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This is an author produced version of a paper published in:

Brain Injury (ISSN: 0269-9052)

Citation for the published paper:

Ulfarsson, T. ; Lundgren Nilsson, Å. ; Blomstrand, C. et al. (2014) "A history of unemployment or sick leave influences long-term functioning and health-related quality-of-life after severe traumatic brain injury". *Brain Injury*, vol. 28(3), pp. 328-335.

<http://dx.doi.org/10.3109/02699052.2013.865274>

Downloaded from: <http://gup.ub.gu.se/publication/196607>

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**A history of unemployment or sick leave influences long-term functioning
and health-related quality of life after severe traumatic brain injury**

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Keywords: traumatic brain injury; pre-morbid; prediction; outcome assessment; disability; rehabilitation

Abstract

Primary objective: The consequences of pre-morbid factors in adults with severe traumatic brain injury have not been widely addressed. This study aimed to determine whether being unemployed or on sick leave before injury influences long-term health-related quality of life (HRQL) and functioning in patients with severe traumatic brain injury.

Subjects: We studied 51 consecutive patients; age 16–65 years, with severe traumatic brain injury who were admitted to Sahlgrenska University Hospital, Gothenburg, from 1999 to 2002.

Methods: The patients were assessed once, 2–11 years after trauma. Data from the time of injury were combined into a validated prognostic model to adjust for injury severity. Data on sick leave and unemployment before injury were gathered from the Swedish social insurance agency. Outcomes were measured with the Short Form-36 Health Survey, the Glasgow Outcome Scale–Extended, and a self-report questionnaire specifically designed for this study to measure functioning.

Results: In a multivariate analysis, a history of sick leave/unemployment predicted a worse long-term global outcome, more problems with personal activities of daily living and worse HRQL.

Conclusion: These results should be considered when refining outcome predictions and optimizing rehabilitation interventions for patients with severe traumatic brain injury.

Introduction

The outcome after traumatic brain injury (TBI) can range from complete recovery to death [1-5]. Especially after severe injury, serious cognitive, behavioural, emotional, and sensorimotor impairments can occur that have major consequences for the patient's activity patterns, social participation, and quality of life issues [1,2,4,6-9].

Factors that must be considered in rehabilitation after TBI vary considerably. Some are directly related to the injury, but others, including environmental factors, predate the injury [10-13]. Co-morbidities such as substance abuse and pre-morbid demographic characteristics such as age, education, and employment are important for outcome [14-22]. A systematic review of prospective cohort studies investigating prognostic factors at least 1 year after injury found strong evidence that pre-injury unemployment and pre-injury substance abuse predict disability and nonproductivity in patients with TBI [23]. In a study of the specific sick leave pattern before TBI of various severities in patients at Sahlgrenska University Hospital in Gothenburg, the strongest factor predicting long-term sick leave after TBI was being on sick leave on the day of the trauma [24].

Although several studies have investigated the long-term prognosis after TBI, little is known about pre-morbid factors in adults with severe TBI, and meaningful effects of pre-morbid factors have not always been noted [10,14,15]. Furthermore, the impact of TBI-related disability on self-reported health and well-being has received limited investigation [25]. The aim of this study was to evaluate the relationship between a history of sick leave and unemployment before TBI and self-reported health-related quality of life and functioning in patients 2–10 years after severe TBI.

Patients and method

Patient enrolment and retrospective evaluation

The catchment region of Sahlgrenska University Hospital includes about 1.5 million inhabitants in the Västra Götaland region in western Sweden, with roughly 500,000 in the city of Gothenburg. Between January 1, 1999, and December 31, 2002, 419 patients with TBI (ICD 10 diagnostic codes S06.1–S06.9) were admitted to the Neuro-intensive Care Unit (NICU) at Sahlgrenska University Hospital, Gothenburg, Sweden. Their medical files were reviewed retrospectively to collect data on the level of consciousness upon arrival at the hospital. Consciousness was evaluated with the Reaction Level Scale (RLS), a hierarchically ordered scale with 8 categories (“reaction levels”); higher scores denote worse responsiveness, and a score ≥ 4 denotes a nonresponsive patient [26]. The eight point RLS is widely used in Sweden and at the NICU, Sahlgrenska it is used instead of the Glasgow Coma Scale (GCS). According to Starmark, RLS scores were converted to GCS [27]; Scores on the GCS of 3-8 and on the RLS of 8-4 reflect similar severity of injury, the RLS having been shown to have somewhat better inter-rater reliability than the GCS. RLS scoring is in the opposite direction to GCS scoring, with the highest RLS score of 8 reflecting the most severe injuries [27,28].

The inclusion criteria were (I) age 16–65 years, (II) a GCS score ≤ 8 , indicating a severe TBI, (III) survival to discharge from the NICU, and (IV) residence in the Västra Götaland region at the time of follow-up. 104 patients met the inclusion criteria and were invited by letter to participate in the study. Those who did not respond within 1 month received another letter, a phone call, or both. Fourteen patients declined to participate, 17 did not respond to the invitation, 20 had died after discharge from the NICU, and 2 could not be located. Thus, 53 patients were lost to follow-up, and 51 patients were included in the study (13 women and 38 men). The mean age was 37.9 SD 16.1 years. At the time of the TBI, 19

patients (37.3%) were either on sick leave or were unemployed; 10 (two women) (19.6%) were on sick leave and nine (one woman) (17.7%) were unemployed (table 1). The 53 patients who were lost to follow-up did not differ in mean age (40.7 SD 13.0 years; 95% CI = -2.8 – 8.4), injury severity, according to CRASH (Corticosteroid Randomization After Significant Head injury) (68.0% risk of unfavourable outcome; 95% CI = -3.9 – 13.7) or gender (14 women and 39 men; $p = 1.00$) from the 51 patients included in the study.

Data collection

All the patients were assessed once, in a quiet setting at the Sahlgrenska University Hospital, between September 2004 and June 2010, 2–11 years after the TBI (median = 68 months; range = 30–131). No statistical difference was found in months to follow up between the group of patients on sick leave/unemployed or not at injury (95% CI = -13.3 – 17.4). The patients underwent a health assessment by a physician (physical examination and medical history), and completed self-report questionnaires. Data from the time of injury were collected retrospectively from medical files.

Premorbid and sociodemographic data and injury characteristics

The Swedish social insurance agency is the authority that administers the various types of insurance and benefits, which make up social insurance in Sweden. The Swedish social security system is a Beveridge-type, tax based system that covers everyone who lives or works in Sweden [29–31]. It provides financial security for families and children, for disabled persons and in connection with illness, work injury and old age (<http://www.forsakringskassan.se>). Data on sick leave and unemployment were gathered from the Swedish social insurance agency, which keeps records of all economic compensations to individuals funded by the state. For patients categorized as being on sick leave/unemployed at the day of the TBI, data on sick leave and unemployment over a 1-year

period before the TBI were gathered.

Included in the term “sick leave” were full-time and part-time daily sickness allowances and disability pensions. Included in the term “unemployment” were full-time and part-time unemployment benefits and welfare benefits.

Data on co-morbidity and sociodemographic characteristics at the time of injury were recorded retrospectively from the medical files. At the time of follow-up, these data were obtained with a questionnaire specifically designed for this study and from the medical history gathered by the physician. The injury characteristics were obtained from the acute care medical files, including age, sex, major extracranial injury, RLS score, and pupillary status after arrival at the hospital. The findings from each patient’s first and second CT scans after arrival at the hospital were registered as cranial fracture and type, diffuse brain swelling, Non-evacuated haematoma, visible petechiae, midline shift of more than 5 mm, basal cistern compression, and subarachnoid haemorrhage.

To provide a valid comparison of the injury characteristics versus pre-injury sick leave/unemployment as outcome predictors, we combined the predictive value of some of the clinical parameters and CT findings into CRASH, a validated and generalizable prognostic model of TBI [32,33]. For this purpose RLS scores were converted to GCS scores.

Measures of functions, activity, participation, and health-related quality of life (HRQL) at follow-up

The primary outcome measures were assessment of functioning, disability, and HRQL. Body functions, activities, and participation (household, work and studies) were assessed with a patient-reported questionnaire specifically designed for this study, using the framework of the International Classification of Functioning, Disability, and Health [³⁴]. The questionnaire consists of 50 “yes-no” questions, 38 questions about physical and psychological functions,

and 12 questions about personal and instrumental activities of daily living. The questionnaire also gathers sociodemographic information, including household, work, and studies, and the need for support (personal, economical, or technical), and information on co-morbidities (cardiovascular disease, diabetes mellitus, epilepsy, cancer, gastrointestinal disease, kidney disease, rheumatic disease, respiratory disease, endocrine disease, and significant injury other than TBI), medications, smoking, alcohol consumption, and drug abuse. (A copy of the questionnaire can be obtained from the corresponding author).

HRQL was assessed with the Short Form-36 Health Survey (SF-36), a widely used health outcome measure, validated for the TBI population [35-38]. The 36 questions are designed to measure patient-reported health-related functioning and well-being along eight subscales, each graded 0–100 (worst to best). Despite the ordinal nature of the SF-36, it has been recommended that the subscales of the SF-36 be aggregated into summary scores that represent the two main dimensions of health: the physical component summary and the mental component summary, calculated as weighted sums of the subscales scores [35-38].

Another outcome measure was the eight-point Glasgow Outcome Scale–Extended (GOS-E), in which information from the specifically designed questionnaire was interpreted together with the physical examination and medical history, obtained by physician according to the study protocol [39]. The physician completed the questionnaires by interviewing the patient ($n = 45$) or, if that was not possible due to severe sequelae of the TBI, the physician interviewed a relative or personal assistant of the patient ($n = 6$).

Data analysis

All statistical analyses were performed with PASW (Chicago, IL) version 18.0. Functioning, disability, and health were compared between the groups who were or were not unemployed or on sick leave before injury. Fisher's exact test and independent-samples t test were used to compare the groups. Data from the specifically designed questionnaire on functional

impairment and activity limitation were analysed by factor analysis. Principal components analysis with Varimax rotation based on the correlation matrix was used to make informed decisions on reducing the number of variables while retaining as many variables as needed to describe performance and dependency. Principal components analysis gives the number of variables (components) needed to capture most of the variance in the original data set. The determination of the specific variables to be extracted was both a statistical and a qualitative decision of the first author. The correlation matrix was used to determine which variables clustered together in a meaningful way and may measure aspects of the same underlying dimension (factor). Components were extracted according to Kaiser's criterion; thus, variables with loading values ≥ 0.6 were included from the rotated component matrix, and clustered into the following four domains, measuring different outcomes:

- 1) Physical function (included components: arm function, leg function, swallowing, talking, sensory functions and headache).
- 2) Psychological function (included components: depression, anxiety, sleep, concentration and sexual drive).
- 3) Personal activities of daily living (P-ADL) (included components: walk, climb stairs, get dressed, manage personal hygiene, manage elimination needs, read, and maintain a home).
- 4) Instrumental activities of daily living (I-ADL) (included components; drive, manage transportation, engage in leisure activities, watch a movie and manage household economy).

Multivariate analyses were performed to determine whether a history of sick leave and unemployment before TBI independently predicted outcome; multiple regression was used to control for the outcome predictors of injury severity, age and gender. Additionally two outcome predictors, substance abuse and co-morbidity were controlled for in the regression

model, as these variables showed a statistical difference between the groups (table 4). The multivariate analysis did not present multicollinearity, as the independent variables controlled for were not highly intercorrelated (Tolerance > 0.6, Variance inflation factor < 1.5).

Ethics

The study was approved by the regional ethical review board of Västra Götaland (Dnr 634-09 and Dnr 330-02). The aim of the study was carefully explained to the patients at the time of inclusion and again at the time of patient assessment. Informed consent was obtained from each patient or the next of kin.

Results

Premorbid and sociodemographic data and injury characteristics at the time of the injury

Comparisons were made between the groups who were or were not on sick leave/unemployed before injury. The patients who were on sick leave/unemployed were further divided into three subgroups; I) on sick leave/unemployed ≥ 12 months, II) on sick leave, III) unemployed), and each subgroup compared to all the other patients. No statistical differences were found in age, gender, or injury severity (according to CRASH) between patients who were on sick leave/ unemployed before the injury and those who were not (table 1). A history of alcohol and drug abuse was significantly more common in patients who were unemployed at the time of injury (table 1). The most common causes of TBI were traffic accidents (53%), falls (29%), and assault (12%). Assault was a cause of injury in one third of the unemployed patients; however, the difference was not significant between the groups ($p=0.06$).

Insert table 1 about here

Functioning and quality of life at the time of follow-up

In a multivariate analysis, a history of sick leave/unemployment seemed to predict a significantly worse outcome, measured as perceived problems with P-ADL and as decreased

HRQL measured with the SF-36 subscale for physical functioning (table 2). Being unemployed or on sick leave for 12 months or more before TBI seemed to predict a significantly worse global outcome, measured with the GOS-E (table 2). However, according to the multivariate analysis, a history of sick leave/unemployment did not seem to influence the outcome measures of I-ADL, physical function or psychological function.

When outcomes were analysed separately in patients who were unemployed and those who were on sick leave before TBI, only unemployment seemed to predict a significantly worse global outcome ($p = 0.01$; R^2 change = 0.089).

Insert table 2 about here

Patients who were on sick leave/unemployed before the injury reported significantly less participation in work at follow-up (table 3). These patients also significantly more often reported depression at follow-up (table 4). A history of alcohol and drug abuse and other comorbidities at follow-up was significantly more common in patients with a history of unemployment before TBI (table 4). Patients who had a history of alcohol and drug abuse before TBI reported significantly decreased HRQL at follow-up, measured with the SF-36 subscale for physical functioning (60.2; 95% CI = 0.9–38.7). Patients with a history of unemployment before the injury more often lived alone at follow-up, the difference being statistically significant between the groups (table 3).

Insert table 3 and 4 about here

Discussion

The results from this study show that pre-morbid labour force participation influences long-term outcome in patients with severe TBI. Being unemployed or on sick leave before the injury predicted worse HRQL and more disabilities, measured as perceived problems with

personal activities of daily living. Additionally, being unemployed or on sick leave for 12 months or more before severe TBI predicts a worse long-term global outcome, measured by GOSE. Patients with a history of unemployment or sick leave more often reported depression and less participation in work at follow up. The findings also link a history of unemployment to substance abuse in patients with severe TBI.

The few studies that have addressed the long-term consequences of pre-morbid factors in adults with severe TBI have yielded conflicting results, and meaningful effects of pre-morbid factors have not always been noted [10,14,15]. Therefore, we examined the importance of pre-injury sick leave and unemployment on health-related quality of life and functioning in a well-defined group of patients with severe TBI and a long follow-up time. All of the patients had a severe TBI and received similar acute care in a modern NICU at a university hospital where all severe TBI patients are admitted within the Västra Götaland region. In this relatively homogenous group of patients, it was possible to compare injury characteristics as outcome predictors versus pre-injury sick leave or unemployment by combining the predictive value of some of the clinical parameters and CT findings into CRASH, a validated and generalizable prognostic model of TBI [32,33]. This approach made it possible to estimate pre-injury sick leave or unemployment as independent predictors of outcome.

In Sweden, sickness allowance and unemployment benefits are central to the welfare of people who are ill or unemployed. In the current study, 19 patients (37%) were either unemployed or on sick leave before the trauma. By contrast, during the period of the study, only 25% of the general Swedish population age 16–65 years were unemployed or not in the labor force (students included) [40]. The high prevalence of unemployment/sick leave in the current study sample strengthens the message from this study that individuals exposed to severe TBI are vulnerable by a multifactorial and bio-psychosocial perspective. The finding

that being unemployed or on sick leave for 12 months or more before severe TBI predicted a worse global outcome suggests that the longer the duration of sick leave or unemployment before the injury, the more likely it will have a negative effect on the long-term outcome.

The study shows a high prevalence of alcohol and drug abuse in the TBI patients, especially among those who were unemployed before the injury, compared to the general Swedish population [41]. Previous studies have also reported a high prevalence of substance abuse among persons who incur TBI, and, as would be expected, generally found poorer outcomes in TBI patients with substance abuse [15]. These findings underscore the need to provide interventions for alcohol and drug abuse for these patients.

The impact of TBI-related disability on self-reported health and well-being has received limited investigation, and studies are lacking [25]. We decided to use a patient-report questionnaire, using the International Classification of Functioning, Disability and Health model to characterize the consequences of TBI. We expected that this biopsychosocial approach would allow us to understand the extent of disability at follow-up, many years after the TBI [34]. Measures of outcomes are incomplete if the subjective well-being of the individual is not considered [42]. A consensus meeting of international experts concluded that patients' self-reported HRQL values are necessary in TBI research [43]. Therefore, we assessed HRQL with the Short Form-36 Health Survey (SF-36), a widely used measure of health outcome that has been validated for the TBI population [35-38].

Matched traumatic non-head injury controls were not used in our study. Therefore, our findings could be true of any new major injury or illness and need to be studied more extensively in different group of patients (e.g. non-head injury, stroke, etc.)

Our study has a number of limitations. The incidence of severe TBI is low compared to the incidence of the milder forms of TBI and many patients are lost to follow-up so many years after the trauma, which made it difficult to include a large sample in a geographic area

of Västra Götaland, with a small population size. The relatively small sample size, in addition to the fact that the findings are subject to multiple testing, resulted in a poor ratio of subjects to variables and p-values of results with respect to specific symptoms signs and diseases are less reliable (Table 4). One implication of this is that gender and sick leave/unemployment are not totally separable.

Another limitation of the study is that we used a patient-report instrument to measure functioning; therefore, the results are less reliable than if we had used a combination of patient reports and functional tests. Additional weakness of the study is the unknown psychometric properties of the study's specifically designed questionnaire. Finally, the patients who were lost to follow-up might have differed from the study population in regard to co-morbidity and psychosocial status. The assessment of global outcome in our study included functions, activities, participation, and HRQL. Since the patients were assessed once, 2–11 years after the injury, in a retrospective follow-up, we were unable to predict whether important determinants of global outcome, premature death, and serious illness that would hinder participation in our study might be more common in patients with a history of unemployment or sick leave before severe TBI.

The major finding of this study – that a history of unemployment or sick leave seems associated with functional outcome after severe TBI – needs to be studied more extensively. The results should be considered when refining long-term outcome predictions and optimizing rehabilitation interventions and care pathways for this group of patients.

Acknowledgements

This study was based on data from the Sahlgrenska University Hospital. We gratefully acknowledge the participants and their next of kin for their kind participation in the study. We thank Thord Rosén, Gudni Gudnason, Olof Ehn, and Olof Strandberg (Department of Endocrinology, Sahlgrenska University Hospital) for support and for help in assessing the

patients and Ingrid Morberg and Katharina Stibrant Sunnerhagen (Rehabilitation Medicine, Sahlgrenska University Hospital) and Heléne Seeman-Lodding (NICU, Sahlgrenska University Hospital) for support and practical assistance.

Declaration of interest

The authors report no conflict of interest. This work was supported by a grant from the Swedish Association of Persons with Neurological Disabilities and a grant from the Länsförsäkringar Alliance. Stephen Ordway (Golden Gate Biomedical Communications) provided much appreciated scientific writing assistance.

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Table 1. *Premorbid and sociodemographic data and injury characteristics of the patients at the time of the traumatic brain injury. The patients are categorized as being on sick leave/unemployed or not.*

	All patients n=51	No sick leave/ unemployment (n=32)	Sick leave/ unemployment (n=19)	95% CI/ p-value ^a	Sick leave/ unemployment ≥12 months (n=10)	95% CI/ p-value ^a	Sick leave (n=10)	95% CI/ p-value ^a	Un- employment (n=9)	95% CI/ p-value ^a
Age (yr)	37.9 (16-64)	36.2 (16-64)	40.8 (20-61)	-13.9 – 4.6	39.7 (20-61)	-13.6 – 9.3	45.4 (24-61)	-20.4 – 1.9	35.8 (20-59)	-9.3 – 14.6
Gender	13 F/38 M	10 F/22 M	3 F/28 M	p = 0.32	3 F/7 M	p = 0.70	2 F/8 M	p = 1.00	1 F/8 M	p = 0.42
Alcohol/drug abuse	12 (24%)	5 (16%)	7 (37%)	p = 0.17	4 (40%)	p = 0.22	2 (20%)	p = 1.00	5 (55%)	p = 0.03 ^b
Injury severity ^c										
Risk of unfavourable outcome	63.1%	64.0 %	61.7%	-11.6 – 16.2	55.1%	-6.8 – 6.7	68.8%	-23.9 – 9.8	53.8%	-6.1 – 28.7

Data are given as mean (range) or absolute number (%).

M, male; F, female.

^a 95% confidence interval of the difference between each group of patients and all other included patients/ p-value.

^b A significant difference between the groups.

^c Retrospectively analysed, according to the CRASH prognostic model. Unfavourable outcome = Glasgow Outcome Scale–Extended score 1-4.

Table 2. *Effects of sick leave/unemployment before injury on outcome measures adjusted for age, gender, injury severity, co-morbidity, and substance abuse.*

Outcome	Explanatory variables at the time of injury							
	Sick leave/unemployment (n=19)				Sick leave/unemployment \geq 12 months (n=10)			
	Unstandardized				Unstandardized			
	coefficients		p-	Fraction of variance explained	coefficients		p-	Fraction of variance explained
B	SE	value	(R ² change)	B	SE	value	(R ² change)	
GOS-E ^a	-0.7	0.4	0.08	0.046	-1.3	0.5	0.01	0.089
P-ADL ^b	1.4	0.7	0.04	0.077	1.9	0.9	0.04	0.083
SF-36 physical function ^c	-20.7	8.3	0.02	0.101	-23.9	10.9	0.03	0.080

^aGlasgow Outcome Scale–Extended: 1 = dead, 2 = vegetative state, 3 = lower severe disability, 4 = upper severe disability, 5 = lower moderate disability, 6 = upper moderate disability, 7 = lower good recovery, 8 = upper good recovery.

^bPersonal activities of daily living, assessed with a questionnaire specifically designed for the study. Higher scores denote more impairment or limitation. Scores 0–7.

^cShort Form Health Survey-36. Lower scores indicate a worse health-related quality of life. Scores 0–100.

Table 3. *Functioning, disability and the need of support at the time of follow up. The patients are categorized as being on sick leave/unemployed or not at the time of the traumatic brain injury.*

Measures ^a	All (n=51)	No sick leave/ unemployment (n=32)	Sick leave/ unemployment (n=19)	95% CI/ p-value ^b	Sick leave/ unempl ≥12 months (n=10)	95% CI/ p-value ^b	Sick leave (n=10)	95% CI/ p-value ^b	Unemployment (n=9)	95% CI/ p-value ^b
Functional impairment										
General 0-12 (n=49)	4.3 (0-11)	3.8 (0-11)	5 (0-11)	-0.5 – 2.9	4.7 (1-9)	-1.7 – 2.6	4.5 (0-11)	-1.8 – 2.5	5.4 (1-11)	-0.7 – 3.6
Physical 0-7	2.1 (0-7)	2.0 (0-6)	2.2 (0-7)	-1.0 – 1.6	2.0 (0-5)	-1.6 – 1.5	1.9 (0-7)	-1.7 -1.3	2.5 (0-6)	-0.9 – 2.1
Psychological 0-5	2.3 (0-5)	2.0 (0-5)	2.8 (0-5)	-0.1 – 1.8	2.8 (1-5)	-0.5 – 1.8	2.8 (0-4)	-0.5 – 1.8	2.9 (1-5)	-0.5 -1.9
Activity/particip limit										
ADL 0-12 (n=48)	3.0 (0-12)	2.4 (0-12)	4.1 (0-12)	-0.4 – 3.9	4.9 (0-12)	- 0.5 – 5.0	3.7 (0-12)	-1.9 – 3.7	4.6 (0-10)	-0.8 – 4.8
P-ADL 0-7 (n=50)	1.7 (0-7)	1.2 (0-7)	2.6 (0-7)	0.1 – 2.7 ^c	3.1 (0-7)	0.1 – 3.3 ^c	2.3 (0-7)	-1.0 – 2.5	2.9 (0-7)	-0.2 – 3.1
I-ADL 0-5 (n=49)	1.4 (0-5)	1.2 (0-5)	1.7 (0-5)	-0.5 – 1.6	2.2 (0-5)	-0.3 – 2.2	1.4 (0-5)	-1.3 – 1.2	2.3 (0-5)	-0.4 – 2.3
Probl with ADL %	33 (69%)	20/31 (65%)	13/17 (77%)	p = 0.52	7/8 (88%)	p = 0.41	6/9 (67%)	p = 1.00	7/8 (88%)	p = 0.41
Not working %	30 (59%)	15 (47%)	15 (79%)	p = 0.04 ^c	8 (80%)	p = 0.17	8 (80%)	p = 0.17	7 (78%)	p = 0.28
Not work full time %	41 (80%)	24 (75%)	17 (90%)	p = 0.29	10 (100%)	p = 0.18	8 (80%)	p = 1.00	9 (100%)	p = 0.18
Houshold										
Single (n=50)	21 (42%)	11/31 (36%)	10 (53%)	p = 0.26	7 (70%)	p = 0.07	3 (30%)	p = 0.49	7 (78%)	p = 0.03 ^c
Support										
Personal/technical %	22 (43%)	13 (41%)	9 (47%)	p = 0.77	6 (60%)	p = 0.23	4 (40%)	p = 1.00	5 (56%)	p = 0.48
Economic %	41 (80%)	24 (75%)	17 (90%)	p = 0.29	10 (100%)	p = 0.18	8 (80%)	p = 1.00	9 (100%)	p = 0.18

Data are given as mean (range) or absolute number (%).

ADL, activities of daily living; P-ADL, personal activities of daily living; I-ADL, instrumental activities of daily living.

^aQuestionnaire specifically designed for the study, using the framework of ICF; Clinical examination. Higher scores denote more impairment or limitation.

^b95% confidence interval of the difference between each group of patients and all other included patients/ p-value.

^cA significant difference between the groups.

Table 4. *Disease, symptoms, and signs at the time of follow-up. The patients are categorized as being on sick leave/unemployed or not at the time of injury.*

Measures ^a	All patients (n=51)	No sick leave/ unemployment (n=32)	Sick leave/ unemployment (n=19)	p- value	Sick leave/ unemployment ≥12 months (n= 10)	p- value	Sick leave (n=10)	p- value	Unemployment (n=9)	p- value
Fatigue	42 (82%)	29 (91%)	13 (68%)	0.06	6 (60%)	0.06	7 (70%)	0.35	6 (67%)	0.19
Irritability	23 (45%)	12 (38%)	11 (58%)	0.20	4 (40%)	1.00	7 (70%)	0.15	4 (44%)	1.00
Sleep disturbances	19 (37%)	12 (38%)	7 (37%)	1.00	5 (50%)	0.47	2 (20%)	0.29	5 (55)	0.27
Concentration problems	37 (73%)	21 (66%)	16 (84%)	0.20	8 (80%)	0.71	9 (90%)	0.25	7 (78%)	1.00
Memory problem	36 (70%)	21 (66%)	15 (79%)	0.36	9 (90%)	0.25	7 (70%)	1.00	8 (89%)	0.25
Speech problem	23 (45%)	15 (47%)	8 (42%)	0.78	4 (40%)	1.00	4 (40%)	1.00	4 (44%)	1.00
Depression	25 (49%)	12 (38%)	13 (68%)	0.04 ^b	7 (70%)	0.17	7 (70%)	0.17	6 (67%)	0.29
Anxiety	17 (33%)	9 (28%)	8 (42%)	0.36	3 (30%)	1.00	5 (50%)	0.27	3 (33%)	1.00
Arm motor impairment	19 (37%)	11 (34%)	8 (42%)	0.76	4 (40%)	1.00	3 (30%)	0.72	5 (56%)	0.27
Leg motor impairment	18 (35%)	9 (28%)	9 (47%)	0.23	5 (50%)	0.23	4 (40%)	0.72	5 (56%)	0.25
Problem swallowing	6 (11%)	3 (9%)	3 (16%)	0.66	1 (10%)	1.00	2 (20%)	0.58	1 (11%)	1.00
Problem talking (n=50)	17 (33%)	11 (34%)	6/18 (33%)	1.00	3/9 (33%)	1.00	2/9 (22%)	0.70	4 (44%)	0.47
Impaired touch sense	17 (33%)	11 (34%)	6 (31%)	1.00	2 (20%)	0.46	3 (30%)	1.00	3 (33%)	1.00
Dizziness	15 (29%)	9 (28%)	6 (31%)	1.00	3 (30%)	1.00	3 (30%)	1.00	3 (33%)	1.00
Visual impairment	17 (33%)	12 (38%)	5 (26%)	0.54	2 (20%)	0.46	3 (30%)	1.00	2 (22%)	0.67
Hearing impairment	18 (35%)	12 (38%)	6 (32%)	0.77	4 (40%)	0.73	3 (30%)	1.00	3 (33%)	1.00
Impaired smell sense	14 (28%)	8 (25%)	6 (32%)	0.75	2 (20%)	0.71	4 (40%)	0.43	2 (22%)	1.00
Headache (n=50)	5 (10%)	3 (9%)	2 (10%)	1.00	1/9 (11%)	1.00	1/9 (11%)	1.00	1 (11%)	1.00
Other chronic pain	18 (35%)	9 (28%)	9 (47%)	0.23	5 (50%)	0.23	5 (50%)	0.30	4 (44%)	0.70
Co-morbidity ^c	37 (73%)	22 (67%)	15 (79%)	0.53	10 (100%)	0.04 ^b	6 (60%)	0.43	9 (100%)	0.05 ^b
Alcoholism	11 (22%)	4 (13%)	7 (37%)	0.07	4 (40%)	0.19	2 (20%)	1.00	5 (56%)	0.02 ^b
Alcoholism and drug abuse	14 (28%)	5 (16%)	9 (47%)	0.02 ^b	6 (60%)	0.02 ^b	2 (20%)	0.71	7 (78%)	0.01 ^b
Smoking	16 (31%)	11 (34%)	5 (26%)	0.76	4 (40%)	0.70	1 (10%)	0.14	4 (44%)	0.44

Values are absolute number (%).

^aQuestionnaire specifically designed for the study, using the framework of ICF; Physician's health assessment

^bA significant difference between the groups.

^cIncluding cardiovascular disease, diabetes mellitus, epilepsy, cancer, gastrointestinal disease, kidney disease, rheumatic disease, respiratory disease, endocrine disease, and significant injury other than TBI.

