

# Prediction of employment outcomes among veterans with substance use disorders: A chi-squared interaction detector analysis

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## Abstract.

**OBJECTIVE:** The purpose of this study was to explore factors associated with employment outcomes of veterans with substance use disorders.

**METHODS:** Chi-squared automatic interaction detector (CHAID) was used to explore how interactions between participant entry characteristics and treatment participation variables relate to employment outcome. Participants included 46,641 veterans with substance use disorders from the Veterans Health Administration's Compensated Work Therapy (CWT) Programs during the period of 1993 to 2005. The data used in this study were administrative archival data routinely collected by the Northeast Program Evaluation Center (NEPEC) from all CWT programs nationwide.

**RESULTS:** Factors most highly associated with competitive employment outcome included greater treatment intensity, defined as higher weekly mean earnings and longer treatment duration; higher vocational functioning prior to admission defined as a shorter length of time since employed for at least a month; and participation in a transitional work experience position on the VA grounds.

**CONCLUSION:** The CHAID analysis was able to construct an optimal model using participant entry characteristics and treatment participation variables to explain the variance in the dependent variable, employment outcome. Through the process of segmentation of the sample into mutually exclusive homogeneous subgroups with different probabilities of positive outcomes, CHAID provided detailed information about interactions between the participant entry characteristics and treatment participation variables on the one hand and the outcome variables on the other.

Keywords: Employment, vocational rehabilitation, substance use, veteran, data mining

## 1. Introduction

Understanding how veterans' health conditions and related treatment services impact community participation outcomes could not be more urgent at this

time (Humensky, Jordan, Stroupe, & Hynes, 2013). It is a nationwide priority for the Veterans Health Administration (VHA), as well as other health care and rehabilitation systems, to provide high quality services to help veterans lead healthy lives and reintegrate into civilian society (Hoge et al., 2008). Substance use and other mental health disorders are among the most severe and complicated health conditions experienced by veterans (Watkins et al., 2011).

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In the United States, the entire veteran population is estimated at 22.5 million, representing about 14% of the total population (U.S. Census Bureau, 2012). Compared to the general population, veterans experience higher rates of alcoholism (Bridevaux, Bradley, Bryson, McDonell, & FihnM, 2004), as well as other substance-related problems (Dietz, 2007). From 2000 to 2007, the number of veterans with substance use and other mental health disorders treated by the VHA increased from 3.7 million to over 5.1 million (Wagner, Sinnott, & Siroka, 2011), with VA data suggesting that over 625,000 veterans had been diagnosed with a substance use disorder (SUD) (Dalton, Saweikis, & McKellar, 2004).

Substance use disorders have been described as the most serious public health concern in the United States (Schneider Institute for Public Health Policy, 2001). Indeed, substance use is often associated with higher rates of premature mortality and psychiatric disorders (particularly Post-Traumatic Stress Disorder [PTSD] and depression) among veterans (Rosen, Kuhn, Greenbaum, & Drescher, 2008; Seal et al., 2011). If untreated, these SUDs can contribute to repeated violations of the law, homelessness, and unemployment (Dietz, 2007; MacDonald & Shields, 2004; Zivin et al., 2011). Furthermore, veterans with SUDs face significant barriers to treatment due to stigma related to a perceived mental weakness or "character flaw" when asking for help with recovery (Kim, Britt, Klocko, Riviere, & Adler, 2011). On the other hand, one of the most successful and reliable predictors of addictions treatment and recovery is competitive employment (e.g., Magura & Staines, 2004; West, 2008). Meaningful work can facilitate the rehabilitation process by improving self-esteem and by creating a network of sober peers (Kerrigan et al., 2000). Previous research studies have demonstrated that competitive employment is associated with treatment compliance and recovery maintenance (e.g., Magura & Staines, 2004; Platt, Widman, Lidz, Rubenstein, & Thompson, 1998). Employment has also been found to correlate with reduced lifetime rates of SUDs, lower rates of co-occurring mental health conditions, and a higher quality of life (Kreutzer et al., 2003; Platt, 1995). Therefore, employment can act as an important public health intervention for veterans in the United States.

Individuals with histories of substance use may have unfocused employment goals, difficulties with interpersonal and communication skills, inconsistent work histories, negative work experiences, criminal records, limited education, and a lack of marketable job skills, all of which may affect their ability to obtain and

maintain employment (Kleinman et al., 1993). Furthermore, individuals returning to the workforce after a period of unemployment may have little confidence in their ability to work due to the loss of general and specific work skills (Arulampalam, Gregg, & Gregory, 2001). Stress and anxiety experienced by persons with SUD may be exacerbated by poor problem-solving skills that, when combined with emotional stress, may lead to work failure (Platt, 1995). Individuals with SUDs are also subject to workplace discrimination due to negative stigma associated with their health condition. Given the high rates of SUD diagnoses coupled with significant employment barriers, effective vocational rehabilitation interventions are critically needed for this veteran group. Vocational services can help with overcoming employment obstacles and refocusing veterans with SUDs toward the world of work and, subsequently, toward reentry into the community (Deren & Randell, 1990). Studies have found participation in vocational services to be related to increased employment and retention, as well as to reduced criminal activity and substance abuse (Gerstein & Harwood, 1990; Kashner, Rosenheck, & Campinell, 2002). While the public health and economic benefits of providing employment services to individuals with substance use disorders has been well documented in the past, more empirical evidence is needed about which specific vocational rehabilitation services promote successful employment outcomes (Kerrigan, Kaough, Wilson, Wilson, & Bostick, 2004; Krieshok, Ulven, Hecox, & Wettersten, 2000).

The Veteran's Health Administration (VHA) has offered therapeutic work programs since the 1950s, with legislation (38 USC 1718) authorizing the Compensated Work Therapy (CWT) program in 1976. The two main types of work therapy models used within CWT programs at the time of this study included sheltered workshops and transitional work (TW). Legislative authority was provided in December 2003 for VHA to expand these services to include supported employment, which was implemented nationally beginning in 2004 (Resnick & Rosenheck, 2007). Data used in this study, however, were collected prior to implementation of supported employment, and were therefore not captured in this dataset.

Several prior research studies have attempted to identify predictors of employment outcomes among individuals with SUDs (e.g., Chronister et al., 2008; Kerrigan et al., 2000; Room, 1998; Thompson, Boeringa, Thornby, & Lewis, 1995). However, to the best of our knowledge, the research is dated, has mostly

focused on participant characteristics, and has yielded inconsistent findings, highlighting the need for more current research in this area. In addition, there is a paucity of studies focusing on investigating the specific predictors of employment outcomes among veterans with SUDs in the VA's CWT program. The present study used the Chi-Squared Automatic Interaction Detector (CHAID) to examine relationships of participant entry characteristics and treatment participation variables with vocational rehabilitation employment outcomes, using a sample of participants within VHA's CWT programs located throughout the U.S.

## 2. Method

### 2.1. Source of data

The data used in this study were administrative archival data that are routinely collected by the VA's Northeast Program Evaluation Center (NEPEC) from all CWT programs nationwide. NEPEC has monitored CWT programs since 1993 (Resnick et al., 2010). Administrative data are collected at each site by the vocational rehabilitation specialists, who are the primary professional staff members. The data collected are based on a clinical interview and patient clinical records at intake and on financial records of the vocational rehabilitation program at discharge. The total number of participants extracted from the CWT database for the current study was 46,641 Veterans who were discharged from the program between 1993 and 2005. The participants were predominantly men (97%), and they ranged in age from 20 to 60 ( $M=45$ ,  $SD=7$ ). Racial/ethnic backgrounds were reported as African-American (50%), White (43%), and Other (7%). The majority reported being divorced, separated, or widowed (63%), with 28% single, and 8% married. Most indicated the housing status of homeless when last residing in the community (64%), with 52% residing in a structured institutional living environment during the month prior to CWT program admission (e.g., hospital or nursing home, domiciliary, halfway house/transitional living facility). Disability benefits were received by 33% of the participants and 38% had a dual diagnosis of a mental health disorder and a substance use disorder. The majority of the participants had either a high school diploma or a general education diploma (GED; 52%), whereas 8% had less than 12 years of education and had not obtained a GED, and 39% had more than 12 years of education. It should be

noted that the participants in this study differ from the general population in that they were mostly men, older, and either widowed, separated, or divorced. Participant characteristics can be found in Table 1.

### 2.2. Independent variables

The independent variables for this study were divided into two categories: participant entry variables and treatment participation variables. Participant entry variables or characteristics included: (a) demographic variables (age, gender, race/ethnicity, and marital status); (b) measures of work functioning prior to admission (educational level; vocational functioning in the three years prior to admission as defined by employment, unemployment due to disability, or unemployment in the absence of a disability; length of time since last employed for at least a month; and job loss due to substance use); (c) financial support (disability benefits or public support; and amount of money received from these sources in the past 30 days); (d) military history (period of service; and combat experience); (e) housing status (living situation prior to admission; homelessness; and current domiciliary or inpatient status); (f) referral source; and (g) diagnostic data (most common psychiatric diagnoses; medical diagnoses; or clusters of diagnoses).

Treatment participation variables included: (a) duration of participation (number of months from the date of admission to the date of discharge); (b) intensity of participation (mean hours of participation per week and mean earnings per week), and (c) treatment modality (job locations, defined as workshop or transitional work experience on VA grounds or in the community). These variables represent process variables.

### 2.3. Dependent variables

The dependent variable in this study was employment status. Participants whose employment status after discharge from CWT was either full-time or part-time paid competitive employment were considered to have a successful outcome. Participants whose employment situation after discharge from CWT was unemployed, retired, disabled, too ill to work, or who left program without indicating his or her employment situation were considered to have an unsuccessful outcome. In order to limit the sample to veterans who were clearly employed vs. unemployed at discharge, veterans discharged into status "VA's Incentive Therapy," "unpaid volunteer," "student/trainee," and "other" were excluded from this analysis.

Table 1  
Description of sample

Demographic variable	<i>n</i>	%
Age ( <i>n</i> = 46,641)		
18–34	3,179	6.8
35–44	18,568	39.8
45–60	24,894	53.4
Gender ( <i>n</i> = 46,487)		
Male	44,933	96.7
Female	1,554	3.3
Race ( <i>n</i> = 46,370)		
White	20,102	43.4
Black	22,999	49.6
Other	3,269	7.0
Marital status ( <i>n</i> = 46,128)		
Married	3,717	8.1
Widowed/Separated/Divorced	29,358	63.6
Never Married	13,053	28.3
Years of education ( <i>n</i> = 46,324)		
<12	3,887	8.4
12 (includes GED)	24,121	52.1
>12	18,316	39.5
Usual employment pattern during last 3 years ( <i>n</i> = 46,036)		
Full-time	20,528	44.6
Part-time	3,860	8.4
Irregular part-time	9,792	21.0
Student/training program	256	0.6
Service/volunteer	107	0.2
Retired/disabled	2,155	4.7
Unemployed	8,212	17.8
Other	1,126	2.4
Receiving any VA benefits or compensation		
Yes	6,488	13.9
No	40,153	86.1
Receiving any Social Security benefits or compensation		
Yes	3,048	6.5
No	43,593	93.5
Homeless at CWT entry ( <i>n</i> = 46,505)		
Yes	29,880	64.3
No	16,625	35.6
Co-morbid psychiatric diagnosis ( <i>n</i> = 46,561)		
Yes	17,799	38.2
No	28,762	61.8
Previous job loss due to alcohol or drug problems ( <i>n</i> = 46,344)		
Yes	28,945	62.5
No	17,399	37.5
Type of work during CWT participation*		
Workshop on VA grounds	15,872	34.1
TW on VA grounds	30,861	66.3
Workshop in the community	4,633	10.0
TW in the community	7,639	16.4

\*Participants can participate in more than one type of work during CWT participation and therefore the percentage will exceed 100%.

#### 2.4. Data analysis

A CHAID analysis was used to examine participant entry characteristics and treatment participation variables in predicting employment outcomes of individuals with substance use disorders. CHAID is an

exploratory technique for investigating large quantities of categorical data. Data were analyzed with SPSS AnswerTree 2.0 (SPSS, 1998) using Exhaustive CHAID, a specific data mining approach that uses a decision-tree method for building classification trees (Chan, Cheing, Chan, Rosenthal, & Chronister,

2006). The current study used the CHAID analysis to explore how the interactions between participant entry characteristics and treatment participation variables are associated with the employment status at discharge of individuals with substance use disorders.

CHAID uses classification trees to model the relationships between a dependent variable and a group of independent variables (Kass, 1980). A CHAID analysis starts with all participants in one group (the parent group). Exhaustive CHAID uses a systematic algorithm to detect the strongest association between predictors and the outcome variable through a comprehensive search of the predictors and the levels of predictors from the entire set that show the most differentiation among participants on the outcome variable. Each possible split on each predictor variable is tested with Bonferroni adjusted chi-squared values to find the split that leads to the most statistically significant difference on the dependent variable. The parent group is then split on levels of the best predictor until the association between the variable and outcome cannot be further improved statistically; in other words, the process is repeated until no non-significant splits are found. The degree of differentiation is depicted in descending sequence in a decision tree format to show the optimally split predictors. A major advantage of CHAID is that it avoids the assumptions of linearity and additivity.

Only variables that had a Bonferroni adjusted *p*-value of less than or equal to 0.01 were eligible for segmentation. Any group that had less than 100 participants was ineligible for further analysis, and the minimum group size for resulting subgroups was set at 50. Results of all analyses were cross-validated using a method similar to the jack-knife procedure (SPSS, 1998).

### 3. Results

An optimal model was constructed using participant entry characteristics and treatment participation variables to explain the variance in employment status at discharge. The competitive employment rate upon discharge from CWT for the overall sample used in this analysis was 43% (18,479 of 42,685), with 57% not employed upon discharge. Results of the Exhaustive CHAID analysis revealed a risk of false classification of 34%, with 8,900 of 27,286 participants predicted to have an unsuccessful outcome actually being successful and 5,820 of 15,399 participants predicted to be successful actually being unsuccessful, and a risk on

cross-validation of 36%. The overall correct classification accuracy of 66% is a substantial improvement over the base rate of 57%. Overall, the predictors were better at predicting vocational rehabilitation participants who were not competitively employed upon discharge (76% accuracy, with 18,386 of the 24,206 participants with unsuccessful outcomes predicted to be unsuccessful), as compared to those who were successful in achieving competitive employment, with 52% accuracy (9,579 of the 18,479 participants with successful outcomes predicted to be successful).

The CHAID analysis decision tree grew to 9 levels, and the sample was segmented into 117 homogeneous subgroups. Only 3 levels are shown in Figs. 1 and 2 in order to facilitate interpretation. The diagram is depicted in two figures: Fig. 1 shows the right split of the decision tree, depicting the competitive employment rates of the sample of participants who were first segmented according to weekly mean earnings, with participants having higher weekly earnings appearing in this figure; Fig. 2 shows the left split of the decision tree depicting the competitive employment rates of the sample of participants with lower weekly earnings.

#### 3.1. Review of CHAID segmentation

Mean earnings per week, one of the treatment participation variables measuring intensity of program participation, was the most highly predictive variable (Level 1). Participants with average weekly earnings of greater than or equal to \$180 per week during their participation in the CWT program had employment rates of 52% upon discharge from the CWT program, while participants with average weekly earnings of less than \$180 per week had employment rates of 39%.

Work functioning prior to admission, as measured by the length of time since last employed for at least a month, was the second most predictive variable (Level 2) for this subgroup (Fig. 1). Participants who held a job lasting at least a month within the 3 years prior to admission had employment rates of 54% upon discharge from CWT. Participants for whom it was 4 or more years since they had held a job lasting at least a month, had employment rates of 43% upon discharge from CWT.

The next most predictive variable was duration of participation (number of months from the date of admission to the date of discharge; Level 3). While both subgroups appeared to benefit from longer treatment duration, participants with longer periods of unemployment prior to program entry appeared to require a longer





Table 2  
Gains chart (node-by-node) statistics for the top eight successful groups

Group	No. of Subjects	% of Total Sample	No. Success	% of Success Sample	Gain (%)	Index (%)
1	107	0.25	85	0.46	79.44	183.50
2	1104	2.59	846	4.58	76.63	177.01
3	76	0.18	57	0.31	75.00	173.24
4	392	0.92	279	1.51	71.17	164.40
5	405	0.95	287	1.55	70.86	163.69
6	1156	2.71	800	4.33	69.20	159.86
7	746	1.75	501	2.71	67.16	155.13
8	1759	4.12	1144	6.19	65.04	150.23

Note. The gain percent represents competitive employment rate.

transitional work experience on the VA grounds, but did participate in community-based transitional work experience positions. They held a job that lasted at least a month within the 3 years prior to their admission to CWT, and had a psychiatric diagnosis of adjustment disorder. Further, they were residing in a VA domiciliary or inpatient unit at the time of admission to the CWT program. This group represents 0.25% of the participants in the overall sample. The employment rate upon discharge from the CWT program for this group was 79%. An index score of the ratio of these two percentages indicates the comparison between the proportion of participants who were employed in this group as compared to the proportion of participants who were employed in the overall sample. For this group, the index score was 183% (0.005/0.25) and reveals that the proportion of participants who were competitively employed upon discharge from the CWT program was approximately 183% better than the competitive employment rate for the overall sample.

*Group 2* included 1,104 veterans with substance use disorders whose earnings while in the CWT program averaged more than \$180 per week, and who held a job that lasted at least a month within the 3 years prior to their admission to CWT. Their treatment duration in CWT was 7 or more months. Their usual employment pattern during the 3 years prior to their admission to CWT was full-time or part-time employment, and their period of service in the military was Post-Vietnam Era, Persian Gulf, or Post Persian Gulf. The employment rate upon discharge from the CWT program for this group was 77%, and the index score was approximately 177% better than the employment rate of the overall sample.

*Group 3* included 76 veterans with substance use disorders whose earnings while in the CWT program averaged less than \$180 per week and who participated in transitional work positions on the VA grounds. They held a job that lasted at least a month within the 3 years prior to their admission to CWT, and their

treatment duration in CWT was 7 or more months. Their usual employment pattern during the 3 years prior to their admission to CWT was Irregular Part-Time, Service/Volunteer, Unemployed, or Other. While in the CWT program, this group participated in a work activity an average of more than 35 hours per week. The employment rate upon discharge from the CWT program for this group was 75%, and the index score was approximately 173% better than the employment rate of the overall sample.

*Group 4* included 392 veterans with substance use disorders whose earnings while in the CWT program averaged more than \$180 per week. This group last held a job lasting at least a month 4 or more years prior to their admission to CWT, and their treatment duration in CWT was 7 or more months. This group either received Supplemental Security Income (SSI) or did not receive any form of public financial support. The employment rate upon discharge from the CWT program for this group was 71%, and the index score was approximately 164% better than the employment rate of the overall sample.

*Group 5* included 405 veterans with substance use disorders whose earnings while in the CWT program averaged more than \$180 per week. This group held a job lasting at least a month within the 3 years prior to their admission to CWT, and their treatment duration in CWT was 4-6 months. This group either received VA Service Connected compensation or did not receive any form of public financial support. They participated in community based transitional work positions. The employment rate upon discharge from the CWT program for this group was 71%, and the index score was approximately 164% better than the employment rate of the overall sample.

*Group 6* included 1,156 veterans with substance use disorders whose earnings while in the CWT program averaged more than \$180 per week. This group held a job lasting at least a month within the 3 years prior to their admission to CWT, and their treatment duration

Table 3  
Gains chart (node-by-node) statistics for the eight bottom groups

Group	No. of Subjects	% of Total Sample	No. Success	% of Success Sample	Gain (%)	Index (%)
1	88	0.21	3	0.02	3.41	7.87
2	187	0.44	10	0.05	5.35	12.35
3	676	1.58	46	0.25	6.80	15.71
4	227	0.53	17	0.09	7.49	17.30
5	76	0.18	6	0.03	7.89	18.24
6	112	0.26	10	0.05	8.93	20.62
7	112	0.26	10	0.05	8.93	20.62
8	375	0.88	36	0.19	9.60	22.18

Note. The gain percent represents competitive employment rate.

in CWT was 7 or more months. Their usual employment pattern during the 3 years prior to admission was either full-time or part-time employment, and their period of service in the military was during the Korean War, between the Korean and Vietnam Eras, or during the Vietnam Era. The employment rate upon discharge from the CWT program for this group was 69%, and the index score was approximately 160% better than the employment rate of the overall sample.

Group 7 included 746 veterans with substance use disorders whose earnings while in the CWT program averaged more than \$180 per week. This group held a job lasting at least a month within the 3 years prior to their admission to CWT, and their treatment duration in CWT was 7 or more months. Their usual employment pattern during the 3 years prior to admission was either irregular part-time, student/training program, service/volunteer, retired/disabled, unemployed, or other. They participated in a work activity an average of more than 35 hours per week. Their employment rate upon discharge from the CWT program for this group was 67%, and the index score was approximately 155% better than the employment rate of the overall sample.

Group 8 included 1,759 veterans with substance use disorders whose earnings while in the CWT program averaged less than \$180 per week, and who participated in transitional work positions on the VA grounds. This group held a job lasting at least a month within the 3 years prior to their admission to CWT, and their treatment duration in CWT was 7 or more months. Their usual employment pattern during the 3 years prior to admission was full-time or part-time employment or student/training program. Participants in this group did not have psychiatric diagnoses of personality disorders or PTSD. The employment rate upon discharge from the CWT program for this group was 67%, and the index score was approximately 155% better than the employment rate of the overall sample.

Analysis of the subgroups with the highest employment rates confirms the role of previous vocational functioning in predicting future vocational functioning. Seven of the eight top performing subgroups had shorter periods of unemployment prior to program admission. Additionally, increased CWT participation was associated with better outcomes, as defined by longer CWT treatment duration and higher weekly earnings.

### 3.3. Review of homogenous subgroups with lower than average employment rates

The following is a brief description of the 8 homogenous subgroups that had significantly lower than average competitive employment rates as compared to the overall sample. Table 3 shows gain chart statistics for these bottom 8 subgroups.

Group 1 included 88 veterans with substance use disorders whose earnings while in the CWT program averaged more than \$180 per week and who last held a job that lasted at least a month 4 or more years prior to their admission to CWT. Treatment duration was 0–3 months. The referral source for this group was a VA inpatient unit, VA outpatient program, self-referral, Vet Center, or other. This group received financial support in the form of a VA Non-Service Connected (NSC) pension or Social Security Disability Income (SSDI). The employment rate upon discharge from the CWT program for this group was 3%, and the index score was 8% indicating that their employment rate was about 8% of the average employment rate of the overall sample.

Group 2 included 187 veterans with substance use disorders whose earnings while in the CWT program averaged less than \$180 per week and who did not participate in transitional work positions on the VA grounds. This group last held a job lasting at least a month 4 or more years prior to their admission to CWT. During the 30 days prior to their admission to CWT, they received more than \$1,000 from public sources of

financial support. The employment rate upon discharge from the CWT program for this group was 5%, and the index score was 12% indicating that their employment rate was about 12% of the average employment rate of the overall sample.

*Group 3* included 676 veterans with substance use disorders whose earnings while in the CWT program averaged less than \$180 per week, and who did not participate in transitional work positions on the VA grounds or in the community. This group last held a job lasting at least a month 4 or more years prior to their admission to CWT. During the 30 days prior to their admission to CWT, they received between \$501 and \$1,000 from public sources of financial support. The employment rate upon discharge from the CWT program for this group was 7%, and the index score was 16% indicating that their employment rate was about 16% of the average employment rate of the overall sample.

*Group 4* included 227 veterans with substance use disorders whose earnings while in the CWT program averaged less than \$180 per week and who participated in transitional work positions on the VA grounds. They did not participate in workshop settings on VA grounds. This group last held a job lasting at least a month 4 or more years prior to their admission to CWT. Treatment duration was 0–3 months. Referral sources for this group were VA inpatient unit, VA outpatient program, Non-VA health care provider, self-referral, or Vet Center. During the 30 days prior to their admission to CWT, they received more than \$500 from public sources of financial support. The employment rate upon discharge from the CWT program for this group was 7%, and the index score was 17%, indicating that their employment rate was about 17% of the average employment rate of the overall sample.

*Group 5* included 76 veterans with substance use disorders whose earnings while in the CWT program averaged less than \$180 per week. This group participated in community based workshop settings, but not in community or VA based transitional work experience positions. They held a job lasting at least a month within the 3 years prior to their admission to CWT. Their living situation during the month prior to admission was their own apartment, room, or house, or a hospital or nursing home, domiciliary, or halfway house/transitional living facility. During the 30 days prior to their admission to CWT, they received more than \$500 from public sources of financial support. The employment rate upon discharge from the CWT program for this group was 8%, and the index score was 18%, indicating that their

employment rate was about 18% of the average employment rate of the overall sample.

*Group 6* included 112 veterans with substance use disorders whose earnings while in the CWT program averaged less than \$180 per week. This group did not participate in community or VA based transitional work experience positions. They held a job lasting at least a month within the 3 years prior to their admission to CWT. Referral sources for this group were VA inpatient unit or self-referred. They received financial support from either a VA NSC pension or SSDI. The employment rate upon discharge from the CWT program for this group was 9%, and the index score was 21%, indicating that their employment rate was about 21% of the average employment rate of the overall sample.

*Group 7* included 496 veterans with substance use disorders whose earnings while in the CWT program averaged less than \$180 per week. This group participated in community based workshop settings, but not in community or VA based transitional work experience positions. They held a job lasting at least a month within the 3 years prior to their admission to CWT. Their living situation during the month prior to admission was a hotel/single room occupancy, or else a shelter for the homeless or outdoors, in an abandoned building or car. Referral source was a VA inpatient unit, VA outpatient program, self-referral, or Vet Center. The employment rate upon discharge from the CWT program for this group was 9%, and the index score was 21% indicating that their employment rate was about 21% of the average employment rate of the overall sample.

*Group 8* included 375 veterans with substance use disorders whose earnings while in the CWT program averaged less than \$180 per week. This group did not participate in community based workshop settings or in community or VA based transitional work experience positions. This group last held a job lasting at least a month 4 or more years prior to their admission to CWT. During the 30 days prior to their admission, they received less than \$500 from public sources of financial support. Their usual employment pattern during the past 3 years was irregular part-time, student/training program, service/volunteer, or unemployed. Their living situation during the month prior to admission was their own apartment, room, or house, or a shelter for the homeless, outdoors, in an abandoned building, or in a car. The employment rate upon discharge from the CWT program for this group was 10%, and the index score was 22% indicating that their employment rate was about 22% of the average employment rate of the overall sample.

The subgroup analysis reveals that poorer employment outcomes were found among subgroups receiving public financial support. Receipt of public financial support was present in seven of the bottom eight subgroups, with SSDI and NSC most often associated with the poorest employment outcomes. Employment rates were lower in the subgroups with the highest income from public financial support. Additionally, these subgroups had lower treatment intensity and longer period of unemployment prior to program admission. Overall, they did not participate in the transitional work experience treatment modality.

#### 4. Discussion

Mean earnings per week during CWT participation was the most highly predictive variable of employment outcome, with higher earnings associated with better outcomes. Mean earnings per week during the CWT program was included in the study as a measure of intensity of participation. This result is consistent with findings by Rosenheck and Seibyl (1997) in which earnings per week, along with frequency of toxicology screens and length of stay, were among the most consistent relationships between treatment elements and outcomes, using a sample of 496 veterans with substance use disorders participating in a CWT-Transitional Residence. Overall, greater treatment intensity was associated with better outcomes.

Drew et al. (2001) suggested that income is potentially relevant to restrictions on disability compensation. In their analysis of 22,515 individuals who participated in CWT programs between 1993 and 1998, they found that participants receiving disability benefits worked fewer hours each week, earned less income, had a higher dropout rate, and were less likely to be competitively employed at discharge. They concluded that disability compensation programs unintentionally discourage full participation in vocational rehabilitation and result in poorer rehabilitation outcomes. In the present sample, receipt of disability benefits was also associated with poorer employment outcomes and interacted with treatment intensity variables. Subgroups on one half of the classification tree (i.e., the subgroups with lower weekly earnings during CWT participation on the first split) were more likely to have disability benefits appear as predictive of outcome. Disability benefits, indicated by receipt of public financial support and by amount received from these sources in the past 30 days, appear in seven of the eight subgroups

with the lowest employment rates, while only appearing in two of the top eight performing groups. SSDI and VA NSC pension were the disability compensation programs most consistently associated with the poorest employment outcomes. Employment rates were progressively lower as the amount of income received from public financial support increased.

This trend is not unique to individuals with substance use disorders, and it is a common finding in vocational rehabilitation research (e.g., Chronister et al., 2008; Hayward & Schmidt-Davis, 2002). People often have to fight long battles to prove their disabilities, and thus the possibility of losing the benefits upon return to work poses a significant barrier to full participation in vocational rehabilitation and return to work. In addition, they rely on the security of those benefits to meet their basic survival needs, and the potential loss of those benefits can threaten their sense of security. Although legislative efforts have been made to decrease the negative effects of disincentives for Social Security recipients, similar actions have not been taken for recipients of VA NSC pensions. While the reduction or denial of an NSC pension as a result of participation in a VA work rehabilitation programs is specifically prohibited by law, individuals risk losing the pension upon transitioning into competitive employment. As competitive employment is a primary outcome objective of CWT, the possible loss of benefits can pose a significant barrier to vocational rehabilitation.

Work functioning prior to admission, as measured by the length of time since last employed for at least a month, was the next most predictive variable for the group of participants with higher weekly earnings. This finding is in line with results from other prediction studies that demonstrate previous vocational functioning is consistently a significant predictor of future vocational functioning (e.g., Hayward & Schmidt-Davis, 2002). The other studies, however, have used different methods of operationalizing previous work functioning. In the present study, four variables were included that were indicative of work functioning prior to admission: educational level; vocational functioning in the three years prior to admission as defined by employment, unemployment due to disability or unemployment in the absence of a disability; length of time since last employed for at least a month; and job loss due to substance use. Of these variables, length of time since last employed for at least a month proved to be the most predictive measure of employment outcome in the present study. The longer period of time that individuals were unemployed prior to entry into CWT, the lower their

employment rates upon discharge. Additionally, participants with longer periods of unemployment were more likely to receive disability benefits and to have lower levels of treatment intensity.

Another important finding was the significant role that treatment participation variables play in predicting outcomes. These findings provide support for Schwab and DiNitto's (1993) supposition on the importance of services. Schwab and DiNitto's comparison between successfully and unsuccessfully rehabilitated clients at the Texas Rehabilitation Commission found that the more evident differences between the two groups were the services provided. Treatment participation variables appeared to be of such significance in the present study that they overshadowed the demographic and psychosocial variables often found predictive of outcome. The demographic and psychosocial variables may have played a role, however, in clinician decision-making in determining treatment programming.

Longer treatment duration was consistently correlated with better employment outcomes. The highest employment rates occurred among the groups with treatment duration of 7 months or more, followed by the subgroups with treatment duration of 4–6 months. The lowest employment outcomes were found in the subgroups with treatment duration of 1–3 months. Of note, longer treatment duration was associated with better outcomes for the subgroups with higher vocational functioning, as indicated by a shorter period of unemployment prior to entry into CWT, as well as for the subgroups with lower vocational functioning, indicated by longer periods of unemployment. Individuals with longer periods of unemployment required a longer period of program involvement, however, to produce employment outcomes similar to those obtained by individuals with shorter periods of unemployment. For example, participants with longer periods of unemployment prior to program entry required a treatment duration of 7 months or more to attain competitive employment rates comparable to those attained by participants with shorter periods of unemployment in 4–6 months of treatment (60% and 60%, respectively). The present study does not allow for identification of which aspects of CWT treatment contribute to these improved employment outcomes. More research is needed in this area.

Participation in the treatment modality of transitional work experience on VA grounds was a predictive factor for improved competitive employment rates among subgroups at high risk for poorer employment outcomes based upon having a longer period of unemployment prior to CWT admission. Among the participants with

longer periods of unemployment, competitive employment rates increased significantly for the group that participated in VA based TW in comparison to the group that did not (33% versus 17%). Likewise, the participants with a shorter period of unemployment also demonstrated better outcomes if participating in VA based TW (47% versus 34%).

In this study, which was conducted before supported employment was available in CWT programs, we have support for the efficacy of community based and VA based TW. While the sample size of veterans participating in community based TW was small, the subgroup with the highest employment rates participated in this treatment modality. Participation in VA based TW brought the employment rate of participants with poorer work histories to a level comparable to that of participants with better work histories who did not participate in VA based TW (33% and 34%, respectively). It cannot be determined from the present study which aspects of VA based TW contribute to improved outcomes among these high-risk groups. Results of the present study suggest that this may be an area warranting further investigation. This study suggests that for certain participants, VA based TW may be the most beneficial modality. Possible explanations for this could include the close proximity of the work placement to vocational counselors, allowing for additional support and monitoring, as well as the close proximity to medical, psychiatric, and addictions treatment, which would facilitate compliance with other aspects of rehabilitation; additionally, worksite supervisors would be VA employees, who may be more willing to make needed accommodations.

#### 4.1. Implications

One implication of this study is the potential demonstrated for the use of CHAID in the study of the complex interactions and interrelationships that exist in human services research. The CHAID analyses provided the opportunity to examine the interactions between entry characteristics and treatment participation variables and employment outcome. This allowed for an examination of the characteristics of the top and bottom performing subgroups, thus enhancing understanding of the factors associated with outcomes. Results from previous prediction studies have been inconsistent in the identification of predictors of vocational rehabilitation outcomes. Demographic and psychosocial characteristics have received the most attention in vocational rehabilitation prediction research among individuals

with substance use disorders. In the present study, however, service variables were found to be more predictive of outcome. Future research could further our ability to identify those at high risk for unsuccessful outcomes through a CHAID analysis consisting only of entry characteristics available upon program admission.

Another implication of the current research is the importance of specific services in the vocational rehabilitation of persons with substance use disorders. Overall, greater treatment intensity, reflected by longer treatment duration, higher weekly earnings during participation, and higher hours worked per week, were associated with better outcomes. Additionally, participation in transitional work experience on the VA grounds was correlated with higher employment rates among participants at higher risk for poor outcomes. The subgroup analysis, however, found that the subgroup with the highest employment outcome participated in community based TW. The sample of veterans participating in community based TW was not large enough in this study to draw conclusions regarding a comparison between community based and VA based TW. Future research should explore which aspects of treatment are effective in producing improved outcomes. Future research should also further explore the interactions between client characteristics and service variables to assist in determining which services are most effective for which individuals.

Lastly, the study highlights the importance of disability benefits on employment outcomes. Subgroups with poorer employment outcomes were more likely to have receipt of public financial support appear as a predictive factor in outcome. Disability benefits, including receipt of public financial support and the amount received from these sources in the past thirty days, appeared in seven of the eight subgroups with the lowest employment rates, while only appearing in two of the top eight performing groups. SSDI and VA NSC pension were the disability compensation programs most consistently associated with the poorest employment outcomes. Employment rates were progressively lower as the amount of income received from public financial support increased. The negative effects of disability benefits on employment outcomes have been long known. Legislative change has occurred to minimize the work disincentives in Social Security benefits. Similar legislative change should be advocated for VA disability benefits, particularly VA NSC pension benefits. Benefits protection exists while the veteran is participating in CWT; however that protection does not extend after they leave CWT. Additionally,

benefits counseling should be emphasized in rehabilitation planning. An empirical understanding of factors contributing to employment outcomes is important to vocational rehabilitation programs. The present study was intended to contribute to understanding both participant and service variables contributing to employment outcomes in CWT programs for veterans with substance use disorders. Continued research is warranted to continue to build a stronger empirical base underlying service provision, not only in the CWT program but in other vocational rehabilitation programs as well. More information is needed to determine who benefits from which services.

#### 4.2. Limitations

Several limitations should be considered in the interpretation of the results of this study. First, portions of the data are based on retrospective, self-report by clients, making Part 1 of the admission section of the CWT Monitoring Data Sheet vulnerable to self-report error and bias. A second limitation is that the analyses are limited to data already being collected for administrative purposes. There is limited information regarding the validity and reliability of administrative data such as the diagnoses or ratings of prior work functioning (Drebing, Rosenheck, Schutt, Kaspro, & Penk, 2003). A third limitation is that the study was retrospective and observational using administrative archival data and an ex post facto design. As an experimental design was not employed, causality cannot be inferred. A fourth limitation of the study is that generalizability of the results may be limited due to the use of a veteran population and a Veterans Health Administration vocational rehabilitation program. Further, as the population consisted primarily of males, the results may not be generalizable to females with substance use disorders.

#### 5. Conclusion

CWT is a primary vocational rehabilitation program within VHA providing employment services to veterans with mental health disorders, including SUDs. Considering that favorable outcomes in vocational rehabilitation programs are dependent on both personal characteristics and treatment process variables, it is important to determine the specific components that reliably predict competitive employment. Past studies have attempted to establish successful predictors of

employment outcomes for individuals with SUDs; however, there continues to be a need for additional research in this area especially among veterans with SUDs. The present study, using data mining techniques, identified several significant participant entry (e.g., higher vocational functioning) and treatment participation (e.g., greater treatment intensity, participation in a TW experience position on the VA grounds) predictor variables for competitive employment outcomes of participants within VHA's CWT programs. The findings of this study can be used for vocational rehabilitation programs to determine service components offered, as well as to help vocational rehabilitation professionals select the most effective intervention strategies when working with veterans with substance use disorders.

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