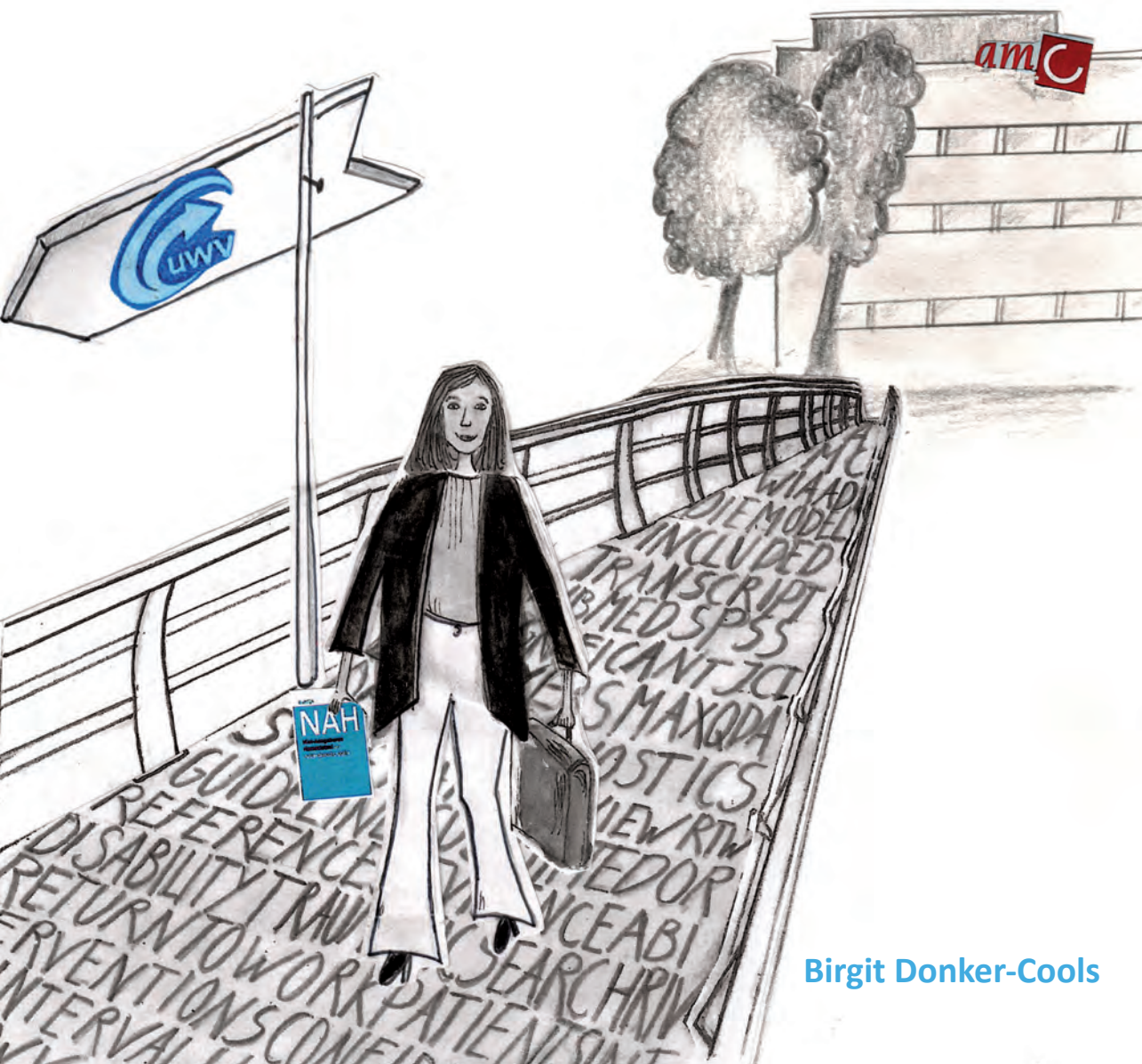
Acquired brain injury and work participation



Birgit Donker-Cools

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Contents

1

General introduction

Acquired brain injury

Acquired brain injury (ABI) is a well-recognized socioeconomic problem and occurs frequently in the Western world [1-4]. Stroke, one significant example of ABI, has a considerable annual incidence rate of more than 795000 people in the US [3]. Incidence rates for traumatic ABI are also high, varying between 47 to 694 cases per 100000 individuals every year in Europe [2] and 538 in the US [4]. In the Netherlands, the prevalence of ABI, as registered by general practitioners, comprised more than 645000 individuals in 2016 [5].

ABI occurs at all ages [3,5] and a substantial group of individuals with ABI are part of the working population [6-8]. In the Netherlands, the prevalence of ABI in the working population was 203600 in 2016 [9]. As many as 60% of these individuals are affected by traumatic ABI and up to 30% by ABI with a non-traumatic cause [6-8].

Of those individuals with ABI who were working before injury, on average, 40% return to work within two years [8], with return to work (RTW) varying considerably among both patients with traumatic (30-65%) [8] and non-traumatic brain injury (35-60%) [8]. This implies that more than half of the working population who suffer ABI do not return to work.

Patients with ABI attribute great value to work [10-15], which has also been found to be the case for patients with a chronic disease or disorder in general [14]. However, RTW is difficult for individuals who suffer from ABI due to its complexity and variable expression [11]. ABI is defined as an injury to the brain that occurs after birth and is not hereditary, congenital, degenerative or caused by birth trauma [16]. ABI has external or internal causes, and can be categorized into traumatic and non-traumatic ABI. Traumatic ABI may, for example, appear in high-energy trauma such as a motor vehicle accident, but might also be due to an accidental fall. Non-traumatic ABI typically results from cardiovascular disease, including cerebral ischemia or intracranial haemorrhage, or from hypoxia, infection, intoxication or neoplasm [16].

ABI has numerous adverse consequences that range from mild to severe and can be categorized into physical (e.g. paresis, paralysis), cognitive (e.g. attention deficits), and emotional/behavioural (e.g. anxiety, impulsive behaviour) domains, including psychiatric disorders, such as depression and post-traumatic stress disorder, which are more prevalent in the ABI population [16-18].

Acquired brain injury and work

ABI restricts the activities of daily life and social participation, and negatively affects RTW [6,19-21]. ABI is perceived as a disabling condition and, according to patients, recovery often takes a great deal of time [21]. For patients with ABI, RTW is connected to normality, growth [11,12], financial independence and social integration [10,12,14]. Patients mention the importance of social contact with colleagues in the workplace. For people with ABI, RTW creates feelings of acceptance by their environment and society as a whole [10-12,14,15]. RTW is considered an important outcome of successful rehabilitation [10,12-14,22] and is related to psychosocial and physical wellbeing [10-15,22] and a better quality of life [10,12,13,22]. Patients with ABI have reported that they are hindered in their job by various symptoms, and also mention complaints such as fatigue, or limitations in concentration and memory [10,21,23].

Moreover, patients with ABI may experience problems in communicating and do not always have adequate insight into their ABI and the related consequences [10]. These functional and cognitive problems after ABI are difficult to comprehend and may be invisible to colleagues and employers [10,21,23,24]. Several symptoms, such as paresis and coordination disorders, are easily detectable, while fatigue and cognitive disabilities that could make RTW difficult often go unnoticed [10,21,23-25].

Multidisciplinary care for the patient with ABI

After injury, patients with ABI are supported by multiple medical and paramedical professionals, such as neurologists, neuropsychologists, rehabilitation physicians, occupational therapists, physiotherapists, general practitioners and occupational physicians [26-28]. They all provide specific contributions to diagnosis, therapy, coaching and assessment. They rely on mono-disciplinary guidelines issued by their own medical and paramedical associations. As a consequence, the approach to care for patients with ABI is fragmented and therefore prone to inconsistency in advice and support. This could lead to low-quality care of patients with a chronic condition, specifically patients with ABI, who often require long-term support [29,30].

The effectiveness of inter-professional cooperation and the coordination of care in the RTW-process has been demonstrated in chronic diseases other than ABI [31,32]. A meta-analysis of nine randomized controlled trials revealed that assignment to RTW coordination during sick-leave leads to better RTW-outcomes when compared to usual care (risk ratio=1.08, 95% CI 1.03-1.13) [31]. Another study reported that RTW coordination and collaboration

between healthcare and occupational professionals results in quicker RTW in a subgroup of sick-listed patients with low back pain [32].

Role of the insurance physician in the return to work process

Insurance physicians (IPs) play a specific role in the multidisciplinary RTW-process of patients with ABI. IPs make decisions that have important consequences for the patient. In particular, the IP's principal task is to determine whether RTW may or may not be a realistic option for patients with ABI who have not been able to fully return to work during their initial two-year sickness absence. If work is still an achievable goal despite disabilities, the patient may be urged to return to work based on an IP's assessment. However, an IP may also conclude that the patient is no longer able to return to work, due to severe and permanent disability, but should receive a disability benefit, meaning that further activities or interventions aimed at work will cease.

IP assessments comprise a review of the preceding RTW-process, assessment of the functional abilities of patients with ABI and evaluation of the prognosis of functioning over the longer term. In other words, to accomplish their specific professional task, IPs are trained to evaluate the RTW-process and to assess functional abilities and prognosis of functioning.

In order to perform their assessment, IPs must gather information, with the patient being the most important source. IPs therefore conduct an assessment interview with the patient. During this interview, IPs explore the patient's social and medical history, and the actual complaints and restrictions faced in daily life activities and work participation, as perceived by the patient. During the assessment interview, verbal communication is the principle method used to obtain information from the patient [33]. However, patients with ABI often experience problems in such communication and do not always have adequate insight into their ABI and the related consequences due to cognitive problems [10,21]. Moreover, these cognitive problems may remain unnoticed during an IP assessment. To address this potential oversight and obtain more insight into the individual patient concerning diagnosis, comorbidity and treatment, as well as efforts made during the RTW-process, IPs could request additional information from other medical and paramedical professionals involved.

Additionally, in relation to their assessments, IPs should be able to recognize patients with ABI who are hindered from RTW and require extra support. Thus, IPs need to know which aspects are relevant to RTW of patients with ABI. It has been recognized that ABI has various and occasionally severe consequences and comorbidities, such as mental disorders,

which are frequent. In addition, IPs lack information about the patient's own perspective on RTW and what solutions would be the most adequate to help during the RTW-process. To evaluate the RTW-process and to assess prognosis of functioning, IPs need to know which aspects are relevant to RTW, offering input to support these patients. To provide this support and to evaluate guidance during the RTW-process, IPs also need information about effective interventions that could help patients with ABI to return to work. Therefore, our knowledge on these topics must be improved, with the aim of enabling IPs to perform evidence-based evaluations and assessments. This would also improve the quality of IP assessments and be of benefit to the patient [34].

Factors associated with return to work

IPs need to have insight into factors that are positively or negatively associated with RTW to improve their assessment and identification of patients for whom RTW may be hindered. A previous systematic review reported that, although numerous factors were investigated in the studies included, evidence for an association of these factors with RTW was limited [35]. In subsequent years, several studies have provided additional evidence [36,37], which warrants an update of our current knowledge, with the goal of better supporting IPs in identifying those patients for whom RTW is likely to be successful and those for whom it might be difficult.

Mental disorders in patients with acquired brain injury

Patients with ABI experience many difficulties in daily life, the causes of which include mental disorders, which are found to be more prevalent in the ABI population than the general population [17,18,38]. A previous study demonstrated that traumatic ABI is related to an elevated risk of depression (IRR=1.59, 95% CI 1.53-1.65) [39]. It was found that mental disorders (mood and anxiety disorders) were frequently not identified and remained untreated in individuals claiming a disability benefit [40]. In addition, other studies have reported that mood disorders were substantially left unaddressed in patients with ABI, and they emphasized the relevance of the recognition and treatment of these mood disorders [41-44]. Thus, mental disorders have been found to be related to disability in patients with ABI; however, the influence of mental disorders as a comorbidity on RTW of patients with ABI is unknown. Specific knowledge concerning the association of mental disorders as a comorbidity in patients with ABI may allow us to improve support during reintegration and RTW of these patients. This knowledge would also make IPs aware of potential untreated mental disorders in their assessments of functional abilities and their evaluation of the RTW-process of patients with ABI.

Effective interventions for return to work after acquired brain injury

Given the relevance of RTW for patients with ABI [10,12-15,22], it is essential that they are given assistance in the RTW-process. However, there remains a lack of knowledge on how best to give this support to patients with ABI. While one previous systematic review described several vocational rehabilitation programmes, evidence of the effectiveness of these programmes is weak and it remains unclear which RTW-interventions would be the best [45].

In recent years, new findings concerning RTW-interventions for patients with ABI have emerged [46-48]. As a consequence, a new international and systematic analysis of the relevant scientific literature is required. Scientific knowledge about effective RTW-interventions could help IPs to evaluate whether patients have been adequately supported during the RTW-process and, if not, whether these interventions could still be provided to assist patients with ABI to participate in work.

Perspectives of patients in the return to work process after acquired brain injury

In addition to the need for better insights into the latest findings in the scientific literature, the experiences of patients with ABI themselves during the RTW-process still remain relatively unknown. Studies reporting barriers to and facilitators of RTW based on patient perceptions are scarce [21]. Patients have mentioned that they would prefer to be actively involved in their own RTW-process, and would like to have the opportunity to discuss options to realize RTW with the healthcare professionals involved and their employer [10,49]. Knowledge about patient experiences in the RTW-process, specifically concerning the facilitators of and barriers to RTW, as well as solutions when, according to patients with ABI, RTW is hindered, could enable the professionals involved to target support to the individual patient. This knowledge could help IPs to better consider the personal needs of the patient during assessment and evaluation, and to determine whether there are solutions or certain arrangements that could be provided to facilitate the patient's RTW.

Perspectives of employers in the return to work process after acquired brain injury

Patients have also mentioned the importance of a good and confident relationship with their employer during the RTW-process. This requires an employer to take the needs and comfort of their employee into account [10,49]. It is important to note here that, in the Netherlands, it is not only the patient who is responsible for their recovery, but also the employer, who is obliged to be involved in and formally responsible for ensuring that an employee with ABI is provided with an adequate RTW-intervention.

When an employed individual has an illness or a disorder that hinders his participation in work, this ultimately results in sickness absence. During sickness absence, individuals are entitled to wage replacement from their employer. According to Dutch legislation, patient and employer are both responsible for the realization of RTW of the patient, and they are supported in this by an occupational physician. However, currently, employers have difficulties assisting their employees with ABI during the RTW-process due to a lack of knowledge and experience [24]. It has been found that both patients and employers face problems during the RTW-process. Thus, the perspective of employers on RTW needs to be investigated to determine how best to enable them to plan and realize RTW of an employee with ABI. An understanding of both the patient's and the employer's experiences in practice would also assist IPs to determine and evaluate whether in the preceding two years of sick leave all possible solutions and arrangements have been applied to assist the patient and employer during the RTW-process.

Application of scientific knowledge

An overview of the latest scientific knowledge concerning relevant aspects of RTW and effective RTW-interventions will be presented in the first part of this thesis. It is argued that this new scientific knowledge can support professionals involved in the RTW-process of patients with ABI, specifically occupational healthcare professionals, with a focus on IPs. In particular, this knowledge serves as a basis of IP care and support during the RTW-process, as well as decision-making in the assessment of functional abilities and the evaluation of the RTW-process after two years of sick leave.

Previous studies have demonstrated that this knowledge increases the quality of occupational healthcare professionals' care during the RTW-process [50] and IP assessments [34], which may result in higher inter-rater reliability of these assessments [51]. Therefore, this new scientific knowledge needs to be implemented in IPs' practice. Ideally, it should be made available to IPs, and IPs should adopt and learn to use it in daily practice. However, former studies have also demonstrated that the implementation process is difficult [52,53]. The availability and distribution of such knowledge among healthcare professionals is currently not sufficient to positively and systematically influence their behaviour, and there is no guarantee that these professionals apply this knowledge in their job [54,55].

The implementation difficulties have been extensively addressed in the literature [52,54,56-58]. Various studies have reported barriers to the implementation and application of new scientific knowledge [52,54,56-58]. These barriers are categorized into several aspects, such as knowledge-related, attitude-related and external barriers [52,57]. Examples of

these barriers include occupational healthcare professionals' lack of awareness of, or familiarity with new knowledge, and lack of motivation or time to apply new scientific knowledge [52,56-59].

Previous studies have also demonstrated that educational interventions could address occupational healthcare professionals' lack of knowledge and help these professionals to apply this knowledge in daily practice [54,60,61]. However, it is not known how IPs could best adopt new scientific knowledge about ABI and the RTW-process as a basis for their assessment of functional abilities, prognosis of functioning and evaluation of the RTW-process of patients with ABI. Therefore, the focus of the second part of this thesis will be to address how and whether IPs might gain scientific knowledge to support their assessments of patients with ABI.

An important step to implement scientific knowledge in IP practice consists of the development of a training programme.

Development of a training programme

Instructional design principles will be considered as the starting point in the development of a training programme [62-65]. Instructional design is defined as "the systematic and reflective process of translating principles of learning and instruction into plans for instructional materials, activities, information resources and evaluation" [65]. In recent years, several instructional design models have been developed to support instructors to teach new knowledge in an optimal way [64,65]. One of the most frequently used is the ADDIE model (Figure 1), an acronym for 'Analysis, Design, Development, Implementation, and Evaluation' [66]. The underlying concepts of the ADDIE model were developed by the Center for Educational Technology at Florida State University, in collaboration with the US Army. The concepts evolved into the Interservice Procedures for Instructional Systems Development for military training, as described by Briggs and Branson [66,67].

In subsequent years, the ADDIE model has been widely used to develop courses and training programmes for medical students, nurses and other healthcare professionals in the form of continuing medical education (CME) and continuing professional development [68-75]. It is not known when the ADDIE model was introduced into medical education, nor are there studies available in which the ADDIE model was applied to design training programmes for IPs or other occupational healthcare professionals. However, the ADDIE model is well recognized and generally accepted as an instructional systems design model [68,71-75].

Several versions of the ADDIE model are available. The hierarchical ADDIE model comprises five phases: analysis, design, development, implementation and evaluation [65-67,76,77]. These stages guide the designer through the development of a training programme in a systematic way, with each phase completed before moving to the next. An outline of the considerations in each stage of the ADDIE model is presented and discussed below [65-67,76,77].

Analysis

During the analysis phase, the instructional aims are identified. In our case, we must determine whether IPs lack knowledge about ABI and RTW and, if so, what is lacking. This will determine whether there is a need for a training programme and also allow us to outline what needs to be taught, as the basis for further determining the specific content of the training programme for IPs. Specifically, the knowledge needed to support IPs to perform assessments of patients with ABI must be identified as the foundation for the learning objectives. An analysis of the target audience is also required. This explores the learning characteristics of IPs with the aim of optimizing the instructional design. It considers, for example, adult learning theory and delivery options. All of the findings support the designer in creating the best instructional context [65-67,76,77].

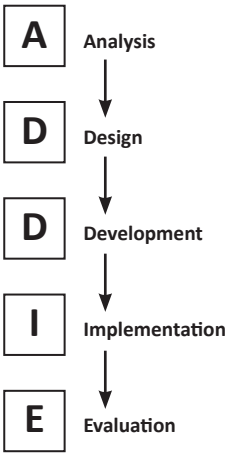

Figure 1. The ADDIE model [66]

Design

The design part of the model focuses on systematic and specific development of learning goals, the identification of approaches to realize the learning goals and assessment methods [65-67,76,77]. In our case, the learning goals will indicate what IPs should be able to achieve during the training programme. Furthermore, an overall blueprint of training transfer is

produced [65-67,76,77], which comprises the best methods to instruct participating IPs in order to optimize an increase in knowledge.

Development

The development phase is characterized by the practical realization of an 'ABI and RTW' training programme. In this phase, based on learning goals and on the teaching methods, the actual lesson materials are created; for example, Power Point slides or realistic, written case scenarios about the RTW-process of a patient with ABI. A course syllabus is also written in this phase, which can help to standardize the teaching, allowing the 'ABI and RTW' training programme to be applied in other groups of IPs [65-67,76,77].

Implementation

The implementation phase of the ADDIE model comprises delivery of the 'ABI and RTW' training programme for IPs [65-67,76,77].

Evaluation

The evaluation phase will determine whether the 'ABI and RTW' training programme for IPs has achieved its goal. Several methods and frameworks are available to evaluate healthcare professionals' education and training programmes [78-81]. One of these is Miller's pyramid of assessment (Figure 2) [80]. This assessment framework consists of four levels: 1) knowledge, 2) competence, 3) performance and 4) action [78,80]. At the base of Miller's pyramid is knowledge, as a foundation for building competence [80]. The trainee's knowledge is tested, specifically whether the trainee "knows" what is needed to perform professional functions adequately [80]. The second level concerns the assessment of trainees' competence, namely whether trainees "know how" to apply the acquired knowledge [80]. The third level evaluates performance. Here, trainees "show how" they apply the knowledge when dealing with a patient [80]. Finally, the action element concerns what a trainee "does" when working in practice independently [80].

Specifically, this thesis will evaluate whether the training programme increased IPs' knowledge of ABI and the RTW-process. Knowledge will be tested by assessing the IPs' recall of information after attending the 'ABI and RTW' training programme. This will determine whether or not the IPs learned what is required to perform assessments of a patient with ABI [82].

This methodology is congruent with the base of Miller's pyramid of clinical assessment (Figure 2) [80] and in line with the aim of the training programme: to increase IPs' knowledge about ABI and the RTW-process. In this way, the teaching methodology of the 'ABI and RTW' training programme will be aligned with its assessment [79].

The evaluation of the 'ABI and RTW' training programme will not only include knowledge tests of participating IPs, but also comprise assessment of the feasibility of the training programme, with the aim of future implementation of the programme in IPs' practice. Specifically, this thesis investigates the responses of the participating IPs to the 'ABI and RTW' training programme [83] and whether, according to IPs, the knowledge taught is relevant, suitable and appropriate. Furthermore, the IPs' view concerning implementation will be evaluated, looking specifically at the facilitators of and barriers to implementation of the knowledge imparted. Insight into these barriers and facilitators is required for future implementation of knowledge about ABI and the RTW-process in daily practice.

Figure 2. Miller's pyramid of clinical assessment [80]

In summary, the thesis comprises two parts: Part I focuses on improving the scientific knowledge needed to support IPs' assessments of patients with ABI; while Part II aims to evaluate how and whether IPs might gain more scientific knowledge to support their assessment of patients with ABI. This results in the following objectives:

I. To acquire scientific knowledge concerning ABI and the RTW-process: specifically, to determine the relevant aspects and factors related to RTW and interventions that effectively improve RTW of patients with ABI
II. To investigate how and whether IPs might gain scientific knowledge that supports their assessment of functional abilities, prognosis of functioning and evaluation of the RTW-process of patients with ABI

Research questions of the thesis

In line with the thesis objectives, the research questions are:

Related to Part I

1. Which factors, aspects and comorbidities are related to the RTW of patients with ABI?
2. What are effective RTW-interventions for patients with ABI?

Related to Part II

3. Does a training programme increase IPs' scientific knowledge such that it supports their assessment of functional abilities, prognosis of functioning and evaluation of the RTW-process of patients with ABI?

Outline of the thesis

Part I

Chapters 2, 3 and 4 address the first research question.

Chapter 2 presents the results of a systematic review of factors associated with RTW of patients with ABI.

Chapter 3 presents the results of a qualitative study and outlines aspects that are perceived to be facilitators of or barriers to RTW, as well as solutions to RTW- problems, according to both patients with ABI and employers.

Chapter 4 focuses specifically on the association of mental disorders as a comorbidity with RTW in individuals with ABI. This is investigated by performing a systematic review.

Chapter 5 addresses the second research question. It presents the results of a systematic review of effective RTW-interventions for patients with ABI and provides an overview of these interventions.

Part II

Chapters 6 and 7 address the third research question.

Chapter 6 demonstrates how the 'ABI and RTW' training programme for IPs was designed, based on empirical evidence and educational expert advice concerning effective teaching strategies.

Chapter 7 outlines the feasibility of the knowledge taught in the 'ABI and RTW' training programme for IPs. It demonstrates whether the training programme adequately influences IPs' knowledge such that it supports their assessment of functional abilities, prognosis of functioning and evaluation of the RTW-process of patients with ABI.

Chapter 8 summarizes and discusses the main research findings, and considers the implications of the research findings for practice and future study.

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2

Prognostic factors of return to work after traumatic or non-traumatic acquired brain injury

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Abstract

Purpose

To investigate and to determine evidence of prognostic factors for return to work (RTW) after acquired brain injury (ABI).

Methods

A systematic literature search was conducted in PubMed (2008-2014), applying terms for ABI and RTW. In addition, studies published after 2003 of a previous review on the same topic were added. The methodological quality of the included studies was assessed and evidence was classified.

Results

Twenty-seven studies were included. There is strong evidence that a high education level is positively associated with RTW after traumatic ABI; a low education level, unemployment and length of stay in rehabilitation are negatively associated, and a clear tendency has been deduced from the studies that conscious state in the Emergency Department is not associated with RTW. After non-traumatic ABI, there is strong evidence that independence in activities of daily living is positively associated with RTW and aetiology of stroke is not.

Conclusions

This study confirms earlier findings that after both traumatic and non-traumatic ABI injury-related factors in the Emergency Department are not associated with RTW. In addition, it provides further evidence that personal factors after traumatic ABI and activity-related factors after non-traumatic ABI are strongly associated with RTW.

Introduction

An acquired brain injury (ABI) is an injury to the brain, which is not hereditary, congenital, degenerative, or induced by birth trauma but has occurred after birth [1]. It includes all types of traumatic brain injuries and also brain injuries with a non-traumatic cause, e.g. cerebral vascular accidents [1].

ABI is one of the most important causes of disability worldwide [2,3]. According to the World Health Organization (WHO), ABI with a traumatic cause will even surpass many diseases as the major cause of death and disability by the year 2020 [4].

ABI leads to short- and long-term physical, cognitive and behavioural impairments, which negatively impact participation activities, such as sustaining work or return to work (RTW) [5,6].

RTW is one of the most important psychosocial predictors of wellbeing and social integration [7]. It was shown that the quality of life of previously employed patients of working age who were unable to return to work after traumatic ABI had deteriorated [5]. Having employment also promotes wellbeing and life satisfaction after a stroke [3]; people who have suffered a stroke and who do not return to work have poorer psychosocial outcomes [8]. RTW is considered to be an important factor for recovery and has been associated with successful rehabilitation and community integration after traumatic and non-traumatic ABI [8,9].

Traumatic ABI typically affects individuals either early in their productive years or once they have established a productive life. Approximately 40% of patients with traumatic ABI hospitalized each year are aged between 15 and 44 [5]. In addition, another study reports that 58% of patients with traumatic ABI are of working age [6]. Non-traumatic ABI more often occurs at increased age but also younger individuals experience a stroke: approximately one in four individuals suffering a stroke is under the age of 65 [10-12].

RTW after ABI has been analysed in several studies [9] showing varying success rates ranging from 10% to 70% in traumatic ABI [13] and 11% to 85% after a stroke, respectively [3]. In a systematic review published in 2009, it was shown that a mean of 40% of patients with ABI return to work within 2 years after injury [14].

Given the importance of RTW after ABI, research should focus on optimization of care to facilitate patients with ABI to return to work. For this reason, it is essential to identify factors influencing RTW. So far, only a limited number of studies have reported on factors associated with RTW after ABI [15]. In 2009, a systematic review was conducted on prognostic factors of RTW after ABI [16]. Injury severity, depression and anxiety, gender and anatomic location were not associated with RTW, and inpatient length of stay was negatively associated with RTW [16]. Since then, several longitudinal studies have been performed in order to identify factors associated with RTW after traumatic and non-traumatic ABI [2,17]. To provide optimal treatment and support for patients, it is important to identify those patients for whom RTW is possible and those for whom it is less likely.

Therefore, the purpose of this systematic review is to investigate and determine the level of evidence of prognostic factors associated with RTW that might help to improve the RTW-process of patients with traumatic and non-traumatic ABI.

Methods

Literature search

In order to collect the most recent literature on prognostic factors of RTW after ABI, a database search was performed in PubMed. The search strategy was determined by population and outcome variables using both keywords and Medical Subject Headings (MeSH) terms that were related to ABI and RTW. The search was limited to articles available in the English, German and Dutch languages. In addition, it was narrowed down to studies published between mid 2008 and February 2014. The search terms used are presented in Appendix 1.

Study selection

Studies that were retrieved by the searches were assessed for relevance to the topic based on the title and abstract. The following inclusion criteria were defined for selection: the study population comprised adults with non-progressive ABI and RTW, or other varieties of participation were cited in the title or abstract. Second, studies were included or excluded after appraisal of full papers according to the following inclusion criteria: individuals were between 18 and 65 years old, had a paid job or were looking for work pre-injury and the study reported research on factors associated with RTW. The outcome RTW in this review was characterized as having part-time or full-time paid or supported employment without consideration of the job demands or working hours. Studies with the following designs were included in the review: randomised controlled trials, controlled clinical trials or the following kinds of observational studies: case-control study, prospective cohort study or retrospective cohort study.

The first author (BDC) conducted the search and performed the study selection. The second author (HW) replicated the selection in a random sample. In cases of doubt, consensus was achieved through discussion and, if necessary, the third author (MFD) arbitrated. Using the same approach, reference lists of included items were assessed additionally for relevance to the inclusion criteria. Studies published in 2003 or earlier were not included.

In addition to the above-mentioned systematic literature search, studies published after 2003 and used in a prior review on the same theme [16] were also included. In our review we used the same method and the same inclusion criteria for study selection as conducted by Van Velzen et al. [16]. In order to update the level of evidence of prognostic factors for RTW since 2003, we added the studies used in this review.

Data extraction

Using a data extraction form, the first author extracted information from the included articles on reference and geographic location, study design, study population, length of follow-up and loss to follow-up, variables and instruments, prognostic and non-prognostic factors and outcome.

Methodological quality assessment

The methodological quality of the included studies was evaluated using an established criteria list, recommended by Borghouts et al. [18]. The list consists of 13 items describing aspects on the selection of the study population and size, inclusion criteria, the design of the study, potential prognostic factors, outcome measures and follow-up. Each item was assessed based on the available information in the article and scored one point if adequate, thereby generating a total score of 0-13 points. Studies with a sum score of at least seven points were considered to be of high quality. In contrast, if studies achieved six points or less they were judged to be of low quality and consequently excluded. Quality assessment was performed by the first author (BDC), while the second author (HW) evaluated a randomly selected part. Disagreements between the reviewers regarding quality were discussed in a consensus meeting.

Determining levels of evidence

Level of evidence for all potential prognostic factors was determined qualitatively and was based on criteria modified from De Croon et al. [19] and Van Velzen at al. [16]. The different levels of evidence were the following: 1) Evidence was absent if there was only one study available. 2) Weak evidence was ascertained if two studies identified a significant association in the same direction or established no association, or if two out of three studies determined a significant association in the same direction and the other identified no association. 3) Evidence was strong if three studies identified a significant association in the same direction (either a positive, negative or no association). Where four or more studies were available, evidence was strong if at least 75% ascertained a significant association in the same direction. 4) In all other circumstances, evidence was inconsistent.

Results

Literature search and study selection

The PubMed database search resulted in 1930 potential relevant studies. After selection based on title and abstract, 88 articles were identified that met the inclusion criteria. Of these, 20 studies passed full review [2,3,6,8,9,17,20-33]. Reference checking of these studies yielded one additional article [5]; consequently 21 studies were selected.

In some cases (N=2), disagreements between the first two authors (BDC and HW) were resolved by consensus. The main reasons for exclusion were that outcomes evaluated in the studies were not covered by the definitions stated above, or that studies had a cross-sectional design.

In order to combine evidence ascertained by Van Velzen et al. [16], eight studies utilised in that review were included on a supplementary basis [7,15,34-39]. As a result, the total number of studies selected for this review was 29. The results of the search and the study selection are presented in a flow chart in Figure 1.

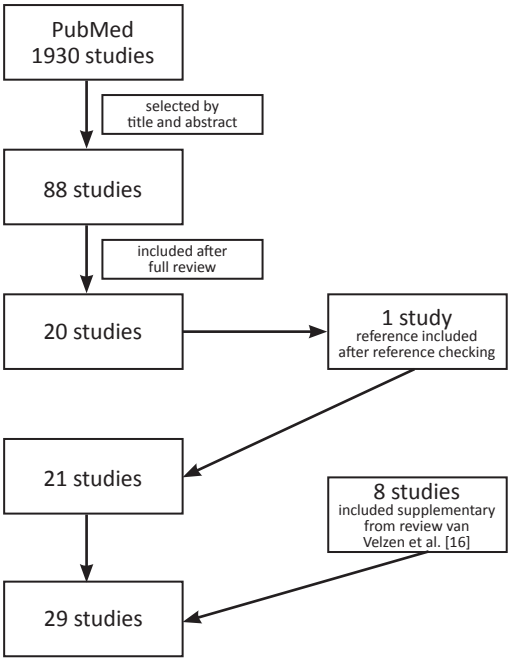

Figure 1. Results of study selection

Methodological quality assessment and data extraction

The study characteristics are presented in Appendix 2.

All included 29 articles were subjected to quality assessment [18]. A total of 27 studies were of high quality with total scores between 7 and 12. Two studies had a low quality and were therefore not included in the analysis for determination of the level of evidence [28,38]. The overall agreement between the first two authors (BDC and HW) was high; disagreements on two items were resolved in a consensus meeting. The results of scoring per item are shown in Table 1.

Table 1. Methodological quality of included studies evaluated by criteria list of Borghouts et al.

Article (first author, year)	(A)[a]	(B)[b]	(C)[c]	(D)[d]	(E-a)[e]	(E-b)[e]	(F)[f]	(G-a)[g]	(G-b)[g]	(G-c)[g]	(H)[h]	(I)[i]	(J)[j]	Total score[k]
Andelic 2012	+	+	+	+	-	-	+	-	-	-	+	+	+	8
Arango 2008	+	-	+	-	+	+	+	-	-	-	+	+	-	7
Avesani 2005	+	-	+	-	+	-	+	-	-	-	+	+	+	7
Brown 2010	+	+	-	+	+	-	+	-	-	-	+	+	+	8
Busch 2009	+	+	+	-	+	-	+	-	-	-	+	+	+	8
Doucet 2012	+	+	+	-	+	-	+	-	-	-	+	+	+	8
Esbjörnsson 2013	+	+	+	+	-	-	+	+	+	-	+	+	+	10
Franulic 2004	+	-	+	-	+	-	+	-	-	-	+	+	+	7
Fraser 2006	+	-	+	+	+	-	+	+	-	-	+	+	+	9
Gary 2009	+	+	+	-	+	+	+	+	-	-	+	+	-	9
Glozier 2008	+	+	+	+	+	-	-	-	-	+	+	+	+	9
Grauwmeijer 2012	+	+	+	+	+	-	+	+	-	+	+	+	+	11
Guerin 2006	+	+	-	-	-	-	-	+	+	+	-	+	-	6
Hackett 2012	+	+	+	+	+	-	+	+	+	+	+	+	+	12
Hannerz 2012	+	+	+	+	+	+	+	+	+	-	+	+	+	12
Kauranen 2012	+	+	+	+	-	-	-	+	-	+	+	+	+	9
Ketchum 2012	+	+	+	-	+	-	+	-	-	+	+	+	+	9
Mailles 2012	+	+	+	+	+	-	+	+	-	-	+	+	+	10
Naess 2009	+	+	-	-	+	-	+	+	-	-	-	+	-	6
Nakase 2007	+	+	+	+	+	-	+	+	-	+	+	+	+	11
Palmcrantz 2012	+	+	+	-	+	-	+	-	-	+	+	+	+	9
Saeki 2004	+	+	+	-	+	-	+	+	+	-	+	-	+	9
Saeki 2010	+	+	+	+	+	-	+	-	-	+	+	+	+	10
Stulemeijer 2008	+	+	+	+	+	-	-	-	-	+	+	+	+	9
Tanaka 2011	+	+	+	+	-	-	-	-	-	+	+	+	+	8
Trygged 2011	+	+	+	+	+	+	+	-	-	-	+	+	+	10
Waje-Andreassen 2013	+	+	+	-	+	-	+	-	-	-	+	+	+	8
Walker 2006	+	+	+	-	+	-	+	-	-	+	+	+	+	9
Wilz 2009	+	+	+	+	-	-	+	+	-	+	+	+	+	10

[a] (A) Selection of study population
[b] (B) Description of inclusion-exclusion criteria
[c] (C) Description of potential prognostic factors
[d] (D) Prospective study design
[e] (E-a) Course cohort >100 patient years
[e] (E-b) Prognostic factor subgroups >200 patient years
[f] (F) Follow up >12 months
[g] (G-a) Drop outs/loss to follow up <20%
[g] (G-b) Drop outs/loss to follow up <10%
[g] (G-c) Information completers versus loss to follow up/drop outs
[h] (H) Relevant outcome measures
[i] (I) Frequencies of most important outcome measures
[j] (J) Appropriate analysis techniques
[k] Sum score of at least seven points: high quality; six points or less: low quality and consequently excluded
\+ item scored adequate
\- item scored inadequate

Prognostic factors

A total of 27 studies were used to investigate and to determine the level of evidence of potential prognostic factors; 13 trials studied patients with traumatic ABI [2,5-7,9,20,22,23,30,34-36,39]; 14 articles concerned patients with ABI due to a non-traumatic cause [3,8,15,17,21,24-27,29,31-33,37]. From these studies, factors identified to be significantly associated with RTW**,** were classified according to the International Classification of Functioning, Disability and Health (ICF model), namely disease and disorder, functions and structures, activities, external factors and personal factors [40]. Moreover, they were further broken down into separate factors for ABI with a traumatic or a non-traumatic cause.

The most important results are summarised below and also presented in Tables 2 and 3. If desired, the reader may request more detailed information from the first author.

Table 2. Factors associated with return to work after acquired brain injury with traumatic cause and level of evidence

Variable	Positive association	Negative association	No association	Evidence (strong/ weak/ no/ inconsistent)
Disease/disorder				
Injury related				
Conscious state Emergency Department (Glasgow Coma Scale)	[34]	[22]	[9] [30] [39] [36] [7]	Inconsistent
Length of stay rehabilitation (inpatient rehabilitation)		[6] [9] [34]		Strong neg
Activities				
Disability (Disability Rating Scale) discharge-worse functioning		[5] [6]	[9]	Weak neg
Personal factors				
Education high level	[30] [39] [7]		[36]	Strong pos
Education low level		[5] [6] [9]	[34]	Strong neg
Unemployment pre-injury		[2] [6] [9]	[5]	Strong neg
Not married		[5] [6]		Weak neg
Ethnicity minority		[5] [6]		Weak neg

Table 3. Factors associated with return to work after acquired brain injury with non-traumatic cause and level of evidence

Variable	Positive association	Negative association	No association	Evidence (strong/ weak/ no/ inconsistent)
Disease/disorder				
Injury related				
Conscious state			[8]	Weak no
(Glasgow Coma Scale)			[26]	
Aetiology diagnosis			[21]	Strong no
			[26]	
			[17]	
Stroke location			[21]	Weak no
			[15]	
Activities				
ADL-BI (Barthel Index)		[8]	[26]	Weak neg
low score-dependent		[37]		
ADL-BI (Barthel Index)	[21]			
high score-independent	[3]			Strong pos
	[17]			
Personal factors				
Education high level	[27]		[26]	Weak pos
	[31]			
Education low level		[29]	[21]	Weak no
Living alone		[21]	[24]	Weak neg
		[29]		
Ethnicity minority		[8]		Weak neg
		[37]		

Disease/disorder

Injury related

After traumatic ABI, there is a clear tendency that conscious state in the Emergency Department, recorded by Glasgow Coma Scale (GCS) is not associated with RTW [7,9,30,36,39]. Namely, five out of seven studies found that conscious state is not associated with RTW [7,9,30,36,39]. The study populations involved patients with mild [30], moderate [7,36,39] and severe injury [9,39]. Through logistic regression analysis by Ketchum et al. [9] the conscious state measured in the Emergency Department was identified to be associated with employment status 1 year post-injury; however, after adjusting for the other variables, it was no longer significant (p=0.73). Fraser et al. [36] found no significant association between admission GCS score and RTW, neither did Walker et al. [7], Nakase-Richardson et al. [39] and Stulemeijer et al. [30]. On the other hand, Esbjörnsson et al. [22] found that the non-working group in a small study population was more severely brain injured, as shown by the conscious state compared to those at work. In addition,

Avesani et al. [34] found a significant difference in conscious state between re-employed and employed patients with severe traumatic brain injury (GCS=7.2 versus GCS=6.0). The five studies that found no association taken together would generate strong evidence that conscious state is not associated with RTW [7,9,30,36,39]. However, as two studies found differences regarding conscious state between working individuals and those who were not [22,34], this turns out as being 71% (five out of seven) of the studies that did not find an association, which is just below the pre-defined 75%-threshold of strong evidence. Although there is no strong evidence, clearly, the results point towards the finding that conscious state is not associated with RTW.

Regarding RTW, traumatic brain injury severity was also evaluated by 'Time to Follow Commands' [36], duration of post-traumatic amnesia (PTA) [9,20,30,34,39], and computed tomography (CT) abnormalities [2,30]; there is no evidence for an association of 'Time to Follow Commands' with RTW [36] and inconsistent evidence for an association of PTA duration [9,20,30,34,39] or CT abnormalities [2,30] with RTW.

In patients with non-traumatic ABI, there is weak evidence that conscious state (recorded by GCS) is not associated with RTW, as two studies reported no significant association [8,26].

Furthermore, in patients with non-traumatic ABI, the aetiology (ischemic [atherosclerosis, embolism, small artery occlusion], haemorrhagic) was not associated with RTW [17,21,26]. As three studies found no association, there is strong evidence that aetiology of non-traumatic ABI is not associated with RTW [17,21,26].

Moreover, two studies found no association between location of stroke (right, left, or both hemispheres or small/large cortical lesion, subcortical lesion, infratentorial lesion) and RTW [15,21]. Consequently, there is weak evidence that anatomic location is not associated with RTW in non-traumatic ABI [15,21].

Ketchum et al. [9] and Gary et al. [6] found in a multiple logistic regression model that a longer stay in inpatient rehabilitation after traumatic ABI was negatively associated with RTW. A third study also reported that in patients with severe brain injury, inpatient rehabilitation length of stay was negatively associated with RTW [34]. Through these studies, strong evidence was found that a longer stay in inpatient rehabilitation is negatively associated with RTW after traumatic brain injury [6,9,34]. Inconsistent evidence was found for the association of acute hospital stay with RTW [6,7,9,23]. Specifically, two studies reported a negative association [6,7]; whereas two other studies found no significant association [9,23].

Functions/structures

Many studies examined variables concerning neurologic functions related to RTW after traumatic [22,36,39] and non-traumatic brain injury [3,15,17,21,26,32], specifically physical [3,15,21] and cognitive [17,21,22,26,32,36,39] functions. There is predominantly no and in

part inconsistent evidence for an association of functions with RTW after traumatic or non-traumatic ABI [3,15,17,21,22,26,32,36,39].

Activities

Arango-Lasprilla et al. [5] investigated the influence of ability level to perform activities at discharge on RTW after traumatic ABI. A low level of ability at discharge turned out to be negatively associated with RTW at 1 year after injury [5]. Gary et al. [6] found that a low ability level, both at admission and discharge from rehabilitation, was negatively associated with RTW. According to the results of a study conducted by Ketchum et al. [9], ability level at discharge from rehabilitation was not significantly associated with RTW 1 year after traumatic brain injury. Consequently, there is weak evidence for a negative association of low ability level and RTW after traumatic ABI [5,6,9].

Saeki et al. [3] found that patients with first stroke who independently performed activities of daily living (ADL) at admission were three times more likely to return to work early than those who were totally dependent on others for ADL. Tanaka et al. [17] found that higher Barthel Index scores (indicating independence for ADL) at the onset of stroke were positively associated with very early RTW of patients with first stroke. Doucet et al. [21] also found that patients with stroke who had returned to work were more independent for ADL than those who did not. Therefore, there is strong evidence that independence in ADL is positively associated with RTW after stroke [3,17,21].

In contrast, lower Barthel Index scores as a sign of needing assistance in ADL were negatively associated with RTW [8,37]. Busch et al. [8] found that dependence in performing ADL in the acute phase of the stroke was negatively associated with RTW. Glozier et al. [37] found that dependence on others for basic self-care activities, as assessed by scores on the Barthel Index in the first week after stroke, was associated with unsuccessful RTW. Kauranen et al. [26] did not find a significant relation between ADL and RTW. Subsequently, there is weak evidence that dependence on others regarding ADL is negatively associated with RTW [8,26,37]. Consequently, ADL are an important factor, regarding their significant association with RTW after non-traumatic ABI.

External factors

Only a few studies evaluated potential association of environmental and job-related factors with RTW [17,21,25]. There is no evidence for a significant association between external factors and RTW after non-traumatic ABI [17,21,25]. There are no studies available that investigated the association between external factors and RTW after traumatic ABI.

Personal factors

Age and gender

After both traumatic and non-traumatic brain injury, evidence is inconsistent for an association of age and gender and RTW [2,3,5-9,21,23,24,26,30-34,36,37,39].

Education

After traumatic brain injury (TBI), level of education proves to be significantly associated with RTW. High school graduates are 2.3 times more likely to RTW than non-graduates [7]; more than 11 years of education was also significantly associated with a greater chance of RTW [30]. Fraser et al. [36] did not find a significant association between high-level education and RTW. Nakase-Richardson et al. [39] found that individuals with traumatic brain injury at the 75th percentile regarding years of education (13 years) had 2.48 times the odds of being employed at 1 year compared with those at the 25th percentile (10 years of education). Consequently, there is strong evidence that high-level education is positively associated with RTW after traumatic ABI.

Ketchum et al. [9] found that those who had an eighth grade of education level were far more likely to be unemployed after traumatic brain injury. The odds of not being competitively employed post-injury were significantly higher for individuals with less than high school pre-injury than for those with at least high school education (OR=2.34, 95% CI 1.86-2.94) [6]; the odds of being unemployed at 1 year (versus being employed) were 1.99 for persons with less than high school education versus those with at least high school education [5]. Avesani et al. [34] found no significant association between education and RTW. Subsequently, there is strong evidence that low-level education is negatively associated with RTW after traumatic ABI.

In studies conducted in populations of persons with non-traumatic brain injury, weak evidence was found for an association between high-level education and RTW [26,27,31]. Mailles et al. [27] and Trygged et al. [31] found a positive association between high-level education and RTW, while Kauranen et al. [26] did not. Furthermore, there is weak evidence that low-level education is not significantly associated with RTW [21,24,29].

Occupation pre-injury

Ketchum et al. [9], Andelic et al. [2] and Gary et al. [6] found that the odds of not being competitively employed after traumatic brain injury (versus being competitively employed) were higher for those who were not competitively employed pre-injury (unemployed, student, homemaker, volunteer work, retired). Arango-Lasprilla et al. [5] found no significant association between employment status pre-injury and RTW. Therefore, there is strong evidence for a negative association between not being competitively employed at the moment traumatic ABI occurred and RTW [2,5,6,9].

Marital status

Not being married appeared to be negatively associated with RTW after ABI with a traumatic cause. Specifically, the odds of being unemployed versus being employed were 1.57 times greater for unmarried versus married patients with traumatic ABI (95% CI 1.28-1.92) [5]; furthermore, the odds of not being competitively employed versus being competitively employed were significantly higher for those who were not married pre-injury than for those who were (OR=1.39, 95% CI 1.11-1.74) [6]. Consequently, there is weak evidence that unmarried patients with traumatic brain injury have worse vocational outcomes [5,6]. Persons who were living alone at the time of their stroke returned to work significantly less frequently than those who lived with a partner [21,29]. There is weak evidence for a negative association between living alone and RTW after non-traumatic ABI [21,29].

Ethnicity

Weak evidence was found that ethnic origin is associated with RTW after both traumatic and non-traumatic brain injury [5,6,8,37]. The odds of minorities being unemployed at 1 year after traumatic brain injury were 2.17 times greater than the odds of whites being unemployed (95% CI 1.78-2.65) [5]. Furthermore, blacks had significantly greater odds of not being competitively employed versus being competitively employed as compared with whites (OR=2.61, 95% CI 1.93-3.53) [6].

Black ethnicity was associated with lower odds of RTW 1 year after stroke (OR=0.41, 95% CI 0.19-0.88) [8]; furthermore non-New Zealand/European ethnicity (OR=0.40, 95% CI 0.17-0.91) was negatively associated with RTW after first or recurrent stroke [37].

Discussion

The purpose of this study was to investigate and to determine the level of evidence of prognostic factors of RTW after ABI.

In summary, after traumatic ABI there is strong evidence that a high education level is positively associated with RTW, whereas a low education level, unemployment and length of stay in rehabilitation are negatively associated with RTW. Furthermore, there is a clear tendency that conscious state in the Emergency Department, recorded by GCS is not associated with RTW [7,9,30,36,39]. After non-traumatic ABI, there is strong evidence that independence in ADL is positively associated with RTW while aetiology of stroke is not.

This study (tends to) confirm earlier findings that after both traumatic and non-traumatic ABI, injury-related factors in the Emergency Department are not associated with RTW. In addition, it provides new evidence that personal factors (i.e. education and unemployment pre-injury) after traumatic ABI and activity-related factors after non-traumatic ABI are strongly associated with RTW.

Disease-related factors

Our conclusions tend to imply that the initial severity of injury, indicated by conscious state on admission, is not associated with RTW after traumatic ABI. However, longer length of rehabilitation stay proved to be negatively associated with RTW. These findings correspond with the results of previous research [6,9,13,34,41,42] and with those of the systematic review of Van Velzen et al. [16]. A longer period of rehabilitation is to some extent associated with more severe injury or comorbidities; other aspects, like organisation of healthcare [31], discharge arrangement [13], job policies, or employer flexibility [9] have also been considered relevant in this regard. The results of this study indicate that disease-related factors do not determine whether patients with ABI return to work. These findings are also in line with previous research by Stulemeijer et al. [30], who concluded that in order to enable prediction of outcome after mild traumatic ABI, factors unrelated to the head injury are of major importance. In this context also, among workers on long-term sick leave it has been shown that predisposing factors regardless of the disease determine long-term sickness absence [43]. In addition, Van der Giezen et al. [44] showed that psychosocial aspects of health and work in combination with economic aspects have a significantly larger impact on RTW when compared to relatively more physical aspects of disability in sick-listed low back pain patients.

Activity-related factors

Furthermore, our data reveal that independence in ADL is a significant factor determining whether individuals return to work after non-traumatic ABI. These findings are in line with the results of earlier work [3,8,17,37,45]. Earlier, a systematic review demonstrated this association based on weak evidence, whereas we clearly show a strong association [16]. Dependence for everyday activities is incompatible with the autonomy level required to work [34]. Our study underlines the crucial role of independence in ADL with respect to successful RTW after non-traumatic ABI; therefore we advise focusing also on ADL training during the RTW process besides work-related activities, as it appears to increase the chances of returning to work. Moreover, self-care activities have been found to correlate with employment of people with other diseases [46]. Namely, self-care ability (Barthel Index) was significantly associated with the probability of returning to work of individuals who had sustained traumatic spinal cord injury [46]. The authors suggested that assistive technologies for self-care activities are likely to improve the independence of persons with spinal cord injury [46].

Personal factors

Furthermore, the results of this study provide enhanced insights into the contribution of personal factors, namely, educational level and unemployment, with respect to RTW in patients with traumatic ABI. Specifically, there is strong evidence that high-level education

is positively associated with RTW and that low-level education and not being competitively employed pre-injury are negatively associated with RTW. Personal factors were mentioned in numerous studies as being related to vocational outcome after traumatic ABI [2,5-7,9,30,39]. The results of this systematic review show strong evidence for an association of personal factors, i.e. educational level and unemployment, with RTW after ABI with a traumatic cause. The results of this study are in line with the findings of publications on other diseases. In a systematic review, strong evidence was demonstrated that level of education is a prognostic factor for the duration of work disability of individuals with acute orthopaedic trauma [47]. Detaille et al. [48] also conducted a systematic review on prognostic factors of work disability among employees with a chronic somatic disease. High education was shown to be a negative prognostic factor for work disability in employees with rheumatoid arthritis and ischemic heart disease [48].

Methodological considerations

In order to maximize the possibility of retrieving relevant studies, we systematically searched the literature; the database search was a sensitive one, with a broad selection of terms being used. In addition, we checked the references of selected studies, thereby preventing relevant publications from being overlooked.

For the assessment of the methodological quality of the selected studies, study population, study design, follow-up and outcome measures were reflected. Studies with a low quality were excluded from analysis, meaning that level of evidence and conclusions were based on high-quality studies only.

In order to quantify evidence, possibilities to perform a meta-analysis were considered. Studies that were utilised for this review investigated selected populations, differing from each other for example regarding brain injury severity and socio-demographic characteristics. Many variables were analysed in these studies and measurements were not always homogenised. Furthermore, descriptions of dependent vocational outcome measures, for instance RTW, were not standardised. Due to this heterogeneity of the study populations, prognostic variables and outcome measures, statistical pooling of data in a meta-analysis was not able to be achieved. For this reason, evaluation of available evidence was performed based on variables mentioned in the different studies.

Practical relevance

In this review, personal factors (after traumatic ABI) and ADL (after non-traumatic ABI) proved to be associated with RTW.

This investigation provides information to recognise patients with ABI potentially at risk for poor RTW outcomes. In this sense, professionals involved in the RTW-process of patients with ABI must realise that they are better informed about the chances for RTW for these patients. In their daily practice, they encounter individuals that need extra attention and

support during the RTW-process. Modifiable factors, namely ADL, are clearly associated with RTW. This highlights the need for interventions that address ADL to optimise vocational outcome. Several vocational rehabilitation programmes have been developed; according to the descriptions, ADL are not apparently addressed specifically in these treatment programmes [49]. Furthermore, evidence to support the effectiveness of the interventions is only weak [49].

Further research

Future analyses should focus on the available evidence to unravel the effectiveness of vocational programmes identifying modifiable factors, specifically ADL, in order to optimise RTW-outcomes as a major purpose. It was found that vocational outcomes are better when the patient participates in decision-making regarding his/her own rehabilitation [50,51]. Therefore, we suggest that early in the RTW-process a plan for vocational rehabilitation is made in collaboration with the rehabilitation physician, the occupational physician and the patient. It is important that personal experiences of ABI patients are taken into account, like factors that motivate them and aspects they perceive to be barriers to and facilitators of RTW [52]. The patients' own conception of why they have not returned to work would help to improve the RTW-process. Future studies that focus on the perspectives of ABI patients are needed in order to optimise vocational outcomes after ABI.

Conclusion

This study provides factors associated with RTW after ABI and the level of evidence for these associations. Activity-related factors after non-traumatic ABI and personal factors after traumatic ABI have proven to be associated with RTW. Both after non-traumatic and traumatic ABI, injury-related factors in the Emergency Department tend not to be associated with RTW. It is advised to focus treatment on optimising ADL during the vocational process. Furthermore, professionals must pay extra attention and provide additional support to patients for whom RTW is expected to be less likely.

Implications for rehabilitation

- We found strong evidence for a significant association between RTW and personal factors (education level, unemployment) after traumatic ABI and ADL after non-traumatic ABI
- We advise to focus on work-related activities during the RTW-process besides ADL-training and pay attention to and support patients at risk for not returning to work

Declaration of interest

The authors report no declarations of interest.

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Appendix 1

Search strategy

PubMed

Limitations
Age: adolescent, young adult, adult, middle aged
Languages: English, German or Dutch
Publication: first search between mid 2008 and May 2012; update between Jan 2012 and end of Feb 2014

Population (P)
"brain injury" [tiab] OR "head injury" [tiab] OR "craniocerebral trauma" [tiab] OR stroke [tiab] OR "brain vascular accident" [tiab] OR "cerebrovascular accident" [tiab] OR CVA [tiab] OR "cerebrovascular disorder" [tiab] OR "cerebrovascular disease" [tiab] OR "intracranial hemorrhage" [tiab] OR "brain hemorrhage" [tiab] OR meningitis [tiab] OR encephalitis [tiab] OR "brain tumor" [tiab] OR "brain tumour" [tiab] OR "brain neoplasm" [tiab] OR "intracranial neoplasm" [tiab] OR "intracerebral neoplasm" [tiab] OR "hypoxic encephalopathy" [tiab] OR "post-anoxic encephalopathy" [tiab] OR "brain hypoxia" [tiab] OR "hypoxia, brain" [MeSH] OR "brain anoxia" [tiab]

AND

Outcome (O)
"vocational reintegration" OR "occupational reintegration" OR "occupation" [tiab] OR work [tiab] OR work* [tiab] OR job [tiab] OR employment [tiab] OR employ* [tiab] OR re-employment [tiab] OR unemployment [Mesh] OR unemploy* [tiab]

Appendix 2

Characteristics of included studies (traumatic cause)

Reference First author Year of publication Geographic location	Design P[a] R[b]	Population N: number of subjects G: gender M/F[c] A: age mean, SD[d], range I: injury	Follow-up	Loss to follow-up	Prognostic factors	Non prognostic factors (not significant)	Outcome
Andelic **2012** **Norway**	P	N: 147 fulfilled inclusion criteria N: 93 sample G: 71/22 A: 31.0, 11.2 I: moderate-severe TBI[e]	1 year	N: 27 refused participation N: 23 died N: 4 dropped out	OR[f], 95% CI[g] CT[h] Marshall score ≥3 0.26, 0.07-1.00 FIM-COG[i] limitations 0.18, 0.04-0.96 Pre-injury employment 0.05, 0.01-0.27	Associated injuries FIM-M[j] CIQ[k] Age Gender	Employment (working full-time or part-time vs. unemployed)
Arango-Lasprilla **2008** **United States**	R	N: 5259 N: 3636 analysed G: 3884/1374 whites A: 38.8, 18.2 minorities A: 36.1, 15.3 I: moderate-severe TBI	1 year	N: 1623	Wald χ^2, adjusted p DRS[l] discharge 203.49, <0.001 Age 16.62, <0.001 Education low level 45.66, <0.001 Unmarried 19.15, <0.001 Minority 58.23, <0.001	Cause Gender Employment pre-injury	Employment status (competitively employed vs. unemployed)

Reference First author Year of publication Geographic location	Design P[a] R[b]	Population N: number of subjects G: gender M/F[c] A: age mean, SD[d], range I: injury	Follow-up	Loss to follow-up	Prognostic factors	Non prognostic factors (not significant)	Outcome
Avesani **2005** **Italy**	R	N: 438 population N: 353 remained G: 275/78 A: 27.7, 18-68 RTW[m] A: 29.7, 18-68 No RTW I: severe TBI	2-10 years	N: 85	p Higher GCS[n] 7.2 vs. 6.0 0.00 Shorter PTA[o] 49.4 vs. 111.4 gg 0.00 Shorter LOS[p] 45.6 vs. 117.3 0.00 Lower GOS-E[q] 0.1 vs. 2.6 0.00	Age Education	Reemployment
Brown **2010** **United States**	R	N: 7050 total N: 5250 sample G: 73.6/6.4% A: 37.8 I: TBI	1 year	N: 1800 no data	Shorter PTA < 4 weeks		Employment status (competitively employed vs other)
Esbjörnsson **2013** **Sweden**	P	N: 16 N: 15 employed pre-injury G: 9/7 A: 37.3, 15.1, 20-62 I: TBI	1 year	N: 0	p GCS 0.00 Acute phase testability (GCS=14) 0.00 BNIS[r] attention/ concentration 0.02	BNIS total	RTW

Reference First author Year of publication Geographic location	Design P[a] R[b]	Population N: number of subjects G: gender M/F[c] A: age mean, SD[d], range I: injury	Follow-up	Loss to follow-up	Prognostic factors	Non prognostic factors (not significant)	Outcome
Franulic **2004** **Chile**	R	At 2 years N: 70 A 37.3 RTW A: 40.9 no RTW At 5 years N: 72 A: 40.5 RTW A: 43.4 no RTW At 10 years N: 58 A: 36.3 RTW A: 39.3 no RTW I: mild-severe TBI	2, 5 and 10 years	N: 2	P Hamilton scale depression/anxiety Less symptoms of Depression 5 years post injury Anxiety 10 years post injury <0.05 NRS-R[s] metacognition 2, 5, 10 years post injury NRS-R cognitive 2, 5, 10 years post injury NRS-R emotional control 5 years post injury <0.05	Symptoms of Depression 2, 10 years Anxiety 2, 5 years NRS-R affectivity 2, 5, 10 years NRS-R emotional control 2, 10 years	Employment status
Fraser **2006** **USA**	P	N: 156 N: 140 successfully followed G: 118/22 A: 35 I: mild-severe TBI	1 month, 6 months, 1 year, 3-5 years	N: 16	p Time to follow commands (GCS motor=6) 0.00 Memory SRT[t] 0.00 Cognitive efficiency WAIS[u] 0.00 Gender 0.04 Alcohol abuse 0.02	GCS Age Education Reasoning skills Specific vocational preparation Occupation (DOT[v]) Job stability Income Drug abuse Arrested anytime	RTW half time or more at 3-5 years/ RTW but not sustained at 3-5 years/no RTW

Reference First author Year of publication Geographic location	Design P[a] R[b]	Population N: number of subjects G: gender M/F[c] A: age mean, SD[d], range I: injury	Follow-up	Loss to follow-up	Prognostic factors	Non prognostic factors (not significant)	Outcome
Gary **2009** **United States**	R	N: 2022 G: 1526/496 A: 34.1, 11.6 I: TBI	1, 2, 5 years	N: 373	OR, 95% CI LOS acute 1.80, 1.55-2.09 LOS rehabilitation 1.27, 1.11-1.46 Cause violent 1.45, 1.09-1.94 DRS admission 1.43, 1.15-1.77 DRS discharge 1.51, 1.33-1.72 Older age T1: 1.60, 1.29-1.97 T2: 2.03, 1.63-2.53 T3: 3.40, 2.67-4.32 Female sex 1.26, 1.01-1.57 Education low level 2.34, 1.86-2.94 Pre-injury employment 3.39, 2.65-4.32 Unmarried 1.39, 1.11-1.74 Minority T1: 2.61, 1.93-3.53 T2: 2.10, 1.56-2.83 T3: 3.15, 2.30-4.30		Employment status (not competitively vs competitively paid employment full-time or part-time)

Reference First author Year of publication Geographic location	Design P[a] R[b]	Population N: number of subjects G: gender M/F[c] A: age mean, SD[d], range I: injury	Follow-up	Loss to follow-up	Prognostic factors	Non prognostic factors (not significant)	Outcome
Grauwmeijer 2012 **Netherlands**	P	N: 113 G: 82/31 A: 33.2, 13.1 I: moderate-severe TBI	3, 6, 12, 18, 24, 36 months	N: 19	Adjusted OR, p Psychiatric symptoms 10.6, <0.019 Cognitive FAM[w] 0.92, <0.002	LOS hospital Discharge destination ADL[x] BI[y] FIM[z] GOS[aa] Age	Employment status
Ketchum 2012 **United States**	R	N: 593 N: 418 no missing data G: 337/81 A: 29.6, 10.2 I: TBI	1 year	N: 175	Adjusted OR, 95% CI PTA still vs. <2 wks 4.88, 1.53-15.60 still vs. 2-4 wks 4.45, 1.46-13.57 ≥4 wks vs. <2 wks 3.21, 1.37-7.54 ≥4 wks vs. 2-4 wks 2.92, 1.36-6.30 LOS rehabilitation 1.25, 1.06-1.47 Cause violent 3.99, 1.60-9.94 Cause fall 2.59, 1.15-5.86 Associated spinal cord injury 7.17, 1.81-28.50 FIM-M discharge 1.18, 1.04-1.33 Education low level 8th grade or less 2.54, 1.09-5.94	GCS LOS acute DRS FIM-COG	Competitive employment status

Reference First author Year of publication Geographic location	Design P[a] R[b]	Population N: number of subjects G: gender M/F[c] A: age mean, SD[d], range I: injury	Follow-up	Loss to follow-up	Prognostic factors	Non prognostic factors (not significant)	Outcome
					9th-11th grade 3.04, 1.37-6.74 Pre-injury employment 2.85, 1.29-6.31		
Nakase-Richardson 2007 United States	P	N: 191 qualified participants N: 171 study participants G: 120/51 A: 16-? I: mild-severe TBI	1 year (10-14 months)	N: 20	IQR[ab], 95% CI, p Confusion DeIRS-R98[ac] 0.35, 0.14-0.87, 0.02 Age 0.33, 0.15-0.73, 0.01 Education high level 2.48, 1.47-4.19, 0.00	GCS PTA	Employment
Stulemeijer 2007 Netherlands	P	N: 453 total cohort N: 201 G: 123/78 A: 35.6, 12.3 I: mild TBI	6 months	N: 252	OR, 95% CI No nausea/vomiting 5.1, 1.8-14.3 No extracranial injuries 3.4, 1.6-7.3 Education high level 6.4, 2.3-18.3	GCS LOC[ad] PTA CT Cause Comorbidities Prior head injury Age Gender	Full RTW (not on sick leave or no change in working status because of the accident)
Walker 2006 United States	R	N: 1926 potential participants N: 1341 follow-up data available G: 1033/308 A: 35.0, 18-62 I: mild-severe TBI	1 year	N: 585	Adjusted OR, p Referenced 75% vs. 25% LOS 0.42, <0.05 Independence FIM 2.38, <0.05 Age 0.58, <0.05 Female 1.42, <0.05	Unconsciousness	RTW (competitively employed)

Reference First author Year of publication Geographic location	Design P[a] R[b]	Population N: number of subjects G: gender M/F[c] A: age mean, SD[d], range I: injury	Follow-up	Loss to follow-up	Prognostic factors	Non prognostic factors (not significant)	Outcome
					Education high level 2.32, <0.05 Pre-injury occupation Professional/ managerial 3.16, <0.05 Skilled 1.71, <0.05 Married 1.52, <0.05		

Characteristics of included studies (non-traumatic cause)

Reference First author Year of publication Geographic location	Design P R PC[ae]	Population N: number of subjects G: gender M/F A: age mean, SD, range I: injury	Follow-up	Loss to follow-up	Prognostic factors	Non prognostic factors (not significant)	Outcome
Busch **2009** **England**	R	N: 400 working before stroke N: 266 follow-up data available G: 261/139 A: 53.8, 12.9 I: First stroke	1 year	N: 134	OR, 95% CI Diabetes Mellitus 0.25, 0.08-0.79 ADL BI 0.24, 0.11-0.49 Age 55-64 years 0.14, 0.05-0.42, ≥65 years 0.23, 0.07-0.76 Female sex 0.43, 0.21-0.91 Minority 0.41, 0.19-0.88	GCS	Return to paid work
Doucet **2012** **France**	R	N: 72 included N: 56 responded G: 35/21 A: 48.3, 10.1 I: Stroke Ischemic N: 28 Haemorrhagic N: 20 Cerebromeningeal haemorrhage N: 8	3 years	N: 16	p Language disorders 0.02 ADL BI 0.00 Disability mRS[af] 0.00 Resumption of driving 0.00 Professional support 0.00 Discussed by staff and occupational physician 0.01 Living with a partner 0.01	LOS rehabilitation Stroke type/location Epilepsy Disorders (motor, sensory, cognitive, visual) Age Gender Education Occupation pre-injury Company size Time (in work/with employer) Handicapped worker	RTW (vs. no RTW: invalidity, retirement, training, retraining)

Reference First author Year of publication Geographic location	Design P R PC[ae]	Population N: number of subjects G: gender M/F A: age mean, SD, range I: injury	Follow-up	Loss to follow-up	Prognostic factors	Non prognostic factors (not significant)	Outcome
Glozier **2008** **New Zealand**	P	N: 210 G: 144/66 A: 55 I: Stroke	6 months	N: 55	OR, 95% CI Psychotropic medication/ treatment depression 0.39, 0.18-0.81 Dependent ADL BI 0.28, 0.13-0.59 Pre-injury part-time job 0.6, 0.15-0.89 Minority 0.40, 0.17-0.91	Diabetes Mellitus Age Gender	RTW (return to paid work)
Hackett **2012** **Australia**	P	N: 441 recruited N: 416 remained N: 271 study group (working pre-injury) G: 196/75 A: 50.7, 10.1 RTW A: 52.9, 9.3 no RTW I: Stroke	28 days, 6 months, 1 year	N: 25	OR, 95% CI No illness restricting activity before stroke Male 6.40, 1.46-28.03 Female 5.89, 1.21-28.70 Independent ADL FAI[ag] 10.23, 4.11-25.6 Age 0.94, 0.90-0.98 No health insurance 0.40, 0.18-0.89	No depression No history of depression No other comorbidity Gender Education low level	RTW (full-time or part-time paid work-same/ different job)

Reference First author Year of publication Geographic location	Design P R PC[ae]	Population N: number of subjects G: gender M/F A: age mean, SD, range I: injury	Follow-up	Loss to follow-up	Prognostic factors	Non prognostic factors (not significant)	Outcome
Hannerz **2012** **Denmark**	P	N: 13178 N: 12106 in analysis G: 60.4%/39.6% A: 47.6, 21-57 I: Stroke (haemorrhage/ infarction/ not specified)	2 years	N: 1072	OR, 95% CI Enterprise size (employees) Micro (1-9) 0.83, 0.73-0.95 Small (10-49) 0.87, 0.77-0.98	Enterprise size (employees) Medium (50-249)	Gainful occupation (1=self employed/ assisting spouse/ employee, 0=unemployed/not economically active/ dead)
Kauranen **2013** **Finland**	PC	Patients N: 161 fulfilled inclusion criteria N: 140 study population G: 83/57 A: 52.0, 10.5 I: First ischemic stroke Controls N: 50 G: 31/19 A: 54.3, 9.0	6 months	N: 21	Wald, OR, 95% CI, p Number of cognitive deficits 8.240, 2.25, 1.29-3.92, 0.004	GCS NIHSS[ah] Aetiology (TOAST[ai]) Persistent cognitive deficits ADL BI Age Education high level Occupation pre-injury	Inability to return to work (not returning to paid employment outside the house either full-time or part-time)
Mailles **2012** **France**	P	N: 205 eligible patients N: 176 included N: 63 employed G: ratio M/F 1.6 A: 53.5, 1mo-89y I: Encephalitis	3 years	N: 29	p Resumption leisure activities 0.00 Education high level 0.00		RTW

Reference First author Year of publication Geographic location	Design P R PC[ae]	Population N: number of subjects G: gender M/F A: age mean, SD, range I: injury	Follow-up	Loss to follow-up	Prognostic factors	Non prognostic factors (not significant)	Outcome
Palmcrantz 2012 Sweden	R	N: 232 included N: 158 returned questionnaire G: 104/54 A: 59, 32-64 I: Stroke Infarction N: 126 Haemorrhage N: 28 Not specified N: 4	Up to 7 years	N: 74	OR, 95% CI SSS[aj] 3.91, 1.46-10.46 Education low level 2.69, 1.19-6.08 Living alone 2.30, 1.04-5.10		Limitations/restrictions in returning to work
Saeki 2004 Japan	R	N: 126 G: 99/27 A: 54, 18-64 I: First stroke	Mean 1418 days	N: 5	HR[ak], 95% CI No muscle weakness 3.74, 1.13-12.4 No apraxia 10.7, 1.24-82 Occupation pre-injury 2.11, 1.17-3.81	Stroke location	Return to work (1 month or more in active employment)
Saeki 2010 Japan	P	N: 325 N: 253 answered follow-up questionnaire G: 264/61 A: 55.1, 7.4 I: First stroke	18 months	N: 72	OR, 95% CI Function hemiplegic hand 4.66, 1.40-19.53 Independent ADL BI 2.71, 1.08-7.03 Gender 3.24, 1.11-10.96	Function hemiplegic leg	RTW (active employment at former or new occupation (full-time/part-time competitive employment or self-employment)
Tanaka 2011 Japan	P	N: 335 selected N: 254 analysed G: 267/68 A: 55.2, 7.2 I: First stroke	1 month	N: 81	OR, 95% CI Occupation pre-injury 2.06, 1.00-4.21 ADL BI 1.02, 1.01-1.03 Employment status 17.36, 3.15-95.72 Dysfunction	Aetiology Mental stress at work	RTW (1 month after discharge)

Reference First author Year of publication Geographic location	Design P R PC[ae]	Population N: number of subjects G: gender M/F A: age mean, SD, range I: injury	Follow-up	Loss to follow-up	Prognostic factors	Non prognostic factors (not significant)	Outcome
					Attention 0.35, 0.14-0.91 Memory 0.35, 0.14-0.89 Intelligence 0.32, 0.12-0.89		
Trygged **2011** **Sweden**	P	N: 11864 whole sample N: 7081 analysed G: 4548/2533 A: 40-59 I: First stroke	4 years	N: 4783	RR[aj], 95% CI Education high level 1.13, 1.04-1.22 Income 1.94, 1.77-2.12	Gender	RTW (return to paid job, at least 6.600 €/ year)
Waje-Andreassen **2013** **Norway**	PC	Patients N: 232 inclusion N: 198 first follow-up N: 144 second follow-up Fulltime work N: 61 G: 42/19 A: 51.6, 7.7 Part-time/no work N: 83 G: 40/43 A: 53.5, 8.7 I: ischemic stroke Controls N: 453 inclusion N: 215 first follow-up N: 167 second follow-up Fulltime work N: 92 G: 61/32 A: 53.4, 7.1 Part-time/no work N: 75 G: 30/45 A: 55.7, 6.1	1998-2001 2004-2005 2012-01-01	Patients N: 34 Controls N: 238 Patients N: 54 Controls N: 48	OR, 95% CI, p No memory problems *0.18, 0.07-0.47, <0.001 Functional outcome mRS *0.02, 0.002-0.12, <0.001 Male gender *0.24, 0.10-0.61, 0.002 *OR in article incorrect, reevaluation (personal communication with U. Waje-Andreassen)		Full-time work (versus part-time work or no work)

Reference First author Year of publication Geographic location	Design P R PC[ae]	Population N: number of subjects G: gender M/F A: age mean, SD, range I: injury	Follow-up	Loss to follow-up	Prognostic factors	Non prognostic factors (not significant)	Outcome
Wilz **2009** **Germany**	P	N: 70 G: 56/14 A: 52.4, 8.1, 30-65 I: First stroke	1 year	N: 10	OR, p ADL PCRS[am] 1.21, 0.006	PCRS cognition Gender Income	RTW

[a] P prospective
[b] R retrospective
[c] M/F male/female
[d] SD standard deviation
[e] TBI traumatic brain injury
[f] OR Odds Ratio
[g] 95% CI 95% confidence intervals
[h] CT computerized tomography
[i] FIM COG Functional Independence Measure Cognitive
[j] FIM M Functional Independence Measure Motor
[k] CIQ Community Integration Questionnaire
[l] DRS Disability Rating Scale
[m] RTW return to work
[n] GCS Glasgow Coma Scale
[o] PTA post-traumatic amnesia
[p] LOS length of stay
[q] GOS-E Extended Glasgow outcome scale
[r] BNIS Barrow Neurological Institute Screen
[s] NRS Neurobehavioral Rating Scale
[t] SRT Selective Reminding
[u] WAIS Wechsler Adult Intelligence Scale
[v] DOT Dictionary of Occupation Titles
[w] FAM Functional Assessment Measure
[x] ADL activities of daily living
[y] BI Barthel Index
[z] FIM Functional Independence Measure
[aa] GOS Glasgow outcome scale
[ab] IQR interquartile range coefficients
[ac] DELRS-R98 Delirium Rating Scale Revised 98
[ad] LOC loss of consciousness
[ae] PC patient control
[af] mRS modified Rankin scale
[ag] FAI Frenchay Activities Index
[ah] NIHSS National Institutes of Health Stroke Scale
[ai] TOAST Trial of Org 10172 in acute stroke treatment
[aj] SSS Scandinavian Stroke Scale
[ak] HR Hazard ratio
[al] RR relative risk
[am] PCRS Patient Competency Rating Scale

3

Return to work following acquired brain injury: the views of patients and employers

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Abstract

Purpose

To investigate which factors are experienced as facilitators of or barriers to return to work (RTW), or as solutions to RTW-problems, by patients with acquired brain injury (ABI) and by employers.

Design

Qualitative study.

Methods

Ten patients with ABI and seven employers participated in semi-structured interviews. Patients and employers were unrelated. Transcripts were open coded. Factors perceived to be facilitators, barriers or solutions to RTW-problems were grouped on a thematic basis.

Results

Both patients and employers distinguished patient-related and work-related facilitators. When questioned about barriers, both patients and employers emphasized the importance of work-related factors such as sensory overload at the workplace and condition-related factors such as fatigue. Patients regarded poor guidance and support as barriers, but employers did not. Employers and patients suggested that solutions to RTW-problems were work-related, if necessary backed up by professional supervision. Patients also mentioned the need for understanding and acceptance of the limitations resulting from ABI.

Conclusions

Both patients and employers mentioned work-related and patient-related facilitators, work-related and condition-related barriers and work-related solutions to RTW-problems. Patients mentioned lack of guidance and support as barriers, and stressed the need for understanding and acceptance of the limitations resulting from ABI in any RTW-solution.

Introduction

Acquired brain injury (ABI) is an injury to the brain, either with a traumatic or a non-traumatic cause, that occurs after birth [1]. ABI often results in long-term cognitive, physical, behavioural and emotional disabilities that can have an adverse effect on return to work (RTW) [2,3]. It has been shown that only 40% of the patients with ABI, who were working before the injury return to work within two years after the injury [4]. This is an important finding, as about 75% of the patients with ABI are of working age [3]. Research has demonstrated that RTW is a crucial element in the quality of life of patients with ABI, providing a social environment, financial independence and a sense of purpose [5,6].

Given the importance of RTW, research in this field has focused on optimization of patient care to support RTW of patients with ABI. In this context a systematic review was conducted on factors associated with RTW after traumatic and non-traumatic ABI [7]. In summary, personal factors after traumatic ABI (education level, unemployment), and activity-related factors after non-traumatic ABI have proven to be associated with RTW [7]. Besides, another systematic review demonstrated that a combination of work-directed interventions, coaching/education and/or skills training are effective for RTW after ABI [8]. These studies provide information to recognise patients for whom RTW is probably less likely [7] and which interventions might facilitate RTW for patients with ABI [8].

However, it remains unclear how patients experience the RTW-process themselves. It is recognized that patients play a central role in the RTW-process [9]. Besides, it was shown that patients prefer to be actively involved [10,11]. The patient's subjective experience provides crucial input for optimization of the RTW-process. As a key figure in this process, the patient himself can provide highly relevant insights on factors that he sees as facilitating or hindering RTW and what he considers to be effective solutions to problems in this context [12]. However, only a few studies reported the experience of patients with ABI during RTW [10-13]; another study investigated the experiences of employer specialists, without actively involving the patients themselves [14]. Hence, it remains unclear what patients regard as possible solutions when RTW is problematic. According to patients with ABI, a supportive employer with a positive approach facilitates RTW, while lack of knowledge and support from employers and colleagues were mentioned as important limiting factors [12,13]. Not only the patient but also the employer seems to have an important role to play in achieving successful RTW. Nevertheless, research on the employer's perspective on RTW of patients with ABI is scarce [15]. In order to fill this gap, the present study has therefore been designed to investigate the factors experienced as barriers to or facilitators of RTW, or as solutions to RTW-problems, according to both patients with ABI and employers.

Methods

The study was designed to be qualitative and conducted in accordance with the consolidated criteria for reporting qualitative research (COREQ) [16]. Patients and employers participated in individual, semi-structured interviews. These interviews were conducted to explore their views on the barriers to or facilitators of RTW after ABI and on possible solutions to problems encountered in this process. Sampling was guided by the research question (i.e. what are barriers to, facilitators of RTW and possible solutions to RTW-problems?). Patients and employers were unrelated.

Ethics

The research was conducted in accordance with the declaration of Helsinki [17]. The research proposal was submitted to, and approved by the Medical Ethical Committee of the Academic Medical Center, that judged that a comprehensive evaluation was not required since this study was not subject to the Medical Research Involving Human Subjects Act (Reference number W13_043# 13.17.0057).

Patients

Patients were eligible to take part in the study if they had non-progressive ABI, were of working age (18-65 years), had a paid job at the moment of injury, had an adequate command of Dutch and were willing to participate. They were recruited through Dutch ABI-patients associations. Representatives and experts from these associations posted information about the study on their website or in magazines, and also distributed flyers containing written information about the study to potential participants in their regional networks. Dutch rehabilitation centres were also asked to hand out such flyers to their patients. The recruitment procedure was designed to collect a heterogeneous sample of patients with different work settings from different geographic regions in the Netherlands. When patients indicated that they were interested, the first author (BDC) contacted them by telephone or by e-mail to clarify the aims and procedures of the study. All interested patients received detailed written information about the study and an informed consent form. The research team decided to plan interviews with the first twelve consecutive patients who met the inclusion criteria and agreed to participate, had signed the informed consent form and were enrolled in the study. Patients were interviewed sequentially until no new facts appeared regarding facilitators of, barriers to RTW and solutions to RTW-problems according to preliminary analysis of the previous interviews; it was concluded at this point that data saturation had been reached.

Employers

Employers – that is, directors, line managers, supervisors, HR managers and the like who were closely involved in the RTW-process of at least one patient with ABI – were eligible to participate in the study. Initial attempts to recruit employers by contacting various companies were unsuccessful. The research team therefore decided to approach all fifteen employers who were nominated for awards by the Dutch Brain Foundation between 2010 and 2012. These annual awards were established for employers demonstrating sustained and outstanding efforts aimed at helping patients with any type of brain damage to return to work. According to the website of the Dutch Brain Foundation eleven of the fifteen nominees (including those who actually won the awards) had at least one patient with non-progressive ABI among their employees. These eleven employers were contacted and informed about the aims of the study. If they were interested, they received further written information. Those employers who were willing to participate were sent an informed consent form, which was filled in and signed before the interview took place. The interviews were continued until it was concluded that no new information was being obtained regarding facilitators of, barriers to RTW and solutions to RTW-problems according to preliminary analysis of the previous interviews and thus that data saturation had been reached.

Interviews

Participants were fully informed about all aspects of the study, including the fact that all information collected was treated in strict confidence, before the start of the interview. The first author, who is an experienced insurance physician trained in qualitative research on ABI and RTW, held face-to-face semi-structured interviews with all patients and employers. She had had no contact with the participants before the start of the study. Participants were interviewed once, with no one else present, at a time and location that suited them. All interviews were audio-recorded with the consent of the participants. The research team developed one interview structure for patients and another for employers. Interviews were based on the use of topic lists derived from the study objectives. The topic lists for all participants contained items concerning demographic characteristics; work-related issues, such as patients' former and current employment status; barriers to and facilitators of RTW and solutions to RTW-problems. In addition, patients were asked about their medical history and the treatment they had received. The interview was guided by open-ended questions, developed through discussion with the research team. Typical questions addressed to patients included: "What did you experience as a barrier to your RTW?", "What impact did this have on your own RTW?" and "What approach was taken to deal with this problem?" The questions for employers included: "Which factors, in your opinion, enabled your employee to return to work?", "Which factors do you believe made it more difficult for your employee to return to work?" and "In retrospect, what steps were taken to resolve the problems that arose during your employee's RTW?" Both patients and

employers were encouraged to take active part in the discussion and to speak freely about any matters they saw as key RTW-issues. The interviewer summarized the interviewees' replies and presented the summaries to them, in order to give them an opportunity to clear up any misunderstandings.

Data analysis

All audio-recorded interviews were transcribed verbatim. The transcripts were read and reread by the first two authors (BDC and MS) to obtain an overall impression of their content. MAXQDA qualitative data analysis software (Verbi GmbH Marburg, Germany) was used to facilitate data management.

Interview data obtained from patients and employers were analysed separately. The first author (BDC) initially coded the first patient interview line by line and discussed the selected codes with the research team (MS, HW and MFD) until consensus was reached. The coding process involved identifying words or phrases representing the basic meaning of the text as closely as possible. The first two authors (BDC and MS) then both coded the next patient interviews separately. The codes initially identified were subsequently grouped under three headings: facilitators, barriers and solutions to RTW-problems as perceived by patients. The first two authors then compared each other's coding and inconsistencies were discussed until consensus was reached. The codes were also discussed with the whole research team until disagreements concerning the codes and their grouping had been resolved. The interviews with employers were analysed in the same way.

Results

Data saturation was achieved after ten of the twelve planned patient interviews had been performed. All interviews were held in May 2013; three at the patient's home and seven at the workplace. The mean duration was 63 minutes (range 44-87).

Nine of the eleven eligible employers were willing to participate. Interviews were also held in May 2013; all except one at the workplace. They lasted on average 38 minutes (range 28-51). In this case, data saturation was reached after seven interviews.

Characteristics of participants

Participant characteristics are presented in Tables 1 and 2. Five patients were male and five were female. Their mean age was 47 years (range 34-63). In two patients ABI was caused by a traumatic event; seven sustained non-traumatic ABI and one suffered two ABIs. The mean time since ABI was 10 years (range 2-32). Eight patients were highly educated. Before their injury, the patients had worked in business, science, health and teaching. Six had a full-time job, three worked part-time and one was at school. After ABI, five patients returned to their

former employer with permanent job adaptations. Two moved to a different type of work, and one failed to return to work. One patient initially returned to work and then retired. The employers were all middle-aged; four were male and three were female. Three of them worked as a line manager, one as a director, another as a supervisor and two were HR managers. They had worked in a wide variety of different sectors – including the police, a hospital, a school, a factory and a national sports federation - for several years. The organization size ranged from 30 to 11000 employees, with a mean of 2500 employees.

Table 1. Patient characteristics (gender, age, time since ABI, cause ABI, work status before/after ABI)

Patient	Gender	Age when interviewed[a]	Time since ABI when interviewed[a]	Cause ABI[b]	Work status before ABI[c]	Work status after ABI[c]
1	Female	63	5	NT	Part-time	Part-time
2	Female	48	18; 6	T and NT	Part-time	Part-time
3	Male	36	5	NT	Full-time	Part-time
4	Male	47	5	T	Full-time	-
5	Male	40	32	NT	-	Part-time
6	Female	34	2	T	Full-time	Full-time
7	Male	50	15	NT	Full-time	Full-time
8	Female	37	2	NT	Full-time	Part-time
9	Female	58	12	NT	Part-time	Part-time
10	Male	56	3	NT	Full-time	Part-time

[a] In years
[b] Non-Traumatic (NT), Traumatic (T)
[c] Part-time = <38, full-time = z38

Table 2. Employer characteristics (gender, company, number of employees, position)

Employer	Gender	Company	Number of employees	Position
1	Male	Town hall	1900	Supervisor
2	Female	Academic hospital	11000	Line manager
3	Female	National Sports Federation	29	HR manager
4	Male	Police office	1230	Line manager
5	Male	School (13,836 students)	2965	Director
6	Male	School (1,400 students)	140	Line manager
7	Female	Factory	240	HR manager

Interview findings

Patients and employers mentioned a large number of facilitators, barriers and solutions to RTW-problems. The research team grouped these into the following categories: 1) condition-related, 2) patient-related, 3) work-related, 4) environment-related and 5) guidance/coaching/support. Furthermore, a distinction was made between effectuated

solutions (which had been put into practice) and hypothetical solutions (which had not). All facilitators, barriers and solutions are presented in detail in Appendix 1. Some are outlined below, along with quotations to illustrate them.

Factors experienced as facilitators of RTW according to patients and employers

Patient-related

Patients and employers identified several factors facilitating RTW, such as the patient's drive. Patients and employers agreed that good job performance prior to ABI facilitated RTW. One employer stressed the importance of being a good team worker.

"…as far as I could see, he really fitted into the team … He did a lot to promote social cohesion" (employer 5).

Only patients mentioned the importance of active involvement in their own RTW-process:

"…I did it my way … that was very important to me" (patient 1).

Work-related

Employers emphasized the importance of ensuring that RTW did not lead to financial loss for the company.

"…After all, in the final analysis we're here to make profits" (employer 7).

Employers also referred to their own role in helping patients to return to work, and noted the importance of their willingness to support the patient. It helped if they really wanted the patient back at work. Patients confirmed this from their own perspective. In addition, both patients and employers noted that if an employer had sufficient knowledge of ABI and how it might affect the ability to work, this definitely facilitated RTW.

One patient mentioned his employer allowed him to work at his own pace.

Environment-related

Both patients and employers underlined the importance of support from the partner, whose observation of the patient's functioning at home helped to reset goals during the RTW-process.

Guidance/coaching/support

Patients and employers both mentioned that professional support facilitated RTW.

"… the labour expert had already prepared me to play my role" (employer 2).

Patients appreciated contact with fellow sufferers, they learned from their experience.

"…All I can say is that I learned an awful lot from it" (patient 9).

Factors experienced as barriers to RTW according to patients and employers

Condition-related

Patients reported feeling vulnerable during RTW due to invisible disabilities such as fatigue or cognitive problems. Employers reported observing similar problems.

Patients' inability to explain these disabilities was mentioned as a problem in its own right.

"I didn't have a clear picture of what was going on at that time … it was impossible to explain the problem to anyone else" (patient 6).

Patients and employers mentioned fatigue as an important barrier to RTW in this context.

"…my colleagues told me, 'just go home, old chap. There's no point in staying on'… I just couldn't handle it: I was so tired!" (patient 4).

Patient-related

Employers noted that if the patient was too driven, for example by the need to maintain financial security, the resulting stress might threaten successful RTW.

"…'look, I need the money… what if I won't be able to work at all anymore… who will look after me then?'" (employer 3 citing patient).

Work-related

Patients and employers both noted that line managers' lack of knowledge of sick leave, and company reorganization, were barriers to RTW. One employer added that reorganization led a patient to be placed in an unsuitable job.

"As a result of the reorganization, he was …placed in the administration department... Well, if there's one job … he's not good at, that's administration" (employer 1).

Patients stated that many work-related factors, such as a gradual increase in workload, impeded successful RTW.

"…the workload was gradually increased, and then at a given moment you realize that you simply can't cope any more" (patient 8).

Both patients and employers mentioned sensory overload at the workplace as major barriers to RTW.

"…if you have to work in an open-plan office like this, with continuous murmur, normal functioning is dramatically hindered." (patient 2).

Environment-related

Patients and employers mentioned pressures at the patient's home or people claiming a patient's time as barriers to RTW.

"…the home situation was already so burdensome… it could not be combined with work" (patient 4).

Guidance/coaching/support

Patients complained that they did not receive sufficient information about the consequences of ABI from the physicians who treated them. They had no clear picture of their limitations when they returned to work, which led to a feeling of helplessness. Patients further noted that occupational and insurance physicians had insufficient knowledge of ABI, which slowed down the RTW-process in their opinion. Several patients needed to know more about the relevant regulations, and found it difficult to access the appropriate sources of information.
"… The people I need to call on for advice… are hidden away behind the almost impenetrable maze of options set up by call centres" (patient 3).
Employers mentioned no barriers in this context.

Effectuated solutions according to patients and employers

Condition-related

Contact with fellow sufferers and work samples helped patients to gain a better understanding of the limitations caused by their ABI.

Patient-related

Both patients and employers mentioned that RTW is facilitated if the patient sets limits.
"…and then I started thinking… there's no point in overloading myself… so I told …I don't want to work more than … 5 and a half hours a day, 5 days a week" (patient 10).
One patient benefited from training on personal effectiveness.
"… what really helped me was… a training course… where I worked on my own personal effectiveness" (patient 5).

Work-related

Patients and employers both mentioned focusing on abilities as a crucial initial step in the RTW-process.
"But the most important thing for me was …making up my own mind about what I was able to do" (employer 2).
Both parties mentioned the importance of workspace adaptations.
"…for example, we had to convert a soundproofed studio into an office with low external noise levels" (employer 6).
They also stated that an adaptation of working hours could have a positive effect on RTW.
Patients reported that colleagues drove them to and from work if they had problems driving themselves.
"I get taken to work and brought home … And I've never had anyone at all complain about the inconvenience it caused them" (patient 7).

Environment-related

One of the patients arranged to have home help to perform domestic tasks she felt too tired to do herself.

Guidance/coaching/support

Both patients and employers mentioned cases where professional assistance was called in during RTW, as a sounding board for the employer and to act as a coach for the patient.

Hypothetical solutions according to patients and employers

Patients and employers also listed a number of promising solutions that had not already been put into practice in the experience of the interviewee in question. Patients mentioned such possibilities in all categories; these suggestions included engaging professional assistance during the RTW-process.

"… to provide supervision and support…very important…to do that on a professional basis" (patient 9)

The hypothetical solutions recommended by employers were only work-related, and involved professional support if appropriate. One employer mentioned the importance of emphasis on abilities instead of limitations during RTW.

"…you need to see what he can do, and put him in a job where he can use those skills" (employer 1).

Discussion

The purpose of this study was to investigate the factors experienced by patients with ABI and their employers as facilitators of or barriers to RTW, and as possible solutions to RTW-problems. Facilitators, barriers and solutions to RTW-problems according to patients and employers were grouped into subcategories: 1) condition-related, 2) patient-related, 3) work-related, 4) environment-related and 5) guidance/coaching/support. The solutions were categorized into effectuated solutions (which had been put into practice) and hypothetical solutions (which had not).

Both patients and employers identified patient-related factors, such as good pre-injury job performance and work-related factors, such as supportive colleagues (e.g. taking over patient's duties, showing understanding, providing emotional support) that facilitate RTW. As far as barriers to RTW are concerned, both patients and employers underlined the importance of work-related factors such as sensory overload at the workplace and condition-related factors like fatigue. Patients mentioned that a lack of guidance and support could hinder RTW, but employers did not. Most of the solutions mentioned by patients and employers were work-related, supplemented if necessary by professional assistance.

Patients also listed other essential solutions such as understanding and acceptance of the limitations of ABI.

Comparison with other studies

An inability to ignore sensory overload at the workplace was commonly perceived as a barrier to RTW by the patients and employers participating in the present study. This problem seems to be particularly relevant to patients with ABI, as they often have problems with attention and concentration. Reduction of sensory overload might therefore make a substantial contribution to RTW of patients with ABI.

Some of the results of this study are in line with those of prior qualitative studies on RTW of patients with other chronic diseases [18-21]. Patients and employers in the present study underlined the importance of invisible limitations such as cognitive disabilities and fatigue as barriers to RTW. These experiences are consistent with those of patients with cancer, who reported that fatigue and cognitive problems impeded work functioning for a long time after cancer diagnosis and treatment [18,19].

Cognitive problems were dealt with by reducing the amount of tasks to be performed in a working day [18]. Fatigue could be combated by reducing working hours [18] or working from home [20]; in line with the solutions in this study.

Patients in this study reported a lack of understanding by employers as a barrier to RTW, in agreement with the results of other qualitative studies concerning workers with back pain [21] and cancer [19]. Cancer patients suggested that this lack of understanding might be due to the fact that their limitations were not visible to the naked eye [19], in line with the comments of the patients and employers in the present study. Cancer patients mentioned that provision of information on such topics as fluctuations in fatigue level might be helpful [19]. Similarly, calling in the assistance of a professional such as a rehabilitation specialist was seen as a valuable solution by patients and employers in the present study. This is consistent with the findings of a previous investigation, where the rehabilitation professional provides information on measures that might facilitate RTW of patients with ABI [22]. The results were promising: the rehabilitation professionals, patients, employers and occupational physicians involved agreed that this approach did facilitate RTW of patients with ABI [22].

Methodological considerations

The design of this qualitative study allowed a better understanding of the complex RTW-process by exploring the experience of patients and employers – the most important stakeholders in this process – through semi-structured interviews [16]. Analysis of the extensive overview obtained in this way may point out ways of improving RTW of patients with ABI.

The patients in this study were self-selected; they proactively indicated that they were

interested in participating. This may have yielded a population consisting of individuals who were highly motivated to RTW. The patients in this study suggested a number of solutions to RTW-problems, such as emphasis on abilities that may be applicable to patients with ABI in general. Further research building on the results of this study may make it possible to develop procedures that will be helpful in the daily practice of assisting patients to return to work after ABI.

In line with previous reports [23], it was difficult to recruit employers for the present study; they may have been reluctant to participate due to considerations of business confidentiality, and because they did not wish to have their methods of managing employees' RTW analysed in detail by a third party. The research team therefore decided to recruit employers who were motivated to participate because they had been nominated for an award recognizing outstanding performance in the RTW of patients with ABI. This resulted in a sample of nine employers. Data-saturation was reached after seven consecutive interviews: no new facts appeared regarding facilitators of or barriers to RTW and solutions to RTW-problems. The analysis of unsuccessful attempts to help such patients to return to work might have yielded useful additional insights. However, the strength of the present study is that the solutions reported as having been adopted did lead to success in the RTW-process. This makes them valuable examples of proven practice in RTW of patients with ABI that could be applied by other organisations.

Implications

Employers as well as patients are intimately involved in RTW of patients with ABI. Patients and employers need one another, and both their perspectives need to be taken into account. Other authors have similarly demonstrated the importance of employer involvement during RTW of cancer patients [23,24]. However, the communication between the stakeholders in the RTW-process is still often inadequate [25]. Patients in the present study mentioned having problems understanding and accepting the limitations they were subject to as a result of their ABI, which hindered their communication with the employer and consequently RTW. Patients gained a better understanding of their limitations through contact with fellow sufferers. This enabled them to discuss their limitations with their employers and to propose limits on their own activities. Employers saw such input as helpful in facilitating their employees' RTW.

Employers in the present study, in their turn, facilitated RTW of patients with ABI in their employment by restructuring the workplace to take the patients' strengths into account, and mentioned that professional assistance (from a rehabilitation specialist, occupational physician, labour expert, re-integration agency or the like) could be crucial in this context.

Patients in this study noted the importance of self-involvement in the RTW-process, which can be facilitated if all stakeholders work together to promote patient-centred care through shared decision-making. In line with this, RTW of patients with ABI may be facilitated in

the future if all professionals involved in the RTW-process are aware of the perspectives reported in this study and implement them successfully in their daily practice.

Conclusions

Patients and employers identified patient-related factors, such as good pre-injury job performance and work-related factors, such as supportive colleagues that could facilitate RTW. As barriers to RTW both patients and employers underlined the importance of work-related factors, such as sensory overload at the workplace and condition-related factors, such as fatigue. Patients mentioned that a lack of guidance and support could hinder RTW. Most of the solutions mentioned by patients and employers were work-related, supplemented if necessary by professional assistance. Patients also emphasized the need for understanding and acceptance of the limitations resulting from ABI in any RTW-solution.

Implications for rehabilitation

- Patients and employers are important stakeholders in the RTW-process of a patient with ABI
- Professionals in rehabilitation practice, occupational and insurance physicians (IP)s need to help patients and employers to realize RTW
- Professionals have to be aware of the perspectives of patients and employers regarding RTW, such as:
  - Little understanding of limitations resulting from ABI
  - Work-related aspects hindering RTW, such as sensory overload and high work pressure
  - Condition-related barriers to RTW, such as (invisible) cognitive limitations and fatigue
  - Need for professional assistance during the RTW-process

Disclosure statement

The authors report no declarations of interest

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Appendix 1

Factors experienced as facilitators of return to work (RTW) according to patients and employers

Patients	Employers
1. Condition-related	***1. Condition-related***
X	**X**
2. Patient-related	***2. Patient-related***
• **involved in own RTW-process**	• **attitude to RTW**
• **characteristics**	o strong work ethic
o drive/passion	o motivated
o structured	o proactive
o confident	o driven/passionate
• **pre-injury employment contract**	o go-getter who radiates purpose
o work experience	o positive attitude
o good pre-injury job performance	o enthusiastic
	o enjoyment in work
	• **qualities**
	o good job performance
	o bonus/valued by employer
	• **social/communication**
	o nice person
	o fits in with team/ good team worker
	o social agent
	o frank about limitations
3. Work-related	***3. Work-related***
• **working conditions**	• **company**
o financial aspects	o many RTW-opportunities available
- remuneration	o adapted work feasible
o employee insurance provides safety net during incapacity	o RTW feasible (without financial loss)
	o supportive culture
• **workload**	• **workspace**
o no high work pressure	o no adaptations necessary
• **line manager**	- patient has few physical limitations
o knowledge/experience	o adaptations/facilities present
- of ABI	- aids
- of reintegration and sick leave	speech recognition
o active facilitating role	software
- few organizational layers	headset
o employer wants patient to work	desk
o trusted by colleagues and employer	- disabled toilet
o understanding	• **line manager regarding RTW-process**
o support	o knowledge of ABI/sick leave
• **colleagues**	o feels capable
o knowledge and experience of ABI	o determined
o understanding	o has put in much effort
o support	o personal control
	o positive mind-set
	o positive attitude
	- willingness to adjust work schedule

	o has known patient a long time o knows patient's value o wants patient back at work o familiar with patient's abilities/limitations o supported by labour expert o understanding o provides support o open communication with patient • **colleagues/team** o employee well-liked by colleagues o positive attitude regarding RTW o willingness to take over patient's duties o close-knit team o support
4. Environment-related	***4. Environment-related***
• **partner involved in RTW-process** • **supportive partner**	• **supportive spouse** • **social network**
5. Guidance/coaching/support	***5. Guidance/coaching/support***
• **contact with fellow sufferers** • **personal assistance** • **team consultation** • **support professionals**	• **support professionals** o occupational physician o reintegration agency

Factors experienced as barriers to RTW according to patients and employers

Patients	Employers
1. Condition-related	***1. Condition-related***
• **stagnation in recovery** • **ABI-related limitations** o little understanding of limitations - inability to explain o vulnerability o limitations not visible • **cognitive limitations** o thinking - ordering thoughts - thinking speed o concentration o memory - auditory memory • **physical limitations** o vision o left arm o writing o walking • **lack of energy/fatigue** o overburdened	• **limitations not visible** • **unable to express thoughts** • **linguistic deterioration** • **fatigue**

- **limitations due to comorbidities**
  - o rheumatism
  - o neck and back problems
- **performance**
  - o variable abilities
  - o information processing
  - o speed of action
    - slow
  - o no longer able to multitask
  - o difficulty adapting to changes
  - o accuracy
  - o problems using English

2. Patient-related

- **characteristics**
  - o lack of self-confidence
- **insufficient knowledge**
  - o of ABI
  - o of laws and regulations

3. Work-related

- **bureaucracy**
- **working conditions**
  - o low income
  - o return on investment made in patient
- **working environment**
  - o organizational developments
    - dismissal due to reorganization
  - o physical
    - sensory overload
      - noise in the workplace
      - visual stimuli
      - olfactory stimuli
  - o psychological
    - frequent change of workspace
    - chaos
    - carve out a position
    - isolation
    - negative atmosphere
- **workload**
  - o gradual workload increase during reintegration
  - o excessive duties
    - high work pressure
      - excessive caseload
    - deadlines
    - coaching sessions
    - large group consultations
      - lengthy meetings
    - commute
- **line manager**
  - o little knowledge and experience of reintegration and sick leave

2. Patient-related

- **attitude to RTW**
  - o too driven/passionate
  - o motivated by need to maintain financial security
- **mourning process**
  - o loss of former dream job
  - o acceptance of inability to perform former work

3. Work-related

- **company**
  - o few other jobs available
  - o reorganization
    - no suitable job
- **patient unable to perform job duties**
  - o disorganized
  - o typing
  - o physical examination
  - o operating a car
- **workspace**
  - o sensory overload
    - many activities
    - many interactions
- **line manager**
  - o lack of knowledge of ABI/sick leave
- **commute**
  - o patient not allowed to drive

o passive role - negligent regarding reintegration o lack of support o lack of understanding o poor rapport o no open communication • **colleagues** o lack of understanding o no support	
4. Environment-related	***4. Environment-related***
• **no support from ex-partner** • **pressures at home**	• **people claiming patient's time** • **lack of social safety net**
5. Guidance/coaching/support	***5. Guidance/coaching/support***
• **long waiting times** • **professional has insufficient knowledge of ABI** o occupational physician o insurance physician • **poor information provision** o clinical phase - not informed about diagnosis - consequences of ABI o regulations - lack of access - lack of explanation	**X**

Overview of effectuated solutions according to patients and employers

Patients	**Employers**
1. Condition-related	***1. Condition-related***
• **understanding of limitations** o through contact with fellow sufferers o through work samples • **medication** o anticonvulsant drug	**X**
2. Patient-related	***2. Patient-related***
• **frank about limitations** o patient o third parties • **limits set** o by patient o by employer • **acceptance of ABI** • **training/working on personal effectiveness**	• **patient sets limits**
3. Work-related	***3. Work-related***
• **RTW-budget provisions** • **emphasis on possibilities/ abilities** • **adaptation of workload** o gradual workload increase o create structure	• **company** o document job duties in case of reorganization • **adaptation of activities** o create practicable long-term job description o think outside the box

  - o limit work pressure
  - o more time for tasks
  - o avoid large group meetings
  - o put information in writing
    - - use of pictographs
- **opportunity to recover**
  - o adaptation of working hours
  - o take breaks
  - o opportunities for rest
  - o adapted schedule
- **workspace adaptations**
  - o ergonomics
  - o aids
    - - white board/bulletin board
    - - telephone alerts
    - - e-reader
    - - large monitor
    - - earplugs/ear buds
  - o reduce sensory overload
    - - work from home
    - - quiet workspace
    - - own office
    - - adjusted lighting
- **commute adaptations**
  - o more restful transport
  - o colleagues drive patient to and from work
- **patient is frank about limitations**
  - o continuing challenge for patient
  - o continuing satisfaction for patient
  - o remains useful for company
  - o former work as much as possible
  - o keyed to patient's strengths
    - - patient has experience with tasks
    - - provide training
    - - coordination of tasks
    - - coaching
    - - confidential adviser
    - - small group of learners
  - o existing interests
  - o more structure
  - o more repetitive work
  - o no work pressure
  - o no deadlines
  - o fewer conflicts
- **adaptation of working hours**
  - o reduced working hours
  - o more breaks
  - o no shift work
  - o no rotations
- **workspace adaptations**
  - o work from home
  - o reduction sensory overload
  - o quieter children
  - o fewer people around
  - o calm
  - o less hectic
  - o less fork-lift traffic
  - o less noise
  - o closed fork-lift truck
  - o old sound studio converted into office
  - o large monitor
  - o automated door opener
  - o disabled bicycle parking
  - o automated car
- **commuting arrangements**
  - o acquaintances drive patient to and from work
- **line manager regarding RTW-process**
  - o pro-active
  - o takes necessary time
  - o focuses on abilities
    - - premised on abilities
    - - emphasis on abilities instead of limitations
    - - workload matches patient's abilities
    - - continuous adjustment according to abilities
  - o consultation
    - - open communication with patient
    - - discussion of solutions with patient
    - - sets limits
    - - demands honesty regarding patient's limits

	- patient is clear about abilities and limitations - alerted by patient when patient can't keep up - regarding increase in working hours • **colleagues in RTW-process** o informed about ABI by patient o take over tasks - assistance when communication is difficult - writing letters - physical examination
4. Environment-related	***4. Environment-related***
• **domestic services**	**X**
5. Guidance/coaching/support	***5. Guidance/coaching/support***
• **call in a professional** o re-integration agency o coach o coach on good terms with patient	• **call in professional assistance** o consultation with rehabilitation specialist o occupational physician as a sounding board o occupational physician to prevent medically imprudent work o labour expert o re-integration agency

Overview of hypothetical solutions, according to patients and employers

Patients	Employers
1. Condition-related	***1. Condition-related***
X	**X**
2. Patient-related	***2. Patient-related***
• **frank about limitations** • **acceptance of ABI** • **recovery of self-confidence**	**X**
3. Work-related	***3. Work-related***
• **create more RTW-options** • **emphasis on possibilities/abilities** • **adaptation of workload** o spread out workload o more time to perform tasks • **create opportunities to recover** o adaptation of working hours • **workspace adaptations** o reduce sensory overload o reduce noise/voices • **line manager regarding RTW-process** o active facilitating role - extremely flexible - performance feedback • **colleagues** o more support	• **line manager regarding RTW-process** o knowledge of ABI/sick leave - learns about ABI - gathers knowledge calls in a professional suited to patient o takes time needed o focuses on abilities - premised on abilities - emphasis on abilities instead of limitations o customization o seeks suitable work within company o creates long-term job satisfactory to both patient and employer o makes commuting arrangements o consultation - open communication - patient is frank about limitations

	- listens carefully to patient - informs and involves colleagues
4. Environment-related	***4. Environment-related***
• **partner involved in RTW-process**	**X**
5. Guidance/coaching/support for RTW	***5. Guidance/coaching/support for RTW***
• **earlier intervention** • **call in a professional** o occupational physician • **provide information** o laws and regulations - specialized ABI service point - to patients - to employers • **contact with fellow sufferers** o among patients o among affected employers	• **call in a professional**

4

Return-to-work in patients with acquired brain injury and psychiatric disorders as a comorbidity: A systematic review

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Abstract

Objective

To explore the association between psychiatric disorders as a comorbidity and return to work (RTW) in individuals with acquired brain injury (ABI).

Methods

A systematic review was performed. The search strategy (2002-2012) contained terms related to ABI, psychiatric comorbidity and keywords adapted to the outcome measure RTW. Selection and review were performed by two authors independently. In the case of uncertainty, a third author was consulted to reach consensus on inclusion or exclusion. The methodological quality of included studies was determined and evidence was classified.

Results

Seven studies were included. Strong evidence was found for a negative association between psychiatric disorders as a comorbidity (like depression, anxiety and post-traumatic stress disorder) and RTW of patients with ABI. Patients with a previous history of psychiatric disorders were at considerably higher risk for a new episode and lower RTW rates following ABI.

Conclusion and implications

Psychiatric disorders as a comorbidity after ABI are strong negatively associated with RTW. The heightened frequency of psychiatric disorders as a comorbidity after ABI and more important their amenability to treatment, implicates that more attention should be paid to diagnosing and treating psychiatric disorders as a comorbidity in patients with ABI in order to further improve reintegration in work.

Introduction

In the Netherlands every year, 60000 citizens (or 400/100000) are registered in hospitals due to acquired brain injury (ABI) [1]. This group of disorders includes all types of brain injury occurring after birth, with ~ 25% of the cases caused by traumatic events and 75% by non-traumatic events (like cerebrovascular diseases) [1]. A prominent percentage of patients with ABI, 50% of those with traumatic brain injury (TBI) and 30% of those with non-traumatic brain injury, are part of the working population [2]. There is a wide variance in return to work (RTW) rates following ABI, with reported results ranging from 13%-73% [3,4]. A systematic review shows that only a minority of individuals with ABI (~ 40%) are able to return to work within 2 years [2]. Employment is an essential part of daily living, affecting social integration, health status and quality-of-life [5]. Considering the importance of employment, RTW should be one of the main outcome goals of rehabilitation and treatment in patients with ABI.

In order to provide targets to improve reintegration, it is important to understand the consequences of ABI and to identify key variables influencing the daily life and RTW of these patients. ABI is known to be one of the leading causes of morbidity affecting physical, neurological, psychiatric and cognitive functions [6,7]. Despite the impact of the brain injury itself, patients need to cope with disabilities and adapt to changes in day-to-day life [8,9]. For example, patients are confronted with the inability to accomplish everyday activities. These impeding conditions place an enormous burden on patients and may lead to psychological distress, which could eventually result in the development of psychiatric disorders.

Behavioural and psychiatric disorders are known to occur frequently in individuals with ABI [10]. Regarding the known epidemiologic data, previous literature found a heightened occurrence of psychiatric disorders as a comorbidity in patients with ABI compared to known prevalence rates in the general population [11-15]. Koponen et al. [16] report that ABI might cause decades-lasting vulnerability to developing psychiatric disorders. Furthermore, it has been noted that psychiatric disorders often remain undiagnosed and therefore untreated [15,17]. Some authors even speak of a “silent epidemic” [18].

Although previous reports have shed light on factors that influence RTW [1,19] the literature evaluating the contribution of psychiatric disorders as a comorbidity remains scarce and inconsistent. To the author’s knowledge, no systematic review exists that specifically evaluates the association of psychiatric disorders for RTW in patients with ABI. Understanding the occurrence and impact of these psychiatric disorders is essential in order to improve the support and reintegration of this group of patients. This review will therefore cover literature on the association between psychiatric disorders as a comorbidity and RTW in patients with ABI. The objective of this systematic review is to explore the association between psychiatric disorders and RTW in patients with ABI. Psychiatric comorbidity is

defined as the presence of co-existing or additional psychiatric disorders (i.e. depression, anxiety disorders, post-traumatic stress disorder) with reference to the initial diagnosis, i.e. ABI. This review focuses on non-progressive brain injury.
It is hypothesized that psychiatric disorders as a comorbidity are negatively associated with RTW in patients with non-progressive ABI. In order to further explore this hypothesis, the following research question was formed: are psychiatric disorders associated with RTW in patients with non-progressive ABI?

Methods

Search strategy

Based upon the research question, a systematic literature search was performed involving the following databases: PubMed, EMBASE and PsycINFO. The search strategy comprised numerous search terms related to ABI (population), psychiatric disorders (factor) and RTW (outcome). When available, Medical Subject Headings were used. Sub-headings were selected to specify the search and reduce contamination. Limitations were set on language and publication year (2002-2012). A more detailed report of our search strategy (e.g. used filters, sub-headings and limitations) is included in the Appendix.

Study selection criteria

After performing the search, retrieved studies were selected by screening titles and abstracts on relevance (step 1) based on inclusion criteria that were defined and used to ensure capturing all relevant literature. When title and abstract did not provide enough information to decide whether or not the inclusion criteria were met, the article was included for full text selection (step 2). Inclusion criteria were defined, summarized for each research step individually.

- Step 1: the relevant articles were selected on title and abstract on the following inclusion criteria: a) the study concerned individuals with non-progressive ABI, b) the study included subjects aged 18-65 (working population) and c) a relationship with work was mentioned in the title or abstract.
- Step 2: for full review the selection was based on the following inclusion criteria: a) work was defined as paid or voluntary (unpaid) work; b) patients were working before ABI and c) the study explored the association of psychiatric disorders with the outcome measure RTW. Studies with the following designs were entered in the review: randomized controlled trials, controlled clinical trials or the following kinds of observational studies: case-control study, prospective cohort study or retrospective cohort study. Selection and review were performed independently by two authors (SFG and BDC). In the case of doubt on inclusion or exclusion, consensus was achieved through discussion with the

third author (HW). According to the same approach reference lists of included items were assessed additionally for relevance to the inclusion criteria.

Data extraction

A data extraction form was used by the first author (SFG) in order to extract the information from each included study, containing: first author's name, country, year of publication, study design, study population, diagnosis, variables and used instruments, method, return to work and statistics. Subsequently, two other authors (BDC and HW) checked the extracted data; in cases of doubt, data were discussed and consensus was achieved.

Methodological quality assessment

The methodological quality of the selected studies was assessed independently (SFG and HW) using the criteria list of the Dutch Cochrane Centre for cohort studies [20]. Based on eight criteria, included studies were classified as being of "high quality" when meeting seven or more criteria, of "medium quality" when meeting five or six criteria and of "low quality" when meeting less than five criteria.

Determining levels of evidence

Strength of evidence for the association of psychiatric disorders with RTW after ABI was determined qualitatively and was based on criteria modified from de Croon et al. [21]. Evidence was absent if there was only one study available. Weak evidence was ascertained if two studies identified a significant association in the same direction or established no association or if two out of three studies determined a significant association in the same direction and the other identified no association. Evidence was strong if three studies identified a significant association in the same direction. Where four or more studies were available, evidence was strong if at least 75% ascertained a significant association in the same direction. In all supplementary circumstances, evidence was inconsistent.

Results

Search strategy and study selection

Our search provided a total of 610 references. After applying the study inclusion criteria on title and abstract (step 1), 61 studies were included for full text review (step 2). The selection procedure provided seven articles for inclusion (Figure 1). The most important reasons for exclusion were that the studies did not fulfil all criteria of inclusion and the lack of an association between psychiatric disorders as a comorbidity and return to work as outcome. Disagreements regarding inclusion or exclusion of articles were resolved by consulting the third author (HW).

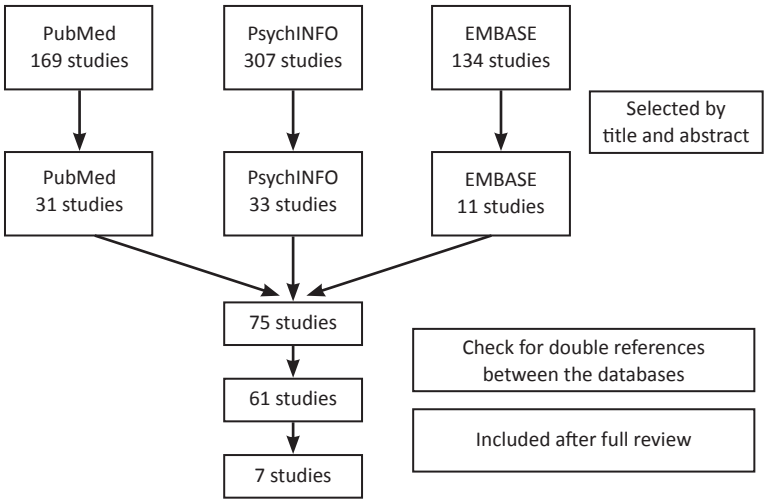

Figure 1. Review flow chart.
The flow diagram shows the number of studies identified, selected by title and abstract and included after full text review

Data extraction

The study characteristics of the included articles are outlined in Table 1.

Table 1. Characteristics of included studies

Reference (first author, country, year of publication)	Design	Demographic data (study population (sp), total number of subjects (n), mean age/SD/range, gender (M/F), previous work status at onset (WS) and pre-injury psychiatric disorders if known, control	Neuropsychiatric disorder (variable)	Variables and used instruments	Method and work definition	Return to work/ working	Statistics
Hedlund et al. Sweden, 2011	prospective cohort study	Study population (n=83); mean age/SD/ range (52/9/30-74), WS; full-time/part time (44/22), student (1), M/F (30/53), lifetime psychiatric disorder (pre-SAH*) 37 (45%)	Depression/PTSD	SCID-I	Interview, full/part-time, full-time study	25/67 returned to work/study 7th-month post-SAH	Depression/PTSD (post-SAH) negative effect on RTW (4/29 RTW vs. 21/38 with no symptoms (x^2 = 12.1; p = 0.001)
Jorge et al. United States, 2005	prospective, case-control surveillance study	Study population (n= 158, from which 104 completed the study, 66/104 TBI), 71 males, mean age/SD (35.9/15.7), (63.4%), 34.8% AA* pre-TBI	Mood disorders	Semi structured interview (by psychiatrist), and SCID-I	Interview, competitively employed or able to return to previous occupation	73/104 RTW at 1 year post-TBI	The occurrence of mood disorders (Wald $X^2$1 =4.9, P=.03), and a history of AA/D (Wald X ^{2}1 =4.8, P=.03) associated with poor vocational outcome
Dawson et al. Canada, 2007	prospective cohort study	Study population TBI (n=46, all student/ working at time of injury), mean age/SD/ range (27.6/9.7/16-60), male 54.4% (n = 25), mean follow-up/SD/ range (4.3/0.9/2.9–5.8). control (n=15, all	Depression	BDI	Structured interview and difficulties reported on the Sickness Impact Profile. Return to productivity (work and/or school); RTP*-OK, RTP-D, No-RTP	36/46 (78.26%) returned to work/school, with 17/36 (47.22%) reported difficulties in their primary activity (RTP-D). 12/14 controls RTP	Correlation 0.55 (p < 0.0001) between depression and RTW, i.e. severity of depression related to poor RTP

Reference (first author, country, year of publication)	Design	Demographic data (study population (sp), total number of subjects (n), mean age/SD/range, gender (M/F), previous work status at onset (WS) and pre-injury psychiatric disorders if known, control	Neuropsychiatric disorder (variable)	Variables and used instruments	Method and work definition	Return to work/ working	Statistics
		relatives, 14 working or student at time of injury), mean age/SD/ range (28.61/9.13/18-50), M 57.1% (n = 8)					
Glozier et al. New Zealand, 2008	prospective cohort study	Study population stroke (n=164), mean age/SD (55/11), F (n= 49)	Psych. Morbidity (in stroke literature defined as "depression")	GHQ-28	Interview	At 6 months; 155 alive and interviewed, 86 returned to paid work (55%)	The likelihood of working reduced in the presence of early psychiatric morbidity (44/69 vs. 37/86 , OR 0.42; 95% CI 0.22 to 0.80)
Morris et al. Scotland, 2004	prospective cohort study	Study population SAH (n = 52/70 interviewed and 36/70 fulfilled an additional questionnaire), mean age/SD/range (45.2/15.2/25-74), mean/SD/range of follow-up (16.3/2.1/14-23 months)	Depression/Anxiety	Interview, HADS, BDI and State-Trait Anxiety inventory	Interview	33/52 (63.5%) RTW at time of interview, of whom all but two returned to the same job.	Interview: patients no RTW, were significantly more likely to report elevated levels of anxiety (58 versus 18%, $\chi^2 = 9.13$, P = 0.003) and depression (64 versus 11%, $\chi^2 = 15.66$, P = 0.001) vs. those that RTW Questionnaires: ability to return to previous work was reduced

Reference (first author, country, year of publication)	Design	Demographic data (study population (sp), total number of subjects (n), mean age/SD/range, gender (M/F), previous work status at onset (WS) and pre-injury psychiatric disorders if known, control	Neuropsychiatric disorder (variable)	Variables and used instruments	Method and work definition	Return to work/ working	Statistics
							both in those with moderate to severe HADS depression (5 of 5 versus 14 of 31; P = 0.047, Fisher's exact test) and in those with moderate to severe HADS anxiety (10 of 13 versus 9 of 23; χ^2 4.76, P = 0.029) relative to those with normal or mild levels.
Guerin et al. Canada, 2006	retrospective analysis	Study population (n= 110; all MTBI), mean age 37.4/10.5, M/F (70/40)	Mood (e.g. depression)/ Anxiety	X	Work-related activities (full-time or part-time employment, in school, searching for work) vs. no work-related activities	65/110 (59.1%), returned to some form of work-related activity (41 (37.2% of total sample) fulltime, 13 (11.8%) part-time, 11 (10.1%) in school or looking for work	No correlation between post-MTBI diagnosis of a mood or anxiety disorder and vocational outcome (p>0.05)

Reference (first author, country, year of publication)	Design	Demographic data (study population (sp), total number of subjects (n), mean age/SD/range, gender (M/F), previous work status at onset (WS) and pre-injury psychiatric disorders if known, control	Neuropsychiatric disorder (variable)	Variables and used instruments	Method and work definition	Return to work/ working	Statistics
Franulic et al. Chili, 2004	prospective cohort study	Study population (n=202); at 2 yr. post-TBI (n=71), at 5 yr. (n= 73) and at 10 yr. (n=58), mean age employed vs. unemployed at 2 years (37.3/40.9), 5 years (40.5/43.4), 10 years (36.3/39.3), mild-TBI (5yr =59.1%, 2yr=71.4%)	Depression/Anxiety	Interview, HAS, HDS, NRS-R	Interview by an occupation therapist, with patient and direct supervisor	At time of the study, over half of the patients in each group were employed (53.5% at 2 years, 55.6% at 5 years and 69% at 10 years)	No statistical significance ($p > 0.05$) reached when comparing psychiatric symptoms among; unemployed vs. employed group

SAH (subarachnoid haemorrhage), PTSD (post-traumatic stress disorder), SCID-1 (Structured Clinical Interview for DSM-IV Diagnosis), RTW (return to work), AA (alcohol abuse), TBI (traumatic brain injury), AA/D (alcohol abuse or dependence), BDI (Becks Depression Inventory), RTP (return to productivity), GHQ (General Health Questionnaire), HADS (Hospital Anxiety and Depression Scale), MTBI (mild traumatic brain injury), HAS (Hamilton Anxiety Scale), HDS (Hamilton Depression Scale), NRS-R (Neurobehavioural Rating Scale)

Methodological quality assessment

The methodological quality of the selected studies was assessed (Table 2). Six out of seven articles were rated as being of high quality: five studies met seven criteria; one study received the maximum score. One study had a low quality after assessment, performed independently by two authors (SFG and HW).

Within these results, five high-quality studies report a negative association between psychiatric comorbidity of ABI and RTW. By contrast, two studies (one high-quality and one low-quality) found no statistical significant difference when comparing the employed group with the unemployed patient group.

A significant negative association

Five out of the seven included studies report a negative association between psychiatric disorders as a comorbidity and RTW. All five were rated as being of high quality after assessment of the methodological quality.

Glozier et al. [17] found a negative impact of early psychiatric disorders on RTW 6-months post-stroke. The likelihood of working was reduced in the presence of early psychiatric comorbidity (OR=0.42, 95% CI 0.22-0.80). Psychiatric disorders at 28 days were associated with being younger, a greater stroke severity and previous treatment for depression. After 6 months, 155 patients were interviewed, of whom 86 returned to paid employment (55%). Of these employed patients, 37 had psychiatric disorders (43%) at 28 days compared to 44 of the 69 unemployed patients (64%). In the multivariable models performed, this association was not confounded by demographic or other factors, which were identified in univariate analyses as being associated with RTW.

Additionally, Dawson et al. [22] identified the variable depression contributing to variance in productivity outcomes (return to work or school). They report an association between depression and poor return to productivity, with increasing severity of depression resulting in lower rates of return to productivity. Severe depression (defined as a score of 16 or more on the Beck Depression Inventory) was found in five of the seven people who did not return to productivity compared to only two of 19 participants who had returned to productivity.

Morris et al. [23] report that depression and anxiety disorders subsequent to spontaneous subarachnoid haemorrhage (SAH) were negatively associated with RTW. Of the 70 patients interviewed, 52 were working before the SAH. At the time of the interview (mean follow-up assessment 16.3 months), 33 (63.5%) of these patients had returned to work. Patients who did not return to their work were significantly more likely to report elevated levels of anxiety (58 vs. 18%, χ^2=9.13, p=0.003) and depression (64 vs. 11%, χ^2=15.66, p=0.001) when compared with those who had returned to work. The ability to return to previous work was reduced both in those with moderate to severe depression (5 of 5 vs. 14 of 31, p=0.047, Fisher's exact test) and in those with moderate to severe anxiety (10 of 13 vs. 9 of 23, χ^2=4.76, p= 0.029) on the Hospital Anxiety and Depression Scale relative to those with

Table 2. Methodological quality of included studies

Reference (first author, country, year of publication)	Design*	Sample size	Study population fully described	Selection bias can be excluded	Prognostic factor described and method correctly described	Outcome assessment (return to work) and method correctly described	Outcome assessment blinded to prognostic factor	Follow up of patients (> 3 months)	Selected follow up loss be excluded	Appropriate design used	Total quality score (0-8)	Quality label*
Hedlund et al. Sweden, 2011	P	83	+	+	+	+	-	+	+	+	7	HQ
Jorge et al. United States, 2005	P	104/158	+	+	+	+	+	+	+	+	8	HQ
Dawson et al. Canada, 2007	P	46	+	+	+	-	+	+	+	+	7	HQ
Glozier et al. New Zealand, 2008	P	164	+	-	+	+	+	+	+	+	7	HQ
Morris et al. Scotland, 2004	R	52/70	+	+	+	+	+	+	-	+	7	HQ
Guerin et al. Canada, 2006	R	110	+	-	-	-	+	-	+	+	4	LQ
Franulic et al. Chili, 2004	P	202	+	+	+	+	+	+	-	+	7	HQ

*Design: prospective (P) or retrospective (R); quality label: high quality (HQ) meets 7 criteria, medium quality (MQ) meets 5-6 criteria, low quality (LQ) meets < 5 criteria

normal or mild levels. A majority of patients reported that their social and leisure activities were still reduced 16 months after the haemorrhage.
Jorge et al. [24] showed that the occurrence of mood disorders (Wald $\chi^2 1 = 4.9$, $p=0.03$) after TBI was associated with poor vocational outcome.
Hedlund et al. [25] found that patients with a lifetime history of a psychiatric disorder (i.e. major depression) were at considerably higher risk of developing new psychiatric disorders and lower RTW rates following SAH. Symptoms of depression and/or post-traumatic stress disorder in the form of sub-syndromal or full post-traumatic stress disorder at 7th month post-SAH resulted in lower RTW rates (4/29 RTW) in comparison with the group without symptoms (21/38 RTW, $\chi^2 = 12.1$, $p = 0.001$).

No significant association
In contrast to the above-mentioned findings, the low-quality study of Guerin et al. [26] reported no association between the presence of a mood or anxiety disorder after traumatic ABI and vocational outcome (i.e. work-related activities; full-time or part-time employment, in school, searching for work). Moreover, no significant association was determined between RTW and pre-morbid psychiatric problems.
Finally, the high-quality study of Franulic et al. [27] compared the occurrence of anxiety and depression between employed and unemployed patients at 2, 5 and 10 years after traumatic ABI. When evaluating the scores on the Hamilton Anxiety and Depression scales individually, the difference between employed and unemployed patients rose over time, reaching statistical significance for anxiety at 10 years and for depression at 5 years. When adding data from the different scales used (i.e. Hamilton Anxiety and Depression Scale, Neurobehavioral rating scale) to the data on cognitive impairment and employment situation, a greater incidence of symptoms is found among the unemployed group compared to the employed group, including among those without cognitive deficits.

Discussion

The present study examined the association between psychiatric disorders in ABI patients and RTW. The results indicate that survivors of ABI who develop psychiatric disorders are more prone to not returning to work. Strong evidence showed that psychiatric disorders as a comorbidity (i.e. depression, anxiety and post-traumatic stress disorder) are negatively associated with RTW of patients with ABI, with severity of the psychiatric disorder inversely related to vocational outcome. Furthermore, we found evidence that individuals with a lifetime history of psychiatric disorders are at higher risk of developing new psychiatric disorders following ABI.
Previous studies showed heightened prevalence rates of psychiatric disorders among

patients with ABI compared to known prevalence rates within the general population, underlining the importance of this comorbidity. There is a sizeable body of literature supporting heightened frequencies of depression, anxiety disorders and post-traumatic stress disorder in patients with ABI compared to the general population. [11-16,25,28-31]. Identification of factors contributing to the development of psychiatric disorders as a comorbidity might provide a starting point for further improvements in care and re-integration in work of patients with ABI.

Strikingly, through evaluating previously published literature, an overlap seems to be apparent between prognostic factors known to influence the re-integration of patients with ABI and risk factors for developing psychiatric disorders after ABI. Foregoing studies found that cognitive and physical dysfunction were associated with poor vocational outcome [1]. Additionally, these factors have been shown to increase the risk of developing psychiatric disorders in individuals with ABI. Lower physical disability scores (e.g. Glasgow outcome scale and the short form-36 score) were significantly associated with increased prevalence [32] and severity [33-35] of depression. Supporting these findings, McDermott et al. [35] showed a relative risk of depression of 2.6 in patients with traumatic ABI and physical disabilities, compared to only 0.2 in the nondisabled. Furthermore, Hoofien et al. [36] found a clear pattern between psychiatric disorders (scored on the SCL-90-R) and the Acceptance of Disability score, indicating that the lower the acceptance of disability, the higher the psychological symptomatology and vice versa. Additionally, Barker-Collo et al. [14] found cognitive performance explaining the greatest proportion of variance in prevalence of both depressive and anxiety disorders. These findings suggest that functional impairments (e.g. physical, cognitive) are not only directly related to RTW but also increase the risk of developing psychiatric disorders, that in turn, result in lower return to work rates.

Interestingly, it has been shown that psychiatric disorders following ABI negatively impact performance in rehabilitation [34], which implies that there is a bidirectional downward relationship between poor functional outcome and the development of psychiatric disorders following ABI. With poor functional outcome resulting in a feeling of lack of control, this undermines the ability of the patient to cope and exacerbates psychological distress, subsequently increasing the vulnerability to developing psychiatric disorders. On the other hand, psychiatric disorders after ABI influence the re-integration process of these patients, negatively affecting recovery. Considering this relationship, one can conclude that the association between functional outcome and psychiatric disorders should be addressed as part of the re-integration process. Identification of psychiatric problems may assist in targeting secondary and tertiary prevention efforts for ABI-related disability [34,37].

A limitation of this study is that the number of studies for the outcome RTW was relatively small; nevertheless, strong evidence was found that psychiatric disorders are negatively associated with RTW of patients with ABI.

Considering the above-mentioned overlap between risk factors for not returning to work and developing psychiatric disorders, the negative impact of psychiatric disorders on RTW and the minority of patients receiving adequate psychiatric treatment, one can assume that, if comorbid psychiatric disorders are diagnosed and treated adequately, this might improve the RTW-process of patients with ABI.

Conclusions and recommendations

Strong evidence was found that psychiatric disorders as a comorbidity are associated with poor vocational outcome in patients with ABI. Diagnosis, treatment and awareness of the importance of psychiatric disorders after ABI should receive particular consideration in the re-integration process. More attention for diagnosing and treating psychiatric disorders provides a starting point to further improve the vocational rehabilitation process and may provide optimal possibilities for RTW.

Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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Appendix

Research question
Are psychiatric disorders associated with RTW in patients with non-progressive ABI?
P: Patients with non-progressive ABI
I: (neuro-)psychiatric comorbidity
O: Return to work

PubMed

Search performed on 16-02-2012; Limitations: Humans, language (Dutch, English), published in the last 10 years. Clinical Queries: (Prognosis/Broad [Filter])

P: Cerebrovascular Disorders [Mesh] OR Stroke [Mesh] OR Craniocerebral trauma [Mesh] OR Intracranial Hemorrhages [Mesh] OR Brain Injuries [Mesh] OR "acquired brain injury" OR "traumatic brain injury" OR "TBI" OR "ABI" OR Meningitis [Mesh] OR "meningitis" OR Encephalitis [Mesh] OR "encephalitis" OR "CVA" OR "Cerebrovascular accident" OR "Brain injur*" OR "Hypoxia, Brain" [Mesh] OR "Cerebrovascular disease" OR "Head injur*"
AND
I: Mood Disorders [Mesh] OR Psychotic disorders [Mesh] OR Personality Disorders [Mesh] OR Cognition disorders [Mesh] OR "Psychiatric sequelae" [TIAB] OR "psychiatric morbidity" [TIAB] OR "psychiatric dis*" [TIAB] OR Hallucinations [Mesh] OR Paranoid Disorders [Mesh] OR Obsessive-Compulsive Disorder [Mesh] OR Mental disorders [Mesh] OR Depressive Disorder, major [Mesh] OR Depression [Mesh] OR Depressive Disorder [Mesh] OR Anxiety Disorder [Mesh] OR Aggression [Mesh] OR agitation [Mesh] OR Apathy [Mesh] OR "Delusional Disorder" OR Schizophrenia, paranoid [Mesh]
AND
Full return to work OR Partial return to work OR Work [Mesh] OR "work participation"[TIAB] OR "participation"[TIAB] OR "work resumption"[TIAB] OR "work re-entry"[TIAB] OR "employment status"[TIAB] OR "re-employment"[TIAB] OR Unemployment [Mesh] OR Employment, Supported [Mesh] OR Employment [Mesh] OR "return to work"[TIAB] OR "vocational reintegration"[TIAB] OR "RTW"[TIAB] OR "Work"[TIAB]

EMBASE

Search performed on 15-02-2012; Limitations: Human, language (Dutch or English) and "year 2002 – current". Prognosis (best balance of sensitivity and specificity) filter used.
Subheadings: Complication, Disease Management, Epidemiology, Etiology, Rehabilitation and Therapy see [#]

P: Exp brain injury/ [#] OR exp traumatic brain injury/ [#] OR acquired brain injur* OR TBI OR ABI OR exp cerebrovascular accident [#] OR CVA OR exp stroke/ [#] OR exp brain hemorrhage/ [#] OR exp head injury/ [#] OR exp cerebrovascular disease/ [#]
I: exp apathy/ OR apath* OR mental disorder* OR exp agitation/ OR exp delusion/ [#] OR exp paranoia/ [#] OR exp mood disorder/ [#] OR exp mental disease/ [#] OR exp depression/ [#] OR exp major depression/ [#] OR exp behavior disorder/ [#] OR exp anxiety disorder/ [#] OR exp obsessive compulsive disor-

der/ [#] OR psychiatric morbidity OR psychiatric dis* OR neuropsychiatric complication*
O: Exp work/ OR work OR exp occupation/ OR exp employment/ OR exp employment status/ OR RTW OR supported employment OR exp unemployment/ OR re-employment OR work re-entry OR participation OR vocational reintegration OR exp work resumption/ OR return to work

PsycINFO

Search performed on 15-02-2012; Limitations: Human, language (Dutch or English), 2002 to current, "empirical study" or "Literature or systematic review" or "meta-analysis" or "quantitative study"

P: Brain injur* OR TBI OR exp traumatic brain injury/ OR brain damage/ OR acquired brain injury OR head injury OR exp Head injuries/ OR exp Cerebrovascular accidents/ OR exp cerebral ischemia/ OR Cerebrovascular disorders/ OR cerebrovascular disease OR ABI OR Stroke OR CVA OR exp Cerebral Hemorrhage/ OR Cerebral haemorrhage
I: apath* OR exp Mental Disorders/ OR exp Behavior Disorder OR exp anxiety disorders/ OR depression OR exp major Depression/ OR exp Obsessive compulsive disorder/ OR "compulsive behavior*" OR "Obsessive behavio*" OR psychiatric morbidity OR psychiatric dis* OR Paranoia (psychosis) OR exp affective disorders/ OR exp psychosis/ OR exp personality disorders/ OR exp cognitive impairment/
O: "work re-entry" OR Occupation OR exp Occupations/ OR exp reemployment/ OR RTW OR Work OR exp employment status/ OR Employment OR exp Supported Employment/ OR supported employment OR exp unemployment/ OR re-employment OR participation

5

Effective return-to-work interventions after acquired brain injury: a systematic review

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Abstract

Objective

To gather knowledge about effective return-to-work (RTW) interventions for patients with acquired brain injury (ABI).

Methods

A database search was performed in PubMed, EMBASE, PsycINFO, CINAHL and the Cochrane Library using keywords and Medical Subject Headings. Studies were included if they met inclusion criteria: adult patients with non-progressive ABI, working pre-injury, and an intervention principally designed to improve RTW as an outcome. The methodological quality of included studies was determined, and evidence was assessed qualitatively.

Results

Twelve studies were included, of which five were randomized controlled trials and seven were cohort studies. Nine studies had sufficient methodological quality. There is strong evidence that work-directed interventions in combination with education/coaching are effective regarding RTW and there are indicative findings for the effectiveness of work-directed interventions in combination with skills training and education/coaching. Reported components of the most effective interventions were tailored approach, early intervention, involvement of patient and employer, work or workplace accommodations, work practice and training of social and work-related skills, including coping and emotional support.

Conclusion and implications

Effective RTW-interventions for patients with ABI are a combination of work-directed interventions, coaching/education and/or skills training. These interventions have the potential to facilitate sustained RTW for patients with ABI.

Introduction

Acquired brain injury (ABI) is an injury to the brain that is not hereditary, congenital, degenerative or induced by birth trauma; it occurs after birth [1]. ABI includes both brain injuries with a traumatic cause and a non-traumatic cause, like stroke [1].
Just 30 years ago, 50% of all individuals diagnosed with ABI died [2]. Survival rates have increased in the recent years [3]: after traumatic ABI [4,5] and after stroke [6]. However, many patients with ABI experience long-term physical, cognitive, emotional and behavioural problems, forming a substantial obstacle to return to work [3,7,8].
Regarding return to work (RTW), ABI is of major public concern, as it is estimated that 75% of patients with ABI are of working age [3]. ABI with a traumatic cause mostly occurs at a time when people are aiming for vocational goals [9]. Non-traumatic ABI is associated with increasing age but also younger individuals experience having a stroke: approximately one in four individuals suffering a stroke are under the age of 65 [10,11].
RTW turns out to be a significant problem after ABI [4,12,13]. The proportion of patients post-stroke returning to work varies between 11-85% [12] and between 11-82% after traumatic ABI [13]. In a systematic review it was shown that only 40% of previously employed patients under the age of 65 years returned to work within two years of ABI [14].
Research demonstrates that work is an important element in the life of patients with ABI: both patients with a stroke or a traumatic brain injury acknowledge the meaning of work as providing a social environment and a sense of purpose [15].
Given the importance of RTW, it is essential that patients with ABI are assisted to return to work. However, little is known concerning how to support them to return to work. A few vocational rehabilitation programmes were described in the past, but evidence for the effectiveness of these interventions was limited [16]. Consequently, there is a lack of information about effective RTW-interventions for patients with ABI. The aim of this study is, therefore, to gather knowledge about effective RTW-interventions for patients with traumatic and non-traumatic ABI in a systematic way.
The research question is: what are effective RTW-interventions for patients with traumatic and non-traumatic ABI?

Methods

This research followed the guidelines laid out in the PRISMA-P 2015 statement for reporting systematic reviews [17].

Literature search

To collect literature about interventions that focus on RTW after ABI, the following databases were searched: PubMed, EMBASE, PsycINFO, CINAHL, the Cochrane Central Register of Controlled Trials (CENTRAL) and the Cochrane Library. The first author (BDC) and a clinical librarian (JGD) formulated the search in PubMed and adapted it to make it applicable for the other databases. The search strategy was determined by population, interventions and outcome variables using both keywords and Medical Subject Headings (MeSH) terms. The searches were limited to articles available in the English, French, German or Dutch language. All details of the search strategies and the search terms are presented in Appendix 1.

Study selection

Studies retrieved by the search were split into two parts, with each part being selected by an author pair (BDC with HW, and BDC with MFD respectively). The authors of each pair performed the study selection independently. In cases of doubt, a consensus meeting with a third author was arranged (MFD or HW respectively). Studies were initially assessed for relevance to the topic on the basis of title and abstract. The following inclusion criteria were defined for selection: studies were published between January 2000 and March 2015 and the study population comprised adults with non-progressive ABI from any cause, as defined by the Brain Injury Association of America [1]. Furthermore, studies were selected if RTW or other varieties of participation were cited as an outcome in the title or abstract. Second, full articles were included if they met the following inclusion criteria: individuals were adults of working age (16-67 years) who had a paid job, irrespective of position or organisation. Additionally, any article that reported research on interventions principally designed to improve RTW-outcomes was included. RTW in this review was characterised as having part-time or full-time paid or supported employment without consideration of the job demands or working hours. Studies were included with the following designs: randomized and non-randomized controlled trials (RCT)s, controlled clinical trial (CCT)s, interrupted time series studies, historically controlled studies, case series, case control studies, cohort studies and longitudinal studies. Furthermore, reference lists of included studies and of selected reviews were hand-searched to find additional publications. These studies were included if they met inclusion criteria. A record of rejected studies and the reasons for rejection were documented.

Data extraction

The first author (BDC) extracted data using a data extraction form that included information on reference and geographic location, study design, population (intervention group and control group), the intervention and the control group treatment, follow-up period and effect of the intervention on RTW. Two authors (HW and MFD) each verified a random sample. In cases of disagreement, consensus was achieved through discussion (between BDC and HW, or BDC and MFD respectively). If data were missing, authors of the studies were contacted and additional information was requested.

Methodological quality assessment

The methodological quality of included RCTs and CCTs was evaluated using a list recommended by Van Tulder et al. [18] and Steultjens et al. [19]. The list consists of 11 criteria for internal validity, six descriptive criteria and two statistical criteria [19]. Criteria and specifications of the criteria are demonstrated in Appendix 2. All criteria were scored as "yes", "no" or "unclear" [19]. If six or more criteria for internal validity, three descriptive criteria and one statistical criterion were scored positively, the study was judged to be of high quality.

The methodological quality of studies with designs other than RCTs and CCTs, was also assessed by the list of Van Tulder et al. [18] and Steultjens et al. [19], adapted and advocated by Steultjens et al. [19]. Items that were only applicable to RCTs or CCTs were removed or reformulated [19]. This resulted in a list containing seven criteria for internal validity, four descriptive criteria and two statistical criteria. Descriptions of the criteria are outlined in Appendix 2. These criteria were also scored as "yes", "no" or "unclear". A study was of sufficient quality if at least four criteria for internal validity, two descriptive criteria and one statistical criterion were scored positively [19].

The first author performed the assessment of the methodological quality independently; two authors (HW and MFD) replicated the assessment in a random sample. In cases of doubt, consensus was achieved through discussion (between BDC and HW or BDC and MFD, respectively).

Data synthesis

The interventions originating from studies with a sufficient methodological quality were described and, if possible, grouped according to their components. An intervention was assessed to be effective if the authors of the study demonstrated a significant effect of the intervention on RTW.

Level of evidence

If the included studies were sufficiently homogeneous, meta-analysis was to be conducted. However, if heterogeneity precluded quantitative synthesis, level of evidence for the

effectiveness of the categorised interventions was determined qualitatively. Five levels of evidence were defined, based on Van Tulder et al. [20] and performed and adapted by other reviewers [19]. The different levels of evidence were the following: strong evidence provided by consistent, statistically significant findings in outcome measures in at least two high quality RCTs; moderate evidence provided by consistent, statistically significant findings in outcome measures in at least one high-quality RCT and at least one low-quality RCT or high-quality CCT; limited evidence provided by statistically significant findings in outcome measures in at least one high-quality RCT, or provided by consistent, statistically significant findings in outcome measures in at least two high-quality CCTs (in the absence of high-quality RCTs); indicative findings provided by statistically significant findings in outcome and/or process measures in at least one high-quality CCT or one low-quality RCT (in the absence of high-quality RCTs), or provided by consistent, statistically significant findings in outcome and/or process measures in at least two ODs with sufficient quality (in the absence of RCTs and CCTs) and no evidence in cases of results of eligible studies that do not meet the criteria for one of the above-stated levels of evidence, or in case of conflicting results among RCTs and CCTs, or in the case of no eligible studies [19,20].
Only results of studies contributing to the outcome of the best evidence synthesis, e.g. RCTs with a high methodological quality, low-quality RCTs with significant findings, high-quality CCTs with significant findings, and high-quality ODs with significant findings are presented [19].

Results

Search results and study selection

Figure 1 shows the flowchart of the study selection process. The database search identified 5017 citations. After removing 967 duplicates, titles and abstracts of the remaining 4050 papers were examined for eligibility. A total of 40 articles were retrieved for full text selection, of which 11 met the inclusion criteria [21-31]. The most common reasons for exclusion were that the studies did not involve an intervention or did not report RTW as an outcome. If desired, a documentation of rejected studies and the reasons for rejection are available from the first author.
The reference lists of the 11 included articles were screened; no additional relevant studies were identified. The reference lists of four reviews that were retrieved by the search and fulfilled the inclusion criteria [7,16,32,33] were checked. One further article was detected and included [34], originating from one of these reviews [32]. As a result, the total number of studies included in this review was 12.

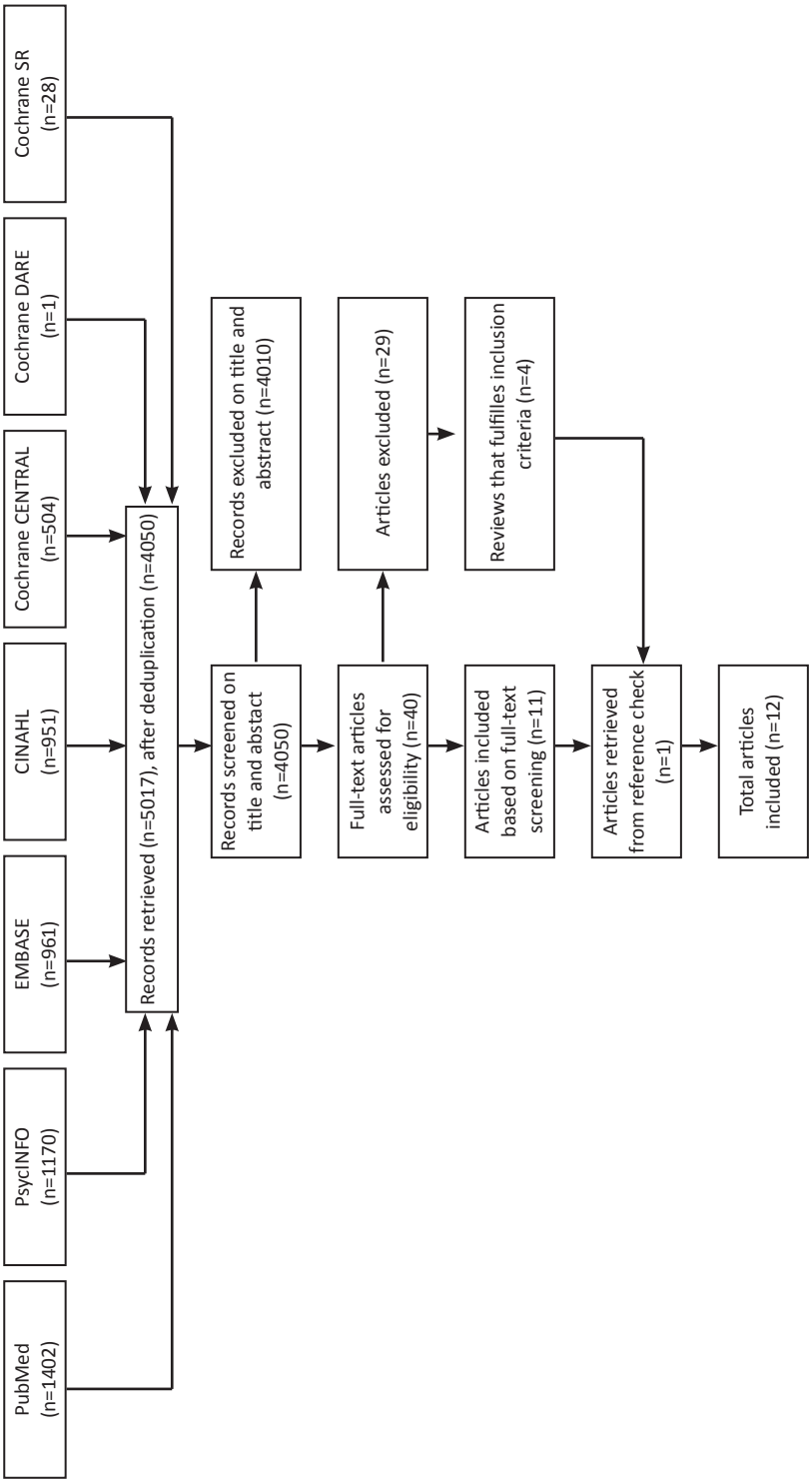

Figure 1. Review flow chart
The flow diagram shows the number of studies identified, selected by title and abstract and included after full text review

Study characteristics

The characteristics of the 12 included studies are presented in Appendix 3.

Five studies were RCTs [24,27,28,30,31]. Seven studies had "other designs" (OD)s: six were prospective cohort studies [21-23,25,26,29] and one study had a retrospective design [34]. Four of the six prospective studies had a controlled design: two studies with a control group [21,29], one study with waiting controls [26] and one with a 3-month waiting list control period [23].

Five studies were conducted in the US, five in European countries (two in the UK, two in the Netherlands, one in Finland), one in Hong Kong and one in South Africa.

Methodological quality assessment

The methodological quality of the selected studies was assessed: five RCTs and seven ODs. Four out of the five RCTs were rated as being of high quality [27,28,30,31] and five out of the seven ODs had sufficient quality [22,23,25,26,29]. The methodological quality score of the studies is presented in Appendix 4; it demonstrates positive scored items/criteria.

Study populations

Participants involved in the 12 included studies varied. Namely, five studies comprised patients with ABI [22,23,25,26,30]; five studies involved patients with traumatic brain injury (TBI) [21,24,28,29,31] and one study included stroke patients [27]. Another study involved patients with "a variety of neurological problems" [34], a subgroup of this study population comprised patients with ABI, the results were reported separately.

Injury severity varied between studies: from mild and moderate [24] to severe [22] and very severe injury [25]. Study participants had only slight physical disabilities [29] or were classified as having a severe disability [21]. Due to a high diversity in study populations, regardless of the cause of injury, it was decided to analyse the data of the studies altogether.

Time since injury

There was a wide disparity in the time from onset of ABI to the start of the intervention: from less than eight weeks [27] to several years after injury [22,25].

Outcomes

All studies reported RTW as the primary or secondary outcome measure. The definitions of RTW varied between studies: e.g. full-time or part-time gainful military or civilian employment [28] or work situation, namely having a paid job or not [23]. Data on RTW were obtained through questionnaires [27,29], interviews [22,31], or databases [25].

Follow-up

Follow-up duration varied from 90 days [21] to 24 months [28,29]. The last follow-up measurement was after six months in four studies [24,26,27,30] and after one year in three studies [22,23,31].

Interventions

All interventions described in the included studies were predominantly designed to improve RTW-outcomes and comprised several components or a combination thereof. The effectiveness of these interventions is reported below. As the included studies showed diversity regarding population, intervention and outcome, it was not possible to pool the results. Consequently, level of evidence for the effectiveness of the interventions was evaluated qualitatively [19,20].

Work-directed intervention components and education/coaching

Ntsiea et al. [27] demonstrated in an RCT that a workplace intervention programme was effective regarding RTW. Therapist, patient and employer developed a plan to overcome identified barriers for RTW. This plan was individual-specific and comprised adaptation and evaluation of the working tasks, hours and environment, vocational counselling, including coaching and advice on coping strategies [27]. After six months, stroke patients in the intervention group had 5.2 greater odds of returning to work than those in the control group (OR=5.2, 95% CI 1.8-15.0) [27].

Another RCT demonstrated the effectiveness of support during the RTW-process, although the study population was small [30]. Patients in the intervention group were assigned to resource facilitators who assisted them to return to work, by identifying person-centred goals and facilitating access to resources for support and education. Services were provided in a variety of settings including the place of work [30]. The former employer was, when appropriate, engaged in an RTW-plan [30]. At follow-up, 64% of the patients with ABI in the intervention group were employed (four full-time; three part-time), compared with 36% of the control group (three full-time; one part-time). The distributions of these ordinal data, i.e. full-time, part-time, unemployed, were significantly different between the two groups (Wald-Wolfkowitz $z=-3.277$, $p<0.0001$) [30].

Both RCTs were assessed as being of sufficient quality [27,30]. Consequently, there is strong evidence that work-directed interventions combined with education and coaching are effective regarding RTW [27,30].

Skills training, education/coaching and work-directed intervention components

Two prospective cohort studies investigated the effectiveness of a residential community reintegration programme for patients with ABI and severe psychosocial problems [22,23]. This intervention involved training of coping strategies and social skills, education on the

consequences of ABI, work practice and an assessment of working tasks, working hours and assistance or workplace adjustments required. One study with a 3-month waiting list control period demonstrated that the intervention significantly improved the work situation of the patients [23]. The other study was uncontrolled; it reported that the number of patients who were working increased, from 9 to 14, and the hours of work per week increased from 8 to 15 [22]. Both prospective studies were considered to be of sufficient quality [22,23].

One retrospective cohort study reported a project that assisted patients with ABI to return to work [34]. Patients with ABI were helped to develop work-related skills, moved on to training courses and were placed in work [34]. An audit was conducted to review the progress, 18 out of 58 patients with ABI had returned to paid work [34]. The methodological quality of this retrospective study was not sufficient, however [34].

The two prospective studies generated indicative findings for the effectiveness of work-directed interventions in combination with skills training, and education/coaching [22,23].

Cognitive rehabilitation, skills training education/coaching and work-directed intervention components

An RCT, having sufficient methodological quality, demonstrated no significant differences between patients in the intervention group or in the control group with respect to RTW [28]. An individualised neuropsychological subgroup rehabilitation programme, the so called INSURE programme, significantly enhanced productivity outcomes in a high-quality non-randomized controlled trial [29]. The programme comprised neuropsychological rehabilitation, education about TBI, psychotherapy, and tailored support to find work [29]. The productive outcome of the treatment group was better and significantly different from that of the control group (OR=6.96, 95% CI 1.26-38.44, p=0.02) [29]. Another high-quality prospective study presented a preliminary evaluation of the Rehab UK vocational rehabilitation programme [25]. Forty-one per cent of the patients gained paid competitive employment; however, the study was uncontrolled [25]. As a result, due to inconsistent findings, the three studies created no evidence for the effectiveness of work-directed interventions in combination with cognitive rehabilitation, skills training and education/coaching [25,28,29].

Skills training

A low-quality RCT investigated the effectiveness of artificial intelligent 3-D virtual reality vocational problem-solving training in enhancing employment opportunities; there were no significant differences between groups regarding job status [24]. A prospective study assessed to be of sufficient quality with waiting controls examined the effectiveness of a neurobehavioral, employability-enhancing intervention, the Vocational Transitions Program [26]. After completion of the programme, marginal significant differences were

reported between the intervention group and the control group regarding employment outcomes (Chi-square=0.69, df=1, p=0.41) [26].
Consequently, there is no evidence for the effectiveness of skills training interventions.

Cognitive rehabilitation
A large high-quality RCT did not reveal significant differences in RTW-outcomes between the intervention and the control group [31]. Consequently, there is no evidence for the effectiveness of this cognitive rehabilitation programme [31].

Supported employment
One prospective cohort study investigated the effectiveness of supported employment during vocational rehabilitation [21]. Patients who received supported employment services had significantly better competitive employment outcomes than those who were not provided supported employment services ($p<0.003$) [21]. The methodological quality of the study was not sufficient [21]. As a result, there is no evidence for the effectiveness of supported employment services [21].

Discussion

The aim of this study was to gather knowledge about effective RTW-interventions for patients with ABI. Strong evidence was found that interventions containing a combination of work-directed components, like adaptation of the working tasks, and education and coaching, like emotional support, are effective regarding RTW. This study presents indicative findings for the effectiveness of the aforementioned combination of components along with skills training, like social skills. Specifically, it was effective to focus on assisting patients with ABI during the RTW-process, realising tailored work adjustments and involving the employer. Therefore, paying attention to both the workplace and the employer seems to be important regarding RTW after ABI. The ultimate success of the intervention depends on the availability of the former job of the patient with ABI and the cooperation of the employer. Namely, chances to RTW are enhanced if the employer is offering a job and is willing to adapt the workplace and working tasks [27].
However, if unemployment has occurred, RTW is hampered as demonstrated in earlier research [4,35]. In this context it might be useful to consider job placements and thereby improving RTW-outcomes along with work practice, work-related skills training and providing information [22,23,26].
Work-directed interventions are not only effective after ABI, but have also been proven to facilitate RTW in other illnesses [36-38]. Furthermore, it was found that the interventions were effective in patients with traumatic ABI as well as non-traumatic ABI; the cause of

injury was not relevant [22,23,25-27,30]. Consequently, patients with ABI due to a traumatic or a non-traumatic cause could be considered as one population. Therefore, it seems that addressing work and workplace, as well as involving the employer, might improve RTW, regardless of illness or underlying cause of ABI.

Methodological considerations

A strength of this study is that a sensitive search was conducted in all relevant databases and that the search strategy was peer-reviewed by a clinical librarian.

The studies included in this review demonstrated highly heterogeneous populations and outcome measures. This heterogeneity precluded a meta-analysis; consequently, a qualitative evidence synthesis approach was applied. In order to do so, the interventions reported in the included studies were categorized according to the specific focus of the approach in relation to RTW, namely: 1) interventions that focus on work or workplace issues: work-directed interventions; 2) interventions focusing on the patient: education and coaching; 3) interventions focusing on activity limitations in order to enhance RTW: skills training; 4) interventions that included any type of treatment to improve (cognitive) functioning and chances of RTW: cognitive rehabilitation; 5) placement in work along with provision of support and training on the job: supported employment and 6) combinations of these intervention components. This categorisation complies with the International Classification of Functioning, Disability and Health (ICF model) [39]. The intention was to conduct a transparent review; therefore the categorisation of the interventions was discussed until consensus between all researchers involved was achieved.

Implications for research

The majority of the interventions comprised a great variety of components, while it remains to be determined which specific components are most effective and for whom. In order to establish the effectiveness of intervention components, more intervention studies are needed.

Conclusion

This study provides knowledge about effective RTW-interventions for patients with ABI, having both a traumatic and a non-traumatic cause. Effective RTW-interventions for patients with ABI are a combination of work-directed interventions, coaching/education and/or skills training. These interventions have the potential to facilitate RTW for patients with ABI.

Declaration of interest

The authors report no declarations of interest. The autors alone are responsible for the content and writing of the paper.

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Appendix 1

Search terms and search strategies

Searches performed March 12 2015

PubMed

("Brain Diseases"[Mesh:noexp] OR "Akinetic Mutism"[Mesh] OR "Amnesia, Transient Global"[Mesh] OR "Auditory Diseases, Central"[Mesh] OR "Hearing Loss, Central"[Mesh] OR "Basal Ganglia Diseases"[Mesh] OR "Basal Ganglia Cerebrovascular Disease"[Mesh] OR "Chorea Gravidarum"[Mesh] OR "Dystonia Musculorum Deformans"[Mesh] OR "Meige Syndrome"[Mesh] OR "Multiple System Atrophy"[Mesh] OR "Neuroleptic Malignant Syndrome"[Mesh] OR "Tourette Syndrome"[Mesh] OR "Brain Abscess"[Mesh] OR "Toxoplasmosis, Cerebral"[Mesh] OR "Brain Damage, Chronic"[Mesh] OR "Brain Injury, Chronic"[Mesh] OR "Cerebral Palsy"[Mesh] OR "Persistent Vegetative State"[Mesh] OR "Brain Diseases, Metabolic"[Mesh] OR "Hepatic Encephalopathy"[Mesh] OR "Marchiafava-Bignami Disease"[Mesh] OR "Mitochondrial Encephalomyopathies"[Mesh] OR "Myelinolysis, Central Pontine"[Mesh] OR "Reye Syndrome"[Mesh] OR "Wernicke Encephalopathy"[Mesh] OR "Brain Edema"[Mesh] OR "Brain Injuries"[Mesh:noexp] OR "Brain Concussion"[Mesh] OR "Brain Hemorrhage, Traumatic"[Mesh] OR "Brain Injury, Chronic"[Mesh] OR "Diffuse Axonal Injury"[Mesh] OR "Epilepsy, Post-Traumatic"[Mesh] OR "Pneumocephalus"[Mesh] OR "Brain Neoplasms"[Mesh] OR "Cerebral Ventricle Neoplasms"[Mesh] OR "Infratentorial Neoplasms"[Mesh] OR "Neurocytoma"[Mesh] OR "Pinealoma"[Mesh] OR "Supratentorial Neoplasms"[Mesh] OR "Cerebellar Diseases"[Mesh:noexp] OR "Cerebellar Ataxia"[Mesh] OR "Cerebellar Neoplasms"[Mesh] OR "Miller Fisher Syndrome"[Mesh] OR "Cerebrovascular Disorders"[Mesh:noexp] OR "Basal Ganglia Cerebrovascular Disease"[Mesh] OR "Brain Ischemia"[Mesh] OR "Carotid Artery Diseases"[Mesh] OR "Cerebral Small Vessel Diseases"[Mesh] OR "Cerebrovascular Trauma"[Mesh] OR "Intracranial Arterial Diseases"[Mesh] OR "Intracranial Arteriovenous Malformations"[Mesh] OR "Intracranial Embolism and Thrombosis"[Mesh] OR "Intracranial Hemorrhages"[Mesh] OR "Sneddon Syndrome"[Mesh] OR "Stroke"[Mesh] OR "Susac Syndrome"[Mesh] OR "Vascular Headaches"[Mesh] OR "Vasculitis, Central Nervous System"[Mesh] OR "Vasospasm, Intracranial"[Mesh] OR "Vertebral Artery Dissection"[Mesh] OR "Diffuse Neurofibrillary Tangles with Calcification"[Mesh] OR "Kluver-Bucy Syndrome"[Mesh] OR "Lewy Body Disease"[Mesh] OR "Pick Disease of the Brain"[Mesh] OR "Encephalitis"[Mesh] OR "Anti-N-Methyl-D-Aspartate Receptor Encephalitis"[Mesh] OR "Cerebral Ventriculitis"[Mesh] OR "Encephalomyelitis"[Mesh] OR "Limbic Encephalitis"[Mesh] OR "Meningoencephalitis"[Mesh] OR "Encephalomalacia"[Mesh] OR "Leukomalacia, Periventricular"[Mesh] OR "Epilepsy"[Mesh:noexp] OR "Epilepsies, Myoclonic"[Mesh] OR "Epilepsies, Partial"[Mesh] OR "Epilepsy, Generalized"[Mesh] OR "Epilepsy, Post-Traumatic"[Mesh] OR "Epilepsy, Reflex"[Mesh] OR "Landau-Kleffner Syndrome"[Mesh] OR "Seizures"[Mesh] OR "Seizures, Febrile"[Mesh] OR "Status Epilepticus"[Mesh] OR "Headache Disorders"[Mesh:noexp] OR "Post-Traumatic Headache"[Mesh] OR "Hydrocephalus"[Mesh] OR "Hydrocephalus, Normal Pressure"[Mesh] OR "Hypothalamic Diseases"[Mesh] OR "Hypothalamic Neoplasms"[Mesh:noexp] OR "Pituitary Diseases"[Mesh] OR "Hypoxia, Brain"[Mesh] OR "Hypoxia-Ischemia, Brain"[Mesh] OR "Intracranial Hypertension" [Mesh:noexp] OR "Hydrocephalus"[Mesh] OR "Hypertensive Encephalopathy"[Mesh] OR "Pseudotumor Cerebri"[Mesh] OR "Intracranial Hypotension"[Mesh] OR "Kluver-Bucy Syndrome"[Mesh] OR "Leukoencephalopathies"[Mesh] OR "Posterior Leukoencephalopathy Syndrome"[Mesh] OR "Neuroaxonal Dystrophies"[Mesh] OR "Subdural Effusion"[Mesh] OR "Thalamic Diseases"[Mesh] OR Akinetic

Mutism[tw] OR Transient Global Amnesia[tw] OR central auditory diseases[tw] OR central Hearing Loss[tw] OR (basal ganglia disease[tw] OR basal ganglia diseases[tw]) OR Basal Ganglia Cerebrovascular Disease[tw] OR Chorea Gravidarum[tw] OR Dystonia Musculorum Deformans[tw] OR Meige Syndrome[tw] OR Multiple System Atrophy[tw] OR Neuroleptic Malignant Syndrome[tw] OR Tourette Syndrome[tw] OR Brain Abscess[tw] OR Cerebral Toxoplasmosis[tw] OR Cerebral Palsy[tw] OR Persistent Vegetative State[tw] OR metabolic Brain Diseases[tw] OR Hepatic Encephalopathy[tw] OR Marchiafava-Bignami Disease[tw] OR Mitochondrial Encephalomyopathies[tw] OR Central Pontine Myelinolysis[tw] OR Reye Syndrome[tw] OR Wernicke Encephalopathy[tw] OR Brain Edema[tw] OR Brain Concussion[tw] OR Traumatic Brain Hemorrhage[tw] OR Diffuse Axonal Injury[tw] OR Post-Traumatic Epilepsy[tw] OR Pneumocephalus[tw] OR Brain Neoplasms[tw] OR cerebral ventricle neoplasms[tw] OR (infratentorial neoplasm[tw] OR infratentorial neoplasms[tw]) OR Neurocytoma[tw] OR Pinealoma[tw] OR (supratentorial neoplasm[tw] OR supratentorial neoplasms[tw]) OR (cerebellar disease[tw] OR cerebellar diseased[tw] OR cerebellar diseases[tw]) OR Cerebellar Ataxia[tw] OR (cerebellar neoplasm[tw] OR cerebellar neoplasms[tw]) OR (brain tumor[tw] OR brain tumorigenesis[tw] OR brain tumors[tw]) OR (brain neoplasm[tw] OR brain neoplasms[tw]) OR (intracranial neoplasm[tw] OR intracranial neoplasms[tw]) OR Miller Fisher Syndrome[tw] OR (cerebrovascular disorder[tw] OR cerebrovascular disorders[tw]) OR basal ganglia cerebrovascular disease[tw] OR Brain Ischemia[tw] OR (carotid artery disease[tw] OR carotid artery disease,[tw] OR carotid artery diseases[tw]) OR (cerebral small vessel disease[tw] OR cerebral small vessel diseases[tw]) OR Cerebrovascular Trauma[tw] OR (intracranial arterial disease[tw] OR intracranial arterial diseases[tw]) OR (intracranial arteriovenous malformation[tw] OR intracranial arteriovenous malformations[tw]) OR Intracranial Embolism[tw] OR (intracranial thromboses[tw] OR intracranial thrombosis[tw]) OR (intracranial hemorrhage[tw] OR intracranial hemorrhages[tw]) OR Sneddon Syndrome[tw] OR Stroke[tw] OR cerebrovascular accident[tw] OR cva[tw] OR Susac Syndrome[tw] OR (vascular headache[tw] OR vascular headaches[tw]) OR Cerebral Vasculitis[tw] OR Intracranial Vasospasm[tw] OR Vertebral Artery Dissection[tw] OR Diffuse Neurofibrillary Tangles with Calcification[tw] OR Kluver-Bucy Syndrome[tw] OR Lewy Body Disease[tw] OR "Pick Disease of the Brain"[tw] OR (cerebral scleroses[tw] OR cerebral sclerosis[tw]) OR Encephalitis[tw] OR Cerebral Ventriculitis[tw] OR Encephalomyelitis[tw] OR Limbic Encephalitis[tw] OR Meningoencephalitis[tw] OR Encephalomalacia[tw] OR Leukomalacia[tw] OR (epilep[tw] OR epilepax[tw] OR epilepay[tw] OR epilepcy[tw] OR epilepetic[tw] OR epilepetogenic[tw] OR epilepgraine[tw] OR epilepic[tw] OR epilepicus[tw] OR epilepiform[tw] OR epilepitc[tw] OR epilepitcus[tw] OR epilepitic[tw] OR epilepitus[tw] OR epilepleptogenic[tw] OR epilepraria[tw] OR epilepse[tw] OR epilepsi[tw] OR epilepsia[tw] OR epilepsia's[tw] OR epilepsiae[tw] OR epilepsiapartialis[tw] OR epilepsias[tw] OR epilepsics[tw] OR epilepsie[tw] OR epilepsie'[tw] OR epilepsiebestrijding[tw] OR epilepsiecentrum[tw] OR epilepsiechirurgie[tw] OR epilepsied[tw] OR epilepsiediagnostik[tw] OR epilepsien[tw] OR epilepsiepatienten[tw] OR epilepsies[tw] OR epilepsies'[tw] OR epilepsietherapie[tw] OR epilepsiezentrum[tw] OR epilepsiform[tw] OR epilepsihospitalet[tw] OR epilepsis[tw] OR epilepsiy[tw] OR epilepstic[tw] OR epilepsticus[tw] OR epilepsu[tw] OR epilepsy[tw] OR epilepsy'[tw] OR epilepsy''[tw] OR epilepsy's[tw] OR epilepsyand[tw] OR epilepsycases[tw] OR epilepsyfoundation[tw] OR epilepsyil[tw] OR epilepsymst[tw] OR epilepsyontology[tw] OR epilepsypsychoses[tw] OR epilepsys[tw] OR epilept[tw] OR epileptagenic[tw] OR epileptasid[tw] OR epileptc[tw] OR epileptform[tw] OR epilepti[tw] OR epileptia[tw] OR epileptic[tw] OR epileptic'[tw] OR epileptic's[tw] OR epileptica[tw] OR epileptica'[tw] OR epileptical[tw] OR epileptically[tw] OR epilepticas[tw] OR epilepticdrugs[tw] OR epileptici[tw] OR epilepticism[tw] OR epileptick[tw] OR epileptico[tw] OR epilepticogenic[tw] OR epilepticos[tw] OR epilepticpathological[tw] OR epileptics[tw] OR epileptics'[tw] OR epilepticseizure[tw] OR epilepticus[tw] OR epilepticus'[tw] OR epilepticusas[tw] OR epileptid[tw] OR epileptieus[tw] OR epileptifiorm[tw] OR epileptifom[tw] OR epileptiform[tw] OR epileptiform'[tw] OR epileptiformal[tw] OR epileptiforme[tw] OR

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AND

("Return to Work"[Mesh] OR ("return to"[tw] AND (job[tw] OR work[tw] OR employment[tw])) OR "back to work"[tw] OR "Unemployment"[Mesh] OR unemployment[tw] OR "Employment"[Mesh] OR (employment[tw] AND status[tw]) OR employability[tw] OR work status[tw] OR work resumption[tw] OR working age[tw])

AND

("Rehabilitation, Vocational"[Mesh] OR (vocational rehab[tw] OR vocational rehabilitation[tw] OR vocational rehabilitationists[tw] OR vocational rehabiltiation[tw]) OR vocational reintegration[tw] OR vocational integration[tw] OR vocational recovery[tw] OR (vocational intervention[tw] OR vocational interventions[tw]) OR (vocational trainee[tw] OR vocational trainees[tw] OR vocational trainer[tw] OR vocational trainers[tw] OR vocational training[tw]) OR Therapy/Narrow[filter] OR treatment[tw] OR (therap[tw] OR therapaeutic[tw] OR therapak[tw] OR therapatic[tw] OR therapautic[tw] OR therapax[tw] OR therapay[tw] OR therapcutic[tw] OR therapeatic[tw] OR therapeautic[tw] OR therapeautical[tw] OR therapeautics[tw] OR therapecuical[tw] OR therapeeutic[tw] OR therapehtic[tw] OR therapeia[tw] OR therapeies[tw] OR therapeis[tw] OR therapeituc[tw] OR therapentic[tw] OR therapentical[tw]

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therapoetic[tw] OR therapogen[tw] OR therapoietic[tw] OR therapon[tw] OR theraponis[tw] OR therapore[tw] OR theraport[tw] OR theraposid[tw] OR therapoutic[tw] OR therapoy[tw] OR therappy[tw] OR therapqutic[tw] OR theraprutic[tw] OR theraps[tw] OR therapsid[tw] OR therapsida[tw] OR therapsids[tw] OR therapst[tw] OR therapst's[tw] OR therapteutic[tw] OR theraptic[tw] OR therapties[tw] OR theraptique[tw] OR theraptosis[tw] OR therapu[tw] OR therapuetic[tw] OR therapuetical[tw] OR therapuetics[tw] OR therapueutic[tw] OR therapulse[tw] OR therapunitive[tw] OR theraputants[tw] OR theraputic[tw] OR theraputical[tw] OR theraputically[tw] OR theraputicimstruction[tw] OR theraputics[tw] OR theraputty[tw] OR therapv[tw] OR therapy[tw] OR therapy'[tw] OR therapy''[tw] OR therapy's[tw] OR therapy'useful[tw] OR therapy0[tw] OR therapy31[tw] OR therapy54[tw] OR therapya[tw] OR therapyaccomplishments[tw] OR therapyamong[tw] OR therapyangle[tw] OR therapyaq[tw] OR therapyas[tw] OR therapybenefit[tw] OR therapybiomarkersapplication[tw] OR therapybiomarkersbasic[tw] OR therapybiomarkerswhat[tw] OR therapybofill[tw] OR therapybrussels[tw] OR therapybut[tw] OR therapyclinical[tw] OR therapycombination[tw] OR therapycontrols[tw] OR therapye[tw] OR therapyedge[tw] OR therapyejection[tw] OR therapyfor[tw] OR therapyfree[tw] OR therapyfrom[tw] OR therapyfuture[tw] OR therapygenetic[tw] OR therapygenetics[tw] OR therapygin[tw] OR therapygkrs[tw] OR therapygtr[tw] OR therapyh[tw] OR therapyhave[tw] OR therapyi[tw] OR therapyibut[tw] OR therapyies[tw] OR therapyimatinibsunitinibnew[tw] OR therapyincludes[tw] OR therapyincluding[tw] OR therapyinduced[tw] OR therapying[tw] OR therapyintervention[tw] OR therapyinterventions[tw] OR therapyinvolved[tw] OR therapyiqr[tw] OR therapyis[tw] OR therapyists[tw] OR therapyl[tw] OR therapylike[tw] OR therapymetabolic[tw] OR therapymethodologypsycho[tw] OR therapymilan[tw] OR therapyn[tw] OR therapynaive[tw] OR therapynew[tw] OR therapyof[tw] OR therapyon[tw] OR therapyper[tw] OR therapyplatelet[tw] OR therapyplus[tw] OR therapypredictive[tw] OR therapyprogram[tw] OR therapyrelated[tw] OR therapyrelevant[tw] OR therapyresistance[tw] OR therapyresistant[tw] OR therapyresistent[tw] OR therapys[tw] OR therapysalvage[tw] OR therapyselective[tw] OR therapyself[tw] OR therapysignificantly[tw] OR therapyspatially[tw] OR therapyspecial[tw] OR therapysrs[tw] OR therapystart[tw] OR therapystop[tw] OR therapystudies[tw] OR therapysystemic[tw] OR therapytargeted[tw] OR therapytechnique[tw] OR therapythe[tw] OR therapytm[tw] OR therapytrade[tw] OR therapyusing[tw] OR therapywhat[tw] OR therapywith[tw]) OR "therapy"[Subheading])

AND
(English[lang] OR Dutch[lang] OR French[lang] OR German[lang])

EMBASE

1. acute brain disease/ or brain cortex lesion/ or brain cyst/ or brain edema/ or brain hypoxia/ or exp brain infection/ or brain pseudotumor/ or brain toxicity/ or exp brain tumor/ or cerebral blindness/ or cerebral salt wasting/ or exp cerebrovascular disease/ or colloid cyst/ or dialysis encephalopathy/ or exp encephalitis/ or encephalomalacia/ or exp extrapyramidal syndrome/ or hashimoto encephalopathy/ or heat stroke/ or hypertension encephalopathy/ or exp intracranial hypertension/ or intracranial hypotension/ or exp metabolic encephalopathy/ or organic brain syndrome/ or organic psychosyndrome/ or pneumocephalus/ or exp "seizure, epilepsy and convulsion"/
2. exp cerebrovascular accident/
3. exp cerebrovascular disease/
4. meningitis/

5. brain embolism/
6. (Akinetic Mutism or Transient Global Amnesia or central Auditory Disease* or central Hearing Loss or Basal Ganglia Disease* or Basal Ganglia Cerebrovascular Disease or Chorea Gravidarum or Dystonia Musculorum Deformans or Meige Syndrome or Multiple System Atrophy or Neuroleptic Malignant Syndrome or Pantothenate Kinase-Associated Neurodegeneration or Parkinsonian Disorder* or Tourette Syndrome or Brain Abscess or Cerebral Toxoplasmosis or Cerebral Palsy or Persistent Vegetative State or metabolic Brain Diseases or Hepatic Encephalopathy or Marchiafava-Bignami Disease or Mitochondrial Encephalomyopathies or Central Pontine Myelinolysis or Reye Syndrome or Wernicke Encephalopathy or Brain Edema or Brain Concussion or Traumatic Brain Hemorrhage or Diffuse Axonal Injury or Post-Traumatic Epilepsy or Pneumocephalus or Brain Neoplasms or Cerebral Ventricle Neoplasm* or Infratentorial Neoplasm* or Neurocytoma or Pinealoma or Supratentorial Neoplasm* or Cerebellar Disease* or Cerebellar Ataxia or Cerebellar Neoplasm* or brain tumor* or brain neoplasm* or intracranial neoplasm* or Miller Fisher Syndrome or Cerebrovascular Disorder* or Basal Ganglia Cerebrovascular Disease* or Brain Ischemia or Carotid Artery Disease* or Cerebral Small Vessel Disease* or Intracranial Arterial Disease* or Intracranial Arteriovenous Malformation* or Intracranial Embolism or intracranial Thrombos* or Intracranial Hemorrhage* or Sneddon Syndrome or Stroke or cerebrovascular accident or cva or Susac Syndrome or Vascular Headache* or Cerebral Vasculitis or Intracranial Vasospasm or Vertebral Artery Dissection or Diffuse Neurofibrillary Tangles with Calcification or Kluver-Bucy Syndrome or Lewy Body Disease or "Pick Disease of the Brain" or Cerebral Scleros* or Encephalitis or Cerebral Ventriculitis or Encephalomyelitis or Limbic Encephalitis or Meningoencephalitis or Encephalomalacia or Leukomalacia or Epilep* or Landau-Kleffner Syndrome or Hydrocephalus or Hypothalamic Disease* or Hypothalamic Neoplasm* or Pituitary Disease* or Brain Hypoxia or hypoxic or anoxia or Intracranial Hypertension or Hypertensive Encephalopathy or Pseudotumor Cerebri or Intracranial Hypotension or Kluver-Bucy Syndrome or Leukoencephalopath* or Demyelinating Autoimmune Disease* or Posterior Leukoencephalopathy Syndrome or Neuroaxonal Dystrophies or Subdural Effusion or Thalamic Disease* or meningitis or brain injur* or craniocerebral trauma or tbi or abi).ab,kw,ti. Insert Search Statement Edit Search Statement Delete Search Statement
7. brain.mp. and neurotoxicity/
8. (brain adj3 toxic*).ab,kw,ti.
9. 7 or 8
10. 1 or 2 or 3 or 4 or 5 or 6 or 9 [population]
11. exp employment/ or unemployment/ or employability/ or voluntary worker/ or return to work/
12. ((employment and status) or unemployment or employability or occupation* or working age).ab,kw,ti.
13. ("return to" adj3 (work or job or employment)).ab,kw,ti.
14. or/11-13 [Return to Work]
15. vocational rehabilitation/
16. (vocational adj1 (rehab* or intervention? or reintegration or integration or recovery or training)).ab,kw,ti.
17. 15 or 16 [vocational rehabilitation]
18. (integration program* or reintegration program*).ab,kw,ti.
19. randomized controlled trial/
20. (randomized and controlled and trial).ab,ti.
21. or/17-20 [therapy - 1]
22. 10 and 14 and 21 [final search part 1]

23. 10 and 14
24. limit 23 to "therapy (maximizes specificity)"
25. 22 or 24 [final search]
26. limit 25 to (article or conference abstract or conference paper or conference proceeding or "conference review" or report or "review")
27. remove duplicates from 26 [remove duplicates from 24]

PsycINFO

1. brain disorders/ or acute alcoholic intoxication/ or exp aphasia/ or athetosis/ or balint's syndrome/ or brain neoplasms/ or cerebrovascular accidents/ or chronic alcoholic intoxication/ or dysexecutive syndrome/ or exp encephalitis/ or exp epilepsy/ or exp epileptic seizures/ or general paresis/ or intracranial abscesses/ or kluver bucy syndrome/ or tay sachs disease/ or exp meningitis/
2. (Akinetic Mutism or Transient Global Amnesia or central Auditory Disease* or central Hearing Loss or Basal Ganglia Disease* or Basal Ganglia Cerebrovascular Disease or Chorea Gravidarum or Dystonia Musculorum Deformans or Meige Syndrome or Multiple System Atrophy or Neuroleptic Malignant Syndrome or Pantothenate Kinase-Associated Neurodegeneration or Parkinsonian Disorder* or Tourette Syndrome or Brain Abscess or Cerebral Toxoplasmosis or Cerebral Palsy or Persistent Vegetative State or metabolic Brain Diseases or Hepatic Encephalopathy or Marchiafava-Bignami Disease or Mitochondrial Encephalomyopathies or Central Pontine Myelinolysis or Reye Syndrome or Wernicke Encephalopathy or Brain Edema or Brain Concussion or Traumatic Brain Hemorrhage or Diffuse Axonal Injury or Post-Traumatic Epilepsy or Pneumocephalus or Brain Neoplasms or Cerebral Ventricle Neoplasm* or Infratentorial Neoplasm* or Neurocytoma or Pinealoma or Supratentorial Neoplasm* or Cerebellar Disease* or Cerebellar Ataxia or Cerebellar Neoplasm* or brain tumor* or brain neoplasm* or intracranial neoplasm* or Miller Fisher Syndrome or Cerebrovascular Disorder* or Basal Ganglia Cerebrovascular Disease* or Brain Ischemia or Carotid Artery Disease* or Cerebral Small Vessel Disease* or Intracranial Arterial Disease* or Intracranial Arteriovenous Malformation* or Intracranial Embolism or intracranial Thrombos* or Intracranial Hemorrhage* or Sneddon Syndrome or Stroke or cerebrovascular accident or cva or Susac Syndrome or Vascular Headache* or Cerebral Vasculitis or Intracranial Vasospasm or Vertebral Artery Dissection or Diffuse Neurofibrillary Tangles with Calcification or Kluver-Bucy Syndrome or Lewy Body Disease or "Pick Disease of the Brain" or Cerebral Scleros* or Encephalitis or Cerebral Ventriculitis or Encephalomyelitis or Limbic Encephalitis or Meningoencephalitis or Encephalomalacia or Leukomalacia or Epilep* or Landau-Kleffner Syndrome or Hydrocephalus or Hypothalamic Disease* or Hypothalamic Neoplasm* or Pituitary Disease* or Brain Hypoxia or hypoxic or anoxia or Intracranial Hypertension or Hypertensive Encephalopathy or Pseudotumor Cerebri or Intracranial Hypotension or Kluver-Bucy Syndrome or Leukoencephalopath* or Demyelinating Autoimmune Disease* or Posterior Leukoencephalopathy Syndrome or Neuroaxonal Dystrophies or Subdural Effusion or Thalamic Disease* or meningitis or brain injur* or craniocerebral trauma or tbi or abi).ab,id,ti.
3. brain.mp. and neurotoxicity/
4. (brain adj3 toxic*).ab,id,ti.
5. or/1-4 [population]
6. employment status/ or unemployment/ or employability/ or reemployment/
7. ((employment and status) or unemployment or employability or reemployment or occupation* or working age).ab,id,ti.
8. ("return to" adj3 (job or work or employment)).ab,id,ti.

9. or/6-8 [return to work]
10. exp vocational rehabilitation/
11. (vocational adj1 (rehab* or intervention? or integration or reintegration or recovery or training)).ab,id,ti.
12. 10 or 11 [vocational rehabilitation]
13. random:.tw.
14. placebo:.mp.
15. double-blind:.tw.
16. exp treatment/
17. 33*.cc.
18. or/13-17 [therapy]
19. 5 and 9 and 12
20. 5 and 9 and 18
21. 19 or 20
22. limit 21 to ((“0100 journal” or “0110 peer-reviewed journal” or “0120 non-peer-reviewed journal” or “0130 peer-reviewed status unknown” or “0400 dissertation abstract” or “0500 electronic collection”) and (dutch or english or french or german))

CINAHL

S1. SU Akinetic Mutism or Transient Global Amnesia or central Auditory Disease* or central Hearing Loss or Basal Ganglia Disease* or Basal Ganglia Cerebrovascular Disease or Chorea Gravidarum or Dystonia Musculorum Deformans or Meige Syndrome or Multiple System Atrophy or Neuroleptic Malignant Syndrome or Pantothenate Kinase-Associated Neurodegeneration or Parkinsonian Disorder* or Tourette Syndrome or Brain Abscess or Cerebral Toxoplasmosis or Cerebral Palsy or Persistent Vegetative State or metabolic Brain Diseases or Hepatic Encephalopathy or Marchiafava-Bignami Disease or Mitochondrial Encephalomyopathies or Central Pontine Myelinolysis or Reye Syndrome or Wernicke Encephalopathy or Brain Edema or Brain Concussion or Traumatic Brain Hemorrhage or Diffuse Axonal Injury or Post-Traumatic Epilepsy or Pneumocephalus or Brain Neoplasms or Cerebral Ventricle Neoplasm* or Infratentorial Neoplasm* or Neurocytoma or Pinealoma or Supratentorial Neoplasm* or Cerebellar Disease* or Cerebellar Ataxia or Cerebellar Neoplasm* or brain tumor* or brain neoplasm* or intracranial neoplasm* or Miller Fisher Syndrome or Cerebrovascular Disorder* or Basal Ganglia Cerebrovascular Disease* or Brain Ischemia or Carotid Artery Disease* or Cerebral Small Vessel Disease* or Intracranial Arterial Disease* or Intracranial Arteriovenous Malformation* or Intracranial Embolism or intracranial Thrombos* or Intracranial Hemorrhage* or Sneddon Syndrome or Stroke or cerebrovascular accident or cva or Susac Syndrome or Vascular Headache* or Cerebral Vasculitis or Intracranial Vasospasm or Vertebral Artery Dissection or Diffuse Neurofibrillary Tangles with Calcification or Kluver-Bucy Syndrome or Lewy Body Disease or “Pick Disease of the Brain” or Cerebral Scleros* or Encephalitis or Cerebral Ventriculitis or Encephalomyelitis or Limbic Encephalitis or Meningoencephalitis or Encephalomalacia or Leukomalacia or Epilep* or Landau-Kleffner Syndrome or Hydrocephalus or Hypothalamic Disease* or Hypothalamic Neoplasm* or Pituitary Disease* or Brain Hypoxia or hypoxic or anoxia or Intracranial Hypertension or Hypertensive Encephalopathy or Pseudotumor Cerebri or Intracranial Hypotension or Kluver-Bucy Syndrome or Leukoencephalopath* or Demyelinating Autoimmune Disease* or Posterior Leukoencephalopathy Syndrome or Neuroaxonal Dystrophies or Subdural Effusion or Thalamic Disease* or meningitis or brain injur* or craniocerebral trauma or tbi or abi

S2. (MH "Employment+")
S3. (MH "Job Re-Entry")
S4. TI (employment AND status) OR unemployment OR employability OR reemployment OR working age OR job reentry OR job re entry OR return to work
S5. AB employment OR unemployment OR employability OR reemployment OR working age OR job reentry OR job re entry OR return to work
S6. S2 OR S3 OR S4 OR S5
S7. MH "Rehabilitation, Vocational") OR SU vocational intervention OR SU vocational rehab* OR TI vocational intervention OR TI vocational rehab* OR AB vocational intervention OR AB vocational rehab* OR SU vocational reintegration OR TI vocational reintegration OR AB vocational reintegration OR SU vocational integration OR TI vocational integration OR AB vocational integration OR SU vocational recovery OR TI vocational recovery OR AB vocational recovery OR SU vocational training OR TI vocational training OR AB vocational training
S8. SU therapy or treatment
S9. S7 OR S8
S10. S1 AND S6 AND S9
S11. S1 AND S6
S12. S10 OR S11
Dutch/Flemish, English, French, German

Cochrane Library

(Akinetic Mutism or Transient Global Amnesia or central Auditory Disease* or central Hearing Loss or Basal Ganglia Disease* or Basal Ganglia Cerebrovascular Disease or Chorea Gravidarum or Dystonia Musculorum Deformans or Meige Syndrome or Multiple System Atrophy or Neuroleptic Malignant Syndrome or Pantothenate Kinase-Associated Neurodegeneration or Parkinsonian Disorder* or Tourette Syndrome or Brain Abscess or Cerebral Toxoplasmosis or Cerebral Palsy or Persistent Vegetative State or metabolic Brain Diseases or Hepatic Encephalopathy or Marchiafava-Bignami Disease or Mitochondrial Encephalomyopathies or Central Pontine Myelinolysis or Reye Syndrome or Wernicke Encephalopathy or Brain Edema or Brain Concussion or Traumatic Brain Hemorrhage or Diffuse Axonal Injury or Post-Traumatic Epilepsy or Pneumocephalus or Brain Neoplasms or Cerebral Ventricle Neoplasm* or Infratentorial Neoplasm* or Neurocytoma or Pinealoma or Supratentorial Neoplasm* or Cerebellar Disease* or Cerebellar Ataxia or Cerebellar Neoplasm* or brain tumor* or brain neoplasm* or intracranial neoplasm* or Miller Fisher Syndrome or Cerebrovascular Disorder* or Basal Ganglia Cerebrovascular Disease* or Brain Ischemia or Carotid Artery Disease* or Cerebral Small Vessel Disease* or Intracranial Arterial Disease* or Intracranial Arteriovenous Malformation* or Intracranial Embolism or intracranial Thrombos* or Intracranial Hemorrhage* or Sneddon Syndrome or Stroke or cerebrovascular accident or cva or Susac Syndrome or Vascular Headache* or Cerebral Vasculitis or Intracranial Vasospasm or Vertebral Artery Dissection or Diffuse Neurofibrillary Tangles with Calcification or Kluver-Bucy Syndrome or Lewy Body Disease or "Pick Disease of the Brain" or Cerebral Scleros* or Encephalitis or Cerebral Ventriculitis or Encephalomyelitis or Limbic Encephalitis or Meningoencephalitis or Encephalomalacia or Leukomalacia or Epilep* or Landau-Kleffner Syndrome or Hydrocephalus or Hypothalamic Disease* or Hypothalamic Neoplasm* or Pituitary Disease* or Brain Hypoxia or hypoxic or anoxia or Intracranial Hypertension or Hypertensive Encephalopathy or Pseudotumor Cerebri or Intracranial Hypotension or Kluver-Bucy Syndrome or Leukoencephalopath* or Demyelinating Autoimmune Disease* or Posterior Leukoencephalopathy Syndrome or Neuroaxonal Dys-

trophies or Subdural Effusion or Thalamic Disease* or meningitis or brain injur* or craniocerebral trauma or tbi or abi)

and

(employment or unemployment or employability or reemployment or working age or return to work or job reentry or job re entry)

and

(vocational rehab* or vocational reintegration or vocational integration or vocational recovery or vocational intervention* or vocational train* or treatment or therap*):ti,ab,kw (Word variations have been searched).

Appendix 2

Criteria of methodological quality* [18,19]

Randomized Clinical Trials (RCT)s, Controlled Clinical Trials (CCT)s
Patient selection
a) were the eligibility criteria specified?
b) treatment allocation:
1) was a method of randomization performed?
2) was the treatment allocation concealed?
c) were the groups similar at baseline?
Interventions
d) were the index and control interventions explicitly described?
e) was the care provider blinded for the intervention?
f) were co-interventions avoided or comparable?
g) was the compliance acceptable in all groups?
h) was the patient blinded to the intervention?
Outcome measurement
i) was the outcome assessor blinded to the interventions?
j) were the outcome measures relevant?
k) were adverse effects described?
l) was the withdrawal/drop out rate described and acceptable?
m) timing follow-up measurements:
1) was a short-term follow-up measurement performed?
2) was a long-term follow-up measurement performed?
n) was the timing of the outcome assessment in both groups comparable?
Statistics
o) was the sample size for each group described?
p) did the analysis include an intention-to-treat analysis?
q) were point estimates and measures or variability presented for the primary outcome measures?

Other than controlled design (OD)
Patient selection
a) were the eligibility criteria specified?
Interventions
d) was the intervention explicitly described?
f) were co-interventions avoided?
g) was the compliance acceptable?
Outcome measurement
i) Was the outcome assessor not involved in the treatment?
j) were the outcome measures relevant?
k) were adverse effects described?
l) was the withdrawal/drop out rate described and acceptable?
m) timing follow-up measurements:
1) was a short-term follow-up measurement performed?

2) was a long-term follow-up measurement performed?
n) was the timing of the outcome assessment in all patients comparable?
Statistics
o) was the sample size of the patient group described?
p) did the analysis include an intention-to-treat analysis?
q) were point estimates and measures or variability presented for the primary outcome measures?

*Internal validity: b, e, f, g, h, i, j, l, n, p; descriptive criteria: a, c, d, k, m; statistical criteria: o, q.

Specification of the criteria for methodological quality [18, 19]
a. In order to score a 'yes' details about ABI should be reported.
b1. A random (unpredictable) assignment sequence. Methods of allocation using date of birth, date of admission, hospital numbers, or alternation should not be regarded as appropriate.
b2. Assignment generated by an independent person not responsible for determining eligibility of the patients. This person has no information about the persons included in the trial and has no influence on the assignment sequence or the decision about eligibility of the patient.
c. In order to receive a 'yes' groups have to be similar regarding: age, duration of disease, severeness of disease, baseline main outcome measure(s). If a baseline difference exists in one of these factors, a no applies.
d. Adequate description of type, modality, application technique, intensity, duration, number of frequency of sessions for both the experimental interventions and control intervention(s) in order to replicate the study.
e. The reviewer determines when enough information about the blinding is given in order to score a 'yes'.
f. Co-interventions concerning other similar interventions are avoided or either standardised.
g. The reviewer determines when the compliance to the interventions is acceptable when based on the reported intensity, duration, number and frequency of sessions for the experimental intervention and the control intervention(s). Criterion compliance >70% in all groups.
h. The reviewer determines (per outcome parameter) when enough information about blinding is given to score a 'yes'.
i. The reviewer determines when enough information about independency/blinding is given to score a 'yes'.
j. Concerning the outcome RTW.
k. Each event described and correctly attributed to (allocated) treatment; if explicit report of 'no adverse effect' a 'yes' applies. Scores either a 'yes' or a 'no', a don't know doesn't exist.
l. Participants who were included in the study but did not complete the observation period or were not included in the analysis must be described. If the percentage of withdrawals and drop-outs does not exceed 20% for short-term follow-up and 30% for long-term follow-up and does not lead to substantial bias a 'yes' is scored. No drop-outs reported scores as don't know.
m1. Outcome assessment at the end of the intervention period.
m2. Outcome assessment ≥6 months after pre-test.
n. Timing of outcome assessment identical for all patients or identical for all intervention groups; for all important outcome assessments.
o. To be presented per group at pre-test and for most important outcome assessments.
p. All patients are reported/analysed for the most important moments of effect measurement (minus missing values) irrespective of non-compliance and co-interventions.

q. Both point estimates and measures of variability should be presented (to be scored for each important outcome parameter separately). Point estimates are: means, medians, modes etc. Measures of variability are; standard deviations, 95% confidence intervals, etc. For dichotomous or categorical data proportions have to be presented.

Scores RCTs and CCTs
All criteria were scored as yes, no, or unclear. Studies were considered to be of high quality if at least six criteria for internal validity, three descriptive criteria, and one statistical criterion were scored positively.

Scores ODs
All criteria were scored as yes, no, or unclear. Studies were considered to be of sufficient quality if at least four criteria for internal validity, two descriptive criteria, and one statistical criterion were scored positively.

Appendix 3

Characteristics of included studies

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
Bisiker J **2007** **UK** **Retrospective design**	I: N: 74 G: 56/18 A: 16-64 In: neurological problems: brain injury (SAH*, diabetic coma, AV* malformation, brain abscess) 8 Head Injury 27 Stroke 23 MS* 5 Guillain Barré syndrome 2 Other 9	Follow up: NIA* N: 3 unable to participate due to health deterioration	Equal Pathways to Work C: Maintaining/starting vocational route: work goals, needs in relation to work, basic skills, confidence, insight/ self awareness, anger management, social skills, benefit advice, transport, learning strategies Pursuing vocational routes: returning to existing job: Job/ workplace evaluations, education employer, liason with DEA* "Acces to work", improve work related skills or retraining (suitable training courses, CV* writing, interview skills, social skills, behavioral management) Sustaining employment: Work placements, graded RTW, regular review with		Returned to paid work N Brain Injury: 4 of 8 Head Injury: 8 of 27 Stroke 6 of 23 Total population 25 of 64	OD Low

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
			client and employer for 6 months after RTW for maximum hours and duties P: senior OT*, project coordinator with training background, support workers, clerical support S: community F: NIA D: NIA			
Gamble D **2003** **USA** **Prospective cohort study**	I: N: 78 C: N: 995 G: 69.9/30.1% A: 35.4, 9.68, 16-71 In: TBI* Severe disability yes/no 88.8/11.2%	90 days	Supported employment services during vocational rehabilitation C: Training on the job and supports for as long as the client needed them P: NIA S: NIA F: NIA D: NIA	No supported employment services during vocational rehabilitation P: NIA S: NIA F: NIA D: NIA	Competitive employment N I: 53 of 78 C: 468 of 995 χ^2=12.67, p<0.003	OD Low
Geurtsen GJ **2008** **The Netherlands** **Prospective cohort study**	I: N: 24 G: N/N: NIA, 75/25% A: 35.4, 9.7, 16-71 In: severe ABI*	N: 1 refused to cooperate N: 1 moved and could not be traced T0 Start T1 End of	Brain Integration Program C: 3 modules independent living module social-emotional module work module (neuropsychological		Working N T0 9 of 24 T1 11 of 24 T2 14 of 24 Work hours per week mean of all participants/	OD Sufficient

Reference First author Year of publi-cation Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
	TBI 18 Stroke 3 Tumor 2 Encephalitis 1 Impaired illness awareness, alcohol/drug problems and/ or behavioral problems	treatment T2 after 1 Y	assessment, work practice, evaluation working abilities in vocational assessment unit, evaluation of abilities to perform supported/ sheltered/ volunteer work, advice about leisure activities) P: rehabilitation team members (neuropsychologist, neuropsychiatrist, physiatrist, occupational therapist, cognitive therapist, social worker, speech language therapist, physical therapist, nurses/coaches) S: individual counseling, group therapy and family education, residential setting rehabilitation center F: NIA D: Mean 198.9 days, SD 71.4, range 112-382 Intervention ~250 hours (total); work module ~44 hours		SD T0 8.0/ 14.2 T1 7.4/ 11.2 T2 15.5/ 12.9	

Reference First author Year of publi-cation Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
Geurtsen GJ 2011 **The Netherlands** **Prospective cohort study**	I: N: 70 G: 46/24 A: 25.1, 7.9, 18-49 In: ABI TBI 47 Stroke 7 Tumor 10 Encephalitis 4 Hypoxia 2 Problems social functioning/ emotional control/ work integration	N: 2 refused follow-up assessment N: 1 could not be located T0 Inclusion T1 Start of treatment T2 End of treatment T3 after 1 Y	Brain Integration Program C: 3 modules independent living module social-emotional module work module P: rehabilitation team members (neuropsychologist, neuropsychiatrist, physiatrist, occupational therapist, cognitive therapist, social worker, speech language therapist, physical therapist, nurses/ coaches) S: individual 90%, small group 10% tertiary rehabilitation center F: NIA D: Mean 196.2 days, SD 61.9, range 44-357 Intervention ~250 hours (total); work module ~44 hours	3 month waiting list control period	Work (paid job) N T0 12 of 70 T1 11 of 70 T2 23 of 70 T3 36 of 70 Hours per week mean of working patients/ SD T0 14.3/ 10.8 T1 12.9/ 16.3 T2 18.1/ 11.3 T3 18.8/ 11.2 Significant effect of time on work situation Wald=23.976, df=1, p=0.0	OD Sufficient

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
Man DWK 2013 **Hong Kong** **RCT**	I: N: 25 C: N: 25 G: NIA A: 18-55 In: mild and moderate TBI	1, 3, 6 M I: N: 5 dropped out C: N: 5 dropped out	Artificial intelligent 3D virtual reality-based vocational training system (AIVTS) C: problem solving/ vocational skills training modules: introduction, training, practice and review of these skills (clerical work) P: trainer explains the program; computer (user exercises direct control over virtual environment, interactive, immediate feedback) S: computer laboratory of department of rehabilitation sciences F: 12 sessions (each 20-25 minutes) D: NIA	Conventional psycho-educational vocational training program (PEVTS) same as AIVTS in form of training manual and practicing under supervision of vocational trainer	No significant differences between groups regarding job status	RCT Low
Murphy L 2006 **UK** **Prospective cohort study**	I: N: 232 G: N/N: NIA 82/12% A: 33, 17-62 In: (very) severe ABI	50 W (mean program duration) I: N: NIA, 13% withdrew	Rehab UK vocational rehabilitation program C: Element A (A) pre-vocational intensive basic cognitive rehabilitation Element B (B) placements		Paid competitive employment N: NIA 41%	OD Sufficient

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
	N: NIA TBI 62% Cardiovascular 22% Tumor 4.3% Neurological 4.3% Hypoxia 2.6% Other 0.75%		in real work settings while disability payments monitored by job coach (who encourages client to use compensatory strategies, informs employer on ABI, and needed workplace adjustments), assessment of ability to work in competitive standard, gradual increase hours and tasks Center based sessions to improve job seeking skills, practice talking about ABI and gaps in CV Supported job search Job coaching support Follow-up support P: clinical/occupational psychologist with trans disciplinary team of tutors, job coaches, assistant psychologist, key worker S: A: 3 Rehab UK Centers, in groups 8-12 persons B: work setting and center-based			

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
			F: A: sessions spread over 12 weeks, B: every 12 weeks evaluation and update of goals D: A: 12 weeks, B: work placement at least 4 weeks-several months; complete program 9-12 months; follow-up support up to 5 years			
Niemeier JP 2010 USA **Prospective cohort study**	N: 71 I: N: 39 C: N: 32 G: 49/22 A: 43.3, 12.3 In: ABI auto accident 16 assault 1 fall 3 stroke 13 tumor 1 aneurysm 4 other 29	At completion of VTP and after 6 M N: 1 dropped out	Vocational Transitions Program (VTP) C: 20 sessions each session 5 parts (4 steps and wrap-up time) manualized employability-enhancing intervention, work-related information and skills to improve chances of return to competitive employment, topics: work readiness, overcome obstacles, goal setting, find a mentor, skills to find a job, strategies for coping, anger management, stress management, how	Waiting controls receiving VTP after conclusion of the study	Working (working and volunteering, working but not volunteering) I: N: 6 C: N: 4 χ^2test=0.69; df=1; p=0.4052	OD Sufficient

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
			solving problems P: clubhouse staff coordinators and directors S: treatment groups 5-8 attendees, at 6 different brain injury clubhouses F: 2 sessions/ week D: 10 weeks			
Ntsiea 2014 **South Africa** **RCT**	I: N: 40 C: N: 40 I: G: 21/19 A: 45, 8.5, 29-60 C: G: 20/20 A: 44, 8.9, 26-50 In: stroke, less than 8 weeks after onset stroke, Barthel Index at least 12 (of 20)	3, 6 M I: N: 5 C: N: 3	Workplace intervention programme C: week 1: assessment for work: work modules to assess perception, visual discrimination, sequencing ability, numerical ability, reasoning and language ability, motor coordination, eye hand coordination, measurement ability, color discrimination week 2: interview stroke survivor and employer separately: barriers and enablers for RTW meeting therapist, stroke survivor and employer: plan to overcome barriers and	C: usual stroke rehabilitation at the hospital general activities to improve impairments and activity limitations and prepare for return home, consideration of job requirements, without work visits and workplace intervention P: physiotherapist, occupational therapist (and speech therapist and/or social worker when necessary)	RTW at 6 months I: N: 24 of 40 C: N: 8 of 40 p<0.001 OR*=5.2 SE*=2.8 95% CI: 1.8-15.0	RCT High

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
			strengthen enablers week 3: individual specific working on barriers, work visit, identify what stroke survivor can (not) do, vocational counseling, coaching, emotional support, adaptation working environment, advice on coping, compensate for functional limitations, fatigue management (Therapist Portable Assessment Lab, administration job content questionnaire) Week 4-6 continuation, monitoring progress, making adjustments if necessary at the workplace P: physiotherapist, occupational therapist (and psychologist, speech therapist and/or social worker when necessary S: at stroke survivor's place of work (except for	S: inpatient and outpatient F: NIA D: NIA		

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
			assessment) F: once per week for one hour, except for assessment (minimum of four hours) D: 6 weeks: Usual therapy at hospital continued: general activities to improve impairments and activity limitations and prepare for return home, consideration of job requirements, without work visits and workplace intervention			
Salazar AM 2000 **USA** **RCT**	Active duty military members I: N: 67 G: N/N: NIA, M 93% A: 25, 6.6 C: N: 53 G: N/N: NIA, M 96% A: 26, 6.2 In: TBI moderate-severe GCS* mean/SD I: 9.4/3.7	8 W 6, 12, 24 M I: N: 7 withdrew (medical reasons 2, non-medical 5) C: N: 6 received supplemental therapy	In-hospital interdisciplinary cognitive rehabilitation C: milieu oriented approach modified to fit in a military framework Physical fitness training, Group and individual (cognitive, speech, occupational, coping skills therapies) Group therapies (planning, organization, cognitive skills, pragmatic speech, milieu, psychotherapy and	Home rehabilitation C: TBI education and individual counseling, recommended strategies for enhancing cognitive and organizational skills, education materials, various home number and card game exercises, encouraged to watch news programs, read magazines and	RTW after 1 year N: NIA % I: 90 C: 94 p=0.51 95% CI:-5-14%	RCT High

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
	C: 9.5/3.4 PTA*>7 d N: NIA % I/C 41/42 Period unconsciousness N: NIA, % I/C >1 h, 53/76 >24 h 30/38 Cause (in peacetime): N: NIA % I/C motor vehicle accident 49/72 assault 27/9		community reentry) Work therapy program Placement in various work settings as similar to previous military specialty as possible P: conducted by board certified physiatrist, staff: certified neuropsychologist experienced in milieu TBI rehabilitation, certified OT, speech pathologist, 2 rehabilitation assistants (when needed physical therapy, neurological/ psychiatric consultations) S: in-hospital, group and individual F: NIA D: NIA	books, daily physical exercise weekly contact with psychiatric nurse inquiring week's events, offering support and advice in addressing problems (30-minute telephone calls) P: psychiatric nurse, with families when available profession trainer S: home F: daily training, weekly 30-minute telephone calls D: duration		
Sarajuuri JM 2005 Finland **Prospective cohort study**	I: N: 19 G: 16/3 A: 30.5, 10.6 C: N: 23 G: 17/3 A: 29.5, 11.0 In: TBI moderate-	2 Y I: N: 0 C: N: 3	Individualized Neuropsychological Subgroup Rehabilitation Program (INSURE) C: post acute interdisciplinary inpatient rehabilitation	Conventional clinical care and rehabilitation, referred by physicians in the local health care system C: physical,	Gainful work after 2 years Full time I: 1 of 19 C: 7 of 20 Part time I: 3 of 19	OD Sufficient

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
	severe GCS mean/SD I: 7.9/2.7 C: 8.0/2.5 Mechanism N I/C motor vehicle collision 8/7 bicycle collision 3/1 pedestrian-auto collision 1/3 assault 1/1 other 5/8 unknown 1/0 CT*/MRI* I/C Contusion and/or hematoma 15/16 Diffuse axonal injury 8/5 Severe intracranial pressure 7/5 Craniotomy 4/5		neuropsychological rehabilitation and psychotherapy Standardized and individualized (to meet special needs) Group meeting (goals for the day, program, promote psychological and physiologic arousal, foster personal orientation; discussion on injury related aspects; compensate cognitive symptoms; mastering communication disorders; express emotions and experiences through photography; social and material issues; encourage sport activities) Individual (assess goals for work) After 4 weeks INSURE seminar with participants and significant others, employers (share information)	occupational, speech, neuropsychological, psychotherapy Individually tailored Evaluations of rehabilitation needs, multidisciplinary inpatient rehabilitation, outpatient follow up. P: NIA S: hospital or outpatient F: NIA D: NIA	C: 1 of 20 χ^2test=1.64 p=0.20 Productive (gainful and non gainful work volunteer work, work trial, study) I: 17 of 19 C: 11 of 20 OR=6.96 95% CI: 1.26-38.44 $\chi^2$1test=5.72 p=0.02	

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
			Supported and individually tailored interventions to find productive activities that fit interest and abilities Supported work trials Follow up support P: neuropsychologist, neurologist, rehabilitation nurse, social worker, speech and language pathologist, OT, physical therapist S: inpatient, in groups 5-8 members and individual F: 8:30 AM-4.00 PM on weekdays Neuropsychological psychotherapy 4 days/ week Individual sessions daily Cognitive twice a week D: 6 weeks			
Trexler LE 2010 USA	I: N: 12 C: N: 11 I: G: 6/5	6 M N: 1 missing data	Resource facilitation (RF) C: assisting participants to return to work (needs assessment,	No contact, only after 6 months to obtain follow-up measures	Employed N (full-time/part-time) I: N: 7 (4/3) C: N: 4 (3/1)	RCT High

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
RCT	A: 43.2, 12.0 C: G: 8/3 A: 42.6, 12.8 In: TBI I: 3, C: 4 Intracranial haemorrhage I: 4, C: 3 Stroke I: 3, C: 3		person centered goal setting, evaluate effectiveness of what was utilized in the past, facilitate access to resources, monitor status and quality of supports, education about brain injury, personal advocacy, partnership development, maintenance of RF Handbook including projected discharge plan) P: resource facilitator, when appropriate former employer actively engaged in RTW plan S: outpatient neurorehabilitation clinic, home, community, workplace, telephonic communication F: every 2 weeks contact facilitator-participant; every week or 2 contact facilitator-author(s); 3 case conferences		Wald-Wolfkowitz z=-3.277, p<0.0001	

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
			facilitator-authors-vocational rehabilitation counselor D: 6 months; mean number of hours of intervention 10.6, median 8.0			
Vanderploeg RD 2008 **USA** **RCT**	Active duty military members I: N: 184 G: 165/15# A: 33.2, 13.5 C: N: 182 G: 170/10# A: 31.7, 12.9 In: non-penetrating TBI moderate-severe GCS mean/SD I: 6.8/3.5 C: 6.7/3.7 PTA<7 d I: 12/177# C: 19/176# PTA>7 d I: 165/177# C: 157/176#	1 Y N: I/C rescinded before treatment 3/2 lost to follow-up 13/16 refused follow-up 1/5 deceased 3/3 unable to be contacted for 1 Y follow-up 9/6 N: I/C included in analysis I: 180 of 184 C: 180 of 182	Cognitive didactic rehabilitation C: didactic trial and error learning treatment emphasizes building self-awareness interventions target executive functions (working memory, mental tracking, communication, executive self awareness) real life tasks not included P: certified experienced therapists (provided occupational, physical, speech/cognitive, neuropsychological therapy in their own professions) S: office setting, individual	Functional experiential rehabilitation C: experiential interventions errorless learning focus on developing functional abilities or skills interventions target functional behaviors (compensation techniques, environmental management, functional task-specific checklists) self-analytic interventions or focus in self-	RTW (work and or school) I: 65 of 167# C: 58 of 164# #missing data $\chi^2_{1,n=329}$=0.45, p=0.5	RCT High

Reference First author Year of publication Geographic location Design	Population I: intervention group C: control group N: number of subjects G: gender M/F* A: age mean, SD*, range In: injury	Follow-up Loss to follow-up Y: years M: months W: weeks N: number I: intervention group C: control group	Description intervention C: content P: profession trainer S: setting F: frequency D: duration	Description control intervention C: content P: profession trainer S: setting F: frequency D: duration	Effect of intervention Proportion RTW* vs. no RTW	Methodological Quality Design: RCT* Quality high/low Design OD* Quality sufficient/low
	Cause Accident I: 148/165# C: 151/64# Assault I: 17/165# C: 13/164# #missing data		F: 1.5-2.5 hours/day D: 20-60 days (Monday to Friday), 26-84 calendar days	awareness not included P: therapists S: real life environments (hospital recreation area, simulated home environment), group session F: 1.5-2.5 hours/day D: 20-60 days (Monday to Friday), 26-84 calendar days		

* Notes

M/F male/female	CV curriculum vitae
SD standard deviation	OT occupational therapist
RTW return to work	TBI traumatic brain injury
RCT randomized controlled trial	ABI acquired brain injury
OD other design	OR odds ratio
SAH subarachnoid haemorrhage	SE standard error
AV arteriovenous	GCS Glasgow coma scale
MS multiple sclerosis	PTA post traumatic amnesia
NIA no information available	CT computed tomography
DEA disability employment adviser	MRI magnetic resonance imaging

Appendix 4

Methodological quality of selected studies randomized controlled trials (RCT)s and other designs (OD)s [18,19]

Reference	Internal validity	Descriptive	Statistical	Methodological quality RCT high/ low OD sufficient/ low
RCT				
Man 2013	g, j, l, n	c, d, m1, m2	o, q	low
Ntsiea 2014	b1, b2, g, l, j, l, n, p	a, c, d, m1, m2	o, q	high
Salazar 2000	b1, b2, g, j, l, n, p	a, c, d, m1, m2	o, q	high
Trexler 2010	b1, f, g, j, l, n	a, c, d, m1, m2	o, q	high
Vanderploeg 2008	b1, b2, g, i, j, l, n, p	a, c, d, m2	o, q	high
OD				
Gamble 2003	j	k	o, q	low
Geurtsen 2008	g, i, j, l, n, p	a, d, m1, m2	o, q	sufficient
Geurtsen 2011	g, i, j, l, n	a, d, m1, m2	o, q	sufficient
Murphy 2006	g, i, j, l, n	a, d, m1, m2	o	sufficient
Niemeier 2010	g, j, l, n	a, d, m1, m2	o	sufficient
Sarajuuri 2005	i, j, l, n	a, d, m2	o, q	sufficient
Bisiker 2007	j, l, n	a, d	o	low

Specifications and descriptions of the criteria are demonstrated in Appendix 2.
Only the criteria scored positive are reported. Cut-off points regarding quality level are described in the methods section

6

Development of a training programme for insurance physicians on acquired brain injury and return to work

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Submitted for publication.

Abstract

Objective

Development of a training programme to impart insurance physicians (IP)s knowledge about acquired brain injury (ABI) and return to work (RTW).

Methods

The training programme was developed in three steps: 1) formulation of learning objectives; 2) literature review and consultation with educational experts; and 3) realization of the training programme.

Results

Step 1) the learning objectives were: IPs are aware of the causes, consequences, and impact of ABI; IPs know which aspects of ABI are relevant for RTW; and IPs know which interventions can affect the work capacity and long-term prognosis of patients with ABI. Step 2) the teaching methods in this training programme comprise a combination of several active components, for example, interactive exercises and case scenarios. Step 3) the one-day, four-hour 'ABI and RTW' training programme for IPs consists of four parts, which correspond to the learning goals and the core tasks of IPs.

Conclusions

The one-day, four-hour multifaceted, interactive, 'ABI and RTW' training programme was developed for IPs and based on effective teaching methods from the literature, learning theories, and educational expert's advice. This study underlines the significance of providing a link to daily practice when developing a training programme for IPs.

Introduction

Insurance physicians (IPs) assess patients on long-term sick leave who apply for disability benefits. IPs consider a patient's functional abilities and limitations, evaluate the return to work (RTW)-process, and determine whether RTW is an achievable aim. As a result of these assessments, patients either need to RTW or are exempt from RTW and granted disability benefits. IPs see patients with a broad range of disorders and base their assessments on their knowledge about these disorders, with a focus on RTW. IPs' assessments may sometimes be complex, particularly in the case of acquired brain injury (ABI). ABI has a broad spectrum of manifestations that can be discrete or even undetectable, and it is therefore particularly difficult for IPs to assess patients with ABI.

Scientific knowledge about ABI and RTW—specifically of aspects of ABI that are relevant for RTW and of effective RTW-interventions for patients with ABI—can help IPs to identify patients for whom RTW may be problematic, and to evaluate whether adequate care was or can be provided to facilitate RTW [1-5]. As a next step, IPs need to apply the available knowledge in practice. However, the use of scientific knowledge in occupational and healthcare practice is known to be limited [6-13], and thus there is a gap between the available knowledge and the actual care provided in practice.

In order to narrow the evidence practice gap and to address the related barriers [14-19], a training programme focusing on how IPs can obtain knowledge about ABI and RTW can offer a solution, since it has been shown that merely disseminating scientific knowledge, for example, through printed educational materials, is not sufficient to change the behaviour of occupational healthcare professionals [20-23]. The way knowledge can be applied in practice could be established as a training programme that integrates learning and practice [24,25]. It was demonstrated that such training programmes provide participants an opportunity to link new knowledge to prior knowledge and experiences [26-28]. Furthermore, training programmes enable participants to reflect on application in practice [29]. Therefore, a training programme is needed that addresses IPs' lack of knowledge about ABI and RTW, and teaches IPs how to apply this knowledge in assessments of patients with ABI.

For the specific context of IPs' assessments of patients with ABI, it is not known how best to train IPs to gain specific knowledge about ABI and RTW, and which are the best training methods to impart this knowledge.

The aim of the present study was to develop a training programme and to address the following research question: What elements and aspects must be integrated into a training programme for IPs in order to facilitate the application of knowledge about ABI and RTW in their practice?

Methods

The training programme was developed in three steps: 1) formulation of learning objectives; 2) selection of teaching methods tailored to IPs; 3) realization of the training programme.

Step 1. Formulation of learning objectives

The available knowledge about ABI and RTW, obtained from recent research projects [1-5], formed the basis for the learning objectives and the scientific content of the training programme.

IPs' scope of professional practice was considered and the content relevant for the assessment of patients with ABI was distributed over four topics: 1) what ABI is; 2) evaluation of the RTW-process; 3) assessment of work capacity; and 4) assessment of medical prognosis and prognosis of functioning.

Step 2. Selection of teaching methods tailored to IPs

In order to achieve the learning objectives through proven effective methods that are tailored to IPs, the research team made an inventory of available resources in PubMed about effective teaching approaches [20-23,30,31] and learning theories [32-37].

Methods and theories that could be applied to enhance IPs' learning were selected from these resources.

To supplement the findings from the literature survey with practical experience, three educational experts were consulted through the professional network of the research team: 1) A physician and professor of medical education and training, with specific expertise in teaching evidence-based medicine, the way physicians learn, and the application of research findings in training programmes for general practitioners; 2) a staff member at the department of continuing medical education (CME) of a large university hospital, with expertise in the design of training programmes for general practitioners; and 3) a chief of the educational department of a large organization that employs IPs, with expertise in the design, development, and implementation of educational interventions for IPs.

The experts were asked what they considered the appropriate strategies to teach healthcare professionals, like IPs, based on their scientific and practical experience, and their familiarity with the professional context of IPs.

Step 3. Realization of the training program

Based on the results of the scientific literature study [20-23,30,31], learning theories [32-37] and the advice from the educational experts, the training programme—including learning objectives and training activities to achieve the learning objectives—was realized.

Results

Step 1. Formulation of learning objectives

The learning objectives are:

Regarding ABI

- IPs know what ABI is (knowledge)
- IPs know the causes of ABI, the consequences of ABI, and the impact of ABI on RTW (knowledge)

Regarding evaluation of the RTW-process

- IPs know what factors are relevant for RTW (knowledge)
- IPs know the facilitators of and barriers to RTW and are aware of solutions to RTW-problems, according to patients and employers (knowledge)
- IPs know which effective RTW-interventions can be provided in the RTW-process (knowledge)
- IPs know how multidisciplinary care is organized in the RTW-process (knowledge)
- When IPs evaluate the RTW-process in a case scenario, they are able to recognize which aspects hinder RTW, and which solutions and effective interventions can be provided in the RTW-process and by whom (comprehension)

Regarding assessment of work capacity

- IPs know the impact of ABI or comorbidities on work capacity (knowledge)
- IPs know which work-related aspects can hinder functioning and which work adjustments can be applied (knowledge)
- When IPs assess work capacity in a case scenario, they are able to recognize relevant consequences of ABI or comorbidities that affect work capacity, which work-related aspects can hinder functioning, and which work adjustments can be applied (comprehension)

Regarding assessment of medical prognosis and prognosis of functioning

- IPs know which aspects can affect the long-term prognosis of the medical situation and the functional capacity (knowledge)
- IPs know which interventions can improve the long-term prognosis of the medical situation and the functional capacity (knowledge)
- When IPs assess the medical prognosis and the prognosis of functioning in a case scenario, they are able to recognize relevant aspects that can affect the long-term prognosis of the medical situation and the functional capacity, and are able to advise on the application of interventions to improve the long-term prognosis (comprehension)

Step 2. Selection of teaching methods tailored to IPs

Effective teaching approaches from the scientific literature

IPs participate regularly in education to keep up to date with advances in the field, which is line with CME. CME programmes improve the knowledge and performance of physicians [20,21,30,31] and other healthcare professionals [20,31], as demonstrated by three systematic reviews of systematic reviews [20,21,30] and one integrative review [31]. Performance improvement was greater when CME was interactive, multifaceted [20,21,30,31], and lasted longer [21]. Various methods were identified as effectively improving knowledge and performance, such as case-based learning in small groups, interaction with peers and group discussions [20,30,31], problem-based learning [21], lectures [20,21,30], audit and feedback [20,21,30,31], and interactive techniques [21]. In addition, didactic presentations [21] or printed educational materials, when applied as a single method, have no [22] or only a small positive effect on professional practice outcomes [20,21,23].

Learning theories

Insight into how adults learn and their learning context assists in tailoring a training programme to the target audience [32-37]. In line with the adult learning theory, adult learners [32-37]:

- are motivated to learn when the imparted knowledge is essential to them and related to the situations they encounter in their daily work
- need support from their peers during learning
- need to learn in small groups to apply imparted knowledge in a case scenario and to share learning experiences
- need coaching during learning and feedback on their performance

Educational expert consultation

According to the educational experts, a training programme needs to be relevant for the daily practice of IPs. The experts underlined the importance of focusing on practical applicability and advised introducing realistic case scenarios to enable participants to apply imparted knowledge. According to the experts, IPs (and other adult learners) need a safe and comfortable learning environment and prefer to learn in small groups, supported by peers.

The experts stated that occupational healthcare professionals, such as IPs, prefer face-to-face training and active training methods, for example, exercises and quizzes. The experts advised starting with a quiz to provide IPs and teachers with insights into participants' level of knowledge gaps, which motivates participating IPs to learn. According to the experts, adult learners (including IPs) appreciate knowing how well they are performing and need feedback from their teachers. Lectures should be interactive and last no longer than 20

minutes. One expert advised creating a summary of imparted knowledge, which would enable IPs to find information quickly, as IPs have to deal with patients suffering from a broad range of diseases.

Step 3. Realization of the training programme

The findings from the literature and the educational experts' advice were integrated into the 'ABI and RTW' training programme for IPs. The training programme takes four hours (including a 30-minute break) and consists of four parts, each of which corresponds with one of the core tasks of IPs.

The learning objectives generated in the first step were aligned with proven effective training methods and learning circumstances that best suit IPs to optimize the learning process, such as quizzes and case scenarios in small groups. The 'ABI and RTW' training programme is illustrated in Table 1.

Table 1. The one-day, four-hour 'ABI and RTW' training programme plan for IPs

Topics related to IPs' professional tasks	Teaching methods	Time
Introduction		5 mins.
ABI	– Interactive lecture	10 mins.
Evaluation of the RTW- process of patients with ABI	– Interactive lecture – Quizzes – Exercises – Simple case scenarios in small groups – Plenary feedback – More complex case scenarios in small groups, facilitated by instructor – Plenary feedback – Plenary discussion – Reflection on own practice	1.5 hrs.
Assessment of work capacity of patients with ABI	– Interactive lecture – Quizzes – Exercise – Case scenarios in small groups – Plenary feedback – Plenary discussion – Reflection on own practice	1 hr.
Assessment of medical and functional prognosis of patients with ABI	– Interactive lecture – Quizzes – Exercise – Simple case scenarios in small groups – Plenary feedback – More complex case scenario derived from daily practice in small groups, facilitated by instructor – Plenary feedback – Plenary discussion – Reflection on own practice	1 hr.

In addition, a course syllabus detailing the training programme was composed in order to assure reproducibility and to facilitate a broader implementation in the future.

Discussion

The aim of this study was to develop a training programme to impart IPs knowledge about ABI and RTW, and to teach them how to apply this knowledge in practice. It resulted in the one-day, four-hour 'ABI and RTW' training programme for IPs, which consists of multifaceted and interactive teaching approaches.

These multifaceted and interactive teaching approaches were derived from the literature, specifically from reviews of reviews [20,21,30] and an integrative review that bundled the results of systematic reviews and randomized controlled trials [31]. The use of the literature is a strength of this training programme, as the conclusions concerning the effectiveness of the interventions included in these studies were based on a large number of study participants [20,21,30,31]. However, the results of these studies alone were not sufficient to develop the training programme, as it was not clear in what context and under what conditions these teaching approaches were most effective [21]. Therefore, and specifically in order to tailor the programme to IPs, learning theories were considered [32-37] and experts were consulted. This mixed methods approach, resulted in a multidimensional understanding of elements that could be used in this training programme for IPs. A link to practice is provided in this way, which is in line with adult learning theory [32-37]. In addition, case-based learning methods give participants the opportunity to interact in small groups, and to connect new material with prior knowledge and to integrate it, in line with constructivism [26-28].

The topics of the training programme are related to IPs' assessments in practice.

The purpose of the training programme is to transfer knowledge for use in practice, although it is realized that imparted knowledge is potentially not completely new for IPs, as they often already have some knowledge of ABI and RTW. The training programme is aimed to fill the knowledge gaps and to build on prior knowledge.

A one-day training programme lasting for a few hours could be perceived as a limitation, but a limited time frame is sufficient, as IPs are capable of adopting the imparted knowledge in conjunction with previous knowledge [24,38-40]. This was demonstrated in earlier studies about training programmes imparting knowledge for physicians' daily practice [24,38-40]. The short duration of these training programmes did not hinder effective knowledge increase [24,38-40]. In addition, IPs in this study were introduced to the training programme content through reading assignments in advance, which allowed to save time for aspects that could increase the effect of short training programmes, such as reflective, interactive exercises and integrating learning and practice through case scenarios [41]. The

training programme was mainly developed to increase the knowledge of IPs about ABI and RTW, which is useful for use in practice. Four aspects seem to be important to transfer knowledge in practice and to change healthcare professionals' behaviour: 1) identification of barriers, 2) choice of intervention components, 3) use of theory, and 4) engagement of end-users [42]. These aspects were also addressed in the development of this training programme aimed to remove a barrier, namely IPs' lack of knowledge about ABI and RTW, resulting in learning objectives related to IPs' professional tasks, which was achieved through effective teaching strategies derived from the scientific literature. In addition, the training programme was tailored to IPs based on learning theories [42]. A systematic stepwise approach as applied in this study is recommendable, as it provides insight into the development of the programme, which is often reported to be poorly described in previous studies [43]. Insight into the development of a training programme may allow its understanding [44] and reproducibility, and enable tailoring of the training programme to other contexts [45,46].

Conclusions

A multifaceted, interactive, one-day, four-hour case-based 'ABI and RTW' training programme for IPs was designed, based on the latest scientific insights into the training and education of occupational and other healthcare professionals, on learning theories from the literature, supplemented with advice from educational experts. This study highlights the importance of selecting active teaching methods and creating a link to daily practice when designing a training programme for health care professionals.

Practice points

- Teaching methods for professionals are most practical when they are based on proven effective teaching strategies combined with the practical experience of experts in teaching and education
- Effective teaching methods for professionals are interactive and multifaceted, and comprise interactive lectures, exercises, and case-based and peer-group learning
- Case-based learning methods assist training programme developers to provide a link to practice

Declaration of interest

The authors report no declarations of interest.

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7

‘Acquired brain injury and return to work’: the feasibility of a training programme for insurance physicians

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Abstract

Purpose

To study the feasibility (limited efficacy, acceptability and implementation) of a training programme for insurance physicians (IP)s.

Methods

Limited efficacy was evaluated over time (T0-T2) by conducting knowledge question tests using realistic case scenarios, analyzed by non-parametric Friedman and Wilcoxon signed-rank tests. Acceptability was evaluated by asking participants to agree or disagree with statements; for example, the knowledge was “relevant”, “useful” or “appropriate”. Answers were analyzed using descriptive statistics. Open-ended questions were used to ask participants what, in their opinion, were the facilitators of and barriers to implementing the knowledge taught. Their answers were coded and categorized.

Results

Fifty-one IPs participated in the study. Concerning limited efficacy: the median values of the knowledge scores increased significantly over time and between time points from 16 (T0) to 21 (T1) and 32 (T2), $p<0.00$. Concerning acceptability: 46 of 47 respondents perceived the training programme to be “relevant”, “useful” and “appropriate”; 44 respondents intended to use it in practice. Concerning implementation: participants reported “training” and “utility” as examples of facilitators and “lack of time”, for example, as a barrier.

Conclusion and implications

The feasibility (limited efficacy, acceptability, implementation) of the training programme is demonstrated; the training programme can be applied in practice.

Introduction

Acquired brain injury (ABI), both with a traumatic and a non-traumatic cause affects many individuals of working age every year [1]. Less than half of those who are working before suffering ABI return to work (RTW) within two years of the injury [2]. It has been reported that RTW after ABI has a significant positive impact on a person's quality of life and life satisfaction [3-5]. In this study, RTW was defined as having part-time or full-time paid employment without consideration of the job demands or working hours. Given the importance of work, the RTW-process of patients with ABI should be optimized.

In the multidisciplinary RTW-process, medical and paramedical professionals, such as neurologists, rehabilitation physicians, general practitioners, and occupational healthcare professionals, such as occupational therapists, job coaches, occupational physicians and insurance physicians (IPs), all collaborate to help patients with ABI to return to work [6,7]. As part of this, the specific role of occupational physicians in the Netherlands is to guide patients with ABI through the RTW-process during two years of sick leave. IPs evaluate the RTW-process after long-term sick leave and assess the patient's functional abilities and prognosis of functioning. In addition, IPs provide recommendations regarding RTW. In order to support IPs' tasks, scientific evidence on ABI, the RTW-process and related effective interventions has recently been obtained [6,8-11]. In addition, researchers have investigated the RTW-experiences of patients and employers, and gathered expert opinion on the coordination of multidisciplinary care in the RTW-process. This knowledge is embedded in the multidisciplinary guideline 'ABI and Work Participation' intended for all (para)medical and occupational healthcare professionals involved in the RTW-process of patients with ABI [12]. Although adherence to guidelines allows for evidence-based best practice and has been shown to improve quality of care [13,14], implementing new guidelines is still challenging [15,16]. Numerous studies have revealed barriers at the organizational, patient or professional level, such as lack of knowledge on the part of individual healthcare physicians [13,15,17,18]. A range of approaches can be taken to address these knowledge gaps, such as educational interventions [13,19,20]. Among these, interactive multifaceted interventions have proven to be effective in changing healthcare professionals' knowledge [21,22]. These insights formed the basis for developing the 'ABI and RTW' training programme for IPs [23]. As a first step, prior to implementation in IPs' practice, we investigated the feasibility of this programme for imparting knowledge and whether it needed to be adapted [13,24,25]. A feasibility study provides information on, for example, how the target population reacts to an intervention, whether an intervention is likely to be applied within an existing or a different system, and whether the intervention yields trends for positive outcomes [24]. In accordance with recommendations on the design of feasibility studies [24], the aim of this study was to address specifically: 1) whether the training programme resulted in an increase in IPs' knowledge concerning ABI and the RTW-process ("limited efficacy"); 2)

whether IPs perceive the knowledge taught in the 'ABI and RTW' training programme to be relevant, useful and appropriate ("acceptability"); and 3) regarding "implementation" in daily practice, what, according to IPs, are potential facilitators of or barriers to the implementation of the knowledge acquired.

Methods

Feasibility was studied by undertaking a pilot of the 'ABI and RTW' training programme for IPs. Limited efficacy was evaluated by using an experimental pre-post design. Acceptability and implementation were studied by means of a qualitative design.
The research was conducted in accordance with the principles set out in the Declaration of Helsinki [26]. The research proposal was submitted to and approved by the Medical Ethical Committee of the Academic Medical Center. The latter judged that a comprehensive evaluation would not be required, on the grounds that this study is not subject to the Medical Research Involving Human Subjects Act (Reference number W17_028 # 17.040).

Participants

Participants who were registered as or training to become IPs, who were employed by the Dutch National Institute for Employee Benefit Schemes and working at one of three offices of the Dutch National Institute for Employee Benefit Schemes in the eastern part of the Netherlands, were considered eligible and invited to participate. They were informed about the study's aim and procedure during a regular staff meeting at their workplace. They received additional detailed written information about the study and an informed consent form. Participants were given a guarantee that participation was voluntary and that all data would remain confidential and used solely for research purposes. Those IPs who agreed to participate signed the informed consent form and returned it to the first author. They were subsequently enrolled in the study and assigned to three different training groups at three different local training sites.

Training programme

The research team designed the 'ABI and RTW' training programme for IPs.
The content of the training programme was based on evidence-based recommendations embedded in a multidisciplinary guideline [12]. The research team selected recommendations relevant for IPs and defined learning objectives, based on the knowledge contained in the guideline. The learning objectives were categorized in accordance with IPs' professional tasks: evaluating the RTW-process and assessing capacity to work and prognosis of functioning of patients with ABI. The detailed learning objectives are presented in Appendix 1.

The training format was based on learning theories and empirical evidence of effective teaching methods [21,22,27-30]. In addition, educational experts advised on how best to enable participants to acquire new knowledge. The learning objectives and input on teaching methods were incorporated to produce a one-day, four-hour interactive training programme, featuring case-based learning activities that provide a link to IPs' daily practice. The second author, an experienced IP, moderated the training programme. The first author contributed to the content of the programme when needed. The training programme plan is outlined in Table 1.

Table 1. The one-day, four-hour 'ABI and RTW' training programme plan for IPs

Topics related to IPs' professional tasks	Teaching methods	Time
Introduction		5 mins.
ABI	– Interactive lecture	10 mins.
Evaluation of the RTW-process of patients with ABI	– Interactive lecture – Quizzes – Exercises – Simple case scenarios in small groups – Plenary feedback – More complex case scenarios in small groups, facilitated by instructor – Plenary feedback – Plenary discussion – Reflection on own practice	1.5 hrs.
Assessment of work capacity of patients with ABI	– Interactive lecture – Quizzes – Exercise – Case scenarios in small groups – Plenary feedback – Plenary discussion – Reflection on own practice	1 hr.
Assessment of medical and functional prognosis of patients with ABI	– Interactive lecture – Quizzes – Exercise – Simple case scenarios in small groups – Plenary feedback – More complex case scenario derived from daily practice in small groups, facilitated by instructor – Plenary feedback – Plenary discussion – Reflection on own practice	1 hr.

Limited efficacy

In order to evaluate whether the training programme resulted in increased knowledge over time, knowledge was assessed three times using test questionnaires [31]: without documentation (T0), after reading a print version of the guideline 'ABI and Work Participation' (T1) and, finally, after attending the face-to-face training programme (T2).
The test questionnaires were aligned with the learning objectives [31] and comprised three sets of 16 questions, with equivalent content for three measures at T0, T1 and T2, respectively. The knowledge test items were a combination of true or false, multiple choice and open-ended questions. The open-ended questions required participants to construct their own answers built around a written realistic case scenario concerning the RTW-process of patients with ABI.

The topics of the test questions provided were as follows:
- Consequences/causes of ABI, disorders of which ABI is a result
- Aspects that are positively or negatively associated with RTW of patients with ABI
- Patient, work and environment-related aspects that might hinder RTW
- Professionals involved in the RTW-process of a patient with ABI
- Aspects that can facilitate/hinder RTW
- Solutions for barriers to RTW
- Effective RTW-interventions
- Prognosis of functioning of a patient with ABI

The following is an example of an open-ended question:
- "Patients with ABI often lack insight into the consequences of ABI. Mention two interventions that can be applied accordingly".

The following is an example of a multiple-choice question:
- "Indicate which of these aspects are associated with RTW: long stay in rehabilitation, high level of education, low level of education, unemployment prior to injury, independence in activities of daily living".

The following is an example of a true or false question:
- "A majority of patients with ABI do not experience changes in functioning after two years. True or false".

The test questionnaires were constructed by the research team, and subsequently reviewed and approved by an educational expert. The first author formulated answers based on the content of the guideline, and developed a detailed scoring document on how to evaluate participants' performance. This document was then verified by the research team. The

questionnaires and scoring documents are available from the corresponding author on request. The score for each correct response ranged from 0 to 5 points. The performance of all participating IPs was assessed based on the sum score of all of the responses they provided. This resulted in a minimum total score of 0 and a maximum total score of 40 points. The participants' performance was measured at each time point (T0, T1 and T2).

Acceptability

In order to evaluate acceptability, participants were requested to complete a survey after attending the training programme (T2). The survey comprised eight statements about the 'ABI and Work Participation' guideline that was taught during the training session.

These statements were:

- "The guideline is easy to read"
- "The guideline is clear"
- "The guideline is relevant for daily practice"
- "The guideline is useful for daily practice"
- "The guideline is appropriate for use with patients with ABI in daily practice"
- "The guideline is appropriate for assessing the functional capacity of patients with ABI"
- "The guideline is appropriate for assessing the prognosis of patients with ABI"
- "I intend to continue using the guideline"

Participants were asked to indicate whether or not they agreed with the statements, using a 4-point scale: "strongly agree", "agree", "disagree", and "strongly disagree".

Implementation

In order to evaluate whether the 'ABI and RTW' training programme could be implemented in practice, participants were requested to answer three open-ended questions after the training programme (T2).

These questions were:

- "In my opinion, facilitators of implementation of the guideline in daily practice are…"
- "In my opinion, barriers to the implementation of the guideline in daily practice are…"
- "In my opinion, if implementation was hindered, … would be needed/necessary".

Analysis

Limited efficacy

The participants' performance, that is, the sum scores of the knowledge tests taken by all participating IPs, was evaluated over time (from T0 to T2). The values of the participants' sum scores were analysed for normality using the Kolmogorov-Smirnov and the Shapiro-

Wilk tests, at each time point (T0, T1, and T2). If the participants' sum scores were normally distributed, analysis of sum scores over time was performed using the Repeated Measures ANOVA. If the distribution of the scores was not normal, the non-parametric Friedman test was used. If significant differences were found, this was followed by a post-hoc analysis, that is, the Wilcoxon signed rank test. If the p-values were below 0.05, differences were considered to be significant.

Acceptability
Participants' agreements or disagreements with the statements were analyzed, applying descriptive statistics.

Implementation
The first author and a research assistant read and coded the participants' answers individually. Subsequently, the first author and the research assistant independently categorized the codes into "facilitators" of and "barriers" to implementation and "what is needed/necessary when implementation is hindered", using qualitative data analysis software. The first author and the research assistant created subcategories based on similar answers concerning the main categories, and then reached consensus on the subcategories. The results of the categorization were presented to and checked by the second and third author.

Results

Participants

Eighty-two IPs were invited to the staff meeting at their workplace. Fifty-seven IPs were willing to participate, six IPs were unable to attend the training programme due to holidays (N=1), sick leave (N=2), other training (N=1), and for unknown reasons (N=2). As a consequence, 51 IPs participated in the study, of whom 27 were male. The mean age of the participants was 49 years (SD=11, range 27-64 years). The participants' mean practice experience was 14 years (SD=11, range 1-34 years). All participants were employed by the Dutch National Institute for Employee Benefit Schemes.

Training programme

The face-to-face 'ABI and RTW' training programme was provided on three occasions in April and May 2017, at three different locations in the east of the Netherlands.
All 51 participants completed the limited efficacy questionnaires at baseline (T0), just before the training programme (T1), and directly after the training programme (T2). Up to seven participants did not indicate their level of agreement with each specific statement

of the survey on acceptability. Five participants did not answer any questions concerning facilitators of and barriers to implementation and what, in their opinion, would be needed or necessary if implementation is hindered. One participant gave a reason for this, namely, not having read the guideline.

Limited efficacy

The knowledge tests at T0, T1 and T2 each took 15-20 minutes to complete. The first and the second author scored the questionnaires of all participants independently, based on the scoring document, and resolved any disagreements. The values of the sum scores of the knowledge tests of all participants were found to be non-normally distributed. The non-parametric Friedman test demonstrated that the median values of knowledge scores increased significantly over time from 16 (range 8-23, T0) to 21 (range 12-32, T1) and 32 (range 20-36, T2), $\chi 2(2)=95.95$, $p<0.00$. Post-hoc analysis showed a significant knowledge increase from T0 to T1 ($p < 0.00$) and from T1 to T2 ($p < 0.00$), respectively.

Acceptability

A majority of participants reported that the 'ABI and Work Participation' guideline [12] taught in the 'ABI and RTW' training programme was easy to read, clear, relevant, useful and appropriate, and that they intended to continue using it.
The results are outlined in detail in Table 2.

Table 2. Acceptability of the 'ABI and RTW' training programme for IPs (N=51)

	Statements (Number of respondents)	Strongly disagree (N)	Disagree (N)	Agree (N)	Strongly agree (N)
1	The guideline is easy to read (N=44)	0	1	37	6
2	The guideline is clear (N=44)	0	1	37	6
3	The guideline is relevant for daily practice (N=47)	0	1	34	12
4	The guideline is useful for daily practice (N=47)	0	1	34	12
5	The guideline is appropriate for use with patients with ABI in daily practice (N=47)	0	1	36	10
6	The guideline is appropriate for assessing the functional capacity of patients with ABI (N=45)	0	5	31	9
7	The guideline is appropriate for assessing the prognosis of patients with ABI (N=45)	0	1	36	8
8	I intend to continue using the guideline (N=44)	0	0	28	16

Implementation

The participants reported various facilitators and barriers concerning implementation, as well as what, in their opinion, would be needed/necessary if implementation is hindered. These facilitators, barriers and necessary measures have been categorized and outlined in detail in Appendix 2. A few are presented below; quotations have been included as examples.

1. Facilitators of implementation

Familiarity with guideline

"That attention is paid to this" (participant 12)

Training

"Practise/discuss with colleagues" (participant 51)

Summaries

"Clear and well-organized; the summary card is particularly useful as a guide for practice" (participant 44)

Utility

"Easy to apply" (participant 5)
"Being given enough time by the Dutch National Institute for Employee Benefit Schemes to do high-quality assessment" (participant 24)
"Attractive design" (participant 1)

2. Barriers to implementation

Training

"Lots of tests" (participant 22)

Utility

"If one of the 3-4 physicians (rehabilitation physician, general practitioner, occupational physician, insurance physician) doesn't use the guideline" (participant 42)
"A guideline can be difficult to apply at the case level" (participant 50)
"Time constraints in daily practice, also in view of timeliness" (participant 25)
"Lots of information to go through every time" (participant 36)

3. Needed/necessary when implementation is hindered

Familiarity with guideline

"Should pay attention to this" (participant 35)

Training
"Compulsory refresher courses" (participant 23)
"Regularly discuss in case histories" (participant 32)
"Brush up on an occasional basis" (participant 30)

Utility
"Effective consultation with the other disciplines" (participant 39)

Design
"Brief and succinct execution" (participant 29)

Time
"Allow the time to apply this well" (participant 2)

Discussion

The aim of this study was to evaluate the feasibility of the 'ABI and RTW' training programme for IPs, specifically in relation to limited efficacy, acceptability and implementation. The results of this study demonstrate the limited efficacy of the training programme, leading to a significant increase in knowledge over time. The participants considered the knowledge embedded in the guideline to be acceptable for daily practice and intend to continue using it. The participants reported aspects that could facilitate or form barriers to the implementation of this knowledge, such as "training" and "lack of time", respectively.

Context of the training programme
When designing the face-to-face training programme, the target audience was taken into account. The trainees were experienced physicians who underwent this training alongside their professional activities and were actively taking part in a training course linked to practice. The 'ABI and RTW' training programme was therefore based on the principles of adult learning theory, constructivism and cognitive load theory [27-30]. In this sense, the IPs learned to apply new knowledge actively in exercises and realistic case scenarios, and encountered practical problems; an approach that, according to adult learning theory, creates motivation to learn [30,32]. The face-to-face mode was chosen, as it provided participants the opportunity to discuss with peers and to reflect on their practice. The participants linked new knowledge to existing knowledge and assimilated it; according to constructivism, which is associated with deeper understanding and retention in the longer term [27,28,33]. Finally, by working up from simple exercises to more complex case scenarios, the cognitive load of the training programme was limited [29].

Limited efficacy

One aim of this study was to investigate the limited efficacy of the 'ABI and RTW' training programme in a small population of IPs and, specifically, to establish whether it resulted in a significant knowledge increase on the part of participants and demonstrated the potential for broad implementation [24]. The 'ABI and RTW' training programme consisted of reading the guideline, followed by a one-day, four-hour face-to-face training programme, including serial assessments of knowledge.

In order to optimize knowledge transfer, the training programme made use of active teaching approaches that have been shown to improve physician performance and guideline implementation [21,22]. Training programmes designed in this way have been shown to result in knowledge increase in the context of guideline implementation for IPs [34] and occupational physicians [35]. Specifically, when guidelines need to be implemented in IPs' practice, the use of interactive lectures and subgroup exercises with a trainer providing feedback has been demonstrated to increase IPs' knowledge significantly [34]. Therefore, in this 'ABI and RTW' training programme, knowledge was imparted in a similar way, by means of interactive plenary lectures, exercises, simple case scenarios providing participants with opportunities to have short discussions with peers, and more complex, realistic case scenarios whereby participants learned to apply the knowledge in small groups of two or three participants. This case-based learning method allowed participants to reflect on their own practice when evaluating the RTW-process, and when performing assessments of functional abilities and prognosis.

The knowledge tests over time revealed an increase in knowledge not only after completing the entire training programme, but also after the IPs had read the printed version of the guideline. This is remarkable, as previous studies have demonstrated that printed education materials as a single intervention are not an effective means of influencing physicians' knowledge or behaviour [21,36], or have only a limited effect on professional practice outcomes as demonstrated in a systematic review [37]. The increase in IPs' knowledge after reading the guideline 'ABI and Work Participation' could have resulted from their awareness that their knowledge would be tested. On the one hand, the participants were motivated to achieve a good result, but on the other hand, they reported that the number of tests formed a barrier to the implementation of the training programme. Moreover, this increase in knowledge could be a so-called "testing effect"; in other words, testing itself can create a learning effect and has been proven to increase the transfer and recall of information [38-40]. One systematic review, for example, reported that test-enhanced learning interventions such as short-answer questions resulted in better learning outcomes for trainees in health professions education when compared to repeated studying [39]. Teachers could therefore consider including assessments in training programmes in order to improve learning outcomes in health professions education [39,40].

Acceptability

The IPs considered the 'ABI and RTW' training programme to be acceptable: clear, relevant, useful and appropriate. These positive comments could potentially be attributed to the content of the training programme, which is congruent with IPs' main professional tasks; namely, assessment of functional capacity, prognosis of functioning, and evaluation of the RTW-process of patients with ABI. This close link between the content of the training and daily practice was highly appreciated by the participants in this study, as well as in other studies [22,32]. This, in turn, could potentially have a positive impact on IPs' adherence to the guideline in practice, since participants indicated their intention to continue using the guideline [41]. This is important additional information with respect to broad implementation in the future, as it was derived directly from the stakeholders themselves. These positive results concerning acceptability indicate the 'ABI and RTW' training programme's potential for broad implementation in IPs' practice [24,42]. It is recommended to evaluate IPs' long-term adherence to the guideline.

Implementation

Based on the abovementioned results, the 'ABI and RTW' programme is ready to be implemented in practice. This is important, as the potential of the training programme stimulates participants to adopt evidence-based knowledge for their practice [35]. The IPs mentioned several aspects that they considered to be potential facilitators of the implementation of the knowledge taught, such as "training" and "the summary card for use in practice"; by contrast, potential barriers included "lack of time". Barriers were also reported in other studies [13,15,17,18] and should be addressed when implementing the programme more broadly. With regard to "lack of time", for example, the short duration of the training programme makes it feasible; a relatively limited amount of time is required to attend the training programme. Furthermore, the programme is accredited, meaning that IPs earn the credit points they need for their medical registration.

Implications for practice

Based on the findings of this study, the 'ABI and RTW' training programme will be provided to all IPs. The authors recommend the training programme to be mandatory for all IPs in training, and to be integrated into continuing medical education for specialised IPs, as IPs see patients with ABI frequently [1,2]. Being regularly confronted with patients with ABI provides IPs the opportunity to practise the knowledge that has been acquired during the training programme. Future studies should focus on the development of skills and methods to sustain knowledge. This one-day training programme did increase knowledge in the short term, but educational meetings should be repeated to facilitate the practising of the knowledge that has been acquired, a requirement that was also mentioned by participants in this study.

The RTW-process in patients with ABI is a multidisciplinary process [12] that requires the involvement of all relevant (para)medical and occupational healthcare professionals. The adequate dissemination of the guideline content and training among these professionals could therefore improve the RTW-process. The 'ABI and RTW' training programme could be used to achieve this aim, as it is also suitable for all other (para)medical and occupational healthcare professionals involved in the RTW-process of patients with ABI. It is recommended to evaluate the effect of the training programme on actual RTW.

Conclusion

The feasibility of the 'ABI and RTW' training programme has been demonstrated: the training programme resulted in an increase in the participants' knowledge of ABI and the RTW-process over time (limited efficacy). The training programme was perceived to be for example relevant, useful and appropriate by participants who attended the training programme (acceptability). The participants indicated aspects that could facilitate or form barriers to the implementation of imparted knowledge, such as "training" and "lack of time", respectively (implementation). The 'ABI and RTW' training programme can be applied in practice.

Implications for rehabilitation

- The 'ABI and RTW' training programme can be applied in postgraduate teaching and continuing medical education for IPs.
- Interactive teaching methods including realistic case scenarios with a link to practice are recommended to provide IPs the opportunity to learn to apply and discuss new knowledge and effectively improve IPs' knowledge.
- Implementation of a training programme for IPs can be facilitated if a brief summary of the imparted knowledge is available.
- Barriers, such as "other occupational healthcare and (para)medical professionals being unfamiliar with the imparted knowledge" need to be addressed when implementing the 'ABI and RTW' training programme.

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Declaration of interest

The authors report no conflicts of interest.

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Appendix 1

Learning objectives of the 'ABI and RTW' training programme for IPs

Concerning ABI:
- IPs know what ABI is; its causes and consequences; and its impact on RTW-outcomes.

Concerning evaluation of the RTW-process:
- IPs know how multidisciplinary care is organized; which factors are associated with RTW; which aspects patients and employers perceive to be facilitators of or barriers to RTW, or solutions to RTW-problems; and which effective RTW-interventions can be applied in the RTW-process.
- IPs are able to identify which aspects hinder RTW; what solutions and effective interventions can be applied in the RTW-process, and by whom. IPs are able to apply this knowledge and demonstrate this when they evaluate the RTW-process in a case scenario.

Concerning assessment of work capacity:
- IPs are aware of the impact of ABI or comorbidities on work capacity; which work-related aspects might hinder functioning and which work-related adaptations could be applied.
- IPs are able to identify relevant consequences of ABI or comorbidities affecting work capacity; which work-related aspects might hinder functioning and which work-related adaptations could be applied. IPs are able to apply this knowledge and demonstrate this when they assess work capacity in a case scenario.

Concerning assessment of medical and functional prognosis:
- IPs know which aspects might affect and which interventions might improve long-term prognosis of the medical situation and functional capacity.
- IPs are able to identify relevant aspects that might affect long-term prognosis of the medical situation and functional capacity and are able to advise on the application of interventions to improve long-term prognosis. IPs are able to apply this knowledge and demonstrate this when they assess medical and functional prognosis in a case scenario.

Appendix 2

Overview of codes concerning implementation

1. Facilitators of implementation of the guideline in daily practice

- A. Familiarity with guideline
  - I. Familiarity
  - II. Attention
- B. Training
  - I. Education
  - II. The approach taken
  - III. Course
  - IV. Joint study
  - V. Explanation, discussion, training
  - VI. Brought up on regular basis
  - VII. Other professionals also receive training
  - VIII. Case histories
  - IX. Compulsory participation
  - X. E-learning
- C. Content
  - I. Disorders
    - Attention to invisible impairments
  - II. Diagnostics
    - Basis for prognosis
  - III. Treatment
    - Attention to intervention options
- D. Summaries
  - I. Brief summary
  - II. Summary card
- E. Utility
  - I. Relevance
    - IP and management perceive utility of guideline
    - Practical utility
    - Regularly encounter clients
    - Is common
    - Supported by broad group
  - II. Application in practice
    - Repetition, with guideline
    - Summarized guideline at office
    - Easy to apply
    - Practical to use
    - That everyone will use the guideline
    - Notable successes
    - Standardization
  - III. Employer of the IP
    - Sufficient time and space
  - IV. Other professionals
    - Supported by other professional groups, including occupational physicians
    - Occupational physician will also use guideline

V. Design
Attractive design
Readability
Well-organized, with checklists

2. Barriers to implementation of the guideline in daily practice

A. Training
I. Tests
Lots of tests

B. Utility
Held back by own limited hours
Time available for deepening
I. Relevance
Don't see added value
High degree of open-door content
II. Application in practice
Not always practical
Insufficiently applicable
Guideline difficult to apply at case level
Cannot be translated to impairments
Risk of non-use
Cooperation between different professional groups
Less applicable for IPs than for occupational physicians
One of the professional groups does not use the guideline
Insufficient support
No experience
Use other guideline
III. Employer of the IP
Production pressure
Lack of time
Time pressure
IV. Readability
Unclear guideline
Too much information

3. Needed/necessary when implementation is hindered

A. Familiarity with guideline
Attention

B. Training
I. Refresher courses multidisciplinary/compulsory
II. Revisit
III. Case histories
IV. Accreditation

C. Utility
I. Application in practice
Various professional groups consult on patient
Implementation by occupational physicians and IPs
Practical actions
Management focuses on quality rather than quantity
Better support, more physicians
Accepting that it is sometimes necessary to limit hours
A number of professional groups consult on patient

II. Scientific research

D. Design

I. Brief and succinct execution

E. Time

I. To be applied

8

General discussion

This thesis comprises two main objectives: first, to acquire scientific knowledge concerning acquired brain injury (ABI) and the return to work (RTW)-process, specifically to determine the relevant aspects and factors related to RTW and interventions that effectively improve RTW of patients with ABI; second, to investigate how and whether insurance physicians (IP)s might gain scientific knowledge that supports their assessment of functional abilities, prognosis of functioning and evaluation of the RTW-process of patients with ABI.
This chapter provides a brief overview of the main findings. In addition, the methodological considerations and the interpretation of these findings are discussed. Finally, recommendations for practice and future research are provided.

Main findings

Objective part I: acquiring scientific knowledge concerning ABI and the RTW-process
A systematic review identified factors associated with RTW **(chapter 2)**, i.e. personal factors (level of education and unemployment) after traumatic ABI and activity-related factors after non-traumatic ABI. Aspects related to initial injury (such as Glasgow Coma Scale score) were not found to be associated with RTW. In addition, patients and employers mentioned facilitators of and barriers to RTW and solutions when RTW was hindered, categorized as: related to condition (e.g. fatigue), patient (e.g. patient's motivation), work (e.g. company reorganization), environment (e.g. support from partner) and guidance, coaching and support (e.g. professional assistance) **(chapter 3)**.
Moreover, a systematic review demonstrated that mental disorders, which occur more frequently in the ABI population than in the general population, were, as comorbidities of ABI, negatively associated with RTW **(chapter 4).**
A systematic review presented evidence for effective RTW-interventions, that consisted of a combination of work-directed interventions (e.g. adaptation of work tasks), education (e.g. about ABI) and coaching (e.g. emotional support) and, in addition, indicative findings if these interventions were combined with skills training **(chapter 5).**

Objective part II: investigating how and whether IPs might gain scientific knowledge that supports their assessments of patients with ABI
A training programme was developed to increase IPs' knowledge concerning ABI and the RTW-process **(chapter 6).** The training programme was based on learning objectives and effective teaching methods for occupational healthcare physicians. The feasibility of the training programme was demonstrated: knowledge of participating IPs increased significantly over time. According to participating IPs, the training programme was relevant, useful and appropriate; IPs reported several potential facilitators of (e.g. the summary card for use in practice) and barriers to implementation (e.g. lack of time) **(chapter 7).**

Methodological considerations

Different study designs were applied in this thesis in order to achieve the thesis objectives. A discussion on the applied study designs is outlined below.

Objective part I: acquiring scientific knowledge concerning ABI and the RTW-process
Systematic reviews were conducted, as described in chapters 2, 4 and 5, in order to acquire scientific knowledge concerning ABI and the RTW-process, specifically which factors and aspects are related to RTW and what interventions are effective in improving RTW of patients with ABI [1-3].

Systematic reviews in general are a useful method to summarize the latest literature [4-6] and to provide IPs with a broad and comprehensive overview of the available international scientific knowledge concerning ABI and RTW.

Articles found in the database searches were all peer-reviewed studies. In addition, the methodological quality of the retrieved studies was evaluated in detail and the level of evidence was determined, based on standardized methods [7-12]. This enabled a transparent report of the results and prevented that inappropriate conclusions were drawn to guide IPs' assessments in daily practice. These methodological approaches of scientific quality assurance in the reviews could be advantageous, when compared to taking studies from 'grey literature'. Grey literature is not published in scientific journals [13-15] and not subjected to a peer-review process. A previous study reported that there is evidence that grey studies have a lower methodological quality than published studies [15]. However, the inclusion of studies from other sources than from conventional databases, such as PubMed, provides contextual information, for example concerning a specific country [13,16] and these studies could therefore contain relevant information for this thesis. However, it was shown that the inclusion of grey studies influenced the final results in only four of 129 reviews [17] and combined with the often unclear quality of the studies it was decided not to include grey studies. This approach led to the realization of the aim to provide IPs with reliable, state-of-the art knowledge, concerning factors significantly associated with RTW, and proven effective RTW-interventions, derived from high-quality, peer-reviewed international scientific publications.

Although the systematic reviews in this thesis were conducted with the intention of providing an international overview and a broad understanding of relevant factors for RTW and effective RTW-interventions, they did not have the potential to establish information about issues that personally matter to individual patients and employers in the RTW-process [18]. These personal experiences regarding RTW both of patients with ABI and

of employers (as important stakeholders) are also relevant to optimizing the support and assessments of patients with ABI. The personal experiences and perspectives of patients and employers during the RTW-process were explored in order to supplement the review findings and to acquire a more detailed understanding of the complexity of the RTW-process of patients with ABI [19].

Focus group studies and individual interviews are among the accepted methods of collecting qualitative data [20,21]. Individual interviews were performed in order to allow patients and employers to express their experiences and perspectives regarding RTW in their own words.

Individual interviews were considered the most appropriate method for patients with ABI, as these patients are known to have difficulties in concentrating [19,22,23-25] and communicating in a group of people [19,23-25], which is in turn inherent to focus group studies [21,26,27]. It is known that focus group studies can potentially yield additional data, when compared to individual interviews, as a result of group interaction [26-28]. However, this possible advantage of focus group studies was considered to be reduced, when used in patients with ABI, as they are limited in their ability to interact within a group as a result of potential cognitive limitations [19,22-25]. For this thesis therefore, individual, semi-structured interviews were held with the patients with ABI.

Several important aspects inherent to ABI were taken into account in order to create the most optimal and convenient circumstances for all individuals while conducting the interviews. Patients featuring in this thesis mentioned that they experienced difficulties with travelling due to reduced energy after ABI [19]; this was also reported in other studies [24,25,29]. As a consequence, participants were given the opportunity of choosing a location for their interviews which might be convenient for them, either the patients' workplace or their home. These preferred locations, made participants felt comfortable and able to speak freely, including about sensitive and personal issues [30]. It has been reported that practical adaptations are required in order to enhance patient participation, specifically when performing research into patients with ABI [29].

In order to take the cognitive restraints and communication problems of patients with ABI into account, the patients featuring in this thesis could take time to consider their answers to the interview questions. They were given the opportunity to sort out their perspectives concerning RTW in detail.

During the individual interviews, the interviewer could clarify the questions and the conversation if needed, as the participants might have difficulties understanding conversation, finding words, speaking, organizing thoughts [19,24,25] or concentrating [19,22,24,25]. This is an advantage of individual interviews, when compared for example to questionnaires; the aim was to maximize the spectrum of relevant information gathered during these individual interviews. The use of interviews as a methodology is underscored, despite possible influences the interviewer might have on the data collection. However, the interviews were recorded, transcribed and analysed by two researchers separately, and discussed within the research team. In this way, the method applied allowed for a transparent analysis of the gathered data.

Semi-structured interviews, as performed with patients and outlined above, were also conducted with employers. These employers had been nominated or won an award for their efforts during the RTW-process of a patient with ABI [19]. As the employers all experienced the successful RTW of their employees, the approach in interviewing them specifically provided insight into RTW-solutions. It should be realized that successful RTW after ABI is of particular interest and therefore this thesis provides an overview of solutions that facilitated and led to successful RTW. These solutions could, when tailored to individual patients, serve as a valuable foundation for IPs' advice and guidance to patients with ABI during the RTW-process. Although, it was also intended to include the employers' perspective of unsuccessful RTW, this was not accomplished. A possible explanation could be that employers are reluctant to share negative experiences in this context, or that unsuccessful RTW might include sensitive matters, which in turn could have influenced the decision not to participate. As a result, insights into barriers and potential solutions that failed to solve the RTW-barriers in unsuccessful cases could not be included in this thesis. However, the solutions reported in the successful cases can be implemented as examples of best practice and serve as a basis for specific improvement and related adaptations of the RTW-process of patients with ABI.

Objective part II: investigating how and whether IPs might gain scientific knowledge that supports their assessments of patients with ABI

New scientific knowledge concerning ABI and the RTW-process has become available for IPs and they should learn to apply this knowledge in daily practice. A training programme in line with the ADDIE model, which represents an instructional design model, was developed to achieve this [31-35]. Instructional design models can help teachers develop an organized and comprehensive training programme, which will enable them to teach the appropriate matter in an optimal way [36-38]. When developing a training programme with the use of models such as the ADDIE model, clear objectives can be defined and the characteristics of the learner can be reflected [39,40]. This could render the training programme more

effective. The ADDIE model used in this thesis was successfully applied in several other studies, including studies concerning the development of training programmes integrated into continuing medical education (CME) [41-49].

The development of the training programme in this thesis corresponded with the different phases of the ADDIE model: analysis, design, development, implementation and evaluation, as reported in a set of explanatory publications [31-35] and outlined in detail below.
In the analysis phase of the ADDIE model, the research team defined what needed to be taught, specifically the content of the training programme, which comprised newly available knowledge about ABI and RTW, in particular the knowledge IPs need for use in daily practice. IPs see patients with ABI in their practices on a regular basis [50] and are already familiar with ABI and RTW to a certain extent. Accordingly, the training programme could build on IPs' prior knowledge and add new knowledge specifically needed for IPs' assessments [51,52].

The content of the training programme was divided into training topics and linked to IPs' assessments in practice: the evaluation of the RTW-process, the assessment of work capacity and the assessment of medical prognosis and the functional prognosis. This approach allowed IPs to be taught content that was not only relevant but also practically applicable; this has been shown to enhance trainees' motivation [36,53].

In addition, in line with the analysis phase, the learner characteristics of IPs as the target group (adult learners and practising physicians) were taken into consideration in order to impart the training content in the most optimal way possible [31-35].

The scientific literature was reviewed to obtain an overview of teaching methods that effectively enhanced knowledge and performance of healthcare professionals [54-57]. To supplement the literature on effective teaching methods for healthcare professionals, learning theories were studied and advice was obtained from educational experts. These educational experts were experienced in teaching healthcare professionals, including IPs.
The combination of these research methods as a whole, literature review, studying learning theories and educational expert consultation, provided multi-perspective insights into the elements that could be used to undertake the subsequent steps in the development of the training programme. The methodology applied in the analysis phase of the ADDIE model is in line with the methods used in other studies [58]. These studies were bundled in a review of important elements in changing the behaviour of healthcare professionals, i.e. the identification of barriers, choice of intervention components and use of theory [58]. In this thesis, the aforementioned elements were also applied: IPs' lack of knowledge about ABI and RTW (identification of barriers) was addressed by effective teaching approaches taken

from the literature (choice of intervention components) [54-57] while learning theories were studied (use of theory) [36,51-53,59-63] to tailor the programme to IPs.

In the next phase of the ADDIE model (the design phase), the content of the training programme, defined in the analysis phase, served as a basis for the formulation of the learning objectives and the learning outcomes that IPs should achieve [64]. This approach is in line with the principles of constructive alignment [65]; this is an advantage, as previous studies have reported that alignment led to better learning outcomes of trainees [66,67]. The learning objectives and outcomes were formulated in line with IPs' assessments in daily practice. The specific, newly available knowledge needed to perform these assessments could be connected to these learning objectives. For example, with regard to the evaluation of the RTW-process, knowledge about effective RTW-interventions could be of help to IPs when deciding whether these interventions should be applied or not. In addition, several proven effective active training methods were selected based on the information gathered in the analysis phase [54-57]; these included a combination of interactive lectures, exercises, quizzes and case-based learning methods. These training methods were selected as they have several advantages, as outlined below.

In detail, a new training topic could be introduced during interactive lectures and participants could reply to statements with response cards. This provided both teacher and participants with insight into participants' level of knowledge and enabled the teacher to give feedback, which IPs appreciated and is in line with adult learning theory [36,53,60-63]. In addition, the interactive training programme allowed participants to assimilate new knowledge about ABI and RTW together with existing knowledge, consistent with constructivism [51,52,59]. Furthermore, case-based methods provided IPs the opportunity to learn how to apply the knowledge in practice training together with peers in small groups. This has been demonstrated to generate motivation to learn, according to adult learning theory [36,53,60-63].

A training programme blueprint was created after the analysis and the design phase and the actual training programme, based on this blueprint, was realized in the development phase of the ADDIE model. Slides were produced for the interactive lectures, which introduced the training topics; in addition, exercises, quizzes and case scenarios were prepared, the latter were based on real-life cases from practice. A course syllabus was drawn up, which created the opportunity to standardize the teaching content for application in future training groups.

In the implementation phase of the ADDIE model, the one-day, four-hour 'ABI and RTW' training programme was provided in-company, or at a location near IPs' workplaces. The short duration and the location of this training programme were chosen, as both aspects

rendered the programme more feasible as far as time constraints were concerned. As participating IPs already had some knowledge and were acquainted to a certain level with ABI and RTW, they should be able to quickly take on board the knowledge being provided. In addition, it was reported that the short timespan of other short-lasting training programmes for physicians did not hinder a significant increase of the participants' knowledge [68-71]. This demonstrates that similar short-timespan training programmes were also effective in other settings [68-71].

In this thesis, participating IPs were given reading assignments two weeks before attending the face-to-face training programme to become familiar with the training content. This allowed more time to be left for IPs to learn how to apply the knowledge during the short face-to-face training programme through taking part in interactive exercises and case scenarios [72]. These interactive training approaches helped participants to link new knowledge with existing knowledge [68-71] and enhanced the effect of the short training programmes [72].

It is known that participants' knowledge could potentially decrease in the longer term [73], and that training courses should therefore be repeated to refresh the knowledge. Future studies might evaluate whether training repetition is effective and acceptable; this, however, is outside the scope of this thesis.
The evaluation phase of the ADDIE model comprised investigating whether the training programme was feasible: effective, appropriate, useful and relevant and what, in IPs' opinion, were facilitators of or barriers to implementation of the knowledge provided [74]. It should be noted, that the evaluation of the training programme in this thesis was conducted after delivering the programme. Evaluation after delivering the training programme complies best with the hierarchical version of the ADDIE model, with each phase of the model being completed before moving to the next, without evaluations after each phase or adaptations of the training programme in between the phases [31-35]. Evaluation after the training programme gave participating IPs the opportunity to provide their perspectives regarding acceptability and facilitators of and barriers to implementation of the training programme [74] after they had actually attended the training programme. This was an advantage, as a better understanding was gained into how the training programme could be improved in the future.

Interpretation of the results of the thesis

Objective part I: acquiring scientific knowledge concerning ABI and the RTW-process
In this thesis, it was found that injury-related factors, such as conscious state in the acute

phase of traumatic ABI, were not associated with RTW [2]. Other ABI-related variables such as post-traumatic amnesia duration and cause of stroke (ischaemic versus haemorrhagic) were also not found to be relevant factors in RTW [2].

This underscores the idea that injury-related and disease-related aspects do not necessarily apply to prognostication of RTW-outcomes in the longer term.

The abovementioned findings on injury-related factors are in line with the results of studies about patients with other chronic diseases, such as locomotor disease, cardiovascular disease or diabetes mellitus, where it was found that disease-related factors were not associated with RTW [75,76]. This means that IPs have to bear in mind that clinical findings related to injury or disease severity, do not necessarily translate into assessment of the prognosis of RTW.

However, concerning the longer-term clinical course, strong evidence was found that the length of stay in rehabilitation was negatively associated with RTW [2]; this was also reported in other studies [77-79]. This might indirectly be the result of the individual injury severity or limited recovery, however, other aspects such as organization of healthcare, for example discharge policy, could also be possible explanations [78,79]. These findings underscore the complexity of interpreting all the different aspects of disease severity and rehabilitation process in terms of RTW-outcome. Therefore, it is essential that IPs consider the aforementioned knowledge as a basis for an individualized assessment of patients with ABI.

In this thesis, factors other than those related to injury were clearly found to be associated with RTW; these included personal factors (individual educational level and unemployment) and activities of daily living (ADL) [2]. Studies reported that individuals who functioned independently in ADL had better RTW-outcomes [80-82].

The abovementioned findings could help IPs to recognize patients during assessments for whom RTW is likely to be difficult. In addition, other professionals involved in the RTW-process, such as rehabilitation physicians, could address ADL, as it is associated with positive RTW-outcomes [2,80-82].

In addition to these findings from the literature review concerning factors associated with RTW [2], patients themselves reported that work participation makes an important contribution to their quality of life after ABI [83,84]. If RTW fails, however, they might experience psychological distress that could lead to mental disorders [85-87]. It was reported that mental disorders are more prevalent in the ABI population, than in the general

population [88,89]. In this thesis, it was shown, that mental disorders as comorbidities of ABI are negatively associated with RTW [3]. Therefore, it is essential that mental disorders are recognized and eventually treated during the reintegration process [88,90-92]: it was reported that mental disorders impede functioning and RTW, and also hinder rehabilitation and the recovery of patients with ABI [88,93].

This thesis and other studies report that ABI has several consequences, such as cognitive problems (problems in concentration, remembering) and fatigue [19,22,24,25,94]. These cognitive problems may not be noticeable for the professionals involved with patients with ABI [24] and patients indicated that they had problems communicating about these limitations [19] as a result of a lack of insight, or inability to explain these limitations [19,24]. Patients underlined the support and advice from other patients and occupational and other healthcare professionals in helping them to gain insight into their own limitations [19]. Support from professionals also enabled the acceptance of these limitations and facilitated patients in communicating about their limitations with their employers and with other professionals, such as IPs [19]. In addition, it was found that providing support and advice on coping strategies and educating patients about the consequences of ABI was effective; patients reported that they lacked this knowledge [1,19]. Employers also stated that they lacked knowledge about ABI and related (invisible) consequences and did not know how to support their employees in their RTW [19]. Employers mentioned, that they were not reminded of these invisible consequences, which made it difficult to account for the employees' limitations at the workplace. IPs also need to pay specific attention to these invisible consequences of ABI during assessments, as these invisible consequences result in important limitations that hinder the work participation of patients with ABI.

The limitations resulting from ABI are also an important starting point for job adjustments during the RTW-process of patients with ABI [1,19]. A systematic review demonstrated that effective RTW-interventions comprise work-directed interventions combined with education/coaching and skills training [1]. These interventions are suitable to be applied in practice, and not surprisingly, they also directly address the limitations indicated by patients with ABI and by employers [1,19]. These interventions require the expertise and collaboration of different disciplines involved with ABI patients: for example, the rehabilitation physician, when it comes to ADL and skills training, the occupational physician and the employer, concerning specific job adjustments. Examples of work-directed interventions are job adjustments, such as the reduction of workload [1]. Specifically, reduction of working hours and opportunities to recover during breaks were reported as important solutions for fatigue, which is frequently reported as a limitation in ABI. Patients and employers also indicated the relevance of focusing on abilities of the specific individual during the RTW-process [19]; patients also stressed the importance of being actively involved in the RTW-process.

It was also reported that it is crucial to prevent the patient losing his job, as unemployment may lead to distress and depression, potentially making it more difficult to find new employment with adequate adaptations catering to the individual concerned and where ABI is taken into account [22].
In conclusion, the scientific knowledge acquired in this thesis and outlined above is suitable for IPs when performing assessments of patients with ABI.

The results of this thesis, which concerns relevant factors in and aspects of RTW and effective RTW-interventions, should not only serve IPs but also other medical and paramedical healthcare professionals involved in the RTW-process of patients with ABI. The significance of inter-professional collaboration has also been indicated by patients themselves in previous studies [23,95]. For example, occupational physicians should use the knowledge on effective interventions to support employees during sick leave towards RTW. Furthermore, the findings of this thesis [1-3,19] contribute to a better understanding of the RTW-process from a multidisciplinary perspective, for example concerning the perspectives of patients and employers on RTW-solutions and effective RTW-interventions.

These perspectives and interventions need to be integrated into multidisciplinary care, as integrated care during the RTW-process is of utmost importance for patients with ABI and employers [19,96]. It remains to be determined how and whether the integration of the research findings into multidisciplinary care might lead to better RTW-outcomes for patients with ABI.

Objective part II: investigating how and whether IPs might gain scientific knowledge that supports their assessments of patients with ABI
In this thesis, it was demonstrated that the 'ABI and RTW' training programme led to a significant knowledge increase over time (limited efficacy), according to participants the knowledge provided was relevant, appropriate and useful (acceptability) and participants mentioned facilitators of (training programme) and barriers to (lack of time) the implementation of the knowledge provided (implementation), which is described in chapter 7.

In line with assessment according to Miller's pyramid of clinical assessment, knowledge is the first and lowest level of assessment [64]. The aim was to teach knowledge (knows) and therefore the higher levels of assessment, competence (knows how), performance (shows how) and action (does), were neither trained nor evaluated as part of this thesis [64]. However, IPs see ABI patients frequently, [50,97] and this provides IPs with the opportunity to practise the knowledge acquired during the training programme. Other research methods are needed to evaluate whether IPs know how to apply the acquired

knowledge when solving a problem (know how), show the skills when confronted with standardized patients (show how) and eventually apply knowledge when observed in daily practice (do) [64].

Concerning the acceptability in this thesis, IPs considered the knowledge provided to be acceptable for daily practice: appropriate, useful and relevant [74]. Specifically, participating IPs appreciated the training programme's link to practice, in line with adult learning theory [36,53,60-63]. This link to practice was also relevant in other training programmes for IPs and occupational and other healthcare professionals [36,68,69,70,71,98,99]. The acceptability of the 'ABI and RTW' training programme implies the necessity for broad implementation of the training programme in IPs' practice. In addition, the acceptability of the training programme might lead to use of knowledge in practice, and participants stated that they intended to continue use of the knowledge taught. However, whether knowledge will eventually be applied in practice, should be investigated through other research methods [64].

Regarding the implementation in IPs' practice, participants mentioned that a "summary card for daily practice" and "the training programme provided in this way" were facilitators of the implementation of knowledge about ABI and RTW. According to participating IPs, a barrier to implementation was that other professionals do not use the knowledge provided. A suggested solution was to train these other professionals.

The RTW-process of patients with ABI is a process in which several medical, paramedical and occupational healthcare professionals are involved. Patients indicated the importance of collaboration between healthcare professionals and other stakeholders during the RTW-process [23,95], but also reported shortcomings in their care and experienced a lack of assistance, advice and information concerning RTW from the professionals involved [100,101]. Some patients stated that the focus of therapy was on aspects such as functions of the body, daily activities, controlling pain and pharmacological treatment, rather than RTW, although according to these patients, RTW was their most prominent goal [102,103]. It has also been reported that support from medical healthcare professionals who are not directly linked to reintegration does assist RTW [25,100]

Also professionals emphasize the importance of inter-professional collaboration regarding work-related care of employees [104]. More specifically professionals mentioned the importance of the exchange of information concerning for example work adjustments [104]. It is therefore recommended, that the knowledge dealt with in this thesis becomes available for these professionals in order to foster multidisciplinary care in the RTW-process after ABI.

In conclusion, according to both patients and healthcare professionals, integrated care during the RTW-process is important. Previous studies demonstrated promising results regarding the effectiveness of RTW coordination programmes for work disability, for patients with low back pain [105,106] and for patients with ABI [96]. In the latter study it was reported that early vocational rehabilitation is feasible and facilitates multidisciplinary care regarding RTW of patients with ABI [96], however, currently, there is still a lack of evidence on the effectiveness of integrated care on RTW of patients with ABI. This needs to be investigated in future studies.

Recommendations

Considering the results of this thesis, recommendations can be made: for practice (for patients, employers, IPs and other occupational healthcare professionals, medical and paramedical professionals, IPs' employers and policymakers/the government) and for future research.
Recommendations are outlined in detail below.

Recommendations for practice
It is recommended that patients with ABI:

- have contact with other ABI patients (e.g. during meetings organized by patient organizations) in order to gain better understanding and acceptance of their own limitations.
- are actively involved in their own RTW-process and try to be as open as possible about their limitations when communicating with medical and paramedical professionals and occupational healthcare professionals, such as IPs.

It is recommended that employers:

- are informed about the consequences of ABI and are aware that these consequences can be completely or partly invisible.
- know that they have an important contribution to make towards the RTW of their employee with ABI, with work and workplace adaptations, such as reduction of sensory overload.

It is recommended that IPs and other occupational healthcare professionals:

- are aware that the consequences of ABI, such as cognitive problems, can be invisible and that patients with ABI may have little understanding of their own limitations, which may hinder communication and result in a lack of essential information concerning the limitations of the ABI patient during IPs' assessments.

- are aware of and pay attention to relevant aspects concerning RTW, related to person (such as being too driven), condition (such as fatigue), activities (such as independence in ADL) and work (such as high workload) so as to enable a more comprehensive assessment and to better recognize patients for whom RTW could be hindered.
- know that mental disorders are frequently present as comorbidities among ABI patients and that IPs should explicitly pay attention to the sometimes unusual manifestation of these mental disorders during assessment of ABI patients as mental disorders reduce the chances of RTW.
- consider whether solutions and effective interventions for RTW, such as work and workplace adaptations, have or could have been applied when performing assessments of ABI patients.
- attend the 'ABI and RTW' training programme to acquire new scientific knowledge that supports their assessments of patients with ABI.

It is recommended that medical and paramedical professionals involved in the RTW-process of ABI patients:

- are aware that patients with ABI attribute great value to work and that the professionals should acquire new scientific knowledge concerning ABI and the RTW-process so as to provide professional support and advice about ABI and related consequences to patients and employers during the RTW-process.
- provide information about diagnostic and therapeutic aspects, such as rehabilitation goals and achievements during the RTW-process.
- are aware of mental disorders in the ABI population, which occur as comorbidities more frequently in patients with ABI and reduce the chances of RTW.

It is recommended that employers of IPs:

- integrate the 'ABI and RTW' training programme into postgraduate IP training and into continuing medical education.
- render the 'ABI and RTW' training programme obligatory for all IPs.
- facilitate IPs' attendance of the 'ABI and RTW' training programme.
- facilitate IPs learning to apply new scientific knowledge about ABI and the RTW-process in daily practice.

It is recommended that policymakers/the government:

- consider adaptation of legislation (as it does not always fit with the duration of the recovery process of ABI patients) and offer flexible solutions for individual patients whose recovery lasts more than two years; these solutions being based on IPs' assessments after two years of sick leave (this is the point at which it is decided whether an ABI patient should either be encouraged to return to work or be provided with disability

benefit and at which further activities or interventions aimed at a return to work are stopped).

Recommendations for future research

It is recommended to:

- evaluate whether the scientific knowledge provided concerning ABI and the RTW-process will lead to higher levels of performance, improved quality of IPs' assessments and will effectively improve RTW of patients with ABI.

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9

Summary

Acquired brain injury (ABI) is an injury to the brain that occurs after birth and is not hereditary, congenital, degenerative or caused by birth trauma; it can be categorized as traumatic and non-traumatic ABI. ABI occurs frequently in the working population and has a broad spectrum of physical, cognitive, emotional and behavioural consequences. ABI hinders functioning in daily life and negatively affects return to work (RTW).
When a patient with ABI has not been able to fully return to work within two years of the injury, the insurance physician (IP) has the specific task of evaluating the RTW- process and determining whether RTW may or may not be a realistic option. However, there is a lack of scientific knowledge of ABI and the RTW-process, specifically concerning relevant aspects and factors related to RTW, and proven effective RTW-interventions. In addition, it is not known how and whether IPs might gain scientific knowledge concerning ABI and RTW so as to support their assessments of patients with ABI.

This resulted in the two objectives of this thesis:

Thesis objective I
To acquire scientific knowledge concerning ABI and the RTW-process, specifically to determine the relevant aspects and factors related to RTW and any interventions that effectively improve RTW of patients with ABI. This first objective has resulted in the following research questions:
1. Which factors, aspects and comorbidities are related to RTW of patients with ABI?
2. What are effective RTW-interventions for patients with ABI?

Thesis objective II
To investigate how and whether IPs might gain scientific knowledge that supports their assessment of functional abilities, prognosis of functioning and evaluation of the RTW-process of patents with ABI. The following research question has been formulated in line with this second objective:
3. Does a training programme increase IPs' scientific knowledge such that it supports their assessment of functional abilities, prognosis of functioning, and evaluation of the RTW-process of patients with ABI?

Research question 1: Which factors, aspects and co-morbidities are related to RTW of patients with ABI?
With respect to this research question, factors associated with RTW after traumatic or non-traumatic ABI have been identified, as detailed in **chapter 2.** After a systematic review of the literature, that includes 29 studies covering more than a decade of scientific knowledge (2003-2014), strong evidence has been found that a high education level is positively associated with RTW after traumatic ABI, whereas a low education level, unemployment

and the length of stay in the rehabilitation process are negatively associated with RTW. After non-traumatic ABI, there is strong evidence that independence in the activities of daily living (ADL) is positively associated with RTW. Moreover, ABI-related factors, i.e. conscious state in traumatic ABI and aetiology of a stroke are not associated with RTW. Thus, the evidence on RTW after ABI points to personal factors (education level and unemployment) after traumatic ABI and activity-related factors after non-traumatic ABI as being strongly associated with RTW.

Chapter 3 explores aspects experienced as facilitators of or barriers to RTW, or as solutions to RTW-problems, as reported by ABI patients and by employers. In a qualitative study, individual semi-structured interviews were conducted with ten patients and seven employers. It was found, that both patients and employers mentioned patient-related and work-related facilitators. When questioned about barriers, both groups underscored the relevance of work-related factors such as sensory overload at the workplace and condition-related factors, such as cognitive problems and fatigue. Patients mentioned lack of information, guidance and support as barriers, while employers did not. Employers and patients suggested that solutions to RTW-problems were work-related, if necessary, backed up by professional advice. Patients also mentioned the need for understanding and acceptance of their limitations resulting from ABI as relevant aspects to consider in any RTW-solution.

In **chapter 4**, the specific situation of patients with a mental disorder as a comorbidity of ABI is investigated in relation to the RTW-process, as mental disorders are highly prevalent and frequently not recognized in the ABI population. A systematic review is conducted which includes all relevant evidence from 2002 to 2012. Seven studies are included, of which six are classified as high quality. In this way, strong evidence has been found for a negative association between mental disorders (e.g. depression, anxiety and post-traumatic stress disorder) as comorbidities and RTW of patients with ABI. Patients with a former history of mental disorders are at a substantially higher risk of the reoccurrence of mental disorders and lower RTW rates following ABI.
In addition, the high prevalence of mental disorders as comorbidities after ABI and the importance of treatment implies that, in general, attention should be paid to the diagnosis and treatment of mental disorders during the RTW-process of patients with ABI in order to further improve RTW-outcomes.

Research question 2: What are effective interventions for patients with ABI?
Chapter 5 investigates which interventions are effective in the support of RTW of patients with ABI. To this end, a systematic review of the literature (2000-2015) is carried out focusing on interventions designed to improve RTW. It includes 12 studies, nine of which are

considered to be of sufficient methodological quality. Strong evidence is found, that work-directed interventions, in combination with education/coaching are effective in regard to RTW and there are indicative findings for the effectiveness of work-directed interventions in combination with skills training and education/coaching. Reported components of the most effective interventions are early intervention, involvement of patient and employer, workplace adaptations, and social or work-related skills training, including coping strategies advice, coaching and emotional support.

Research question 3: Does a training programme increase IPs' scientific knowledge such that it supports their assessment of functional abilities, prognosis of functioning and evaluation of the RTW-process of patients with ABI?

As a next step, the newly acquired scientific knowledge of ABI and the RTW-process needs to be disseminated among IPs in order to support them in their assessments. This has led to the development of the 'ABI and RTW' training programme for IPs, in line with the Analysis-Design-Development-Implementation-Evaluation (ADDIE) model, as is outlined in **chapter 6**. It was not known how IPs can best learn to apply the available knowledge in practice. The aim has therefore been to design a specific training programme, which increases IPs' knowledge of ABI and the RTW-process required to apply when performing assessments in daily practice. The training programme has been developed in three steps: 1) the formulation of learning objectives based on new scientific knowledge of ABI and the RTW-process; 2) the selection of teaching methods in line with the learning objectives and tailored to IPs, using a literature search and expert educational advice; 3) the design of the actual programme.

The learning objectives are that the IPs: gain knowledge of the causes and consequences of ABI and are aware of its impact on RTW-outcomes; are able to identify what aspects are relevant for RTW and what effective interventions can be applied in the RTW-process; know how multidisciplinary care is organized; know which aspects, including comorbidity, may affect the work capacity of patients with ABI and know which aspects may affect and which interventions can improve the long-term prognosis of the medical situation and functional capacity.

The teaching methods in the 'ABI and RTW' training programme comprise a combination of several active components, for example interactive lectures and exercises. Participating IPs have the opportunity to interact and discuss case scenarios in small groups. It has resulted in the interactive, one-day, four-hour 'ABI and RTW' training programme for IPs, comprising four parts, each of which corresponds to one of the learning goals, directly related to the core tasks of IPs.

Chapter 7 evaluates the feasibility of the 'ABI and RTW' training programme for IPs (and occupational healthcare professionals in general), as outlined in chapter 6. Fifty-one IPs

attended the 'ABI and RTW' training programme. The feasibility of the training programme is analysed in terms of limited efficacy, acceptability and implementation and it is shown that participants' knowledge about ABI and the RTW-process increased significantly over time. Moreover, IPs perceive it to be relevant, useful and appropriate in daily practice. In conclusion, the 'ABI and RTW' training programme for IPs is feasible.

In **chapter 8** the main findings of this thesis are discussed and recommendations are made for practice and for future research.
It is recommended that IPs and other occupational healthcare professionals are aware of relevant factors, such as education level; aspects, for example fatigue; comorbidities, like a depression; and of effective interventions and solutions for RTW of patients with ABI and help their patients to gain insight into ABI-related consequences.
IPs should attend the 'ABI and RTW' training programme and learn how to apply knowledge taught in daily practice.
It should be evaluated whether the knowledge provided in the 'ABI and the RTW' training programme will lead to an improved quality of IPs' assessments.

10

Samenvatting

Niet-aangeboren hersenletsel (NAH) komt veel voor in de westerse wereld en treft vaak individuen uit de beroepsbevolking. NAH is een verzamelnaam voor meerdere aandoeningen met als gemeenschappelijk kenmerk een beschadiging van de hersenen die is ontstaan na – en niet als gevolg van – de geboorte. NAH kan verschillende oorzaken hebben, bijvoorbeeld een traumatische oorzaak zoals een ongeval of een niet-traumatische oorzaak zoals een bloeding of een infarct, een infectie, zuurstofgebrek, vergiftiging of een tumor.

Beschadiging van de hersenen kan vele gevolgen hebben, zoals lichamelijke stoornissen (bijvoorbeeld verlamming), cognitieve stoornissen (waaronder concentratie- en geheugenproblemen), gedragsproblemen (zoals agressie) en emotionele problemen. Verder is bekend dat psychische problemen kunnen ontstaan die bij patiënten met NAH frequenter voorkomen dan bij de bevolking als geheel.

Deze gevolgen kunnen voor de betrokkenen problemen opleveren in het dagelijks leven en voor het functioneren in werk. Van degenen die werkzaam zijn voordat ze NAH krijgen, is 40% na twee jaar weer aan het werk. Het is bekend dat patiënten met NAH grote waarde hechten aan (terugkeer naar) werk, niet alleen vanwege de sociale contacten maar ook omdat werk financiële onafhankelijkheid oplevert. Anderzijds kan het niet terugkeren naar werk tot psychische en/of sociale problemen leiden.

Daarom is het belangrijk om patiënten met NAH te ondersteunen tijdens het proces van terugkeer naar werk. Diverse (para)medische professionals zijn betrokken bij patiënten met NAH, bijvoorbeeld neurologen, revalidatieartsen, fysio- en ergotherapeuten en bedrijfsartsen. Verzekeringsartsen leveren eveneens een belangrijke bijdrage aan het proces naar werk van patiënten met NAH. Na twee jaar ziekteverzuim hebben verzekeringsartsen de taak om het proces naar werk te beoordelen. Ook stellen zij vast wat de mogelijkheden van de patiënt met NAH zijn om in het werk te functioneren. Verder doet de verzekeringsarts een uitspraak over de te verwachten voortgang van het functioneren in werk.

Deze beoordelingen hebben belangrijke consequenties voor patiënten met NAH. Enerzijds kunnen zij door deze beoordelingen aangezet worden om terug te keren naar werk, anderzijds kan de verzekeringsarts tot de conclusie komen dat werken niet meer mogelijk is en de betrokkene daarom een uitkering dient te krijgen. Het is niet goed bekend welke aspecten en bijkomende psychische problemen relevant zijn voor terugkeer naar werk van patiënten met NAH. Daardoor kunnen verzekeringsartsen patiënten voor wie terugkeer naar werk wellicht niet haalbaar is, slecht herkennen. Verder is onvoldoende bekend tegen welke belemmeringen de betrokken patiënten en werkgevers aanlopen bij terugkeer naar werk, welke oplossingen daarvoor bestaan en of passende, bewezen effectieve interventies mogelijk zijn. Hiervoor bestaat tot nu weinig wetenschappelijk bewijs.

Daarom is het doel van het eerste deel van dit promotieonderzoek wetenschappelijke kennis te vergaren over relevante aspecten en factoren voor terugkeer naar werk en over effectieve interventies die terugkeer naar werk bevorderen.
Om deze kennis te verkrijgen, zijn onderstaande onderzoeksvragen geformuleerd:

1. Welke factoren, aspecten en bijkomende psychische problemen zijn relevant in verband met terugkeer naar werk van patiënten met NAH?
2. Welke interventies zijn effectief voor de bevordering van terugkeer naar werk van patiënten met NAH?

Onderzoeksvraag 1: Welke factoren, aspecten en bijkomende psychische problemen zijn relevant in verband met terugkeer naar werk van patiënten met NAH?
Om deze onderzoeksvraag te beantwoorden, is in **hoofdstuk 2** onderzoek gedaan naar internationale wetenschappelijke publicaties over factoren die geassocieerd zijn met terugkeer naar werk van patiënten met NAH. Er zijn 29 studies gevonden, gepubliceerd tussen 2003 en 2014. Er is bewijs gevonden dat bij traumatisch NAH een positief verband bestaat tussen een hoog opleidingsniveau en terugkeer naar werk. Het verband met terugkeer naar werk is negatief als het opleidingsniveau laag is, als sprake is van werkloosheid vóór het letsel of als sprake is van langdurige opname op een revalidatieafdeling. Voor patiënten met NAH met een niet-traumatische oorzaak blijkt de kans op terugkeer naar werk groter te zijn wanneer ze zelfstandig kunnen functioneren in het algemene dagelijks leven. Uit de resultaten van dit onderzoek blijkt dat de mate van bewustzijn direct na het ontstaan van het letsel niet samenhangt met terugkeer naar werk.

In aanvulling op de bevindingen van het literatuuronderzoek is in **hoofdstuk 3** ingegaan op de persoonlijke ervaringen van patiënten en werkgevers met terugkeer naar werk. Daartoe zijn individuele interviews afgenomen met tien patiënten met NAH en zeven werkgevers van patiënten met NAH die na het letsel weer aan het werk zijn gegaan. Uit deze interviews is naar voren gekomen dat de bevorderende aspecten voor terugkeer naar werk patiëntgerelateerd (bijvoorbeeld motivatie) en werkgerelateerd (bijvoorbeeld steun van de werkgever) zijn. Zowel patiënten als werkgevers ervaren werkgerelateerde aspecten (zoals veel prikkels) en aspecten gerelateerd aan de aandoening (zoals onzichtbare cognitieve problemen, een gebrekkig ziekte-inzicht en vermoeidheid) als belemmerende factoren. Patiënten noemen een gebrek aan informatie over NAH en het ervaren van weinig steun als knelpunten voor terugkeer naar werk. Patiënten en werkgevers geven aan het belangrijk te vinden dat het werk wordt aangepast, bijvoorbeeld door de werktijden of de prikkels te verminderen, om belemmeringen voor terugkeer naar werk weg te nemen. Daarnaast vinden ze deskundige begeleiding belangrijk, als coach voor de patiënt en als klankbord voor de werkgever. Patiënten voelen zich geholpen door lotgenotencontact, met name doordat ze beter inzicht krijgen in de gevolgen van NAH.

In het specifieke geval dat de gevolgen van NAH hebben geleid tot psychische problemen, is onderzocht wat dit betekent voor terugkeer naar werk. Er is al eerder aangetoond dat psychische problemen vaker voorkomen bij NAH; vooral individuen die al eerder een psychische ziekte hebben gehad, lopen het risico op psychische problemen. In **hoofdstuk 4** is de relatie tussen psychische aandoeningen bij NAH en werk onderzocht in de internationale literatuur. Er zijn zeven relevante wetenschappelijke studies gevonden, waarvan zes van goede kwaliteit. Uit deze studies komt naar voren dat de kans op terugkeer naar werk voor patiënten met NAH kleiner is wanneer er psychische problemen zijn (zoals een depressie). Daarom is het belangrijk dat bij patiënten met NAH gelet wordt op de aanwezigheid van bijvoorbeeld een depressie, deze te behandelen en niet alleen op fysieke problemen te focussen.

Onderzoeksvraag 2: Welke interventies zijn effectief voor de bevordering van terugkeer naar werk van patiënten met NAH?
Er is onvoldoende bekend welke interventies terugkeer naar werk kunnen vergemakkelijken. In **hoofdstuk 5** is in de internationale literatuur uitgebreid gezocht naar studies over interventies die zijn opgezet om terugkeer naar werk van patiënten met NAH te bevorderen. Daarbij zijn twaalf studies gevonden, gepubliceerd tussen 2000 en 2015, waarvan negen van voldoende kwaliteit. Uit de onderzoeken is gebleken dat interventies gericht op werk (zoals aanpassingen van werk en werkplek) in combinatie met educatie (onder andere over de gevolgen van NAH), coaching en vaardigheidstraining (vaardigheden nodig voor werk) effectief zijn. Wanneer deze interventies ingezet worden, bevordert dit mogelijk terugkeer naar werk van patiënten met NAH.

In het eerste deel van dit promotieonderzoek is kennis vergaard over relevante aspecten en factoren voor terugkeer naar werk en effectieve interventies die terugkeer naar werk kunnen bevorderen. Deze kennis kan professionals, zoals verzekeringsartsen, ondersteunen bij de beoordeling van patiënten met NAH. Het doel van het tweede deel van het onderzoek is om na te gaan of en hoe verzekeringsartsen deze kennis kunnen verwerven en vervolgens kunnen benutten bij de beoordeling van het proces van terugkeer naar werk en bij het vaststellen van de werkmogelijkheden van een patiënt met NAH, ook op de langere termijn.

Dit doel heeft geleid tot de derde onderzoeksvraag:
3. Leidt het volgen van een onderwijsprogramma tot kennistoename bij verzekeringsartsen ten aanzien van NAH en terugkeer naar werk?

Onderzoeksvraag 3: Leidt het volgen van een onderwijsprogramma tot kennistoename bij verzekeringsartsen ten aanzien van NAH en terugkeer naar werk?
Om de in het eerste deel van dit promotieonderzoek verkregen kennis te kunnen overdra-

gen aan verzekeringsartsen, is een onderwijsprogramma ontwikkeld en geëvalueerd volgens het ADDIE-model ('analysis, design, development, implementation, evaluation'). Het stapsgewijze ontwikkelingsproces van dit onderwijsprogramma is beschreven in **hoofdstuk 6**. Naar aanleiding van de verkregen kennis zijn leerdoelen geformuleerd en toegespitst op het specifieke werk van de verzekeringsarts. Er moet rekening worden gehouden met de manier waarop verzekeringsartsen als medisch specialisten de nieuwe kennis het meest effectief kunnen aanleren. Daartoe is literatuuronderzoek verricht naar effectieve onderwijsmethoden en zijn drie onderwijsexperts gevraagd naar hun ervaringen met onderwijs aan (verzekerings)artsen.

Op basis van de leerdoelen en de onderwijsmethoden is een eendaags, vier uur durend onderwijsprogramma voor verzekeringsartsen ontwikkeld. Het bestaat uit vier onderdelen: een korte introductie en de onderdelen 'evaluatie van het proces van terugkeer naar werk', 'vaststellen van de functionele mogelijkheden voor werk' en 'beoordelen van de prognose' (zowel medisch als ten aanzien van het functioneren). Tijdens deze onderdelen wordt gebruikgemaakt van diverse onderwijsmethoden, zoals een leesopdracht (huiswerk als voorbereiding), interactieve presentaties, korte oefeningen, quizzen, casuïstiek en (op basis van deze casuïstiek) discussies en uitwisseling van praktijkervaringen. Het onderwijsprogramma is daarmee zoveel mogelijk toegespitst op de dagelijkse praktijk van de verzekeringsarts.

De haalbaarheid van het onderwijsprogramma in termen van kennistoename, aanvaardbaarheid en implementatie is onderzocht in **hoofdstuk 7**.
Hiertoe hebben 51 verzekeringsartsen, al dan niet in opleiding, deelgenomen aan het onderwijsprogramma. Zij hebben drie schriftelijke kennistoetsen afgelegd: twee weken voorafgaand, direct vóór (na de leesopdracht) en direct na het bijwonen van het onderwijsprogramma. Uit de resultaten is gebleken dat de kennis op het gebied van NAH en terugkeer naar werk van de deelnemers is toegenomen, zowel na de leesopdracht als na het bijwonen van het onderwijsprogramma. Direct na het programma is de deelnemers gevraagd een lijst met vragen in te vullen, onder andere over nut, relevantie en bruikbaarheid van de onderwezen kennis voor de dagelijkse praktijk. Meer dan 85% van de deelnemende verzekeringsartsen heeft aangegeven dat ze de onderwezen kennis goed leesbaar, relevant, nuttig en bruikbaar vinden voor de praktijk. Deelnemers hebben verder open vragen beantwoord over potentieel bevorderende (aantrekkelijke vormgeving) en belemmerende (tijdgebrek) aspecten in verband met bredere toepassing van het onderwijsprogramma. De resultaten zijn relevant voor verdere implementatie van het onderwijsprogramma in de praktijk.

In **hoofdstuk 8** wordt een overzicht gegeven van de belangrijkste uitkomsten van het promotieonderzoek en aanbevelingen voor vervolgonderzoek.

Verzekeringsartsen, bedrijfsartsen en andere professionals op het gebied van arbeid en gezondheid dienen op de hoogte te zijn van factoren, zoals opleidingsniveau; aspecten, zoals vermoeidheid; bijkomende aandoeningen, zoals depressie, die relevant zijn voor terugkeer naar werk en verder te weten welke interventies en oplossingen benut kunnen worden om terugkeer naar werk te bevorderen.
Verzekeringsartsen wordt aangeraden het onderwijsprogramma 'NAH en Arbeidsparticipatie' te volgen en te leren hoe de getrainde kennis kan worden toegepast in de praktijk.
In vervolgonderzoek dient te worden nagegaan of het volgen van het onderwijsprogramma 'NAH en Arbeidsparticipatie' leidt tot een betere kwaliteit van de beoordelingen van arbeidsmogelijkheden van patiënten door verzekeringsartsen.

Appendices

Curriculum vitae

Birgit Helena Petra Maria Donker-Cools was born on 28 January 1968 in Brunssum, The Netherlands. After completing secondary school at the Romboutscollege, she studied Medicine at the Maastricht University. She graduated in 1994 and worked in several clinical departments: gynaecology/obstetrics, surgery, cardiology and completed partially a specialization in internal medicine. In 2001 she started working as an insurance physician in training at the Dutch Institute for Employee Benefit Schemes (UWV) and specialised in insurance medicine; in 2006 she was registered.

From 2009 Birgit was involved in the development of the multidisciplinary guideline 'Acquired brain injury and work participation', at the Coronel Institute of Occupational Health, Amsterdam University Medical Centers, location AMC. This guideline was published in 2012.

Subsequently, she started her PhD project at the Research Center for Insurance Medicine (Kenniscentrum Verzekeringsgeneeskunde), a joint initiative of the AMC, UWV, the University Medical Center Groningen (UMCG) and the VU University Medical Center (VUmc). She worked at the Coronel Institute of Occupational Health, Amsterdam University Medical Centers, location AMC.

The results of this research project are presented in this thesis: the first part focuses on improving scientific knowledge concerning acquired brain injury (ABI) and return to work (RTW) and the second part how and whether insurance physicians might gain scientific knowledge about ABI and RTW.

Currently, Birgit is working as an insurance physician at UWV in Utrecht and as a senior researcher at the Research Center for Insurance Medicine, Coronel Institute of Occupational Health, Amsterdam University Medical Centers, location AMC. She is also involved in education and training of medical students and insurance physicians in the Netherlands and at the Academy of Swiss Insurance Medicine, Basel, Switzerland. In addition, she is a member of the scientific committee of the Dutch Society for Insurance Medicine.

Birgit is married to Dirk Donker; they have a son Aaron and two daughters Eline and Marit.

PhD portfolio

Name PhD student: Birgit Donker-Cools
PhD period: November 2012 – March 2019
PhD supervisors: Prof. dr. M.H.W. Frings-Dresen and prof. dr. H. Wind

	Year	Workload	
		Hours	ECTS
1. PhD training			
General courses			
AMC World of Science	2006	20	0.7
Epidemiologisch onderzoek: opzet en interpretatie EMGO VUmc	2006	40	1.4
Systematische reviews: theorie en praktijk EMGO VUmc	2006	24	0.9
Qualitative health research	2013	54	1.9
Scientific writing in English for publication	2014	42	1.5
Oral presentation in English	2018	22	0.8
Specific courses			
Evidence based richtlijnontwikkeling (EBRO) CBO	2010	8	0.3
Reference manager basis	2006	4	0.1
Endnote	2013	3	0.1
Feedback geven aan en beoordelen van co-assistenten AMC	2016	3	0.1
Tutorial GRADE APH Methodology	2018	2	0.1
Seminars, workshops and master classes			
Seminars Research Center for Insurance Medicine (Kenniscentrum Verzekeringsgeneeskunde)	2010-2019	80	2.9
Research meetings (refereerbijeenkomsten) Coronel Institute of Occupational Health AMC	2012-2019	100	3.6
Presentations			
Poster presentation Amsterdam Public Health annual meeting	2017	14	0.5
Oral presentation research meetings Coronel Institute of Occupational Health AMC (3x)	2011, 2012, 2014	42	1.5
Oral presentation seminars Research Center for Insurance Medicine (Kenniscentrum Verzekeringsgeneeskunde) (4x)	2010, 2012, 2015, 2016	56	2.0
Poster presentation yearly conference Research Center for Insurance Medicine (Werkconferentie Kenniscentrum Verzekeringsgeneeskunde) (2x)	2011, 2014	28	1.0
Oral presentation yearly conference Research Center for Insurance Medicine (Werkconferentie Kenniscentrum Verzekeringsgeneeskunde) (3x)	2010, 2013, 2016	42	1.5
Poster presentation Muntendam symposium Research Center for Insurance Medicine (Kenniscentrum Verzekeringsgeneeskunde) (4x)	2012, 2013, 2014, 2015	56	2.0
Short oral presentation Muntendam symposium Research Center for Insurance Medicine (Kenniscentrum Verzekeringsgeneeskunde) (1x)	2016	14	0.5
Oral presentation Muntendam symposium Research Center for Insurance Medicine (Kenniscentrum Verzekeringsgeneeskunde) (1x)	2017	14	0.5
Oral presentation Work Disability Prevention and Integration (WDPI) conference	2016	14	0.5
Oral presentation European Union for Medicine in Assurance and Social Security (EUMASS) (4x)	2012, 2014, 2016, 2018	56	2.0
Poster presentation Dutch International Congress on Insurance Medicine 'Verzekeringsgeneeskundige dagen' (4x)	2010, 2015, 2017, 2018	56	2.0
Oral presentation Dutch International Congress on Insurance Medicine 'Verzekeringsgeneeskundige dagen' (2x)	2011, 2016	28	1.0
Poster presentation Dutch Congress on Occupational Medicine 'Bedrijfsgeneeskundige dagen' (4x)	2011, 2012, 2013, 2015	56	2.0

	Year	Workload	
		Hours	ECTS
Oral presentation UWV Academiseringsdag (5x)	2014, 2015 (2x), 2017 (2x)	70	2.5
Oral presentation for insurance physicians UWV Heerlen	2012	14	0.5
Oral presentation for insurance physicians UWV Utrecht	2015	14	0.5
Oral presentation UWV contactpersonen	2018	14	0.5
Oral presentation UWV kennismarkt	2018	14	0.5
Oral presentation Advisory Board 'Adviesraad' Research Center for Insurance Medicine (Kenniscentrum Verzekeringsgeneeskunde)	2017	14	0.5
Oral presentation for insurance physicians ASR/De Amersfoortse Verzekeringen Utrecht	2016	14	0.5
Oral presentation for rehabilitation physicians Werkgroep CVA Nederland van de Nederlandse Vereniging van Revalidatieartsen (VRA)	2018	14	0.5
Oral presentation congress guideline 'Acquired brain injury and work participation'	2012	14	0.5
Oral presentation Hersenletselcongres	2011	14	0.5
Poster presentation 11th world congress International Brain Injury Association	2016	14	0.5
Oral presentation Dystonievereniging	2013	14	0.5
Oral presentation SKION LATER voor LATER conference for childhood cancer survivors	2014	14	0.5
(Inter)national conferences			
Amsterdam Public Health annual meeting	2017	8	0.3
Muntendam symposium Research Center for Insurance Medicine (Kenniscentrum Verzekeringsgeneeskunde) (7x)	2012-2018	28	1.0
Yearly conference Research Center for Insurance Medicine (Werkconferentie Kenniscentrum Verzekeringsgeneeskunde) (8x)	2010-2016, 2018	72	2.6
Work Disability Prevention Knowledge (WDPI) conference	2016	24	0.9
European Union for Medicine in Assurance and Social Security (EUMASS) congress (4x)	2012, 2014, 2016, 2018	80	2.9
Dutch International Congress on Insurance Medicine 'Verzekeringsgeneeskundige dagen' (6x)	2010, 2011, 2015-2018	48	1.7
Dutch Congress on Occupational Medicine 'Bedrijfsgeneeskundige dagen' (4x)	2011, 2012, 2013, 2015	32	1.1
UWV Academiseringsdag (5x)	2014, 2015 (2x), 2017 (2x)	20	0.7
Congress guideline 'Acquired brain injury and work participation'	2012	4	0.1
Hersenletselcongres	2011	8	0.3
11th world congress International Brain Injury Association	2016	24	0.9
Invitational conference guideline 'The chronically ill and work'	2016	4	0.1
International symposium on occupational health care	2016	8	0.3
SKION LATER voor LATER conference for childhood cancer survivors	2014	4	0.1
Symposium The Netherlands Center for Occupational Diseases (NCvB) 'Beroepen en ziekten: van curatie naar preventie'	2017	3	0.1
Other			
Organisation congress guideline 'Acquired brain injury and work participation'	2012	42	1.5
Organisation yearly conference Research Center for Insurance Medicine (Werkconferentie Kenniscentrum Verzekeringsgeneeskunde) (4x)	2016-2019	168	6.0
Organisation Muntendam symposium Research Center for Insurance Medicine (Kenniscentrum Verzekeringsgeneeskunde) (4x)	2015-2018	168	6.0

	Year	Workload	
		Hours	ECTS
Meetings scientific committee Dutch Society for Insurance Medicine	2016-2019	72	2.6
Expertmeeting functional cognition	2019	3	0.1
2. Teaching			
Lecturing			
Junior internship 2nd year medical students (3x)	2014	36	1.3
Senior internship 6th year medical students teaching (20x)	2015-2019	80	2.9
Senior internship 6th year medical students evaluation presentations (20x)	2015-2019	160	5.7
Lecture 3th year medical students (college arbeidsongeschiktheid blok 3.6)	2018	14	0.5
Keuze onderwijs 2nd year medical students 'Leven en werken met een chronische ziekte' (4x)	2014, 2015, 2017, 2018	56	2.0
Netherlands School of Public & Occupational Health 'NAH en Arbeidsparticipatie' (2x)	2012	28	1.0
Netherlands School of Public & Occupational Health 'Cognitieve functiebeperkingen' (2x)	2012	28	1.0
Netherlands School of Public & Occupational Health 'Voorbeeld onderzoeksproject verzekeringsgeneeskunde'	2013	14	0.5
Academy of Swiss Insurance Medicine, Master Versicherungsmedizin, Modul EbM in der Versicherungsmedizin 'Begutachtung in den Niederlanden, Vortrag mit Diskussion' (4x)	2012, 2014, 2016, 2018	56	2.0
Academy of Swiss Insurance Medicine, Master Versicherungsmedizin, Modul EbM in der Versicherungsmedizin 'Leitfaden Begutachtung in den Niederlanden, Vortrag mit Diskussion' (4x)	2012, 2014, 2016, 2018	56	2.0
Supervising			
Bachelorthesis 'Return-to-work in patients with acquired brain injury and psychiatric disorders as a comorbidity: A systematic review'	2012	28	1.0
Other			
Speeddate co-assistenten AMC (4x)	2014-2017	8	0.3
Co-assistentenwerving ZGT Almelo workshop	2017	14	0.5
3. Parameters of esteem			
Awards and prizes			
Yearly conference Research Center for Insurance Medicine (Werkconferentie Kenniscentrum Verzekeringsgeneeskunde) incentive prize 'aanmoedigingsprijs'	2010		
Dutch Congress on Occupational Medicine 'Bedrijfsgeneeskundige dagen' Poster and elevator pitch presentation winner guideline 'Acquired brain injury and work participation'	2012		
Dutch Congress on Occupational Medicine 'Bedrijfsgeneeskundige dagen' Poster and elevator pitch presentation winner bachelorthesis SF Garrelfs 'Return-to-work in patients with acquired brain injury and psychiatric disorders as a comorbidity: A systematic review'	2013		
Speeddates co-assistenten door medisch specialisten AMC (2nd prize)	2016		
TOTAL (28 hrs=1 ECTS)		**2514**	**89.8**

List of publications

Articles related to this thesis

- **Donker-Cools BH**, Wind H, Frings-Dresen MH. Prognostic factors of return to work after traumatic or non-traumatic acquired brain injury. Disabil Rehabil. 2015;3:1-9.
- **Donker-Cools B**, Schouten MJE, Wind H, Frings-Dresen MH. Return to work following acquired brain injury: the views of patients and employers. Disabil Rehabil. 2018;40:185-191.
- Garrelfs SF, **Donker-Cools BH**, Wind H, Frings-Dresen MH. Return-to-work in patients with acquired brain injury and psychiatric disorders as a comorbidity: A systematic review. Brain Inj. 2015;29:550-557.
- **Donker-Cools BH**, Daams JG, Wind H, Frings-Dresen MH. Effective return-to-work interventions after acquired brain injury: A systematic review. Brain Inj. 2016;30:113-131.
- **Donker-Cools BHPM**, Wind H, Frings-Dresen MHW. Development of the "Acquired brain injury and return-to-work" training programme for insurance physicians. Submitted for publication.
- **Donker-Cools BHPM**, Wind H, Frings-Dresen MHW. 'Acquired brain injury and return to work': the feasibility of a training program for insurance physicians. Disabil Rehabil. 2019:1-7. doi: 10.1080/09638288.2018.1527400. [Epub ahead of print]

Other publications

- **Donker-Cools BHPM**, Van Bennekom CAM, Wind H, Frings-Dresen MHW. Multidisciplinaire richtlijn Niet-aangeboren Hersenletsel en Arbeidsparticipatie [Acquired brain injury and work participation: a multidisciplinary guideline]. Coronel Instituut voor Arbeid en Gezondheid [Coronel Institute of Occupational Health]. Amsterdam, The Netherlands; 2012.
- **Donker-Cools BHPM**, Wind H, Frings-Dresen MHW. Richtlijn Niet-Aangeboren Hersenletsel en Arbeidsparticipatie [Acquired brain injury and work participation: a multidisciplinary guideline]. Coronel Instituut voor Arbeid en Gezondheid, Academisch Medisch Centrum [Coronel Institute of Occupational Health, Academic Medical Center]. Amsterdam, The Netherlands; 2017.
- **Donker-Cools BHPM**, Van Bennekom CAM, Wind H, Frings-Dresen MHW. Niet-aangeboren hersenletsel en arbeidsparticipatie: Een multidisciplinaire richtlijn voor Beoordelen, Behandelen en Begeleiden (3B). TBV - Tijdschr Bedrijfs Verzekeringsgeneeskd 2012;20:201-206.
- Goossens PH, **Donker-Cools BHPM**, van Velzen JM, Wind H. De richtlijn Niet-Aangebo-

ren Hersenletsel (NAH) en Arbeidsparticipatie (2011): Wat is relevant voor de revalidatiegeneeskunde? Ned Tijdschr Revalidatiegeneeskd 2012;34:32-36.

- **Donker-Cools B.** Muntend@m Symposium 2016 Congresverslag: Digitalisering en de verzekeringsgeneeskunde. TBV-Tijdschr Bedrijfs Verzekeringsgeneeskd 2017;25:75.
- **Donker-Cools B**. Muntendam Symposium 2015 Congresverslag: Terug naar de toekomst... met een knipoog naar de film! TBV - Tijdschr Bedrijfs- en Verzekeringsgeneeskd 2016;24:80.

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