depression and engagement in meaningful and pleasant activities. These low levels of community participation for individuals with depression could potentially initiate a self-reinforcing cycle of decreased involvement and increased depression.

Similar to depression, the prevalence rate of anxiety (29.2%) appeared to be comparable to the lifetime prevalence rate of anxiety (29%) typically observed in the general population.⁴⁵

Table 5. Odds of secondary complications as a function of substance misuse and substance misuse over time

Outcome	Predictor			
	Substance misuse (<i>n</i> = 466)		Substance misuse over time (<i>n</i> = 356)	
	OR (95% CI)	<i>P</i>	OR (95% CI)	<i>P</i>
Chronic medical condition	1.26 (0.81-1.95)	.31	0.99 (0.93-1.05)	.63
Pressure ulcer	1.62 (1.14-2.30)	<.01**	1.03 (0.97-1.09)	.31
UTI	1.08 (0.76-1.55)	.66	1.05 (0.99-1.10)	.09
Pneumonia/respiratory failure	0.92 (0.42-2.05)	.85	1.05 (0.90-1.23)	.54
Bladder accidents	1.16 (0.79-1.70)	.44	0.94 (0.89-1.00)	.05*
Bowel accidents	0.90 (0.56-1.47)	.68	0.99 (0.92-1.08)	.88
Hospitalization	1.30 (0.93-1.83)	.13	1.04 (0.99-1.10)	.14
Pain	1.45 (1.04-2.04)	.03*	1.00 (0.94-1.06)	.95
Muscle spasms	1.47 (1.00-2.17)	.05	1.04 (0.99-1.10)	.14
Neck or back pain	2.03 (1.16-3.54)	.01*	0.98 (0.89-1.07)	.67
Shoulder pain	1.26 (0.84-1.88)	.27	0.97 (0.91-1.04)	.41
Arm or elbow pain	1.06 (0.63-1.79)	.82	0.91 (0.85-0.98)	.02*
Wrist or hand pain	1.21 (0.82-1.77)	.33	0.97 (0.91-1.03)	.33
CHART subscales				
Economic Self-sufficiency	0.80 (0.53-1.19)	.27	1.01 (0.95-1.08)	.69
Physical Independence	1.25 (0.84-1.86)	.28	0.98 (0.92-1.03)	.40
Cognitive Independence	0.94 (0.67-1.33)	.74	1.00 (0.94-1.06)	.93
Mobility	1.02 (0.70-1.48)	.92	1.00 (0.95-1.05)	.99
Occupation	0.63 (0.44-0.88)	<.01**	0.97 (0.92-1.03)	.37
Social Integration	1.20 (0.85-1.69)	.30	1.03 (0.98-1.08)	.30
Smoke	3.42 (2.34-5.01)	<.01**	1.03 (0.97-1.10)	.32

Note: Reference group for all calculations were individuals who did not meet stated criteria for substance misuse. CHART = Craig Handicap Assessment and Reporting Technique; OR = odds ratio; UTI = urinary tract infection.

P* ≤ .05. *P* ≤ .01.

This finding is also consistent with the literature described previously that suggests that a significant proportion of people with SCI are at risk for anxiety symptoms.^{8,9,12,16} The symptoms of anxiety, such as feeling overwhelmed and intense excessive worry, would make sense in a population with a potentially stressful and demanding medical regime, however, it is particularly impressive that individuals with pediatric-onset SCI do not appear to be at particularly greater risk for anxiety symptoms than those in the general population despite the greater degree of concerns around physical health and mobility associated with SCI. It may also be the case that certain injury etiologies are more prone to specific types of anxiety. For example, individuals whose injury was caused by some type of life-threatening accident may be particularly prone to anxious unwanted thoughts and feelings or to re-experiencing the original

trauma, as would be the case with posttraumatic stress disorder (PTSD). Although this was not specifically assessed in the current study, the ability to distinguish between more general anxiety symptoms and PTSD would be an important goal for future research.

The results indicate that individuals with anxiety had increased odds of hospitalization and pain that impaired activity (overall pain as well as neck and shoulder pain). The increased risk of having pain that interferes with activity in individuals with anxiety symptoms has important consequences for the medical management and treatment of pain in these individuals. Effective cognitive behavioral interventions aimed at reducing anxiety might improve anxiety disorders and the ability to cope with pain symptoms. Additionally, the heightened state of arousal associated with untreated anxiety and pain can further undermine health and increase risk for

other chronic medical conditions, complicating the already multifaceted medical care for SCI.

The last area of mental health examined in this study was substance misuse. Nearly a quarter of participants endorsed harmful or risky substance use; misuse of marijuana accounted for the majority of those who were in this category. On the whole, men were much more likely to misuse substances than women, and the prevalence of drug misuse (16%) was almost double the estimate of illicit drug use in the general US population (9%).⁴⁶ The prevalence rate of alcohol misuse, on the other hand, was only 11% and appears a good deal lower than the estimated 23% of individuals in the United States who are engaging in risky drinking behaviors.⁴⁶

Individuals who misused substances were at greater risk for pressure ulcers and pain (overall pain as well as neck or back pain that limited activity) and decreased odds of occupational involvement. This is consistent with previous research that has found associations between substance misuse and pressure ulcers, hospitalizations, and pain in adult-onset SCI⁵²⁻⁵⁵; however, it is in contrast to results from a previous study in pediatric-onset SCI suggesting that substance use was not significantly associated with increased risk for secondary medical complications.²² There are several possible explanations for this discrepancy, including that the cross-sectional design of the study might not have accounted for a potential cumulative effect of substance use on medical complications over time. The inconsistency may also be accounted for by the different definitions used in the study. The current study was particularly interested in “misuse,” which is harmful or risky alcohol or drug consumption, versus regular or typical “use,” which might include individuals who have normative drinking behaviors. It may be the case that substance use is not associated with an increased incidence of medical complications, but that misuse is significantly associated with certain medical complications.

When examining the added effect of time, we found that individuals with substance misuse problems had a lower risk of bladder accidents and arm/elbow pain. The reasons for this finding were unclear, but more than half of the individuals

in the substance misuse category were specifically reporting misuse of illegal substances such as marijuana. It may be the case that individuals are utilizing marijuana as an analgesic, in which case a reduction in pain may be expected. It is recommended that future studies explore this finding in greater depth.

Limitations

This study adds to the current literature by examining how mental health symptoms affect the occurrence of medical and health outcomes longitudinally, but there are several limitations. The study sample consisted of a majority of Caucasian individuals from the same hospital system, which may limit the generalizability of the results to the larger population of adults with pediatric-onset SCI. Additionally, all data obtained for this study were self-reported and prone to the biases and problems associated with self-report measures. Related to this, it is possible that the measures we utilized (such as the BAI) might inflate anxiety scores, because they contain items biased toward medical complications associated with SCI; however, we attempted to address this weakness proactively by utilizing subscale scores rather than overall scores.

Conclusions

The purpose of this study was to investigate the prevalence of negative psychological outcomes after pediatric-onset SCI and determine the relation of these emotional stressors to the occurrence of medical complications and psychosocial well-being over time. The number of individuals with clinically significant concerns with depression, anxiety, and substance misuse emphasizes the importance of attending to both medical and psychological concerns when treating SCI in rehabilitation and community settings. It also highlights the necessity of psychological intervention and monitoring when indicated. Further research is needed to clarify the nature of negative psychological outcomes in reference to the timeline of medical complications to better determine causality.

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