

Functional limitations in TBI and their relationship to job maintenance following work re-entry

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Abstract. Using data from the Job Accommodation Network Information System (JANIS), the utility of self-reported functional limitations was examined in relationship to job maintenance for individuals with traumatic brain injury (TBI) who had returned to work. It was found that memory loss and attention/concentration concerns were the most common functional limitations reported. To further establish which limitations were associated with job maintenance, a binary logistic regression was applied. Results suggested that the presence of medical symptoms and emotional dysregulation were reliably and inversely associated with job maintenance. Implications are provided for further research as well as the practice of rehabilitation counseling.

Keywords: Traumatic brain injury, job maintenance, functional limitations, indicators, employment

1. Introduction

Many individuals with traumatic brain injury (TBI) struggle with meeting work demands because of functional limitations, which are the residual symptoms directly related to the injury [5, 9, 24, 36–38, 49]. Functional limitations include a wide array of symptoms that vary in type, duration or intensity, and include sensory, gross and fine motor, physiological, communication, emotional, and cognitive impairments. Concomitant psychological syndromes such as anxiety and depression may also occur in addition to personality changes [11, 13, 14, 30, 32, 38–41]. Many authors cite cognitive and emotional deficits as the most persistent and disabling, particularly in terms of employment [7, 13, 17, 29, 35, 41]. Thus, a variety of rehabilitation and job-placement services, including job accommodations, may be needed for people with TBI to return to

work and maintain employment [27]. This has resulted in a substantial amount of research devoted to examining employment issues after TBI.

Most researchers have been concerned with return to work or job stability. Severity of TBI and persistence of functional limitations have been found to be predictive of work re-entry. Specifically, individuals with severe TBI have poorer re-employment outcomes than those with mild TBI and fewer functional limitations [1, 14, 32, 46]. Other investigators have examined the broader construct of work adjustment for those who have returned to employment following TBI. *Work adjustment* refers to the entire relationship between an individual and her/his work environment [21, 22], which includes job satisfaction and satisfactoriness. Issues that contribute to work adjustment include social support, quality of services received, and functional limitations [16]. Similar to job acquisition, people with severe impairments, especially cognitive, executive, and emotional/behavioral deficits, have less successful work adjustment than those with mild or no impairment [14, 16, 27, 38, 44].

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A third group of investigations have focuses on a specific measure of work adjustment; i.e., job maintenance (also termed job stability, job tenure, or job retention). The key concept is that low levels of work adjustment will ultimately lead to either voluntary or involuntary separation from the workplace. Investigations of this matter among individuals with TBI have linked increased cognitive impairment, executive function deficits, and emotional dysregulation with poor job stability [13, 28, 36]. The present study is an expansion of this line of inquiry, with a specific focus on the role of functional limitations in job maintenance.

2. Method

2.1. Design

Most research conducted on work adjustment and functional limitations has been qualitative in nature and/or small in sample size [16, 38, 44]. These studies were significant contributions to the field and served as a foundation for the current study. Our intention is to expand upon the existing knowledge by empirically substantiating indicators of job maintenance in persons with TBI in a broad geographical sample. The nature and number of functional limitations was examined in the current study to indicate job status *after* returning to work, which shifts the emphasis to job maintenance (the ultimate outcome measure in work adjustment). The current investigation was a quantitative, retrospective data analysis which asked:

- (a) What are the most common problematic functional limitations reported by people with TBI in the workforce?
- (b) To what extent can functional limitations be used as indicator variables to establish risk factors for subsequent separation from the workforce? *Indicator* variables are distinguished from *predictor* variables, because predictor variables are gleaned at a time proximate to injury. Indicator variables are based on functioning at the time of measurement, and yet are treated like predictor variables in statistical analyses [5, 6].

2.2. Indicator and criterion variables

An extensive literature review was conducted regarding functional limitations and matters of return to work, job stability, and work adjustment involving individuals

with TBI. A list of functional limitations was compiled, many of which were repeated throughout the literature with only slight differences in wording. Each functional limitation was tallied to record the frequency of its appearance in the literature. Next, these limitations were collapsed based on repetition and frequency of appearance into six categories that served as indicator variables.

The *resulting indicator variables* were (a) emotional dysregulation, (b) cognitive deficits, (c) executive functioning deficits, (d) deficits involving persistence/pace, (e) communication and social deficits, and (f) medical symptoms. Each was defined carefully to avoid multicollinearity, which compromises statistical analyses [45]. The first indicator variable, emotional dysregulation, referred to behaviors stemming from poor stress tolerance and mood lability. Cognitive deficits formed the second indicator variable, and included limitations associated with learning, memory, visual-spatial processing, and academic skills. Executive deficits, the third indicator variable, referred to problems associated with frontal lobe functioning, such as attention, concentration, prioritizing, organizing, and consistency of performance. The fourth indicator variable, persistence/pace deficits, included fatigue and slowed work pace. The fifth indicator variable, communication and social deficits, involved limitations related to social behavior and speech-language. The sixth indicator variable was medical symptoms, which contains a broad array of motor, neurological, and sensory deficits that did not directly refer to the cognitive processes by which they are mediated. Examples might include dizziness, headache, double vision, etc.

The *discreet and dichotomous criterion variable* for this study was a subject's current employment status which was divided into two types: working or not working. An individual was considered "not working" if he/she was terminated, resigned, or on extended leave of absence. Conversely, an individual was considered "working" if he/she was still attending work, full or part-time.

2.3. Sample and data selection

Data were drawn from a database at the Job Accommodation Network (JAN; 25), a service of the Office of Disability Employment Policy of the U.S. Department of Labor. Located in Morgantown, West Virginia, JAN is a nationwide consulting service that provides technical assistance through telephone, email, and online chat regarding Title I (Employment Provisions) of the

Americans with Disabilities Act (ADA). Services provided by JAN consultants include technical assistance regarding employers' responsibilities and employees' rights under the ADA, the reasonable accommodation process, customized workplace accommodation solutions, assistive technology, and other technical matters. Because of the nature of JAN's services, the information collected provides valuable insights into common ADA issues that present in the workplace, such as functional limitations that affect the performance of employees with disabilities, their accommodation needs, and the nature and scope of accommodations actually provided by employers [20].

All JAN consultants have a minimum of a master's degree related to business (e.g., labor and industrial relations, occupational health and safety, business administration), academics (e.g., special education, higher education administration), law, or the helping professions (e.g., rehabilitation counseling, counseling, psychology). Newly hired consultants undergo several months of extensive training, which includes Title I of the Americans with Disabilities Act (ADA) and its overlap with other laws, such as the Family and Medical Leave Act and Workers Compensation (B.A. Loy, personal communication, October 9, 2009).

Information on calls, chats, and emails (henceforth called cases) are entered into a database called the Job Accommodation Network Information System (JANIS). The consultant enters case notes in JANIS, which include a summary of key points discussed with the client, as well as verbatim exchanges if germane to the case. In addition, JANIS has a multitude of data fields, which are drop-down menus from which relevant data are selected by the consultant. A researcher can search for cases based on any data field within any time span, and results can be exported to Microsoft Excel.

To avoid unnecessary complexity, only the JANIS data fields used in this study will be discussed:

- (a) *caller description* indicates the role of the person contacting JAN, such as an "employee with a disability," "employer," "individual with disability, not employed," "union representative," and many others;
- (b) *causative factors* indicates the health condition reported by the individual with a disability, and contains a list of approximately 200 health conditions;
- (c) *limitations* indicates the reported functional limitations of the individual with a disability

which are selected from a comprehensive list of sensory, motor, cognitive, behavioral/social, immunology/endocrinology, and miscellaneous limitations; (this field is the source of all "indicator" variables); and

- (d) *career status* indicates the individual's job status at the time he/she contacted JAN: employed or not employed. (This field is the source of the criterion variable).

The files extracted for this study involved the following inclusion criteria:

- Person with disability who reported a causative factor of TBI (cases with comorbid diagnoses were excluded unless the case notes indicated that the comorbid diagnosis was a direct result of TBI) and was the person with TBI him/herself (not employer, union rep, family member, or other stakeholder).
- The Limitations field was populated with functional limitations or these could be extrapolated from case notes.
- Person with a disability who had returned to work since TBI onset, but may have been subsequently separated from employment (students or self-employed were excluded).

2.4. Procedure

Files which met the inclusion criteria were extracted and subsequently exported into Microsoft Excel. Multiple cases from the same client were collapsed into a single case, with all functional limitations compiled and the most recent job status of the individual recorded. G*Power Version 3.0.10 [18] was used to determine the necessary sample size for the current study, which was established at $N = 160$.

Eligibility analysis started with cases from December 31, 2008, going backward in time until the required sample size was obtained. The earliest case included was from January 3, 2002. JANIS cases filed on/after January 1, 2009 (the effective date of the ADA Amendments Act of 2008 (ADAAA)) were excluded due to alterations in the definition of "disability" which rendered the law more inclusive [47]. Following extraction and export, JANIS cases were carefully reviewed to ensure that functional limitations and job statuses were verified and complete, using case notes when necessary. Each was assigned to and coded with a corresponding indicator variable. If evidence indicated

termination, resignation or extended leave of absence, the individual was considered to be not working. If evidence indicated any other status (such as new hire, job in jeopardy, promotion, or unknown job security), the individual was regarded as working. The state from which the client contacted JAN was collected in order to examine the geographic distribution of the sample. Before statistical analyses were initiated, half the cases in the sample were randomly selected to be reviewed by other JAN personnel to double check for coding mistakes and clarify ambiguities in case notes.

2.5. Statistical analyses

Logistic regression was selected as the preferred method to indicate group membership (working or not working, the outcome measure) based on our six discrete categorical indicator variables [45]. Logistic regression cannot be completed if multicollinearity exists; i.e., if indicator variables are strongly related to one another. To rule out this circumstance, a multiway frequency analysis was performed.

It was hypothesized that at least one category of functional limitation would predict job maintenance at a statistically significant level. Because most research indicates that cognitive/executive, emotional, and social deficits are strongly related to job maintenance in people with TBI, these indicator variables were specified in the hypothesis. Since functional limitations have not been subject to extensive quantitative examination based on their influence on job maintenance, this study was exploratory.

3. Results

3.1. Descriptive statistics

3.1.1. Characteristics of the sample

The JANIS cases (each representing one person with TBI) spanned a time period of seven years, ranging from January 3, 2002 to December 29, 2008. Thirty-nine states and the District of Columbia were represented in 156 of the 160 cases; 4 cases involved "location unknown." The mean number of cases per state was 4.16 ($SD = 4.02$). An increased density of cases was found in states with higher populations and multiple metropolitan areas, such as New York, Florida, California, and Texas.

3.1.2. Reported functional limitations

The 160 survivors in the sample reported a total of 408 functional limitations (range from one to eight per person with a mean of 2.48 and SD of 1.49). Addressing the first research question of the study, the most common functional limitation reported was memory loss. Seventy subjects reported memory loss, which comprised 44% of the entire sample and 17% of all functional limitations reported. The second most common was attention/concentration, which was reported by 50 subjects or 31% of the entire sample and 12% of all functional limitations reported.

3.1.3. Inferential statistical analyses

SPSS/PASW multiway frequency analysis (called General Loglinear) produced a likelihood ratio with statistical significance of 0.521, suggesting no statistically significant relationships between indicator variables; i.e., no multicollinearity was found. The logistic regression proceeded using SPSS/PASW Version 18. Forward stepwise regression was conducted to explore which indicator variables were part of a model that could predict job maintenance with some degree of accuracy. First, the constant was entered into the logistic regression equation (predicting that all subjects would be classified as working) in order to serve as a comparison to a model including the indicator variables. Based on the frequency of observed vs. expected outcomes, the model yielded a hit-rate of 51.3%. In other words, a logistic regression model containing only the constant, with no influence of the six indicator variables, correctly predicted the job maintenance 51.3% of the time. The Wald Statistic [15], which measures strength of association, was not statistically significant ($p = 0.752$), nor was the odds ratio of 0.951. Therefore, the constant had but a negligible effect on the outcome [15, 45].

Forward stepwise logistic regression was performed next using the constant plus the six indicator variables. The first concern involved how well the model created by the logistic regression procedure fitted the data. The Hosmer and Lemeshow Test was applied as a goodness-of-fit statistic [15, 45] to ascertain how well the model fit the data. A non-statistically significant result ($p > 0.05$) of 0.749 was obtained, indicating an adequate model fit.

Another source of information about model fit was the hit rate, which refers to the accuracy of the statistical model's predictions. For each iteration (step) of the regression equation, the Classification Table (Table 1) shows the model's job maintenance predictions, with

Table 1
Classification table

	N Predicted	N Observed	% Correct
Step 1 (insert emotional dysregulation)			
Working	82	7085.4	
Not Working	78	24	30.8
Overall Percentage			58.8
Step 2 (insert medical)			
Working	82	46	56.1
Not Working	78	52	66.7
Overall Percentage			61.3

a percentage that shows how many of the predictions were correct; i.e., the hit rate. After the first iteration (when emotional dysregulation was inserted) the model generated an overall hit rate of 58.8%. After the second iteration (when medical symptoms was inserted) the model generated an improved hit rate of 61.3%. The regression model with the constant plus the indicator variables of emotional dysregulation and medical symptoms improved the hit rate by 10 percentage points (to 61.3%) compared to the constant-only model (51.3%), with an overall hit rate of 61.3%. In addition, 56.1% of working subjects were correctly classified, and 66.7% of those not working were correctly classified.

Emotional dysregulation and medical symptoms were included in the final model. These two were the only indicator variables reliably associated with job maintenance. The Variables in the Equation table (Table 2) shows the Wald statistics and odds ratios for these two indicator variables. The Wald Statistic for emotional dysregulation, medical symptoms, and the constant were statistically significant, supporting this conclusion. Furthermore, the odds ratios' diversion from 1 indicated that emotional dysregulation and medical symptoms were reliably related to and had a significant negative influence on job maintenance. Specifically, the presence of both functional limitations

indicated that an individual with both functional limitations was only 43% as likely to maintain employment as compared to a member of this sample without these specific problems at the time of contacting JAN.

Although the Hosmer and Lemeshow Test indicated that the model was an adequate fit, other procedures provide information about how well the model fit the data. Nagelkerke's R square, which provides a rough estimate as to how much variance in outcomes is accounted for by the model, was computed at 0.100. This indicates that approximately 10% of the variance in outcomes could be attributed to the logistic regression model. Clearly, the model created was an adequate fit to the data; however, the amount of variance accounted for by the model and the hit rate of the model were not robust.

4. Discussion

This study sought to add to the existing research on TBI and employment by empirically substantiating the functional limitations related to job maintenance in a sample of people with TBI. The sample was geographically broad although not evenly distributed across the United States. In addition, the population was self-selected since only those who called JAN were considered, rather than the entire population of employed TBI survivors. The time span was as compressed as possible to minimize the influence of important external events such as the Great Recession and the ADA Amendments Act.

The cognitive symptoms of memory and attention/concentration were the most commonly reported functional limitation. This finding is consistent with the TBI literature [7, 10, 13, 17, 26, 28, 29, 32, 35, 36, 39, 41, 48, 49]. Individuals who struggle with memory impairments may forget important items, such as directions, meeting times, deadlines, work procedures, or tools. Memory impairments also vary in terms of

Table 2
Variables in the equation

Steps	b	SE	Wald statistic	df	Significance	Odds ratio
Step 1						
Emotional Dysregulation	-0.953	0.397	5.571	1	0.016	0.386
Constant	0.693	0.354	3.844	1	0.050	2.000
Step 2						
Emotional Dysregulation	-1.041	0.407	6.526	1	0.011	0.353
Medical Symptoms	-0.845	0.337	6.267	1	0.012	0.430
Constant	1.262	0.432	8.532	1	0.003	3.534

sensory mode (visual or auditory) and they often complicate learning new tasks. Attention and concentration are critical to productivity and safety, and both have the potential to disrupt workflow and irritate supervisors and coworkers [5, 13, 31, 44].

In the second research question we discovered that their prevalence in the literature notwithstanding, these same cognitive deficits did not “bubble up” to be the most serious impediments to job maintenance. Indeed, matters of emotional dysregulation and medical symptoms carried the day in the logistic regression analysis. It appears important to differentiate functional limitations which are most commonplace and persistent from those which inhibit job retention.

Emotional dysregulation is the less surprising of the two. Research on TBI and employment is replete with examples of emotional dysregulation being particularly disabling in relation to achieving and maintaining gainful employment for varying reasons [7, 13, 17, 29, 35, 41]. Individuals with difficulty regulating their emotions are more prone to anger outbursts, crying, or verbal attacks, which can be interpreted as insubordination or violations of workplace conduct rules. As a result, the individual will likely be disciplined, up to and including termination [9, 12, 13, 16, 27, 32, 38, 48]. *Anosognosia*, which is a lack of awareness of one’s deficits, can contribute to problems with emotional dysregulation. A person cannot take steps to correct a problem that he/she is not aware of, even when presented with feedback [4, 23, 31]. In addition, employers tend to have more negative attitudes toward individuals with emotional impairments than toward individuals with physical impairments [2, 33, 34]. Our results suggest that emotional dysregulation issues may be a risk factor for job separations for people with TBI who have re-entered the workforce.

The other statistically significant indicator variable was medical symptoms. Many people with TBI experience physical, sensory, and various neurological symptoms [3, 11, 31, 35, 43], but most research on TBI and employment focuses on cognitive, emotional, behavioral, and social functioning. Few comparisons to previous research can be made, yet relationships between medical symptoms and employment status have been found, such as Chamelian and Feinstein’s [3] investigation of dizziness and Stulemeijer et al.’s [43] study regarding pain. Medical symptoms may interfere with a TBI worker’s ability to perform physical job functions, such as lifting, bending, and standing/sitting/walking for extended periods of time. They may also be sources of additional emotional stress and

fatigue. They may remind individuals with TBI of activities they can no longer perform, or have substantial difficulty performing [9, 16, 17]. For example, chronic headaches from TBI can be exacerbated by physical activity, such as bending and lifting, as well as bright lights, noise, and excessive reading or use of computer screens. Furthermore, pain medications can cause drowsiness, short-term memory problems, and “foggy” thinking. An individual may become depressed or anxious about changes in lifestyle or activities to necessary to treat or accommodate medical complications. We are mindful that our broad definition of “not employed” includes medical leave, and this functional limitation may explain the elevated levels of job separation to which it is linked. The inclusion of medical symptoms in the final logistic regression model was somewhat surprising, and further research is needed to draw stronger conclusions regarding why this may be the case. Future research that focuses on specific medical symptoms may also reveal valuable clues about the relationship between these functional limitations and risk for job separation.

4.1. Implications for Vocational Rehabilitation (VR)

The data suggest that memory loss and problems with attention/concentration may be at the forefront of concerns for many employees with TBI; however, difficulties with emotional dysregulation and the presence of medical symptoms may be stronger indicators of whether or not an individual can hold onto his/her job, particularly during the “buyers’ market” of recession and economic recovery. Therefore, the presence of emotional dysregulation and medical symptoms may be risk factors for temporary or permanent job separations, warranting particular attention by VR professionals who have clients with TBI. It is worth noting that EEOC complaints related to unlawful discharge represent 32% of all discrimination charges under ADA, nearly twice as many as the next most common issue – failure to reasonably accommodate. These ratios are for all individuals with disabilities and are very similar for those with TBI [33].

Functional limitations and their impact on work can be assessed after an individual returns to work. Discussing problematic job tasks and stressful aspects of the job with the individual is helpful; not all employees with TBI lack awareness into their impairments and many have valuable insights into their work experiences. Reviewing the job description, going over

performance reviews, meeting with the supervisor, and observing his/her work may also yield valuable data on the impact of specific functional limitations.

The solutions for problematic functional limitations vary depending on the specific limitation and the nature of the job, and are therefore highly individualized. A complete review of accommodations for all functional limitations is beyond the scope of this article. However, it is possible to highlight potential solutions for the key functional limitations referenced herein.

- Memory deficits: tape recording or writing down important information, using checklists, posting instructions on equipment, labeling/color coding items in the workstation, providing written and verbal instructions, and allowing additional training time [25].
- Attention and concentration deficits: reduce distractions as much as possible; turn off audible email notifications and allow phone calls to go to voicemail for certain times during the day to reduce the intrusions of communication devices; use noise-canceling headsets, white-noise machines, or sound-absorption panels to reduce auditory distractions; work facing a wall rather than a window or door mitigates the effects of visual distractions; reduce the amount of multitasking; eliminate clutter in the workstation [25].
- Medical symptoms: mobility aids, customized stools and chairs, equipment to aid with reaching and grasping, and compact lifting devices; ergonomic workstations may help reduce pain and muscle strain, as well as ergonomically designed tools; frequent rest breaks can be scheduled into the day to mitigate fatigue; for example, an hour-long lunch break can be divided into four 15-minute breaks; noise sensitivity can be managed with noise abatement equipment, noise canceling headsets, and private office space with a door that can be closed; light sensitivity and vision problems may be helped with different lighting (full spectrum, low lighting, fluorescent light filters), glare guards for computer screens, screen magnification, as well as labels, keyboards and written materials in large print or high contrast print [25].
- Problems with emotional dysregulation are less likely to be solved with assistive technology: a job coach can monitor and provide corrective feedback regarding problematic behaviors; a genuine rehabilitation psychologist who specializes in treating individuals with TBI can help

with emotional adjustment to new physical and cognitive limitations, provide stress management training (such as relaxation, deep breathing, and meditation/mindfulness), practice communication and assertiveness skills, and assist with building coping skills; a neuropsychiatrist who specializes in behavioral and emotional difficulties of people with TBI may be able to prescribe medications for mood regulation.

4.2. *Limitations of the current study*

Although emotional dysregulation and medical symptoms were found to be statistically significant indicators of job maintenance, their influence was not overly strong based upon classification hit-rates. Concluding that they are risk factors for employment is therefore tentative, and could be strengthened by further research. In addition, this study was not without limitations.

One area of concern was our reliance on self-report. Subjects may attribute problems to TBI or certain functional limitations, but may not be accurate in their self-assessment. Lack of self-awareness, as well as misinterpretation of symptoms, can influence what they report. Second, JAN consultants vary in their interaction styles and case documentation, although the training and supervision in this regard are fairly consistent and intensive. Nevertheless, this does not rule out consultant error or underreporting by subjects.

Another potential limitation was a lack of data about TBI severity. It is well documented that people with severe TBI, and therefore more persistent and disabling limitations than those with mild TBI, are less likely to be employed [1, 8, 14, 41, 46, 48]. JAN consultants, who gather the data from subjects, are not able to accurately measure injury severity. JAN clients may report sustaining a concussion, or that their injury was severe, but this information cannot be verified through access to medical records. The severity of specific limitations is also not recorded in JANIS, although it is frequently explored to clarify what accommodations may be necessary for the individual. The understanding of TBI severity is therefore qualitative and not reliably recorded in the JANIS case notes.

Demographic factors, such as race, gender, and age, were not considered in this research. Other researchers have explored the impact of demographic factors on rehabilitation outcomes [8, 10, 12, 14, 19, 30, 35, 42, 43, 46, 48, 49]. Since consultation at JAN concerns functional limitations, disability law, and reasonable

accommodations, information about age, gender, and race is not consistently recorded in JANIS. The inclusion of demographic factors may have provided more contexts to this study.

Other limitations relate to context. Follow-up studies, whereby investigators could determine the outcome of the employees who called JAN, could not be conducted with the sample. Information from such follow-up would provide context to the identified risk factors and serve as a comparison to the model's predictions. Other factors, such as whether an individual was receiving accommodations at the time of calling JAN, or had already disclosed his/her TBI to the employer, were not consistently available. Case notes only contain this information if it was relevant to the questions posed by the client, which vary substantially. However, the aforementioned issues would be invaluable to future research.

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