Journal of Head Trauma Rehabilitation:Volume 18(2)March/April 2003p 128-138

Moderating Factors in Return to Work and Job Stability After Traumatic Brain Injury [Moderating Factors in Rehabilitation Outcome]

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Supported by grant H133A70021 from the National Institute on Disability and Rehabilitation Research, United States Department of Education.

The contributions of the National Institute on Disability and Rehabilitation Research-funded traumatic brain injury centers are gratefully acknowledged.

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Article Outline

Figures/Tables

Abstract TOP

Objective: To examine job stability moderating variables and develop a postinjury work stability prediction model.

Design: Multicenter analysis of individuals with traumatic brain injury (TBI) who returned for follow-up at 1, 2, and 3, or 4 years postinjury, were of working age (between 18 and 62 years of age at injury), and were working preinjury.

Setting: Six National Institute on Disability and Rehabilitation Research TBI Model System centers for coordinated acute and rehabilitation care.

Participants: A total of 186 adults with TBI were included in the study.

Main outcome measures: Job stability was categorized as stably employed (employed at all 3 follow-up intervals); unstably employed (employed at one or two of all three follow-up intervals); and unemployed (unemployed at all three follow-up intervals).

Results: After injury, 34% were stably employed, 27% were unstably employed, and 39% were unemployed at all three follow-up intervals. Minority group members, people who did not complete high school, and unmarried people were more likely to be unemployed. Driving independence was highly influential and significantly related to employment stability. A discriminant function analysis, which included age, length of unconsciousness and Disability Rating Scale scores at 1 year postinjury, accurately predicted job stability groupings.

Conclusion: Data analysis provided evidence that employment stability is predictable with a combination of functional, demographic, and injury severity variables. Identification of people at risk for poor employment outcomes early on can facilitate rehabilitation planning and intervention.

TRAUMATIC BRAIN injury (TBI) typically results in a variety of short- and long-term sequelae including cognitive, behavioral, and physical impairments. Perhaps one of the most discouraging consequences is unemployment. Employment has been associated with higher perceived quality-of-life, [1-3] whereas failure to return to work (RTW) has been associated with poorer psychosocial adjustment and physical ailments. [4-6]

Rates of employment after TBI vary widely from study to study. Brooks and colleagues [7] found that unemployment levels rose from 14% preinjury to 71% postinjury. Others have reported similar rates of unemployment after TBI, ranging from 55% to 78%, [8-11] whereas some researchers have documented much lower levels of unemployment ranging from 10% to 34%. [12,13] Differing definitions of employment help explain widely varying RTW rates reported by different researchers. For example, some investigators include sheltered or subsidized and unpaid work, which includes volunteer, homemaker, and student. Broader definitions may more accurately portray productivity outcome [14-17] as opposed to employment outcome.

Differences in TBI cohort selection criteria likely lead to further variance in reported unemployment rates. TBI predictor studies have consistently found that early injury severity measures strongly correlate with RTW outcome, [9,13,16-27] implying that comparisons are not valid between cohorts with different injury severity mixes. In addition, other moderating variables are often cited to influence postinjury unemployment including older age, [13,23] premorbid unemployment, [9,28] and lower levels of education. [7,21,29] Impairment on acute rehabilitation-based measures such as the Disability Rating Scale (DRS) [9] and the FIM instrument; [18] longer lengths of inpatient rehabilitation stay [28] and poor performance on early neuropsychological testing [16] have also been found to predict unemployment after TBI.

Less clear is the role of ethnicity and marital status on employment after TBI. With regard to ethnicity, some researchers have found no association, [17,18,30] whereas others [15,29] found that minority status was associated with higher rates of unemployment. Ip and colleagues [21] determined that unmarried subjects were less likely to be employed postinjury than married subjects; however, marital status was found to be unrelated to RTW by Greenspan and colleagues. [29]

Recent literature has also suggested that variables measured at 6 months and 1 year may add predictive power to earlier measures. [17,31] Felmingham and colleagues examined data collected at 6 months postdischarge to predict employment at 24 months postdischarge. The addition of postdischarge predictors including psychologic distress (General Health Questionnaire), community integration (Community Integration Questionnaire, CIQ), and cognitive status (Functional Assessment Measure cognitive scale) significantly improved the accuracy of predictions of work status for the sample. In another study, [17] researchers collected DRS ratings, CIQ responses, and information on whether subjects had returned to productive activity (return to preinjury-comparable work, full-time school, or homemaking) at 1 year postinjury. Results indicated that greater impairment on the DRS and CIQ was associated with a higher rate of failure to return to productive activity.

Describing employment for a single time period is a noticeable drawback of nearly all TBI RTW studies. Recent longitudinal data suggest that most individuals' employment status changes with time. [32] The present study sought to expand upon earlier studies of RTW using a longitudinal sample of individuals who were employed before injury. With the benefits of a longitudinal sample, job stability across three annual follow-up visits was determined. Injury severity, functional status at 1 year postinjury, and demographic variables were used to predict job stability after TBI.

METHODS TOP

Subjects TOP

All subjects were participants in the National Institute on Disability and Rehabilitation Research-funded Traumatic Brain Injury Model System (TBIMS) program, a collaborative effort between 17 medical centers initiated in 1987. [33,34] Each center includes emergency medical services, intensive and acute medical care, inpatient rehabilitation, and a spectrum of community rehabilitation services. All patients were admitted to an acute care hospital within 24 hours of injury. Individuals with a history of prior brain injury, preexisting neurologic condition, or substance abuse are included in the TBIMS program. Informed consent was obtained from the patient or responsible family member.

At the time of this investigation, data from 2,682 people with TBI were available in the TBI Model Systems National Database. Of these, 1,041 people sustained their injuries 4.25 years before September 1, 1997, so that the windows for their 4-year postinjury follow-ups were closed. Among potential participants, 405 met the additional qualifications of working age (between 18 and 62 years) and employed at the time of their injury. Follow-up data for 1-, 2-, and 3- or 4-year were available for 186 of the 405 potential participants. These 186 people form the study sample for this longitudinal investigation.
An effort was made to determine if the 186 patients who were available for consecutive follow-ups were comparable with the overall sample eligible for follow-up (n = 405). Analysis of variance revealed no between-group differences (p > .05) for age, admission Glasgow Coma Scale (GCS) score, and rehabilitation length of stay. The longitudinal sample appeared to have more severe injuries in comparison to the overall sample, as indicated by a greater mean length of unconsciousness, acute care length of stay, and rehabilitation admission Disability Rating Scale and FIM scores (p < .05). The longitudinal group comprised 61% severe, 22% moderate, and 17% mild brain injuries, as determined by admission GCS score. Comparisons are displayed in Table 1. Chi-square analyses revealed no differences between the longitudinal sample and the overall sample with regard to gender (79% and 78% male, respectively), marital status (34% and 30% married, respectively), and education (73% and 69% completed high school, respectively). However, the proportion of minorities in the longitudinal sample (34%) was lower than the proportion in the sample eligible for follow-up (51%), (χ^2 = 14.3; degrees of freedom (df) = 1, p < .001).

	Longitudinal sample $n = 186$	Eligible sample $n = 405$
Age at injury (years)	33.22 (11.04)	32.46 (10.61)
Admission GCS	8.11 (3.61)	8.45 (3.85)
Days unconscious	12.39 (18.13)	8.41 (13.79)
Days in acute care	25.11 (19.43)	21.02 (17.46)
Days in rehabilitation	39.97 (28.31)	35.88 (30.46)
DRS rehabilitation admission	13.69 (5.38)	12.38 (5.28)
FIM rehabilitation admission	50.02 (26.08)	58.01 (26.73)

Note: Mean values given with standard deviations in parentheses.
*Between-group differences noted at $p < .05$.
**Between-group differences noted at $p < .01$.
GCS = Glasgow Coma Scale; NS = not significant; DRS = Disability Rating Scale.

Table 1. Description of longitudinal sample in comparison to sample eligible for follow-up

Instruments TOP

Category of productive activity TOP

Through interviews with patients and caregivers and through records review, patients' primary area of activity was labeled as follows: (1) competitively employed; (2) specially employed (e.g., sheltered workshop, supported employment); (3) unemployed; (4) student; (5) retired; (6) homemaker; or (7) volunteer.

Job stability TOP

Job stability was coded to indicate employment levels across follow-up times (year 1, year 2, and year 3 or 4). Patients were coded as: stably employed (employed at all three times); unstably employed (employed at one or two of three times); and unemployed (not employed at any follow-up time). Students, volunteers, retirees, homemakers, and those specially employed were not coded for this variable.

Disability Rating Scale TOP

The DRS reflects functional recovery and contains eight items. Clinician's ratings are given on scales with a range of 3 to 5 designating impairment, disability, and handicap. An overall score was determined indicating whether disability is absent (0), mild (1-3), moderate (4-6), or severe (>6). [35] Lower scores denote higher levels of functioning. [36]

FIM instrument TOP

The FIM instrument is an 18-item, 7-point scale on which higher values indicate greater levels of independence. The 18 items describe levels of self-care, continence, mobility, communication, and cognition. [36-39]

Duration of unconsciousness TOP

Calculated based on time elapsed between onset of injury and the time a patient was able to consistently follow one-step commands (GCS motor score = 6).

Procedure TOP

Data were collected at six model systems rehabilitation centers (all centers with patients 3 or more years postinjury). An individualized, comprehensive program of inpatient rehabilitation was provided to each patient. The following services were provided at each center: nursing; occupational therapy; physiatry and related medical services; physical therapy; psychology and neuropsychology; therapeutic recreation; social services; and speech and language therapy. Each program's admission and discharge criteria were based on Rehabilitation Accreditation Commission standards.

Information about medical aspects of injury was obtained from hospital records. Admission DRS and FIM scores were obtained within 72 hours of admission. Scores were determined by appropriate interdisciplinary team members using standard protocols. [34]

Every effort is made to ensure the reliability of the Model Systems data. The data entry program for the Model Systems database restricts the ranges for data entered. In addition, error reports are generated by the National Data Center's database software highlighting suspect entries. The National Data Center also provides summaries of the data, which are reviewed by the project directors for their respective centers and for the database as a whole.

An annual follow-up interview is attempted with every individual entered in the database. An in-person interview with the patient is the first choice of follow-up method. If this is not possible, a telephone interview is attempted, and if this is unsuccessful, data are collected using a mail questionnaire or interview with a significant other or family member.

Data analysis TOP

Descriptive statistics including means, standard deviations, and proportions were computed for all relevant variables. Chi-square analyses were computed to examine changes in level of employment from year to year. Where data were categoric, chi-squares were also computed (e.g., gender, race, marital status, education, cause of injury, and transportation at 1 year follow-up) for comparisons between people who were stably employed, unstably employed, and unemployed.

A canonical discriminant function analysis was used to establish a classification model for predicting job stability. Canonical discriminant function analysis measures the extent that a quantitative predictor variable correctly classifies group membership, using a qualitative grouping variable. [40] Age, length of unconsciousness, and DRS score at 1 year follow-up were used to predict group membership (stably employed, unstably employed, or unemployed). The three predictor variables were chosen based on a review of the literature, identifying variables that have most often predicted RTW. [7,19,23,24,28]

RESULTS TOP

Productivity status TOP

Employment and productivity status at follow-up each year are presented in Table 2. As shown, of the 186 patients employed before their injury, 35% were employed at 1 year postinjury, 37% at 2 years postinjury, and 42% at 3 or 4 years postinjury. A relatively small number of patients described their primary role as student, homemaker, volunteer, or retired postinjury.

Year	Competitively employed	Special employed	Student	Retired	Homemaker	Volunte
Year 1	35%	1%	4%	1%	3%	2%
Year 2	37%	1%	8%	2%	2%	5%
Year 3	42%	2%	6%	2%	4%	3%

Table 2. Employment and productivity status

Chi-square analyses were computed to examine changes in employment across follow-up intervals. Significant differences were noted between 1-year follow-up and 2- and 3-year follow-ups (χ^2 = 66.9; *df* = 1, *p* < .0001; χ^2 = 54.9; *df* = 1, *p* < .0001, respectively). If a person was employed 1 year after his or her injury, that person was more likely to be working at 2 and 3 years postinjury. Of those employed at 1 year, 84% remained employed at 2 years, and 90% were employed at 3 years postinjury. If a person was not working at 1 year postinjury, they were more likely to be unemployed at 2 and 3 years postinjury. Of those unemployed at 1 year, 85% remained unemployed at 2 years, and 74% were unemployed at 3 years postinjury.

Job stability TOP

To better examine job stability over the course of the follow-up years, patients were categorized as stably employed (34%); unstably employed (27%); and unemployed (39%). Table 3 displays information on categorical variables examined in relation to job stability. Chi-square analyses were significant for minority status, marital status, education level, and transportation mode at 1 year follow-up.

	Stable employment (*n* = 44)	Unstable employment (*n* = 35)
Race		
Nonminority	43%	26%
Minority	19%	29%
Marital status		
Unmarried	24%	34%
Married	58%	11%
Education		
Less than high school	20%	49%
High school graduate or some college	39%	17%
College graduate or graduate degree	47%	16%
Transportation at year 1		
Drives own vehicle	63%	27%
Relies on others	15%	27%

Note: For all variables chi-square analyses indicated, differences between employment groups

Table 3. Characteristics of participants (qualitative variables) and job stability

Analyses indicated that non-minority group members were significantly more likely to be stably employed than minorities (χ^2 = 8.9; *df* = 2, *p* < .01). More than twice as many nonminority group members (43%) were stably employed as compared with individuals in minority groups (19%). Additionally, married subjects were significantly more likely to be stably employed than were unmarried subjects (χ^2 = 15.1; *df* = 2, *p* < .001). Almost 60% of those who were married were stably employed compared with 24% of those who were unmarried. Results also indicated that individuals with higher levels of education were significantly more likely to be stably employed than those with less education (χ^2 = 15.0; *df* = 4, *p* < .01). Only 20% of individuals who did not finish high school were stably employed, whereas 47% of individuals with college degrees remained stably employed. Finally, subjects who drove their own vehicle at 1 year postinjury were significantly more likely to be stably employed than those who had to rely on others for transportation (χ^2 = 37.2; *df* = 2, *p* < .0001). Sixty-three percent of those who could drive their own vehicle were stably employed, whereas only 15% of those who relied on others were stably employed. No significant differences were found with regard to gender or cause of injury (violent versus non-violent).

Prediction of job stability TOP

Table 4 displays means and standard deviations for the three groups with regard to age, injury severity, and functional status at admission to rehabilitation and at 1 year postinjury. Among quantitative variables, age, length of unconsciousness, and DRS scores have most often predicted RTW in the literature. [7,19,23,24,28] Consequently, a discriminant function analysis (DFA) was performed using the three variables as predictors. Given the relatively small size of the unstably employed group, no more than three variables were considered in the DFA to limit the likelihood of a type I statistical error.

	Stably employed ($n = 44$)	Unstably employed ($n = 35$)
Age at injury (years)	36.07 (9.58)	29.29 (9.48)
Admission GCS	8.61 (3.73)	7.74 (3.53)
Days unconscious	4.67 (6.89)	8.25 (9.06)
Days in acute care	13.95 (8.4)	20.86 (12.95)
Days in rehabilitation	21.61 (11.53)	33.94 (14.87)
DRS rehabilitation admission	10.81 (4.58)	13.27 (5.8)
FIM rehabilitation admission	65.38 (22.28)	53.3 (27.17)
DRS year 1	.27 (.62)	1.92 (1.51)
FIM year 1	123.5 (3.12)	121.18 (3.57)

Note: Mean values with standard deviations given in parentheses.
GCS = Glasgow Coma Scale; DRS = Disability Rating Scale.

Table 4. Characteristics of participants (quantitative variables) and job stability

Canonical discriminant function analysis was run and combined the predictors into bivariate functions using SPSS (version 10.0). The bivariate model was significant (Wilks λ = .478, *p* < .001). A significant factor loading (canonical correlation = .668) indicated that one year DRS score and length of unconsciousness (Function 1) contributed a significant proportion of the model variance (83.6%). Age (Function 2) also contributed a significant proportion to the variance (canonical correlation = .369, 16.4% of variance). A review of the classification matrix indicated that 70.2% of grouped cases were correctly classified (Table 5). Individuals who were stably employed were most likely to be accurately predicted, with 78.6% correctly classified. Patients who were unstably employed or unemployed at all years were less likely to be correctly classified, 63.3% and 66.7%, respectively.

	Predicted group membersh			
	Stable employment		Unstable employment	
Actual group membership	*n*	%	*n*	%
Stable employment	33	78.6	8	19.0
Unstable employment	8	26.7	19	63.3
Unemployed at all years	4	9.5	10	23.8

Note: Overall percentage of correctly classified cases = 70.2%.

Table 5. Classification analysis for job stability group membership

One-year DRS impairment levels TOP

The DFA indicated that the 1-year DRS score was an impressive predictor of job stability over time. The strong relationship between DRS scores and employment stability is illustrated in Figure 1. For summary purposes, DRS scores were grouped by impairment levels, using the classification system developed by Rappaport and colleagues. [35] Of those with no impairment, as rated by the DRS, the majority (78%) were stably employed and 5% were unemployed. In contrast, all individuals rated severely impaired at one year were unemployed at all three follow-up periods.

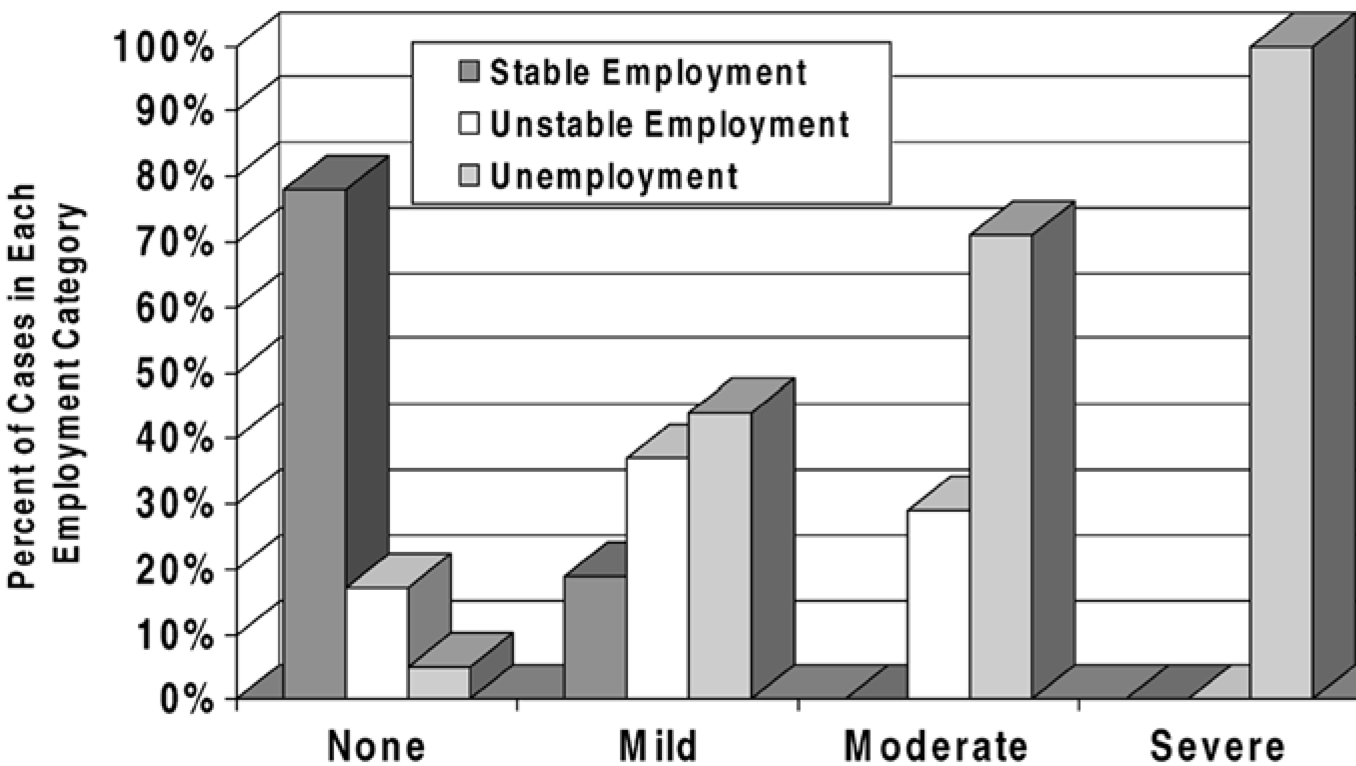

Fig 1. DRS impairment levels one year postinjury and employment stability.

DISCUSSION TOP

Employment status TOP

The present investigation provides hope that a substantial number of people who were working before their injury are able to return to work. The trend in employment and unemployment rates provides a basis for increased optimism with increasing time postinjury. Each year, the proportion of employed people increased. For example, 42% were employed 3 years after injury in comparison to 35% at 1 year postinjury. Conversely, unemployment rates fell over time, beginning at 54% and dropping to 41%. The proportion of employed and unemployed patients was roughly equivalent 3 years postinjury. Unfortunately, the present analysis does not indicate whether people returned to the same job or responsibilities. Future research can help address job changes and ascertain whether the trend to higher employment rates continues over time. Research by Johnson 41 and Possl and colleagues 42 provides support for assertions that employment rates improve over time.

Sander et al 32 described employment and productivity outcomes for a TBIMS longitudinal sample consisting of 42 people. The previously reported sample, comprises less than 25% of the present sample (*n* = 186). As might be expected, return to work rates are similar (Figure 2). The earlier data provided evidence of positive and negative changes in employment rates over time, whereas the present data provided evidence of upward trends.

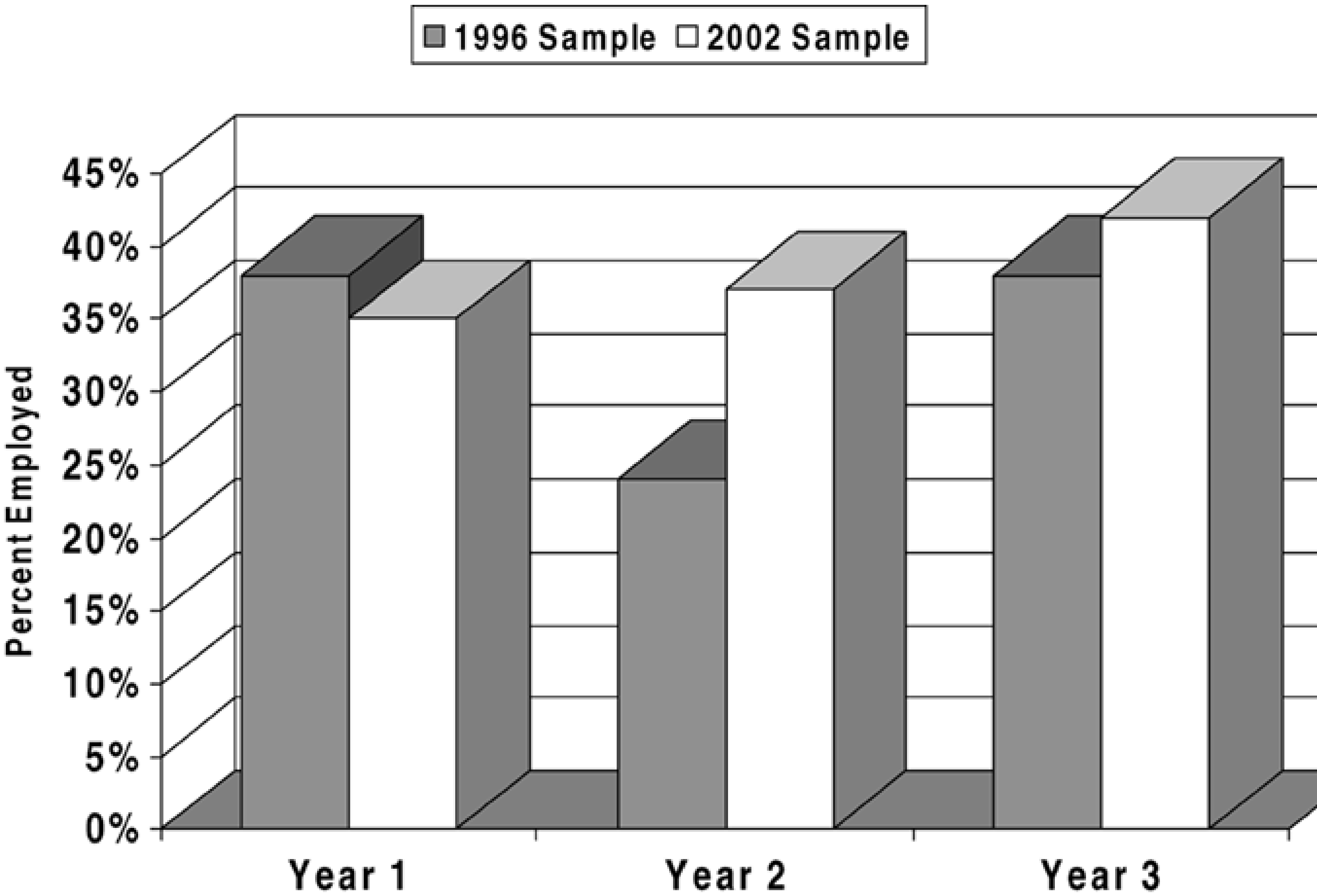

Fig 2. Comparison between 1996 and 2002 TBIMS employment rates.

With regard to work alternatives, relatively few people were labeled as homemakers or retired. The proportions were relatively stable throughout the follow-up period, ranging from 1% to 5%. Wehman, Kreutzer, and others 43-45 have emphasized the benefits of supported employment and volunteer work. Surprisingly few people were in either situation. The proportions ranged from 1% to 5% over the follow-up period. Similarly, the number of people in the student category was relatively small, ranging from 4% to 8%. In comparison to Sander and colleagues' 32 earlier TBIMS investigation, the proportion of special employed, students, retired, volunteers, and homemakers is comparable.

Employment stability TOP

The present investigation is the first longitudinal investigation of employment stability after TBI. Relying predominantly on postal questionnaire data, Johnson 41 investigated the work stability of 64 patients 10 years after severe TBI. Forty-two percent of the sample was categorized as able to sustain stable employment. Possl and colleagues 42 conducted interviews to classify the work stability of a mixed neurological sample (TBI, *n* = 24;

CVA, *n* = 15, other = 4) 7 to 8 years after onset of their condition. Thirty-seven percent were described as having stable employment.

Employment stability rates were similar for the present investigation. One-third of participants (34%) were categorized as stably employed-that is, were employed at all follow-up intervals. A smaller number (27%) were employed at either one or two of the three follow-up intervals. More than a third (39%) were unemployed at all follow-up intervals. The data suggest that a substantial number of people are able to continue working for a number of years, whereas a slightly larger proportion is entirely unsuccessful.
Investigators have indicated that ethnicity, marital status, and education are among a group of qualitative variables significantly related to employment outcome. For example, Rosenthal [15] and Greenspan [29] and colleagues found that minority status was associated with lower employment rates. Ip and colleagues [21] found higher unemployment rates among unmarried people. Furthermore, Brooks, [7] Ip, [21] Greenspan, [29] and colleagues found that lower education levels were associated with higher unemployment rates.

The present data were consistent with findings reported by other investigators. Nonminority group members were more than twice as likely to be stably employed. Similarly, married people were more than twice as likely to be stably employed. People who completed high school or college educations had similar levels of job stability, and both groups were nearly twice as likely as people without a high school degree to be stably employed. Perhaps most impressive was the relationship between driving independence and work stability. People who drove on their own were more than 4 times as likely to have found stable employment.

Data analysis provided evidence that employment stability is predictable with a combination of variables including age, length of unconsciousness, and DRS at 1 year after injury. Classification accuracy rates were better for predicting stable employment with more than three out of four patients correctly classified. Approximately two of every three patients classified as unstably employed or unemployed all 3 years were correctly classified. Accurate employment stability prediction methods can be used to guide treatment planning and help identify people at risk for unemployment.

The present findings are limited in several respects, and representativeness is a key issue. Virtually all the patients in the present sample were recipients of comprehensive inpatient rehabilitation services, and all were employed before their injury. Generalization to patients receiving different levels of inpatient rehabilitation is uncertain. Comparisons between the longitudinal sample and the larger model system sample revealed important differences. The present sample included people with more severe injuries and a lower proportion of minority group members. Furthermore, information about postdischarge rehabilitation services was unavailable. Researchers are encouraged to collect such information in future studies to help evaluate the efficacy of postacute services.

The present findings provide categorical employment information derived from annual follow-up evaluations. Collecting data at more frequent follow-up intervals (e.g., 6 months) would provide opportunities for finer analysis of employment stability. Future studies which examine changes in job responsibilities, positions, titles, wages, and earnings could prove to be very helpful for rehabilitation planning and intervention.

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Keywords:

employment outcome; *job stability*; *return to work*; *traumatic brain injury*