**RURAL VERSUS URBAN DIFFERENCES IN HEALTHCARE UTILIZATION AND LONG-TERM OUTCOMES IN ADULTS WITH PEDIATRIC-ONSET SPINAL CORD INJURY**

by

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**ABSTRACT**

Individuals with pediatric-onset spinal cord injury (SCI) require long-term care and have a high risk of secondary health conditions. Individuals who live in rural areas potentially have unmet medical needs due to insufficiency of medical infrastructure and medical providers, illustrating a significant issue to public health. We studied how factors affecting health usage differed between rural versus urban-living participants with pediatric-onset SCI including patient independence, employment, income, and access to private insurance. In addition, we examined differences in healthcare outcomes such as hospitalizations, paid expenses, urinary tract infections (UTIs), and pressure ulcers.

This study was part of a larger longitudinal study on long-term outcomes of adults with pediatric-onset SCI. Participants (N=471) reported on sociodemographic and injury characteristics and medical outcomes. Participant zip codes were identified as rural or urban using the ProximityOne database based on the ZIP Code Tabulation Areas from the 2010 census.

Those living in rural areas have decreased income, decreased access to private health insurance, fewer hours of paid personal care assistance, and increased incidence of pressure ulcers. There were no differences with respect to incidence of UTIs, hospitalizations or psychosocial functioning. Rural-living individuals with pediatric-onset SCI experience economic barriers to healthcare, but differences in secondary health conditions were limited to increased incidence in pressure ulcers.

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preface

Acknowledgements

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# Introduction

Challenges to accessing timely and comprehensive healthcare can have far reaching implications on health outcomes for all patient populations and particularly those with chronic health conditions. According to the National Spinal Cord Injury Statistical Center, nearly 275,000 individuals in the U.S. live with SCI, with an incidence of 12,000 per year.(Devivo, 2012) Spinal cord injury is a sudden and debilitating injury that results in paralysis, sensory deficits and drastically altered function and quality of life. (Dijkers, 2004) SCI is also extremely costly, with personal costs ranging from $40,589 to $177,808 in years following injury.(NSCISC, 2013) More than half of all individuals with SCI do not have private health insurance(James S. Krause, Saladin, & Adkins, 2009), thus costs associated with SCI greatly affect their lives as well as the public support system. Individuals with pediatric-onset spinal cord injury (SCI) represent one such patient subgroup that is at great risk when access to healthcare is frequently compromised.

Individuals with SCI individuals require long-term follow-up and healthcare due to secondary health conditions such as neurogenic bowel and bladder, pressure ulcers, autonomic dysreflexia, pain, urinary tract disorders, and sexual dysfunction.(DeVivo & Farris, 2011; Goodridge et al., 2014; Hwang, Chlan, Vogel, & Zebracki, 2012) Individuals with SCI are more likely than their healthy counterparts to develop severe medical complications that lead to hospitalizations.(James S. Krause & Saunders, 2011) Additionally, over a 10-year period, 93% of patients with SCI experienced at least one adverse health condition requiring medical attention.(Pickelsimer, Shiroma, & Wilson, 2010) Individuals are most frequently need to seek hospitalization due to respiratory complications and urinary tract infections.(Cardenas, Hoffman, Kirshblum, & McKinley, 2004; A R Meyers et al., 1985) Preventable conditions such as pressure ulcers are also highly concerning as they lead to longer hospital stays.(Chen, DeVivo, & Jackson, 2005) Further, Young et al found pressure sores and other skin conditions to be the leading cause of hospitalization among persons with tetraplegia, followed by orthopedic and urologic conditions.(Young, Webster, Giunti, Pransky, & Nesathurai, 2006) Hospitalizations leads to reduced odds of both job acquisition and job retention in adults with SCI (Meade, Forchheimer, Krause, & Charlifue, 2011a)

In addition to physical symptoms, emotional sequalae of SCI include distress, role strain, anxiety, depression and substance abuse.(Craig, Tran, & Middleton, 2009) Non-Hispanic black and Hispanic women with SCI have more depressive symptoms in comparison to non-Hispanic men and non-Hispanic white women and men.(Kemp & Krause, 1999; James S. Krause, Kemp, & Coker, 2000) Further psychosocial factors include concomitant structural challenges such as housing, transportation, finance equipment and employment.(Anson & Shepherd, 1996; Bloemen-Vrencken, Post, Hendriks, De Reus, & De Witte, 2005; Cox, Amsters, & Pershouse, 2001; Widerström-Noga, Felipe-Cuervo, Broton, Duncan, & Yezierski, 1999) Unemployment in those with disabilities such as SCI has been linked to poor physical and mental health outcomes (Zunzunegui, Forster, Gauvin, Raynault, & Douglas Willms, 2006), as depression increased over time in those that were unemployed. (Hwang et al., 2014)

SCI as well as its associated health conditions greatly affect employment and occupational functioning, as employment is a critical social determinant of health for persons with disabilities. (Kirsh et al., 2009) People with disabilities are poorly represented in the American workforce, despite efforts to close the gap through policy and research.(Anderson & Vogel, 2002) Employment rates in the SCI population are much lower than the general population, ranging from 11 to 74%, depending on the definition of employment and sample population.(Lidal, Hjeltnes, Røislien, Stanghelle, & Biering-Sørensen, 2009) Individuals injured in childhood or adolescence may experience different employment outcomes in adulthood as they had little work experience before injury and/or pursuing education at the time of injury and may have been able to adapt to the consequences of sustaining the injury. Anderson and Vogel reported an employment rate of 51% in this population (Anderson & Vogel, 2002). They also found that education, community mobility, functional independence and lower occurrence of medical complications to be predictive of employment.

The availability of employment, recreation, transportation within a community is also a determinant of wellbeing for those with SCI (Hagglund, Clay, & Acuff, 1998) The existence of crime was also found to be detrimental to functioning in those with SCI (Liang et al., 2008). More green space is associated with a better quality of life and greater community participation for individuals with SCI (Botticello, Rohrbach, & Cobbold, 2014) Blacks and whites living in socially and economically disadvantaged neighborhoods engage in elevated rates of unhealthy behaviors (drinking, smoking, obesity and physical inactivity) and experience higher rates of adverse outcomes such as diabetes, hypertension and activity limitations (Bleich, Thorpe, Sharif-Harris, Fesahazion, & Laveist, 2010; T. LaVeist et al., 2008; T. LaVeist, Pollack, Thorpe, Fesahazion, & Gaskin, 2011; T. A. LaVeist et al., 2007; Thorpe et al., 2014)

In terms of SCI as a whole, individuals with the condition frequently experience poor employment retention and work-life expectancy, with rates dropping sharply around age 50 (Lidal et al., 2009; Pflaum, McCollister, Strauss, Shavelle, & DeVivo, 2006) Employment odds decreased with occurrence of autonomic dysreflexia, spasticity or other chronic conditions.(Hwang, Zebracki, Chlan, & Vogel, 2014) Lack of employment can increase risk for health complications whereas paid employment improves quality of life.(Yasuda, Wehman, Targett, Cifu, & West, 2002) Employment allows for those with SCI to increase their independence, social integration, life satisfaction and quality of life (Hess, Kolakowsky-Hayner, Cifu, & Huang, 2000; Ottomanelli & Lind, 2009). Paid employment and other types of participation have been linked to higher life expectancy.(James S. Krause, Devivo, & Jackson, 2004) Life satisfaction increased over time with those that remained employed (Hwang et al., 2014) Gender, race, independent living and mobility were associated with stable employment.(Anderson, Vogel, Willis, & Betz, 2006) Ideally, we would devote resources towards and providing work and training to those with SCI to improve their health and wellbeing and avoid the consequences of unemployment.

SCI disproportionally affects minorities: There is a racial employment gap post-injury between non-Hispanic whites and minority groups that may affect rehabilitation and return to self-sufficiency (Arango-Lasprilla et al., 2010; James S. Krause & Terza, 2006; Meade, Forchheimer, Krause, & Charlifue, 2011b) Non-Hispanic white and Hispanic participants had comparatively more improvement in self-care and mobility during inpatient rehabilitation compared with non-Hispanic black participants, although these differences disappeared 1 year post-injury (Fyffe, Deutsch, Botticello, Kirshblum, & Ottenbacher, 2014) Racial and ethnic minorities are at increased risk for secondary health complications (Cardenas, Bryce, Shem, Richards, & Elhefni, 2004; Lad et al., 2013; Saladin & Krause, 2009), psychological distress (James S. Krause et al., 2009; James S Krause, Broderick, Saladin, & Broyles, 2006), poorer quality of life(James S. Krause et al., 2009; Myaskovsky et al., 2011) and poorer wheel chair quality.(Hunt et al., 2004)

In terms of long term health outcomes, those from racial/ethnic minority backgrounds are more likely to be hospitalized than non-Hispanic white adults for secondary conditions.(J. S. Krause & Saunders, 2009) African Americans also experience longer stays when hospitalized than those of other ethnic backgrounds.(Mahmoudi et al., 2014) Non-Hispanic black and Hispanic women with SCI have higher rates of severe pressure ulcers requiring invasive treatment SEC.(Fyffe, Botticello, & Myaskovsky, 2011) Darker skin pigment may make it more difficult to identify early stages of pressure ulcers, thus reducing preventative care.(Chen et al., 2005) Differences in SES and access to resources explain the gaps between whites and blacks with respect to secondary complications, rehospitalization and indicators of wellbeing (James S Krause et al., 2006; Saunders, Krause, & Acuna, 2012) This may be due to the fact that they are more likely to be unemployed and unmarried at the time of injury.(J. S. Krause & Saunders, 2009; James S Krause et al., 2006) Race is also heavily tied to neighborhood environment. (Diez Roux et al., 2010; Williams & Collins, 2001) Racial minority groups had lower community participation relative to whites, suggesting poorer community integration and may result in inequalities in health, disability and quality of life. (Botticello et al., 2016)

Communities play a large role in successful rehabilitation for those with SCI -- community stratification is associated with diminished well-being for persons (Botticello et al., 2011) Many health indicators, including perceived health (Kim & Kawachi, 2006), physical disability (Clarke & George, 2005; Freedman, Grafova, Schoeni, & Rogowski, 2008), cognitive impairment (Wight et al., 2006) and emotional distress (Aneshensel et al., 2007) vary between communities suggesting the importance of the local community as a critical determinant of health (Botticello et al., 2011) Botticello, Boninger & Charlifue have strongly implicated the role of residential neighborhood characteristics, including ethnic makeup, unemployment and urbanicity, in accounting for large variations in healthcare access.(Botticello et al., 2016; Botticello, Chen, & Tulsky, 2012) Community characteristics also explain the large geographic variation in long-term outcomes in SCI, including perceived health, life satisfaction and depressive symptoms.(Botticello et al., 2011)

To partly explain the effect on community composition on geographical differences in health outcomes, Runciman proposed that people make socioeconomic comparisons to people around them, which affects their health (Runciman, 1966). Botticello et al. confirmed that differences in SES and urban composition of communities contributed to differences in health outcomes for persons with SCI, and affected perceived health except for depressive symptom. Furthermore, greater accessibility (Richards et al., 1999) and fewer physical barriers(DeJong, Branch, & Corcoran, 1984; Whiteneck et al., 2004) in certain communities predict higher functioning.(Botticello, Chen, Cao, & Tulsky, 2011) Those with lower incomes are more likely to experience greater stress associated with lower status (Pham-Kanter, 2009). Likewise, those with SCI in urban areas were more likely to report dissatisfaction with life (Botticello et al., 2011)

Rural-living individuals with SCI encounter multiple barriers in seeking care versus their urban-living counterparts. The primary concerns are the lack of timely access to primary and specialized healthcare services and difficulty with transportation, which often results in delayed diagnosis and treatment of preventable conditions.(Goodridge et al., 2014) There is a mismatch between geographical location of vocational services for persons with disabilities and areas with large concentrations of persons with disability.(Metzel, 2007) Those with physical and cognitive and physical disabilities living in urban areas receive more vocational services (Johnstone et al., 2003) A lack of healthcare practitioners, especially those sufficiently skilled in care for patients with SCI, as well as the shortage of advanced diagnostic and treatment equipment have been noted.(Goodridge et al., 2014; Lishner, Richardson, Levine, & Patrick, 1996) Transportation and the presence of physical and architectural barriers may also prevent readily accessible care(Hagglund et al., 1998), and difficulty accessing transportation has been predictive of greater number of secondary conditions in persons with high level of SCI.(Allan R Meyers, Mitra, Walker, Wilber, & Allen, 2000)

In addition to SCI rehabilitate resources, urban areas have more options for employment recreation, transportation and healthcare (Hagglund et al., 1998) However, crime rates in urban areas are detrimental to functioning for those with SCI. (Liang et al., 2008) Rural locations tend to lack opportunities to engage in health-promoting activities as well as complementary therapies, sports, peer support, equipment and mobility-related services.(Goodridge et al., 2014) This study also reported that issues of affordability, availability, and accessibility of care were all concerns raised by individuals living in rural areas.(Goodridge et al., 2014)

To our knowledge, prior studies have not yet examined exactly how rural-living affects the overall accessibility of care in individuals with SCI. The identification of disparities in health resources in rural areas would help to improve the care of individuals with SCI residing in those areas. To this end, the current study seeks to examine differences in healthcare utilization, secondary health conditions and long-term outcomes in rural versus urban-living individuals with pediatric-onset SCI.

Given the existing research on discrepancies between patient populations in urban versus rural areas, we hypothesized that rural-living participants would have a reduced amount of healthcare usage and decreased access to care in these areas. Secondly, we predicted that rural-living individuals would have a higher incidence of secondary health conditions such as urinary tract infections (UTIs) and pressure ulcers and lower quality of life measures.

## METHODS

This study was part of a larger longitudinal study on long-term outcomes of adults with pediatric-onset SCI. Inclusion criteria consisted of individuals who had sustained an SCI at less than 19 years of age, did not have a significant brain injury, were able to communicate in English, and were living in the United States. Participants were recruited from Shriners Hospitals in Chicago, Philadelphia and Northern California. Informed consent was obtained from all participants in the study, and participation involved completing annual phone interviews with trained research specialists. Institutional Review Board approval was obtained for this study.

Individuals aged 19-51 were interviewed using a study-specific structured questionnaire assessing sociodemographic characteristics, healthcare resources and utilization, and secondary health conditions. Medical and injury-related information were obtained from medical records and the Shriners Hospitals for Children SCI database. Level and severity of injury were categorized based on the American Spinal Injury Association (ASIA) Impairment Scale (AIS) using the International Standards for Neurological Classification of Spinal Cord Injury (American Spinal Injury Association, Revised 2011). Injury severity was categorized into the following four neurological impairment groups: C1–4 AIS ABC, C5–8 AIS ABC, T1–S5 AIS ABC and AIS D. The occurrence of secondary health conditions in the previous year was recorded and included pain, days hospitalized, urinary tract infections (UTIs), pressure ulcers, and days hospitalized due to pressure ulcers.

Standardized measures were utilized to assess psychosocial outcomes. The Patient Health Questionnaire-9 (PHQ-9) assesses depressive symptoms using diagnostic criteria for major depressive disorder according to the Diagnostic and Statistical Manual, Fourth Edition. The Beck Anxiety Inventory (BAI) was used to assess current symptoms of anxiety.(Beck, Epstein, Brown, Steer, & others, 1988) The General Happiness Scale is a global measure of subjective happiness(Lyubomirsky & Lepper, 1999) and the Satisfaction with Life Scale is a measure of global life satisfaction.(Pavot & Diener, 1993) The SF-12v2 Health Survey assesses an individual’s perception of his/her health-related quality of life.(Ware et al., 2008) The Craig Handicap Assessment and Recording Technique (CHART) assesses community participation in 6 domains: physical independence, cognitive independence, mobility, occupation, social integration, and economic self-sufficiency.(Whiteneck et al., 1992) These measures are validated and have been used in previous studies focused on life satisfaction, depression and community participation outcomes of individuals with SCI.(Hall et al., 1998)

To assign participants to the appropriate geographical subtype, participant zip codes corresponding to their most recent mailing address on file were entered into the ProximityOne database (Proximity, http://proximityone.com). ProximityOne is a program that can geocode based on zip code. The program uses data from the 2010 Census and relies on ZIP Code Tabulation Areas (ZCTAs), which provide information as to the geographic makeup of different ZIP code areas within the United States. To assign each participant to the appropriate geographical category, the most recent zip code for each participant was entered into the database and was subsequently designated as either urban or rural by the program.

Of the 481 total participants in the larger study, 10 were excluded from the present study due to their most current address corresponding to a location outside of the United States (all 10 that were excluded were residing in Canada.) The 471 remaining participants were eligible for the current study and included in the analyses.

## aNALYSES

To assess differences in outcomes between urban and rural-dwelling participants, a series of analyses were performed. Chi-square, Fisher’s Exact and T-tests were conducted to compare demographic data between study participants.

We used linear regression analyses to compute adjusted means and mean differences between urban and

Chi-square tests were used to compare sex, race, impairment groups, driving independence, living independence, marital status, educational level, employment, private insurance access, having pain, and having hospitalizations, pressure ulcers or UTIs in the past year. Fisher’s Exact was used to compare race, etiology. T-tests were used to compare hours worked, income, out of pocket expenses, personal care expenses, social and economic self-sufficiency totals as well as anxiety, depression, happiness, SWL and perceived health scores. Descriptive statistics were used for demographic and injury-related information as well as healthcare utilization, and employment status based on geographical location.

To determine the effect of urban-living on the two major long-term outcomes (incidence of pressure ulcers and UTIs), we ran a logistical regression models considering the participant race, employment status, household income, urban vs. rural living. All data was obtained from participants’ most recent interviews. For all analyses, statistical significance was determined by p-values below .05.

# results

### Participant Characteristics

Table 1 demonstrates the demographic and injury characteristics of the study population. Rural-living participants were significantly less likely to have a college degree (24.2% v. 46.5%; p<.001) and be employed (28.4% v. 51.6%, p<.001). In addition, rural-living participants were significantly more likely to live with parents or a guardian (52.6% v. 30.6%, p<.001) and they had significantly lower personal ($17,615 v. $36,455, p<.001) and household incomes ($33,220 v. $53,595, p=.02). Finally, rural-living participants were less likely to have private insurance (32.6% v. 50.5%, p<.002). Furthermore, there were a greater proportion of female participants living in urban areas (39.6% vs. 27.4%, p=0.27). There was no difference between race, neurological impairment groups, etiology of injury or driving status.

In terms of healthcare factors listed in Table 2, rural participants were more likely to have a pressure ulcer in the last year (42.1% v. 30.1%, p=.028). They also received fewer hours/day of paid personal care assistance (0.9 v. 1.65 hours, p=.006) and rated themselves as less socially integrated (84.5 v. 91.6, p<.001) and economically self-sufficient (65.8 v. 74.8, p=.049). No differences were found in terms of hospitalizations, use of unpaid home assistance or having out of pocket medical expenses. There were also no differences in the incidence of urinary tract infections, days hospitalized, or other health-related outcomes (depression, anxiety, or satisfaction with life). Table 3 lists the output of the logistic regression and suggests that unemployment and reliance on public insurance significantly explained the differences between differences in the rates of UTI and pressure ulcers.

## dISCUSSION

To our knowledge, few studies have observed the long-term health outcomes of patients with pediatric-onset SCI. Within our cohort, 20% lived in rural areas, consistent with the national average of 19%. A previous study of veterans with spinal cord injuries showed a higher proportion living in rural areas (39.2 %).(St. Andre et al., 2011) With respect to education, our participants were well-educated, with urban participants having a higher attainment of college degree than the national average (33%). Patients in rural areas, however, were less likely to have a college degree and less likely to be employed than our urban participants. Moreover, rural-living employed individuals had a much lower personal yearly income compared to urban dwelling, with an overall average difference of $18,840 (including unemployed). which is notably more than the national difference of $15,779 between the general population of urban versus rural-living employed individuals. It may simply be cheaper for those unemployed to live in rural areas, however. The lower educational levels in rural-living individuals may also explain the disparity in employment. Unfortunately, we could not account for participants that moved to urban areas in pursuit of further education or higher-paying employment opportunities or those who had income from other sources.

Rural-living individuals do appear to have difficulty in accessing private health insurance, which could be due to disparities in employment and decreased income as well as distance to care. There was also no difference in unpaid home assistance, however, those in rural areas received fewer hours of paid home assistance, also possibly due to limited income or lack of area health services.(Goodridge et al., 2014)

In terms of secondary health outcomes, we noted that rural patients were more likely to have a pressure ulcer in the past year, but there was no difference in frequency of UTIs or presence of pain. Goodrich et al. noted that rehabilitative services such as physiotherapy and occupational therapy were highly valued by participants in preventing pressure ulcers (Goodridge et al., 2014; Lishner et al., 1996), which may be more difficult to access in rural settings. With respect to psychosocial functioning, no differences emerged on anxiety and depressive symptoms, happiness and life satisfaction, and perceived health-related quality of life; however, our rural participants reported decreased social integration and self-sufficiency. This could be related to greater distances to accessible social opportunities and the decreased income and employment, as we noted earlier.

There are several limitations to this study. Rural versus urban status was determined solely by zip code, but individual zip codes may cover multiple areas of differing population density. Data regarding factors such as distance traveled to seek medical care and specific transportation needs were not available. Generalizability is limited as participants were predominantly Caucasian and male, although this is in line with the general U.S. SCI population (NSCISC). Nevertheless, the present study benefited from a large (N=471) and geographically diverse sample and long-term follow-up.

# Conclusions:

The findings highlight that the disparities of adults with pediatric-onset SCI living in rural areas have with respect to education, employment, income, and self-sufficiency. Our findings noted the disparities in employment and income in patients in rural areas. We also noted decreased access to educational opportunities and employment. We postulate that challenges to obtaining rehabilitative services may explain the increased incidence of pressure ulcers in a rural setting; however, further studies would be needed to establish a causal relationship.

**APPENDIX: TABLES**

Table 1: Participant Demographics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Totaln=471  | Rural Livingn=95 | Urban Livingn=376 |  |
| Characteristics | n (%)or Mean (SD) | n (%)or Mean (SD) | n (%)or Mean (SD) | P value |
| *Age*  *Range* | 31.8 (6.3)19-51 | 31.5 (6.4) | 31.9 (6.3) | .557 |
| Time Since Injury (years) | 17.6 (7.3) | 17.02 (7.7) | 17.74 (7.2) | .390 |
|  |  |  |  |  |
| *Female* | 175 (37.2%) | 26 (27.4%) | 149 (39.6%) | .027 |
|  |  |  |  |  |
| *Race* |  |  |  | .107 |
|  African-American | 28 (6.0%) | 7 (7.4%) | 21 (5.6%) |  |
|  Caucasian | 400 (85.8%) | 85 (91.4%) | 315 (84.5%) |  |
|  Other | 38 (8.1%) | 1 (1.1%) | 37 (9.9%) |  |
|  |  |  |  |  |
| *Neurological Impairment Groups* |  |  |  | .546 |
|  C1-C4 ABC | 66 (14.0%) | 17 (17.9%) | 49 (13.1%) |  |
|  C5-C8 ABC | 163 (34.7%) | 28 (29.5%) | 135 (36.0%) |  |
|  T1–S5 ABC | 196 (41.7%) | 39 (41.1%) | 157 (41.9%) |  |
|  AIS D | 45 (9.6%) | 11 (11.6%) | 34 (9.1%) |  |
|  |  |  |  |  |
| *Etiology* |  |  |  |  |
|  Vehicular/pedestrian | 232 (50.1%) | 54 (56.8%) | 178 (48.4%) | .341 |
|  Violence | 42 (9.1%) | 5 (5.3%) | 37 (10.1%) |  |
|  Fall/flying object | 30 (6.5%) | 8 (8.4%) | 22 (6.0%) |  |
|  Sports | 114 (24.6%) | 21.1 (20%) | 94 (25.5%) |  |
|  Medical Surgical | 45 (9.7%) | 8 (8.4%) | 37 (10.1%) |  |
|  |  |  |  |  |
| *Drives independently* | 287 (60.9%) | 59 (62.1%) | 228 (60.6%) | .584 |
|  |  |  |  |  |
| *Lives independently* | 306 (65.0%) | 45 (47.4%) | 261 (69.4%) | <.001 |
|  |  |  |  |  |
| *Married* | 116 (26.6%) | 22 (23.2%) | 94 (25.0%) | .790 |
|  |  |  |  |  |
| *Education level* |  |  |  | <.001 |
|  Less than high school | 16 (3.4%) | 8 (8.4%) | 8 (2.1%) |  |
|  High school or equivalent | 47 (10.0%) | 15 (15.8%) | 32 (8.5%) |  |
| **Table 1 Continued** |
|  Some College  | 210 (44.6%) | 49 (51.6%) | 161 (42.8%) |  |
|  Bachelor degree or higher | 198 (42.0%) | 23 (24.2%) | 175 (46.5%) |  |
|  |  |  |  |  |
| *Employed* | 221 (46.9%) | 27 (28.4%) | 194 (51.6%) | <.001 |
|  |  |  |  |  |
| Hours worked/week | 38.9 (14.5) | 12.1 (20.7) | 20.1 (21.7) | <.001 |
|  |  |  |  |  |
| *Income* |  |  |  |  |
|  Personal annual income Median Range | $32,634 ($61,742)$17,000$0-$1,000,000 | $17,615 ($14,652)$10,356$0-$64,000 | $36,455 ($68,252)$21,000$0-$1,000,000 | <.001 |
|  Household annual income  Median Range | $49,754 ($66,635)$35,000$0-$1,000,000 | $33,220 ($27,987)$25,500$1,000-$120,000 | $53,595 ($33,220)$39,500$0-$1,000,000 | .020 |
|  |  |  |  |  |
| *Private Health Insurance* | 221 (46.9%) | 31 (32.6%) | 190 (50.5%) | .002 |

Table 2: Secondary Health Outcomes and Psychosocial Functioning

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | TotalN=471  | Rural Livingn=95 | Urban Livingn=376 |  |
| Characteristics | n (%)or Mean (SD) | n (%)or Mean (SD) | n (%)or Mean (SD) | P value |
| *Current Pain (yes)* | 111 (61.3%) | 20 (62.5%) | 91 (61.1%) | .023 |
| *Pain Intensity* |  | 2.53 (2.74) | 2.06 (2.33) | .317 |
| *Hospitalized in the past year (yes)* | 108 (23.0%) | 28 (29.5%) | 80 (21.4%) | .095 |
| *Pressure ulcer in the past year(yes)* | 153 (32.5%) | 40 (42.1%) | 113 (30.1%) | .028 |
| *UTI in the past year (yes)* | 326 (69.4%) | 71 (74.7%) | 255 (68.0%) | .215 |
|  |  |  |  |  |
| *CHART* |  |  |  |  |
| Out of pocket medical expenses | $3,628 ($14,962)$0-$250,000 | $1,659 ($3,333)$0-$22,800 | $4,094 ($16,528)$0-$250,000 | .212 |
| Hours of paid personal care assistance in 24 hours | 1.5 (3.05) | .91 (1.99) | 1.65 (3.24) | .006 |
| Hours of unpaid personal care assistance in 24 hours | .66 (1.75) | .67 (1.34) | .66 (1.84) | .965 |
| Physical Independence subtotal | 91.73 (11.93) | 93.06 (10.45) | 91.39 (12.26) | .227 |
| Cognitive Independence subtotal | 87.06 (7.67) | 96.38 (10.57) | 97.23 (6.73) | .332 |
| Mobility subtotal | 88.45 (17.95) | 83.74 (21.51) | 89.65 (16.74) | .014 |
| Occupational subtotal | 75.18 (31.09) | 69.02 (31.3) | 76.74 (30.88) | .031 |
| Social Integration subtotal | 90.1 (15.7) | 84.5 (19.4) | 91.6 (14.3) | <.001 |
| Economic Self-sufficiency subtotal | 73.1 (34.1) | 65.8 (34.0) | 74.8 (33.9) | .049 |
| *Anxiety* (BAI) | 4.25 (7.55) | 3.13 (5.12) | 4.49 (7.96) | .355 |
| *Depression* (PHQ9) | 3.51 (4.45) | 3.48 (4.17) | 3.52 (4.53) | .946 |
| *Happiness* (GHS) | 5.55 (1.24) | 5.79 (1.02) | 5.50 (1.25) | .250 |
| *Satisfaction with Life (SWL)* | 24.12 (7.79) | 23.55 (7.92) | 24.26 (7.76) | .433 |
| *Perceived health (SF12v2)* |  |  |  |  |
| Physical component | 42.79 (10.73) | 39.10 (10.62) | 43.58 (10.62) | .031 |
|  Mental component | 55.08 (9.26) | 57.44 (7.00) | 54.58 (9.62) | .055 |

Table 3: Logistic Regression - UTI and Pressure Ulcer

|  |  |  |
| --- | --- | --- |
|  | UTI in the Past Year | Pressure Ulcer in the Past Year |
| Intercept | OR (SE) | P | OR (SE) | P |
| Rural-living | -0.186 | 0.511 | -4.20 | 0.103 |
| Less than High-School | -0.329 | 0.624 | 1.727 | 0.778 |
| Unemployed | 0.484 | **0.029** | 0.721 | **.001** |
| Black | 0.105 | 0.822 | 0.276 | .530 |
| Hispanic | 0.285 | 0.494 | -.135 | 0.745 |
| Publicly-insured | -0.478 | **0.034** | -0.645 | **.004** |

Table 4: Logistic Regression - Different Models for Pressure Ulcers

|  |  |  |
| --- | --- | --- |
|  | Model 1 | Model 2 |
| Intercept | OR (SE) | P | OR (SE) | P |
| Rural-living | -4.20 | 0.103 | N/A | N/A |
| Less than High-School | 1.727 | 0.778 | N/A | N/A |
| Unemployed | 0.721 | **.001** | 0.673 | **.002** |
| Black | 0.276 | .530 | N/A | N/A |
| Hispanic | -.135 | 0.745 | N/A | N/A |
| Publicly-insured | -0.645 | **.004** | -0.611 | **.005** |

bibliography

Aneshensel, C. S., Wight, R. G., Miller-Martinez, D., Botticello, A. L., Karlamangla, A. S., & Seeman, T. E. (2007). Urban neighborhoods and depressive symptoms among older adults. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, *62*(1), S52–S59. https://doi.org/10.1093/geronb/62.1.S5

Beck, A. T., Epstein, N., Brown, G., Steer, R. A., & others. (1988). An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology*, *56*(6), 893–897. https://doi.org/10.1037/0022-006X.56.6.893

Botticello, A. L., Boninger, M., Charlifue, S., Chen, Y., Fyffe, D., Heinemann, A., … Rohrbach, T. (2016). To What Extent Do Neighborhood Differences Mediate Racial Disparities in Participation After Spinal Cord Injury? *Archives of Physical Medicine and Rehabilitation*, *97*(10), 1735–1744. https://doi.org/10.1016/j.apmr.2016.04.007

Botticello, A. L., Chen, Y., Cao, Y., & Tulsky, D. S. (2011). Do communities matter after rehabilitation? The effect of socioeconomic and urban stratification on well-being after spinal cord injury. *Archives of Physical Medicine and Rehabilitation*, *92*(3), 464–71. https://doi.org/10.1016/j.apmr.2010.08.028

Botticello, A. L., Chen, Y., & Tulsky, D. S. (2012). Geographic variation in participation for physically disabled adults: the contribution of area economic factors to employment after spinal cord injury. *Social Science & Medicine (1982)*, *75*(8), 1505–13. https://doi.org/10.1016/j.socscimed.2012.06.010

Clarke, P., & George, L. K. (2005). The role of the built environment in the disablement process. *American Journal of Public Health*. https://doi.org/10.2105/AJPH.2004.054494

Devivo, M. J. (2012). Epidemiology of traumatic spinal cord injury: Trends and future implications. In *Spinal Cord* (Vol. 50, pp. 365–372). https://doi.org/10.1038/sc.2011.178

DeVivo, M. J., & Farris, V. (2011). Causes and Costs of Unplanned Hospitalizations Among Persons with Spinal Cord Injury. *Topics in Spinal Cord Injury Rehabilitation*, *16*(4), 53–61. https://doi.org/10.1310/sci1604-53

Dijkers, M. P. J. M. (2004). Quality of life of individuals with spinal cord injury: A review of conceptualization, measurement, and research findings. *The Journal of Rehabilitation Research and Development*, *42*(3sup1), 87. https://doi.org/10.1682/JRRD.2004.08.0100

Freedman, V. A., Grafova, I. B., Schoeni, R. F., & Rogowski, J. (2008). Neighborhoods and disability in later life. *Social Science and Medicine*, *66*(11), 2253–2267. https://doi.org/10.1016/j.socscimed.2008.01.013

Fyffe, D. C., Botticello, A. L., & Myaskovsky, L. (2011). Vulnerable Groups Living with Spinal Cord Injury. *Topics in Spinal Cord Injury Rehabilitation*, *17*(2), 1–9. https://doi.org/10.1310/sci1702-01

Fyffe, D. C., Deutsch, A., Botticello, A. L., Kirshblum, S., & Ottenbacher, K. J. (2014). Racial and ethnic disparities in functioning at discharge and follow-up among patients with motor complete spinal cord injury. *Archives of Physical Medicine and Rehabilitation*, *95*(11), 2140–2151. https://doi.org/10.1016/j.apmr.2014.07.398

Goodridge, D., Rogers, M., Klassen, L., Jeffery, B., Knox, K., Rohatinsky, N., & Linassi, G. (2014). Access to health and support services: perspectives of people living with a long-term traumatic spinal cord injury in rural and urban areas. *Disability and Rehabilitation*, *8288*(October), 1–10. https://doi.org/10.3109/09638288.2014.972593

Hagglund, K. J., Clay, D. L., & Acuff, M. (1998). Community reintegration for persons with spinal cord injury living in rural America. *Topics in Spinal Cord Injury Rehabilitation*, *4*(2), 28–40. https://doi.org/10.1310/3502-06MD-F2NK-LBGK

Hall, K. M., Dijkers, M., Whiteneck, G., Brooks, C. a, Krause, J. S., K.M., H., … J.S., K. (1998). The Craig Handicap Assessment and Reporting Technique (CHART): metric properties and scoring. *Topics in Spinal Cord Injury Rehabilitation*, *4*(1), 16–30. https://doi.org/10.1310/V5RU-FRFE-50E6-E2NA

Hwang, M., Chlan, K. M., Vogel, L. C., & Zebracki, K. (2012). Substance use in young adults with pediatric-onset spinal cord injury. *Spinal Cord*, *50*(7), 497–501. https://doi.org/10.1038/sc.2012.8

Kim, D., & Kawachi, I. (2006). A multilevel analysis of key forms of community- and individual-level social capital as predictors of self-rated health in the United States. *Journal of Urban Health*, *83*(5), 813–826. https://doi.org/10.1007/s11524-006-9082-1

Kirsh, B., Stergiou-Kita, M., Gewurtz, R., Dawson, D., Krupa, T., Lysaght, R., & Shaw, L. (2009). From margins to mainstream: What do we know about work integration for persons with brain injury, mental illness and intellectual disability? *Work*. https://doi.org/10.3233/WOR-2009-0851

Liang, H., Tomey, K., Chen, D., Savar, N. L., Rimmer, J. H., & Braunschweig, C. L. (2008). Objective measures of neighborhood environment and self-reported physical activity in spinal cord injured men. *Archives of Physical Medicine and Rehabilitation*, *89*(8), 1468–1473. https://doi.org/10.1016/j.apmr.2008.01.017

Lishner, D. M., Richardson, M., Levine, P., & Patrick, D. (1996). Access to Primary Health Care Among Persons With Disabilities in Rural areas: A Summary of the Literature. *The Journal of Rural Health*, *12*, 45–53. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10172606

Lyubomirsky, S., & Lepper, H. (1999). A measure of subjective hap- piness: Preliminary reliability and construct validation. *Social Indicators Research*, *46*, 137–155.

National Spinal Cord Injury Statistical Center (NSCISC). (2013). SCPavot, W., & Diener, E. (1993). Review of the Satisfaction With Life Scale. *Psychological Assessment*, *5*(June), 164–172. https://doi.org/10.1037/1040-3590.5.2.164

Pham-Kanter, G. (2009). Social comparisons and health: Can having richer friends and neighbors make you sick? *Social Science and Medicine*, *69*(3), 335–344. https://doi.org/10.1016/j.socscimed.2009.05.017

Runciman, W. G. (1966). Relative Deprivation and Social Justice. *Journal of Personality & Social Psychology*, *3*(5), 611. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=sih&AN=16644465&site=ehost-live

St. Andre, J. R., Smith, B. M., Stroupe, K. T., Burns, S. P., Evans, C. T., Ripley, D. C., … Weaver, F. M. (2011). A Comparison of Costs and Health Care Utilization for Veterans with Traumatic and Nontraumatic Spinal Cord Injury. *Topics in Spinal Cord Injury Rehabilitation*, *16*(4), 27–42. https://doi.org/10.1310/sci1604-27

Ware, J. E., Kosinski, M., Bjorner, J. B., Turner-Bowker, D. M., Gandek, B., Maruish, M. E., & others. (2008). *User’s manual for the SF-36v2 Health Survey*. Quality Metric.

Whiteneck, G. G., Brooks, C. A., Charlifue, S., Gerhart, K. A., Mellick, D., Overholser, D., & Richardson, G. N. (1992). Guide for use of the CHART. *Craig Hospital, Englewood (CO)*.

Wight, R. G., Aneshensel, C. S., Miller-Martinez, D., Botticello, A. L., Cummings, J. R., Karlamangla, A. S., & Seeman, T. E. (2006). Urban neighborhood context, educational attainment, and cognitive function among older adults. *American Journal of Epidemiology*, *163*(12), 1071–1078. https://doi.org/10.1093/aje/kwj176