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ANALYZING VOCATIONAL OUTCOMES OF INDIVIDUALS WITH PSYCHIATRIC DISABILITIES WHO RECEIVED STATE VOCATIONAL REHABILITATION SERVICES: A DATA MINING APPROACH

DAVID A. ROSENTHAL, JACQUELYN A. DALTON & ROBERT GERVEY

ABSTRACT

This study examines factors affecting vocational outcomes in the vocational rehabilitation process for individuals experiencing psychiatric disabilities who had received state vocational rehabilitation (VR) services. A data mining approach was used to analyze the Rehabilitation Services Administration FY 2001 Case Service Report (RSA-911). Receiving job placement services was found to be the most important variable differentiating individuals who were working from those who were not working. Results regarding vocational outcomes suggest a positive effect for persons receiving job placement services.

The 1992 Amendments to the Rehabilitation Act called for the state–federal vocational rehabilitation program to emphasize working with individuals with the most severe disabilities; i.e., those disabilities that significantly limit one or more life functions (Rehabilitation Services Administration, 1995). One of the largest groups of such individuals is the approximately 10 million individuals in the United States with serious psychiatric disabilities, or Serious Mental Illness (SMI), that effectively prevent them from obtaining employment (MacDonald-Wilson *et al.*, 2003). According to Ingraham *et al.* (2001), state vocational rehabilitation (VR) programs report that they are serving increasing numbers of clients who are diagnosed with psychiatric disorders such as schizophrenia, bipolar disorder and post-traumatic stress disorder.

Given that community reintegration and independent living are standard vocational rehabilitation (VR) treatment goals for those with even the most severe and persistent forms of psychiatric disability, the increasing demand for VR services in the US by this disability group is not surprising. Unfortunately, however, even after participation in VR services and interventions, the employment rates for persons with psychiatric disabilities remain low (Cook, 2003). At a national level, 80% to 85% of individuals with psychiatric disabilities are unemployed (Anthony *et al.*, 2002). Research has repeatedly substantiated patterns of poorer VR outcomes for persons with psychiatric disabilities than for those with physical disabilities (Andrews *et al.*, 1992; Corbière *et al.*, 2005; Latimer *et al.*, 2004; Marshak & Bostick, 1990).

The nature of psychiatric disabilities does not suffice to explain this disparity: past research has revealed that when adults with psychiatric disabilities have been provided with adequate treatment, they are able to find and maintain employment (Anthony *et al.*, 2002; Bond & Resnick, 2000; Corbière *et al.*, 2005; Latimer *et al.*, 2004). Moreover, individuals with psychiatric disabilities

express a strong desire to work (Louis Harris & Associates, 1986) and they have historically represented a significant number of referrals to the state–federal vocational rehabilitation system (Farkas & Anthony, 2001). Even when individuals with psychiatric disabilities do find employment, it is often in low-paying and entry-level jobs without career opportunities (Leech & Holcomb, 2001). Indeed, there remains a glaring lack of job opportunities for persons with psychiatric disabilities whose career goals, intelligence, educational achievements and interests make unskilled, entry-level positions poor job matches (Finch & Wheaton, 1999).

Persons with psychiatric disabilities present unique challenges for rehabilitation psychologists and counselors (Kress-Shull, 2001), and rehabilitation professionals trained in traditional rehabilitation counseling training programs may not be equipped with the skills necessary to meet these challenges (Leech & Holcomb, 2001). In a longitudinal study of persons receiving services in Ohio's mental health system, Roth *et al.* (1996) reported that both professionals and persons receiving services believed that the system was not meeting the needs for jobs and skills training. Considered more broadly, though, the field of vocational rehabilitation suffers from a fundamental inability to achieve consensus regarding the relationship between its services and clients' vocational outcomes, in part due to inadequate research (Bond & Boyer, 1988; McGurrian, 1994).

From a historical perspective and not surprisingly, this problem plagues psychiatric rehabilitation specifically: Bond and McDonel (1991) observed that the lack of research into vocational rehabilitation services and outcomes mirrors both the low priority given to vocational issues in mental health programs and to psychiatric rehabilitation services in vocational rehabilitation programs. A number of studies have been undertaken to determine which vocational program interventions produce positive employment outcomes (e.g., Bond *et al.*, 1997, 1999, 2001; Bond & McDonel, 1991; Corbière *et al.*, 2005; Latimer *et al.*, 2004). Fortunately, some of the recently developed models (e.g. the *Individual Placement and Support* model) have been found to be quite efficacious for persons with psychiatric disabilities.

In the US, the federal agency called the Rehabilitation Services Administration (RSA) oversees all public vocational rehabilitation services. Public rehabilitation services have existed in the US since 1920. The RSA's primary responsibility is to administrate state VR agencies to provide employment-related services for individuals with disabilities, giving priority to individuals who are significantly disabled. The administration's primary database captures services provided, consumer characteristics and vocational outcomes each fiscal year; this database is referred to as the RSA-911 data.

Although much has been written about the potential barriers to employment faced by persons with psychiatric disabilities, and several models of intervention have been developed, no comparable data mining studies have explored the combined interaction of demographic variables and employment outcomes for persons with psychiatric disabilities using the Rehabilitation Services Administration 911 database.

Data mining techniques

Data mining techniques, which extract hidden predictive information from large databases (Nong, 2003), have been developed over recent years primarily by market researchers to study interactions between demographic variables and consumer behavior in order to target specific markets more precisely. Techniques such as the Chi-square Automatic Interaction Detector (CHAID) can be used

to segment large groups of people into homogeneous subgroups in terms of behavior and demographics. Today, pattern recognition or data mining is a widely used technique for credit scoring, wage prediction and market segmentation research (Nong, 2003; SPSS, 1998). Data mining has also been used to study the interaction between demographic characteristics of web users and their consumer behavior on the internet, identifying subgroups for targeted marketing strategies (Nong, 2003).

Because of their success in business and marketing research, data mining techniques have increasingly been used to analyze pattern recognition problems in large healthcare and social service databases. For example, Lugar (1998) used CHAID to provide descriptive and predictive analyses of the practice of family therapy in selected managed mental healthcare settings. Smith and Grawe (2003) applied CHAID in an exploratory search for meaningful patterns of process and session-outcome variables. Ma (2000) applied CHAID to discover the determinants of the outcome of alcoholism treatment (readmission) and subsequently to develop a patient-treatment model. Forthofer and Bryant (2000) applied CHAID to provide a comparison among various approaches to developing health behavior change strategies. Melchoir *et al.* (2001) applied CHAID with indicators reflecting service needs, vulnerabilities and demographic characteristics to a group of 478 participants with HIV/AIDS in order to find which group's needs went most severely unmet.

The usefulness of pattern recognition techniques to rehabilitation outcome research was recognized decades ago (Bolton, 1972a, 1972b, 1972c). However, this type of research has only recently been available to rehabilitation researchers owing to advances in computers and statistical software available to conduct the analyses. Pattern recognition techniques appear particularly suited to re-examining within the current RSA-911 the effects of demographic variables on vocational outcomes, as well as the effects of demographic variables, process variables and their interaction effects on rehabilitation outcomes. Data mining techniques, such as CHAID, offer an opportunity to obtain more robust information from data than does the traditional logistic regression analysis, thus offering an opportunity to uncover patterns often undetected by logistic regression analysis and other traditional statistical analyses. The purpose of the current study is to use data mining techniques to examine factors influencing vocational rehabilitation outcomes of individuals with psychiatric disabilities.

METHOD

Participants

Data for this study were extracted from the Rehabilitation Services Administration Case Service Report (RSA-911) for the fiscal year (FY) 2001. The RSA-911 dataset provides administrative data and comprehensive employment and disability data on all for VR case closures during a fiscal year. The individual case data are input into the system by rehabilitation case managers using a uniform reporting system. Variables in the dataset include race, ethnicity, gender, age, socio-economic status, work history and disability, as well as services provided and closure status (e.g. type of closure, weekly wages and weekly hours worked). The dataset is available to the public through the Rehabilitation Services Administration at the US Department of Education. The entire database (all disabilities) contains 639,823 individuals. The number of individuals with psychiatric disabilities was the largest group served ($N=205,207$), constituting 32.2% of the entire sample.

Employment outcomes analysis

For the employment outcomes investigation, only individuals with psychiatric disabilities who were accepted for services were included in this group. Of the 85,274 customers with psychiatric disabilities accepted for services, the database included 41,376 men (48.5%) and 43,898 women (51.5%). Racial and ethnic backgrounds were diverse, including 71.1% European American, 19.7% African American, 6.7% Latino, 1.6% Asian American and 1% Native American. A stratified random sample based on race was drawn from that database, which resulted in 820 individuals from each racial group ($N=4,100$, 4.8% of the overall sample of persons with psychiatric disabilities). Mean age of participants in the stratified sample was 36.3 years ($SD=11.21$), and 52.1% were women. About 45% had completed high school, 27% had less than high school education, 24% had at least some college education and only 3.9% had special education. In terms of severity of disability, 90.6% were considered to have a severe disability while the other 9.4% had a non-severe disability or no disability.

Variables

Dependent variable

The dependent variable in the analysis was employment status. RSA-911 status codes are outcome or closure status codes, indicating the employment outcome for the individual consumer. For data analysis, only individuals in the database who had status codes of 26 or 28 were kept. Status 26 indicates that the individual's case was closed with the consumer competitively employed. Status 26 cases were coded as '1', working. Status 28 indicates the individual's case was closed with the consumer not competitively employed. Status 28 cases were coded as '0', not working.

Independent variables

The predictor variables include gender (men or women), race (European American, African American, Hispanic/Latino, Native American and Asian American), severity of disability (severe vs not severe), age (16–34, 35–54, 55–64, 65 and older), education (special education, less than high school, high school graduate, and at least some college), government benefits (e.g. public assistance, health insurance, supplemental security income (SSI), and/or social security disability insurance (SSDI) benefits), and rehabilitation services provided.

The rehabilitation service variables (coded as 1 = Yes, 0 = No) include: Assessment, Restoration (Physical and Mental), College/University Training, Business and Vocational Training, Adjustment Training, On-the-Job Training, Miscellaneous Training, Counseling and Guidance-Substantial, Job-Finding Services, Job Placement, Transportation, Maintenance, Other Services (e.g. work tools and equipments), Personal Assistance Services, Rehabilitation Engineering, and Assistive Technology. Note that variables available in the RSA-911 datasets that are found in vocational outcome analyses in the rehabilitation counseling literature were selected for this study. Because the Exhaustive CHAID (Chi-square Automatic Interaction Detector) data mining technique used to analyze the data requires the use of categorical variables, continuous variables (e.g. age and education) were recoded to categories to conform to this requirement.

Data analysis

Decision trees – tree-shaped structures representing sets of decisions or classifications – were used to generate rules for the classification of this dataset. Decision tree methods of data mining include Classification and Regression Trees (CART) for regression-type problems and Chi-square

Automatic Interaction Detector (CHAID) for building classification trees (Biggs *et al.*, 1991; Hoare, 2004; Melchoir *et al.*, 2001; SPSS, 1998). Exhaustive CHAID was used to build classification trees. The technique uses a systematic algorithm to detect the strongest associations between predictors and the outcome variable (i.e. employment outcome in this study). The degrees of differentiation among the levels of predictors and the outcome variable are represented sequentially in a decision tree format to produce and display the optimally split predictors. Thus, homogeneous groups of people were identified in terms of their observed levels on the outcome variable. The alpha level for all statistical tests was 0.05, corrected for the number of statistical tests within each predictor using a Bonferroni correction. SPSS AnswerTree 2.0 statistical software was used to conduct the Exhaustive CHAID analyses (SPSS, 1998).

RESULTS

Data mining results – employment outcomes

For the exhaustive CHAID analysis with race, gender, severity of disability, age and education as predictor variables and employment outcome as the criterion variable, a solution was found with a risk of false classification of 33% and a risk of 36% for cross-classification. The predictors are found to be equally proficient at predicting employment (67%) and unemployment (67%). The overall correct classification of 67% is significant improvement over the base rate of 48%. In order to fit the CHAID diagram to the page, the tree diagram is shown in two figures. Figure 1 shows the right split of the decision tree, predicting the employment status of people that received job placement services; and Figure 2 shows the left split of the tree, predicting the vocational outcomes of people that did not receive job placement services.

In total, the CHAID results provided 10 levels of analysis. Owing to space limitations, Figures 1 and 2 show only the three highest splits provided by the CHAID results.

The most significant predictor of employment is receiving job placement services. The percentage of people employed in the overall sample was 47.8%. Of those persons who did receive job placement services ($N=1,366$, 33.3%), the employment rates improved to 67.6%, contrasted with 38% for individuals who did not receive job placement services ($N=2,734$, 66.8%). The CHAID analysis split the sample to 35 end groups (terminal nodes).

Seven groups were found to have approximately 1.5 (or higher) times the likelihood of employment of the overall sample. The following is a brief description of the four groups that had the highest likelihood for successful employment.

High employment groups

- *Node 52*: Node 52 represents 63 people most likely to be employed. The people in this node received job placement and counseling services; were not receiving SSI or SSDI; were in special education in high school, graduated from high school or had college experience; and did receive comprehensive assessment and vocational training. The 63 individuals in this node represent 1.54% of the overall sample and 2.90% of all employed people in the sample. An index score of the ratio of these two percentages shows how the proportion of the people working in this group compares with the proportion of people employed in the overall sample. For node 52, the index score is about 189%, meaning that the proportion of people employed in this group is approximately 189% the employment rate for the overall sample.

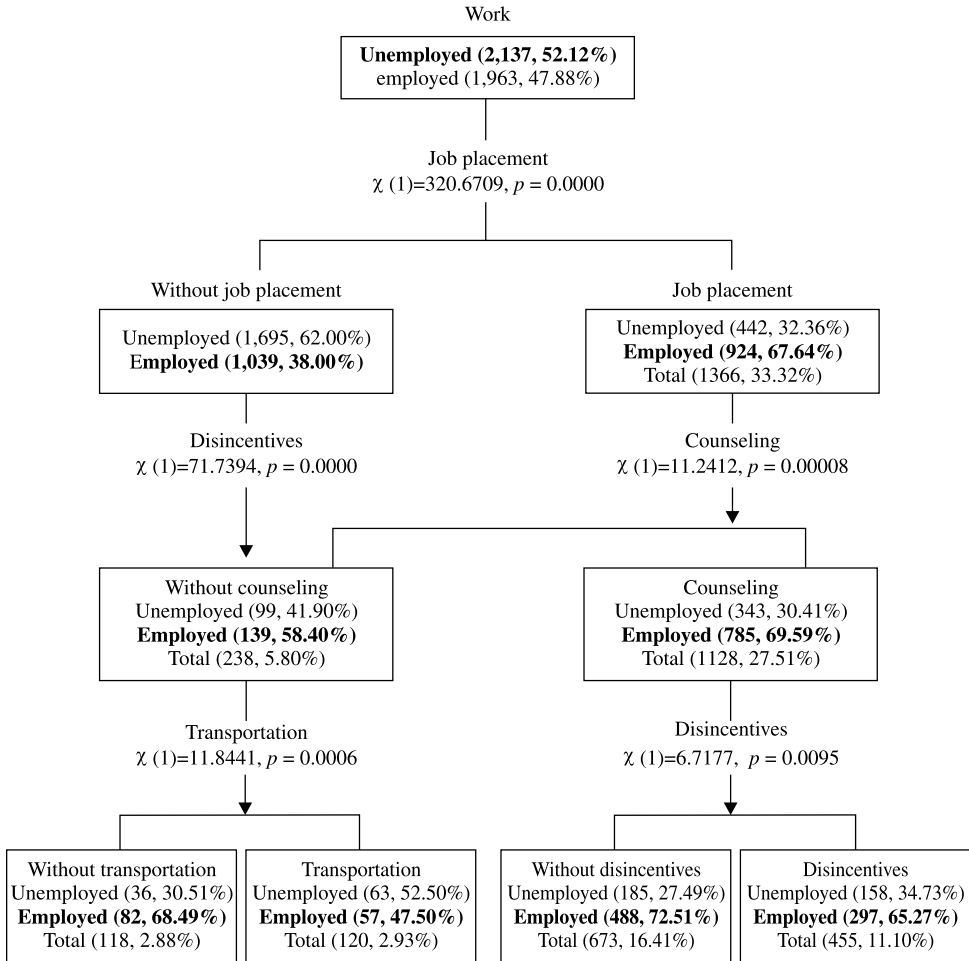


Figure 1. CHAID diagram of the splits of employment outcomes for individuals that received job placement service

- *Node 22*: Node 22 represents 46 people who received job placement and counseling services, did not receive transportation services, and were either African American or Asian American. The 46 individuals in this node represent 1.34% of the overall sample and 2.34% of all employed people in the sample. The index score for node 22 is approximately 175%.
- *Node 51*: Node 51 represents 307 people who received job placement and counseling services, did not receive transportation services, and were either African American or Asian American. The 46 individuals in this node represent 7.49% of the overall sample and 12.38% of all employed people in the sample. The index score for node 22 is approximately 165%.
- *Node 39*: Node 39 represents 38 people who received job placement and counseling services, did not receive SSI or SSDI, did not receive comprehensive assessment, and were European

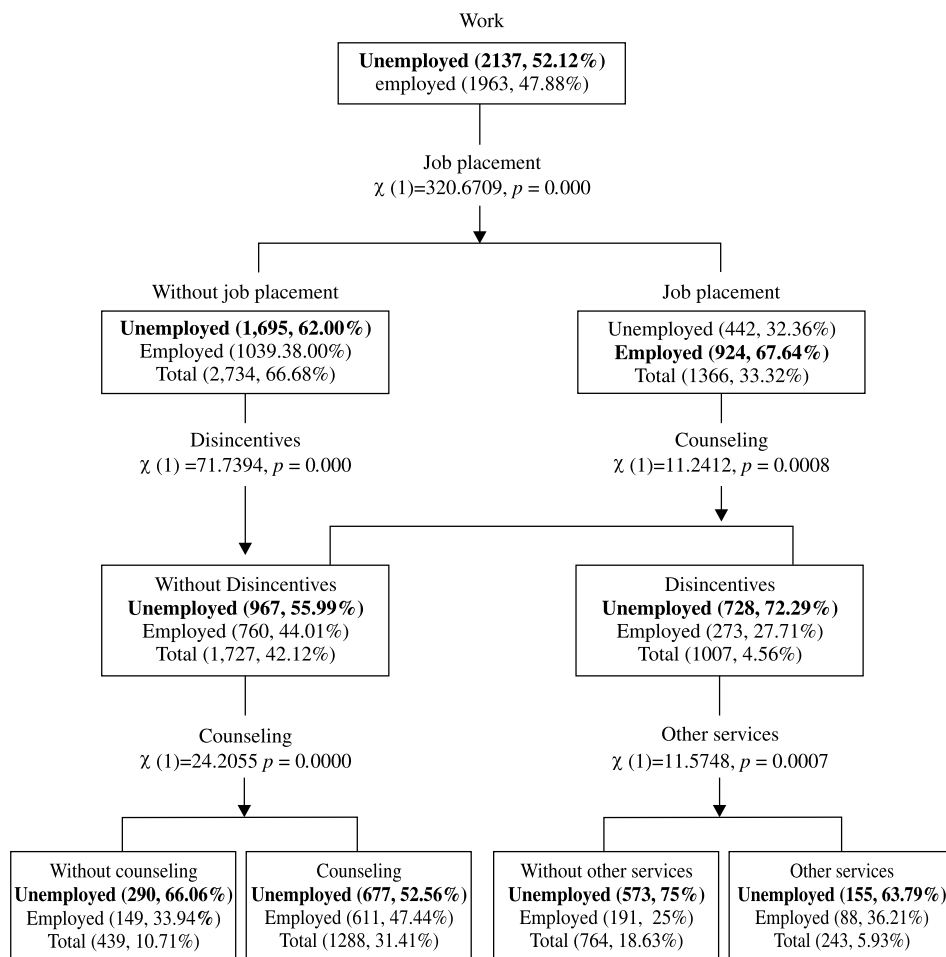


Figure 2. CHAID diagram of the splits of employment outcomes for individuals that did not receive job placement services

American or African American. The 38 individuals in this node represent 0.93% of the overall sample and 1.53% of all employed people in the sample. Comparable to node 51, the index score for node 39 is approximately 165%.

Four groups were found to have approximately 1.5 (or higher) times the likelihood of unemployment than the overall sample. The following is a brief description of these high unemployment groups.

High unemployment groups

- *Node 57*: Node 57 represents 52 men who did not receive job placement services but did receive counseling, restorative and transportation services, as well as SSI or SSDI. The 52

individuals in this node represent 1.27% of the overall sample and 2.20% of all people in the sample who were unemployed. For node 57, the index score is about 173%, meaning that the proportion of people unemployed in this group is about 173% of the unemployment rate for the overall sample.

- *Node 36*: Node 36 represents 207 people who did not receive job placement services but did receive comprehensive assessment and SSI or SSDI. The 207 individuals in this node represent 5.05% of the overall sample and 8.33% of all people who are unemployed in the sample. The index score for node 36 is approximately 165%.
- *Node 43*: Node 43 represents 99 men who did not receive job placement or counseling services, did not receive SSI or SSDI, and did receive comprehensive assessment services. The 99 individuals in this node represent 2.41% of the overall sample and 3.98% of all people who are unemployed in the sample. Comparable to node 36, the index score for node 43 is approximately 165%.
- *Node 58*: Node 58 represents 58 women who did not receive job placement or restorative services but did receive counseling and transportation services as well as SSI or SSDI. The 58 individuals in this node represent 1.41% of the overall sample and 2.06% of all people who are unemployed in the overall sample. The index score for node 58 is approximately 146%.

DISCUSSION

The purpose of this study was to investigate what variables influenced employment outcomes for individuals with psychiatric disabilities who received vocational rehabilitation services provided through the state–federal vocational rehabilitation system. The results of the employment outcomes investigation revealed that the people in the group most likely to be unemployed did not receive job placement services. Indeed, not receiving job placement services was consistent across all four of the highest unemployment groups. People in the single group most likely to be unemployed did not receive job placement services but did receive counseling, restorative and transportation services, in addition to SSI or SSDI. In fact, three of the four highest unemployment groups were receiving SSI/SSDI benefits. As documented in the literature regarding persons with psychiatric disabilities, receiving SSI or SSDI can be a substantial disincentive to employment in the absence of proper financial planning and vocational support (MacDonald-Wilson *et al.*, 2003).

Among other variables, three of the four nodes representing high unemployment groups consisted of men; however, the last node in the high unemployment groups consisted of women. Gender was not found to be a variable that influenced the high work groups. Interestingly, receiving transportation services was one of the variables in two of the four highest unemployment groups. Although one might be inclined to assume that receiving transportation services would assist people to access work environments, one may also surmise that the need for transportation services is indicative of an individual who is potentially less mobile in terms of access to work. Race did influence the high employment groups, with being African or Asian American surfacing in the second and third highest employment nodes (the fourth high employment node consisted of European and African American people).

Conversely to the most significant predictors of unemployment, the findings revealed that people in the group most likely to be employed received job placement and counseling services but were

not receiving SSI or SSDI. The receipt of job placement and counseling services was consistent across the groups most likely to be employed. Job placement services have long been a centerpiece of public VR programs, and research has demonstrated that job placement is the single most important predictor of competitive employment for persons receiving VR services (Bolton *et al.*, 2000). However, only 33.3% of the individuals in the sample received job placement services.

There are several possible explanations for the low percentages of job placement services provided to VR persons with psychiatric disabilities. People with psychiatric disabilities face unique challenges in the attempt to find suitable employment, such as the fluctuating nature of psychiatric disability and the potential for inadequate interpersonal communication and social skills. One could surmise that such characteristics limit the number of acceptable job matches for persons with psychiatric disabilities and thus the options in job placement services. It is also possible that vocational rehabilitation practitioners either consider that competitive employment for their persons with psychiatric disabilities is infeasible or do not consider those individuals to be *work-ready*. However, work is widely considered to be therapeutic for persons with psychiatric disabilities when properly structured with an appropriate job match, and it has been almost 40 years since it was first recognized that non-vocational approaches with emphases on insight and skill training in contrived environments do not generalize to improved work capacity (Vitale & Steinbach, 1965; Wilder *et al.*, 1966). Although there is repeated evidence of the limited generalizability of train and place models, persons with psychiatric disabilities have consistently demonstrated superior vocational gains in place and train models (Bond, 1992). Given the fluctuating nature of psychiatric disability, it is plausible that if rehabilitation practitioners wait for persons with psychiatric disabilities to become work-ready and asymptomatic before engaging in job placement activities, fewer of them will access viable employment.

Implications for rehabilitation counselors

There is evidence that individuals with psychiatric disabilities have unique needs that are best addressed through the *Individual Placement and Support* (IPS) model (Bond *et al.*, 2001; Drake & Becker, 1996). The IPS model addresses the critical lack of generalization of skills to new environments for persons with psychiatric disabilities. According to Bond and his colleagues (2001), the types of supports needed in supported employment for persons with psychiatric disabilities differ from those needed by persons with severe developmental disabilities. One of the primary differences is that supported employment for persons with psychiatric disabilities typically requires less job coaching at the job site but consistent, on-going, off-site support addressing interpersonal and psychosocial problems. The IPS model also emphasizes careful job-matching based on the consumer's preferences and choices rather than a provider's judgement (Drake & Becker, 1996).

The results of this study also indicate that counseling services, in addition to job placement services, do benefit persons with psychiatric disabilities in VR settings. Persons with psychiatric disabilities need on-going psychosocial support, help in navigating social interactions, and counseling specific to financial management and benefits (Anthony *et al.*, 2002). However, these counseling services should consistently go hand-in-hand with job placement services: the study results also indicate that receiving counseling without job placement services could actually serve as a liability, as two of the four highest unemployed groups received counseling services but not job placement services.

Limitations

All data used in this study were from the RSA-911 database generated from information recorded by vocational rehabilitation counselors at various stages in the case service process. In the RSA-911 data, the type of disability is entered before an eligibility decision is made and the wage and occupation data are entered when the case is closed. Thus it is possible that if counselors did not consult the case file to verify which services were delivered and relied solely on memory, data could be incorrect. In addition, data input errors may occur accidentally. Therefore, it is impossible to know how many errors exist in the data. To overcome these potential errors, the Rehabilitation Services Administration (1995) developed 18 cross-checks to reduce the potential for error. However, even with these cross-checks in place, an unknown number of errors may still exist in the database. Fortunately, these errors are assumed to be random and therefore should not result in systematic bias in the data. Finally, because this study used archival data and employed an ex post facto design, causality cannot be inferred.

CONCLUSION

Examining all applicants for VR services in the RSA-911 database for the fiscal year 2001, we found that psychiatric disability was by far the largest group. The breakdown of disability status by percentage is as follows: psychiatric 32.2%, orthopedic 20.4%, Developmental Disability and Mental Retardation (DD/MR) 19.3%, chronic medical 11.4%, sensory 10.4%. This statistic is expected to rise as more individuals with psychiatric disabilities are provided services by public vocational rehabilitation than community-based programs (Ingraham *et al.*, 2001). As the order of selection process requires public vocational rehabilitation providers to serve individuals with the most severe disabilities, the treatment implications from this study indicate an increasing need for rehabilitation professionals to understand the vocational capacities and requirements of person with psychiatric disabilities engaged in the VR system, and the provision of ongoing services without the time limitations and constraints.

The poor vocational outcomes associated with persons with psychiatric disabilities imply that rehabilitation professionals may benefit from training pertaining to the psychosocial as well as the vocational needs of persons with psychiatric disabilities. Findings of the current study have several implications for maximizing outcomes for persons with psychiatric disabilities. First, rehabilitation professionals must gain awareness of the unique challenges to vocational pursuits for persons with psychiatric disabilities (including work disincentives). Lastly, rehabilitation professionals must be trained to provide services by understanding and implementing *Individual Placement and Support* models (Bond *et al.*, 2001; Drake & Becker, 1996) that have been found to be effective with persons experiencing psychiatric disability.

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