INTENSIVE MULTI-DISCIPLINARY OUTPATIENT REHABILITATION FOR FACILITATING RETURN-TO-WORK AFTER ACQUIRED BRAIN INJURY: A CASE-CONTROL STUDY

Gabriela MORENO LEGAST, MD1, Amandine DURAND2, Tatiana ABOULAFIA BRAKHA, PhD3, Armin SCHNIDER, MD2 and Adrian G. GUGGISBERG, MD3,4

From the 1Division of Neurology, Department of Clinical Neuroscience, 2Division of Neurorehabilitation, Department of Clinical Neuroscience, 3Division of Psychiatry, Department of Clinical Neuroscience, University Hospital of Geneva, Geneva and 4Universitäre Neurorehabilitation, Universitätsklinik für Neurologie, Inselspital, University Hospital of Berne, Bern, Switzerland

Objective: Return-to-work is often the most important objective of working-age patients with acquired brain injury, but is often difficult to achieve. There is a lack of evidence for effective treatment. This study aimed to assess the benefit of a multi-disciplinary neurorehabilitation in a daytime hospital on return-to-work after an acquired brain injury.

Design: Retrospective case-control study.

Patients: Acquired brain injury patients between 18 and 65 years of age.

Methods: Two periods, before (n=82 patients) and after (n=89 patients) the implementation of a daytime hospital in our neuro-rehabilitation unit were compared. Patients followed in the daytime hospital received intensive, interdisciplinary, coordinated, individual and group-level physical, cognitive, and vocational rehabilitation. During the control period, patients received outpatient neurorehabilitation with less intensive treatment without interdisciplinary coordination. The main outcome was the proportion of patients returning to >50% of their premorbid work activity.

Results: Fifty-five percent of patients were able to resume more than 50% of their premorbid work level in the daytime hospital period vs 41% in the control period (p = 0.076).

Conclusion: Intensive and coordinated outpatient neurorehabilitation may facilitate return-to-work after an acquired brain injury.

Key words: acquired brain injury; fatigue; return-to-work; daytime hospital; neurorehabilitation; vocational rehabilitation.

Accepted Jun 29, 2022; Epub ahead of print July 21, 2022

J Rehabil Med 2022; 54: jrm00313

DOI: 10.2340/jrm.v54.416

Correspondence address: Adrian Guggisberg, Universitätsklinik für Neurologie, Inselspital, CH-3010 Bern, Switzerland. E-mail aguggis@gmail.com

Acquired brain injury (ABI) is a major public health issue because of its prevalence and its consequences in terms of survival, handicap and global costs (1). In people of working age, work is a major part of their daily life activities and is essential for their physical and psychological well-being, as well as for their social integration (2, 3). However, the rate of return-to-work after an ABI is variable (3–5), with a mean of only 40% of patients returning within 2 years post-injury (6). The rate of return-to-work seems to depend on many factors (3, 5, 7), which are debated. Some factors are non-modifiable, such as age, comorbidities, and those related to the ABI cause. Some factors are modifiable, such as the symptoms the patients present, the therapies they receive (6), and adaptations of the workplace.

Therapies such as physical reconditioning, cognitive behavioural therapy and occupational therapy are usually recommended based on limited evidence, as they may improve post-ABI symptoms such as fatigue, diminished muscle strength, pain, or psychological and neuropsychological disorders (8–12).
However, access to these interventions is often limited, in part because there remains an urgent need for evidence about the utility of intensive outpatient rehabilitation for facilitating return-to-work. On the contrary, a previous study has suggested that medical consultations by rehabilitation specialists combined with low-intensity therapy is not more effective for facilitating return-to-work than follow-ups by general practitioners (13).

In our rehabilitation centre, we propose since April 2016 interdisciplinary, intensive and structured interventions in a daytime hospital targeted towards improvement in modifiable factors for return-to-work, such as physical deconditioning, fatigue, and cognitive and emotional symptoms. Based on limited existing evidence, patients receive physical cardio training and muscle strengthening, neuro-psychological support with cognitive-behavioural compensation strategies, occupational therapy specialized in returning to work and integrating the employer in the patient care, and medical visits with a specialist in neurorehabilitation. Other treatments are applied as needed by the individual patient.

In order to evaluate the utility of interdisciplinary outpatient neurorehabilitation, a retrospective case-control study was performed verifying whether the rate of patients with ABI who return to work improved after the opening of the daytime hospital. Cases were compared with a control group of patients with ABI who were treated, during the 2 years before the opening of the daytime hospital, through outpatient visits with less treatment intensity and without interdisciplinary coordination.

### MATERIAL AND METHODS

**Patients**

This is a retrospective case-control study comparing 2 periods: patients followed before introduction of the daytime hospital in the Division of Neurorehabilitation, University Hospital Geneva, Switzerland (“Pre” period, 1 January 2014 to 31 December 2015) and patients treated during the first 2 years of the daytime hospital (“Coord” period, 1 April 2016 to 31 March 2018). The last follow-up was in April 2021. All outpatients who were between 18 and 65 years old and seen during these periods were identified based on the hospital’s registry of outpatient visits and screened independently by 2 physicians for the following criteria, which were the same for both periods.

Patients were included if they: (i) were > 18 years old and younger than the age of retirement (<65 years); (ii) had had an ABI (traumatic or non-traumatic); (iii) were unable to work since their ABI; (iv) were followed-up in our daytime-hospital or our outpatient consultation. The patients were excluded if they: (i) were not working before the ABI; (ii) had less than 2 follow-up visits in our unit in the return-to-work period; (iii) had no attainable goal of work resumption, i.e., if they were considered definitively unable to work without prospect of regaining any remunerated work already before or at the first outpatient visit.

The ethics committee of the canton of Geneva approved all study procedures. Most patients have given general consent for usage of their clinical data at the University Hospital of Geneva. In order to avoid biased data due to missing values, anonymized analysis of all patients was performed, as approved by the ethics committee.

This study is not registered in a clinical trial registry.

**Interventions**

Before the implementation of the daytime hospital (Pre period), patients received outpatient therapies given by each therapist as prescribed by physicians without formal, interdisciplinary coordination meetings. Medical visits with a specialist in neurorehabilitation started at approximately 6 weeks after leaving the hospital. Medical follow-ups were performed every 4–8 weeks to check the evolution and adjust treatment. Decisions for treatment adjustments were made by the physician after bilateral discussions with therapists. Visits were adapted to the patient’s needs and professional situation and continued until a final stable work level was reached or a final decision of inability to work was made.

Since the introduction of the daytime hospital (Coord period), patients can be admitted to a daytime hospital if they need at least 2 different types of therapy at our division and interdisciplinary coordination between the therapists and the physicians. The organization of the daytime hospital includes medical visits with a specialist in neurorehabilitation starting within 2 weeks after leaving the hospital, at the beginning of outpatient therapy. Therapies are more intensive and applied several days a week for several weeks (usually 3 months). Group interventions are also applied (see below). In addition, the interdisciplinary team of physicians, nurses and therapists meet on admission, every 4–6 weeks, and at the end of the intervention. This enables clear goal definition and treatment adjustment according to the evolution. Medical follow-up visits and therapies were then continued with individualized frequency until a stable final return-to-work rate was reached or until the decision of a definite inability to work.

If patients do not meet the above-mentioned criteria for daytime hospital, they are followed by outpatient visits without interdisciplinary coordination, similarly to during the Pre period. The inclusion of all patients...
Outpatient neurorehabilitation for return-to-work

Patients were followed at our division during the periods of interest, 171 patients satisfied the inclusion and exclusion criteria: 89 in the *Coord* period and 82 in the *Pre* period (Fig. 1). Among the remaining patients, 49% were excluded because they had a different diagnosis than acquired brain injury, 23% because they were not working before the ABI, 24% because they had less than 2 follow-up visits or were not followed for return-to-work, and 3% were excluded because they had no attainable goal of work resumption.

Statistical analysis

The continuous variables were compared between *Pre* and *Coord* periods with Wilcoxon rank-sum test, given the ordinal character and often non-normal distribution of the data. Binary variables were compared between the 2 periods with $\chi^2$ statistics.

RESULTS

Out of 598 outpatients who were between 18 and 65 years old and followed at our division during the periods of interest, 171 patients satisfied the inclusion and exclusion criteria: 89 in the *Coord* period and 82 in the *Pre* period (Fig. 1). Among the remaining patients, 49% were excluded because they had a different diagnosis than acquired brain injury, 23% because they were not working before the ABI, 24% because they had less than 2 follow-up visits or were not followed for return-to-work, and 3% were excluded because they had no attainable goal of work resumption.
Outpatient rehabilitation started after acute care and, in most patients, after inpatient neurorehabilitation. The first medical consultation occurred significantly earlier during the Coord period (median 58 days after ABI onset ± 58 days interquartile range after onset of the ABI) than the Pre period (87 ± 56 days), \( p = 0.0005 \), in accordance with the differing protocols. Follow-up continued until a median of 527 days after ABI onset (± 502 interquartile range) after onset and did not differ between the periods (\( p = 0.1 \)). In the Coord period, 75% of patients were admitted to the daytime hospital because they satisfied the criteria of needing at least 2 different types of therapy with interdisciplinary coordination between them, whereas the remaining had regular outpatient visits with the physician and therapists without coordinating meetings, as during the Pre period.

The patients were comparable in the 2 periods concerning age, sex, the type of ABI (diagnosis), premorbid work level and type, and their functional independence (Table I).

The Intensity of treatment was significantly higher during the Coord than the Pre period (Table II). This should be interpreted with caution as treatments outside the hospital, in private practices, were not registered in our data. On the other hand, cognitive and vocational rehabilitations are rarely or not available outside of our institution.

More patients were able to resume more than 50% of their premorbid work level in the group of patients attending to the daytime hospital compared with the control group (55% vs 41%; \( p = 0.076 \)) (Fig. 2), which corresponds to an estimated odds ratio of 1.73.

The final return-to-work rate also tended to be higher (Fig. 3). During the 2 years before introduction of the daytime hospital, the median final work rate was 45% of the premorbid level. This increased to 80% since introduction of the daytime hospital programme. Due to the great variability between patients, the study was underpowered to reveal a significant difference (\( p = 0.187 \)).

The proportion of patients who tried to resume work but failed and remained definitely unable to work was 19% for both periods (\( p = 0.99 \)), thus demonstrating that the higher number of patients resuming work did not lead to more reinsertion failures.

### DISCUSSION

This analysis reveals an encouraging trend that intensive interdisciplinary outpatient neurorehabilitation can facilitate return-to-work after ABI. Although it is difficult to compare studies examining return-to-work after ABI due to different populations, follow-up times, and interventions (3, 5, 6, 14), the return-to-work rate after ABI in the current study is comparable with that specified in previous studies with approximately 40% of patients resuming > 50% of premorbid work levels during the control period (6). We find a trend that this percentage can be improved to approximately 55% if the patients benefit from intensive, coordinated, multi-disciplinary neurorehabilitation.

The techniques used in this study are in alignment with current recommendations for patients with ABI and a goal of returning to work. These recommendations are mostly pragmatic and based on limited evidence. Fatigue is a frequent symptom after ABI, which is directly associated with non-returning to work (15–18) and which may be modifiable with treatment.
ABI and fatigue are further associated with symptoms such as anxiety and depression (19, 20). Indeed, patients with brain injury often present mood disturbances and emotion dysregulation that may benefit from a psychotherapeutic intervention (21). Cognitive behavioural therapy has been shown to be effective for treating anxiety and mood disorders (8). Cognitive behavioural therapy is also suitable for patients with neurological disorders, as it is patient-tailored and allows compensation for cognitive and sensory-motor dysfunctions (9). One study in patients with multiple sclerosis has found that cognitive-behavioural interventions are effective for reducing subjective fatigue (10). Thus, patients received individual and group-based psychotherapeutic treatment with a cognitive-behavioural approach.

Moreover, as cognitive dysfunction, such as attentional and executive impairment and psychomotor slowing, are often present (18, 19), neuropsychological rehabilitation was applied despite limited evidence.

Patients with ABI are often deconditioned, which may lead to reduced efficacy of the motor system in patients with ABI and fatigue symptoms. Indeed, low excitability of motor cortex (22) and diminished muscle contraction (11) have been revealed in patients presenting post-stroke fatigue. Based on these observations, patients received physical reconditioning through cardio exercise and muscle strengthening. There is evidence that physical training enhances physical endurance after stroke (23), but the effect on fatigue and mental endurance is not clear (24).

Finally, patients participated in occupational therapy (vocational rehabilitation), as a meta-analysis assessing the efficacy of interventions on the return-to-work rate concluded that early, personalized occupational therapy with implication of the employer and adaptation of work and work-space is most useful (12, 25).

Since our patients benefited from multiple different interventions, it is not possible to determine which factors contributed to the observed improvement. Clearly, the increased intensity may play a role (26, 27). The interdisciplinary coordination may also be useful, as previous studies suggested that daytime hospital settings can enhance the achievement of rehabilitation goals (28). We do not know if one intervention in particular was effective.

This study presents further limitations. This is a retrospective case-control with a historic control group, which has known issues. In our context, we cannot fully exclude that thrombolysis procedures of acute stroke may have improved during the 4 years of evaluation of this study, but the comparable level of functional independence between periods does not point to such an effect. The statistical power is low because of a large variability between the patients. There may be confounding factors because the return-to-work after an ABI depends on many different variables including premorbid conditions and work relationships.

Yet, the study provides real-life evidence that intensive interdisciplinary outpatient rehabilitation can be a useful resource for patients of working-age. This can be relevant not only for the patient’s quality of life, but also for economic questions, as delayed or absent return-to-work after ABI represents high costs to the society. It is therefore likely that the greater cost related to increased therapy doses in the current study (median 7,811 Swiss franc (CHF) during Coord compared with 1,836 CHF during Pre) are more than compensated later.
In conclusion, this retrospective case-control study shows a trend towards a benefit of a daytime hospital programme comprising multi-disciplinary interventions for return-to-work after an ABI. This should be confirmed in a prospective randomized evaluator-blinded trial, although this may be ethically and practically difficult to achieve. A power analyses based on the effect size in the current study data suggests that a sample size of 213 patients per group will give 80% power to detect differences in the percentage of patients resuming > 50% of premorbid work level between the groups at \( p < 0.05 \).

REFERENCES