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ORIGINAL REPORT

IMPACT OF PERSONAL AND ENVIRONMENTAL FACTORS ON EMPLOYMENT OUTCOME TWO YEARS AFTER MODERATE-TO-SEVERE TRAUMATIC BRAIN INJURY

Marit V. Forslund, MS[1,2], Cecilie Røe, PhD[1,2], Juan C. Arango-Lasprilla, PhD[4], Solrun Sigurdardottir, PhD[3,5] and Nada Andelic, PhD[1,3]

From the [1]Department of Physical Medicine and Rehabilitation, Oslo University Hospital, [2]Faculty of Medicine, University of Oslo, [3]CHARM (Research Centre for Habilitation and Rehabilitation Models and Services), Faculty of Medicine, University of Oslo, Oslo, Norway, [4]IKERBASQUE (Basque Foundation for Science), University of Deusto, Bilbao, Spain and [5]Sunnaas Rehabilitation Hospital Trust, Akershus, Norway

Objectives: **To describe employment outcomes and assess the impact of personal and environmental factors on employment outcomes 2 years after moderate-to-severe traumatic brain injury.**

Design/subjects: **A prospective cohort of 100 patients with moderate-to-severe traumatic brain injury, aged 16–55 years, hospitalized in a Trauma Referral Centre during the period 2005–2007 and followed up at 1 and 2 years post-injury.**

Methods: **Variables of interest were divided into personal and environmental factors. Personal factors include socio-demographics (age, gender, education, work demands, marital status and child-care). Environmental factors included social (support by friends), institutional (number of rehabilitation services, need for well-coordinated healthcare services), and physical (access to own transportation) factors. A multivariate logistic regression analysis was conducted with employment (working part-/full-time or studying) at 2-year follow-up as the dependent variable, and including independent variables based on significance from a univariate analysis, adjusting for injury severity.**

Results: **At the 2-year follow-up, 44% of patients were employed. Patients with less severe injuries (odds ratio (OR) = 1.2, $p = 0.03$), those supported by friends (OR = 3.5, $p = 0.07$), those not in need of well-coordinated health services (OR = 4.1, $p = 0.04$), and patients driving a vehicle at the 1-year follow-up (OR = 8.4, $p < 0.001$) were more likely to be employed at the 2-year follow-up.**

Conclusion: **Rehabilitation professionals should be aware of the role of environmental factors when planning vocational rehabilitation services after traumatic brain injury.**

Key words: traumatic brain injury; environmental factors; employment; prospective study.

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Correspondence address: Marit Vindal Forslund, Olav M. Troviks vei 28 (H505), NO-0864 Oslo, Norway. E-mail: mvforslund@gmail.com

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INTRODUCTION

Traumatic brain injury (TBI) is a leading cause of death and disability in young adults (1). A large proportion of patients with moderate-to-severe TBI experience long-term physical and cognitive impairment as well as emotional and psychosocial problems, which often have negative effects on patients' independence and productivity (1–6). Employment is an essential area of participation for the entire working age population and is a particular challenge in TBI (7, 8).

Employment rates after TBI vary widely between studies. A review by Shames et al. (7) found that 13–70% of TBI patients returned to work (RTW) between 6 weeks and 7 years post-injury. A systematic review by van Velzen et al. (9) found that approximately 40% had returned to work 2 years after TBI. The discrepancy between studies may partly be due to variations in the data collected and a lack of consistency in methodologies. Different definitions of employment and employment systems may further increase the variance in reported rates. Some longitudinal studies have noted that employment rates increase over time after TBI (10, 11), whereas others have suggested increased unemployment among individuals with TBI (12).

Kreutzer et al. (11) investigated employment stability by following previously employed patients over a period of 4 years after injury. The study found that only 34% of patients were stably employed (employed at all 3 follow-up times). Twenty-seven percent were unstably employed (employed at 1 or 2 follow-up times), and 39% were stably unemployed. Fleming et al. (13) investigated whether the patients' work situation changed from before the injury to the follow-up an average of 3.5 years after TBI. A total of 46.5% patients had returned to work at follow-up. Of these patients, 74.5% were working in the same or a similar job as they had held before the injury.

Over the last decade, researchers have become increasingly concerned about the influence of personal and environmental factors on health and functioning after TBI (5, 7, 14). According to the International Classification of Functioning, Disability and Health (ICF) (15), personal factors are "the particular back-

ground of an individual's life and living, and comprise features of the individual that are not part of a health condition", such as gender, race, age, social background, education, profession, etc. Environmental factors are defined as "the physical, social and attitudinal environment in which people live and conduct their lives", such as products and technology, support and relationship, services, systems and policies.

Personal factors associated with lower employment rates after TBI include male gender, older age, less education, unemployment prior to injury, single status and affiliation with ethnic minority groups (5, 7, 11, 16–19). Among the environmental factors, Whiteneck et al. (20) reported that transportation barriers, surroundings, government policies, attitudes and the natural environment were related to less productivity 1 year post-injury. Vogenthaler et al. (21) found that the informal social support system was positively associated with employment outcomes at 4–7 years post-injury.

Less is known about the factors related to employment outcomes after TBI in Scandinavia (18, 22). There is reason to believe that the most important factors influencing employment in these countries differ from those reported in prior research with US samples. The Scandinavian countries are welfare states that provide healthcare, insurance against disability, sickness and unemployment, and old-age pensions for all citizens. There is a long tradition of organization and resource allocation within the Scandinavian healthcare systems for the comprehensive rehabilitation of patients with long-term disabilities (23). Such organization may lead to variation in the environmental factors that are important for employment outcomes in these countries compared with countries with other state systems.

The aims of this study were: (*i*) to describe employment outcomes 2 years after moderate-to-severe TBI; and (*ii*) to assess the role of pre-injury and 1-year post-injury personal and environmental factors in predicting employment outcomes 2 years after moderate-to-severe TBI in a Norwegian patient population. Because personal factors are generally not modifiable, we recorded environmental factors at the 1-year follow-up, to identify factors for which facilitation or intervention may be needed to improve outcomes in the later stages of injury.

MATERIAL AND METHODS

Design and study sample

A prospective cohort study was conducted with clinical follow-up evaluations at 1 and 2 years after injury. Patients with acute TBI were admitted to Oslo University Hospital, Ulleval, from May 2005 to May 2007. This hospital is the Trauma Referral Centre for the Southeast region of Norway, with a population of nearly 2.6 million people.

Inclusion criteria included: (*i*) age 16–55 years; (*ii*) residence in eastern Norway; (*iii*) admitted with International Classification of Diseases 10th edition (ICD-10) diagnosis S06.0–S06.9 within 24 h of injury; and (*iv*) considered to have moderate-to-severe TBI with a Glasgow Coma Scale (GCS) (24) score of 3–12 before intubation. Exclusion criteria included: (*i*) previous neurological disorders/injuries; (*ii*) associated spinal cord injuries; (*iii*) previously diagnosed severe psychiatric or substance abuse disorders; and (*iv*) unknown address or incarceration.

A total of 160 patients met the inclusion criteria. Twenty-seven patients (17%) refused to participate, and 23 (14%) died in acute or post-acute care. Ten (6%) patients had incomplete data and were later excluded, leaving 100 (63%) patients for analysis.

Assessments

Independent variables. According to the ICF classification system (15) and a study by Devitt et al. (14), the variables of interest were divided into personal and environmental factors. Personal factors include sociodemographic factors, such as age, gender, education, work demands, marital status and child-care. Environmental factors include social (support by friends), institutional (number of rehabilitation services used, use of long-term and well-coordinated healthcare services in the form of an individual plan), and physical (access to own transportation, i.e. driving a vehicle) factors.

Acute phase. Information on age (divided at the mean, ≤ 31 vs > 31 years), gender (male vs female), education (≤ 12 years vs > 12 years), marital status (living together with spouse/partner/family vs living alone), pre-injury employment status (employed vs unemployed) and work demands (physical or non-physical, blue or white collar, respectively) were collected in the acute phase. The Glasgow Coma Scale (GCS) score assessed initial injury severity and divided patients into moderate (score 9–12) and severe (score 3–8) TBI (24).

1-year follow-up. Employment status, marital status and child-care (yes vs no), support by friends (yes vs no), the spectrum of rehabilitation services used (i.e. access to community-based rehabilitation services: day care (nurse and/or personal assistant), physiotherapy, occupational therapy, speech therapy, psychologist, social worker and others) dichotomized into none vs 1 or more, having an individual plan (yes vs no), and driving a vehicle (yes (permitted to resume driving after accident) vs no (not permitted to resume driving or without driver's licence)) were registered at 1-year follow-up. Responsibility for child-care and support by friends were explored through the Community Integration Questionnaire (CIQ) and the questions "Who usually cares for the children in your home?" and "Do you have a best friend in whom you confide?", respectively (25, 26). In the present study, the internal consistency of the CIQ scale was measured with Cronbach's alpha and found satisfied ($\alpha = 0.827$). Child-care was dichotomized into yes ("yourself"/"yourself and someone else") and no ("someone else"/"not applicable").

Dependent variable. The outcome measure was employment status 2 years after TBI. Employment was dichotomized into employed and unemployed, where employment was defined as working part-/full-time or studying. An inclusive definition of employment was used including other productive activities, such as studying, as described in our previous studies (18, 6). The students denoted persons who are studying at a high school, college or university in order to enter particular professions. Working or studying full-time is equal to 37.5 productive hours per week (i.e. 100%) and part-time employment was defined as working less than 37.5 h per week. The unemployed group consisted of individuals with TBI who were unemployed or on sick leave/disability pension.

Procedure

Pre-injury and injury-related data were extracted from medical records in the acute phase. At 1- and 2-year follow-ups, an assessment was performed, and patients were interviewed by the physiatrist in the outpatient department. Due to patients' requests, 6 assessments and interviews were conducted in patients' homes.

The study was approved by the Regional Committee for Medical Research Ethics, East Norway, and the Norwegian Data Inspectorate. Written informed consent was obtained from all participants.

Statistical analysis

All analyses were performed using PASW (formerly SPSS) version 18.0. We used two-sided statistical analysis and a 5% significance level. Descriptive statistics, *t*-tests and Mann-Whitney *U* tests were used for continuous variables, and χ^2 were used for categorical variables.

Table I. *Personal and environmental factors at time of injury and 1-year follow-up in relation to employment 2 years after moderate-to-severe TBI* (n=*100)*

	Unemployed (*n*=56)	Employed (*n*=44)	*p*-value	Total (*n*=100)
Personal factors				
Age, years, mean (SD)	30.9 (11.6)	30.8 (11.2)	>0.30	30.9 (11.4)
Gender, *n* (%)			0.054	
Male	39 (70)	38 (86)		77
Female	17 (30)	6 (14)		23
GCS scores, mean (SD)	6.1 (3.0)	8.5 (2.8)	<0.001*	7.1 (3.2)
3–8	46 (82)	22 (50)		68
9–12	10 (18)	22 (50)		32
Education, *n* (%)			>0.30	
≤12 years	34 (61)	23 (52)		57
>12 years	22 (39)	21 (48)		43
Employment pre-injury, *n* (%)			0.007*	
Employed	40 (71)	43 (98)		83
Unemployed	16 (29)	1 (2)		17
Work demands, *n* (%)			>0.30	
Blue-collar	29 (52)	19 (43)		48
White-collar	27 (48)	25 (57)		52
Marital status pre-injury, *n* (%)			0.14	
Living alone	26 (46)	14 (32)		40
Living with spouse/partner/family	30 (54)	30 (68)		60
Marital status at 1-year, *n* (%)			>0.30	
Living alone	29 (52)	26 (59)		45
Living with spouse/partner/family	27 (48)	18 (41)		55
Care of children at 1-year, *n* (%)			0.067	
Yes	9 (16)	14 (32)		23
No	47 (84)	30 (68)		77
Environmental factors				
Cause of injury, *n* (%)			>0.30	
Traffic accidents	34 (61)	25 (57)		59
Other	22 (39)	19 (43)		41
Rehabilitation services at 1-year, *n* (%)			0.003*	
None	13 (23)	23 (52)		36
≥1	43 (77)	21 (48)		64
Support from friends at 1-year, *n* (%)			0.054*	
Yes	39 (70)	38 (86)		77
No	17 (30)	6 (14)		23
Individual plan at 1-year, *n* (%)			<0.001*	
Yes	27 (48)	4 (9)		31
No	29 (52)	40 (91)		69
Driving vehicle at 1-year, *n* (%)			<0.001*	
Yes	7 (13)	29 (66)		36
No	49 (88)	15 (34)		64

*$p \leq 0.05$. *p*-values from univariate logistic regression.
SD: standard deviation; GCS: Glasgow Coma Scale.

Univariate logistic regression analyses were conducted to examine differences in personal and environmental factors between unemployed and employed patients (Table I). We conducted a multivariate logistic regression analysis (Backward: Wald method) with employment at the 2-year follow-up as the dependent variable and included independent variables based on the significant factors from the univariate analysis. In addition, the model was adjusted for injury severity by including acute GCS scores as an independent variable. The categories with the highest number of patients were used as reference groups, except for the variables of support from friends, individual plan and pre-injury employment. Two regression models were developed, the first without and the second with employment status pre-injury as an independent variable. The literature indicates that employment before an injury is strongly associated with employment after the injury. Therefore, we chose to run a model without pre-injury employment in order to highlight the relationships of less frequently investigated factors. The results are presented as odds ratios (OR) with 95% confidence intervals (CI) and *p*-values, Nagelkerke and Cox & Snell R^2. Possible multicollinearity and the presence of outliers were examined before running the multivariate logistic regression analysis. The Hosmer-Lemeshow goodness-of-fit statistic was computed.

RESULTS

The study sample had a mean age of 31 years (standard deviation; SD 11.4), and 77% were men. Based on acute GCS scores before intubation, 68% of the patients had severe TBI, and 32% had moderate TBI. At the time of injury, 56 (67.5%) of the individuals in the employment group were working full-time, while 4 (4.8%) were working part-time and 23 (27.7%) were studying.

Table II. *Association between personal and environmental factors and employment 2 years after traumatic brain injury (TBI), model 1*

Variables	Code	OR	95% CI	*p*-values
Friends	0=yes, 1=no	3.455	0.900–1.469	0.071
Individual plan[a]	0=no, 1=yes	4.149	1.081–15.922	0.038*
GCS score	Continuous	1.223	1.018–1.469	0.031*
Driving vehicle	0=no, 1=yes	8.361	2.819–24.798	<0.001*

*$p \leq 0.05$.
[a]An individual plan is established to coordinate the need of long-term healthcare services.
GCS: Glasgow Coma Scale; OR: odds ratio; CI: confidence intervals.

Seventeen patients were categorized as unemployed at the time of injury. Of these patients, 8 were in fact unemployed, 1 was on long-term sick leave, 3 received work assessment allowances, and 5 were on disability pension. Differences in personal and environmental factors at the time of injury and at the 1-year follow-up in relation to employment status 2 years after moderate-to-severe TBI are presented in Table I.

Employment outcome 2 years after injury

Of all the patients, 50% were employed at 1-year follow-up. Eighteen patients (36.0%) worked full-time, 18 (36.0%) worked part-time and 14 (28.0%) were studying. Two years after the TBI, the employment rate had decreased to 44%. Twenty-six (59.1%) patients were working full-time, 15 (34.1%) were working part-time and 3 (6.8%) were studying. Of the 44 patients employed at 2-year follow-up, 40 patients (91%) were stably employed (employed at both follow-up times). Of these, 38 (95%) were working in a similar job at both the 1- and 2-year follow-ups. Of those who were stably employed, 28 patients (70%) had no change in the number of work hours, whereas 11 (28%) experienced an increase in the hours they worked, and only 1 person (3%) had a decrease in work hours. Of the 17 patients who were unemployed before their injury, only 1 was employed at both follow-up times. As shown in Table I, there were statistically significant differences between employed and unemployed patients in terms of personal factors regarding pre-injury employment and injury severity and in the environmental factors of support by friends, use of rehabilitation services, the presence of an individual rehabilitation plan, and driving a vehicle at the 1-year follow-up.

Table III. *Association between personal and environmental factors and employment 2 years post-TBI, model 2*

Variables	Code	OR	95% CI	*p*-values
Pre-injury employment	0=no, 1=yes	25.599	2.763–237.145	0.004*
Individual plan[a]	0=no, 1=yes	5.328	1.325–21.423	0.018*
GCS score	Continuous	1.210	0.994–1.473	0.058
Driving vehicle	0=no, 1=yes	7.851	2.365–26.064	0.001*

*$p \leq 0.05$.
[a]An individual plan is established to coordinate the need of long-term healthcare services.
GCS: Glasgow Coma Scale; OR: odds ratio; CI: confidence intervals.

Predictors of employment 2 years after injury

The first multivariate logistic regression model showed that patients with less severe injuries had a 1.2-times higher probability (OR = 1.2, p=0.03) of being employed at the 2-year follow-up than those with more severe injuries. Patients with support from close friends had a 3.5-times higher probability of being employed at the 2-year follow-up, with a p-value approaching the significance level (OR = 3.5, $p = 0.07$). Patients without an individual plan of rehabilitation had a 4.1-times higher probability of being employed (OR = 4.1, $p = 0.04$), and patients driving a vehicle at the 1-year follow-up had an 8.4-times higher probability (OR = 8.4, $p < 0.001$) of being employed (Table II). Gender and rehabilitation services were clearly not significant in multivariate models ($p = 0.5$ and $p = 0.6$, respectively). The model as a whole explained 38% (Cox and Snell R^2) and 51% (Nagelkerke R^2) of the variance in employment status and correctly classified 79% of cases. The Hosmer-Lemeshow goodness-of-fit test found that the model was good (p=0.28).

When pre-injury employment was included as an independent factor in the second regression analysis, we found that previously employed patients had a 25.6-times higher probability of being employed 2 years post-TBI (OR = 25.6, $p = 0.004$). Injury severity by GCS score was marginally significant ($p = 0.058$). Patients without an individual plan of rehabilitation had a 5.3-times higher probability of being employed (OR = 5.3, $p = 0.02$), and patients driving a vehicle had a 7.9-times higher probability of being employed at the 2-year follow-up (OR = 7.85, $p = 0.001$) (Table III). Gender ($p = 0.5$), friends (p=0.4) and rehabilitation services ($p = 0.4$) were not significant factors. The second model explained 44% (Cox and Snell R^2) and 59% (Nagelkerke R^2) of the variance in employment status and correctly classified 82% of cases. The Hosmer-Lemeshow goodness-of-fit test showed that the second model was also good ($p = 0.20$).

DISCUSSION

This study attempted to describe employment outcomes 2 years after injury, and to assess the role of personal (gender, age, education, work demands, marital status and child-care) and environmental (support by friends, number of rehabilitation services used, individual plan, driving vehicle) factors in predicting employment outcomes 2 years after moderate-to-severe TBI when adjusting for the acute GCS score. The employment rate at the 2-year follow-up was 44%, and the majority of the patients were considered stably employed. Of the personal factors, age, gender, education, work demands, marital status and responsibility for child-care were not significant predictors. Of the environmental factors, the presence of an individual rehabilitation plan and driving a vehicle were significant predictors of employment 2 years after TBI in both multivariate models. As expected, pre-injury employment was a highly significant predictor of employment outcome at the 2-year follow-up.

The employment rate at the 2-year follow-up was similar to those reported in the van Velzen et al review (9). Previous studies have shown an increase in employment rates over time after TBI (10, 11). However, this was not the case in our study, where the employment rate of 50% at 1 year after TBI dropped to 44% 2 years after injury. This decrease may be understood in the context of Norway as a welfare state. A large proportion of the patients with long-lasting impairments will qualify to receive disability pensions within 2 years after TBI and may therefore not have to return to work. It is well known that changes in the economic climate may lead to a fall in employment. The last employed worker who gets into a company is usually the first to go when cuts are made. However, we do not believe that this was the case in the present study, as the global economic crisis in 2008–2009 has had a significantly smaller impact on Norway compared with other European countries. Furthermore, the fact that the majority of employed patients were stably employed at 2 years may indicate that employers are willing to adapt the working situation to keep them in their jobs, thus reflecting the "cooperative agreement for a more inclusive work place" introduced in Norway in 2004 (http://www.nav.no/).

In contrast to other studies (14), gender was found to be a non-significant predictor of employment outcome 2 years after TBI (10, 14). A limited study sample ($n = 100$) and a small amount of women ($n = 23$) may explain this finding. It was more surprising that neither age nor education were significant predictors, a finding that was in contrast to the literature (27). Many researchers have set the age of 40 years as a cut-off for predicting successful RTW after TBI, where patients below the age of 40 years fare better than older adults (28–30). The limited age range and the fact that only 24% of our patient sample was between 40 and 55 years of age are possible explanations for the finding that age was not a significant predictor in this study.

In line with the study by Keyser-Marcus et al. (30), education level was not a significant predictor in this study. A substantial number of studies support the role of education as predictor of employment outcome in patients with TBI. Gollaher et al. (19) found that education, pre-injury productivity (employment/studying) and level of disability correlated significantly with employment status 1–3 years following TBI. Some possible reasons for the discrepancy between our findings and the literature may be the categorization of education used in this study, a similar frequency of high and low educational groups and the stability of the labour market in Norway.

Marital status was not found to be a significant predictor of employment outcome, in line with some studies (21, 31) and in contrast to others (11, 32). Kreutzer et al. (11) found that married couples were more likely to be employed and to remain stably employed. However, the majority of patients in this study had a stable living situation during the first year after the injury.

Work demands, dichotomized into white-collar (professional, managerial or administrative) and blue-collar (manual labour) work, were not a significant predictor of employment status in this study. However, the existing literature reveals a trend in the relationship between work-type and RTW after TBI. Walker et al. (33) showed that individuals with TBI in prior professional/managerial positions were 3.0 times more likely to RTW than those in manual labour positions. Fleming et al. (13) also found that pre-injury occupational status was a significant predictor of RTW, and patients with prior upper-status occupations were more likely to RTW after TBI. A likely explanation for the discrepancy in the findings between our study and other studies is that the majority of patients in both qualification groups had a stable work experience prior to injury.

Pre-injury employment status and injury severity are known to be strong predictors of post-injury return to work (30, 34, 35). In our previous study (18), we found that the probability of being employed 1 year after injury was 95% lower for pre-injury unemployed patients and 74% lower for patients with more severe brain injury. The main explanation for these findings is that individuals with work experience prior to injury and those with less severe injuries cope better with employment reintegration.

Social support, including family members, friends and community members, was viewed as necessary for successful RTW (36). Support by close friends approached the significance level as a predictor in the first regression model. When prior employment status was included in the model, having friends was no longer a significant predictor. A possible reason might be that many of the friendships were established at and maintained through work, so that the effect of having friends coincided with employment status. In fact, three-quarters of the patients who reported no friends support were in the non-employed group. However, very few studies have focused on friendship in relation to TBI. It has previously been reported that persons with severe TBI are at a high risk of social isolation and significantly decrease in their friendships and social support as well as limited opportunities to establish new social contacts and friends (37). A study by Engberg & Teasdale (38) suggested that the ability to retain a network of family and friends may be an important factor for long-term survival after TBI.

Institutional support, such as the number of rehabilitation services, was not a significant predictor in this study. In contrast, the need for well-coordinated healthcare and rehabilitation services was a highly significant predictor. In Norway, the most central rehabilitation tool for patients in need of long-term and well-coordinated healthcare services is the individual plan, in accordance with statutory regulations (Law for patients rights 1999) (39). Patients with an individual plan often used several coordinated rehabilitation services, indicating more severe impairments. Thus, it was not surprising that the presence of an individual plan was a significant negative predictor for RTW after TBI. Our results are in accordance with the study by Bowman (40), which found that individuals who used several rehabilitation services had lower levels of occupational activity. In contrast, Vogenthaler et al. (21) found that a high level of use of rehabilitation adjustment services was associated with greater productivity.

Kreutzer et al. (11) reported that subjects who could drive their own vehicle 1 year after a TBI were more than 4 times more likely to be stably employed than those who had to rely on others for transportation. Klonoff et al. (27) found that returning to driving was significantly related to competitive status (working/in school) at follow-up 1–7 years after brain injury. For those who were unable to drive, the availability of transportation support was noted to be the strongest instrumental element that influenced RTW after TBI (36). We found that patients who had resumed driving at the 1-year follow-up were approximately 8 times more likely to be employed 2 years after moderate-to-severe TBI than those who were dependent on others for transportation. Patients' driver's licences were revoked after their intracranial brain injuries. To obtain permission to resume driving, patients with TBI must undergo multidisciplinary assessments in order to determine whether they are able to drive, including medical evaluations, neuropsychological assessments, driving simulators and on-road evaluations (41). Individuals who resume driving may be less severely injured and more cognitively able to perform the complex task of driving (which transfers to complex work tasks). In addition, having a car would suggest a higher income because it is expensive to pay for both a licence and a car.

This study has limitations that should be considered when interpreting the results. The study included patients aged 16–55 years who experienced a moderate-to-severe TBI 2 years previously. Therefore, the results may not generalize to patients outside this age range, to patients with mild TBI, or to individuals more than 2 years post-injury. Based on the findings of the regression models, there are other unmeasured factors (such as functional status) that may have a significant effect on employment outcomes.

The study results shed light on several environmental factors that could influence vocational outcome after TBI. The findings support existing evidence on relationships between pre-injury employment, injury severity and future employment outcomes. Of the environmental factors, support from close friends tended to be a positive predictor, whereas the presence of an individual rehabilitation plan was a negative predictor of employment outcomes. Access to one's own transportation was a strong positive predictor of employment at the 2-year follow-up. The data reveal that the important personal and environmental factors influencing employment outcome in the welfare state of Norway did not differ from prior studies from the USA. Rehabilitation professionals should be aware not only of the patients' functional status, but also of the physical, social and attitudinal environment, when planning vocational rehabilitation services after TBI. Interventions designed to improve the employment outcome of patients with TBI should integrate this complexity and include rehabilitation efforts targeting social relations in order to secure best outcomes for patients, and future research should focus on such environmental interventions. In addition, future studies with a mixed model design are required to further explore the relationship between environmental factors and employment outcome.

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