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Service Factors and Personal Characteristics Associated with Employment and Job Quality for Vocational Rehabilitation Consumers with Combined Traumatic Brain Injury and Visual Impairment

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Abstract

BACKGROUND: Visual impairment following traumatic brain injury (TBI) is common, but little research has been conducted regarding employment outcomes for individuals with combined TBI and visual impairment.

OBJECTIVE: The purpose of this study was to determine whether service-related factors, including vocational rehabilitation (VR) agency service strategies, and consumer personal characteristics are associated with competitive employment and job quality for this population.

METHOD: Rehabilitation Services Administration Case Service Report data from fiscal years 2013-2015 was combined with VR agency interview data about strategies utilized for providing services to these consumers. Multilevel modeling was used to determine the predictive ability of nine state/agency-level and 27 individual-level variables.

RESULTS: Two service strategies were significantly associated with competitive employment: "staff with dual expertise" and "staff training on TBI." Service strategies were not associated with job quality. Ten individual-level factors were significantly associated with competitive employment and eight were significantly associated with job quality.

CONCLUSIONS: Having staff with dual expertise in TBI and visual impairment was a strong predictor of competitive employment; educating staff about TBI was also important. VR agencies are encouraged to educate their staff who work with consumers with visual impairment about TBI, including developing expertise in one or more staff members.

Service Factors and Personal Characteristics Associated with Employment and Job Quality for Vocational Rehabilitation Consumers with Combined Traumatic Brain Injury and Visual Impairment

1. Introduction

Traumatic brain injury (TBI), defined as an injury that causes a disruption to the normal function of the brain, is a common cause of death and disability in the United States (Centers for Disease Control and Prevention, 2019). In 2014, there were approximately 2.5 million TBI-related emergency room visits (Centers for Disease Control and Prevention, 2019) and it is estimated that between 3.2 and 5.3 million people in the United States are currently living with TBI-related disability (Centers for Disease Control and Prevention, 2015). TBI can cause a wide range of symptoms, including cognitive dysfunction, motor/mobility impairments, behavioral and emotional changes, and sensory impairments, resulting in temporary or permanent disability.

Visual impairment or dysfunction following TBI is believed to be common, although the exact prevalence is not known, and until recently, little research had been conducted on this topic (Greenwald, Kapoor, & Singh, 2012). With the high incidence of TBI in veterans returning home from recent wars and the increasing recognition of vison-related symptoms as possible long-term sequelae of TBI, the occurrence of combined TBI and visual impairment among veterans has received considerable attention (O'Neil et al., 2014). A literature review investigating the prevalence of specific types of visual dysfunctions indicated that estimates from studies varied widely based on the population studied, study setting, and whether participants were screened for visual dysfunction (O'Neil et al., 2014). In this review, the prevalence of formally diagnosed visual impairment or dysfunction ranged from 0.4 to 22% and self-reported visual impairment or dysfunction ranged from 8.8 to 77.4%.

Neurological vision rehabilitation, used for the treatment of vision problems following TBI, has been studied extensively (Kingston, Katsaros, Vu, & Goodrich, 2010), but virtually no research has been conducted regarding rehabilitation to employment for people who experience a TBI and a visual impairment. We know that employment is problematic for those with a TBI as well as for individuals with visual impairments. Employment following TBI is often considered the ultimate rehabilitation outcome, and employment is associated with greater quality of life among those with TBI (O'Neill et al., 1998; Steadman-Pare, Colantonio, Ratcliff, Chase, & Vernich, 2001). Large bodies of research exist regarding predictors of employment for people post-TBI and for people with visual impairments.

1.1. Predictors of employment for individuals with TBI

Only about 41% of people who experience a TBI return to work within two years of injury (van Velzen, van Bennekom, Edelaar, Sluiter, & Frings-Dresen, 2009). Hundreds of studies that evaluated factors associated with employment or return to work for people with TBI have been conducted, summarized in multiple comprehensive and systematic literature reviews (e.g., Crepeau & Scherzer, 1993; Ownsworth & McKenna, 2004; Saltychev, Eskola, Tenovuo, & Laimi, 2013; Shames, Treger, Ring, & Giaquinto, 2007; Yasuda, Wehman, Targett, Cifu, & West, 2001). In general, these reviews found inconsistencies in relationships between predictor variables and employment outcomes, thought to be caused by methodological differences, such as definitions of independent and dependent variables, the heterogeneity of the effects of TBI, and the complex interaction between factors (Saltychev et al., 2013; Shames et al., 2007). Few pre-existing characteristics or early post-injury factors had strong or even moderate relationships with employment, but some such as age, gender, race, education level, and various measures of injury severity had limited or weak support (Crepeau & Scherzer, 1993; Ownsworth &

McKenna, 2004; Saltychev et al., 2013). Stronger evidence exists for occupational status prior to injury and functional status at discharge from acute care, as well as for the importance of emotional status and neuropsychological indicators such as cognitive and executive functioning (Crepeau & Scherzer, 1993; Ownsworth & McKenna, 2004; Saltychev et al., 2013). Although not evaluated in many studies, there is some evidence that visual deficits are negatively associated with employment after TBI (Crepeau & Scherzer, 1993; Yasuda et al., 2001). Receipt of vocational rehabilitation (VR) services has also been identified as a factor with moderate support for its predictive validity on employment outcomes among those with TBI (Crepeau & Scherzer, 1993; Saltychev et al., 2013; Shames et al., 2007). One review endorsed the efficacy of supported employment as a VR service to help those with TBI obtain employment (Yasuda et al., 2001), but others have documented mixed findings (Fadyl & McPherson, 2009; Saltychev et al., 2013).

A limited number of studies investigating employment outcomes among individuals with TBI who received services from state-federal VR agencies have been conducted. Only five studies that included multivariate analyses were identified; two of these used data from one state agency while the remaining three utilized national VR data, referred to as the Rehabilitation Services Administration Case Service Report (RSA-911) data. The variables available in the RSA-911 data are rather limited in terms of the factors identified as being moderate or strong predictors of return to work following TBI, such as injury-related predictors and neuropsychological indicators, but they do include information about specific services received during VR and receipt of work disincentives, which have not typically been addressed in other TBI research.

The two studies that utilized data from one state identified several specific services received through VR that were associated with employment at case closure. VR counseling and guidance, college, on-the-job training, and job placement were positively associated with employment, while job readiness training was negatively associated with employment (Gamble & Moore, 2003; Johnstone, Vessell, Bounds, Hoskins, & Sherman, 2003). Gamble and Moore (2003) also found that receipt of job readiness training predicted lower earnings and that receipt of job placement, college, and assessment interacted to predict higher earnings.

One of the studies that utilized national RSA-911 data included demographic characteristics, work disincentives, and VR services as predictors of employment for all consumers with TBI closed during fiscal year 2004 (Catalano, Pereira, Wu, Ho, & Chan, 2006). Factors positively associated with competitive employment rates were White race; higher education level; and receipt of job-related services (i.e., job placement, job search, and on-the-job supports), VR counseling and guidance, and maintenance. Factors negatively associated with competitive employment were receipt of work disincentives (measured as the number of government benefits received), presence of a psychiatric disability, and case length. Another national study focused on disparities in outcomes for Hispanic consumers with TBI, but also evaluated predictors of employment (da Silva Cardoso, Romero, Chan, Dutta, & Rahimi, 2007). Factors positively associated with competitive employment were male gender, younger age, higher education level, receipt of eight services (VR counseling and guidance, college, occupational/vocational training, job-related services, maintenance, and rehabilitation technology). In terms of services, job-related services such as job placement and on-the-job supports had the largest effect. Receipt of work disincentives and receipt of transportation as a service were negatively associated with competitive employment. One national study evaluated

predictors of competitive employment specifically for youth with TBI (Rumrill et al., 2016). Similar to other national studies, receipt of Social Security benefits was negatively associated with employment, while receipt of several services (job-related services, maintenance, occupational/vocational training, and information and referral) were positively associated with employment.

1.2. Predictors of employment for individuals with visual impairments

Several systematic reviews have been conducted on factors associated with employment outcomes for individuals with visual impairments (Goertz, van Lierop, Houkes, & Nijhuis, 2010; Lund & Cmar, in press-a, in press-b), one of which included only RSA-911 studies of adult VR consumers (Lund & Cmar, in press-b). Three additional RSA-911 studies have been conducted in recent years, two focusing on youth (Cimera, Rumrill, Chan, Kaya, & Bezyak, 2015; Giesen & Cavenaugh, 2012) and one focusing on Social Security Disability Insurance (SSDI) beneficiaries (Giesen & Lang, 2018). Sociodemographic factors have received the most attention in this body of research. Education level was by far the most consistent predictor; higher education level was positively associated with employment (Cimera et al., 2015; Giesen & Cavenaugh, 2012; Goertz et al., 2010; Lund & Cmar, in press-a, in press-b), earnings (Lund & Cmar, in press-a, in press-b), and earnings above Substantial Gainful Activity (SGA) for SSDI beneficiaries (Giesen & Lang, 2018). Several variables that signify previous work history (e.g., working since onset of disability, and earnings or self-support at VR application) were also positively associated with employment outcomes (Giesen & Cavenaugh, 2012; Giesen & Lang, 2018; Lund & Cmar, in press-a, in press-b).

Relationships between other sociodemographic factors and employment outcomes were less consistent across reviews and studies, but several patterns were apparent. Receipt of

Supplemental Security Income (SSI) or SSDI was negatively associated with competitive employment in most RSA-911 studies (Cimera et al., 2015; Giesen & Cavenaugh, 2012; Lund & Cmar, in press-b). However, higher SSDI amount (likely indicating a more substantial work history) was positively associated with employment outcomes in two studies of SSDI beneficiaries, which supports the relationship between previous work history and employment (Giesen & Cavenaugh, 2013; Giesen & Lang, 2018). Legal blindness (vs. less severe visual impairment) was negatively associated with employment in most RSA-911 studies (Cimera et al., 2015; Giesen & Cavenaugh, 2012; Lund & Cmar, in press-b), but it was not associated with earnings above SGA (Giesen & Lang, 2018). In research conducted with data sources other than RSA-911, findings regarding severity of visual impairment were mixed (Goertz et al., 2010; Lund & Cmar, in press-a). Having a secondary disability was a negative predictor of employment in some studies (Giesen & Cavenaugh, 2012; Goertz et al., 2010; Lund & Cmar, in press-b) but not others (Lund & Cmar, in press-a), and it was negatively associated with earnings above SGA (Giesen & Lang, 2018). Findings for gender and employment were somewhat mixed; results of some studies indicated that males were more likely to be employed than females (Cimera et al., 2015; Giesen & Cavenaugh, 2012; Goertz et al., 2010; Lund & Cmar, in press-a, in press-b). Findings for gender and earnings were more congruent; male gender was positively associated with earnings (Giesen & Lang, 2018; Lund & Cmar, in press-a, in press-b). Results for age, race, and ethnicity were generally mixed across this body of literature (Goertz et al., 2010; Lund & Cmar, in press-a, in press-b).

Some RSA-911 studies also included state, agency, and service variables. Direct effects for state-level variables (e.g., unemployment rate, per capita income) were uncommon (Lund & Cmar, in press-b); however, in two studies of SSDI beneficiaries, state unemployment rate was

negatively associated with competitive employment (Giesen & Cavenaugh, 2013) and earnings above SGA (Giesen & Lang, 2018). Direct effects for VR agency type (i.e., separate agencies for individuals who are blind versus combined/general agencies) were also uncommon (Lund & Cmar, in press-b), but two studies yielded interaction effects between agency type and sociodemographic factors which indicate that separate agencies can help consumers overcome risk factors for poor outcomes (Giesen & Cavenaugh, 2013; Giesen & Lang, 2018). This finding coincides with earlier studies that specifically focused on VR agency type (Cavenaugh, 1999, 2010; Cavenaugh, Giesen, & Pierce, 2000) and a more recent study of deaf-blind consumers (McDonnall & Cmar, 2018), in which consumers were more likely to obtain employment when served by separate agencies.

Relationships between VR services and employment for consumers with visual impairments were examined most frequently in studies that focused on subpopulations of these consumers. The most consistent cross-study finding was that receipt of job-related services (particularly on-the-job supports, job placement assistance, and job search assistance) was positively associated with employment outcomes for SSDI beneficiaries (Giesen & Hierholzer, 2016; Giesen & Lang, 2018) and youth (Cimera et al., 2015; Giesen & Cavenaugh, 2012). College or university training was positively associated with competitive employment (Cimera et al., 2015), as was obtaining a degree through education as a VR service (Capella-McDonnall, 2005). Other services that were positively associated with competitive employment include rehabilitation technology, maintenance (Cimera et al., 2015; Giesen & Hierholzer, 2016); on-the-job training, VR counseling and guidance (Giesen & Hierholzer, 2016); and diagnosis and treatment (Cimera et al., 2015). Services that were negatively associated with competitive employment were job readiness training, reader services, and interpreter services (Cimera et al.,

2015; Giesen & Hierholzer, 2016), as well as assessment and disability-related skills training (Giesen & Hierholzer, 2016).

1.3. Job quality as a measure of employment outcome

Despite the large number of studies evaluating employment outcomes following TBI, we did not identify any studies that investigated job quality of individuals with TBI who did obtain employment. Although a number of studies have included earnings as an employment outcome for people with visual impairments, only one study actually measured job quality beyond earnings (Cimera et al., 2015). In that study, job quality was an objective, composite variable that included average weekly earnings, hours worked per week, and receipt of employer-based health insurance (Cimera et al., 2015). One study of predictors of employment outcomes for VR consumers who are deaf-blind also included an objective, composite measure of job quality, which consisted of earnings compared to the state's living wage and hourly wage and receipt of medical insurance through the job (McDonnall & Cmar, 2018). Common factors associated with higher job quality in those studies were education level and male gender, whereas receipt of SSI or SSDI predicted lower job quality (Cimera et al., 2015; McDonnall & Cmar, 2018). Job quality is considered an important measure of employment outcome beyond the typical dichotomous "employment or not" variable to further explore the value of the job obtained. The focus of the Workforce Innovation and Opportunity Act (WIOA, 2014) is on "high quality, competitive employment" for all VR consumers, helping them establish careers and advance in careers, and it is therefore important to look beyond a dichotomous measure of employment outcome.

1.4. Purpose of study

Individuals who have both a TBI and a visual impairment potentially have unique challenges and needs, with the experience of two very different disabilities. Although several

recent studies have addressed this population, no published studies were identified that investigated employment for this population. The purpose of this study was to determine whether strategies utilized by VR agencies to provide services to this unique population are associated with their employment outcomes, as well as identify consumer personal characteristics and other VR service factors that predict employment outcomes. The research questions we investigated were:

1. Do VR agency service strategies for consumers with combined TBI and visual impairment predict employment outcomes for this population?
2. What factors predict competitive employment for VR consumers with combined TBI and visual impairment?
3. What factors predict the quality of the job obtained by VR consumers with combined TBI and visual impairment?

2. Method

2.1. Sample

This study used RSA-911 data from fiscal years 2013, 2014, and 2015, which includes all VR consumers who were closed during each year. We selected consumers who had blindness and other visual impairments identified as their primary or secondary disability. (Note that we will continue to use the general term “visual impairment,” although almost half [46.3%] of the consumers in our sample were legally blind.) We then limited the sample to consumers who had TBI as a cause of either their primary or secondary disability. For consumers who had an additional disability beyond visual impairment, TBI could be a cause of either the visual impairment or additional disability. However, consumers whose primary or secondary disability was deaf-blindness were excluded from the sample. We further restricted the sample to

consumers between the ages of 18 and 65 who exited with or without an employment outcome after receiving VR services from a separate or combined agency in the United States. Combined agencies serve consumers with all types of disabilities in the state, while separate agencies serve consumers with blindness or visual impairment. States with separate agencies also have a general agency, which serves consumers with other types of disabilities. In our study, consumers served by general agencies were excluded. We also excluded a small number of consumers who were closed due to death or being in an institution, prison, or jail. The final sample consisted of 880 consumers from 50 agencies who had no missing data on all variables of interest.

The sample of 589 men (66.9%) and 291 women (33.1%) had an average age of 39.8 years (*SD* = 13.4). The majority were White (81.4%), followed by 13.2% African American, 2.4% Native American, 1.7% Asian, 1.1% multiple races, and 0.2% Hawaiian or Pacific Islanders. In terms of ethnicity, 9.7% were Hispanics or Latinos of any race. More than a quarter (26.9%) had less than a high school education, 47.6% had high school or some postsecondary education, 9.3% held associate degrees or vocational or technical certificates, 11.4% held Bachelor's degrees, and 4.8% had a Master's degree or above. At VR closure, a small percentage had advanced their education by receiving a higher degree (7.0%, *n* = 62) or a professional license or certificate (1.5%, *n* = 13). More than 15% of the sample (*n* = 134) was competitively employed at the time of VR application and this increased to 41.8% (*n* = 368) at case closure. Table 1 presents more detailed information about the sample overall and by competitive employment outcome.

2.2. VR agency interview data

We obtained information about VR agency strategies for providing services to consumers with combined TBI and visual impairment from state-federal VR agency interview data.

Administrators from combined and separate VR agencies in the United States participated in semi-structured telephone interviews in 2016 and 2017. All 50 states plus the District of Columbia were included in the survey, for a total of 51 agencies (27 combined agencies and 24 separate agencies). Each interview was about one hour long and covered assorted topics related to service delivery for VR consumers with visual impairments, including questions about service provision for consumers with combined TBI and visual impairment. The interviews were audio-recorded and transcribed; three researchers reviewed and analyzed the transcripts using a modified grounded theory approach (Glaser, 1998; Strauss & Corbin, 1990). More information about theme generation and coding is available in McDonnall, Cmar, and Lund (in press). The interview data yielded several strategies that VR agencies used when serving consumers with combined TBI and visual impairment. Five key strategies were included in the current study as independent variables.

2.3. Dependent variables

One dependent variable was competitive employment at case closure, defined as working at an employer job, in self-employment, or in a business enterprise program position and earning at or above the federal minimum wage. Noncompetitive employment included those who were closed as a homemaker or unpaid family worker, who did not earn at least minimum wage, and who were closed without an employment outcome after receiving VR services. Consumers closed with competitive employment were coded “1,” otherwise coded “0.”

The other dependent variable was job quality, which was operationalized based on job benefits and earnings in comparison to a living wage and state hourly wage. We created a three-factor measure for this study that consisted of (a) receipt of medical insurance through the job (yes = 1, no = 0), (b) weekly salary compared to the living wage in that state (a proportion), and

(c) hourly wage compared to state median hourly wage (a proportion). Living wage is a minimum income standard that provides financial independence; it is higher than the poverty threshold and considers cost of living in specific areas (Nadeau, 2017). A living wage has been defined for all states and some large cities.

We conducted a principal components analysis on the three job quality variables to confirm the appropriateness of combining them into a single measure and, if found appropriate, to create a single factor score to use as an outcome measure. The principal axis method was used to extract the components and ones were used as prior communality estimates. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy met the minimum acceptable cutoff (Kaiser & Rice, 1974), and Bartlett's Test of Sphericity was significant (401.34, $p < .0001$), indicating that the data were appropriate for principal components analysis. Results supported the appropriateness of retaining one factor (based on the criterion of having an eigenvalue greater than one) and all factor loadings were above .40 (i.e., .44, .94, and .90). This factor explained 63.1% of the total variance.

A factor score (a linear composite of the weighted observed variables) with a mean of 0 and a standard deviation of 1 was created to represent job quality. The job quality factor score had a range of -0.93 to 9.50 and a median of -0.36 for our sample. Positive scores indicate the person's job quality was higher than the average consumer with both a TBI and visual impairment who was closed with competitive employment, and negative scores indicate the person's job quality was lower. When considering the individual indicators used to create the measure, few consumers achieved minimum criteria to indicate a quality job: (a) 8.5% had a job that provided insurance, (b) 11.7% earned at or above a living wage, and (c) 8.1% had hourly wages at or above the state median wage. Job quality scores were available for the 368

consumers who had a competitive employment outcome; these 368 consumers represented 48 VR agencies.

2.4. Independent variables

Independent variables were in two categories: individual-level (level-1) and state/agency-level (level-2) measures.

2.4.1. Level-1 variables

We selected most of the 27 level-1 variables based on previous research documenting their association with employment for either consumers with TBI or with visual impairments; one additional variable (TBI being the cause of the visual impairment) was included based on the supposition that it might be important for this unique population. The variables consisted of personal characteristics and VR service-related factors. Demographic variables included age at VR case closure, gender (0 = male, 1 = female), minority race (0 = White, 1 = non-White), Hispanic ethnicity (0 = no, 1 = yes), and education at VR application (treated as a continuous variable ranging from 0 = No formal schooling to 12 = Education above a Master's degree). Disability-related variables included severity of vision loss (1 = legal blindness; 0 = less severe visual impairment), TBI as the cause of the visual impairment (0 = no, 1 = yes), and presence of three additional disabilities: cognitive disability, physical disability, and psychiatric disability (0 = no, 1 = yes). Receipt of SSDI and receipt of SSI were dichotomous variables (0 = no, 1 = yes). Competitive employment status at VR application was coded "1" if VR consumers worked at an employer job, self-employment, or in a business enterprise program position earning at or above the federal minimum wage. Receipt of degree or certificate was coded "1" if VR consumers obtained a higher degree or professional certificate while receiving services; otherwise, coded "0." VR case length was a continuous variable indicating months in VR between application and

case closure. Twelve VR service-related factors were coded "1" if an individual received a given VR service before closure; otherwise, coded "0." These services included 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, and occupational or vocational training. All level-1 variables were available in the RSA-911 datasets.

2.4.2. Level-2 variables

This study included nine level-2 independent variables to (a) control for state socioeconomic status and (b) determine whether agency service strategies and agency type were associated with employment outcomes. State socioeconomic status variables included state population (U.S. Census Bureau, 2019), per capita personal income (SSTI, 2016), and unemployment rate (U.S. Bureau of Labor Statistics, 2019). One level-2 agency variable was agency type, coded as "1" for a separate, or blind, agency, and "0" for a combined agency. Five agency-level service strategies identified in the VR agency interview data were included in the models: (a) collaboration, (b) dual expertise, (c) substantial involvement with external organizations, (d) specialized TBI unit, and (e) staff training on TBI. Each of these variables are described in the following paragraphs, and were coded "1" for agencies in which administrators reported using the strategy or "0" for agencies that did not use the strategy.

2.4.2.1. Collaboration

Collaboration involved working with other state-federal VR agency staff to serve consumers with combined TBI and visual impairment, and it was the most common service strategy identified (used by 46% [n=23] of agencies). The nature of this collaboration differed

slightly by agency structure. In states with separate agencies, staff from the separate and general VR agencies worked together to provide services to consumers with combined TBI and visual impairment. Some separate agency administrators reported opening dual, or joint, cases with the general agency. In combined agencies, staff from different units or divisions within the agency worked together, such as a counselor from the blind services division and a counselor with expertise in TBI.

2.4.2.2. Dual expertise

Agencies with dual expertise had at least one person on staff who had expertise in both TBI and visual impairment. One agency had one staff member with dual expertise, and two agencies had multiple personnel with dual expertise. Three agencies (6%) utilized this strategy.

2.4.2.3. Substantial involvement with external organizations

Substantial involvement with external organizations involved an ongoing partnership or working relationship with other organizations as an element of service provision for consumers with TBI and visual impairment; it was utilized by 20% (n=10) of agencies. External organizations included state or private agencies such as medical centers, rehabilitation centers, and brain injury programs.

2.4.2.4. Specialized TBI unit

Agencies with specialized TBI units had a unit, program, team, or counselors specifically for consumers with TBI. These specialized personnel were involved in service provision for consumers with combined TBI and visual impairment, as a provider of direct services in some cases. This service strategy was unique to combined agencies and was used by nine agencies (18%).

2.4.2.5. Staff training on TBI

Six agencies (12%) provided training about TBI to agency staff who serve consumers with visual impairments. Examples included training for counselors provided by the state's brain injury association and annual TBI conference attendance.

2.5. Data analyses

Given that RSA-911 data has a structure (consumers served within agencies) and we had specific level-2 variables to investigate, we utilized multilevel modeling techniques to answer our research questions. For the dichotomous dependent variable – competitive employment outcome, we employed hierarchical generalized linear modeling (HGLM) with the logit link function; for the continuous dependent variable – job quality, we employed hierarchical linear modeling (HLM). Based on a modified sequential variable entry approach (Heck, Thomas, & Tabata, 2012), we first calculated an unconditional two-level model to evaluate the variability in the employment outcome across state VR agencies. Then, we entered all of the 27 individual-level variables and examined the effect of each variable on the employment outcome. Nonsignificant level-1 variables (p-value > .25) were removed to create a more parsimonious model. We constructed the final model with all of the nine level-2 and remaining level-1 variables. All continuous variables at level-1 and level-2 were centered around the grand means, including age at closure, education at application, VR case length, state population, state per capita personal income, and state unemployment rate. HGLM and HLM analyses were conducted with HLM 7.03 software (Raudenbush, Bryk, Cheong, & Congdon, 2011). We applied full PQL (Penalized Quasi-Likelihood) estimation for the HLGM analysis and full maximum likelihood estimation for the HLM analysis. We utilized unit-specific estimation of fixed effects for the HGLM results. There was no multicollinearity found among level-1 and level-2 independent variables.

3. Results

3.1. Competitive employment

The unconditional HGLM model, which did not include any predictor variables, yielded a significant intercept (b = -0.29, OR = 0.745, p = .006) and variance component (0.20, $\chi^2(49)$ = 93.10, $p < .001$). The negative value of the intercept and its associated odds ratio indicate that consumers are more likely to be closed without competitive employment (overall, only 41.8% were closed with competitive employment). The significant variance component indicates that significant variability existed in competitive employment across state VR agencies, with 5.7% of the variability in odds of competitive employment found at the state/agency level. The next step in model development was adding individual-level consumer characteristics and VR service-related factors to the model. For model parsimony, we excluded 10 individual-level variables that were not significantly associated with competitive employment ($p > .25$) from the final model. For the final model, we included the nine level-2 variables along with the 17 level-1 variables that were retained in step 2. See Table 2 for full results of the final HGLM model.

Significant VR service-related factors associated with competitive employment were found at both level-1 and level-2. At the state/agency level, the service strategies “dual expertise in TBI and visual impairment” and “staff training on TBI” were positively associated with competitive employment, as was agency type, with consumers served by separate agencies more likely to be competitively employed. Having staff with dual expertise had the strongest association with competitive employment for state/agency-level variables. At the individual level, obtainment of an educational degree or professional certificate and the receipt of three VR job-related services were associated with higher odds of competitive employment: job placement assistance, job search assistance, and on-the-job supports (supported employment). The odds of

competitive employment were reduced for recipients of disability-related skills training and for those whose cases were open for longer periods of time. For each 6-month increase in VR case length, the odds of competitive employment decreased by 5.8%. Consumer characteristics that were significantly associated with competitive employment were receipt of SSI and minority race (both negatively associated), and competitive employment at application and education level at application (both positively associated).

3.2. Job quality

The estimated level-2 variance component for the unconditional HLM model for predicting job quality was 0.056 ($\chi^2(47) = 60.97$, $p = .08$) and the level-1 variance component was 0.952, resulting in an intraclass correlation coefficient (ICC) of 0.055. Although the level-2 variance component was not statistically significant, 5.6% of the variability in job quality was associated with state VR agencies. To build our model, we added all 27 level-1 variables to the unconditional model. The 15 individual-level variables with a *p*-value greater than .25 were removed from the model before adding the nine level-2 variables to construct the final model. The variance components were substantially reduced by the variables in the final model: 0.026 for level-2 (a 53.6% reduction) and 0.721 for level-1 (a 24.3% reduction), resulting in an ICC of 0.035. f^2 was calculated as an effect size measure for each variable in the final model; it is interpreted as the unique proportion of variance explained by the given variable relative to the proportion of outcome variance unexplained (Lorah, 2018). Table 3 displays the full results for the final HLM model.

Eight individual-level variables were associated with job quality for consumers with combined TBI and visual impairment; no state/agency-level variables were significant predictors. In order of effect size, the following variables were significant predictors of job

quality: higher education level at application, receipt of job search assistance (negative relationship), receipt of SSDI (negative relationship), receipt of SSI (negative relationship), receipt of a degree or certificate, receipt of information and referral services, female gender (negative relationship), and older age at VR case closure.

4. Discussion

This study is the first known investigation of employment outcomes for individuals with both TBI and visual impairment. We combined RSA-911 data with VR agency interview data, which allowed us to examine both individual-level and state/agency-level predictors of employment outcomes for VR consumers with combined TBI and visual impairment. Our results provide insight into service-related factors and personal characteristics that are associated with competitive employment and job quality for this population of VR consumers.

4.1. Competitive employment

Two service strategies utilized by VR agencies predicted competitive employment: (a) dual expertise in TBI and visual impairment and (b) staff training on TBI. Consumers with combined TBI and visual impairment who received services in agencies that had staff with dual expertise or agencies in which staff received training about TBI had higher odds of competitive employment than consumers who received services in other agencies. Despite the importance of these agency-level predictors, only three agencies had staff with dual expertise and an additional six had staff who received training about TBI. Our findings regarding VR agency service strategies exemplify the importance of service providers having an understanding of both TBI and visual impairment, and the larger effect size for the dual expertise variable indicates the value of having at least one person who has not just knowledge about TBI but expertise in this area.

Agency structure is another important factor associated with competitive employment for consumers with combined TBI and visual impairment. The odds of achieving competitive employment were 1.64 times higher for consumers who received services in separate agencies compared with combined agencies. This finding provides additional support for the efficacy of separate agencies in improving employment outcomes for consumers with visual impairments (Cavenaugh, 1999, 2010; Cavenaugh et al., 2000), including subpopulations: SSDI beneficiaries (Giesen & Cavenaugh, 2013; Giesen & Lang, 2018) and deaf-blind consumers (McDonnall & Cmar, 2018). Our findings add to the body of research indicating that receiving services in separate agencies can help to mitigate economic and social disadvantages and other risk factors for poor outcomes (Giesen & Cavenaugh, 2013; Giesen & Lang, 2018) and provide support for the importance of maintaining separate agencies.

Several consumer-level service variables were positively associated with competitive employment for consumers with combined TBI and visual impairment. Getting a degree or certificate while a VR consumer was associated with higher odds of competitive employment, as supported by other studies of VR consumers (Capella-McDonnall, 2005; McDonnall & Cmar, 2018). Receipt of job-related services (i.e., on-the-job supports [supported employment], job placement, and job search assistance) were also associated with higher odds of competitive employment, as found for VR consumers with TBI (Catalano et al., 2006; da Silva Cardoso et al., 2007; Rumrill et al., 2016) and visual impairments (Cimera et al., 2015; Giesen & Hierholzer, 2016). As noted by Giesen and Hierholzer (2016), this finding is not surprising, as job-related services generally indicate consumers' readiness for employment and are often provided after receipt of services meant to prepare consumers for employment. Although findings have been mixed for the efficacy of supported employment for persons with TBI (Fadyl

& McPherson, 2009; Saltychev et al., 2013; Yasuda et al., 2001), our results indicate that consumers with combined TBI and visual impairment who received on-the-job supports (supported employment) as a service had 2.7 times higher odds of competitive employment than those who did not receive this service. This finding provides initial evidence of the value of supported employment with regard to long-term on-the-job supports as a VR service for this population.

Disability-related skills training was the only service associated with lower odds of competitive employment. Although receipt of disability-related skills training is not typically associated with competitive employment outcomes for consumers with visual impairments, it was identified as a risk factor among SSDI beneficiaries (Giesen & Hierholzer, 2016). Several of the services that fall under disability-related skills training (e.g., orientation and mobility, rehabilitation teaching) involve learning alternative techniques for performing visual tasks. Accordingly, consumers who need disability-related skills training may have a more severe or more recent visual impairment than consumers who do not receive this service. Because conventional rehabilitation methods used in the visual impairment field often rely on the cognitive processes (e.g., attention, memory) that may be affected by TBI (Iskow, 2010), consumers with combined TBI and visual impairment may have difficulty learning alternative techniques, which could negatively impact their employment outcomes.

Four personal characteristics were predictors of competitive employment for consumers with combined TBI and visual impairment. Employment at application was the strongest predictor of competitive employment at closure. The odds of competitive employment were more than seven times higher for consumers who were competitively employed at application compared to those who were not, which corresponds with findings for VR consumers who are

deaf-blind (McDonnall & Cmar, 2018) and research that documented the importance of working at application for consumers with visual impairments (Cavenaugh & Rogers, 2002; Giesen & Cavenaugh, 2012, 2013; Giesen & Lang, 2018; Warren, Giesen, & Cavenaugh, 2004). A much smaller percentage of consumers with a combined TBI and visual impairment come to VR with employment compared to all consumers with visual impairments (15.1% in this sample versus 32.4% of consumers with visual impairments; Crudden, McDonnall, & Sui, 2018).

Education level at application was another factor that predicted higher odds of competitive employment for consumers with combined TBI and visual impairment, as documented in studies of consumers with TBI (Catalano et al., 2006; da Silva Cardoso et al., 2007; Rumrill et al., 2016) and visual impairments (Cimera et al., 2015; Giesen & Cavenaugh, 2012, 2013; McDonnall, 2016; Steinman et al., 2013; Warren et al., 2004). The final two personal factors were associated with lower odds of competitive employment. SSI recipients had 51.4% lower odds of competitive employment than non-recipients. This finding is consistent with research indicating that consumers with TBI or visual impairments who receive government benefits, including SSI or SSDI, are at risk for poor outcomes (Catalano et al., 2006; Cimera et al., 2015; da Silva Cardoso et al., 2007; Giesen & Cavenaugh, 2013; McDonnall, 2016; Rumrill et al., 2016). Consumers from racial minority backgrounds had 39.4% lower odds of competitive employment than White consumers, which is supported by some studies of consumers with TBI or visual impairments (Catalano et al., 2006; Giesen & Cavenaugh, 2012; Steinman et al., 2013).

We anticipated that having a visual impairment that was caused by a TBI would result in poorer employment outcomes because learning alternative techniques with a TBI would likely be more difficult. However, our results did not support that presumption. Perhaps this relationship was accounted for by the receipt of disability-related skills training variable, which was a risk

factor for competitive employment. Similarly, severity of visual impairment was not associated with employment outcomes, in contrast to RSA-911 research focusing on consumers with visual impairments (Cavenaugh & Rogers, 2002; Cimera et al., 2015; Darensbourg, 2013; Giesen & Cavenaugh, 2012, 2013; McDonnall, 2016). Variables that are not available in the RSA-911 datasets may help to explain these findings. For example, we do not have information about consumers' functional vision, when their TBI and visual impairment occurred, and related factors that may impact rehabilitation and employment outcomes for consumers with combined TBI and visual impairment.

4.2. Job quality

The job quality factor scores are specific to our sample—the scores indicate job quality in relation to the average for consumers with combined TBI and visual impairment (*not* in relation to all VR consumers). Although our job quality factor scores cannot be used to make comparisons with other disability groups, the three individual indicators that constitute the job quality factor provide a general indication of consumers' job quality. Based on the three indicators, most consumers with combined TBI and visual impairment who achieved competitive employment at VR case closure had low job quality. Specifically, 8.5% of competitively employed consumers in our study had a job that provided medical insurance, 11.7% earned at or above a living wage, and 8.1% had hourly wages at or above the state median. This does not compare favorably to consumers with visual impairments, who had rates of 25.8%, 38.1%, and 23.8%, respectively, for these measures (McDonnall, 2019). These findings (a) indicate the need to focus on improving job quality for consumers with combined TBI and visual impairment and (b) support the importance of examining job quality as an outcome measure in future studies of this population.

None of the agency service strategies identified in the VR agency interview data were associated with job quality; neither was agency structure. Overall, little variability in job quality was present at the agency/state level (i.e., 5.6% in the null model and 3.5% after adding level-2 variables); therefore, differences in job quality are mostly attributable to individual-level factors rather than agency-level factors. At the consumer level, job quality was predominantly related to personal characteristics rather than service factors, as found in other populations of VR consumers (Chan et al., 2016; Cimera et al., 2015; McDonnall & Cmar, 2018). Only 25.8% of the variability in job quality was explained by the model, leaving much of the variability in job quality unexplained.

The personal characteristics identified as predictors of job quality for consumers with combined TBI and visual impairment were the same personal characteristic predictors identified for all VR consumers and consumers with deaf-blindness (Chan et al., 2016; McDonnall & Cmar, 2018). Three of these factors were associated with higher job quality: education level at application, male gender, and older age. These same three factors also predicted higher job quality for persons with and without disabilities in the general U.S. population (Brucker & Henly, 2019). Education level explained the most variance in job quality in our model, as found by McDonnall and Cmar (2018). The other two personal factors—SSDI receipt and SSI receipt—were associated with lower job quality, and they were the third and fourth strongest predictors, respectively.

Although the personal characteristics associated with job quality have been consistent across VR populations, some service-related factors have not been. The three individual-level service variables associated with job quality in this study were getting a degree or certificate, information and referral services, and job search assistance. Getting a degree or certificate and

information and referral services were associated with higher job quality. Job search assistance, on the other hand, was associated with lower job quality. Educational advancement was included in two of the three previous VR job quality analyses; getting a degree or certificate was positively associated with job quality for VR consumers in general (Chan et al., 2016), but not for those who are deaf-blind (McDonnall & Cmar, 2018). Contrary to our findings, Cimera and colleagues (2015) found that receipt of information and referral services predicted lower job quality for youth with visual impairments. Although job search assistance was the second strongest predictor of job quality in this study, it was not associated with job quality in two previous analyses (Cimera et al., 2015; McDonnall & Cmar, 2018). However, Chan and colleagues (2016) found that receipt of a greater number of job-related services (i.e., job search, job placement, and on-the-job supports) predicted lower job quality, and McDonnall and Cmar (2018) found that receipt of on-the-job supports (short-term and supported employment) was associated with lower job quality. These differences indicate that it may be valuable to assess service-related predictors of job quality for consumers based on type of disability. Researchers could also explore potential explanations for these differences and examine specific strategies that service providers can use to improve job quality for their consumers.

4.3. Limitations

Several limitations of this study are important to consider when interpreting our findings. First, consumers' RSA-911 records do not include detailed information about their TBI such as severity. We can infer, however, that severity of TBI for people in our sample was significant enough to have caused at least one of the two disabilities documented in the RSA-911 data. Severity of TBI, time since injury, and related variables may impact rehabilitation outcomes and would be important to consider in future studies of individuals with combined TBI and visual

impairment. Second, additional consumers may have a TBI that was not identified in the RSA-911 data. Because RSA-911 allows for recording of a maximum of two disabilities per consumer, a TBI would only be identified in a consumer's record if it caused his or her primary or secondary disability. A visual impairment caused by TBI could also be unaccounted for in the data if a TBI caused two or more disabilities that were more severe than a consumer's visual impairment. Consequently, our sample may not include all consumers with combined TBI and visual impairment who received VR services during the study timeframe, although it does include all consumers who were labeled as such in the RSA-911 data. Third, because the VR agency interview data were specific to separate and combined agencies, our sample was limited to consumers who received services from separate or combined agencies. An additional 213 consumers with combined TBI and visual impairment whose cases were closed by general VR agencies in fiscal years 2013-2015 were excluded from our sample. Accordingly, our results may not generalize to consumers who received services from general agencies. Finally, given the nature of our study design and variables, we cannot infer causal relationships between service factors and employment outcomes; additional research is needed to directly test the effects of specific service strategies and interventions on employment for consumers with combined TBI and visual impairment.

4.4. Implications for practice

These findings can be helpful to counselors who serve this population by increasing awareness of consumers who may need additional support to obtain competitive employment, particularly those who are not competitively employed at application, have lower levels of education, are racial minorities, receive SSI benefits, or are in need of disability-related skills training such as orientation and mobility or rehabilitation teaching. Our findings regarding SSI

and SSDI support the importance of providing benefits counseling to consumers and their families. Individuals receiving SSI will generally be better off financially if they work (and can often retain partial benefits) and many work incentives are available to beneficiaries, with additional work incentives available to those who are legally blind. Unfortunately, the laws associated with Social Security disability benefits can be complex, and it is important that consumers be provided this information in a one-on-one format through benefits counseling.

Receipt of job-related services was associated with competitive employment, indicating the importance of providing these services once a consumer has completed training. Obtaining a degree or certificate was associated with both competitive employment and higher job quality for consumers with combined TBI and visual impairment; however, only a small portion of consumers (8.5%) in the current study advanced their education while receiving VR services. In another study, only 29.7% of consumers with TBI who received college or university training as a VR service advanced their education; of those who did, 75.5% achieved competitive employment, and their earnings increased with higher levels of education (Tucker & Degeneffe, 2017). Thus, the investment in educational advancement pays off in terms of better outcomes for consumers with TBI and for those with combined TBI and visual impairment. In addition to providing college or university training as a VR service, counselors should emphasize the benefits of completing an educational program that results in a degree or certificate and provide individualized services and supports that consumers need to be successful in higher education. Of course, the consumer must be interested in advancing his or her education, and capable of completing a degree or certificate program for this option to be applicable.

The findings are also relevant for VR agencies, particularly the identification of service strategies that are associated with competitive employment. Of the five agency-level service

strategies included in our models, only dual expertise and staff training were associated with increased odds of competitive employment for consumers with combined TBI and visual impairment. The common element in these two strategies is that agency staff understand both TBI and visual impairment. Our results support the need for VR agencies to have counselors and other service providers on staff who have training or expertise in TBI and visual impairment. This knowledge is likely valuable to all staff, but may be particularly important for staff who provide direct services such as training in orientation and mobility and assistive technology. Most agencies did not have staff with training or expertise in both conditions. In fact, these two service strategies were the least often used – only nine (18.0%) agencies reported utilizing these strategies. However, VR agencies could potentially adopt these strategies. Providing training on TBI to all staff who work with people with visual impairments could be accomplished via online training opportunities, national and in-state conferences, or internal trainings. Continuing education courses related to TBI are available from organizations such as the Commission on Rehabilitation Counselor Certification and Envision University, and a basic course on brain injury and vision loss is offered through the National Technical Assistance Center on Blindness and Visual Impairment. It may be more challenging to hire a staff person with dual expertise, but it would be possible to select a staff person who already has expertise with one disability and an interest in the other disability, and provide extensive training on the other disability. To improve services for this particular population, agencies should consider this option.

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Table 1

Descriptive Statistics for Individual-Level Variables

Variables	Competitively Employed	Not Competitively Employed	Overall
Personal characteristics			
Female	36.1	30.9	33.1
Age at closure	39.5 (13.4)	40.0 (13.4)	39.8 (13.4)
Minority race	12.2	23.2	82.2
Hispanic ethnicity	7.6	11.1	9.7
Education at application	5.3 (2.3)	4.5 (2.3)	4.8 (2.3)
Legal blindness	39.4	51.2	46.3
TBI cause of visual impairment	63.6	67.6	65.9
Cognitive disability	39.7	34.2	36.5
Physical disability	30.4	31.3	30.9
Psychiatric disability	4.9	7.4	6.4
Receives SSDI	30.7	34.2	32.7
Receives SSI	19.6	37.1	29.8
Competitive employment at application	29.6	4.9	15.3
Service-related factors			
Receipt of degree or certificate	12.8	5.5	8.5
On-the-job training	5.7	3.1	4.2
Disability-related skills training	27.5	35.9	32.4
Rehabilitation technology	47.3	46.1	46.6
Job placement assistance	32.1	18.8	24.3
Job search assistance	30.7	16.0	22.2
Job readiness training	17.7	17.4	17.5
On-the-job supports (short-term)	12.0	5.3	8.1
On-the-job supports (supported employment)	6.5	2.3	4.1
VR counseling and guidance	64.7	57.2	60.3
Maintenance	24.5	20.1	21.9
Information and referral	22.6	20.7	21.5
Occupational or vocational training	12.2	10.6	11.3
Case length in months	37.2 (33.7)	45.2 (37.0)	41.8 (35.8)

Note. Values are percentages or means. Standard deviations are presented in parentheses adjacent to means for continuous variables. SSDI = Social Security Disability Insurance. SSI = Supplemental Security Income. Total $N = 880$; competitively employed at VR closure $n = 368$; not competitively employed $n = 512$.

Table 2

Hierarchical Generalized Linear Model (HGLM) Predicting Competitive Employment at VR Closure: Final Model

Variables	**Coefficient**	***SE***	**OR**	**95% CI**	***p***
Intercept	-1.14	0.23	0.32	(0.20, 0.51)	<.01
State/agency-level					
State population	0.00	0.01	1.00	(0.97, 1.02)	.76
Per capita income	-0.03	0.02	0.97	(0.94, 1.01)	.09
Unemployment rate	0.13	0.11	1.13	(0.91, 1.41)	.25
Collaboration	-0.14	0.22	0.87	(0.55, 1.36)	.52
Dual expertise	1.11	0.40	3.05	(1.37, 6.77)	.01
External organization involvement	-0.39	0.28	0.68	(0.38, 1.20)	.18
Specialized TBI unit	0.15	0.32	1.17	(0.61, 2.22)	.63
Staff training	0.68	0.31	1.96	(1.04, 3.71)	.04
Separate VR agency	0.49	0.24	1.64	(1.01, 2.65)	<.05
Individual-level					
Age at closure	-0.01	0.01	0.99	(0.97, 1.00)	.08
Minority race	-0.50	0.23	0.61	(0.39, 0.95)	.03
Education at application	0.12	0.04	1.12	(1.04, 1.21)	<.01
Receives SSDI	-0.35	0.19	0.70	(0.49, 1.02)	.06
Receives SSI	-0.72	0.19	0.49	(0.33, 0.71)	<.01
Competitive employment at application	1.97	0.26	7.17	(4.31, 11.93)	<.01
Receipt of degree or certificate	1.16	0.30	3.20	(1.77, 5.81)	<.01
On-the-job training	0.50	0.41	1.66	(0.74, 3.72)	.22
Disability-related skills training	-0.50	0.21	0.61	(0.40, 0.92)	.02
Rehabilitation technology	0.36	0.19	1.43	(0.99, 2.07)	.06
Job placement assistance	0.75	0.20	2.11	(1.42, 3.15)	<.01
Job search assistance	0.63	0.22	1.88	(1.23, 2.87)	<.01
On-the-job supports (short-term)	0.42	0.31	1.52	(0.83, 2.78)	.18
On-the-job supports (supported employment)	1.00	0.43	2.71	(1.18, 6.24)	.02
Maintenance	0.34	0.21	1.40	(0.92, 2.12)	.11
Occupational or vocational training	0.41	0.27	1.50	(0.89, 2.54)	.13
Case length in months	-0.01	0.00	0.99	(0.99, 1.00)	<.01

Note. N = 880 at the individual level. N = 50 at the state/agency level. *SE* = standard error. OR = odds ratio. CI = confidence interval. SSDI = Social Security Disability Income. SSI = Supplemental Security Income.

Table 3

Hierarchical Linear Model (HLM) Predicting Job Quality at VR Closure: Final Model

Variables	**Coefficient**	***SE***	***t*-ratio**	***p***	f^2
Intercept	0.27	0.16	1.70	.10	
State/agency-level					
State population	0.00	0.01	-0.26	.80	0.001
Per capita income	0.00	0.01	0.43	.67	0.002
Unemployment rate	0.06	0.06	1.01	.32	0.004
Collaboration	-0.16	0.13	-1.25	.22	0.007
Dual expertise	-0.09	0.21	-0.43	.67	0.001
External org. involvement	-0.03	0.17	-0.17	.87	0.000
Specialized TBI unit	0.16	0.18	0.88	.39	0.004
Staff training	0.23	0.18	1.27	.21	0.008
Blind VR agency	-0.11	0.14	-0.82	.42	0.003
Individual-level					
Female	-0.22	0.10	-2.30	.02	0.015
Age at closure	0.01	0.00	1.98	<.05	0.008
Education at application	0.12	0.02	5.59	<.01	0.085
TBI cause of visual impairment	0.09	0.11	0.82	.41	0.005
Physical disability	0.16	0.10	1.57	.12	0.006
Psychiatric disability	0.28	0.22	1.27	.21	0.004
Receives SSDI	-0.46	0.11	-4.37	<.01	0.049
Receives SSI	-0.41	0.12	-3.48	<.01	0.028
Receipt of degree or certificate	0.45	0.14	3.20	<.01	0.023
Job search assistance	-0.42	0.10	-4.04	<.01	0.050
Information and referral	0.23	0.11	1.98	<.05	0.018
Occupational or vocational training	0.26	0.14	1.81	.07	0.010

Note. N = 368 at the individual level. N = 48 at the state/agency level. *SE* = standard error. f^2 = effect size. The variance component estimation includes intercept variance (τ_{00} = 0.026) and residual variance (σ^2 = 0.721). Intraclass correlation coefficient, ICC = $\tau_{00} / (\tau_{00} + \sigma^2)$ = .035. SSDI = Social Security Disability Insurance. SSI = Supplemental Security Income.