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**RESEARCH PAPER**

# Predicting employment outcomes of rehabilitation clients with orthopedic disabilities: A CHAID analysis

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**Abstract**

*Purpose.* To examine demographic and service factors affecting employment outcomes of people with orthopedic disabilities in public vocational rehabilitation programs in the United States.

*Method.* The sample included 74,861 persons (55% men and 45% women) with disabilities involving the limbs or spinal column who were closed either as rehabilitated or not rehabilitated by their state-run vocational rehabilitation agencies in the fiscal year 2001. Mean age of participants was 41.4 years (SD = 11.2). The dependent variable is employment outcomes. The predictor variables include a set of personal history variables and rehabilitation service variables.

*Results.* The chi-squared automatic interaction detector (CHAID) analysis indicated that job placement services significantly enhanced competitive employment outcomes but were significantly underutilized (only 25% of the clients received this service). Physical restoration and assistive technology services along with support services such as counseling also contributed to positive employment outcomes. Importantly, clients who received general assistance, supplementary security income, and/or social security disability insurance benefits had a significant lower competitive employment rates (45%) than clients without such work disincentives (60%).

*Conclusion.* The data mining approach (i.e., CHAID analysis) provided detailed information and insight about interactions among demographic variables, service patterns, and competitive employment rates through the segmentation of the sample into mutually exclusive homogeneous subgroups.

**Keywords:** *Vocational rehabilitation, rehabilitation outcomes, data mining*

Work is fundamental to the physical and psychological health and well-being of people living in contemporary societies [1,2]. The importance of work, both therapeutically and economically, has long been recognized by vocational rehabilitation professionals who have consistently advocated that work is a basic human right of persons with disabilities [3,4]. Effectively, the primary goal of vocational rehabilitation is to assist individuals with disabilities gain or regain their independence through employment or some form of meaningful activity [3,5]. The 1998 Amendments to the Rehabilitation Act defined vocational rehabilitation as a comprehensive sequence of services, mutually planned by the consumer and rehabilitation counselor, to maximize employability, independence, integration and participation of people with disabilities in the workplace and the community [6].

In the United States, the public vocational rehabilitation program was established to provide vocational rehabilitation services to people with physical and psychological disabilities [7,8]. At present, 78.7% of the budget for the public vocational rehabilitation program comes from the federal government and 21.3% comes from state and local funds—an amount that roughly translates into

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approximately two billion dollars in federal grants and $645 million in state and local funds. Because of this federal–state partnership, all public vocational rehabilitation programs follow a standard rehabilitation process, which include the following phases: (a) eligibility determination, (b) rehabilitation plan development, (c) service provision, and (d) job placement [8].

The eligibility determination phase involves diagnostic services such as medical examinations, psychological assessment, and vocational evaluation. The purpose of these diagnostic tools are to determine disability related functional limitations and to identify psychosocial, educational, and economic factors that might interact with the disability to impede the individual's ability to work and live independently. The rehabilitation plan phase involves the development of an individualized plan of employment that outlines the processes and services the client will access to reach identified vocational and educational goals. During this phase, appropriate goals are established based on information gathered from diagnostic services, and services are identified to assist the client achieve immediate objectives and long-term vocational rehabilitation goals. During the service provision stage, an array of rehabilitation services may be accessed depending on the individual's individualized plan and include such services as restoration of physical function (e.g., surgery, prosthesis, or assistive technology), restoration of psychological health (e.g., psychotherapy), academic, business, or vocational training, personal or vocational adjustment training, employment counseling, and job placement and job referral services [8]. Finally, job placement is the last phase of the rehabilitation process and may involve services to support the individual to maintain employment, which typically occurs for 90 days following job placement.

Without question, job placement is the driving force behind the vocational rehabilitation program. Program evaluation and counselor performance are integrally related to the number of job placements obtained by clients. As a result, counselors are faced with performance based evaluation while working with 'hardest to serve' clientele. One way counselors may cope with this challenge is to screen out those individuals with disabilities who are not likely to attain successful outcomes; for example, counselors may elect to allocate more money for services for those clients who are likely to succeed. This process is wrought with problems as those clients with the highest needs fail to receive the services needed for success.

Bolton et al. [9] offer another way to conceptualize the goal of vocational rehabilitation that has the potential to reframe vocational rehabilitation counselors' decision making process. They argue that the goal of vocational rehabilitation should not be a successful outcome, but maximizing the probability of a successful outcome. By redefining the goal of vocational rehabilitation in this way, counselors would use a decision making process that would promote screening clients in for services as opposed to screening them out. This type of feasibility decision making would allow for the prescription of more intensive services for those clients who have a poor probability of success and higher level of service needs.

To implement this decision making process among vocational rehabilitation counselors, Bolton contended that rehabilitation outcome research needs to focus on answering the question, 'Which approach works best for whom under what condition?' Answering this question will provide counselors with information regarding what personal factors and service provision patterns have a high probability of predicting successful outcomes for a specified group of clients. While the notion of finding a homogeneous group of clients within a heterogeneous population in order to match the needs of a specific group with intensive services was advanced by Bolton decades ago [10–12], methodological problems have prevented advancement in this area. According to Bolton and several other rehabilitation researchers, traditional inferential statistics have not been adequate to perform the following types of analyses: For example, Rubin et al. [13] and Byrd [14] stated that it is important to examine the statistical interaction between services and consumer variables in rehabilitation outcome research; Lorenz [15] contended that client outcome is a function of predictor and process variables, wherein process variables interact with predictor variables rather than adding to them; and Sonquist [16] pointed out that interaction among variables and non-linearity of the data appears to be the rule in social science research while additivity and linearity seem to be the exception.

To perform these types of analyses and analyze rehabilitation data in manner that has clinical utility, these researchers recommended the use of a pattern recognition technique (viz., automatic interaction detector [AID]) as opposed to traditional inferential statistics for rehabilitation outcome studies. Bolton [11] identified the following advantages of AID for analyzing large databases: (a) Compared to other multivariate prediction methods, AID requires meeting the least number of assumptions; (b) AID sorts clients into homogeneous groups using an array of independent characteristics and process variables; (c) AID produces results which are displayed in a multivariate expectancy table; and (d) AID allows for the definition of client end groups which can be interpreted by following the sequence of variable

splits to the end group, thus revealing the number of clients in the end group and the proportion who are successful on the outcome variable. Importantly, Bolton [11] noted that AID is not necessarily appropriate for testing specific hypotheses deduced from theory. Rather, it is concerned with inductive model building by the *ex post facto* explanation of a basic set of interrelated propositions which in turn, forms a middle range theory that can form the basis for future hypothesis testing.

While the utility of pattern recognition to rehabilitation outcome research has long been recognized [10–12], this type of research has not been performed to date—a likely result of the lack of computer power and statistical software available to conduct this type of analyses. Recently, however, with the arrival of powerful computers and the advent of the Internet and e-commerce, pattern recognition has emerged as an important research tool, particularly among business and marketing researchers [17]. Today, pattern recognition is popularly known as data mining and has been defined as the extraction of hidden predictive information from large databases [17]. Data mining includes an array of techniques that are used for credit scoring, wage prediction, and market segmentation [17,18]. In addition, data mining has been used to study such areas as the interaction between demographic characteristics of web users and their consumer behavior on the Internet. One commonly used data mining technique includes chi-squared automatic interaction detector (CHAID), which has been used to segment Internet users into homogeneous subgroups and cater advertisement and promotion activities to the unique consumer behavior patterns of each homogeneous subgroup [17].

Because of the success of data mining techniques in solving business and marketing research questions, these techniques have increasingly been used to analyze pattern recognition problems in large healthcare and social service databases, with encouraging results. For example, Ma [19] applied CHAID to discover the determinants of treatment outcomes for individuals with alcohol abuse (readmission) and to subsequently develop a patient-treatment model. The findings of Ma's study indicated that the number of prior arrests, insurance status, current frequency of alcohol use, gender, source of referral, multiple addictions, and employment status significantly predicted the readmission of alcoholism treatment. Ma also discovered that more intensive services such as residential programs and intensive outpatient treatment significantly improved outcomes. Smith and Grawe [20] utilized CHAID as a context-sensitive method of data analysis to conduct an exploratory search for meaningful patterns among therapy process and session-outcome variables using 3,383 10-min sequences of 740 Therapy Spectrum Analysis (TSA)-rated sessions. The analysis revealed that clients' responsiveness to therapeutic intervention and their level of motivation were the strongest predictors of session productivity. Melchoir et al. [21] used CHAID to analyze the unmet needs of groups of traditionally underserved individuals with HIV/AIDS. This study was based on 17 indicators reflecting service needs, vulnerabilities, and demographic characteristics. Segmentation of the 478 participants into homogeneous subgroups revealed that those individuals with HIV/AIDS who used crack cocaine were more likely than other groups to have unmet service needs. In addition, those individuals who were homeless or in precarious housing situations were flagged as highly vulnerable. Forthofer and Bryant [22] applied CHAID to compare various approaches to developing health behavior change strategies. The results not only provided insight into the determinants of breast cancer screening among women, but also enabled the researchers to discover the unique characteristics of population segments with high needs and to focus intervention resources in a manner that was likely to maximize intervention impact [22].

Recently, Chan et al. [23] used CHAID to examine racial bias in acceptance rates of people with disabilities for services in the public vocational rehabilitation program. The analysis revealed that severity of disability followed by race were the first and second most important variables in explaining eligibility decisions. Specifically, individuals with severe disabilities had a significantly higher rate of acceptance (93%) than people without severe disabilities (55%). And, in the severe disability group, Asian Americans had the highest acceptance rate (96%) and African Americans and Latinos had the lowest rate (91%). In addition, the analysis revealed that the prevalence and opportunity for racial bias was smaller when the criteria for eligibility was more clearly defined, as in the case of severe disability, versus situations in which the criteria for eligibility are ambiguous, as in the case of justifying eligibility for vocational rehabilitation services for an individual without a severe disability. Importantly, Chan et al. indicated that the segmentation of rehabilitation clients into homogeneous subgroups that interact significantly with the outcome variable provided additional insight about racial bias that was not identifiable through the traditional chi-square test and logistic regression analysis typically used by rehabilitation researchers who study racial bias problems.

With the advent of computer technology and data mining techniques, it now seems feasible to use the pattern recognition approach advocated by early rehabilitation researchers to analyze large

rehabilitation datasets to study factors influencing employment outcomes of vocational rehabilitation clients. And, the Rehabilitation Service Administration (RSA)-911 dataset, which contains personal history, services, and employment outcome information on those clients receiving public vocational rehabilitation services in the United States, is ideally suited for this type of analyses. This large archival dataset is gathered from 'Case Service Reports' furnished annually to the RSA department of the federal government by public vocational rehabilitation programs across the country, and has been used to study racial bias in eligibility determination and employment outcomes of people with disabilities [9,24]. The purpose of the current study is to apply the data mining approach CHAID, to the RSA-911 dataset in order to determine factors influencing employment rates of a group of vocational rehabilitation clients with orthopedic disabilities.

## Method

### *Participants*

Data for this study was extracted from the RSA-911 dataset. The sample consisted of 74,861 persons with orthopedic disabilities who were closed as rehabilitated or not rehabilitated by public vocational rehabilitation agencies in the fiscal year (FY) 2001. The sample included 41,094 men (55%) and 33,767 women (45%). The majority of these clients were self-referral (58%); 15% were referred by social security, workers' compensation, and state employment agencies; 8% were educational institutions; 5% were health organizations and agencies; 5% were hospitals; 5% were employers; and 4% were welfare agencies. Of these 74,861 persons, about 23% were recipients of social security disability insurance (SSDI) benefits, supplemental security income (SSI) benefits, or public assistance. Racial and ethnic backgrounds of these rehabilitation clients were diverse; 73.2% were European American, 15.4% were African American, 9% were Latino, 1.3% were Native American, and 1.2% were Asian American. Approximately 36% of the clients were married; 34% were never married; 21% were divorced; 6% were separated; and 2% were widowed. Mean age of participants was 41.4 years (SD = 11.2). Approximately 43% completed high school, 20% had less than high school education, 28% had some college education, and 2% had received special education services. In terms of severity, 88% were reported to have a severe disability and 12% a non-severe disability. The average duration between application and acceptance for services was 1.61 months (SD = 2.58); average duration of the rehabilitation process was 29.6 months (SD = 25.9); average number of services received was 3.70 (SD = 2.04); and the average case expenditure was 4,187 U.S. dollars (SD = 7580).

### *Variables*

The criterion variable in this study was employment outcome. For data analysis, individuals closed as rehabilitated in the competitive employment category of were coded as '1' and individuals who were closed as not working were coded as '0'.

The predictor variables included two sets of variables: personal history and rehabilitation services. Personal history variables included gender (male or female); race (European American, African American, Hispanic/Latino, Native American, and Asian American); severity of disability (severe versus not severe); age (16 – 34, 35 – 54, 55 – 64, 65 and older); education (special education, less than a high school education, high school graduate, and at least some college); and government benefits (e.g., public assistance, health insurance, supplemental security income [SSI], and/or social security disability insurance [SSDI] benefits). Rehabilitation services variables (1 = Yes, 0 = No) include:

- Assessment—Assessment involves diagnosis and evaluation and can be medical, psychological, social or vocational in scope.
- Restoration (Physical and Mental)—This category includes those medical and medically-related services which are necessary to correct or substantially modify a physical or mental condition. Examples of restoration services are surgery, therapy, treatment and hospitalization.
- College/University Training—Included is all academic training on a level beyond secondary schooling. Persons attending full- or part-time or evening courses conducted by a university, college, junior college, or a college-level extension school would be recorded as receiving this training.
- Business and Vocational Training—This is non-collegiate post-secondary education. Included is training in (a) a business/commercial school or college and (b) a vocational/trade school. Training in the business/commercial school or college would prepare the individual for work in areas of office practice, typing, word processing, bookkeeping, accounting, data processing, etc. Training in the vocational/trade school would typically prepare the person for occupations such as welding, woodworking, TV repair, electrical wiring, auto and aviation mechanics, drafting, cosmetology, barbering, etc.

- Adjustment Training—This is training which will help the individual adjust to a particular situation hindering his or her ability to work. Included would be work conditioning, developing work tolerance, mobility training, remedial training, literacy training, lip reading, braille, etc.
- On-the-Job Training—This is training by a prospective employer in which the individual usually works for wages while learning the skills of a job.
- Miscellaneous Training—This category is provided to allow classification of types of training that do not readily fit into the previous groupings. Included would be academic training on a secondary education level or lower as well as specialized schools for persons who are blind or deaf which are academic in nature.
- Counseling and Guidance-Substantial—This means that Counseling and Guidance services were of overriding importance in the totality of rehabilitation services delivered to the individual, as determined by a large amount of time and effort expended to provide such services.
- Job-Finding Services—A job-finding service is provided when enough information has been imparted to permit the individual to arrange for a job interview with a possible employer on his or her own.
- Job Placement—A job placement service is rendered when the individual is referred to and is *hired* by an employer. This service may be provided by the State rehabilitation agency, the State employment service, or any other job-finding source such as a private employment agency.
- Transportation—Transportation is any service provided or arranged for by the State agency to enable the individual to arrive at appointments for assessment, medical services, training, or any other rehabilitation service, as well as to permit the individual to get to work. Included would be the provision of vans, taxi cabs, private cars, etc., for the person as well as payments made to these carriers.
- Maintenance—Included under this category are services provided to cover the additional costs incurred by the individual while he or she is undergoing rehabilitation services.
- Other Services—This category allows classification of rehabilitation services that cannot be recorded elsewhere. Included are occupational tools and equipment, initial stocks and licenses, and services to family members for the benefit of the individual. Medical care for acute conditions arising during rehabilitation and constituting a hazard to the determination of rehabilitation potential or to the achievement of the vocational objective is also to be included in this category.
- Personal Assistance Services—Included under this category are services such as reader service for a visually impaired person, an interpreter for a hearing impaired or deaf-blind person, or an attendant for any disabled person.
- Rehabilitation Engineering—Rehabilitation engineering is a complex of services entailing an original design or concept intended to help the individual maintain or enhance his or her ability to function personally, socially, and/or vocationally. The original design or concept encompasses not only devices, equipment, and aids, but also modifications to the environment, work site, and in transportation on behalf of the individual.
- Assistive Technology—These are services that directly assist an individual in the selection, acquisition, or use of an assistive technology device. These devices include any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities.

*Data analysis*

Data was analyzed using the decision-tree technique, a data mining approach. The decision tree technique generates rules for the classification of a dataset and uses a tree-shaped structure to represent sets of decisions. Specific decision tree methods include Classification and Regression Trees (CART) for regression-type problems and CHAID for building classification trees [18,21,25,26]. In the current study, Exhaustive CHAID was used to build classification trees. This technique uses a systematic algorithm to detect the strongest association between predictors and the outcome variable (i.e., employment outcomes) through a comprehensive search of the predictors and the levels of predictors from the entire set that show the most differentiation on the outcome variable. The degree of differentiation is depicted sequentially in a decision tree format to show the optimally split predictors. Thus, homogeneous groups of vocational rehabilitation clients could be 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. The statistical software SPSS AnswerTree 2.0 was used to conduct the Exhaustive CHAID analyses [18]. Notably, the Exhaustive CHAID requires the use of categorical variables.

For this reason, continuous variables (e.g., age and education) were recoded to categories to conform to this requirement.

## Results

### *Descriptive statistics*

Demographic characteristics and employment rates of this sample of orthopedic clients is presented in Table I.

For the overall sample, the employment success rate was 56% and the unsuccessful rate was 44%. Notably, the success rate for employment of this sample of clients who received vocational rehabilitation services (56%) was appreciably higher than the overall employment rate (31%) of people with disabilities in the United States [27]. In this study, women had a slightly higher competitive employment rate (58%) than men (55%); European and Latin Americans had higher competitive employment rates (58%) than African American (51%), Native Americans (52%), and Asian Americans (53%); and, people with non-severe disabilities had a higher competitive employment rate (62%) than people with severe disabilities (56%).

### *Data mining results*

Results from the Exhaustive CHAID analysis that looked at the predictors of race, gender, severity of disability, age, education, government benefits, health insurance, and services, and the criterion of employment outcomes revealed a risk of false classification of 35% and a risk of 36% for cross-classification. Notably, the overall correct classification accuracy of 65% is a significant improvement over the base rate of 56%. In general, the predictors were better at predicting vocational rehabilitation clients who were closed as competitively employed (74% accuracy) than for predicting those who were closed as unemployed (52% accuracy). The decision tree grew to 10 levels and segmented the sample to 203 homogeneous subgroups. In order to fit the CHAID diagram to the page, the tree diagram is depicted in two figures: Figure 1 shows the right split of the decision tree depicting the competitive employment rates of the sample of clients who were first segmented by receiving job placement services; Figure 2 shows the left split of the decision tree depicting the competitive employment rates of the sample of clients who did not receive job placement services. Only three levels of the trees were shown.

Table I. Employment rates of VR clients by gender, race, and severity of disability.

| | Employed | | Not employed | |
|---|---|---|---|---|
| Variable | Frequency | % | Frequency | % |
| Gender | | | | |
| Male | 22,734 | 55 | 18,360 | 45 |
| Female | 19,599 | 58 | 14,168 | 42 |
| Race | | | | |
| European American | 31,586 | 58 | 23,199 | 42 |
| African American | 5,908 | 51 | 5,593 | 59 |
| Latino/a | 3,852 | 58 | 2,851 | 42 |
| Native American | 495 | 52 | 451 | 48 |
| Asian American or Pacific Islander | 492 | 53 | 434 | 47 |
| Severity of disability | | | | |
| Severe | 36,622 | 56 | 28,967 | 44 |
| Non-severe | 5,711 | 62 | 3,561 | 38 |
| Total | 42,333 | 56 | 32,528 | 44 |

The most significant predictor of employment outcomes was job placement services. The effect size (odds-ratio) for job placement services was computed to be 2.92 and is considered a medium effect. Clients who received job placement services had a significantly higher competitive employment rate (75%) than clients who did not receive job placement services (51%). The second most important factor predicting employment outcomes was work disincentives. Clients who received general assistance, supplementary security income, and/or social security disability insurance benefits had a significant lower competitive employment rates (45%) than clients without such work disincentives (60%). As observed from the CHAID analysis, there was a significant interaction effect between the job placement service variable and the work disincentives variable.

The gains chart presented in Table II shows the top 10 subgroups that had significantly higher successful employment rates as compared to the overall sample.

Table II shows the subgroups sorted by a gain score (successful employment rate) revealing from highest to lowest the top ten successful groups that have significantly higher competitive employment rates than the competitive employment rate (56%) of the overall sample. The following is a brief description of these 10 homogeneous subgroups with higher than average competitive employment rates:

*Group 1.* This group represents 157 women with orthopedic disabilities who belong to two age groups; they are either between the age of 16 and 34 or over the age of 65. This group of women had no work disincentives and received substantial counseling, university training, and job placement services. In addition, they had no transportation service needs and did not need any major physical or mental restoration services. These 157 women represent 0.21% of the vocational rehabilitation clients in the

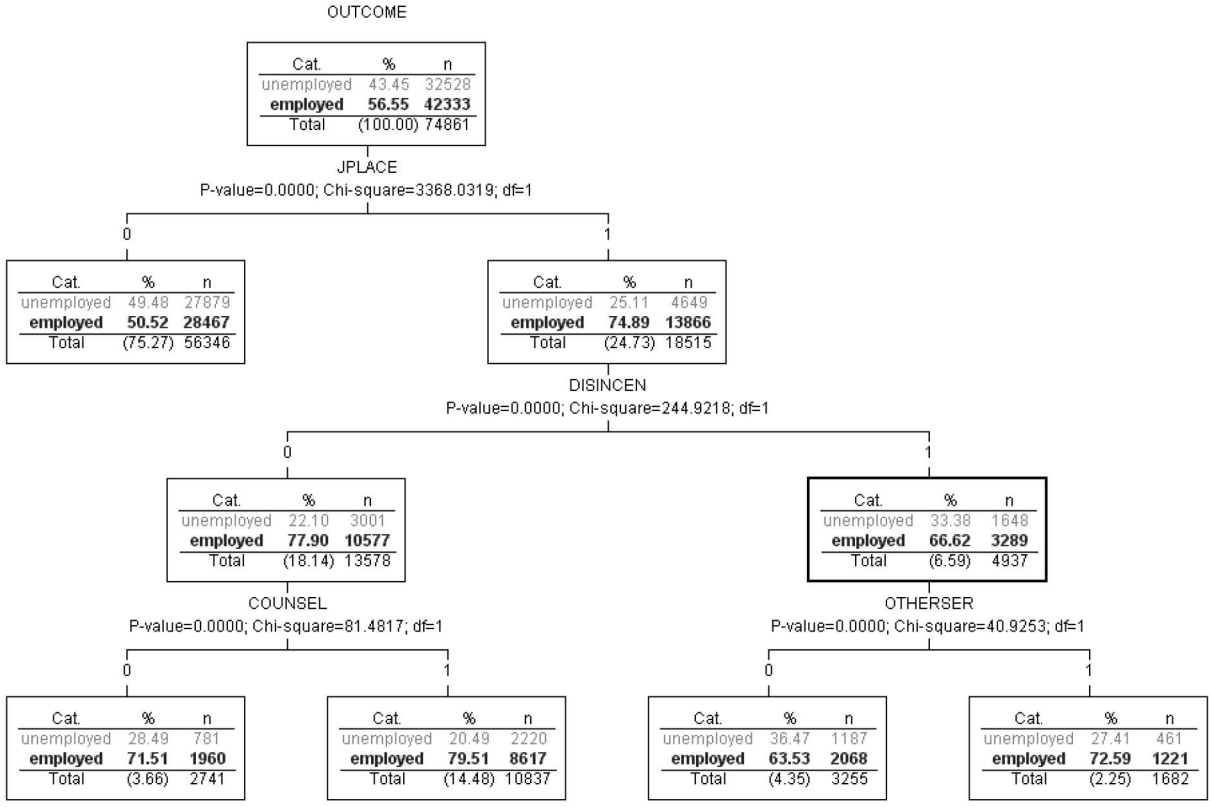


Figure 1. CHAID diagram of the partial tree depicting outcome predictors for rehabilitation clients who received job placement services.

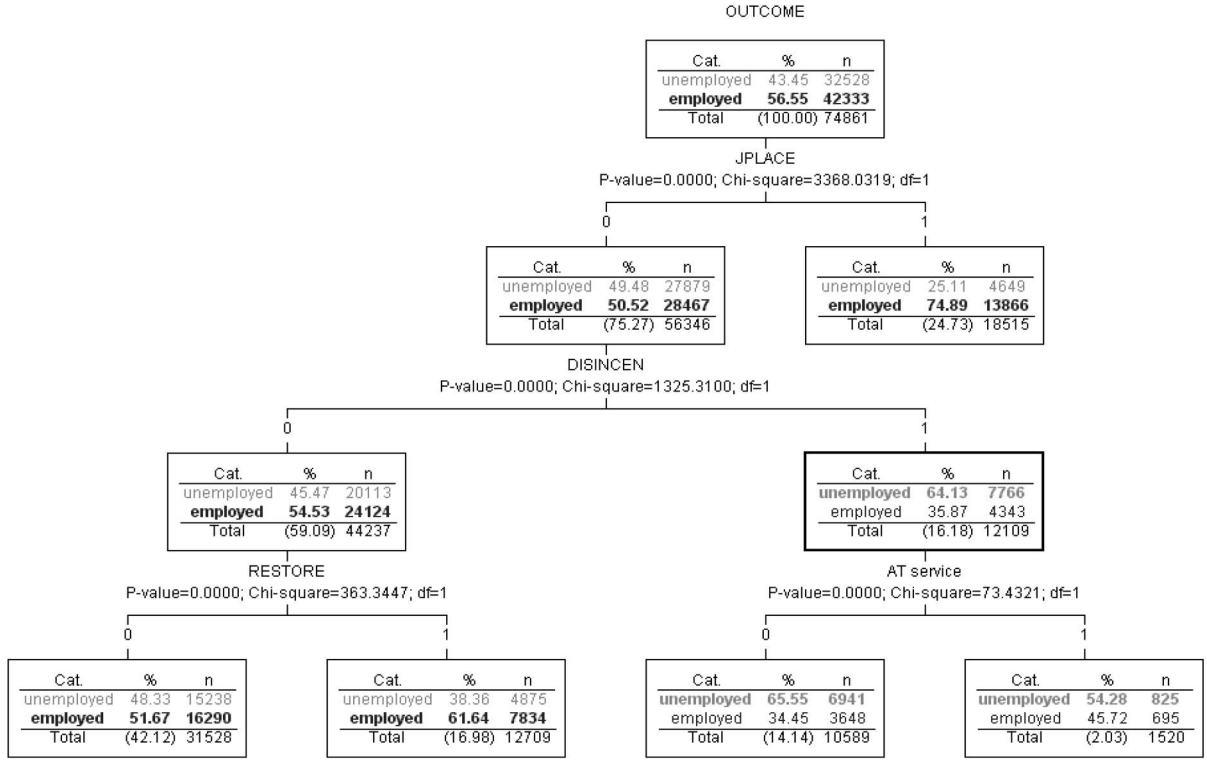


Figure 2. CHAID diagram of the partial tree depicting outcome predictors for rehabilitation clients who did not receive job placement services.

Table II. Gains chart (node-by-node) statistics for the top 10 successful groups.

| Group | No. of subjects | % of total sample | No. success | % of success sample | Gain (%) | Index (%) |
|---|---|---|---|---|---|---|
| 1 | 157 | 0.21 | 154 | 0.36 | 98.08 | 173.46 |
| 2 | 102 | 0.14 | 97 | 0.23 | 95.10 | 168.17 |
| 3 | 89 | 0.12 | 81 | 0.19 | 91.01 | 160.94 |
| 4 | 141 | 0.19 | 127 | 0.30 | 90.07 | 159.28 |
| 5 | 300 | 0.40 | 264 | 0.62 | 88.00 | 155.62 |
| 6 | 99 | 0.13 | 87 | 0.21 | 87.88 | 155.40 |
| 7 | 304 | 0.41 | 267 | 0.63 | 87.83 | 155.32 |
| 8 | 394 | 0.53 | 343 | 0.81 | 87.06 | 153.95 |
| 9 | 66 | 0.09 | 57 | 0.13 | 86.36 | 152.72 |
| 10 | 495 | 0.66 | 425 | 1.00 | 85.86 | 151.83 |

*Note.* The gain percent represents competitive employment rate.

overall sample, and the competitive employment rate for these women was 98%. The 154 individuals who found competitive employment after receiving services represent 0.36% of all clients who were closed as rehabilitated in the overall sample. An index score of the ratio of these two percentages indicates the comparison between the proportion of clients who were employed in this group as compared to the proportion of clients who were employed in the overall sample. For this group, the index score was 173% (0.36/0.21) and reveals that the proportion of clients who found competitive employment in this group is approximately 173% better than the competitive employment rate for the overall sample.

*Group 2.* This group represents 102 clients with orthopedic disabilities who have an educational background of a high school graduate or some college education. This group did not have work disincentives and received four major services: substantial counseling, adjustment training, on-the-job training, and job placement services. The competitive employment rate for this group was 95% and the index score was approximately 168% better than the employment rate of the overall sample.

*Group 3.* This group represents 89 women with orthopedic disabilities. These women belong to two age groups; they are either between the age of 16 and 34 or over the age of 65. These women did not have work disincentives and received substantial counseling, university training, transportation service, and job placement services. The competitive employment rate for this group was 91% and the index score was approximately 161% better than the employment rate of the overall sample.

*Group 4.* This group represents 141 clients with orthopedic disabilities who had either received special education services or had less than a high school education. This group did not have work disincentives and received three major services: substantial counseling, assistive technology services, and job placement services. The competitive employment rate for this group was 90% and the index score was approximately 159% better than the employment rate of the overall sample.

*Group 5.* This group represents 300 clients with orthopedic disabilities who were either European, Asian, or Latino Americans between the ages of 16 and 34 years who had at least some college education. This group did not have work disincentives and received substantial counseling and job placement services. The competitive employment rate for this group was 88% and the index score was approximately 156% better than the employment rate of the overall sample.

*Group 6.* This group represents 99 clients with nonsevere orthopedic disabilities who had some college education. This group did not have any work disincentives and received only assistive technology services. The competitive employment rate for this group was 88% and the index score was about 155% better than the employment rate of the overall sample.

*Group 7.* This group represents 304 clients with orthopedic disabilities who have an educational background of a high school graduate or some college education. This group does not have work disincentives and received only on-the-job training and job placement services. The competitive employment rate for this group was 88% and the index score was approximately 155% better than the employment rate of the overall sample.

*Group 8.* This group represents 394 women with orthopedic disabilities between the ages of 16 and 34 years. These women did not have work disincentives and received substantial counseling, university training, vocational-technical training, and job placement services. The competitive employment rate for this group was 87% and the index score was approximately 153% better than the employment rate of the overall sample.

*Group 9.* This group represents 66 clients with severe orthopedic disabilities. This group did not have work disincentives and they received assistive technology services. The competitive employment rate for this group was 86% and the index score was approximately 153% better than the employment rate of the overall sample.

*Group 10*. This group represents 495 clients with orthopedic disabilities who are between the age of 35 and 54 years and either dropped out of high school or graduated from high school. This group did not have work disincentives and received vocational-technical training and job placement services. The competitive employment rate for this group was 86% and the index score was approximately 152% better than the employment rate of the overall sample.

The subgroup analysis confirmed the importance of job placement services and the helpful effect of not having government benefits on employment outcomes. In addition, women and individuals with less severe disabilities appeared to have greater success in finding employment. Importantly, substantial counseling appears to be an important support service to successful rehabilitation outcomes and university training, vocational-technical school training, and on-the job training have differential effects on employment outcomes. The gains chart in Table III depicts the bottom 10 groups with the lowest rates of competitive employment rates than the overall sample.

The following is a brief description of the 10 homogeneous subgroups which have significantly lower than average competitive employment rates as compared to the overall sample.

*Group 1*. This group represents 70 women with orthopedic disabilities. These women were receiving government benefits such as SSI, SSDI, and/or public assistance and health insurance (i.e., work disincentives) at the time of services. This group was provided a university education but did not receive a comprehensive assessment, substantial counseling, or job placement services. The competitive employment rate for this group of women was 16% and the index score was 194% indicating that their unsuccessful employment rate was 1.9 times higher than the average of the overall sample.

Table III. Gains chart (node-by-node) statistics for the bottom 10 groups.

| Group | No. of subjects | % of total sample | No. of failure | % of failure sample | Gain (%) | Index (%) |
|---|---|---|---|---|---|---|
| 1 | 70 | 0.09 | 59 | 0.18 | 84.29 | 193.98 |
| 2 | 959 | 1.28 | 755 | 2.32 | 78.73 | 181.19 |
| 3 | 64 | 0.09 | 49 | 0.15 | 76.56 | 176.20 |
| 4 | 86 | 0.11 | 65 | 0.20 | 75.58 | 173.95 |
| 5 | 229 | 0.31 | 173 | 0.53 | 75.55 | 173.86 |
| 6 | 224 | 0.30 | 168 | 0.52 | 75.00 | 172.61 |
| 7 | 2342 | 3.13 | 1707 | 5.25 | 72.89 | 167.74 |
| 8 | 215 | 0.29 | 156 | 0.48 | 72.56 | 166.99 |
| 9 | 82 | 0.11 | 58 | 0.18 | 70.73 | 162.78 |
| 10 | 165 | 0.22 | 116 | 0.36 | 70.30 | 161.80 |

*Note*. The gain percent represents unsuccessful employment rate.

*Group 2*. This group represents 959 clients with orthopedic disabilities. This group was receiving government benefits and health insurance (i.e., work disincentives) at the time of services, received only a comprehensive assessment, and no other rehabilitation services. The competitive employment rate for this group was 21% and the index score was 181% indicating that their unsuccessful employment rate was 1.8 times higher than the average of the overall sample.

*Group 3*. This group represents 64 clients with orthopedic disabilities. These individuals were receiving government benefits (i.e., work disincentives) at the time of services. They were provided a comprehensive assessment, physical restoration services, and other services (e.g., acute medical services and work tools and equipment). The competitive employment rate for this group was 23% and the index score was 176% indicating that their unsuccessful employment rate was 1.8 times higher than the average of the overall sample.

*Group 4*. This group represents 88 African and Latino American men with severe orthopedic disabilities who had either received special education or dropped out of high school. These individuals were not receiving government benefits at the time of services and were provided only physical restoration services. The competitive employment rate for this group was 24% and the index score was 174% indicating that their unsuccessful employment rate was 1.8 times higher than the average of the overall sample.

*Group 5*. This group represents 229 clients with orthopedic disabilities. These individuals were receiving government benefits and health insurance (i.e., work disincentives) at the time of services. They received a comprehensive assessment and restoration services. The competitive employment rate for this group was 24% and the index score was 174% indicating that their unsuccessful employment rate was 1.8 times higher than the average of the overall sample.

*Group 6*. This group represents 224 men with orthopedic disabilities who had less than a high school education. These individuals were receiving government benefits (i.e., work disincentives) at the time of services and they received no services. The competitive employment rate for this group was 25% and the index score was 173% indicating that their unsuccessful employment rate was 1.7 times higher than the average of the overall sample.

*Group 7.* This group represents 2,342 clients with orthopedic impairments. These individuals were receiving government benefits and health insurance (i.e., work disincentives) at the time of services. They received a comprehensive assessment and substantial counseling. The competitive employment rate for this group was 27% and the index score was 168% indicating that their unsuccessful employment rate was 1.7 times higher than the average of the overall sample.

*Group 8.* This group represents 215 clients with orthopedic disabilities. These individuals were receiving government benefits and health insurance (i.e., work disincentives) at the time of services. They received a comprehensive assessment, vocational-technical school training, and transportation services. The competitive employment rate for this group was 27% and the index score was 167% indicating that their unsuccessful employment rate was 1.7 times higher than the average of the overall sample.

*Group 9.* This group represents 82 men with orthopedic disabilities. These individuals were receiving government benefits and health insurance (i.e., work disincentives) at the time of services. They received a university education without a comprehensive assessment or assistive technology services. In addition, no job seeking-skills training or job placement services were provided for these clients. The competitive employment rate for this group was 29% and the index score was 163% indicating that their unsuccessful employment rate was 1.6 times higher than the average of the overall sample.

*Group 10.* This group represents 165 clients with orthopedic impairments who had either received special education services or had less than a high school education. These individuals were receiving government benefits at the time of services. They were provided a comprehensive assessment, substantial counseling, and physical restoration services. The competitive employment rate for this group was 30% and the index score was 161% indicating that their unsuccessful employment rate was 1.6 times higher than the average of the overall sample.

Analysis of these high-risk subgroups confirmed the detrimental effect of work disincentives. Particularly, clients who were receiving government benefits and health insurance appeared to have strong work disincentives. Others variables contributing to unsuccessful employment outcomes included gender, race, education, transportation, and medical crises. Specifically, male clients were at a higher risk for unsuccessful employment outcomes than females; clients who had less than a high school education or a history of special education had lower success rates; and African and Latino Americans with poor educational backgrounds, individuals with no means of transportation, and those who had a medical crisis in the rehabilitation process were all at higher risk for unsuccessful employment outcomes. Of particular importance is the finding that providing restoration and training services without providing important services such as comprehensive assessment, substantial counseling, and job placement in conjunction negatively affects outcomes. Specifically, this analysis showed that providing expensive restoration and training services without less expensive support services (e.g., counseling, assistive technology, and job placement) has an adverse affect on competitive employment outcomes.

## Summary and discussion

The data mining approach provides detailed information and insight about interactions among demographic variables, service patterns, and competitive employment rates through the segmentation of a sample into mutually exclusive subgroups. In this study, the results of the CHAID analysis revealed that vocational rehabilitation clients with the highest probability of successful employment were women who had no work disincentives, no transportation barriers, and received counseling, university training, and job placement services. In addition, this group did not need significant physical or mental restoration services, suggesting that their disability and overall health status was stable.

An important finding from this analysis was the central role of job placement services in predicting employment. Specifically, the top five subgroups and eight out of the ten subgroups most likely to be employed received job placement services, whereas the ten subgroups who were at high risk for unemployment did not receive job placement services. This finding is consistent with the rehabilitation literature that shows that job placement services have a strong relationship to employment outcomes. For example, Bolton et al. [9] sampled over 4,000 vocational rehabilitation clients and found that job placement services were the single most important predictor of competitive employment, with service variables in general contributing substantially to the prediction of competitive employment (26% of the variance), personally history accounting for approximately 5% of the variance, and functional limitations not adding significantly to variance.

Nonetheless, while this study found that job placement services significantly enhanced competitive employment outcomes, the use of this service was significantly underutilized (only 25% of the

clients received this service). The limited use of job placement is likely a result of the various models of job placement (i.e., 'person-centered job placement' versus 'select placement') and the different philosophies that underlie these approaches. For example selective placement is defined as 'a process used for placing people with disabilities in employment suited to their age, experience, qualifications, and physical and mental capacities...this is the final stage of rehabilitation and includes three distinct processes: knowing the worker, knowing the job, and matching the worker to the job' [4]. This model is often executed in such job placements services as supported employment, which involves intense staff support before, during, and following placement. Solomone [28] argued, 'the selective placement approach may impair the dignity, independence, and self-confidence of clients because this match or selling approach to placement ... is more applicable to object than people' (p. 401). He contended that clients who have not engaged in their own successful job-hunting practices are likely to return, again and again, to the counselor for additional selective placement services.

These opposing perspectives are reflected in the diverse nature of job placement services. Job placement services range in the intensity of pre-employment support, involvement with employer, and on-site support (i.e., job coaching) and typically include either traditional job placement services that involve preparing the individual for the job search independently, or a more intense model such as supported employment. While the type of job placement service received has historically been determined by the severity of disability, it is likely that job placement services that have a more flexible approach and draw from both these models based on the needs of the individual would be most beneficial.

Of particular importance is the fact that despite the passage of the Americans with Disabilities Act, the employment rate of people of disabilities in the United States has not changed over the past 20 years, hovering around 30% [27]. Perhaps more emphasis on the use of job placement services that match persons with disabilities to specific employers and jobs might improve the probability of vocational rehabilitation clients' chance of getting a job. Counselor-centered job placement may be necessary in light of the strength of employers' stereotypes, prejudice, and discrimination towards hiring people with disabilities and from minority backgrounds. A current study investigating the role of race in employer hiring practices reveals the continued pervasiveness of discriminatory behavior among employers in the U.S. Labor market. Specifically, Bertrand and Mullainathan [29] sent 5000 fictitious resumes to 1300 help-wanted ads in Boston and Chicago newspapers and found significant bias against those resumes with African American sounding names as compared to those resumes with white sounding names. In fact, there were 50% more interview callbacks for those fictitious persons with names appearing to belong to white individuals. This racial gap was found to be uniform across occupations and industries and there was no difference between small or large employers, or those that are listed as 'Equal Opportunity Employers'. It is logical to assume that attitudes toward people with disabilities are equally negative and pervasive among many employers. Thus, rehabilitation professionals may need to consider job placement service approaches that help remove the entrenched discrimination barriers that prevent clients from achieving the first step towards employment.

Another important finding from this study is the adverse effect of work disincentives on employment, despite the introduction of benefits counseling in the 1990s [30]. Specifically, nine of the ten highest unemployment groups were receiving SSI/SSDI benefits at the time of services, and the subgroup of clients who were at highest risk for unemployment were women receiving government benefits and health insurance (i.e., work disincentives) and were provided a university education without going first going through a comprehensive assessment. As documented in the literature, without proper financial planning and vocational support, SSI or SSDI can be a substantial disincentive to employment [31,32].

One of the primary barriers to gainful employment for persons with severe disabilities is weighing the financial benefits of paid work against the real possibility of losing benefits. At any given time, only 6% of people receiving SSI are working [31]. Investigations have reported little change in the numbers of people leaving the disability rolls because of 'work recovery'—estimating a dismal 0.5% for SSDI beneficiaries engaged in the public vocational rehabilitation system [31] to 3% of all SSDI beneficiaries [33]. Moreover, up to one third of those who leave the rolls return. Hennessey [32] reported in a new beneficiary follow-up study (a selected sample of those enrolled since 1972) that approximately 12% of SSDI beneficiaries attempted work after entitlement and 24% of those individuals terminated benefits because of recovery (either medical or work recovery). The results revealed that less than 3% of the original sample left the rolls because of working at what the Social Security Administration calls the 'substantial gainful activity' level.

While SSI/SSDI benefits continue to present obstacles to employment, legislative efforts have occurred to decrease these disincentives. Prior to

the Ticket to Work and Work Incentives Improvement (TWWIIA) Act of 1999, it was not an uncommon scenario to have individuals lose assistance resources (e.g., medical assistance) by going to work. Fortunately, recent legislative initiatives have modified the disincentive effects of Social Security benefits, whereby persons receiving SSI and SSDI benefits that are employed are permitted to work for longer periods of time with less reduction of financial benefits [30]. Thus, the importance of benefits counseling has become increasingly apparent within the vocational rehabilitation system. In fact, Hennessey [32] examined the effect of knowledge of work incentives on recipients' tendency to refuse to work or to stop working following a trial period. Findings suggested that if SSDI beneficiaries had knowledge of the trial work period and the extended period of benefits eligibility under new laws, as well as confirmation that they would receive Medicare benefits, the effects of work disincentives dissipated. Given the importance of benefits counseling in rehabilitation planning, it is suggested that the Rehabilitation Services Administration revise the Case Service Report form to include benefits counseling as a rehabilitation service in order to have the capability to include this important variable in rehabilitation outcome research.

### *Limitations*

All data used in this study was from the RSA-911 dataset generated from information recorded by counselors at various stages in the case service process. In RSA-911 data, the information on 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 do 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 be entered by the counselors accidentally. To overcome these potential errors, the Rehabilitation Services Administration 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. 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 employs an *ex post facto* design, causality cannot be inferred.

### *Clinical practice implications*

There are several important clinical implications that emerge from this study. First, an examination of the RSA-911 dataset for fiscal year 2001 revealed that vocational rehabilitation applicants with orthopedic disabilities constitute the second largest group of clients with the breakdown of client disability status as follows: psychiatric 32.2%, orthopedic, 20.4%, developmental disabilities/mental retardation, 19.3%, chronic medical, and 11.4%, sensory, 10.4%. As the order of selection process requires public vocational rehabilitation providers to serve individuals with the most severe disabilities first, this study suggests that rehabilitation counselors need to better understand the vocational capacities and service needs of clients with severe orthopedic disabilities. Bolton et al. [9] noted that persons with orthopedic disabilities served in vocational rehabilitation settings demonstrated more functional limitations in the areas of physical capacity and motor function, and that the group on average, spent longer time in rehabilitation (along with clients with chronic medical conditions and psychiatric disabilities).

Second, this study highlights the importance of understanding the service needs of clients with disabilities in general and those with orthopedic disabilities in particular. This analysis suggests the importance of a comprehensive assessment prior to initiating expensive restoration or training services, assistive technology services, support services (e.g., substantial counseling to all clients), and benefits counseling. Of central importance is the role of job placement services in the employment outcomes of persons with orthopedic disabilities. Rehabilitation counselors, administrators, and counselor educators have long known the importance of job development and job placement activities in vocational rehabilitation [34,35], yet this service remains underutilized. The clear evidence supporting the use of job placement services demonstrated in the present investigation supports an increased emphasis on job placement in both rehabilitation counselor education programs and through state vocational rehabilitation agency training for counselors.

Third, this study provides insight into those clients with orthopedic disabilities who are at high risk for poor vocational outcomes such as young African American and Latino men and clients with poor educational backgrounds. This information reiterates the importance of conceptualizing the goal of vocational rehabilitation as maximizing the probability of a successful outcome and thereby prescribing more intensive, adequate services for high risk clients. Counselors need to work towards minimizing the influence of stigma against these high risk groups by advocating for the provision of a broad array of vocational services while using a decision making process that uses empirical and evidence based information to make decisions that are rational and objective. Lastly, rehabilitation counselors to

better understand the contribution of psychosocial factors to employment success, and minimize bias against persons from underserved groups as they attempt to procure employment. To do this, counselors need to become aware of their potential for implicit bias against providing viable employment support services such as job placement for persons with severe disabilities.

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