

# Highlights from a KTER Center Systematic Review: Employment Interventions for Return to Work in Working Aged Adults Following Traumatic Brain Injury

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This technical brief presents the findings and implications for *Employment Interventions for Return to Work in Working Aged Adults Following Traumatic Brain Injury (TBI): A Systematic Review*, [http://www.campbellcollaboration.org/lib/project/241/] submitted to The Campbell Collaboration in January 2015. It is co-authored by Carolyn W. Graham, Michael D. West, Jessica Bourdon, and Katherine Inge of Virginia Commonwealth University. The review was supported by the SEDL Center on Knowledge Translation for Employment Research (KTER Center), which is funded by the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR).

The review was designed for the use of these KTER Center audiences: vocational rehabilitation and other employment support professionals, researchers, policymakers, businesses/employers, and people who experience TBI.

## Background on Employment Following TBI

TBI occurs when an external force causes an alteration to brain function, such as loss of consciousness, memory loss, and neurologic defects. TBI can occur by a blow to the head, blast waves from an explosion, swift acceleration or deceleration, or the penetration of a foreign object into the brain (Maas, Stocchetti, & Bullock, 2008; Menon, Schwab, Wright, & Maas, 2010). TBI levels of injury range from mild to severe. Increased level of brain injury severity is typically related to greater degree of impairment post-injury. However, even individuals experiencing mild brain injuries can experience problems in one or more areas of functioning.

Individuals who sustain a TBI often have difficulties in either obtaining competitive employment or maintaining employment as a result of the post-injury difficulties that they exhibit (Andelic, Stevens, Sigurdardottir, Arango-Lasprilla, & Roe, 2009; Ruttan, Martin, Liu, Colella, & Green, 2008). Reported unemployment rates of people with TBI have ranged from 45% to 78% (Doctor, Castro, Temkin, Fraser, Machamer, & Dikmen, 2005; Kendall, Muenchberger, & Gee, 2006), and tend to vary by such factors as severity of the injury, the nature and extent of post-injury impairments, and the age and level of education of the individual at the time of the injury.

Rehabilitation services following TBI focus on assisting individuals to adjust to their on-going impairments and re-enter their communities, workplaces, schools, etc. Post-acute interventions may, but not always, include vocational rehabilitation (VR). In the U.S., the primary sources of return to work (RTW) interventions are employer disability management programs and state VR agencies; other countries have equivalent organizations (United Nations World Health Organization & The World Bank, 2011).

Some of the specific approaches that may be used in returning adults with TBI to work are Employee Disability Management Programs, transitional programs, supported employment, job accommodations, adaptive devices, and assistive technology, and ancillary therapeutic services. This review examined the effectiveness of rehabilitation interventions on return to work (RTW) outcomes of adults with TBI. The goal of this project is to provide information that will inform the target audiences regarding the effectiveness of these rehabilitation employment interventions.

## Interventions and the Study Participants

Studies for this review were identified by using 15 databases (Article First via FirstSearch, Australia Education Index/Australian Council for Educational Research, CIRRIE – Center for International Rehabilitation Research Information and Exchange Database, www.ClinicalTrials.com, Cochrane Central Registry of Controlled Trials, ebrary: Academic Complete Collection, EBSCOhost Research Database, Google Scholar, MEDLINE/PubMed, NARIC REHABDATA, ProQuest, PsycExtra, PsychINFO, Science Direct, and Web of Science). Grey papers (i.e., unpublished or unavailable through scientific databases) were

also searched. We also hand searched reference lists of papers included in the analysis and previous systematic reviews concerning RTW, employment, and TBI.

Studies were included if they used interventions that assist working age adults with TBI return to competitive employment. Competitive employment was used as the outcome measure because it represents optimal rehabilitation expectations. Our definition of competitive employment had three criteria:

1. work tasks performed in an integrated setting with co-workers who are predominantly non-disabled,
2. wages paid by the business or organization where the work was performed (not by a disability organization), and
3. wages commensurate with non-disabled co-workers having similar qualifications and performing similar duties.

Studies had to include the primary outcome, employment status, and could include secondary outcomes such as earnings, hours worked, and job tenure. Studies must have included participants who were between the ages of 18 and 65 who experienced a non-penetrating TBI, engaged in full-time or part-time employment at the time of injury, and were unemployed or on medical leave at time of receipt of intervention. The TBI could have been injured on or off the job. Studies that included mixed disabilities were included only if information was provided separately for TBI participants. Finally, data had to have been presented separately for competitive employment from the non-competitively employed participants. The designs of studies included were either randomized controlled trials (RCTs) or quasi-experimental designs. The comparison groups could consist of treatment as usual, other appropriate interventions, or no intervention.

## Results of the Review

Three RTW intervention randomized controlled trials with people with TBI were found. No significant difference in effect was found among the studies ( $p = 0.81$ ). All three used different interventions: residential, holistic treatment group versus in-home rehabilitation program, 3-D artificial intelligence virtual reality training versus psycho-educational, and CogSMART plus supported employment versus enhanced supported employment. Below is a description of the studies.

**1. Salazar et al., 2000:** The Salazar et al. (2000) study was a randomized controlled trial that was conducted with 120 active duty military service persons who had acquired a moderate to severe traumatic brain injury. Most participants obtained TBI through motor vehicle/traffic incident, assault, and alcohol-related accidents. The mean loss of consciousness was 35 hours. All participants were within 90 days of injury. Participants in the study were randomly assigned to the treatment group or the control group. Each group had a separate treatment team from the other and the treatment teams worked independently. There were periodic reviews of the treatment teams in order to maintain fidelity to each treatment protocol.

- **Residential, Holistic Treatment Group.** The 67 participants assigned to the residential, holistic treatment group received eight weeks of intense residential cognitive rehabilitation program. Their mean age was 24.7 years, 93% were male, 69% were White, 24% were African American, and the rest of the remaining 7% was "other not specified." All had moderate to severe TBI with the mean Glasgow Coma Scale (GCS) of 9.4.

The residential, holistic treatment program consisted of a team of interdisciplinary practitioners including a psychiatrist, neuropsychologist, occupational therapist, speech pathologist, and rehabilitation assistants. The physical therapist, psychiatric and neurological experts were consulted when needed. The participants in the group were expected to follow military standards and a structured daily routine. The structured daily routine consisted of physical fitness training, and group and individual therapies. Therapies included cognitive, psychotherapeutic, pragmatic speech, community re-entry, and integrated work programs.

- **In-Home Intervention Control Group.** The 53 participants assigned to the in-home without VR intervention control group received a limited home rehabilitation program. Their mean age was 26 years, 96% were male, 70% were White, 17% were African American, 11% were Hispanic, and 2% were Native American. All had moderate to severe TBI with a mean GCS of 9.5.

The in-home rehabilitation program included TBI education and individual counseling provided by a psychiatric nurse who made weekly 30-minute phone calls to each participant. Educational materials and strategies to improve cognitive and organizational skills were given to participants.

This included training participants in number and card games, encouraging return to physical exercise, suggesting participants watch newscasts and read. They were also expected to resume daily physical fitness training. No participants in this group received vocational or work rehabilitation.

All study participants were evaluated at 6, 12, and 24 months on RTW, psychosocial, and interdisciplinary tests. Of the 67 participants in the treatment group, 60 (90%) returned to work, whereas 50 of 53 (94%) participants in the control group returned to work. Thus, participants in the residential program experienced a better RTW outcome, with the odds ratio being 0.514.

**2. Man et al., 2013:** The Man RCT was conducted with 50 participants who had mild to moderate TBI recruited from Hong Kong hospitals and rehabilitation facilities. Man did not report the cause of TBI. Inclusion criteria required participants to have a loss of consciousness of less than six hours. There was no report of mean length of loss of consciousness for either group. However, the GSC was used to assess severity of TBI and the mean score on this scale was 10.25 ( $SD = 1.51$ ; Range = 9-14) for the artificial intelligent virtual reality-based vocational training system (AIVTS) (treatment group) and 10.05 ( $SD = 1.31$ ; Range= 9-13) for the psycho-educational vocational training system (PEVTS) (control group). No time since injury information was reported.

Fifty participants were randomly assigned either to the treatment or the control group. Each group began with 25 participants. Both groups had similar informational content but the training platform differed by group.

- **AIVTS Treatment Group.** The AIVTS group received 12 sessions using 3-D artificial intelligence virtual-reality-based training software program. The program begins the training by determining the skill level of the participants. As the participant progresses through training, the program can upgrade, maintain, or downgrade the training level to meet the training needs of the participant based on participant performance. Therefore, when participants performed well, the program would increase difficulty. If the participant's performance declined, the program would revert back to previous level of training.
- **PEVTS Control Group.** The PEVTS group also received 12 training sessions with similar problem solving tasks, content, and structure given by a vocational trainer. Using a manual designed for the intervention, the trainer provided instruction, time to practice skills, and games on problem solving. Four trained rehabilitation professionals assessed fidelity of intervention administration. The fidelity agreement intra-class coefficient was 0.645,  $p = 0.021$ .

Although authors referred readers to a demographic table, the table referred to did not contain demographic information. Forty (20 per group) had three follow-up reports of employment outcome at 1, 3, and 6 months. Primary outcomes related to cognition were measured by the Tower of London test, the Wisconsin Card Sorting Test (WCST), and the Vocational Cognitive Rating Scale (VCRS). Employment outcomes were measured by participants' status in four categories: full-time employment, supported employment, sheltered employment, and unemployed/unable to return to work. No other employment measures were reported.

In order to compare studies, unemployment and sheltered workshop categories were considered unemployed since sheltered workshop is not competitive employment. Further no participants were in the sheltered workshop group. Supported employment is considered competitive employment and was included in the employment group. Of the 20 participants in the AIVTS group that were assessed at follow-up, 17 (85%) were unemployed and 3 (15%) were employed at one month, 14 (70%) were unemployed and 6 (30%) employed at three months, and 12 (60%) were unemployed and 8 (40%) were employed at six months. Of the 20 participants in the PEVTS group that were assessed at follow-ups, 20 (100%) were unemployed and 0 were employed at one month, 16 (80%) unemployed and 4 (40%) were

employed at three months, and 16 (80%) were unemployed and 4 (40%) were employed at six months. More of the AIVTS group was employed than the PEVTS (odds ratio of 2.667).

**3. Twamley et al., 2014:** The Twamley RCT was conducted with 50 veterans with mild to moderate TBI from Operation Enduring Freedom and Operation Iraqi Freedom. All participants in both groups received supported employment for one year. Twenty-five were randomly assigned to the Supported Employment with Cognitive Symptom Management and Rehabilitation Therapy (CogSMART, treatment group) and 25 to Enhance Supported Employment group (control). Twamley did not report on the cause of the injury. No means of GCS were reported. Each group had separate employment specialists. Both groups adhered to standardized procedures with a 0.90 adherence rate.

- **CogSMART Treatment Group.** The mean loss of consciousness was 6.5 hours and time since most recent TBI was 4.08 years ( $SD = 2.78$ ) for the CogSMART treatment group. The majority of participants in this group were men (96%). Thirty-six percent of participants identified as Hispanic (36%) and 24% percent of the treatment group identified as White. No other race was reported. The mean age of participants in the treatment group was 29.68 years ( $SD = 6.05$ ) and the mean educational level was 12.88 ( $SD = 1.27$ ).

The first three months of the intervention, the treatment group received one hour of CogSMART and one hour of supported employment per week for the first three months and then one hour of supported employment for the rest of the year. CogSMART addressed post-concussive symptoms, prospective memory, attention and vigilance, learning and memory, and executive functioning (see cogsmart.com for more information).

- **Enhanced Supported Employment Control Group.** The mean loss of consciousness was 1.0 hour for the control group, the enhanced supported employment group. Time since most recent TBI was 5.04 years and the mean length of loss of consciousness across last four traumatic brain injuries was 1 hour for this control group. As in the treatment group, 96% of participants were men and 36% participants identified as Hispanic. Forty-eight percent of this control group was White. No other race was reported. The mean age of participants was 33.84 years ( $SD = 7.89$ ) and the mean of educational level was 14.00 ( $SD = 1.80$ ) for the control group.

The control group received two hours of supported employment for the first three months and then one hour of supported employment for the rest of the year. This group was given the supported employment intervention “to control for non-specific therapeutic factors provided in CogSMART” (Twamley et al., 2014, p. 62).

Participants were assessed at six and 12 months post treatment. Each group lost four participants during the course of the study or at follow-up, which left each group with 21 participants each. There was no difference in competitive employment at 12 months with both groups having 13 (52%) participants being employed. Thus, CogSMART did not improve the odds of employment for the treatment group. The supported employment sessions that each group received may have contributed to this lack of difference. Further research with three groups: CogSMART only, CogSMART plus supported employment, and supported employment only needs to be conducted to understand better the specific effects of each approach. ■■■■■

## Conclusion

The findings from this review are consistent with prior TBI RTW studies that emphasize the importance of early intervention following TBI (as in the residential holistic models) and in-vivo training and support in the natural work setting (as in the supported employment model) in maximizing RTW outcomes. These interventions are not mutually exclusive, but can be effective as compatible components of TBI rehabilitation. The findings are also consistent with prior reviews of the TBI RTW literature, which have found that the interventions provisionally appeared to be effective but that caution should be used in using this information due to sample size and lack of study replication. Further, two of the studies used military samples and findings may not generalize to civilian populations. These reviews called for higher quality of rehabilitation intervention studies to be conducted to determine accurately whether these interventions were effective. More randomized controlled trials using these interventions (including studies with civilian populations) are needed to assess the strength of evidence for these interventions.



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