ORIGINAL REPORT

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

Gabriela MORENO LEGAST, MD[1], Amandine DURAND[2], Tatiana ABOULAFIA BRAKHA, PhD[3], Armin SCHNIDER, MD[2] and Adrian G. GUGGISBERG, MD[2,4]

From the [1]Division of Neurology, Department of Clinical Neuroscience, [2]Division of Neurorehabilitation, Department of Clinical Neuroscience, [3]Division of Psychiatry, Department of Clinical Neuroscience, University Hospital of Geneva, Geneva and [4]Universitäre 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 inter-disciplinary 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, Universitäre Neurorehabilitation, 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).

LAY ABSTRACT

Acquired brain injury is a common health issue, most frequently caused by head trauma or stroke. Acquired brain injury patients of working age often have difficulties in returning to work, which greatly impairs their quality of life. They often receive insufficient rehabilitation care, partly also because of a lack of evidence regarding intensive rehabilitation in this patient group. This study aimed to assess the benefit of multi-disciplinary neurorehabilitation in a daytime hospital on return-to-work after acquired brain injury. The study compared the rate of return-to-work during the first 2 years after implementation of a daytime hospital to a control period of 2 years before. The daytime hospital provided 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 results show that more patients were able to resume work, at more than 50% of their premorbid work level, since the introduction of the daytime hospital.

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

during both periods reduces the risk of selection bias, which would otherwise occur due to the selection of patients with better rehabilitation potential.

Individual and group-based progressive physical training. Patients participated in twice-weekly group sessions with cardio training and muscle strengthening on workout devices in a gym room, supervised by 1 or 2 physical therapists. Exercises were individually adapted to the patients need and progress by the therapist. Furthermore, they had free access to the gym room for further individual sessions. Patients with particular needs or with difficulties in participating in groups received individual physical therapy with or without additional group therapy.

Neuropsychological rehabilitation. patients were assessed by trained neuropsychologists and speech therapists for cognitive dysfunction. If problems with language, memory, attentional or executive dysfunctions were noticed, an individual cognitive rehabilitation was proposed. This was adapted to the individual patient need.

Individual and group-based cognitive behavioural therapy. Cognitive behavioural therapy is a well-structured and goal-oriented psychotherapeutic approach. Patients learned to identify their emotions, thoughts and behaviour (such as fatigue, anger, anxiety) in different situations, as well as to incorporate progressively changes in the way they think and act. Individual therapy was applied to target individual problems in a personalized and specific way. This was complemented by a group approach in order to improve the dynamics of changes and to give a platform to patients for sharing common difficulties and supporting each other.

Pre-professional occupational therapy (vocational rehabilitation). Occupational therapists analysed the requirements of the workstation and assessed the person's functional limitations that could interfere with their professional tasks. They also investigated the requirements of the job and the work environment. Then they proposed appropriate retraining with concrete exercises to achieve a better balance between the person's abilities and the requirements of the job, which is a positive predictor of return to work. In collaboration with other therapists, physicians, employers and insurance companies, they organized the return to work under the conditions that were best adapted to the person's disabilities and the company's needs. During the professional reinsertion, patients were followed at least monthly by vocational therapists with individual adaptations of the workspace, work level, and performance provisions. Patients benefited from individualized training and counselling to improve in tasks and abilities that were relevant to their work. They also benefitted from meetings with experts from insurance and invalidity counsellors and they followed courses or education as needed for their new work situation.

Outcomes and data collection

Two physicians who were blinded to the treatments received by the patients collected data retrospectively through a systematic review of clinical and administrative files of the patients. Pre-morbid level of work was defined as the total contractual employment level of each patient, with 100% representing full-time employment, i.e. typically 40 h per week in Switzerland. Final work levels were obtained from the last medical certificate given by the treating physician. We verified that the final work level was tolerated on the long-term by follow-ups until a stable work percentage was obtained. Patients who needed to stop or reduce their work activity, not the maximum, but the final, work level was used. The primary outcome was the proportion of patients with a final work level of more than 50% of their pre-morbid work activity. The secondary outcome was the final return-to-work level in any paid work as a percentage of the pre-morbid level. Patients who dropped out from follow-up were contacted by phone and, if necessary, their treating physician was contacted. This enabled us to obtain outcome data for all included patients.

We additionally collected sociodemographic (age, sex, work activity), clinical (type of ABI, type and duration of therapies performed during the follow-up), and economic data (estimated therapy costs). Costs were computed as the total sum of reimbursement for therapies billed to the health insurances for each patient.

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 χ^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.

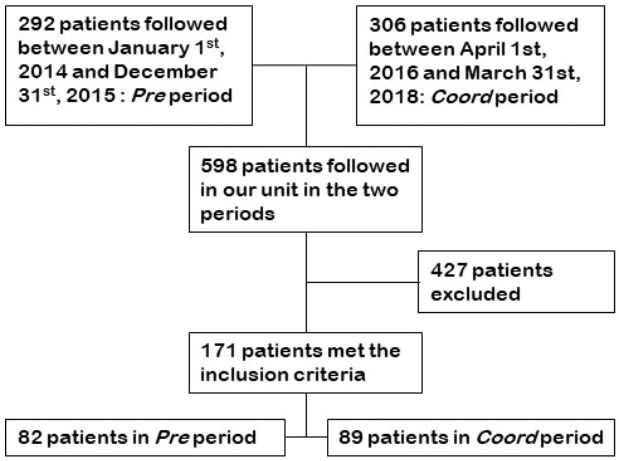

Fig. 1. Flow chart.

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.

Table I. Demographics and diagnoses of the 2 periods

	Pre	Coord	*p*-value
n total	82	89	
% in daytime hospital	0%	75%	< 0.0001
Age, years, mean ± SD	43.9 ± 12.2	44.1 ± 12.2	0.73
% women	30.5%	25.8%	0.50
Functional independence measure, mean ± SD	118.3 ± 8.5	119.9 ± 5.6	0.53
% with stroke	47.6%	40.4%	0.35
% with traumatic brain injury	32.9%	30.3%	0.72
Premorbid work level	96.5 ± 11.7%	95.5 ± 13.4%	0.48
% with physical work type	41.5%	33.7%	0.30
% with mental work type	32.9%	30.3%	0.71
% with management/executive position	8.5%	15.7%	0.15

SD: standard deviation.

Table II. Total treatment duration and costs per patient in the 2 groups during the entire treatment period

	Pre Median (range)	Coord Median (range)	*p*-value
Cognitive therapy, h	120 (0–4,520)	940 (0–5,270)	< 0.0001
Occupational therapy, h	405 (0–12,617)	1,475 (0–12,805)	< 0.0001
Physical therapy, h	0 (0–2,250)	480 (0–4,685)	< 0.0001
Estimated therapy cost, CHF	1,836 (0–23,114)	7,811 (0–429,44)	< 0.0001

CHF: Swiss franc.

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, multidisciplinary 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.

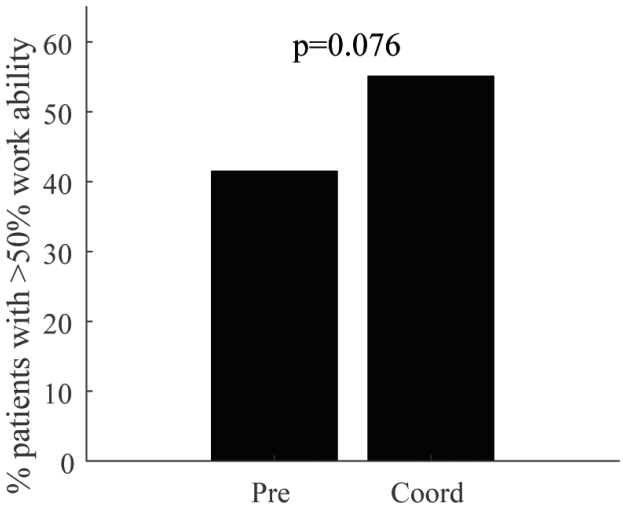

Fig. 2. Percentage of patients able to resume > 50% of their premorbid work level in *Pre* and *Coord* periods.

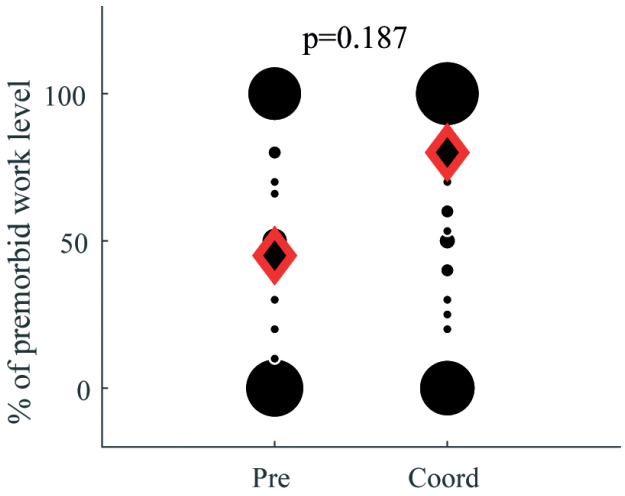

Fig. 3. Final return-to-work rate in *Pre* and *Coord* periods. Size of *circles* represents number of patients. Medians are shown as *diamond shapes with red borders*.

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

1. Feigin VL, Barker-Collo S, Krishnamurthi R, Theadom A, Starkey N. Epidemiology of ischaemic stroke and traumatic brain injury. Best Pract Res Clin Anaesthesiol 2010; 24: 485–494.
2. Saunders SL, Nedelec B. What work means to people with work disability: a scoping review. J Occup Rehabil 2014; 24: 100–110.
3. Westerlind E, Persson HC, Sunnerhagen KS. Return to work after a stroke in working age persons; a six-year follow up. PLoS One 2017; 1: 12.
4. Dahm J, Ponsford J. Long-term employment outcomes following traumatic brain injury and orthopaedic trauma: a ten-year prospective study. J Rehabil Med 2015; 47: 932–940.
5. Edwards JD, Kapoor A, Linkewich E, Swartz RH. Return to work after young stroke: a systematic review. Int J Stroke 2018; 13: 243–256.
6. van Velzen JM, van Bennekom CAM, Edelaar MJA, Sluiter JK, Frings-Dresen MHW. Prognostic factors of return to work after acquired brain injury: a systematic review. Brain Inj 2009; 13: 385–395.
7. Cancelliere C, Kristman VL, Cassidy JD, Hincapié CA, Côté P, Boyle E, et al. Systematic review of return to work after mild traumatic brain injury: results of the international collaboration on mild traumatic brain injury prognosis. Arch Phys Med Rehabil 2014; 95: S201–S209.
8. David D, Cotet C, Matu S, Mogoase C, Stefan S. 50 years of rational-emotive and cognitive-behavioral therapy: a systematic review and meta-analysis. J Clin Psychol 2018; 74: 304–318.
9. Doering B, Exner C. Combining neuropsychological and cognitive-behavioral approaches for treating psychological sequelae of acquired brain injury. Curr Opin Psychiatry 2011; 24: 156–161.
10. Thomas S, Thomas PW, Kersten P, Jones R, Green C, Nock A, et al. A pragmatic parallel arm multi-centre randomised controlled trial to assess the effectiveness and cost-effectiveness of a group-based fatigue management programme (FACETS) for people with multiple sclerosis. J Neurol Neurosurg Psychiatry 2013; 84: 1092–1099.
11. Wolkorte R, Heersema DJ, Zijdewind I. Reduced voluntary activation during brief and sustained contractions of a hand muscle in secondary-progressive multiple sclerosis patients. Neurorehabil Neural Repair 2016; 30: 307–316.
12. Donker-Cools BHPM, Daams JG, Wind H, Frings-Dresen MHW. Effective return-to-work interventions after acquired brain injury: a systematic review. Brain Inj 2016; 30: 113–131.
13. Vikane E, Hellstrøm T, Røe C, Bautz-Holter E, Aßmus J, Skouen JS. Multidisciplinary outpatient treatment in patients with mild traumatic brain injury: a randomised controlled intervention study. Brain Inj 2017; 31: 475–484.
14. Wang V, Fort E, Beaudoin-Gobert M, Ndiaye A, Fischer C, Bergeret A, et al. Indicators of long-term return to work after severe traumatic brain injury: a cohort study. Ann Phys Rehabil Med 2019; 62: 28–34.
15. Andersen G, Christensen D, Kirkevold M, Johnsen SP. Post-stroke fatigue and return to work: a 2-year follow-up. Acta Neurol Scand 2012; 125: 248–253.
16. Buunk AM, Groen RJM, Wijbenga RA, Ziengs AL, Metzemaekers JDM, van Dijk JMC, et al. Mental versus physical fatigue after subarachnoid hemorrhage: differential associations with outcome. Eur J Neurol 2018; 25: 1313–e113.
17. Palm S, Ronnback L, Johansson B. Long-term mental fatigue after traumatic brain injury and impact on employment status. J Rehabil Med 2017; 49: 228–233.
18. Radman N, Staub F, Aboulafia-Brakha T, Berney A, Bogousslavsky J, Annoni JM. Poststroke fatigue following minor infarcts: a prospective study. Neurology 2012; 79: 1422–1427.
19. Johansson B, Ronnback L. Mental fatigue and cognitive impairment after an almost neurological recovered stroke. ISRN Psychiatry 2012; 2012: 1–7.
20. Wu S, Kutlubaev MA, Chun HYY, Cowey E, Pollock A, Macleod MR, et al. Interventions for post-stroke fatigue. Cochrane Database Syst Rev 2015; 2015: CD007030.
21. Aboulafia-Brakha T, Ptak R. Effects of group psychotherapy on anger management following acquired brain injury. Brain Inj 2016; 30: 1121–1130.
22. Kuppuswamy A, Clark E V, Turner IF, Rothwell JC, Ward NS. Post-stroke fatigue: a deficit in corticomotor excitability? Brain 2015; 138: 136–148.
23. Saunders DH, Sanderson M, Hayes S, Kilrane M, Greig CA, Brazzelli M, et al. Physical fitness training for stroke patients. Cochrane Database Syst Rev 2016; 3: CD003316.
24. Zedlitz AMEE, Rietveld TCM, Geurts AC, Fasotti L. Cognitive and graded activity training can alleviate persistent fatigue after stroke: a randomized, controlled trial. Stroke 2012; 43: 1046–1051.
25. Ntsiea M V., Van Aswegen H, Lord S, Olorunju S. The effect of a workplace intervention programme on return to work after stroke: a randomised controlled trial. Clin Rehabil 2015; 29: 663–673.
26. Bell JA, Wolke ML, Ortez RC, Jones TA, Kerr AL. Training intensity affects motor rehabilitation efficacy following unilateral ischemic insult of the sensorimotor cortex in C57BL/6 mice. Neurorehabil Neural Repair 2015; 29: 590–598.
27. Kwakkel G, van Peppen R, Wagenaar RC, Wood Dauphinee S, Richards C, Ashburn A, et al. Effects of augmented exercise therapy time after stroke: a meta-analysis. Stroke 2004; 35: 2529–2539.
28. Bender A, Adrion C, Fischer L, Huber M, Jawny K, Straube A, et al. Long-term rehabilitation in patients with acquired brain injury – a randomized controlled trial of an intensive, participation-focused outpatient treatment program. Dtsch Arztebl Int 2016; 113: 634–641.