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**The Effects of Race/Ethnicity, Comorbid Disabilities, and Vocational
Rehabilitation Services on Employment Outcomes of Individuals with
Traumatic Brain Injury**

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Dedication

To God for his direction, and endless provision, guidance, knowledge, wisdom, and protection throughout this journey.

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The Effects of Race/Ethnicity, Comorbid Disabilities, and Vocational Rehabilitation Services on Employment Outcomes of Individuals with Traumatic Brain Injury

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Individuals with TBI are among the fastest growing population served in the state – federal vocational rehabilitation programs. The increasing rates of individuals with TBI accessing VR programs and the higher rates of unemployment among this population have been reported in the literature. Using the Rehabilitation Services Administration National Case Services Report (RSA-911) fiscal year (FY) 2012, this study examined the predictors of employment outcomes. In order to determine the effective VR services across groups, the moderating effects of race/ethnicity, comorbid disabilities on the effects of VR services on employment outcomes of individuals with Traumatic Brain Injury (TBI) were also examined. A logistic regression was run and results showed a significant disparity in the rate of successful employment outcomes of individuals who are White versus those individuals from racially/ethnically diverse backgrounds, especially Blacks. After controlling for demographic characteristics, on-the-job support, job placement, and on-the-job training emerged as the most important positive set of VR services predictors of successful employment outcome, regardless of race/ethnicity.

Maintenance, assistive technology, and job search assistance emerged as the second set of positive predictors. Diagnosis and treatment service was significantly negatively related to employment outcome, regardless of the race/ethnicity of the individual with TBI. College training and assessment services were found to significantly increase the odds of being successfully employed for Blacks compared to the odds of being successfully employed for individuals who are White. Transportation and supported employment services significantly increased the odds of being successfully employed for individuals from 'Other' ethnic minority groups (i.e., American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islanders) compared to the odds of being successfully employed for those individuals who are White. VR Service variables were stronger predictors of successful employment than demographic variables and pre-employment status as application. Depression was negatively related to successful employment outcome, but did not moderate the effect of VR services on employment outcome. Limitations, implications, and directions for future studies are also discussed.

Keywords: vocational rehabilitation, race/ethnicity, brain injury, employment.

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CHAPTER 1

INTRODUCTION

According to the Centers for Disease Control (CDC), about 1.7 million individuals in the United States are diagnosed each year with Traumatic Brain Injury or TBI. TBI is defined as “brain injury from externally inflicted trauma that may result in significant impairment of an individual’s physical, cognitive, and psychosocial functioning.” National Institutes of Health (NIH, 1998). Among the 1.7 million individuals with TBI annually, 16% (275,000) are hospitalized, with nearly 80% (1.365 million) treated and released from an emergency department (Centers for Disease Control [CDC], 2010). These figures do not include individuals with milder TBI who go undiagnosed or those who are treated in settings other than hospitals. These numbers also do not include military personnel and veterans with TBI. For example, the Brain Trauma Foundation (BTF) reports that about 30% of soldiers admitted to Walter Reed Army Medical Center have TBI. While the current incidence rate is unknown, advocates believe that about 10% to 20% of Iraqi veterans or 150,000 to 300,000 service personnel have some level of TBI (<https://www.braintrauma.org/tbi-faqs/military-tbi/>). According to the CDC, both direct medical costs and indirect costs of TBI, such as lost productivity, totaled an estimated \$60 billion in the United States in 2000 (CDC, 2010).

Fifty-eight percent of people living with TBI are working age (15 - 74 years), many of whom would be looking forward to returning to work in their communities after discharge from the hospital (Gary et al., 2009). However, because of several issues often associated with TBI, these individuals find it difficult to return to a previous job or in obtaining a new job, post injury. Some of the issues that serve as barriers to employment includes: physical, cognitive, emotional, functional limitations (this refers to restrictions in performing major and mental actions used in daily life such as mobility or mental), pain (e.g., headaches), memory and attention problems, and depression (Gary et al., 2009; Yasuda et al., 2001). TBI results in a number of personal and societal consequences (Noone, 2011).

Unemployment rates can be very high (i.e., 10% - 78%) post injury (Brooks, McKinlay, Symington, Beattie, & Campsie, 1987). Studies that have compared pre- and post-injury employment have shown that between 10% – 70% of individuals with TBI were successfully employed post injury compared to 61% and 70% prior to injury (Johnstone et al., 2003; Wachter et al., 1987; Yasuda, Wehman, Targett, Cifu, & West, 2001). The variance between the reported rates of unemployment (i.e. 10% – 70%) across studies has been attributed to diverse definitions of employment outcome (e.g., some definitions include sheltered workshops, employment paying below minimum wage, and unpaid work such as home maker and volunteer work), differences in the methodology used across studies to examine employment outcome, and different periods of follow-up after injury (Kreutzer et al., 2003; Wachter et al., 1987; Yasuda et al., 2001). Given the

fact that the unemployment rate, post injury among individuals with TBI is high (Schonbrun and Kampfe, 2004), it is important to understand the sequelae and barriers of employment for these individuals, the need for state-federal vocational rehabilitation services, and whether certain demographic factors such as race/ethnicity, and co-morbid disabilities (i.e. depression and substance use disorder) moderate successful employment outcomes after TBI.

SEQUELAE OF TBI AND BARRIERS TO EMPLOYMENT

Traumatic brain injury can be classified into mild, moderate and severe with the sequelae of the disability often manifested in physical (Falvo, 2005; Lezak, 1995; Vogenthaler, 1987), emotional/behavioral (Falvo, 2005; Prigatano & Fordyce, 1986; Vogenthaler, 1987), and cognitive symptoms (Falvo, 2005; Lezak, 1995; Prigatano, 1986; Vogenthaler, 1987). TBI has certain unique characteristics. The disruption in cognitive and emotional functioning changes an individual's social and vocational functioning within their community (Catalano, Pereira, Wu, Ho, & Chan, 2006; Wehman, Bricout, & Targett, 2000). TBI may result in physical impairment (e.g., motor and sensory impairment, and fatigue), which can directly affect one's ability to work. However, the more challenging aspects of TBI involve the individual's cognition (e.g., memory, attention, and executive functioning), emotional functioning, and psychological functioning (e.g. aggression and agitation), which have consequences for both the cognitive and interpersonal skills needed for employment success.

In addition to the physical, cognitive, and psychological barriers to employment after TBI, the other barriers to employment include the environment (e.g., transportation, social isolation (Falvo, 2005; Wehman, Bricout, & Targett, 2000), limited vocational assistance (Ashley, Ninomiya, Berryman, & Goodwin, 2004; Wehman et al., 2000), shortage of local job opportunities, and discriminatory attitudes having to do with perception of society concerning the issue of employment for individuals with disabilities (Ashley et al. 2004), government policies, societal and family attitudes (Whiteneck, Gerhart, & Cusick, 2004).

THE NEED FOR VOCATIONAL REHABILITATION SERVICES FOR INDIVIDUALS WITH TBI

The aforementioned challenges or barriers to employment among individuals with TBI underscore the need for assistance such as vocational rehabilitation services to help them gain or regain, and sustain employment. VR services are related to successful employment outcomes for people with disabilities (Dutta, Gerver, Chan, Chou and Ditchman, 2008). Vocational rehabilitation (VR) is meant to help individuals with TBI re-integrate into the workforce. TBI is one of the fastest growing disability groups that is being served by the state-federal VR system (Wehman et al., 2007). Therefore it is of great importance to understand the factors that contribute to better or worse employment outcomes for individuals with TBI who are receiving VR services. Crepeau and Scherzer's (1993) review showed a significant relation between unemployment and fewer vocational rehabilitation services among individuals with TBI. Individuals with TBI returned to successful employment earlier with vocational intervention than without

intervention (Kendall, Muenchberger, & Gee, 2006). Furthermore, Johnstone, Reid-Armdt, Franklin, and Harper (2006) found that the most significant determinant in obtaining successful employment for individuals with TBI was the receipt of VR services.

STATE – FEDERAL VOCATIONAL REHABILITATION

Vocational Rehabilitation refers to a service aimed at increasing the employment opportunity of an individual with a disability. Since 1920 the federal and state governments have worked together to enhance the employment of individuals with disabilities. The state-federal VR system is a federally mandated system in every state to provide services for people with disabilities with 70% of the funding coming from the federal government and 30% from the state. The Rehabilitation Services Administration (RSA) is the federal administrative center for the state-federal VR system. The federal government's main role is to provide leadership and funding, while the states are responsible for the administration of the program in their respective states (McCue et. al., 1994). The RSA collects data annually from each state's VR system on every person with a disability who has contacted this system whether they received services or not. The annual data file includes demographic characteristics (e.g. race/ethnicity, type of disability), the services an individual with a disability received (e.g. college education, assessment, job placement), and VR outcomes that include rate of successful employment, amount a person earns per week, and how many hours a person works per week.

Vocational Rehabilitation Counselors (VRCs) usually employed by federal and state vocational rehabilitation agencies work with professionals in other fields such as medicine, education, and psychology to provide coordinated services to individuals with disabilities while preparing these individuals for successful employment outcomes. Successful employment is defined by RSA as competitive employment in integrated settings in the community for a minimum of 90 days and for which the individual is being paid a wage equal to or more than the minimum wage. (Bolton, Bellini, & Brookings, 2000; Moore, Harley, Gamble, & Hasazi, 2004; Jung, Schaller, & Bellini, 2010; Moore, 2001a; Moore et al., 2000; Moore et al., 2002b; Wheaton, Wilson, & Brown, 1996).

VOCATIONAL REHABILITATION PROCESS

The vocational rehabilitation process generally involves six to seven steps of a sequential set of activities initiated and coordinated by the VRC. First, upon referral the individual with a disability completes an intake and application process, is screened and interviewed. Second, during the eligibility determination phase, the individual is evaluated by the VRC for eligibility to receive VR services. To be eligible for VR services, the individual must meet the following criteria: (a) have a mental or physical impairment diagnosed by a medical professional; (b) the impairment causes an impediment to employment; and (c) the individual can benefit from VR services necessary to prepare for, gain, or retain employment. It is during this phase that the VRC assesses the individual (i.e. through certain activities such as, trial work experiences and extended evaluation) to determine if the individual can work after the provision of VR

services, and to determine the nature and scope of VR services to be included in the individual's Individualized Plan for Employment (IPE) – this is a written plan outlining an individual's employment goal, and the services to be provided to reach the goal. The VRC could work with medical rehabilitation professionals to conduct prevocational testing (to identify deficits that could impact employment outcome), or situational assessments to confirm test findings, or neuropsychological evaluations, and so forth, to make appropriate recommendations. In the fourth phase an IPE is developed by both the individual and the VRC, after an individual has been determined eligible to receive VR services. During this phase, the individual may complete an interest inventory assessment and the VRC may conduct a labor market research, to help determine suitable employment goals. In phase five, the individual with a disability is provided with the services that have been agreed upon in the IPE. In the sixth phase, the individual is placed in a job. Once the individual is able to maintain the job for 90 days, the individual with a disability is regarded as being successfully employed. The individual's case file is closed after 90 days of successful employment. The seventh phase of the VR process is referred to as post-employment services. This refers to services that are provided after a case is closed to assist an individual with a disability to maintain a job.

VOCATIONAL REHABILITATION SERVICES

There are over 20 services provided by state vocational rehabilitation agencies which include but are not limited to assessment, diagnosis and treatment of impairment; VR counseling and guidance; training (such as college training, occupational and

vocational training); job search assistance; job placement assistance; on-the-job supports; transportation services; maintenance; rehabilitation technology; reader services; interpreter services; personal attendant services; technical assistance services; information and referral; and other services such as, medical care for acute conditions that arise during rehabilitation and constitute a barrier to the achievement of a successful employment outcome (Rehabilitation Services Administration, 2012).

VOCATIONAL REHABILITATION LEGISLATION AFFECTING INDIVIDUALS WITH TBI

The main reason behind the provision of vocational rehabilitation services for individuals with disabilities is to ensure successful employment outcomes (Szymanski & Parker, 2010). In order to increase the employment outcomes of individuals with TBI and to bridge the earnings gap between individuals with TBI and individuals without disabilities, it is necessary to examine the key federal legislation that plays a crucial role in the vocational rehabilitation of individuals with TBI.

While several laws exist that support the employment of individuals with disabilities, Goodall, Lawyer, and Wehman (1994) identified five pieces of federal legislation that are particularly useful in assisting individuals with TBI to become successfully employed. These include the Individuals with Disabilities Education Act (IDEA), the Carl D. Perkins Vocational and Applied Technology Act (Perkins Act), the Technology-Related Assistance Act as amended 2004 (Tech Act), the ADA Amendment Act of 2008, and the Rehabilitation Act Amendments of 1992.

A brief overview of these laws shows that individuals with disabilities, including TBI, are eligible for special education services under IDEA. Once reaching the age of 16 years old, the law requires that each individual have an IEP. Based on the goals in the IEP, transition services defined as a set of coordinated activities uniquely designed to support an individual with a disability, is often provided to promote the transiting from school to community integration and participation such as, employment in the community. The Perkins Acts has undergone several reauthorizations. Perkins IV was passed by Congress and was signed into law by President Bush in 2006. The Perkins Act has been authorized for six years and is expected to allocate approximately 1.3 billion dollars in federal aid to local agencies in all 50 states to meet many roles and responsibilities. This law supports the provision of guidance counseling to individuals with disabilities, including TBI. Guidance and counseling services and programs provide vocational and educational information to help promote the educational and career development of all students (Threeton, 2007).

The provision of rehabilitation technology services is an important employment related service provided to individuals with TBI and other disabilities. The Technology related assistance act for individuals with disabilities provides financial assistance to states to assist them in providing assistive technology services and devices to individuals with disabilities. The Americans with Disabilities Act (ADA) is a civil rights law which deals with the issue of nondiscrimination and accommodation in the workplace for individuals with disabilities. Under ADA, it is illegal for employers, state and local

government, and public and commercial facilities to discriminate against an individual with a cognitive disability. Under ADA, accommodations exist to mitigate cognitive issues, stress, and emotional issues associated with TBI. The Rehabilitation Act Amendments of 1992 which was established by the National Vocational Rehabilitation Act in 1920 is a federally funded, but state managed vocational rehabilitation program. Of all five laws however, the Title I Vocational Rehabilitation Program under the Rehabilitation Act Amendments of 1992 is still the most relevant law that provides successful employment support for individuals with disabilities (Goodall, Lawyer & Wehman, 1994). The act allowed for the provision of vocational rehabilitation services to individuals with disabilities. Some of the VR services provided under this act that are of particular applicability to individuals with TBI include, the provision of rehabilitation technology, supported employment, personal assistance services, transition services, and supported employment services (Goodall, Lawyer, & Wehman, 1994).

Statement of the Problem

The prevalence of TBI is particularly high among working-age adults, and particularly high among males; close to 70% of working-age individuals who sustained TBI between 2002-2006 were males. During this same time period, 73.5% of working-age males with TBI required hospitalization (from an overall sample of $n = 170,258$ males with TBI) and 51.7% of females with TBI required hospitalization (from an overall sample of $n = 104,891$ females with TBI). The average annual percentage of working-age adults with TBI requiring hospitalization, broken down by race, showed the following:

78% White, 18% Black, 4% American Indian, Alaska Native, Asian or Pacific Islanders, and 34% Others/unknown (http://www.cdc.gov/traumaticbraininjury/pdf/blue_book.pdf). These statistics point to the high number of working-age individuals who sustain significant TBI and who may require rehabilitation and reintegration services.

Without a doubt, one of the greatest challenges to the rehabilitation of individuals with TBI is reintegration into the workforce. It is therefore no surprise that long-lasting successful employment and economic issues are common with individuals with TBI. What people do for a living is absolutely important to them and the broader society. Impairments arising from TBI can lead to devastating disability in cognition and behavior, which in turn can lead to reduced capacity in the workplace. Successful employment represents, perhaps, the highest achievement of return to life to be achieved after TBI.

However, despite the growing number of studies on employment of individuals with TBI, and even though the majority of individuals with TBI often seek vocational rehabilitation services from public and private VR agencies within their communities, previous studies prior to 2003 failed to provide information on the relationship of VR service variables to successful employment of individuals with TBI. This is the case because the majority of these studies utilized the Traumatic Brain Injury Model System (TBMIS) database that includes only individuals with TBI served in inpatient rehabilitation centers. TBMIS is a national database of individuals aged 16 years and older with traumatic brain injury who received inpatient rehabilitation from one of the 16

TBI Model System Centers and 3 TBI Model System Longitudinal Follow-up Centers across the United States. This database contains mainly medical/health related information (e.g., severity of injury), but does not include individuals with TBI who were served by public VR agencies within their communities. For example, the TBIMS database as of December, 2012, contained information on only 11,772 individuals with TBI (National Data and Statistical Center [NDSC], 2013). Thus, Johnstone et al. (2003d) argue that the TBIMS database is not representative of the population of individuals with TBI. Although more recent studies have examined the impact of VR services on employment outcomes, many have examined only single state VR databases with few of these studies utilizing the national RSA 911 dataset. The RSA 911 is the largest dataset of individuals with any disability including TBI. Furthermore, the majority of the more recent studies on the relationship of VR services on employment outcomes did not hypothesize or test for interactions or moderation of these relations by potentially important variables such as ethnicity. Because TBI is the largest source of cognitive morbidity among working age adults, because of the high cost associated with treatment and rehabilitation, and the persistent high unemployment rate of individuals with TBI, research that utilizes a much larger database such as, RSA 911 to examine the VR services related to successful employment (Schonbrun, Kampfe, and Sales, 2007) in the presence of potentially important moderating variables, is desired.

Significance of this Study

Until recently, the majority of TBI studies have focused on the effects of demographic (e.g. injury severity) variables and neuropsychological factors (i.e. cognitive abilities such as intelligence, memory attention, cognitive processing speed) on employment with little emphasis on non-medical factors such as the receipt of VR services (Catalano et al., 2006; Johnstone et al., 2003d). Because TBI is one of the fastest growing disability groups that is being served by the state-federal VR program (Wehman et al., 2007), the effects of VR services need greater study. Among studies that examined VR service variables, apart from the fact that there was variability across studies in the choice of VR service variables studied, many utilized only single state VR databases instead of the national RSA-911 VR database. Even though some more recent studies such as Catalano et al. (2006) and Da Silva Cardoso et al. (2007) that utilized the national RSA 911 dataset in examining vocational rehabilitation service variables as predictors of employment outcome found certain common VR service variables such as, job placement assistance to be related to employment outcome, it is important to investigate a specific set of VR service variables which a synthesis of previous VR literatures show is consistently related to successful employment outcome for individuals with TBI.

Section 21 of the 1992 amendments to the Rehabilitation Act indicate that ethnic and racial minority group members tend to have higher incidences of disabilities than European Americans. Da Silva Cardoso et al (2007) study found that the incidence of TBI is higher among ethnic/racial minorities than Whites. This finding is consistent with

the rates of TBI hospitalization by age group and race reported by CDC. For example, in the United States, between 2002 – 2006 the CDC report shows that the average annual rate of hospitalization for TBI is higher for Black and Hispanic/unknown racial groups versus Whites in relation to population base rates for these groups (http://www.cdc.gov/traumaticbraininjury/pdf/blue_book.pdf). For example, compared to the average annual incidence rate of TBI of 200 per 100,000 in the U.S. population, Cardoso et al. (2007) report an incidence rate of 263 per 100,000 among Hispanic Americans with TBI. Because there are mixed findings on the relationship of demographic variables of race/ethnicity, on employment outcomes in previous studies and because most studies have not considered that race/ethnicity might moderate the relations of variables such as VR services to outcomes, there is a need to investigate these issues using a larger more representative database than has been used in the past to look at these variables. When racial and ethnic minority groups have been studied, they are often grouped together and examined collectively as one "minority" group (Arango-Lasprilla, 2007; Wehman et al., 2007). This study will disaggregate for racial/ethnic minority group. Most previous studies used the Traumatic Brain Injury Model System (TBIMS) dataset of individuals that were served in one of the medical rehabilitation centers across the United States, a small and potentially unrepresentative sample of individuals with TBI compared to those individuals served by the larger federal-state VR system. Furthermore, among studies that examined VR service variables, few studies utilized the national RSA 911 dataset, which is the largest dataset of individuals with any

disability including TBI. The dearth of research utilizing this database to look at the relationship between VR service variables and employment outcomes, suggest that the RSA 911 database be used in future studies in order to understand what VR service variables are related to employment outcomes and whether those relations are moderated by specific demographic co-morbid diagnoses. Although more recent studies (Catalano et al., 2006; Da Silva Cardoso et al., 2007) that used the national RSA 911 dataset and that examined the impact of vocational rehabilitation services on employment outcome, found the provision of VR services (such as, job placement assistance, counseling and guidance, college education training, on-the-job-support, job search assistance, on-the-job support, maintenance and assistive technology), were positively related to successful employment, these more recent studies did not test whether the relation of VR service variables to employment could be moderated by other variables such as race/ethnicity, and co-morbid diagnosis such as depression. In sum, there are no studies that utilized larger and more representative databases, and that examined the potential interaction of race/ethnicity, health related variables, and rehabilitation services on employment outcomes in a single study. This gap in the literature provides the rationale for the current study, which is to determine which specific VR service variables predict successful employment outcomes for individuals with TBI and whether those relations are moderated by specific demographic variables such as race/ethnicity, and co-morbid disabilities – depression, drug abuse, and alcohol. It is important to know which VR services are associated with positive employment outcomes and for whom. This is particularly important because of

the increased pressure for state-federal VR agencies to do more with less; therefore the provision of VR services might be more efficient and effective if there was knowledge about how to appropriately target these services.

Purpose of the Study

According to Catalano et al. (2006), research directed at increasing employment outcomes of VR individuals remains one of the highest priorities on the national research agenda of National Institute on Disability and Rehabilitation Research (NIDRR). The goal of vocational rehabilitation is to maximize the probability of a successful employment outcome for every individual with disabilities (Bolton, Bellini, & Brookings, 2000). Patient-treatment matching, which involves individualizing, to the extent possible, the choice and application of treatment resources to each individual's needs, is an option that Bolton (1972a, 1972b, 1972c) proposed several decades ago. Even though this option did not receive the kind of response that it deserved when it was first proposed, Rosenthal et al. suggest that treatment matching has received renewed attention in recent years. Individual-treatment matching involves first conducting a detailed assessment (e.g., ethnicity/race, psychiatric, and psychosocial needs) of an individual's service needs and then matching such needs with appropriate type and intensity of VR services needed. Studies that examine the relationship of VR services on employment outcomes vis-a-vis the impact of demographic variables and comorbid diagnosis is necessary in order for us to understand how to better serve individuals with TBI. The purpose of this present study therefore, was to utilize the national RSA 911 2012 dataset to evaluate the relationship

between specific VR services (i.e., job placement, counseling and guidance, college training, job search assistance, maintenance, assistive technology, on-the-job support, on-the-job-training, transportation, diagnosis and treatment, assessment, supported employment) and employment outcome, in the presence of moderating variables (such as, race/ethnicity, and co-morbid disabilities of depression or substance use disorder) of individuals with TBI. Contrary to the method of data analysis utilized in the Catalano et al. (2006), this study utilized multiple (sequential) hierarchical regression analyses that allowed for testing the hypotheses of certain variables such as, race/ethnicity. The outcome of this study would: (1) provide a more detailed information and insight about interactions among demographic variable of race/ethnicity, co-morbid disabilities, VR service variables, and employment outcomes, (2) contribute additional information to the research base that will help determine the optimal intensity and which type of VR services best support culturally and linguistically diverse (CLD) individuals with TBI (Keyser-Marcus et al., 2002). This dissertation addressed the following research questions:

1. Using the 2012 RSA 911 dataset, what are the pre- or -post-injury characteristics (e.g. demographic variables, pre-employment status, levels of public support, receipt of VR services , and co-morbid disabilities such as depression), in a contemporary sample of individuals with TBI served by the state-federal VR system? What are the employment outcomes at closure of this group of individuals with TBI?

2. What set of VR service variables are associated with employment outcomes at closure for individuals with TBI, after controlling for pre-injury characteristics?
3. How does the relation between each variable in the set of VR service variables investigated as predictors of employment outcome at closure vary with respect to each of the following demographic variables: race/ethnicity and co-morbid disabilities of depression and substance use disorder?
 - a. Does race/ethnicity moderate the relation of VR service variables investigated as predictors in question 2, in their effect on employment outcomes?
 - b. Does depression moderate the relation of VR service variables investigated as predictors in question 2, in their effect on employment outcomes?
 - c. Does substance use disorder moderate the relation of VR service variables investigated as predictors in question 2, in their effect on employment outcomes?

In summary, the high rate of TBI both in the population and among individuals receiving VR service, the high cost involved in the rehabilitation of individuals with TBI, the poor employment outcomes, the under-representation of the commonly used TBIMS database for studying this

phenomenon; and among VR studies examined, the lack of information on not just what VR services are related to successful employment outcomes, but for whom, and the increased pressure for state-federal VR agencies to do more with less, suggests the compelling need to know which specific set of variables predict employment outcome for different groups of individuals, post-TBI.

CHAPTER TWO

LITERATURE REVIEW

As stated earlier, the purpose of this present study was to utilize the national RSA 911 2012 dataset to evaluate the relationship between specific VR services (i.e., job placement, counseling and guidance, college training, job search assistance, maintenance, assistive technology, on-the-job support, on-the-job-training, transportation, diagnosis and treatment, assessment, and supported employment) and employment outcome, in the presence of the following moderating variables: race/ethnicity, and co-morbid disabilities (depression, substance use disorder) of individuals with TBI.

This chapter provides the background and conceptual/theoretical framework for this study. The first section of this chapter: (a) reviews the factors that previous studies that examined TBIMS database or that utilized qualitative design studies showed are related to employment outcomes; (b) reviews the relation of demographic variables on employment outcomes, and (c) provides a synthesis of studies that utilized the state VR or national RSA 911 database to examine the relationship of the receipt of VR services and employment outcome. As part of the synthesis section, the literature search strategy, inclusion criteria, a brief introduction of the 13 studies reviewed for the synthesis, limitations of these studies and the synthesis, and relevance of the synthesis as a background for this study proposal are also presented.

FACTORS RELATED TO EMPLOYMENT OUTCOME

A review of previous studies that generally utilized the TBIMS database or that applied qualitative design methodologies found certain factors to be related to employment outcome for individuals with TBI. For example, a review study by Ownsworth and McKeena (2004) found that an individual's social support system was positively correlated with successful employment outcomes. In terms of pre-service employment status, while Yasuda et al. (2001) and Gordon et al. (2006) found a strong relationship between pre-injury employment status and successful employment outcome, Ownsworth and McKenna (2004) found that there was moderate evidence for the relationship of post-injury employment and pre-injury occupational status, but Crepeau and Scherzer (1993) found no relationship between pre-injury employment (being employed or not). However, in a more recent study among VR individuals with TBI, Da Silva Cardoso et al. (2007) did not report any significant relationship between pre-service employment status (employed vs. not employed) and successful post-TBI employment. The negative effects of alcohol and substance abuse (Crisp, 2005; Ownsworth & McKenna, 2004), depression and emotional status (Keyser-Marcus et al. 2002; Sherer, Bergloff, High, Jr., and Nick, 1999) on employment outcome or individuals with TBI, have also been reported in the literature. Other variables also reported as predictors of employment outcome include shorter coma duration/shorter post-traumatic amnesia (PTA)/shorter duration of acute rehabilitation treatment; presence of a co-occurring disabilities, and severity of injury (Crisp, 2005; Dawson et al., 2007; Johnstone, et al.,

2006; Keyser-Marcus et al., 2002; Wehman, Target, West, and Kregel; 2005; Yasuda et al., 2001).

RELATION OF DEMOGRAPHIC VARIABLES ON EMPLOYMENT OUTCOMES

Education

Educational level or attainment was also reported to be positively related to employment outcome in a review of the literature. For example, several studies found higher educational levels prior to the TBI (i.e. 12th grade or higher) to be related to successful employment (Crisp, 2005; Keyser-Marcus et al., 2002; Yasuda et al., 2001). Doctor et al.'s (2005) study which examined individuals working before TBI injury, found the risk of unemployment one year after traumatic brain injury (TBI) was sufficiently smaller for individuals more highly educated than for those individuals who were less educated. This is understandable because in general, individuals with histories of higher qualifications are more competitively employed in the labor market.

Race/Ethnicity

The Kreutzer et al. (2003) study examined the impact of race as a predictor of job stability after 4 years post injury of 186 participants (for whom follow-up data exist for 1, 2, and 3, or 4 years post-injury, with a mean age of 33.22 (SD = 11.04) years at injury and who were all working pre-injury). The results of this study indicated that 34%, 27% and 39% were stably (employed at all 3 follow-up intervals), unstably (employed at one or two of all three follow-up intervals) and unemployed respectively. Using a sample of 129 for a Chi-Square analysis, 19% of minorities in relation to 43% of non-minorities

were significantly less stably employed while 50% of minorities compared to 31% of non-minorities were unemployed. The result seems to suggest a negative relation between race and employment outcome and job stability.

Similarly, using the longitudinal dataset of the [TBIMS], Arango-Lasprilla, et al.'s (2008) retrospective study examined racial differences in employment status and occupational status of 5259 participants, majority (66%) of whom were Whites. With the outcome measure categorized as competitive employment (that is, participants engaged in paid full or part time employment) versus unemployed, Chi Square analysis found that race and/or ethnicity has a significant relationship on employment status at 1 year post injury, after adjusting for pre-injury employment status, sex, Disability Rating Scale at discharge, marital status, cause of injury, age, and education. After accounting for these other predictors, the odds of being unemployed were 2.17 times greater for minorities than for whites.

Gary et al. (2009) in a retrospective cohort study that reviewed the 16 multicenter dataset in the TBMIS database examined racial differences in competitive employment outcomes at 1, 2, and 5 years after TBI in order to investigate whether differences exist specifically between blacks and whites in changes in their competitive employment rates over time. Using a nationwide sample of 2022 adults (615 blacks and 1407 whites, mean age of 34.05 (SD= \pm 11.56), with 1526 participants being males, 496 being females) with moderate to severe TBI, the authors found that after adjusting for demographic and injury characteristic variables, the odds of not being competitively employed were significantly

higher for blacks than whites for years 1, 2, and 5. Thus even though the odds of not being employed significantly decreases over time for all races, the authors concluded that blacks are most negatively affected in terms of short and long-term unemployment status.

The Mwachofi, Broyles and Khaliq (2009) study examined the differences in VR access, employment, and earnings for White and ethnic minority clients. The total sample size of participants in this study was $n = 617,149$ (mean age of 34.92 (SD = 14.05)). The majority (72.3%) of the participants were White and 54.5% of the participants were males. This study found statistically significant racial differences in employment and earnings with Whites experiencing better outcomes than minorities.

Gary et al. (2010) were the first to examine differences in employment outcomes 10 years post TBI between white and racial/ethnic minorities. They used a multi-center nationwide TBIMS database of 382 participants (comprising 188 (50.1%) whites and 194 (49.2%) minorities, mean age of 28.30 (SD = 9.20), 289 males, and 93 females) of individuals with moderate to severe TBI. The results show that after adjusting for other predictors such as age at injury, pre-injury employment status, cause of injury and total length of stay (LOS), the odds of being competitively employed versus not competitively employed at 10 years follow-up were 2.37 times more likely for whites compared to minorities.

Similarly, Arango-Lasprilla, et al.'s (2011) study which utilized a multi-center TBIMS database of 3,404 participants who had employment data for 1, 2, or 5 follow-up

periods, to examine racial differences in post injury employment outcomes over time between Whites, Blacks and Hispanics with moderate to severe TBI post TBI injury, indicated that the odds of competitive employment were significantly higher for whites than blacks and Hispanics at 1 and 2 years after injury. Although the same trend was true for blacks 5 years after injury, the authors did not find any significant differences between the competitive employment of Whites and Hispanics 5 years after injury.

In contrast to these studies that suggest race/ethnicity is related to employment status after TBI, one study suggest little or no relation of race/ethnicity and post-TBI employment. Sherer, et al.'s (2003) study that examined the impact of race on productivity outcome (productivity included employment and was defined as participants who were competitively employed either part-time or full time, students either full or part-time and fulltime homemakers) found that an initial multivariable logistic regression analysis with all predictors including race, accounted for 41% variability in productivity outcome compared to 39% when race was not included as a predictor. Because only 2% of the variability in productivity outcome is accounted for by race alone, the authors concluded that race is not significantly related to productivity. The significant effect of race on productivity is a function of other variables such as pre-injury productivity, education level, and cause of injury.

From the foregoing review, it is clear that all the studies reviewed (regardless of the database used) that examined employment outcome among individuals with TBI, generally suggest a significant relationship of race (in favor of Whites) on employment

outcome. However, a review of meta-analyses and systematic and critical reviews reported mixed findings of the relationships of the demographic variables of race/ethnicity on employment for individuals with TBI. (Crisp, 2005; Ownsworth & McKenna, 2004; Schonbrun & Kampfe, 2004), suggesting the need for further studies. With the increasing rise of ethnic minority population in the United States and the increasing diversity of the vocational rehabilitation consumers seeking services (i.e., increased demand for VR services from multiracial/ethnic consumers), Lewis (2008) posits that there is the need to have a greater understanding of cultural factors related to accessing services, service delivery, and service outcomes as per the requirements of Section 21 of the Rehabilitation Act Amendments of 1992. Although this study will examine the relation of specific VR variables and employment outcomes, the outcome of the foregoing review of the relation of race/ethnicity on employment outcome vis-a-vis the mixed finding from meta-analysis studies, suggests the need to also examine the function of race/ethnicity on the relation of specific VR service variables and employment outcome.

Age

Several studies (Brooks et al., 1987; Kreutzer et al., 2003; Crisp, 2005; Felmingham Baguley & Crooks., 2001) have found age or specifically, being younger at TBI, to be significantly positively related to successful employment. On the other hand, Schonbrun and Kampfe's (2004) review found age to be a non-significant predictor of successful employment. It is unclear from some of these studies, however, whether age

could moderate the effect of VR service variables on employment outcome for individuals with TBI.

Gender

Owensworth and McKenna's (2004) review found a mixed result for the relation between gender and successful employment. Farace and Alves's (2000) meta-analysis of gender differences found that women fare worse in terms of successful employment for individuals with TBI, but Schonbrun and Kampfe's (2004) review found gender to be a non-significant predictor of successful employment.

SYNTHESIS ON VR SERVICES AND EMPLOYMENT OUTCOME

A synthesis of studies that examined the relationship of VR services and employment outcome was conducted; which provides a rationale for the current study (Ahonle, 2014). The research question that guided this synthesis was: which variables from the RSA state-federal VR database are related to successful employment for individuals with TBI? The findings of the synthesis is provided below, including the literature search strategy, inclusion criteria, and a brief introduction of the studies reviewed for this synthesis.

LITERATURE SEARCH STRATEGIES & SELECTION CRITERIA FOR THIS SYNTHESIS

A search of several electronic databases such as the Education Resources Information Center (ERIC), Psych INFO, and EBSCO, CINAHL, Academic Search Complete, and MEDLINE, was conducted to locate published literature in peer-reviewed

journals. Because of the limited number of studies that have examined the issue of the relationship between VR services and successful employment outcome among individuals with TBI, there were no restrictions on the time frame of publication. The keywords used in the computer search were (services OR programs) AND (Traumatic brain injury) AND (employment) NOT (community-based employment) AND (state-federal VR). This search retrieved 31 studies. To determine the relevancy of each article retrieved, the abstract and the result sections were reviewed; this resulted in seven relevant studies. To ensure that all possible relevant studies were examined, further hand search of specific VR journals and a citation search from these seven studies were conducted. This yielded another six studies that met all the inclusion criteria. After this search, a total of 13 studies were identified as studies that met all the inclusion criteria.

INCLUSION/EXCLUSION CRITERIA

The following criteria was used for inclusion in the synthesis: (a) had to be peer-reviewed; (b) had to include the RSA state-federal database that included individuals who had received VR services and whose cases were closed after the receipt of VR services; (c) individuals who qualified for VR services based on either a primary or secondary diagnosis of TBI; and (d) examination of variables using suitable research methodologies: correlational, single subject, or experimental designs. Studies were excluded from this synthesis if they did not meet all inclusion criteria.

INTRODUCTION OF THE STUDIES REVIEWED FOR THE SYNTHESIS

Johnstone, Schopp, Harper, and Koscuilek's (1999) correlational study examined the relationship between neuropsychological variables, successful employment, and case expenditures. The study consisted of 110 individuals', the majority of whom were male and White. Spearman correlation and one way ANOVA analyses showed that, contrary to results of previous studies, severe cognitive impairment was related to successful employment and was associated with greater vocational costs. In other words, individuals with the most significant TBI-related cognitive or neuropsychological impairment (n = 27) had the highest rate of successful employment. Although the authors did not specifically explain this, it is possible that individuals with more severe TBI received supported employment services. The authors concluded that the receipt of vocational evaluation (that examines both relative and absolute indices) as a VR service was related to increased successful employment for individuals with the most significant neuropsychological deficits.

Gamble and Satcher's (2002) correlational study evaluated differences in successful employment, weekly earnings, and case expenditures at case closure for individuals with TBI based upon the receipt of assistive technology as a VR service. The study consisted of 1,145 individuals whose cases were closed in a southeastern state from October 1992 – September 2000. Using regression and chi-square analyses, the authors found assistive technology to be a positive significant predictor of successful employment. Majority of the individuals (73.3%) in the group that received assistive

technology compared to 48.9% in the group that did not receive assistive technology were successfully employed at closure. Even though it is possible that the receipt of VR services other than the receipt of assistive technology could have explained the difference in the rate of successful employment between both groups, the authors did not account for this possibility in this study.

The Johnstone et al. (2003d) observational study reviewed a sample of 78 individuals with TBI who requested services from the state - federal VR system. The purpose of this study was to investigate the relationship between VR services and successful employment, to determine the characteristics of individuals with TBI, types of VR services received, and to investigate the relative contributions of VR services and public support in the prediction of successful employment. Using a series of stepwise regression analyses, the authors found that, of the five variable domains (injury severity, demographic, neuropsychological test scores, financial, vocational services), only the receipt of VR services significantly predicted successful employment; demographic variables such as age, gender, race were not related to successful employment. An analysis of the specific aspects of VR service revealed that vocational guidance and counseling, and on-the-job training emerged as the significant positive predictors of successful employment. The study found no major change in the number of persons who were receiving public support.

Johnstone et al.'s (2003c) study was to determine differences in demographics, injury severity, VR services, and employment (i.e. successful vs. unsuccessful) for

individuals with TBI based on rural (n = 28) versus urban residency (n = 50). The same sample was used as in the Johnstone et al. (2003d) study described above and the same set of variables was examined. Using Wilcoxon Rank-Sum Test and Chi-Square analysis, the authors found no difference between the rural and urban groups in demographic variables of age, gender, level of education, injury severity, or neuropsychological test scores. Using Fisher's exact test, the study found that 24% of the individuals in the urban group were successfully employed after the receipt of VR services, compared to 7% of individuals in the rural group. Unfortunately, the authors did not state if the two groups differed in employment pre-TBI. They, however, hypothesized that their findings between the groups could be due to limited availability of resources in rural areas. The study findings suggest group differences in the receipt of VR services (such as, on-the-job training, maintenance service, and transportation service) and case expenditure, with urban individuals having more access to VR services. Although the authors did not specifically say if the higher rate of VR services provision to urban individuals with TBI explains the higher rate of successful employment for this group over those of the rural group, it is possible that fewer jobs in rural areas could partly explain this difference.

Johnstone et al.'s (2003a) descriptive study examined race differences in demographic, injury severity, VR services provided and employment for the same group of individuals with TBI as in the studies reported above. Using Chi-square and non-parametric MANOVA to evaluate race differences in terms of demographics, injury severity, vocational services provided and vocational outcomes, the authors found no

significant difference on rates of successful employment between White (18%) and African Americans (23%). The receipt of transportation service was significantly different between both groups with a greater percentage (62%) of African Americans receiving transportation services compared to Whites (21%).

Skeel, Bounds, Johnstone, Lioyd, and Harms's (2003) descriptive study of the same sample of 78 individuals who received VR services examined age differences for neuropsychological functioning, 10 VR services (such as job placement), and employment in an attempt to determine whether increasing age is negatively related to successful employment and positively related to more significant neuropsychological impairment. Multivariate analysis of variance, nonparametric Chi-square, and Fisher's exact tests showed that the age groups were similar in level of education, gender, and time since injury, but the younger group was more likely to be single and have higher rates of substance abuse. Statistical tests showed that there were no significant age related differences in successful employment.

Bounds, Schoppa, Johnstone, Unger, and Goldman's (2003) study examined the relationship between gender, and the receipt of 10 VR service variables (such as job placement, job search assistance, and maintenance) on successful employment for the same participants. The average time since injury was 9.2 years ($SD = 9.6$ years) and men and women did not differ on measures of injury severity. The authors did not provide the pre-TBI employment status by gender; however, according to the Bureau of Labor Statistics (BLS), 2003 data of the employment status of the US civilian non-institutional

population 16 years and over by sex, 68.9% men were employed compared to 56.1% women employed in the same time frame. Findings from this study revealed no significant gender differences in injury severity, neuropsychological, and demographic characteristics. MANOVA analysis revealed a significant difference in maintenance services as more men (43.6%) received maintenance services than women (21.7%). In addition, only one of the women was successfully employed compared to 13 (23.6%) of the men.

Gamble and Moore's (2003a) descriptive and correlational study evaluated the relationships between the receipt of six VR services (i.e., assessment, college, counseling/guidance, job placement, restoration, and work adjustment) and employment (measured by successful employment and weekly earnings) of individuals with TBI. The sample consisted of 1,073 individuals whose cases were closed from October 1992 through September 2000 in a southeastern state with majority (69.9%) being males. The authors found a significant relationship between four VR services and successful employment (i.e., three variables were positively related and one was negatively related to successful employment). Logistic regression and factorial ANOVA analyses revealed that college training, counseling and guidance, and job placement services were significantly and positively related to the likelihood of an individual obtaining successful employment after the receipt of VR services. Work adjustment was a significant negative predictor of successful employment. Although the authors did not explain the reason for this negative relationship, it is possible that individuals in this study had more severe

cognitive disabilities and/or experienced severe symptoms of anxiety and depression that made it difficult for them to benefit from work adjustment service.

Gamble and Moore's (2003b) correlational study evaluated differences in successful employment, weekly earnings, and hours worked each week, case expenditures, and time in rehabilitation between individuals who received supported employment services and those who did not. Using the same 1,073 individuals with traumatic brain injury (TBI) as in their earlier study, this study and controlling for an individual's race, education level, age, marital status, gender, prior work experience, and for significant disability, Chi square analyses revealed significant differences in successful employment when comparing individuals who received supported employment services to those who did not. Supported employment is provided to individuals with severe and multiple disabilities.

Using the national RSA-911 data with 7,366 persons with TBI who ended services in 2004, Catalano et al.'s (2006) correlational study analyzed the effects of demographic variables, public support, and VR services on successful employment. The majority of individuals were male (66%) with a mean age of 36.80 years ($SD = 11.8$). Using Chi-squared automatic interaction detector (CHAID) analysis to examine the interaction effects of demographic variables, work disincentives, and VR services, the authors found that job placement assistance, job search assistance, on-the-job supports, counseling and guidance, maintenance services (e.g., monetary support for food, shelter, and clothing), case expenditures, less time in VR, and college degree were unique

positive predictors of successful employment. On the other hand, the receipt of public support, race, and the presence of co-occurring psychiatric disabilities were significantly negatively related to successful employment, because they moderate the effects of the rate of successful employment among the participants, after the receipt of VR services. The authors also found a correlation between assistive technology services and successful employment for individuals with TBI.

Schonbrun, Kampfe, and Sales's (2007) ex post facto correlational study used a national sample of 6,460 individuals with TBI whose data were available through the national RSA database for fiscal year 2002, to evaluate the relationship between specific VR services and successful employment. As with all the other studies previously reviewed, the majority of the individuals in this sample were males (64.9%). The authors did not provide other demographic information such as the racial/ethnic identification in this sample neither did they indicate to what extent injury severity was controlled. The outcome measure was employment (i.e. successful vs. unsuccessful employment). Descriptive Chi-square, logistic regression and ANOVA analyses of the five most frequently provided VR services (i.e., assessment, counseling and guidance, job placement, job search, and diagnosis and treatment), showed that only job placement, job search, and diagnosis and treatment/restoration were significant positive predictors of successful employment. Diagnosis and treatment services were positively related to successful employment and weekly earnings while job placement and job search were negatively related to individuals' weekly earnings at case closure.

Using the national RSA-911 dataset, a more recent correlational study by Da Silva Cardoso, Romero, Chan, Dutta, and Rahimi (2007) examined the relationship between demographic variables, receipt of public support, VR services, and successful employment for White and Hispanic individuals with TBI; and the disparities in competitive employment between these two groups after the receipt of VR services. The total number of individuals in this study was 5,831 and the majority of the individuals were White (92.5%) with Hispanics in the minority 7.5%. The authors stated that in determining the VR variables that are related to successful employment, they controlled for the effect of demographic variables. Odds ratio and logistic regression analyses showed that race was a significant predictor of successful employment. Gender, age, and education were found to be significant predictors of successful employment. Men were 1.2 times more likely to be employed after the receipt of VR services than were women. Individuals 16 to 34 years of age were more likely to achieve successful employment than individuals 35 to 54 years old, and the odds of being successfully employed were less for individuals with less than high school education or high school graduates than for individuals with college education. According to the BLS (2007) report, the employment status of the civilian non-institutional population based statistics for individuals 25 years and over by educational attainment, shows a similar trend (<http://www.bls.gov/cps/aa2007/cpsaat7.pdf>).

Furthermore, statistical analysis showed that eight VR services were found to be significantly positively related to successful employment. These were counseling and

guidance, university training, vocational training, job search assistance, job placement assistance, on-the-job support, maintenance, and assistive technology. Work disincentives such as public support were a negative predictor of successful employment.

A descriptive study by Whitfield and Lloyd (2008) analyzed RSA-911 data from the 2006 fiscal year for disparities in service provision and successful employment. Specifically, they examined disparities in college training, age at application, length of time in the VR program, case expenditures, and weekly earnings and hours worked between American Indians/Native Alaskans (AI/NA) and non-AI/NA with TBI. Of the 11,317 individuals in this sample, 2.5% were AI/NA with a mean age of 37.09 years (SD = 12.20) while 97.5% were from other racial and ethnic groups. Results showed that no significant differences existed between American Indians/Native Alaskans (AI/NA) and non-AI/NA with TBI in terms of education attained, weekly earnings, and hours worked.

DEMOGRAPHIC CHARACTERISTICS OF EMPIRICAL STUDIES REVIEWED

The synthesis comprised a combined sample of 33,380 individuals aged between 15 - 71 years who had received VR services from state VR agencies geared toward successful employment. One of the studies reviewed for this synthesis (i.e., Whitfield & Lloyd, 2008) did not provide information for gender. From the other studies that provided information for gender, this study found that 66% of the individuals were male and 34% were females. One of the studies (i.e., Schonbrun, Kampfe & Sales, 2007) did not provide demographic information of race/ethnicity; six studies (i.e., Catalano et al., 2006; Da Silva Cardoso et al., 2007; Johnstone et al., 1999; Gamble & Moore, 203a; Gamble &

Moore, 2003b; and Gamble & Satcher, 2002) provided complete demographic information of race/ethnicity, and six other studies (Bounds, Schoppa, Johnston, Unger, & Goldman, 2003; Johnstone et al., 2003a; Johnstone et al., 2003c; Johnstone, Vessell, Bounds, Hoskins & Sherman, 2003d; Skeel, Bounds, Johnstone, Lioyd & Harms, 2003; and Whitefield & Lioyd, 2008) had missing information for certain ethnic groups. From the studies that provided demographic information, the aggregate data across those studies showed that 13,036 (82%) were White, 1,342 (8.5%) were African American, 975 (6.1%) were Hispanic, 446 (2.8%) were Native\Indian American, and 80 (0.5%) were Asian American. The majority of the individuals had completed high school. For additional information, See Table 1 for individual characteristics and summary of the articles reviewed for the synthesis.

SYNTHESIS OF RESULTS FROM THE 13 REVIEWED EMPIRICAL STUDIES

Presenting the summary results of the variables reviewed that were found to be statistically significant is good but not very informative. Providing additional information such as the odds ratios and related confidence intervals (CI) is more informative or of practical significance, because such information addresses how strong the relationships between the variables found to be statistically significant to successful employment are. Because confidence intervals (CI) give a very good estimate of the population parameter and address how strong the relationship is, where applicable (especially for later studies), the CI was also reported along with the odds ratios for the variables found across the 13 studies to be related to successful employment. Although one of the later studies (i.e.,

Catalano et al., 2006) reviewed did not report the CI for the variables that this study found to be significantly related to successful employment, the authors adopted CHAID data analysis technique “that uses a systematic algorithm to detect the strongest association between predictors and successful employment” (p. 283).

The following section and Table 3, therefore, categorize and describe the synthesis findings from the 13 reviewed empirical research studies on successful employment outcomes among individuals with TBI.

VR Service Variables and Successful Employment

Across all 13 studies, this synthesis found the following case service variables to be significantly related to successful employment for individuals with TBI. Also reported are the corresponding increase/decrease in the odds of successful employment & CI's (which is an indication of the practical significance of a variable examined) as reported by these studies.

- Job placement ranged from odds ratios of .156 to 20.77 (95% CI: 0.067 to 31.07; Catalano et al., 2006; Da Silva Cardoso et al., 2007; Gamble & Moore, 2003a; Schonbrun, Kampfe, & Sales, 2007).
- Counseling and guidance ranged from odds ratios of 1.24 to 14.12 (95% CI: 1.10 to 83.64; Catalano et al., 2006; Da Silva Cardoso et al., 2007; Gamble & Moore, 2003a; Johnstone et al., 2003d).

- Job search assistance ranged from odds ratios of 0.466 to 1.25 (95% CI: .232 - 1.44; Catalano et al., 2006; Da Silva Cardoso et al., 2007; Schonbrun, Kampfe & Sales, 2007).
- College training/education ranged from odds ratios of 1.31 to 5.21 (95% CI: 1.12 - 9.19; Catalano et al., 2006; Da Silva Cardoso et al., 2007; Gamble & Moore, 2003a).
- Assistive technology - three studies found this variable to be a significant predictor and an odds ratio of 1.27 was reported (95% CI: 1.04 – 1.56; Catalano et al., 2006; Da Silva Cardoso et al., 2007; Gamble & Satcher, 2002).
- Maintenance had an odds ratio of 1.42 (95% CI: 1.20 – 1.68; Catalano et al., 2006; Da Silva Cardoso et al., 2007). One study (Johnstone et al., 2003c) found significant group differences in maintenance service.
- On-the-job support had an odds ratio of 2.18 (95% CI: 1.89 – 2.50; (Catalano et al., 2006; Da Silva Cardoso et al., 2007).
- Case expenditure – two studies (Gamble & Satcher, 2002; Catalano et al., 2006) found this variable to be a significant predictor.
- On-the-job training had an odds ratio of 15.70 (95% CI: 3.08 – 80.05; Catalano et al., 2006; Johnstone et al., 2003d)
- Transportation – one study (Catalano et al., 2006).
- Vocational training had an odds ratio of 1.29 (95% CI: 1.08 – 1.51; Da Silva Cardoso et al., 2007).

- Vocational evaluation/assessment – one study (Johnstone et al., 1999)
- Diagnosis & treatments had an odds ratio of 0.531 (95% CI: .396 - .712; Schonbrun et al., 2007)
- Less time in VR – one study (Catalano et al., 2006). In contrast, Whitefield & Lloyd, (2008) found more time in VR to be positively related to successful employment.
- One study each found a negative relationship of supported employment (Gamble & Moore, 2003b), and work adjustment (Gamble & Moore, 2003b) to successful employment outcome. Other studies showed a positive relationship of maintenance (Johnstone et al., 2003c), and transportation service (Johnstone et al., 2003c) to successful employment.

In summary the VR service predictors reported in this synthesis to be mostly related to successful employment include job placement (four studies), counseling and guidance (four studies), college education/training (three studies), job search (three studies), assistive technology (three studies), maintenance (three studies), on-the-job support (two studies), case expenditure (two studies), on-the-job training (two studies), and transportation (two studies). In contrast, work adjustment was found to significantly decrease the rate of successful employment (Gamble & Moore, 2003b).

Severity of Disability and Successful Employment

One study (Johnstone et al., 1999) found that indices of relative decline (e.g., from high average to an average range) were more significantly related to successful

employment than were indices of absolute functioning (e.g. raw/standard scores). Severity of disability (measured by deficit in neuropsychological functioning, e.g. raw/standard score and relative degree of cognitive decline) was potentially positively related to successful employment.

Individuals in the successfully employed group had more severe cognitive deficits than other groups of individuals. According to Johnstone et al. (1999) individuals in this study could have had less severe TBI compared to individuals in previous studies because individuals with more severe TBI usually have poorer successful employment outcomes (Gary et al., 2009; Yasuda et al., 2001). Another potential reason could be because individuals with severe TBI received supported employment services and were successfully placed in jobs based on individuals' residual capabilities and transferable skills. This hypothesis is supported by Crisp's (2005) review that found that "reentry into the workforce for individuals with spinal cord injuries was most likely to occur when individuals' residual abilities and pre-injury skills were utilized in employment" (p. 31).

Presence of Co-Occurring Psychiatric Disabilities and Successful Employment

Two studies (Catalano et al., 2006; Da Silva Cardoso et al., 2007) found the presence of co-occurring psychiatric disabilities to be negatively related to successful employment with an odds ratio of 0.65 (95% CI: 0.47 - 0.89) - The negative influence of the presence of co-occurring psychiatric disabilities on successful employment for individuals with other disabilities is consistent with Bolton, Bellini and Brookings's

(2000) study that examined other disabilities (i.e., orthopedic, chronic medical, psychiatric, intellectual disabilities, and learning disabilities).

Demographic Variables and Employment Outcome

- **Education.** Three studies (Catalano et al., 2006; Da Silva Cardoso et al., 2007; Gamble & Moore, 2003a) found college education/training to be significantly positively related to successful employment. Individuals with a minimum of high school diploma had better odds of being successfully employed (odds ratio = 0.83; 95% CI: 0.69 – 0.99). Being better educated (i.e., with more than 12 years education) was a frequently cited predictor of successful employment in previous studies with individuals with spinal cord injuries and TBI (Bolton et al., 2000; Crisp, 2005; Keyser-Marcus et al., 2002; Sherer et al., 2002).
- **Race/Ethnicity.** Two studies (Catalano et al., 2006; Da Silva Cardoso et al., 2007) found race/ethnicity (i.e., White) to be positively related to successful employment, but one study (Johnstone et al., 2003a) did not. The Da Silva Cardoso et al. (2007) study result indicated that Whites were 1.27 times more likely to obtain successful employment after receiving VR services than were Hispanics. In addition, one study (Whitfield & Lloyd, 2008) found a significant group difference in the rate of successful employment between Native and Indian Americans and Non-Native/Indian Americans, with the latter group being more successfully employed than the former group. This mixed finding of race/ethnicity (three studies to one study) is supported by Schonbrun and

Kampfe's (2004) review of 16 studies that found a mixed result of the relationship of race to successful employment. Generally, the relationship of race/ethnicity at TBI and employment outcomes is not clear based on the extant literature.

- **Age.** Age (i.e. 16 - 34 years old) was found to be significantly related to successful employment in one study (Da Silva Cardoso et al., 2007) with an odds ratio of 0.87 at 95% CI ranging from 0.77 – 0.97. However, two studies (Johnstone et al., 2003c; Skeel et al., 2003) did not report significant findings related to age. Overall, the relationship of age at TBI and employment outcomes is not clear based on the extant literature.
- **Gender.** One study (Da Silva Cardoso et al., 2007) found a significant gender relationship (in favor of males) to successful employment (odds ratio = 1.16; 95% CI: 1.04 – 1.30), as did Bound et al. (2003). In contrast, Johnstone et al. (2003c) did not find significant gender group differences in the rate of successful employment. Even though the significant relationship of gender in the more recent study (Da Silva et al., 2007) is consistent with Farace and Alves's (2000) meta-analysis of gender differences that found that women fare worse than men in terms of successful employment for individuals with TBI, the 2013 Bureau of Labor Statistics report show that this finding is different from the expected base rate for employment of males versus females with disabilities. According to this report, the unemployment rate for men with a disability (13.0 percent) was about

the same (i.e. 13.5 percent) as the rate for women (<http://www.bls.gov/news.release/pdf/disabl.pdf>).

In summary, education is a significant positive predictor of successful employment. The relationship of race/ethnicity, gender, and age were found to be mixed, with individuals age 16-34 years old being more successfully employed than individuals of other age groups, and with differences between studies for race/ethnicity suggesting the need for more recent studies in order to clarify the effect of these demographic variables on employment outcome.

Public Support and Successful Employment.

Two studies (Catalano et al., 2006; Da Silva Cardoso et al., 2007) with the later study reporting an odds ratio of 0.63 (95% CI: 0.56 - 0.70), found the receipt of public support to be negatively related to successful employment, but one study (Johnstone et al., 2003d) did not. It is important to note that the studies that found a significant negative relationship between public support and successful employment of individuals with TBI used large sample sizes (i.e. Catalano et al., 2006; Da Silva Cardoso et al., 2007), in contrast to the study in which no effect was found (i.e., Johnstone et al.) The two former studies may provide better estimates of the effect of public support on employment. Based on the consistent findings from the two larger studies and the possible problems with sample size in the one study that did not show an effect, on balance, there seems to be a negative relationship between receipt of public support and successful employment. This conclusion is consistent with the results from Berry's (2000) study (not specific to

TBI) that found better odds of successful employment generally for youths with disabilities who were not receiving public support than for youths who were receiving public support. It is important to mention that this finding does not in any way infer causality and therefore, does not suggest: “don’t provide public support because it stops people from looking for employment” because individuals could be on public support because of some third variable (e.g. lack of family and psychological support). This variable rather than the receipt of public support is actually causing them to not be employable.

LIMITATIONS OF THE SYNTHESIS

The synthesis did not include dissertations and other unpublished works because the primary purpose of this synthesis was to present findings of completed peer reviewed works that examined the relationship of VR services and successful employment of individuals with TBI. It is possible that certain service variables related to successful employment could have been missed from such unpublished works.

Second, predictor variables examined in this synthesis were limited to individuals’ demographic characteristics and VR services in relation to successful employment. It is possible that variances explained by post injury characteristics such as significant disability and comorbid disabilities, pre-injury characteristics of pre-employment status at application, and the interaction effects of VR service variables and with certain post injury characteristics on successful employment were not accounted for in this synthesis. Finally, because five of the studies reviewed used the small sample size

of $n = 78$, the interpretation of the findings from these five studies in this review should be done with caution.

RELEVANCE OF THE FINDINGS FROM THE SYNTHESIS TO THIS STUDY

A number of VR service variables were examined across all 13 studies. The synthesis of these studies shows that job placement, counseling and guidance, college education/training, job search assistance, assistive technology, maintenance, on-the-job support, and on-the-job training were mostly reported to be statistically significantly related to successful employment. In contrast, employment was negatively related to the receipt of public support (Catalano et al. 2006). However, some of these studies did not specifically say whether they adjusted for pre- injury characteristics. Because some of the VR service variable findings for TBI are similar to findings from studies that examined the effect of vocational rehabilitation services on employment outcomes of individuals with other disabilities (e.g., HIV/AIDS, sensory/communicative, physical, and mental impairments), it is safe to suggest that these VR service variables are good candidates for being integral to employment outcomes for TBI. This study will therefore, examine if this specific set of VR variables also predicts employment outcomes in a contemporary sample of individuals with TBI. In addition, four other VR service variables, assessment, diagnosis and treatment, transportation, and supported employment will also be examined as possible predictors of successful employment outcome. These services are usually given to individuals with significant disabilities (such as TBI) and to those in need of

medical and psychological needs, but were not all included in each of the more recent studies.

Although recent studies provide some information about the factors that predict successful employment outcomes after TBI, there are still some important questions that these studies do not address. First, most studies did not hypothesize or test for interactions or moderation. For example, although the incidence of TBI is higher among ethnic/racial minorities than Whites (Cardoso et al., 2007), it is not known whether race moderates the relation of particular VR services to employment outcomes. The fact that a synthesis of the 13 studies reviewed earlier provides mixed results for the relationship between demographic variables of race/ethnicity, age, and gender and successful employment for individuals with TBI, suggests that there is the need for further research to provide better clarification of the effect of these demographic variables. Because it is possible that the role of VR service variables on employment outcome could be moderated by certain demographic variables such as, race/ethnicity and presence of secondary co-morbid disabilities, this study will examine the possible moderating effects of race/ethnicity, and co-morbid disabilities (i.e., depression, and substance use disorder) on VR service variables in their effect on employment outcome.

The synthesis therefore, gave rise to three research questions. As stated earlier, these are:

1. Using the 2012 RSA 911 dataset, what are the pre- and post-injury characteristics (e.g. demographic characteristics, pre-employment status, co-morbid psychiatric disability – depression, and levels of public

support), of a contemporary sample of individuals with TBI served by the state-federal VR system? What are the employment outcomes at closure of this group of individuals with TBI?

2. What set of VR service variables are associated with employment outcomes at closure for individuals with TBI, after controlling for pre-injury characteristics?
3. How does the relation between each variable in the set of VR service variables investigated as predictors of employment outcome at closure vary with respect to each of the following demographic variables: race/ethnicity and co-morbid disabilities of depression and substance use disorder?
 - a. Does race/ethnicity moderate the relation of VR service variables investigated as predictors in question 2, in their effect on employment outcomes?
 - b. Does depression moderate the relation of VR service variables investigated as predictors in question 2, in their effect on employment outcomes?
 - c. Does substance use disorder moderate the relation of VR service variables investigated as predictors in question 2, in their effect on employment outcomes?

CONCEPTUAL FRAMEWORK/MODEL

The conceptual framework adopted for this study was Ownsworth and McKeena's (2004) model of factors related to employment outcome and interventions. This model was specifically developed for improving the vocational rehabilitation potential of individuals with TBI. This model was appropriate for individuals with TBI in this study particularly because it encompasses rehabilitation interventions in the various domains of demographic, injury, neuropsychological, metacognitive/emotional, and social/environmental domains necessary for vocational rehabilitation success, and because it recognizes supported employment phases of job placement, job-site training, and compensatory strategies as part of a critical intervention component and the role of public policy and funding decisions required to improve vocational rehabilitation and service delivery for individuals with TBI. This model provided the conceptual framework for this study.

CHAPTER 3

METHODOLOGY

The purpose of this present study was to utilize the national 2012 RSA - 911 dataset to evaluate the relationship between specific VR services (i.e., job placement, counseling and guidance, college training, job search assistance, maintenance, assistive technology, on-the-job support, on-the-job-training, transportation, diagnosis and treatment, assessment, and supported employment) and employment outcome, in the presence of the following moderating variables: race/ethnicity and co-morbid disabilities (i.e., depression, and substance use disorder) of individuals with TBI. The research questions for this study are:

1. Using the 2012 RSA 911 dataset, what are the pre- or post-injury characteristics (e.g. demographic characteristics, pre-employment status, receipt of VR services, co-morbid disabilities, and levels of public support), in a contemporary sample of individuals with TBI served by the state-federal VR system? What are the employment outcomes at closure of this group of individuals with TBI?
2. What set of VR service variables are associated with employment outcomes at closure for individuals with TBI, after controlling for pre-injury characteristics?
3. How does the relation between each variable in the set of VR service variables investigated as predictors of employment outcome at closure

vary with respect to each of the following demographic variables: race/ethnicity and co-morbid disabilities of depression and substance use disorder?

- a. Does race/ethnicity moderate the relation of VR service variables investigated as predictors in question 2, in their effect on employment outcomes?
- b. Does depression moderate the relation of VR service variables investigated as predictors in question 2, in their effect on employment outcomes?
- c. Does substance use disorder moderate the relation of VR service variables investigated as predictors in question 2, in their effect on employment outcomes?

Research Design

This study used a descriptive, ex-post facto, quantitative research design because the dataset is retrospective data. Ex-post facto is one of the two most often used research designs in rehabilitation counseling research (Hansmann, Parker, Saladin & Bolton, 2012). In the ex post facto design, the predictor variable has been manipulated at some point in the past and the effect of the predictor variable is studied only after the fact (Hansmann et al., 2012).

Because many of the variables of interest (such as VR services variables) are not and cannot be manipulated or controlled (especially when these variables are status or

attribute variables), the ex post facto design was the most appropriate design for studying these variables and answering the type of research questions that were asked in this study. The following statistical analyses methods were utilized to analyze the 2012 RSA-911 database in addressing the three research questions. This includes descriptive (i.e. frequency, mean, and standard deviation) and logistic regression. The Statistical Package for the Social Sciences (SPSS) version 22 was used in the analysis. A value of $p < .05$ was selected as an accepted level of significance.

Participants

Participants were derived from a contemporary sample of state-federal individuals who exited the state-federal VR program in the U.S. in FY 2012 ($N = 579,312$). From the population of 8,893 (1.5%) individuals who were reported as having TBI as their primary disability, a final sample of $n = 4,923$ subjects that represents the purest form of dataset that would sufficiently address the research questions in this study was utilized. For the purpose of this study, the sample included only those individuals with a primary cause of disability code of “37” (which is the code in the dataset that indicates TBI as the primary cause of impairment), and for whom type of closure code was 3 or 4 (i.e., individuals who after receiving VR services, exited the VR program with or without an employment outcome). Based on the definition of successful employment adopted for this study, from the initial total sample size of 5,013 subjects that met the inclusion criteria for sample selection, 71 subjects were excluded because they were not competitively employed in integrated settings; 6 subjects who were not between the working ages of 15-74 years

(Gary et al., 2009) were also excluded as possible outliers. Except for Hispanic individuals who also self-identified as White that were recoded as Hispanic, every other individual (i.e., 14 subjects) who reported more than one race/ethnicity were also excluded from this study. In other words, after visual inspection of the data, removing of the outliers and data cleaning procedure, a total of 90 subjects were excluded from the initial sample, resulting in the a final sample size 'n' of 4,923.

Source of Data and Data Collection

The RSA-911 national data file for fiscal year 2012 was obtained, at no cost, through Rehabilitation Services Administration (RSA), which is within the Office of Special Education and Rehabilitative Services (OSERS) and under the U.S. Department of Education. As earlier stated, the RSA-911 data file for fiscal year 2012 provides demographic information, VR services provided, and employment outcomes for all individuals who contacted any of the state/federal vocational rehabilitation agencies in the U.S during the fiscal year 2012.

Coding Variables

Using the RSA-911 (2012) data manual, codes are established for the predictor variables (such as demographics, health related variables and VR service provisions) and criterion variable of employment outcome (i.e. successful versus unsuccessful employment). First, descriptive statistics, including frequency, mean, and standard deviation, are computed for each variable. Based on the requirements of logistic

regression, the categorical variables were represented by “dummy” variables (Tabachnick & Fidell, 2001).

The categorical variables (except the outcome variable of employment outcome) involved in data analysis were effect coded with a value of -1 to reflect the reference group and a value of 1 to reflect the response group. Although Tabachnick and Fidell (2001) suggests dummy coding the dichotomous variables, i.e., coding the reference as 0 and the response as 1, however, in order to examine the interaction effects of two categorical variables, as was the case in research question 3, effect coding was used as the coding of choice because it provides some additional benefits. The primary benefit of using effect coding is that it provides reasonable estimates of both the main effects and interactions. With dummy coding the main effects are not "true" main effects but rather what are called simple effects, i.e., the effect of one variable at one level of the other variable” (Introduction to SAS. UCLA: Statistical Consulting Group. Retrieved from <http://www.ats.ucla.edu/stat/sas/notes2/> (accessed November 24, 2007). Generally, the group with the highest number of responses in each dichotomous variable was coded as the reference group. For example, when looking at race / ethnicity, the White group was observed to have the highest frequency, it was therefore coded as the reference group (i.e. White = -1). Evaluation of interactions between categorical predictor variables was conducted using logistic regression models.

PREDICTOR VARIABLES

Demographic variables

1. ***Gender*** - (coded as 0 = male and 1 = female; dichotomous variable).
2. ***Age at application and closure*** – (recoded 1 = 15 - 34, 2 = 35 – 54, 3 = 55 – 64, 65 - 74; categorical variable). This variable was used as a continuous variable in data analysis.
3. ***Race/ethnicity*** - Identified race/ethnicity include White, Black (i.e., African-Americans or African American), Hispanic or Latino, and Others (i.e., American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islanders). Recoded 1 = White, 2 = Black, 3 = Hispanic, Other = 4; categorical variable.
4. ***Level of education at application***. Educational level is an ordinal variable with five categories. Recoded as 1 = completed special education program, 2 = less than high school, 3 = completed high school, 4 = some post-secondary education/associate degree, 5 = college degree or higher; reference group).
5. ***Employment status at application*** – coded as (1 = employment without supports in integrated setting, 2 = extended employment, 3 = self-employment (except BEP), 4 = state agency-managed business enterprise program (BEP), 5 = homemaker, 6 = unpaid family worker, 7 = employment with supports in integrated setting, 8 = not employed: student in secondary education, not employed: all other students, 10 = not employed: trainee, intern or volunteer, 11 = not employed: other; categorical variable).
6. ***Hours worked in a week at application*** (continuous variable).

7. *Weekly earnings at application* (continuous variable).

8. *Primary source of support at application* – (recoded as 1 = personal income, 2 = family & friends, 3 = public support, and 4 = all other sources; categorical variable).

9. *Living arrangement* – (coded as 1 = private residence, 2 = community residential/group home, 3 = rehab facility, 4 = mental health facility, 5 = Nursing home, 6 = adult correctional facility, 7 = halfway house, 8 = substance abuse treatment center, and 9 = homeless/shelter; categorical variable).

Public Support Variables

Public support at application – This refers to cash payments made by state-federal or other local agencies to an individual as a result of the individual's disability, age, economic, retirement, or survival status. This variable was (coded as 0 = no, 1 = yes; dichotomous variable) for each type of public support for which data was captured in the RSA – 911 database such as such as, Supplemental Security Income (SSI), Social Security Disability Insurance (SSDI), and Temporary Assistance for Needy Families (TANF), General Assistance (GA), workers' compensation, veterans' disability benefits, and any other public support.

Health Related Variables

1. *Depression and other mood disorders* – recoded (0 = no and 1 = yes; dichotomous variable).

2. ***Substance use disorder*** – (i.e., alcohol abuse/dependence or drug abuse/dependence) was coded (0 = no, 1 = yes; dichotomous variable).

3. ***Significant disability*** - (coded as 0 = no significant disability, 1 = yes; dichotomous variable). Individuals who are classified as having a significant disability have physical or mental impairments that (i) seriously limit one or more functional capacities in terms of an employment outcome; (ii) would likely require multiple VR services over an extended period of time; and (iii) one or more of the physical or mental disabilities or another disability or combination of disabilities determined via assessment for eligibility, to cause comparable substantial functional limitation (RSA, 2012).

4. Medical Insurance Variables

Medicaid at application - (coded as 0 = no and 1 = yes; dichotomous variable).

Medicare at application - (coded as 0 = no and 1 = yes; dichotomous variable).

VR Service-Related Variables

1. ***Source of referral*** (1 = educational institutions (elementary/secondary), 2 = educational institutions (post-secondary), 3 = physician or other medical personnel or medical institutions, 4 = welfare agency, 5 = community rehabilitation programs, 6 = social security administration, 7 = one-stop employment/training centers, 8 = self-referral, and 9 = other resources; categorical variable).

2. ***Length of participation in the program*** (continuous variable).

3. *Cost of purchased services* (continuous variable).

4. *Services provided*

With regard to VR services provided, this study included 12 of the over 20 VR services provided to individuals during the vocational rehabilitation process. All of the 12 VR service variables are dichotomous data because they are reported as either provided (coded as 1) or not provided (coded as 0). According to the RSA-911 Case Service Reporting Manual (2012, pp. 22-28), the definitions of the 12 VR services examined in this study are as defined below:

(i) *Assessment*. Services such as trial work experiences and extended evaluation provided (often to individuals with significant disabilities) and activities performed to determine eligibility for VR services, and to determine the nature and scope of VR services to be included in the IPE.

(ii) *Diagnosis and treatment of impairments*. This involves a variety of service often given when medical and psychosocial variables or needs are involved. These includes but not restricted to corrective surgery, diagnosis and treatment for mental and emotional disorders, dentistry, nursing services, hospitalization (inpatient or outpatient care) related with surgery or treatment, drug and supplies, prosthetic, orthotic, hearing aids; or other assistive device, eyeglasses and visual services, podiatry, physical therapy, occupational therapy, speech or hearing therapy, mental health services, treatment of acute or chronic medical complications and emergencies, special services for the treatment of end-stage

renal disease, including transplantation, dialysis, artificial kidneys, and supplies, and other medical or medically related rehabilitation services.

(iii) *Vocational rehabilitation counseling and guidance.* Discrete therapeutic counseling and guidance services required specifically to achieve an employment outcome, including personal adjustment counseling, and any other form of counseling and guidance which is different from general counseling that exists between the counselor and the individual during the entire rehabilitation process.

(iv) *College training.* Full-time or academic training above the high school level leading to a degree (associate, baccalaureate graduate, or professional) and provided by a four-year college or university, community college, junior college or technical college.

(v) *Job search assistance.* This is assistance given to assist an individual in searching for an appropriate job. This include assistance with preparing a resume, identifying job opportunities, developing interview skills, and contacting employers on behalf of the individual with a disability.

(vi) *Job placement assistance.* A referral to a particular job for a job interview, whether or not the individual obtained the job.

(vii) *On-the-job supports.* Services provided to an employed individual for the purpose of job stability and job retention. This includes job coaching, follow-up and follow-along, and job retention services.

(viii) *Maintenance*. This means financial support provided for basic and necessary expenses in connection to an individual's participation in an assessment for eligibility determination purpose and VR needs or while receiving VR service related to work, such as costs of uniforms or other suitable clothing, cost of short-term expenses (e.g., food and shelter), and initial one-time costs (such as, security deposits for utility services necessary for an individual to relocate for a job placement, etc.).

(ix) *Assistive technology*. Any service that directly supports an individual with a disability in the selection, acquisition, or use of an assistive technology device, including evaluating an individual's needs, including functional evaluation in an individual's customary environment; acquisition or leasing of assistive technology devices; selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing assistive technology devices; coordinating and using other therapies, interventions, or services with assistive technology devices (e.g., those related with existing education and rehabilitation plans and programs); training or providing technical assistance for an individual with a disability or family members, guardians, advocates, or authorized representative; and training or providing technical assistance for professionals (such as, individuals providing education and rehabilitation services), employers, or others who provided services to assist an individual with a disability obtain an employment outcome.

(x) *On-the-job training*. This refers to paid training in specific job skills by a potential employer. Usually the individual with a disability remains in the same or a similar job upon successful completion. Apprenticeship-training programs, which is often conducted or sponsored by an employer or a group of employers usually falls under this category.

(xi) *Transportation*. This refers to services and related expenses that are required and offered to enable an individual to participate in a VR service. Example of transportation services include, purchase and repair of vehicles, training in the use of public transportation, relocation expenses and personal care attendant or aide services related to employment.

(xii) *Supported employment*. This refers to services provided to individuals with most significant disabilities that require intensive employment related support in order to perform and maintain competitive work or working towards competitive employment in an integrated work setting (RSA-911 Case Service Reporting Manual (2012, p. 39))

CRITERION VARIABLES

1. ***Employment outcome*** - competitive employment was recoded as (0 = unsuccessfully employed, 1 = successfully employed; dichotomous variable).

Successful employment was defined as competitive employment in an integrated setting, self-employment or state-managed Business Enterprise Program (BEP)

that is performed on a full-time or part-time basis for which individuals who exited after receiving VR services are compensated at or above the Federal or State minimum wage, whichever is higher (Da Silva Cardoso et al., (2007); RSA, 2012).

Unsuccessful employment was defined as individuals who exited the VR system after receiving services, without an employment outcome.

Data Analysis

All statistical analyses were conducted using the IBM software package SPSS version 22. Prior to conducting the various data analyses, the RSA– 911 dataset was screened for missing values and outliers using SPSS. In addition, nominal variables were screened for out-of-range values. On the other hand, the ranges of values, means and standard deviations of continuous variables were examined.

DESCRIPTIVE STATISTICS

***Research question 1** - Using the 2012 RSA 911 dataset, what are the pre- or post-injury characteristics (e.g. demographic characteristics, pre-employment status, VR services, co-morbid disabilities, and levels of public support), in a contemporary sample of individuals with TBI served by the state-federal VR system? What are the employment outcomes at closure of this group of individuals with TBI?*

Research question 1 focuses on descriptors of state-federal VR individuals with TBI's demographics and rehabilitation process. This study used descriptive analysis to

examine overall characteristics of individuals with TBI. Frequencies, percentages, means and standard deviations are reported.

RELATIONSHIPS

***Research question 2-** What set of VR service variables are associated with employment outcomes at closure for individuals with TBI, after controlling for demographic characteristics?*

Research question 2 examined the relationship of VR service related variables and employment outcome (the criterion variable). Logistic regression was chosen to answer research question 2 because logistic regression allows for the prediction of dichotomous variable outcome based on covariates that are continuous, discrete, dichotomous, or categorical in nature (Keith, 2006, Tabachnick & Fidell, 2001). In other words, a logistic regression model was considered to be most appropriate for research question 2 as the criterion variable of successfully employed/unsuccessfully employed was dichotomous (Katz, 1999). The variables that were controlled in these analyses for research question 2 included pre-injury characteristics i.e., pre-employment status at application, race/ethnicity, age, gender, and level of education at application,

In step 1 of the logistic regression model, pre-injury characteristic variables were entered simultaneously in Block 1. In step 2, the set of post-injury characteristics (i.e. SSI, SSDI, significant disability, depression, substance use disorder, and cost of purchased services) were entered. The difference in $-2 \log$ likelihoods: shown in SPSS under block chi-square values (Tabachnick, & Fidell, 2007) which is the difference

between the full model (pre-injury characteristic variables and post-injury predictors), and the reduced model (pre-injury characteristic variables) were examined to assess the significance of adding post-injury characteristic variables. In step 3, 12 VR service variables that were being investigated were entered together in Block 3 to determine their variance contribution in employment outcome over and beyond pre and post-injury characteristics. In step 4, the interaction variables were added in block 4 to determine their variance contribution to employment outcome over and beyond pre and post-injury characteristics, and VR service contributions together. The predictive success of the logistic regression models were assessed by looking at the classification tables, showing correct and incorrect classifications of the criterion variable. The significance of individual independent variables was analyzed by checking their coefficients (as with the Wald statistic) and associated odds ratios.

Research questions 3: *How does the relation between each variable in the set of VR service variables investigated as predictors of employment outcome at closure vary with respect to each of the following variables: race/ethnicity and co-morbid disabilities?*

Because the relationship of race/ethnicity, depression, and substance use disorder to successful employment outcomes among VR individuals with TBI had rarely been studied in combination before, they were of particular interest for this study. Contrary to the method of data analysis utilized in the Catalano et al. (2006), this study utilized sequential (hierarchical) multiple logistic regression analysis that would allow for answering research question 3a, 3b, and 3c respectively. In order to examine the

moderating effects of these variables therefore, in step 4 of the logistic regression analysis, the set of interaction terms between depression, and each of the 12 VR services in the model; as well as substance use disorder and each of the 12 VR services, and those of race/ethnicity and the 12 VR service variables were entered together in Block 4 of the full logistic regression model and the full model was run.

In order to sufficiently answer research question 3a, an additional step involved entering the interaction terms for the three race/ethnicity variables and each of the 12 VR service variables one at a time in the logistic regression model in a separate block, while controlling for every other predictor variables (including other interaction variables), and their effects on the model were analyzed by checking their coefficients and associated odds ratios.

In this study, significance of the predictor variables was examined through *p*-values less than .05, and the impact of these variables was determined by the unstandardized coefficients (B) at the 95% confidence interval (CI) and the standardized coefficients (β) (Chan, 2004). In addition, the Nagelkerke R square was used to measure the relationship of the observed values of the criterion variables and the predicted value based on the regression line (Chan, 2004).

Prior to running the regression analysis, all 12 VR dichotomous predictor variable distributions were examined. Only on-the-job training exceeded the 90% - 10% rule (96.2 of individuals with TBI did not receive this service). However, this variable was still retained in this analysis because of its theoretical importance and the possible influence

of this variable on other predictors in a multivariate analysis. For logistic regression, normality of continuous variables is not a requirement. However because it is possible for outliers to affect the goodness of fit of the model, the continuous variables of age at application and cost of purchased services were checked for outliers. Descriptive measures showed that age at application was slightly skewed (skewness = .30) and cost of purchased services (skewness = 6.3), although their distributions did not present outliers. In testing for multi-collinearity, the procedure described by Menard (1995) was used. A linear regression model with all the single independent variables and the outcome variable was run, and variance inflation factor (VIF) statistic were calculated; VIF values above 6 would be considered problematic and are worthy of concern (Cohen et al., 2003). All variables of interest passed the criteria of no multi-collinearity, because no VIF values were over 6 (Cohen et al., 2003).

CHAPTER 4

RESULTS

This chapter presents the descriptive and conducted data analyses findings, in order to answer the research questions posed in this study in regard to employment outcomes for individuals with TBI who contacted the state/federal vocational rehabilitation (VR) agency and received VR services in the fiscal year 2012. The purpose of this present study, was to utilize the national RSA 911 2012 dataset to evaluate the relationship between specific VR services (i.e., job placement, counseling and guidance, college training, job search assistance, maintenance, assistive technology, on-the-job support, on-the-job-training, transportation, diagnosis and treatment, assessment, supported employment) and employment outcome, in the presence of moderating variables such as, race/ethnicity, and co-morbid disabilities – depression, substance use disorder) of individuals with TBI. Research questions were examined by the use of Statistical Package for the Social Sciences (SPSS) version 22 and their results are presented in the following sections.

Research Question One

What are the pre- or -post-injury characteristics (e.g. demographic variables, pre-employment status, levels of public support, receipt of VR services, and co-morbid disabilities such as depression), in a contemporary sample of individuals with TBI served

by the state-federal VR system? What are the employment outcomes at closure of this group of individuals with TBI?

Descriptive Statistics

This section provides descriptive statistics of demographic, pre-employment status, levels of public support (i.e., SSI and SSDI), VR services provided, and co-morbid disabilities such as depression and substance use disorder, at application and the employment outcomes at closure in a contemporary sample of individuals with TBI served by the state-federal VR system in the fiscal year of 2012. Generally, the sample size $n = 4,923$ was used for descriptive and statistical analyses.

AGE AT APPLICATION, GENDER, AND RACE/ETHNICITY

Individuals in this study ranged in age from 15 to 74 when they applied to the VR program ($M = 34.75$; $SD = 13.17$). Table 4 shows age group breakdown by race/ethnicity. The majority (92.4%) of individuals with TBI were between 15 – 54 years old. Of the 4,923 individuals with TBI, males accounted for 68% ($n = 3,347$), while females were 32% ($n = 1,576$). Racial and ethnic backgrounds were diverse as presented in Table 5. The majority of individuals were Whites, 77.6% ($n = 3,818$), while Blacks represented 13.3% ($n = 655$) and Hispanics/Latinos represented 6.8% ($n = 333$) of the total TBI sample. Individuals in other race/ethnicities accounted for 2.3% ($n = 117$), American Indians or Alaska natives 1.2% ($n = 61$), Asians .9% ($n = 45$) and Native

Hawaiian or other Pacific Islander 0.2% (n = 11) of the TBI sample, respectively. Table 6 shows the gender spread broken down by race/ethnicity.

Table 4

Age and Race/Ethnicity

Age Group	Race/Ethnicity						Total	%
	White	Black	Indian	Asian	Islander	Hispanic		
15-34	1962	341	26	29	8	207	2573	52.3
35-54	1540	278	32	13	2	110	1975	40.1
55-64	295	31	3	3	1	15	348	7.1
65-74	21	5	0	0	0	1	27	.5
Total	3818	655	61	45	11	333	4923	100

Table 5

Gender and Race/Ethnicity

	n	n	%
	Male	Female	
White	2,585	1,233	77.6
Black	442	213	13.3
Hispanic	245	88	6.8
Others	75	42	2.3
Total	3,347	1,576	100

PRE-EMPLOYMENT STATUS, HOURS WORKED PER WEEK, AND WEEKLY EARNINGS AT APPLICATION

Regarding employment status, Table 6 below shows that most of the individuals with TBI 86.2% (4,246) were not employed when they applied to the VR program. Of 4,923 participants, 74% (n = 3,641) were classified as not employed: others, 4.4% (n =

219) and 7.3% (n = 357) were unemployed but in education, and another 0.6% (n = 29) were not employed but in some type of training, Intern, or volunteer positions. Approximately 13.8% of the participants (n = 677) were employed with or without supports in an integrated settings when they applied to the VR program. Working hours and weekly earnings reflect high rates of unemployment. Average hours worked per week at application was 3.24 (range 0 - 58, SD = 9.402) and average weekly earnings at application was \$42.10 (range \$0.00 – \$2,308.00, SD = \$161.59).

Table 6

Pre-employment Status at Application

	n	%
Employment without Supports in Integrated Setting	546	11.1
Extended Employment	14	.3
Self-employment (except BEP)	20	.4
State Agency-managed Business Enterprise Program	1	.0
Homemaker	7	.1
Unpaid Family Worker	8	.2
Employment with Supports in Integrated Setting	81	1.6
Not employed: Student in Secondary Education	357	7.3
Not employed: All other Students	219	4.4
Not employed: Trainee, Intern or Volunteer	29	.6
Not employed: Other	3641	74.0
Total	4923	100.0

Note. All Other students refer to students attending any kinds of educational institutions except for secondary education.

When the unemployment rate was broken down by race/ethnicity, 85% (n = 3,260) of White participants were not employed, 91% of Black participants were not employed, 88% of Hispanic participants were not employed, and 85% was the rate of unemployment at application among other ethnic/racial groups. These findings are in Table 7.

Table 7

Pre-Employment Status and Race/Ethnicity

	White	Black	Hispanic	Other	%
Not Employed	3260 (85%)	595 (91%)	292 (88%)	99 (85%)	86.2
Employed	558 (15%)	60 (09%)	41 (12%)	18 (15%)	13.8
Total	3818	655	333	117	100

LEVEL OF EDUCATION AT APPLICATION

Table 8 presents level of education at application. A relatively small number of participants 4.1% (n = 203) reported holding a special education certificate, 19.2% (n = 946) of the participants had less than a high school education at application, 36.2% (n = 1,784) completed high school, whereas 28.2% (n = 1,390) had some post-secondary education/ associate degree, and 12.2% (n = 600) had a Bachelor's degree or higher degree.

Table 8

Level of Education at Application

	n	%
Completed special education program	203	4.1
Less than high school	946	19.2
Completed high school	1784	36.2
Some post-secondary/Assoc.	1390	28.2
College degree or higher	600	12.2
Total	4923	100.0

Note: Special education is defined as specialized instructions for individuals with disabilities.

SOURCE OF PRIMARY SUPPORT AND LIVING ARRANGEMENT AT APPLICATION

As presented in Table 9 below, 43.1% (n = 2,122) of the participants reported public support as their primary source of support at application, whereas only 8.5% (n = 418) reported personal income as their primary source of support. Participants whose primary source of income was family and friends accounted for 41% (n = 2018) of the participants.

Table 9

Primary Source of Support

	n	%
Personal Income	418	8.5
Family and Friends	2018	41.0
Public Support (SSI, SSDI, TANF, etc.)	2122	43.1
All other (e.g. private disability, insurance and private charities)	352	7.2
Missing	13	.3
Total	4923	100.0

Concerning living arrangement at application (see Table 10), the majority 93.8% (n = 4,616) had a private residence compared to only 2.2% (n = 109) that lived in a community residence or group home, 0.6% (n = 31) in a rehabilitation facility, 0.1% (n = 4) in a mental health facility, 0.2% (n = 8) in a nursing home, or 0.0% (n = 2) in an adult correctional facility. Other types of living arrangement included 0.3% (n = 15) in halfway housing, and 0.3% (n = 16) in substance abuse treatment centers. Of the TBI sample, 0.8% (n = 40) were homeless or stayed at a shelter.

Table 10

Living Arrangement

	n	%
Private Residence	4616	93.8
Community Res./Group Home	109	2.2
Rehab Facility	31	.6
Mental Health Facility	4	.1
Nursing Home	8	.2
Adult Correctional Facility	2	.0
Halfway House	15	.3
Substance Abuse Treat Center	16	.3
Homeless/Shelter	40	.8
Missing	82	1.7
Total	4923	100.0

LEVELS OF PUBLIC SUPPORT AND MEDICAL COVERGE BENEFITS (SSI, SSDI, MEDICAID, AND MEDICARE)

Concerning receipt of public benefits, 21.5% (n = 1,058) and 31.7% (n = 1,561) of the participants indicated receiving SSI and SSDI at application, respectively. Regarding medical insurance coverage, Table 11 also shows that 33.9% (n = 1,667) and 24.1% (n = 1,185) of the participants indicated having Medicaid and Medicare insurance coverage at application, respectively.

Table 11

Levels of Public Support

	Yes		No		Missing	
	n	%	n	%	n	%
SSI	1058	21.5	3836	77.9	29	0.6
SSDI	1561	31.7	3333	67.7	29	0.6
Medicaid	1667	33.9	3232	65.7	24	0.4
Medicare	1185	24.1	3712	75.4	26	0.5

IMPAIRMENTS AND SOURCES OF IMPAIRMENT VARIABLES

From the several types of impairments reported in the 2012 RSA-911 data file, the most frequently reported primary impairments resulting from TBI are mental and physical related impairments. Table 12 shows that more than half (60.4%, n = 2,974) of the participants had cognitive impairments involving learning, thinking, processing information and concentration. Physical impairments 25.5% (n = 1,255) were the second most reported primary impairment caused by TBI, the majority of whom (11.5% n = 568) reported having some types of physical impairment other than mobility orthopedic or neurological impairments, manipulation/dexterity orthopedic/neurological, and limited range of motion impairments. Participants who had psychosocial impairments (i.e., interpersonal and behavioral impairments) accounted for 5.3% (n = 262) of the participants, followed by 4.0% (n = 197) with other mental impairments.

Table 12

Primary Impairments Caused by TBI

	N	%
Cognitive impairment	2,974	60.4
Mobility Orth/neurological impairment	216	4.4
Manipulation and dexterity	101	2.1
Both mobility and manipulation/dexterity	270	5.5
Other Orthopedic impairment e.g. limited range of motion	42	0.9
Respiratory impairments	2	0.0
Fatigue, weakness, pain, etc.	56	1.1
Other physical impairments	568	11.5
Psychosocial impairment	262	5.3
Other mental impairments	197	4.0
All others: sensory/communicative impairments e.g. blindness, deafness	235	4.8
Total	4,923	100

Of the 4,923 individuals with TBI, the majority (98.6 % n = 4,856) reported having a significant disability, whereas only 1.4% (n = 67) did not have a significant disability. Regarding secondary impairment, Table 13 shows that 38.5% (1,893) of the

participants did not report presence of a secondary impairment. Among the remaining individuals that reported presence of a secondary impairment, psychosocial 18.1% (n = 891), cognitive 10.5% (n = 518), and physical impairments 6.9% (n = 338) other than mobility orthopedic or neurological impairments, and respiratory impairments are the more commonly reported secondary impairments.

Table 13

Secondary impairment

	N	%
No impairment	1,893	38.5
Psychosocial impairment	891	18.1
Cognitive impairment	518	10.5
Other physical impairment not listed.	338	6.9
Other mental impairments	251	5.1
Mobility orthopedic/neurological impairments	199	4.0
Both mobility and manipulation/dexterity	163	3.3
Other orthopedic (e.g. limited range of motion)	144	2.9
General physical debilitation (e.g. fatigue, weakness, pain)	124	2.5
Manipulation/dexterity	114	2.3
Respiratory impairments	18	0.4
All others: sensory/communicative impairments e.g. blindness, deafness	270	5.5
Total	4,923	100

Of a total of 37 different types of causes of secondary impairments reported in the

2012 RSA-911 data file, Table 14 below shows that depressive and other mood disorders (10.4%, n = 510) is the commonly reported secondary cause of secondary impairment, followed by accident/injury (other than TBI or SCI) (7.7%, n = 381), substance use disorder (2.9%, n = 143), accident/injury (other than TBI or spinal cord injury), anxiety disorder (2.7%), and epilepsy (2.7%) respectively.

Table 14

Cause of secondary impairment

	n	%
No secondary impairment	1,893	38.5
Depressive and other mood disorders	510	10.4
Substance use disorder	143	2.9
Accident/injury (other than TBI or SCI)	381	7.7
Anxiety disorder	135	2.7
Epilepsy	135	2.7
All 31 other secondary disabilities (such as stroke, epilepsy, learning disabilities, ADHD, Autism, etc.)	820	16.7
Missing/don't know	906	18.4
Total	4,923	100

PRIMARY SOURCES OF REFERRAL

The three most common referral sources to the VR program were self-referral 36.1% (n = 1,778), followed by physician or other medical personnel or institutions 14.2% (n = 701), and elementary/high school institutions 11.2% (n = 550). See table 15 below for details.

Table 15

Source of Referral

	n	%
Self-referral	1,778	36.1
Physician or other medical personnel or institutions	701	14.2
Elementary/secondary institutions	550	11.2
Community rehabilitation programs	417	8.5
Post-secondary educational institutions	120	2.4
One-stop employment centers	118	2.4
Welfare agency (state or local)	80	1.6
Social Security Administration	78	1.6

Note: Other sources of referral was represented by 22%

TYPES OF VR SERVICES PROVIDED, LENGTH OF PARTICIPATION IN THE PROGRAM, AND COST OF PURCHASED SERVICES

Table 16 shows the most commonly provided VR services during the fiscal year 2012. The top three most common VR service were vocational rehabilitation counseling and guidance (69.9%, $n = 3,443$), followed by assessment (69.3%, $n = 3,414$), and job placement assistance (43.1%, $n = 2,122$). Closely following these services are diagnosis and treatment (37.7%), transportation (32.8%), job search assistance (32%), and on-the-job support (26.9%). In contrast, reader services (0.1%), interpreter services (0.1%), and personal attendant services (0.6%) are the three least provided VR services. The average length of time in VR program was 33.99 months (range one month – 333 months, $SD = 27.90$ months) for individuals with TBI. The mean cost of purchased services was approximately \$5,728.87 (range \$0.00 – \$159,636.00, $SD = \$9,972.44$).

Table 16

VR Services

	Yes		No	
	n	%	n	%
Voc. Rehab C&G	3,443	69.9	1,480	30.1
Assessment	3,414	69.3	1,509	30.7
Job placement assistance	2,122	43.1	2,801	56.9
Diagnosis & treatment	1,854	37.7	3,069	62.3
Transportation	1,615	32.8	3,308	67.2
Job search assistance	1,574	32	3,349	68.0
On-the-job support	1,322	26.9	3,601	73.1
Information referral	1,017	20.7	3,906	79.3
Job readiness training	889	18.1	4,034	81.9
Supported employment	866	17.8	3,996	82.2
Maintenance	749	15.2	4,174	84.8
College training	704	14.3	4,219	85.7
Assistive tech	451	9.2	4,472	90.8
On-the-job training	186	3.8	4,737	96.2
Technical assistance	84	1.7	4,839	98.3
Personal attendant	31	0.6	4,892	99.4
Interpreter services	7	0.1	4,916	99.9
Reader services	5	0.1	4,918	99.9

EMPLOYMENT OUTCOME AT CLOSURE

The employment outcome at closure was approximately equally spread between the successfully employed group 49.3% (n = 2431) versus the unsuccessfully employed group 50.7% (n = 2492). From table 17, the employment outcome broken down by race, shows that White had the highest successful employment rate, followed by Hispanics, the other ethnic minorities group, and Blacks.

Table 17

Employment outcome at closure

	White	Black	Hispanic	Other	Total
Unsuccessfully employed	1882 (49.3%)	382 (58.3%)	165 (49.5%)	63 (53.8%)	2492
Successfully employed	1936 (50.7%)	273 (41.7%)	168 (50.5%)	54 (46.2%)	2431
Total	3818	655	333	117	4923

PREDICTORS OF EMPLOYMENT OUTCOMES AT CLOSURE FOR INDIVIDUALS WITH TBI

To appropriately answer research questions two and three, 92 additional individuals with TBI with missing data on some VR services received, such as supported employment services, were deleted from the sample. The cases with missing information were approximately 1.9% of the sample, and were not included in the data analyses for research questions two and three. The final sample size n = 4,831 that was used for data analyses was still large enough to meet the minimum ratio rule of ten cases per predictor

(Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996). A total of 88 predictors (i.e., including interaction variables) were included in the full logistic regression model. The overall logistic regression model was statistically significant, $\chi^2(88) = 1095.745$, $p < .005$. The model explained 27.1% (Nagelkerke R square) of the variance in successful employment outcome and correctly classified 69.5% of cases.

Research Question Two

Which VR program services predict employment outcomes at closure for individuals with TBI, after controlling for demographic characteristics?

To answer this research question, logistic regression was conducted to investigate how the controlled variables (i.e., pre-injury characteristics), post-injury characteristics, and VR services variables predicted employment outcomes at closure. Sequential (hierarchical) multiple logistic regression analysis was used to examine the relationship between VR service variables, and the criterion variable of successful employment outcome, after controlling for the effects of pre-injury characteristics (i.e., age at application, gender, race/ethnicity, education, and pre-employment status at application).

The first step in the logistic regression included entering the pre-injury characteristics in block 1 as follows: gender (with male as the reference category), age at application, race/ethnicity (with White as the reference category), level of education at application (with having a high school degree as the reference category), pre-employment status at application (with being unemployed at application as the reference category).

The post-injury characteristics, that is, receipt of SSI/SSDI at application (with not receiving SSI/SSDI as the reference category), significant disability (with no significant disability as the reference category), substance use disorder (with absence of substance use disorder as the reference category), depression (with absence of depression as the reference group), and cost of purchased services were entered in block 2. The 12 VR related variables were entered in block 3 as follows: VR counseling and guidance, college training, job search assistance, diagnosis and treatment, job placement, assessment, on-the-job support, on-the-job training, transportation, maintenance, assistive technology, and supported employment. For all 12 VR services, not receiving the service was coded as the reference category. In step 1, a logistic regression model including only pre-injury characteristic variables, and the constant was run. In the second step, a logistic regression model consisting of the constant, pre-injury and post-injury characteristic predictors was run, and in step 3, all the variables in step 2 and the set of 12 VR service predictors was run as a single block.

THE EFFECT OF DEMOGRAPHIC CHARACTERISTICS ON EMPLOYMENT OUTCOME

The first model (including only pre-injury characteristic variables) was statistically significant [χ^2 (df =10) = 202.367, $p < .01$], as is shown in the significant block chi-square. So, we can infer that there is a significant relationship between pre-injury variables and the likelihood of a positive employment outcome. The Nagelkerke R square was .055, indicating that 5.5% of the variance in successful employment outcomes could be explained by this group of predictors. Table 18 presents the independent

variables in model 1 and their associated significance values and coefficients of their effect sizes.

Table 18

Logistic Regression Results for Model including Demographic Predictors of Employment Outcomes (ALL Blocks' effects)

	β	S.E.	Wald	p	Exp(β)	95% C.I. for EXP (β)	
						Lower	Upper
Special education	-.234	.121	3.720	.054	.792	.624	1.004
Less than high school	-.222	.067	10.900	.001	.801	.702	.914
Some college education	.141	.059	5.722	.017	1.152	1.026	1.293
College degree or higher	.312	.081	14.811	.000	1.366	1.165	1.601
Age at application	-.013	.002	27.601	.000	.987	.983	.992
Gender	.032	.032	1.027	.311	1.033	.970	1.099
Black	-.163	.083	3.856	.050	.850	.722	1.000
Hispanic	.116	.100	1.349	.245	1.123	.923	1.366
Other ethnicities	-.066	.148	.199	.656	.936	.701	1.251
Pre-employment status	.524	.046	128.415	.000	1.689	1.542	1.849

Note: Special education means the receipt of modified or specialized instruction.

In this step, with the exception of gender, education, age, race/ethnicity, and pre-employment status at application were found to be significantly related to employment outcome. The overall effect of level of education at application was found to be significant [χ^2 (df = 4) = 26.948, $p < .01$]. More specifically, individuals with TBI with some college degree or college degree/higher were found to have approximately 15% (odds ratio=1.15, 95 % CI [1.03, 1.29]) and 37% (odds ratio=1.37, 95 % CI [1.17, 1.60]) respectively increase in odds of becoming successfully employed in comparison to those

individuals with TBI who had high school diploma/degree. On the contrary, individuals with less than high school diploma were found to have a 20% decrease in odds (odds ratio=0.80, 95 % CI [0.70, 0.91]) of becoming successfully employed in comparison to those who had high school diploma/degree. Age was found to be a negative predictor of successful employment outcome. Increasing age slightly (1%) reduces the odds of being successfully employed for individuals with TBI. The overall effect of race/ethnicity [χ^2 (df = 3) = 10.483, p = .015] was found to be significantly related to employment outcome. For individuals who were pre-employed at application, the odds of being successfully employed was increased by 1.69 times (odds ratio = 1.69, 95 % CI [1.54, 1.85]), indicating that individuals who were pre-employed at application were 1.69 times more likely to be successfully employed at closure; i.e., have a 69% increase in the odds of being successfully employed,

THE EFFECT OF POST-INJURY CHARACTERISTICS ON EMPLOYMENT OUTCOME

To determine if the addition of the set of post-injury characteristic variables together significantly contributed to the prediction of successful employment among individuals with TBI after controlling for pre-injury characteristics, the chi-square values from the omnibus tests of model coefficients related with the first and second models were calculated and compared. The difference in the Nagelkerke R square between both regression models was computed to be .047, indicating that 4.7% of the variance in

successful employment outcome could be explained by the addition of post-injury characteristics.

Table 19 showed that the overall accuracy of the second model to predict individuals with TBI to be successfully employed or unsuccessfully employed at closure was 62.4%. This model accurately predicted successful as well as unsuccessful employment outcomes at a rate, 55.5% and 69.2%, respectively.

Table 19

Classification Table of Successful Employment Outcome for Individuals with TBI

		Predicted		
		Unsuccessfully Employed	Successfully employed	%
Observed	Unsuccessfully Employed	1672	743	69.2
	Successfully employed	1074	1342	55.5
Overall Percentage				62.4

Table 20 shows that the receipt of SSI and SSDI, the presence of co-occurring depression, and cost of purchased services were found to be predictors of employment outcome. Specifically, individuals with TBI who received SSI and SSDI were found to have a 22% reduction in odds (odds ratio=0.78, 95 % CI [0.72, 0.84]) and 14% reduction in odds (odds ratio=0.86, 95 % CI [0.81, 0.92]) respectively, of becoming successfully employed in comparison to those who did not receive such benefits. Individuals who had a co-morbid psychiatric disability (i.e. depression), were found to have a 15% reduction in odds (odds ratio=0.85, 95 % CI [0.77, 0.94]) of becoming successfully employed in

comparison to those individuals without depression. The cost of purchased services was a positive predictor of successful employment outcome. This study found that substance use disorder and the presence of a significant disability were not significant predictors of employment outcome.

Table 20

Logistic Regression Results for Model including Demographic and Post-injury Predictors of Employment Outcomes including only Post-Injury Predictors' Results

	β	S.E.	Wald	p	Exp(β)	95% C.I. for EXP (β)	
						Lower	Upper
SSI	-.251	.038	43.608	.000	.778	.722	.838
SSDI	-.151	.034	19.854	.000	.860	.805	.919
Depression	-.164	.050	10.780	.001	.848	.769	.936
Substance use disorder	-.094	.090	1.113	.291	.910	.763	1.084
Significant disability	-.208	.134	2.415	.120	.813	.625	1.056
Cost of purchased services	.039	.004	80.470	.000	1.040	1.031	1.049

THE EFFECT OF VR SERVICE VARIABLES ON EMPLOYMENT OUTCOME

In order to determine if the addition of the set of 12 VR service variables together significantly contributed to the prediction of successful employment among individuals with TBI after controlling for demographic and pre-employment status variables, the chi-square values from the omnibus tests of model coefficients related with the full (i.e., regression model of the third step) and reduced models (i.e., regression model of the

second step) were calculated and compared. The omnibus test of model coefficients in the third model [which is the difference in $-2 \log$ likelihoods between the third regression model (pre and post-injury characteristics, and VR service predictors), and the second regression model (pre and post-injury characteristic variables)] showed another significant chi-squared value [χ^2 (df = 12) = 615.030, $p < .01$]. This indicates that the set of VR service variables alone explain a significant amount of variability in the likelihood of a positive employment outcome over and above any relationship with pre and post-injury characteristic variables.

The difference in the Nagelkerke R square between the third and the second regression models was computed to be .148, indicating that approximately 15% of the variance in successful employment outcome could be explained by the set of VR intervention services. These results showed a significant improvement from the second regression model. In other words, the set of 12 VR service variables alone accounted for more variance (i.e., 15%) in successful employment outcomes than the 10.2% variance that was explained by the set of controlled pre-injury characteristic and post-injury predictors on their own. The third model predicted 69.2% of cases correctly overall. Table 21 showed that the regression model accurately predicted successful as well as unsuccessful employment outcomes at a rate, 65.8% and 72.6%, respectively.

Table 21

Classification Table of Successful Employment Outcome for Individuals with TBI

		Predicted		
		Unsuccessfully Employed	Successfully employed	%
Observed	Unsuccessfully Employed	1753	662	72.6
	Successfully employed	826	1590	65.8
Overall Percentage				69.2

At this stage of the knowledge on TBI employment outcomes there is not enough information to anticipate that one of the selected services would be more likely than others to predict successful employment outcome among individuals with TBI. Table 22 presents the findings for each independent VR service variables in the third logistic regression model. Using beta, standard error, Wald statistic, degrees of freedom, significance level, and Exp (β) or the odds ratio (effect size) of the logistic regression coefficient associated with each independent variable, the importance of individual variables in predicting successful employment outcomes was examined.

Table 22

Logistic Regression Results for Model including demographic, Post-injury and VR Service Predictors of Employment Outcomes including only VR Service Predictors' Results

	β	S.E.	Wald	p	Exp(β)	95% C.I. for EXP(β)	
						Lower	Upper
Supported employment	-.318	.049	42.158	.000	.728	.661	.801
Assessment	-.100	.035	8.017	.005	.905	.844	.970
Diagnosis and treatment	-.098	.034	8.259	.004	.907	.848	.969
Transportation	-.077	.036	4.441	.035	.926	.863	.995
Job search assistance	.090	.038	5.731	.017	1.094	1.016	1.178
Assistive technology	.116	.057	4.063	.044	1.123	1.003	1.257
Maintenance	.158	.047	11.380	.001	1.171	1.068	1.284
On-the-job training	.370	.093	15.692	.000	1.448	1.206	1.739
Job placement	.399	.035	126.943	.000	1.490	1.390	1.597
On-the-job support	.642	.044	214.638	.000	1.901	1.744	2.072
College training	-.023	.050	.205	.651	.978	.886	1.078
Counseling and guidance	.062	.036	2.946	.086	1.064	.991	1.142

After controlling for the effect of the pre and post-injury characteristics, and the other VR service variables in the model on successful employment outcomes, 10 of the 12 VR service variables were found to be significantly related to employment outcome. Supported employment, assessment, diagnosis and treatment, and transportation services, were negatively related to successful employment outcome. On the other hand, job search assistance, maintenance, assistive technology, on-the-job training, job placement, and on-the-job support were found to be positively related to successful employment outcome.

On-the-job support services, job placement, and on-the-job training showed the most positive effect on successful employment with the following odds ratios: (odds ratio = 1.90; 95% CI: 1.74 – 2.07; odds ratio = 1.49; 95% CI: 1.390 - 1.597; odds ratio = 1.45; 95% CI: 1.206 - 1.739, respectively). The odds of obtaining successful employment were almost two times higher for individuals with TBI who received on-the-job support than the odds of those who did not receive this service, that is, individuals who received on-the-job support services had a 90% increase in the odds of being successfully employed than those individuals who did not receive on-the-job support. The odds of obtaining successful employment were 1.49 times and 1.45 times higher respectively for individuals who received job placement and on-the-job training services than for those who did not receive job placement and on-the-job training services. The next set of positive predictors of successful employment and associated odds ratios was: maintenance (odds ratio = 1.17; 95% CI: 1.07 - 1.28); assistive technology (odds ratio = 1.12; 95% CI: 1.00 – 1.26); and job search assistance (odds ratio = 1.09; 95% CI: 1.02 - 1.18, respectively). The odds of being successfully employed was increased by 17%, 12%, and 9% respectively for individuals with TBI who received maintenance, assistive technology, and job search assistance respectively compared to the those individuals who did not receive these services.

On the other hand, supported employment ($\beta = -.318$, $SE = .049$, $Wald = 42.158$, $p = .000$, $Exp(\beta) = .728$) was the strongest negative predictor of successful employment outcome. The odds of finding successful employment (odds ratio = 0.73, 95 % CI [0.66,

0.80]) decreased by 27% for individuals with TBI who received supported employment service than the odds of those who did not receive supported employment. For individuals with TBI who received assessment (odds ratio = 0.91, 95 % CI [0.84, 0.97]), diagnosis and treatment (odds ratio = 0.91, 95 % CI [0.85, 0.97]), and transportation (odds ratio = 0.93, 95 % CI [0.86, 1.00]) services, the odds of being successfully employed decreased by approximately 9% for each of these services than the odds of those who did not receive each of these services.

College training ($\beta = -.023$, $p = .651$) and counseling and guidance ($\beta = .062$, $p = .086$) services were not significantly related to successful employment outcome. In addition, in this third step, receiving SSI/SSDI at application, prior employment status at application, presence of depression as a secondary disability, level of education at application, age and case expenditure still remained significantly related to successful employment outcome, after adjusting for other demographic variables and services in the model. It is noteworthy to mention here that contrary to the first regression model where receiving some college education ($\beta = .115$, $p = .056$) was approaching significance, in this second regression model, receiving some college education ($\beta = .205$, $SE = .04966$, $Wald = 9.819$, $p = .002$, $Exp(\beta) = 1.23$) was significantly related to successful employment. In other words, the odds of being successfully employed is increased by 23% for individuals with some college education (odds ratio = 1.23, 95 % CI [1.08, 1.40]) when compared to the odds for individuals with just a high school diploma.

Research question 3

How do the demographic variables of race/ethnicity and co-morbid disabilities (depression and substance use disorder) moderate the relation between each variable in the set of VR service variables investigated as predictors from research question 2 and employment outcome at closure?

In step 4, a fourth logistic regression model consisting of the all the controlled variables entered in blocks 1 and 2, VR service predictors entered in block 3, and all the set of interaction variables entered together in block 4 was run simultaneously as one single full model. The omnibus test of model coefficients in the fourth and final model [χ^2 (df = 60) = 94.780, $p < .003$] was significant, indicating that the set of interaction variables alone is significantly related to successful employment outcome over and above any relationship with pre and post-injury characteristics, and VR service variables.

The Nagelkerke R square for the overall final model was .271. The difference in the Nagelkerke R square between the final and the third regression models was computed to be .021, indicating that only 2.1% of the variance in successful employment outcome could be explained by including the set of interaction variables in the regression model. In other words, the set of interaction variables alone accounted for only 2.1% variance in successful employment outcomes over and beyond the 25% variance that was explained by the set of demographic, post-injury, and the set of 12 VR service variables on their own. Table 23 presented below showed that the overall accuracy of the full logistic model to predict individuals with TBI to be successfully employed or unsuccessfully

employed at closure was 69.5%. The model correctly classified 66.3% of individuals who were successfully employed and 72.8% of individuals who were unsuccessfully employed at closure. In other words, sensitivity was 66.3% and specificity was 72.8%. The positive predictive value was 70.9% and negative predictive value was 68.3%.

Table 23

Classification Table of Successful Employment Outcome for Individuals with TBI

		Predicted		
		Unsuccessfully Employed	Successfully employed	%
Observed	Unsuccessfully Employed	1757	658	72.8
	Successfully employed	815	1601	66.3
Overall Percentage				69.5

Research question 3a.

Does race/ethnicity moderate the relation of VR service variables investigated as predictors in question 2, in their effect on employment outcomes?

In order to get at the overall significance of the interaction effect of race/ethnicity and each of the set of VR service variables, an additional step involved entering the interaction terms for the three race/ethnicity variables and each of the 12 VR service variables one at a time in the logistic regression model in a separate block, while controlling for every other predictor variables (including other interaction variables), and their effect on the model were analyzed by checking their p-values and their associated coefficients.

Table 24

*Interaction-Specific Effects between Each VR Service Variable and Race/Ethnicity
Variable on Employment Outcomes*

Predictors	Chi-square	p
Transportation x race/ethnicity	14.715	.002
Supported employment x race/ethnicity	12.664	.005
Assistive technology x race/ethnicity	8.534	.036
College training x race/ethnicity	7.646	.054
On-the-job training x race/ethnicity	7.329	.062
Counseling & Guidance x race/ethnicity	6.004	.111
On-the-job support x race/ethnicity	5.218	.157
Assessment x race/ethnicity	4.515	.211
Job search assistance x race/ethnicity	3.123	.373
Maintenance x race/ethnicity	1.676	.642
Diagnosis and Treatment x race/ethnicity	1.642	.650
Job placement x race/ethnicity	.579	.901
Overall Model	1095.745	.000

Table 24 above showed that four VR service variables: transportation [χ^2 (df = 3) = 14.715, p = .002], supported employment [χ^2 (df = 3) = 12.664, p = .005], assistive technology [χ^2 (df = 3) = 8.534, p = .036], and college training [χ^2 (df = 3) = 7.646, p = .054] were significantly moderated by race/ethnicity. This finding therefore suggests that race/ethnicity moderate the effect of VR services variables in their effect on employment outcome. It is noteworthy to mention that even though the main effect of college training was not significantly related to employment outcome (see table 22), the interaction effect of college training with race/ethnicity was significantly related to successful employment

outcome. Table 25 below provides more detailed information of the strength and direction of this interaction effect.

Table 25

*Logistic Regression Results for Model including all Main effects and Interaction effects
for Predictors of VR Services with Race/Ethnicity on Employment Outcomes
Including only VR Service Interaction Effects' Results with Race/Ethnicity*

	β	S.E.	Wald	df	Sig.	Exp(β)	95% C.I. for EXP(β)	
							Lower	Upper
Transportation x Black	-.213	.106	4.003	1	.045	.808	.656	.996
Transportation x Hispanic	-.103	.124	.683	1	.408	.902	.707	1.151
Transportation x Other	.622	.203	9.364	1	.002	1.863	1.251	2.775
Supported employment x Black	-.479	.173	7.626	1	.006	.620	.441	.870
Supported employment x Hispanic	-.470	.219	4.609	1	.032	.625	.407	.960
Supported employment x Other	1.182	.392	9.108	1	.003	3.261	1.513	7.025
Assistive technology x Black	-.289	.172	2.819	1	.093	.749	.535	1.049
Assistive technology x Hispanic	.007	.196	.001	1	.970	1.007	.686	1.480
Assistive technology x Other	.027	.241	.012	1	.912	1.027	.640	1.649
College training x Black	.421	.160	6.930	1	.008	1.524	1.114	2.085
College training x Hispanic	-.082	.159	.270	1	.603	.921	.675	1.257
College training x Other	-.469	.271	2.991	1	.084	.626	.368	1.064
Assessment x Black	.230	.109	4.446	1	.035	1.258	1.016	1.558
Assessment x Hispanic	-.041	.134	.094	1	.759	.960	.738	1.248
Assessment x Other	-.260	.210	1.534	1	.215	.771	.512	1.163
Job placement assistance x Black	-.069	.105	.438	1	.508	.933	.760	1.146
Job placement assistance x Hispanic	-.004	.127	.001	1	.973	.996	.776	1.277
Job placement assistance x Other	.067	.197	.116	1	.734	1.069	.727	1.572
On-the-job support x Black	.269	.142	3.604	1	.058	1.309	.991	1.728
On-the-job support x Hispanic	.213	.178	1.429	1	.232	1.237	.873	1.754
On-the-job support x Other	-.574	.300	3.671	1	.055	.563	.313	1.013

Individuals who are Black and who received transportation services (odds ratio = 0.81, 95% CI [0.656, 0.996]) have a 19% reduction in odds of obtaining successful employment than the odd for individuals who are White that received transportation

service. Interestingly, the reverse was the case for individuals in the ‘Other’ ethnic minority group. The odds of being successfully employed for individuals belonging to the ‘Other’ ethnic minority group that received transportation service (odds ratio = 1.86, 95% CI [1.25, 2.78]) was almost double the odds for individuals who are White that received the same transportation service. This finding is consistent with Johnstone et al.’s (2003d) study that found a positive relationship between transportation and successful employment. The odds of being successfully employed was increased by 86% for individuals with TBI belonging to the ‘Other’ ethnic minority group who received transportation service compared to the odds of being successfully employed for individuals who are White and who received transportation service.

Table 25 shows that the odds of being successfully employed was decreased by 38% and 37% respectively for those individuals who are Black that received supported employment service (odds ratio = 0.62, 95% CI [0.44, 0.87]) or of Hispanic origin (odds ratio = 0.63, 95% CI [0.41, 0.96]) when compared to the odds of being successfully employed for individuals who are White that received supported employment service. On the other hand, the receipt of supported employment service was a significant positive predictor of successful employment for individuals in the ‘Other’ ethnic minority group (odds ratio = 3.26, 95% CI [1.51, 7.03]). The odd of being successfully employed was increased by approximately 3.3 times for ‘Other’ ethnic minority group after receiving supported employment service than was the odds for White.

Although Table 24 shows a significant interaction effect between the three race/ethnicity variables together and assistive technology (with White as the reference group), none of the Black, Hispanic, and ‘Other’ ethnic group interactions with assistive technology service were found to be significant (see table 25). There is the possibility that the interaction may be driven by other ethnicities. Further analysis is necessary to determine if this interaction is potentially between Black and Hispanic, or Black and ‘Other’ ethnic group or Hispanic and ‘Other’ ethnic group. This study found a significant positive interaction effect between college training and being of Black. Individuals who are Black and who received college training as a VR service, have an increased odd of about 1.5 times (50%) greater than the odds of individuals who are White, in obtaining successful employment outcome. For individuals who are black that received assessment service, the odds of obtaining successful employment is significantly increased by 1.26 times (odds ratio = 1.26, 95% CI [1.02, 1.56]) than for Whites who received a similar service.

Research question 3b. Does depression moderate the relation of VR service variables investigated as predictors in question 2, in their effect on employment outcomes?

Table 26

Logistic Regression Results for Model including all Main effects and Interaction effects for Predictors of VR Services with Race/Ethnicity on Employment Outcomes Including only VR Service Interaction Effects' Results with Depression

	β	S.E.	Wald	df	Sig.	Exp(β)	95% C.I. for EXP(β)	
							Lower	Upper
Counseling and Guidance x depression	-.020	.061	.112	1	.738	.980	.870	1.103
College training x depression	.062	.081	.582	1	.445	1.064	.907	1.248
Assessment x depression	.060	.059	1.031	1	.310	1.062	.946	1.192
Diagnosis and treatment x depression	-.017	.056	.094	1	.760	.983	.881	1.097
On-the-job training x depression	-.032	.142	.051	1	.821	.968	.734	1.278
Job search assistance x depression	-.005	.060	.006	1	.939	.995	.884	1.120
Job placement assistance x depression	-.024	.058	.169	1	.681	.976	.871	1.095
On-the-job support x depression	-.063	.069	.838	1	.360	.939	.820	1.075
Transportation x depression	.085	.058	2.140	1	.143	1.088	.972	1.219
Maintenance x depression	-.113	.074	2.320	1	.128	.893	.772	1.033
Assistive technology x depression	.121	.113	1.161	1	.281	1.129	.906	1.407
Supported employment x depression	-.042	.078	.292	1	.589	.959	.823	1.117

Table 26 above shows no significant interaction between any of the 12 VR service variables and depression, indicating that there is no significant interaction effect of depression on the effect of VR services on employment outcome. As stated earlier, the main effect of depression is an important predictor of successful employment (see table

20). However, the presence of depression as a secondary diagnosis does not moderate the effect of VR service variables on successful employment outcome.

Research question 3c. Does substance use disorder moderate the relation of VR service variables investigated as predictors in question 2, in their effect on employment outcomes?

Table 27.

Logistic Regression Results for Model including all Main effects and Interaction effects for Predictors of VR Services with Race/Ethnicity on Employment Outcomes Including only VR Service Interaction Effects' Results with Substance Use Disorder

	B	S.E.	Wald	df	Sig.	Exp(β)	95% C.I. for EXP(β)	
							Lower	Upper
Counseling and guidance x substance use	-.067	.131	.258	1	.612	.936	.724	1.210
College training x substance use	.450	.151	8.925	1	.003	1.568	1.167	2.106
Assessment x substance use	-.243	.127	3.682	1	.055	.784	.612	1.005
Diagnosis and treatment x substance use	-.133	.115	1.340	1	.247	.875	.698	1.097
On-the-job training x substance use	-.181	.342	.278	1	.598	.835	.427	1.634
Job search assistance x substance use	.015	.136	.012	1	.912	1.015	.777	1.326
Job placement assistance x substance use	.045	.124	.134	1	.714	1.046	.821	1.333
On-the-job support x substance use	.229	.152	2.275	1	.131	1.257	.934	1.692
Transportation x substance use	-.078	.120	.417	1	.519	.925	.731	1.171
Maintenance x substance use	.180	.143	1.575	1	.209	1.197	.904	1.586
Assistive technology x substance use	.369	.283	1.701	1	.192	1.447	.831	2.520

Supported employment x substance use	.094	.204	.211	1	.646	1.098	.736	1.638
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Although the moderating effect of assessment ($\beta = -.243$, $SE = .127$, $Wald = 3.682$, $p = .055$, $Exp(\beta) = .78$) was found to be approaching significance, the effect of college training ($\beta = .450$, $SE = .151$, $Wald = 8.925$, $p = .003$, $Exp(\beta) = 1.57$) service on employment outcome was found to be significantly moderated by the presence of substance use disorder in individuals with TBI. The odds of obtaining successful employment was 1.57 times higher for individuals who received college training services and had substance use disorder issues than the odds of those individuals who did not receive college training services and had no history of substance use disorder.

CHAPTER 5

DISCUSSION

Owensworth & McKenna's (2004) model was adopted as the conceptual framework for this study. This conceptual model emphasizes the importance of metacognitive, emotional (e.g. depression) and social environment (e.g. VR program and services) for improving employment outcome. In keeping with this model, and in order to better understand employment outcomes post-TBI, the present study utilized the national RSA 911 2012 dataset to identify the demographic, social and emotional and environmental variables that predict employment outcomes. This study also considered whether the VR variables that predict employment outcomes are moderated by race/ethnicity, and comorbid difficulties including depression and substance abuse. A summary of the findings pertaining to each research question is presented along with the importance of the findings. This is followed by a discussion of study limitations. Implications for practice and suggestions for future research are also presented.

The first research question addressed the demographic characteristics and pre-employment status at application of the sample used in this study and whether these are similar to cohorts that have been reported on in other studies. To the extent that the current sample is similar to previous samples, the findings of the current study may have greater generalizability to the population of individuals with TBI, especially RSA and TBIMS cohorts. The sample studied was composed of $n = 4,923$ individuals who had sustained a TBI and who were in the RSA database because they were referred to the

state/federal VR program and exited the program after receiving VR services at case closure in 2012. Several demographic characteristics of these individuals with TBI including age, gender, race/ethnicity, and educational level at application are similar to those in previous studies. The mean age in this study was 34.75 (SD = 13.17) years with greater numbers of men (68%) than women (32%). Racial and ethnic backgrounds were diverse; 76.6% were White, 13.3% were Blacks, 6.8% were Hispanics, 2.3% were from 'Other' ethnic minority groups. The majority (76.2%) had at least a high school degree. These demographic findings are highly consistent with those from Catalano et al.'s (2006) study using the 2006 RSA database and the demographic characteristics of the TBI sample in the current study are also similar to those found from a synthesis of previous studies (Ahonle, 2014). For example, consistent with this study, the majority (66%) of the individuals in the synthesis were males and White (82%). However, the sample of Blacks (6.1%) in the synthesis was less than half the sample size of Blacks in this present study (12%). It is possible that the missing information for some of the race/ethnic groups in seven of the studies reviewed could explain for this difference.

Some of the demographic characteristics findings in this study including age at application, gender, education, and race/ethnicity are similar to findings from previous studies and consistent with what is known about the larger population of individuals who sustain TBI in the U.S. This similarity in findings suggests that this finding is generalizable to the TBI population in general.

Predictors of Employment Outcomes

The second research question concerns the predictors of employment outcomes including demographics, post-injury variables such as SSI, SSDI, and depression, and VR variables found to be related to employment outcomes in other studies.

DEMOGRAPHIC PREDICTORS

The demographic predictors together accounted for 5.5% amount of variance in employment outcome. This study found that having a degree beyond high school was a significant positive predictor of successful employment. The finding of the importance of level of education in the successful employment outcomes of individuals with TBI is consistent with findings from earlier studies (Catalano et al., 2006; Da Silva Cardoso et al., 2007; Gamble & Moore, 2003a). Being better educated (i.e., with more than 12 years education) was a frequently cited predictor of successful employment in previous studies with individuals with spinal cord injuries and TBI (Bolton et al., 2000; Crisp, 2005; Keyser-Marcus et al., 2002; Sherer et al., 2002).

This study found a significant relationship of age to successful employment outcomes. This finding is consistent with Da Silva Cardoso et al. (2007) who also reported a similar odds ratio of age to employment outcome. Mixed findings on the relation of gender to employment outcomes have been reported in the literature. For example, Da Silva Cardoso et al. (2007) found a significant effect of gender (in favor of males) on successful employment (odds ratio = 1.16; 95% CI: 1.04 – 1.30), as did Bound et al. (2003). In contrast, Johnstone et al. (2003c) did not find significant gender differences in the rate of successful employment. Similar to the finding of Johnstone et

al., the current study did not find gender to be a significant predictor of successful employment outcomes. The current findings are corroborated by the 2013 Bureau of Labor Statistics report that the unemployment rate for women with a disability (13.0 percent) was about the same (i.e., 13.5 percent) as the rate for men in the general population (<http://www.bls.gov/news.release/pdf/disabl.pdf>).

POST-INJURY PREDICTORS

The post-injury variables accounted for 4.7% of variance over and above demographic variables in predicting employment outcomes. In terms of pre-employment status prior to receiving VR services, this study found a significant positive relationship between this variable and successful employment. Individuals with TBI who had been previously employed prior to applying for and receiving VR services had a higher likelihood (i.e. 1.6 times odds ratio) of obtaining successful employment than those who were not employed before application for VR services. This finding is consistent with findings from previous TBI outcome studies and more recent literature reviews (Crisp, 2005; Gordon et al., 2006; Yasuda et al., 2001).

Another finding from this study is that individuals who received SSI/SSDI had significantly lower successful employment outcomes compared to individuals who did not receive SSI/SSDI. This finding is consistent with those from more recent VR studies (Catalano et al., 2006; Da Silva Cardoso et al., 2007). The negative effect of SSI/SSDI is also consistent with the results from Berry's (2000) study that examined other disability categories. Berry's (2000) study found better odds of successful employment generally

for youth with disabilities who were not receiving public support than for youth who were receiving public support. In contrast, Johnstone et al., (2003d) reported no effect of SSI/SSDI on employment outcome. Care must be taken in interpreting the negative relation of receipt of public support and employment success. This correlation cannot be used to infer that the receipt of public support “causes” poorer employment outcomes. For example, it is possible that the lack of family and psychological supports (i.e. a third unmeasured variable) is responsible for this effect, because individuals who lack family support are more likely to seek public assistance and once on public support, may be less likely to exit public support and less enthusiastic to engage in any meaningful employment for fear of losing their monetary and health benefits such as, Medicaid or Medicare; especially if the income from such job will not be able to cover for these losses. On the other hand, individuals who had family support are more likely to exit public support services and be more focused and motivated toward obtaining employment. However, involving benefit counselors from the Social Security Administration in vocational counseling to help educate SSI/SSDI recipients about certain legislative initiatives such as the Ticket to Work and Work Incentives Improvement Act of 1999, that allows SSI/SSDI recipients to work certain number of hours without losing their benefits would help encourage SSI/SSDI recipients to be motivated and committed to obtaining employment.

The average cost of purchased services was found to be significantly higher among successfully employed individuals with TBI than those without successful

employment at closure. This finding is consistent with those reported in previous studies (Gamble & Satcher, 2002; Catalano et al., 2006). However, in this study, the mean costs of purchased services was approximately \$5,728.87 (SD = \$9,972.44), which was higher than the average cost of \$4,237.56 (SD = \$7,837.65) reported in the Catalano et al.'s (2006) study. It is possible that in view of previous similar findings of the positive effect of higher cost of purchased services on successful employment outcomes, individuals in this 2012 RSA-911 dataset had VR counselors who spent more federal dollars on their clients in order to increase the number or intensity of services that these individuals received. An alternative explanation is that the increased cost of these services in 2012 was due to inflation.

VR SERVICE PREDICTORS

In terms of racial and ethnic group differences in the rate of successful employment outcomes at closure for individuals with TBI, the current study showed that White (50.7%), and Hispanic (50.5%) groups achieved the highest successful employment outcomes, while 'Other' ethnic minority (46.2%) and Black (41.7) groups had the lowest rates of successful employment. This mirrors the statistics for these groups in the entire population of the 2012 TB cohorts and individuals with disabilities as a whole in the 2012 dataset. These findings are generally consistent with those reported in the Catalano et al. (2006) study in that more Whites and fewer Blacks achieved successful employment outcomes. However, contrary to the Catalano et al. (2006) findings, Hispanics seem to be doing better in terms of employment outcomes in this

current study with a 2012 cohort because both Whites and Hispanics are more successful in employment than are Blacks for the 2012 data.

Although, the RSA 911 dataset utilized for this study did not disaggregate data in terms of residency and social economic status (SES), it is possible that majority of the individuals who are Black live in the rural areas than in the urban areas, are of low SES. Additionally, it is possible that more Blacks than the other groups received fewer services, and had less money spent on them; especially when the results from this study and Catalano and her colleagues (2006) study showed a significant positive relationship between cost of purchased services and successful employment. Other possible indicators could be client related variables (such as, lack of maintenance of a treatment regimen) and counselor variables (such as, counselor's clinical judgment, racial stereotypes, and perceived cultural competence). These factors are beyond the scope of the current study, but deserve further investigation in future studies.

This study found that the receipt of VR services explains more of the variation in successful employment outcomes for individuals with TBI (i.e.15%) than the variance explained by the pre and post-injury characteristics (i.e., 10%). This finding is consistent with Johnstone et al. (2006) who found that the most significant determinant in obtaining successful employment for individuals with TBI was the receipt of VR services. Therefore, access to vocational rehabilitation interventions is a major determinant of successful employment outcomes, beyond the impact of pre and post-injury

characteristics (Kendall, Muenchberger and Gee, 2006). The significant VR service variables, as well as those that were not significant, are discussed below.

On-the-Job Support, Job Placement, and On-the Job Training: On-the-job support (odds ratio = 1.90), job placement (odds ratio = 1.49), and on-the-job training (odds ratio = 1.45) were related to a higher probability of successful employment at closure. Of these three job-specific VR service variables, job placement service was one that individuals with TBI were more likely to receive (i.e., 43.1%). The important role of on-the-job support and job placement in the successful employment outcome of individuals with TBI is consistent with findings in more recent TBI studies (Catalano et al., 2006; Da Silva Cardoso et al., 2007). Consistent with the significant finding for job placement, two previous studies that did not control for pre-injury characteristics (Gamble & Moore, 2003a; Schonbrun et al., 2007), also found job placement to be a significant predictor of successful employment outcome.

Findings of on-the-job support and job placement services in this study are consistent with the idea that on-the-job support and job placement play a critical role in the VR process in obtaining successful employment outcome for individuals with TBI. Therefore, enhancing on-the-job support and job placement services may increase the probability of gaining successful employment for individuals with TBI. On-the-job support may be required in assisting individuals with TBI, especially for those who have been unemployed for long periods of time, in order to successfully adjust to their new work environment. Providing on-the-job support services may help them in dealing with

the issue of whether or not to disclose their disability, when to disclose, job accommodation, and also with the issue of discrimination in the workplace.

In this study, on-the-job training service was the third most significant positive predictor of successful employment. This finding is consistent with the results of previous studies (Catalano et al., 2006; Johnstone et al., 2003d). Although on-the-job training is a 3rd important predictor, this service was only provided to only 3.8% of the sample of individuals with TBI. Based on the fact that the receipt of on-the-job support service increases the likelihood of obtaining successful employment by 45% for individuals with TBI who received this service (i.e., 26.9%), it is pertinent to increase the percentage of people receiving this service. In order to increase the successful employment outcomes of individuals with TBI, it is important to increase the provision and intensity of on-the-job support (1.9), job placement (1.49), and on-the-job training (1.45).

Maintenance, Assistive Technology, and Job Search Assistance: The next group of significant positive predictors related to a higher probability of successful employment outcomes was maintenance (odds ratio = 1.17), assistive technology (odds ratio = 1.12), and job search assistance (odds ratio = 1.09) respectively. The important role of maintenance service found in this study is consistent with findings from previous studies (Catalano et al., 2006; Da Silva Cardoso et al., 2007; Johnstone et al., 2003c). Even though the odds of being successfully employed is increased by 17% for individuals who received maintenance service than for those who did not receive this service, only 15.2%

of individuals in this sample were provided with maintenance service. The result from this study suggests that, in order to increase the employment outcomes of individuals with TBI, it is necessary to increase the percentage of people who receive maintenance service.

Assistive technology was also a significant positive predictor of successful employment outcome. The current study supports existing research on the importance of assistive technology services for individuals with TBI (Catalano et al., 2006; Da Silva Cardoso et al., 2007; Gamble & Satcher, 2002). Even though the odd of being successfully employed was increased by 12% for individuals who received assistive technology services compared to those who did not receive assistive technology services, only 9.2% of the sample received this service. The result from this study suggests that in order to increase the employment outcomes of individuals with TBI, it is necessary to increase the provision and percentage of people receiving assistive technology services. Similarly, the positive relationship of job search assistance to successful employment outcome for individuals with TBI is consistent with findings of related studies (Catalano et al., 2006; Da Silva Cardoso et al., 2007; Schonbrun, Kampfe & Sales, 2007). The important finding of job search assistance suggests that enhancing job seeking skills, and assisting individuals with TBI in conducting a job search, preparing a resume, and obtaining opportunities for job interviews .may increase the probability of obtaining successful employment outcome.

Diagnosis and Treatment: This study found the receipt of diagnosis and treatment (odds ratio – 0.91) service to be a significant negative predictor of successful employment outcome. This finding is consistent with finding from previous literature (Schonbrun et al., 2007). Diagnosis and treatment services includes but not restricted to corrective surgery, diagnosis and treatment for mental and emotional disorders, dentistry, nursing services, and hospitalization. It is possible that majority of the individuals who received this service (37.7%) were diagnosed and received treatment service for mental disorders. Because of societal stigma and discrimination generally associated with mental disorders, it is possible that a third unmeasured variable e.g., employer bias and perception toward individuals who have been diagnosed with mental disorders may explain the negative relationship of diagnosis and treatment to successful employment outcome.

This current study found no significant effect of counseling and guidance, even though this service was the mostly received VR service (69.9%) in this sample of TBI cohort. This finding is contrary to previous studies finding of significant positive main effects of counseling and guidance on successful employment outcomes (Catalano et al., 2006; Da Silva Cardoso et al., 2007; Gamble & Moore, 2003a; Johnstone et. al., 2003d). A possible reason for this finding could be because vocational rehabilitation professional are not conversant with or do not sufficiently understand the peculiar needs and issues of this special group of people. Generally, professionals working with individuals with TBI are not familiar with their special needs and issues (Butler & Satz, 1988). Although this

was a surprising finding, it is important to continue to provide this service while future studies continue to examine this variable.

In summary, on-the-job support, job placement, on-the-job training, maintenance, job search assistance, and diagnosis and treatment are significantly related to successful employment outcome, regardless of race/ethnicity. While VR service variables are strongly related to employment outcomes, some of these services are more important than others. The most important services are on-the-job support, job placement, and on-the-job training services. Given that these three services appear to have the most practical significant effect on successful employment outcomes for individuals with TBI, it is pertinent to emphasize the benefits of these set of services in state vocational rehabilitation agency training for counselors and to increase the provision and intensity of these services, especially when these services are not always or often provided to all individuals. Additionally, it is important that vocational counselors collaborate with medical professionals and other professionals in order to understand the onset of the TBI, etc. that could help to in determining the provision and intensity of these three VR services.

INTERACTION OF RACE/ETHNICITY, COMORBID DISABILITIES, AND VR SERVICE VARIABLES ON EMPLOYMENT OUTCOMES

Given that limited information exists on how to increase the employment outcomes among racial/ethnic minority groups, individual groups with co-occurring substance use disorder, and depression, this current study examined the question of:

“when” or “for whom” is/are certain VR service interventions/programs most effective. This was accomplished by studying the interaction of race/ethnicity, depression, and substance use with VR service variables on employment outcomes. The interaction predictors together added 2.1% variance in employment outcome over and beyond the variance contributions of demographic, pre-injury, and VR predictors on employment outcome.

Supported employment: The role of supported employment services for individuals with TBI has received much attention in the literature (Ownsworth & Mackenna, 2004). The effect of supported employment on employment outcome was moderated by race/ethnicity. More specifically, supported employment was positively related to successful employment outcome for individuals from the ‘Other racial/ethnic minority group. The odds of being successfully employed were increased by approximately 3.3 times for the ‘Other’ ethnic minority group after receiving supported employment service than it was for Whites. On the other hand, the receipt of supported employment service was a significant negative predictor for individuals who are Black or of Hispanic origin. The provision of supported employment services is generally beneficial to individuals with significant disabilities such as TBI, if provided for longer periods of time. However in VR, supported employment service is often provided for a limited time period. It is possible that individuals with TBI who are Black and Hispanic had more severe TBI than Whites and exhibited more sequelae of TBI, thereby requiring more intensive supported employment services over long periods of time than Whites. On

the other hand, majority of the ‘Other’ ethnic groups may have had less severe TBI than Whites such that, the limited supported employment service provided by VR was sufficient enough to increase their successful employment outcomes.

Transportation: This study found that the receipt of transportation service was positively related to successful employment outcomes for individuals from ‘Other’ racial and ethnic group, but a negative predictor for Blacks. After the receipt of transportation service, the odds of obtaining successful employment for the ‘Other’ ethnic minority group almost doubled that of individuals who are White that received the same service. A possible explanation for this may be because individuals in this group received more transportation service, from professional counselor and enjoyed more support from their families than were Whites. On the other hand, it is possible that Blacks received less transportation service and less support from professional and family members. Another possible explanation could be environmental factors i.e., fewer Blacks compared to Whites and individuals in the ‘Other’ ethnic category may live in urban areas where more VR services exists and transportation is less of an obstacle to employment.

Assessment and College Training.: Blacks seem to benefit from the provision of assessment and college training services. Blacks who received these services had an increased likelihood of 26% and 52% respectively than Whites of obtaining successful employment. Comprehensive assessment is a very important service that is often given to individuals with TBI, It helps professionals and the individual’s alike to identify strength and needs. Crisp (2005) review found that attaining successful employment outcome after

spinal cord injury was most likely to occur when individuals' residual abilities and occupational skills prior to the injury, were considered in their vocational rehabilitation. It is possible that more Blacks than Whites received more assessment services and were therefore, provided with more specific VR services tailored toward obtaining employment in jobs that were comparable to their residual abilities and occupational skills, prior to the injury.

Depression: This study found that the most commonly reported sources of secondary impairment are depressive and other mood disorders (10.4%,). Logistic regression analysis showed that depression was significantly negatively related to successful employment outcome. More specifically, this study found a 15% reduction in odds (odds ratio=0.85, 95 % CI [0.77, 0.94]) of becoming successfully employed in comparison to those individuals without depression. This finding is consistent with findings from previous and more recently conducted TBI studies (Catalano et al., 2006; Da Silva Cardoso et al., 2007; Keyser-Marcus et al. 2002; Sherer, Bergloff, High, Jr., & Nick, 1999). Da Silva Cardoso et al. (2007) found an odds reduction of 0.65 (95% CI: 0.47 - 0.89) in successful employment outcome for individuals with TBI with co-morbid depression compared to individuals who did not have depression. The significant negative influence of the presence of depression on successful employment supports findings of another study that examined other types of disabilities (i.e., orthopedic, chronic medical, psychiatric, intellectual disabilities, and learning disabilities (Bolton, Bellini & Brookings, 2000). Individuals in VR with depression may require additional

services/interventions to enhance their successful employment outcomes. This study did not find any significant interaction effect between depression and any of the 12 VR service variables on employment outcomes. In other words, the provision of VR service variables is related to employment outcome regardless of the presence or absence of depression. This finding is plausible because in the VR program, individuals with depression continue to benefit from VR services for as long as they continue to maintain their treatment regimen.

Substance Use Disorder: Although the negative effect of substance use disorder has been documented in previous studies (Crisp, 2005; Keyser-Marcus et al., 2002; Kreutzer et al., 2003; Sherer, Bergloff, High, Jr., & Nick, 1999; Ownsworth & McKenna, 2004; Wehman, Targett, Yasuda & Brown, 2000), no previous studies examined the moderating effects of substance use disorder on VR services and employment outcomes for individuals living with TBI. Consistent with Catalano's (2006) study, the current study found that substance use disorder (3%) was the third most reported co-occurring secondary disability. This study, however, went further and investigated whether substance use disorder was a significant main predictor of successful employment. It was not. Although this finding is contrary to findings from previous studies, the interaction of substance use disorder with college training on employment outcome was significant. Individuals with TBI who have a comorbid substance use disorder and who received college training had increased odds of being successfully employed than those without comorbid substance use disorder that did not receive college training. It is possible that

individuals who had substance abuse issues were referred for treatment and upon treatment completion and having completed 90 days sobriety resumed VR services and obtained successful employment, after receiving college training services.

Limitation of this Study

Because this study is an ex-post facto study, causality cannot be inferred from the findings reported.

The data utilized for this study is the 2012 RSA state-federal data file. Because counselors enter the data into this database, some of the data in the database could be inaccurate particularly if counselors relied solely on memory to complete the RSA state-federal data file form (Catalano et al., 2006).

Although in determining the VR service predictors related to employment outcome, this study controlled for certain demographic variables i.e., age, gender, race/ethnicity, other demographic variables, e.g., social economic status (SES), geographical factors such as, residency status (urban versus rural), which may be relevant for the employment outcomes were not controlled for in this study.

There were relatively small number ($n = 117$) of ethnic minorities belonging to the ‘Other’ group i.e., the American Indians or Alaska Natives, Asians, and Native Hawaiians, or Other Pacific Islander. The outcome of this study must be viewed with this consideration in mind.

Because of the limitation of the databases used, this study did not investigate other potential factors to successful employment such as, rehabilitation professionals’

multicultural competency, individuals' employment history and motivation for work, environmental factors, and geographical factors. The examination of these variables is beyond the scope of this study.

The RSA-911 state-federal database does not disaggregate TBI data for severity. The lack of a standardized operational definition in the RSA-911 state-federal database that uniquely differentiates between mild, moderate, and severe TBI and the fact that such information was primarily obtained by means of self-report were limitations of this study. This was also a limitation reported in another study (Gamble & Moore, 2003b).

Furthermore, because of the limitation of the database, information obtained regarding co-occurring depression and substance use disorder was very general and lacking in specificity (e.g., specific type of depression; mild, moderate or severe; frequency of substance use, onset of the secondary disabilities i.e. pre or post TBI) and history of substance use disorder). Future research could investigate the specific nature of TBI and depression (mild, moderate, and severe) on the employment outcomes of individuals with TBI. Additional research is necessary to determine if there are certain jobs which are more appropriate for individuals with TBI given the overall sequelae of the disability, severity of the disability (i.e. mild, moderate, or severe)

Findings from this study may not generalize to all individuals with TBI because it does not include people with TBI in the TBIMS.

Implications for Practice

VR services are an important intervention for individuals with TBI. It is important that professionals continue to provide these individuals with VR services. Kendall, Muenchberger and Gee (2006) indicated that VR intervention resulted in a reduction in the costs associated with unemployment benefits for a relatively large sample of individuals with moderate to severe TBI.

The findings from this study suggest that the employment outcomes of individuals with TBI are greatly enhanced when they receive the following VR services: on-the-job support, job placement, on-the-job training, maintenance, assistive technology, and job search assistance. On-the-job support is the single most important predictor of successful employment outcomes. This finding supports the findings of studies that have identified the need for VR assistance in obtaining and maintaining employment among individuals with TBI re-integrating into the workforce. VR professionals should continue to provide these services to individuals with TBI. There is the need to increase the intensity of the provision of on-the-job training, assistive technology, and maintenance services. Among the cohorts in the RSA 2012 database, only 3.8%, 9.2%, and 15.2% respectively received these VR services. VR professionals should focus on the quality and specificity of services needed for each individual with TBI.

Furthermore, even though supported employment was a negative predictor of successful employment for Blacks and Hispanics, these individuals could still benefit from certain components of supported employment such as, job placement and on-the-job

training, especially when both services assist people with TBI general to find a job of interest that is within the individual's capabilities, and both service are among the top three most important predictor of successful employment outcomes. In the light of positive relationship of assessment and college training on employment outcomes for individuals who are Black, one might recommend that more individuals with TBI be provided with such services. Specifically, counselors should consider identifying additional consumers with TBI who might benefit from the provision of assessment and college training and the combination of assessment and college training on successful employment outcomes. Providing such services may lead to greater numbers of individuals with TBI achieving competitive jobs and higher levels of income. To be able to address the unique VR needs of each individual with TBI, it is important that counselors apply individualized approach by considering the individuals unique characteristics, needs, environments, strengths and weaknesses, and pre-injury occupational skills in delivering effective vocational rehabilitation services.

Findings from this study suggest that state vocational rehabilitation services may benefit from providing additional services such as medications and counseling, to individuals with TBI and co-occurring secondary disabilities such as depression and substance use disorder. Given the current budgeting cuts experienced by state agencies, and the increasing waiting lists for some individuals with TBI in some states, most state VR programs provide little or no psychiatric/psychological services, and even when they do, it is usually to individuals with significant disabilities. In this study significant

disability was not a significant predictor of successful employment. State VR programs will benefit from conducting pilot programs to determine if the provision of psychiatric/psychological services to individuals with TBI and depression, and TBI and substance use disorder can increase their employment outcomes, and if mental health services are cost-effective.

With respect to substance abuse disorder following TBI, beyond referral of individuals with substance use disorder for treatment and delaying VR services until such individuals have achieved a mandatory 90 days sobriety, there is the need for professionals to form a working alliance with other professionals in order to develop a more viable option(s) that would integrate both treatment and service delivery. The current study provides information to VR professionals regarding which VR services seem to be more effective with various groups of individuals with TBI. However, it is important to note that in implementing the findings, care must be taken not to stereotype services to individuals from these various groups.

Directions for Future Research

Because one size does not fit all, the factors that predict employment outcome can be expected to vary considerably not just between ethnic/racial groups, gender, age groups, and so forth, but also within groups. Future studies should examine individual outcomes within groups to identify, for example, individuals who achieved successful employment outcomes despite poor prognosis and individuals still remained unemployed after receiving VR services, despite good prognosis.

This study measured employment outcome using only one criterion variable. It is equally important that future studies should examine other criterion variables such as number of hours worked per week, and other clinically meaningful variables. For example, Ownsworth & McKenna (2004) suggested examining outcome variables like time spent at work, number of jobs held, job stability or retention, quality of performance or competency, and role performance in the community rather than simply successful or unsuccessful employment outcome.

Previous studies such as Bounds et al.'s (2003) study suggest that the issues of substance abuse may be more common in men than in women trying to return to work. Additionally, Corrigan, (1995) in his study on mediating factor of substance abuse on employment outcomes stated that about 75% rehabilitation patients may have a history of substance abuse prior to their injuries. About 50% of individuals with TBI will be intoxicated at time of injury. Of this number, the majority of those intoxicated will be younger, will be men, will have been injured in auto accidents or assaults, and will have a history of substance abuse prior to the injury. Future studies should therefore investigate the interacting effects of age, gender, and substance use disorder on employment outcome. Also, the role of client and counselor stereotypes in vocational rehabilitation warrants further study (Bounds et al., 2003). VR professionals should focus on the quality and specificity of services needed for each individual with TBI.

In order to increase our ability to generalize findings in this study to the population of individuals with TBI, future studies should extend this current research to other national databases such as the TBIMS database. Moving beyond the RSA - 911 dataset, could be a viable avenue for examining racial and ethnic disparities in other areas of rehabilitation services for individuals with TBI. Expanding the databases examined to include TBIMS database and with a common definition of employment across these databases, future studies could consider examining several other factors that may affect the employment outcomes of individuals with TBI. These include the complex medical, psychological, social, and environmental aspects of disability; adjustment issues after acquiring TBI; gender-role socialization, family influences, religion and spirituality influences, to name a few.

Future research may need to expand the use of the RSA-911 data by including data from multiple years so that it may better demonstrate the consistency or changes in the findings of VR predictors related to employment outcomes. According to McDonnall and Crudden (2009) future studies using databases that gather data for relevant variables at various multiple points is necessary to increase our believability of outcome study findings.

Additionally, following from the findings in Johnstone et al. (2006) that found co-occurring psychological disorder and learning disabilities to be significantly related to greater employment difficulty, future studies should include these co-occurring disabilities in their investigation. Such studies could divide individuals with TBI into

groups for example, (TBI only; TBI + depression; TBI + substance abuse disorder; TBI + psychological disorder; TBI + learning disability) and examine types of VR service variables, while controlling for pre and post-injury characteristics, are related to successful employment outcome within and across groups.

Conclusion

Individuals with TBI are among the fast growing population served in VR and provision of VR services is an important predictor of successful employment outcomes. The current results from this study provide support of the importance of increased, timely, and focused VR intervention in the successful employment outcomes of individuals with TBI. However, given the heterogeneity and complexity of within and between group differences among racial groups, the findings and suggestions presented in this study are not to be taken as absolute, but rather as contributing to the knowledge base on a continuum.

Appendices

Appendix A. Summary of Studies Reviewed for the Synthesis Section of this Study

Table 1

Studies Using State or RSA Database to Examine Employment Outcomes for People with TBI

S/No.	Study	Sample Size	Participants Characteristics	Purpose of Study	Study Design	Result/Findings
1	Johnstone et al. (1999)	110	Age: 15 – 61 years old Gender: Male = 78 (71%) Female=32(29%) Education: 12.3 White (n = 106), Black (n = 4)	To examine the relationship between neuropsychological variables, vocational outcomes and vocational costs.	Correlational study	Severity of disability is positively related to successful employment.
2	Gamble & Satcher (2002)	1,145	Age: 35.57yrs (SD = 9.73) Gender: Male = 69.9% Female = 29.1% Education: 11.5 Race/Ethnicity: White = 893 Black = 228 Hispanics =14 Others = 10	To evaluate the differences in public vocational rehabilitation outcome (employment status and weekly earnings) and case expenditure for consumers who received assistive technology services vs. those that did not	Correlational study	The receipt of assistive technology is positively related to improved successful employment outcome. No significant differences in weekly earnings between both groups
3	Johnstone et al. (2003d)	78	Age: 36.7 (SD = 10.8) Gender: Male = 55 , Female = 23 Education: 11.8 (SD = 2.2) White (82%) Black (14%) Other (Hispanic, Asian American) (4%)	Investigate the relationship between VR services and TBI outcomes	Observational Study	Demographic variables (age, Education, race, etc.) is related to successful employment. Receipt of VR service variables are related to successful employment (see paper for details).
4	Johnstone et al. (2003c)	“	Age: Rural = 37.1 (10.1) Urban = 36.1 (11.9) Gender: Male = 78 (71%) Female = 32 (29%) Education: for Rural = 12.2 (SD = 2.2) for Urban = 11.5 (SD = 2.2) Race/Ethnicity: White = 62 (79%) Black = 13 (17%) Others = 3 (4%)	Examined rural/urban differences in demographic, injury severity, vocational services and vocational outcomes exists for TBI consumers	Descriptive study	No group differences in demographic variables between rural and urban clients (race, education, age). Significant group differences exist in terms of VR services received and financial case expenditures at closure. Geographical location is a potential predictor of successful employment outcome.
5	Johnstone et al., 2003a)	“	Age: Black: 40.4yrs (SD = 11.1); White: 35.3yrs (Sd = 10.3) Gender: Male = 78 (71%) Female = 32 (29%) Education: Black = 11.2 (SD = 1.8) White =11.9 (SD = 2.1) Race/Ethnicity: White = 62 (79%) Black = 13 (17%) Others = 3 (4%)	Examined race differences in demographic, injury severity, vocational services and vocational outcomes for consumers with TBI.	Descriptive study	Race is not a significant group difference in the rate of successful employment. Transportation is related to successful employment outcome.
6.	Skeel et al. (2003)	“	Gender: Male = 78 (71%) Female = 32 (29%) Education: 9.2 – 14.2 White (56), Black (12),	Hypothesis: (a) increasing age would be associated with less success in	Prospective study design	Age is not a predictor of successful employment.

7.	Bounds et al. (2003)	“	Others (3) Substance abuse = 75.5% Age: 36.7 (SD = 10.8) Gender: Male = 55 , Female = 23 Education: 11.8 (SD = 2.2) White (79%), Black 17%), Others (4%)	successfully obtaining employment outcome. To examine the relationship between gender, the receipt of VR service variables on successful employment	Prospective Study	Gender is significantly related to employment outcome. 4.4% women were successfully employed compared to 23.6% men. @ alpha .05, 521 (48.6%) were successfully employed.
8.	Gamble & Moore (2003a)	1,073	Age: 16 – 71 years old Gender: Male = 69.9% , Female = 30.1% Education: 11.52 (SD = 2.31) White = 836 Black = 213 Hispanic = 14 Others = 10	To examine the relationship between these VR services and employment outcome;	Descriptive and correlation research design	College training, counseling, and job placement were significantly & positively related to employment status at closure with job placement contributing the most.
9.	Gamble & Moore (2003b)	1,073	Age: 16 – 71 years old Gender: Male = 69.9% , Female = 30.1% Education: 11.52 (SD = 2.31) White = 836 Black = 213 Hispanic = 14 Others = 10	To evaluate group differences in outcome variables between individuals who received supported employment vs. those who did not	Correlational Study	Supported employment is a predictor of employment outcome. Study controlled for race, age, education, gender.
10.	Catalano et al. (2006)	7,366	Age: 36.80 (SD = 11.80) Gender: Male = 4,862 (66%) Female = 2,504 (34%) Education: 11.8 (SD = 2.2) Race/Ethnicity: SPED = 5% Less than high school = 21% High school = 41% Post Sec./Asso. degree = 23% College = 10%	To examine effects of demographic characteristics, work disincentives and vocational rehabilitation services patterns on employment outcomes.	Ex post facto design	Job placement assistance, job search assistance, on-the-job-support services, C&G, maintenance e.g. monetary support for food, less time in VT, education, assistive technology and transportation were found to be significant positive predictors of successful employment. Work disincentive, race and co-occurring disabilities were negatively related to successful employment.
11.	Schonbrun et al. (2007)	6,460	Male= 4,193 (64.9%) Female =2267 (35.1%)	To evaluate the relationship between specific VR services and employment outcome; and consumers' earnings at case closure	Ex post facto correlational study	@ alpha = 0.05. Job placement, job search and diagnosis and treatment are significant predictor predictors of successful employment; with job placement being the strongest predictor
12.	Da Silva Cardoso (2007)	5,831	Age: 33.69 (SD = 12.23) Gender: Male = 3812 (65%) Female = 2019 (35%) Education: High school (75%) White (5,394), Hispanic (431) Missing = 63 Co-occurring disability: Depression (11%) Substance use (3%)	Examined disparities in VR outcome between Whites and Hispanic Americans.	Correlational study	Whites were 1.27 times more likely to be successfully employed than were Hispanics . Race (Whites), age (16 – 34yrs) and education (college degree) are significant positive predictors. Counseling, university training, vocational training, job search assistance, on-the-job supports, job placement, maintenance and assistive technology services were positively related to successful employment.

13.	Whitfield and Liloyd (2008)	11,317	Age: 29.4 (SD = +-10.8 American Indians = 285 (2.5%) White/Others = 11,032 (97.5%)	Examined disparities in service provision and employment outcomes between AI/NA and other racial/ethnic groups	Descriptive/correlational study	Work disincentives, co-occurring disability & need for transportation are risk factors. Significant difference in age, race, length of time in VR program, cost of purchased services exist between both groups but no significant differences was observed in weekly earnings and hours worked at closure between both groups
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Appendix B.

Table 2

Factors Related to Employment Outcome as Reported by Previous Studies that utilized TBIMS database or that applied Qualitative Design.

Factors	Authors
Age	Crisp (2005); Felmingham, Baguley, and Crooks (2001); Keyser-Marcus et al. (2002); Wehman et al. (2005); Yasuda et al. (2001).
Race/ethnicity	Arango-Lasprilla et al.(2007); Crisp (2005).
Educational level	Crisp (2005); Doctor et al. (2005); Keyser-Marcus et al. (2000); Wehman et al. (2005); Yasuda et al. (2001).
Pre-injury employment status	Keyser-Marcus et al. (2002); Ownsworth and McKenna (2004); Wehman et al. (2005); Yasuda et al. (2001);
Shorter coma duration, shorter PTA and duration of acute rehabilitation treatment	Keyser-Marcus et al. (2002)
Depression and emotional status	Crisp (2005); Ownsworth & McKenna (2004)
Alcohol and substance abuse	Corrigan, J. D. (1995); Keyser-Marcus et al. (2002); Kreutzer et al. (2003); Sherer, Bergloff, High, Jr., and Nick (1999); Wehman, Targett, Yasuda & Brown (2000)
Self-awareness	Wehman et al. (2005); Yasuda et al. (2001)
Social support	Crisp (2005); Yasuda et al. (2001)
Severity of injury	Crisp (2005); Dawson et al. (2007); Keyser-Marcus et al. (2002); Wehman, Targett, West, and Kregel (2005); Yasuda et al. (2001).

Appendix C

Table 3

Identified Predictors from the Synthesis Study.

VR Service Variables	Severity of Disability/ Co-occurring Disability	Demographic Variables	Receipt of Public Support
Job Placement, and C&G (4 studies each).	Five studies reviewed this variable (others controlled for it).	Education is a significant positive predictor of successful employment (3 studies).	Public support: found negative relationship for public support – 2:1. (Catalano, et al., 2006; Da Silva Cardoso, et al., 2007), but Johnstone et al. (2003d) did not.
College education/training, job search assistance, assistive technology, and maintenance (3 studies each).	Only Johnstone et al. (1999) found it to be related to successful employment. Presence of co-occurring psychiatric disabilities was found in 2 studies to be negatively related to successful employment.	Race/ethnicity: Mixed result for race - 3:1.	
On-the-job support, on-the-job training, and case expenditure (2 studies each).		Age (16-34yrs): Mixed result for age – 1:2 studies. Gender: Mixed result for gender (1:1).	NB: The more recent studies used larger ‘n’ and more rigorous methodologies.

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