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The Effect of Visual Impairment on Return to Work for Vocational Rehabilitation Consumers with Traumatic Brain Injury

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Abstract

The purpose of this study was to evaluate the impact of visual impairment on return to work for vocational rehabilitation (VR) consumers with traumatic brain injury (TBI). Individuals with TBI between the ages of 18 and 67 who received services from state-federal VR agencies were included in the sample. Hierarchical generalized linear modeling was used to identify factors that predict employment following TBI. Visual impairment caused by TBI (VI-TBI) was the primary independent variable of interest and competitive employment at case closure was the outcome measure. VI-TBI was negatively associated with obtaining employment. Other predictors of employment for those with TBI were also identified.

Keywords: visual impairment, traumatic brain injury, return to work, employment, vocational rehabilitation

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Traumatic brain injury (TBI) is a major public health concern in the United States and a prevalent cause of disability and death (Centers for Disease Control and Prevention, 2019). Approximately 3.2 to 5.3 million Americans experience a TBI-related disability.(Centers for Disease Control and Prevention, 2015) The health effects of TBI vary widely across individuals and can lead to functional limitations, disability, and reduced quality of life (Centers for Disease Control and Prevention, 2015). Common TBI symptoms include cognitive deficits, behavioral and emotional changes, somatic symptoms, motor impairments, and sensory impairments, including changes in vision (Centers for Disease Control and Prevention, 2015).

A multitude of vision changes can occur following a TBI, including visual impairment (i.e., blindness or low vision due to visual acuity loss or visual field deficits) and visual dysfunction. The occurrence of visual impairment and visual dysfunction following TBI has been widely acknowledged in the ophthalmology and brain injury fields. Common visual problems and conditions that occur with TBI include reduced visual acuity (Armstrong, 2018; Suchoff, Gianutsos, Ciuffreda, & Groffman, 2000), visual field defects (Armstrong, 2018; Goodrich, Flyg, Kirby, Chang, & Martinsen, 2013; Greenwald, Kapoor, & Singh, 2012), photophobia (Digre & Brennan, 2012; Goodrich et al., 2013; Greenwald et al., 2012; Kapoor & Ciuffreda, 2002; O’Neil et al., 2014), oculomotor deficits (Goodrich et al., 2013; Greenwald et al., 2012), and binocular vision disorders (Goodrich et al., 2013; Kapoor & Ciuffreda, 2002; O’Neil et al., 2014; Stelmack, Frith, Van Koevering, Rinne, & Stelmack, 2009). Although some of these vision changes are short-lived and resolve over time, others are long-lasting or permanent (Magone, Kwon, & Shin, 2014) and result in functional impairment or disability (Kingston, Katsaros, Vu, & Goodrich, 2010).

Comorbid TBI and visual impairment has received increased attention among U.S. servicemembers and veterans who incurred blast-related head injuries during deployments to Iraq and Afghanistan (Goodrich et al., 2013; O'Neil et al., 2014; Okie, 2005; Walsh et al., 2015). Two studies were identified that evaluated the incidence of visual impairment, as opposed to more general visual dysfunction or problems, following TBI. One study that evaluated the frequency of visual impairment among both inpatient and outpatient veterans with TBI found that visual impairment in terms of significant acuity loss and visual field loss were much more common among inpatients (13% and 32.3% respectively) than outpatients (1.2% and 3.6% respectively) (Brahm et al., 2009). A second study retrospectively assessed the presence of visual impairment in medical records of veterans with a blast-related TBI, and found that 0.4% were diagnosed with blindness or low vision, while 1.9% were diagnosed with visual disturbances, and that the incidence of visual problems was strongly associated with TBI severity (Dougherty, MacGregor, Han, Heltemes, & Galarneau, 2011). However, the authors noted that their methodology likely underestimated the actual occurrence of visual problems. Self-report of visual problems following TBI are much more common, at 50% or above, in veteran populations (Brahm et al., 2009; Bulson, Jun, & Hayes, 2012). In a population study investigating negative outcomes of previous TBIs, self-report of poor vision increased with severity of TBI (up to more than 20% for those with severe TBI), and people who experienced all severity levels of TBI reported a significantly higher prevalence of vision problems than people without an injury history (Whiteneck, Cuthbert, Corrigan, & Bogner, 2016).

Visual impairment following a TBI can impact multiple domains of functioning, many of which are important for successful rehabilitation. Vision has a role in balance, gait, attention, and activities of daily living (Greenwald et al., 2012). Accordingly, many aspects of TBI rehabilitation rely on visual input (Ciuffreda et al., 2007; Greenwald et al., 2012). Experiencing visual impairment as a result of TBI can lead to complexities in the rehabilitation process (Iskow, 2010; Kingston et al., 2010), thereby adversely impacting rehabilitation after TBI (Kapoor & Ciuffreda, 2002). Conventional vision rehabilitation techniques have had reduced success among veterans who experienced brain-injury-related vision loss (Koons, Johnson, Kingston, & Goodrich, 2010). Return to work following TBI may also be negatively affected by visual impairment.

Return to Work for Persons With TBI

Return to work is an important outcome for persons with TBI; working promotes financial independence, community engagement, and well-being (Johnstone, Vessell, Bounds, Hoskins, & Sherman, 2003), and not returning to work increases the cost of the TBI and reduces quality of life (Dijkers, 2004; Mar et al., 2011; Matérne, Strandberg, & Lundqvist, 2018). Approximately 41% of people with a TBI return to work within the two years following their injury (van Velzen, van Bennekom, Edelaar, Sluiter, & Frings-Dresen, 2009).

Impact of Vision Problems

Results of some studies have suggested that, among persons with TBI, vision problems are associated with even worse employment outcomes. In one study, fewer persons with severe head injury who successfully returned to work had a perception or vision disability compared to those who returned to work but did not retain their job and those who did not attempt to work (Johnson, 1987). Long-term follow-up studies of veterans with TBI 15 years post-injury indicated that visual impairment (i.e., bilateral impaired field or acuity) was associated with significantly lower employment rates (Dresser et al., 1973) and visual field loss was one of seven impairments most correlated with work status (Schwab, Grafman, Salazar, & Kraft, 1993). Persons with severe TBI who were classified by employment specialists as being “most difficult” to place were more likely to have a visual impairment (Wehman et al., 1993). Poor vision was one of the most common perceived obstacles to employment reported by unemployed persons with TBI (Witol, Sander, Seel, & Kreutzer, 1996). Despite evidence from these early studies indicating that persons with comorbid TBI and visual impairment may be at risk for poor employment outcomes, it does not appear that vision loss has been investigated as a factor potentially associated with employment for persons with TBI since the mid-1990s.

Literature Reviews

A number of literature reviews have been conducted on return to work for persons with TBI (Crepeau & Scherzer, 1993; Ownsworth & McKenna, 2004; Saltychev, Eskola, Tenovuo, & Laimi, 2013; Shames, Treger, Ring, & Giaquinto, 2007; Yasuda, Wehman, Targett, Cifu, & West, 2001); however, only the two earliest reviews mentioned visual impairment (Crepeau & Scherzer, 1993; Yasuda et al., 2001). Findings from these reviews were generally inconsistent, which may be attributed to methodological differences, such as variability in measures and outcomes (Yasuda et al., 2001) and inconsistent terminology, scales, and samples (Saltychev et al., 2013). Despite these differences, the reviews yielded several common sociodemographic, post-injury, and service-related predictors of employment following TBI. The authors found the strongest associations with pre-injury occupational status (Crepeau & Scherzer, 1993; Ownsworth & McKenna, 2004; Saltychev et al., 2013; Shames et al., 2007), early post-injury emotional and behavioral indicators (Crepeau & Scherzer, 1993; Ownsworth & McKenna, 2004), functional status at discharge from acute care (Ownsworth & McKenna, 2004), and post-injury neuropsychological indicators such as cognitive impairments and executive functioning (Crepeau & Scherzer, 1993; Ownsworth & McKenna, 2004; Yasuda et al., 2001).

Most pre-injury sociodemographic factors had weak or limited support, including age (Crepeau & Scherzer, 1993; Saltychev et al., 2013; Shames et al., 2007; Yasuda et al., 2001), gender (Crepeau & Scherzer, 1993; Ownsworth & McKenna, 2004; Saltychev et al., 2013), race (Saltychev et al., 2013), and education level (Crepeau & Scherzer, 1993; Saltychev et al., 2013; Shames et al., 2007). Early post-injury variables with weak or limited evidence were: injury severity measures (Crepeau & Scherzer, 1993; Saltychev et al., 2013; Shames et al., 2007); length of hospitalization (Crepeau & Scherzer, 1993; Shames et al., 2007); self-awareness of deficits (Crepeau & Scherzer, 1993; Shames et al., 2007; Yasuda et al., 2001); driving status or transportation difficulties (Crepeau & Scherzer, 1993; Shames et al., 2007; Yasuda et al., 2001); visual deficits, including visual field loss (Crepeau & Scherzer, 1993; Yasuda et al., 2001); and language deficits (Crepeau & Scherzer, 1993). In terms of service-related factors that are associated with employment outcomes, receipt of vocational rehabilitation (VR) services had moderate support (Crepeau & Scherzer, 1993; Ownsworth & McKenna, 2004). Receipt of supported employment services was supported by one review (Yasuda et al., 2001), despite mixed findings in others (Fadyl & McPherson, 2009; Saltychev et al., 2013; Shames et al., 2007). Some researchers have concluded that return to work following TBI is difficult to predict (Saltychev et al., 2013; Shames et al., 2007), partly due to the complex interaction between multiple factors that appear to influence return to work (Shames et al., 2007).

Predictors of Employment for VR Agency Consumers with TBI

Although extensive research has been conducted on return to work for persons with TBI, few studies have focused on employment for state-federal VR agency consumers. We identified only five studies of employment outcomes for VR consumers with TBI that involved multivariate analyses; only three used national Rehabilitation Services Administration Case Service Report (RSA-911) data (Catalano, Pereira, Wu, Ho, & Chan, 2006; da Silva Cardoso, Romero, Chan, Dutta, & Rahimi, 2007; Rumrill et al., 2016) and two used data from a single state agency (Gamble & Moore, 2003; Johnstone et al., 2003). Sociodemographic factors that were positively associated with employment for VR consumers with TBI include white race (Catalano et al., 2006), male gender (da Silva Cardoso et al., 2007), younger age (da Silva Cardoso et al., 2007), and higher education level (Catalano et al., 2006; da Silva Cardoso et al., 2007). In contrast, presence of a psychiatric disability (Catalano et al., 2006) and receipt of work disincentives such as Social Security disability benefits (Catalano et al., 2006; da Silva Cardoso et al., 2007; Rumrill et al., 2016) were negatively associated with employment. None of these studies included visual impairment as a predictor of employment outcomes.

Receipt of the following VR services was associated with positive employment outcomes for VR consumers with TBI: job-related services, including job placement, job search assistance, and on-the-job supports (Catalano et al., 2006; da Silva Cardoso et al., 2007; Gamble & Moore, 2003; Rumrill et al., 2016); VR counseling and guidance (da Silva Cardoso et al., 2007; Gamble & Moore, 2003; Johnstone et al., 2003); college (da Silva Cardoso et al., 2007; Gamble & Moore, 2003); occupational/vocational training (da Silva Cardoso et al., 2007; Rumrill et al., 2016); maintenance (da Silva Cardoso et al., 2007; Rumrill et al., 2016); rehabilitation technology (da Silva Cardoso et al., 2007); information and referral (Rumrill et al., 2016); and on-the-job training (Johnstone et al., 2003). On the other hand, some service-related factors were negatively associated with employment outcomes: case length (Catalano et al., 2006), transportation as a VR service (da Silva Cardoso et al., 2007), and job readiness training (Gamble & Moore, 2003).

Although visual impairment is known to be associated with TBI and can impact rehabilitation following TBI in many domains, visual impairment among those with TBI has received little attention in the return to work literature. Despite early research documenting that visual impairment can have an impact on return to work following TBI, recent research has not been conducted in this area and studies focusing on employment of VR consumers with TBI have not included visual impairment as a factor. Thus, the purpose of this study was to determine the impact of having a visual impairment on obtaining employment for state-federal VR consumers with TBI. Use of RSA-911 data for this study is advantageous because it provides a large sample of persons with TBI from across the United States who received VR services. Another advantage of using RSA-911 data is that we can generally assume participants are interested in working, which may not be the case with other data sources. Our research questions were as follows:

1. Is having a TBI-related visual impairment associated with employment outcomes for VR consumers with TBI?
2. What factors predict positive employment outcomes for VR consumers with TBI?

Method

Sample

The primary data source for this study was RSA-911 data from federal fiscal years 2013 to 2015. The study sample included individuals with TBI identified as the cause of their primary or secondary disability who received services from a VR agency in the United States and were

18 to 67 years old at VR case closure. Although individuals may have multiple impairments, only two can be identified in the RSA-911 data. We excluded individuals who received services from agencies in U.S. territories and whose cases were closed due to death, institutionalization, or incarceration. Use of data from three fiscal years was necessary to ensure a sufficiently large sub-sample of consumers who met the inclusion/exclusion criteria and who also had a visual impairment. The final sample consisted of 17,807 consumers.

The majority of the sample was White (81.0%), followed by African American (14.1%), multiple races (1.8%), Native American (1.7%), Asian (1.2%), and Hawaiian or Pacific Islander (0.3%). At VR application, 23.2% had less than a high school education, 54.0% had high school or some post-secondary education, 10.5% held associate degrees or vocational or technical certificates, and 12.3% held bachelor’s degrees or above. Cognitive disability was the most commonly identified impairment, followed by physical disability, and psychiatric disability. Only a small portion of the sample had visual impairment identified as a disability, and just 4.2% had a visual impairment caused by TBI. Additional sample demographics are provided in Table 1. [Place Table 1 here]

Dependent Variable

The dependent variable was competitive employment at VR case closure, defined as part-time or full-time work (a) in an integrated setting for an employer, (b) in self-employment, or (c) in a Business Enterprise Program position, and earning at or above the federal minimum wage. This variable was dichotomous, with 1 indicating obtainment of competitive employment and 0 indicating a non-competitive outcome (i.e., homemaker, unpaid family worker, or earned less than minimum wage) or unsuccessful closure (i.e., case closed without employment after receipt of VR services).

Independent Variables

Level-1 (individual). Level-1 variables were selected based on prior TBI research and included both personal characteristics and service-related factors.

Age at closure was a continuous variable, measured in years. Education, measured at VR application, was a continuous variable with values ranging from 0 (no formal schooling) to 12 (education above a Master's degree). Dichotomous variables included gender (1 = female, 0 = male), minority race (1 = non-White, 0 = White), ethnicity (1 = Hispanic, 0 = not Hispanic), competitive employment at application (1 = yes, 0 = no), receives SSDI (1 = yes, 0 = no), and receives SSI (1 = yes, 0 = no). The primary independent variable—visual impairment caused by TBI (VI-TBI)—was coded 1 if the person had a primary or secondary disability of visual impairment (i.e., coded as either "blindness" or "other visual impairments" in the RSA-911 data) that was caused by TBI, and 0 otherwise. The four other disability variables—visual impairment not caused by TBI, cognitive disability, physical disability, and psychiatric disability—were also coded 1 if identified as the consumer's primary or secondary disability and 0 otherwise.

We included 13 variables to indicate receipt of the following VR services: on-the-job training, disability-related skills training, rehabilitation technology, job placement assistance, job search assistance, job readiness training, on-the-job supports (short term), on-the-job supports (supported employment), VR counseling and guidance, maintenance, information and referral services, occupational or vocational training, and transportation; all were coded 1 if the consumer received the service and 0 if not. Receipt of degree or certificate indicated whether consumers advanced their education while receiving VR services (1 = obtained a degree or certificate, 0 = did not obtain a degree or certificate). Case length, a continuous variable, was defined as the number of months between VR application and case closure. Detailed information about these variables is available in the RSA-911 reporting manual (PD-14-01) on the RSA website (https://www2.ed.gov/policy/speced/guid/rsa/subregulatory/pd-16-04.pdf).

Level-2 (state). To account for state-level factors that may influence employment outcomes, we included three level-2 variables: state population (U.S. Census Bureau, 2019), per capita personal income (SSTI, 2016), and state unemployment rate (U.S. Bureau of Labor Statistics, 2019).

Data Analyses

We utilized descriptive statistics to describe the sample characteristics, independent variables, and dependent variable. Given our two-level data structure and dichotomous outcome variable, we used hierarchical generalized linear modeling to identify factors that predict competitive employment. To conduct the analysis, we utilized HLM 7 software (Raudenbush, Bryk, Cheong, & Congdon, 2011) with full penalized quasi-likelihood estimation, logit link function, and unit-specific estimation of fixed effects. We used a modified sequential variable entry approach (Heck, Thomas, & Tabata, 2012) to build the model, starting with an unconditional two-level model. We then added the 28 level-1 variables, followed by the three level-2 variables. The continuous variables at both levels were grand-mean centered. Because VI-TBI was our primary variable of interest, we also tested interactions between VI-TBI and other independent variables, and retained the two statistically significant interactions. Given our very large sample size, we utilized effect sizes (odds ratios) to evaluate the relative importance of our significant predictors. The conventions of small (OR=1.68), medium (OR=3.47), and large (OR=6.71) were used to describe the magnitude of the odds ratios' effects (Chen, Cohen, & Chen, 2010).

Results

Descriptive statistics for model variables are provided in Table 1. Half of the sample (50.4%) was competitively employed at case closure. The estimated variance component among agencies for the unconditional model was 0.096 (τ_{00}), $\chi^2(50) = 423.73$, $p < .001$, signifying that significant variability in employment existed across state VR agencies. The intra-class correlation coefficient was 0.029, indicating that 2.9% of the variability in the odds of being competitively employed at VR closure occurred at the VR agency level, rather than the individual (consumer) level (Anderson, Kim, & Keller, 2013). This significant unconditional model supported the application of a multilevel model, which has more robust significance tests than a single-level model such as logistic regression. Table 2 displays the estimated coefficients, standard errors, odds ratios with 95% confidence intervals, and *p*-values of all variables for the hierarchical generalized linear model. Our primary variable of interest, VI-TBI, was significantly negatively associated with achieving employment, although the effect size was very small. Two interactions with VI-TBI significantly affected the odds of employment at VR closure. First, being employed at application resulted in higher odds of employment at closure for individuals with VI-TBI compared to those without VI-TBI. Second, receipt of disability-related skills training was negatively associated with employment for those with VI-TBI (small effect), but the relationship between receiving disability-related skills training and employment was not significant for those without VI-TBI. [Place Table 2 here]

Discussion

This is the first recent study to consider the impact of having TBI-related visual impairment on employment for individuals with a TBI. In addition, our study adds to the small body of literature utilizing national VR data to evaluate predictors of employment for this population. Approximately half of the individuals with TBI who sought assistance from VR in obtaining employment did obtain competitive employment after receiving services. Individuals with VI-TBI had lower rates of success, with only 42.2% obtaining employment. Our multivariate analyses documented that the odds of achieving employment are significantly different based on the presence of VI-TBI, even when controlling for other factors. The negative effect of having VI-TBI on employment is similar to the effect of having a psychiatric disability or a physical disability. Neither having a cognitive disability nor a visual impairment not caused by TBI were significantly associated with employment.

VI-TBI also significantly interacted with two other predictor variables, one indicating a disadvantage for individuals with VI-TBI and one indicating an advantage. First, individuals with VI-TBI who received disability-related skills training as a service were substantially less likely to obtain employment. Disability-related skills training often involves training in the use of alternative (often non-visual) techniques for individuals with visual impairments, such as braille, orientation and mobility, and independent living skills. This finding potentially indicates that individuals who received this training had a more severe visual impairment. With a severe visual impairment, individuals will likely face additional challenges in adapting to TBI. In addition, cognitive impacts of the TBI can make learning alternative non-visual techniques much more challenging. These types of skills are generally prerequisites for employment for those with significant visual impairments.

The second interaction indicated that being competitively employed at application to VR was a stronger predictor of employment at termination of VR services for individuals with VI-TBI compared to those without VI-TBI. Reasons for this are unclear, although we do know that VR consumers with visual impairments are much more likely to enter VR services with employment than those with other disabilities (Crudden, McDonnall, & Sui, 2018). Being employed at application is typically a strong predictor of employment at the end of services for individuals with visual impairments (Cavenaugh & Giesen, 2012; McDonnall & Cmar, 2019). One study documented that while employment at application was a moderate to strong predictor of employment for those with sensory impairments (visual or hearing impairments), it was only a small to moderate predictor for those with other disabilities (Dutta, Gervey, Chan, Chou, & Ditchman, 2008). Similarly, in this TBI sample, employment at application was a small to moderate predictor of employment, while the relationship was much stronger for those with VI-TBI, as evidenced by the significant interaction between VI-TBI and employment at application. One hypothesis concerning the greater benefit of employment at application for those with visual impairments is that this group may be more likely to have applied to VR specifically for assistance with job retention and need less comprehensive services (such as a worksite accommodation or assistive technology).

Our multilevel analyses documented that a very small amount of variability (less than 3%) was present at the agency level. This amount of variability is smaller than the amount documented in other studies utilizing multilevel modeling with a VR population (Alsaman & Lee, 2017; F. Chan et al., 2016; Giesen & Cavenaugh, 2013), but it is similar to one study (Chan et al., 2014). This finding indicates that differences between agencies do not contribute much to whether individuals with TBI served by VR obtain employment. Instead, individuals' personal characteristics and services received explain the variance in employment outcomes. As found in other studies of predictors of employment for those with TBI (Ownsworth & McKenna, 2004; Saltychev et al., 2013), our significant predictor variables tended to have small effect sizes. Only two personal characteristic variables exceeded a small effect (receipt of SSI benefits and employment at application), and those effects were in the small to medium range. Four service-related variables exceeded a small effect size, but only one was in the medium range (short-term on-the-job supports) and one was in the medium to large range (receipt of degree or certificate). Receiving on-the-job support services indicate that the person had a job while receiving VR services; therefore, its stronger association with employment at case termination is understandable. Two of the other variables warrant additional consideration. Receipt of SSI benefits is a substantial risk factor for this population to return to work. VR professionals who work with individuals with TBI should be aware of this, and provide or refer these individuals for benefits counseling to attempt to mitigate this risk. While receipt of a degree or certificate may indicate that the long-term impact of the TBI is less severe, enabling individuals to succeed at furthering their education and obtaining a job, this is an important finding for VR professionals. It indicates that if consumers are capable of advancing their education, they should be afforded that opportunity and encouraged to do so.

Limitations

While use of the RSA-911 data presents some advantages, it also results in some limitations of the study that should be acknowledged. First, although the data includes numerous personal characteristic and service-related variables, it does not include several variables known to be related to employment for those with TBI. The data also lacks information about the TBI, such as when it occurred and severity level. We do know that the TBI resulted in at least one documented disability for each individual in the study, indicating that the TBI had a lasting functional impact. Another data limitation is that only two disabilities per person can be documented in the system. Because people who experience TBI often have disability or dysfunction in more than two areas, it is possible that some participants who had a visual impairment were not identified as such.

Conclusions

Research related to employment outcomes for people with TBI has a long history, and in the past, attention was paid to visual impairment as a risk factor for employment (Crepeau & Scherzer, 1993; Yasuda et al., 2001). Although visual impairment as an effect of TBI has received more attention recently, it is still often overlooked, despite its apparent negative impact on rehabilitation (Greenwald et al., 2012; Kapoor & Ciuffreda, 2002; Kingston et al., 2010). Recent research has not evaluated visual impairment as a risk factor in terms of employment for this population, but our results suggest that it should be considered. One challenge may be that visual impairment is not well-documented in data that is available to investigate employment for those with TBI. A study utilizing the Traumatic Brain Injury Model System data found that a very low percentage of participants had a documented visual impairment, lower than available estimates and much lower than the prevalence of VI-TBI in this sample (McDonnall, unpublished data, March 2019). Given its potential effect on all aspects of rehabilitation and ultimately employment, it is vital that clinicians and researchers pay attention to the presence and impact of visual impairments on individuals who sustain a TBI.

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Table 1

Descriptive Statistics for Individual-level Variables by Employment Group at VR Closure

Variables	**Competitively Employed**	**Not Competitively employed**	**Overall**
Personal characteristics			
Female	31.9	33.7	32.8
Age at closure	37.3 (12.7)	39.0 (13.0)	38.1 (12.9)
Minority race	16.6	21.3	19.0
Hispanic ethnicity	7.4	8.5	7.9
Education	4.9 (2.1)	4.6 (2.1)	4.8 (2.1)
Competitive employment at application	16.9	6.5	11.7
Receives SSDI	30.1	34.6	32.3
Receives SSI	16.8	28.0	22.4
Visual impairment caused by TBI	3.5	4.8	4.2
Visual impairment not caused by TBI	1.9	2.1	2.0
Cognitive disability	70.4	64.0	67.2
Physical disability	39.4	44.8	42.1
Psychiatric disability	24.3	27.1	25.7
Service-related factors			
Receipt of degree or certificate	13.0	5.0	9.0
On-the-job training	4.2	2.6	3.4
Disability-related skills training	3.8	4.5	4.1

Rehabilitation technology	13.7	11.2	12.5
Job placement assistance	45.8	26.6	36.3
Job search assistance	35.8	26.0	31.0
Job readiness training	15.0	13.6	14.3
On-the-job supports (short term)	14.3	4.0	9.2
On-the-job supports (supported employment)	10.7	5.1	8.0
VR counseling and guidance	64.0	57.7	60.9
Maintenance	21.5	14.4	17.9
Information and referral services	23.9	19.5	21.7
Occupational or vocational training	12.0	10.0	11.0
Transportation	31.7	33.0	32.4
Case length in months	29.7 (26.9)	38.7 (30.5)	34.2 (29.1)

Note. Values are proportions or means. Standard deviations are presented in parentheses adjacent to means. VR = vocational rehabilitation. SSDI = Social Security Disability Insurance. SSI = Supplemental Security Income. SSDI, SSI, and education were at application. Total N = 17,807; competitively employed at VR closure, n = 8,971; not competitively employed at VR closure, n = 8,836.

Table 2

Predicting Competitive Employment at VR Closure using Hierarchical Generalized Linear Modeling

Variable	**Coefficient**	***SE***	**OR**	**95% CI**	***p***
State/agency-level					
State population	-0.01	<0.01	0.99	(0.99, 0.99)	<.01
Per capita income	<0.01	<0.01	1.00	(1.00, 1.01)	.23
Unemployment rate	0.02	0.02	1.02	(0.99, 1.06)	.23
Individual-level					
Personal characteristics					
Female	-0.09	0.04	0.91	(0.85, 0.98)	.01
Age at closure	-0.02	<0.01	0.98	(0.98, 0.99)	<.01
Minority race	-0.17	0.04	0.84	(0.77, 0.92)	<.01
Hispanic ethnicity	-0.08	0.06	0.92	(0.82, 1.05)	.22
Education	0.07	0.01	1.07	(1.06, 1.09)	<.01
Employment at application	0.94	0.06	2.55	(2.28, 2.86)	<.01
Receives SSDI	-0.27	0.04	0.76	(0.71, 0.82)	<.01
Receives SSI	-0.69	0.04	0.50	(0.46, 0.55)	<.01
Visual impairment caused by TBI (VI-TBI)	-0.34	0.11	0.72	(0.58, 0.88)	<.01
Visual impairment not caused by TBI	-0.10	0.12	0.91	(0.71, 1.16)	.44
Cognitive disability	0.04	0.04	1.04	(0.96, 1.14)	.30
Physical disability	-0.12	0.04	0.88	(0.82, 0.96)	<.01

Psychiatric disability	-0.24	0.04	0.78	(0.72, 0.85)	<.01
Service-related factors					
Receipt of degree or certificate	1.58	0.07	4.85	(4.24, 5.55)	<.01
On-the-job training	0.42	0.10	1.53	(1.27, 1.84)	<.01
Disability-related skills training	0.01	0.10	1.01	(0.83, 1.23)	.94
Rehabilitation technology	0.47	0.06	1.60	(1.43, 1.78)	<.01
Job placement assistance	0.82	0.04	2.27	(2.11, 2.44)	<.01
Job search assistance	0.15	0.04	1.17	(1.08, 1.26)	<.01
Job readiness training	-0.01	0.05	0.99	(0.90, 1.09)	.82
On-the-job supports (short term)	1.21	0.07	3.35	(2.94, 3.83)	<.01
On-the-job supports (supported employment)	1.02	0.07	2.78	(2.44, 3.17)	<.01
VR counseling and guidance	0.02	0.04	1.02	(0.95, 1.10)	.61
Maintenance	0.46	0.05	1.59	(1.45, 1.74)	<.01
Information and referral services	0.02	0.04	1.02	(0.93, 1.11)	.68
Occupational or vocational training	0.29	0.06	1.34	(1.20, 1.50)	<.01
Transportation	-0.08	0.04	0.92	(0.85, 0.99)	.03
Case length in months	-0.02	<0.01	0.98	(0.98, 0.99)	<.01
VI-TBI * Competitive employment at application	0.97	0.29	2.65	(1.50, 4.68)	<.01
VI-TBI * Disability-related skills training	-0.53	0.23	0.59	(0.38, 0.92)	.02