Return to work after acquired brain injury
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Chapter 8:
General discussion
The main objectives of this thesis were A) to provide insight into the process of return to work (RTW) after acquired brain injury (ABI); and B) to study the possibilities of supporting the RTW process of people with ABI during rehabilitation. In line with these objectives, the following research questions were formulated: 1) what is the prevalence of RTW after acquiring traumatic or non-traumatic brain injury?; 2) which factors limit or facilitate RTW of people with ABI?; 3) is it possible to implement an approach of Early Vocational Rehabilitation within the ABI unit of a rehabilitation centre in a way that it is feasible for use in the rehabilitation centre and to the satisfaction of the professionals, patients with ABI, employers, and occupational physicians?; and 4) what are the differences in return to work, satisfaction of the actors, and costs of Early versus Late Vocational Rehabilitation after ABI? In this chapter the main findings are described and discussed. Additionally, the methodological considerations are discussed. Finally, recommendations for future research are given as well as recommendations for practice.

Main findings

A. The RTW process after ABI
Concerning the first aim, it was concluded that about 40% of the people who were working before ABI, are able to return to work within two years and that a complex interaction between different factors influences the RTW process. Support given by the employer, colleagues, occupational physician, and occupational specialist is important during the RTW process. These conclusions were based on the following results per research question:

1. What is the prevalence of return to work after acquiring traumatic or non-traumatic brain injury?
In the systematic literature review, prevalences of 30 to 65% RTW in people with traumatic brain injury and 35 to 60% RTW in people with non-traumatic brain injury were found (Chapter 2). The pooled overall estimate was 40% RTW within two years for people with traumatic or non-traumatic ABI. All people were working before ABI. However, changes in occupation and job demands are common among people after ABI. A substantial proportion of the people with ABI who returned to work were not able to sustain their job over time.

2. Which factors limit or facilitate return to work of people with ABI?
The International Classification of Functioning, Disability and Health (ICF) model was used as the theoretical framework when investigating the factors that could influence the RTW process. In figure 1 the factors for which strong or weak evidence on their
**Disease/disorder**
- Positive influence on RTW:
  - Duration and completeness of recovery (if ongoing over time)
- Negative influence on RTW:
  - Longer length of hospital stay (strong)
  - Serious (physical) diseases not related to ABI
  - Duration and completeness of recovery (if going slowly and remaining incomplete)
- No influence on RTW:
  - Severity of injury according to Glasgow Coma Scale (strong)
  - Depression or anxiety (strong)
  - Anatomic location of stroke (strong)
  - Number of associated injuries (weak)

**Body functions and structure**
- Positive influence on RTW:
  - Physical and cognitive consequences of ABI (if absent)
- Negative influence on RTW:
  - Physical and cognitive consequences of ABI (if present)
  - Physical and/or cognitive tiredness

**Activities**
- Positive influence on RTW:
  - Being able to perform activities of daily living (weak)
- Negative influence on RTW:
  - Residual physical deficits/disability level (weak)

**Environmental factors**
- Positive influence on RTW:
  - Nature of job tasks
  - Having family (weak)
  - Support provided by the employer, colleagues, occupational physician, occupational specialists, and relatives
- Negative influence on RTW:
  - Lacking support from the employer, colleagues, occupational physician, occupational specialists, and relatives
  - Lack of knowledge about (RTW) after ABI available by employer, colleagues, and occupational physician
  - Regulations concerning eligibility to drive a car after ABI

**Personal factors**
- Positive influence on RTW:
  - Motivation for RTW of the individual with ABI
  - Humour
- No influence on RTW:
  - Gender (strong)
  - Age (weak)
  - Pre-injury education (weak)

**Figure 1:** The factors that influence the RTW process after ABI in a positive or negative way, or not. Level of evidence provided from the systematic review is presented as strong or weak.
prognostic value was found in the systematic review (Chapter 3), and the factors that were mentioned as most important by the participants of the qualitative study (Chapter 4) are presented per domain of the ICF model. From the review, no evidence was found for the (non-)prognostic value of factors belonging to the domain of the body functions and structure, and from the qualitative study no factors belonging to the domain of the activities were mentioned as being important. However, after integrating the results of both studies, it is seen that all domains of the ICF model are covered. The results presented in figure 1 emphasise the importance of addressing not only disease and personal characteristics in vocational rehabilitation interventions, but also environmental factors.

B. The possibilities of supporting the RTW process of people with ABI during rehabilitation

In the current thesis, two protocols of vocational rehabilitation (VR) were described: the Early Vocational Rehabilitation (EVR) protocol (Chapters 5, 6, and 7) and the Late Vocational Rehabilitation (LVR) protocol (Chapter 7). The main purpose of both interventions is to support people with ABI during their rehabilitation process to return to work sustainably. To deliver that support, a VR intervention is started at an early stage (from the day the standard rehabilitation treatment is started) or later (after inpatient rehabilitation has been ended and one is living at home independently), respectively, during the standard rehabilitation process. The LVR intervention has already been implemented in a Dutch rehabilitation centre. The EVR intervention was newly developed and had to be implemented on an ABI unit of a Dutch rehabilitation centre before the effects could be evaluated. Therefore, possibilities of implementing EVR were analyzed before the results of the EVR and the LVR protocol were compared. Finally, it was concluded that it is possible to implement the EVR intervention in an existing rehabilitation process. Both the EVR intervention and the LVR intervention are suitable to support people with ABI during their RTW process. The differences between the interventions do not lead to differences in RTW outcome, satisfaction of the actors, or costs. These conclusions were based on the following results per research question:

3. Is it possible to implement an approach of Early Vocational Rehabilitation within the ABI unit of a rehabilitation centre in a way that it is feasible for use in the rehabilitation centre and to the satisfaction of the professionals, patients with ABI, employers, and occupational physicians?

It was shown to be possible to implement EVR successfully in an existing rehabilitation process (Chapter 6). Although some difficulties occurred in complying with the timing of the protocol (only three of the 13 goals set on timing were reached), eight of the 13 goals set on performance were reached. In addition, almost 95% of the participants perceived the protocol as being suitable for facilitating RTW after ABI. The contact between the
actors was cited as a promoting factor by all respondents. This is in line with the finding presented earlier that support provided by actors from outside the rehabilitation centre was considered important for the RTW process (Figure 1). Some barriers were reported, such as having insufficient time to work according to the protocol, unfamiliarity with the EVR protocol (both mentioned by the rehabilitation professionals), the quality and quantity of the contact between the rehabilitation professionals and the other actors, and the connection with the patient’s job (both mentioned by patients, employers, and occupational physicians).

4. What are the differences in return to work, satisfaction of the actors, and costs of Early versus Late Vocational Rehabilitation after ABI?
A longitudinal prospective study was conducted in which 22 patients treated according to EVR and 11 patients treated according to LVR participated (Chapter 7). Their employer and occupational physician were asked to participate as well. No statistically significant differences between the EVR and the LVR group were found in time between acquiring brain injury and performing useful tasks for the employer (206 (range 59-509) days in the EVR group versus 190 (range 66-446) days in the LVR group; p=0.82). The percentage of people that returned (partly or fully) to work at 3, 6, 9, and 12 months after the start of the rehabilitation did not differ between the groups either (p=0.48-0.66): three months after the start of the rehabilitation process, 32% of the people in the EVR group and 40% of the people in the LVR group were working. After six months these percentages were 58% and 67%, after nine months 79% and 89%, and after 12 months 88% and 78%, respectively. Also, no statistically significant differences between the group were found in terms of satisfaction of the actors with support received (8 (range 6-9) out of 10 points in the EVR group versus 7 (range 5-9) out of 10 points in the LVR group; p=0.84) and result of the intervention (8 (range 6-9) out of 10 points in the EVR group versus 8 (range 7-9) out of 10 points in the LVR group; p=0.08). Finally, the intervention costs (EVR: €2108 (SEM: 401); LVR: €2165 (SEM: 338) per patient (95%CI -972 to 1069)) and the costs at 18 months after the start of rehabilitation (€28947 (SEM 2194) in the EVR group versus €33263 (SEM 2840) in the LVR group) analyzed from a societal perspective did not differ significantly between the groups (95%CI -10432 to 3923). Neither were there any statistically significant differences found between the groups from the healthcare perspective, the employer’s perspective, or the patient’s perspective.
Interpretations of findings

Implementing a vocational rehabilitation intervention in a standard rehabilitation setting: is it worth the effort?
Getting as many people as possible back to work after ABI is important because employed people report an improved sense of wellbeing, better health status, greater social integration within the community, less usage of health services, more social contacts, and a better quality of life than unemployed people. Two vocational rehabilitation interventions were presented that aim to support people with ABI during their RTW process. Both interventions are implemented in a standard rehabilitation process and are available for implementation elsewhere. However, implementing change, with a view to improving patient care, is difficult. Whether it is worth the effort to implement the VR interventions in a rehabilitation setting is discussed here, based on the results of this thesis.

Effects of the EVR and LVR interventions on return to work results
Implementing the VR interventions is only worthwhile if they lead to acceptable RTW results. From chapter 7 it became clear that overall, about 80 to 90% of the EVR patients and the LVR patients were able to return to work within one year. Because this is not 100%, it can be stated that the interventions do not lead to the best possible results. However, because working is often perceived as 'the highest rung on the rehabilitation ladder' while it requires a certain level of being able to perform a combination of different skills, and ABI is considered as one of the most disabling diseases, expecting a RTW rate of 100% is probably unrealistic.

Although differences in participating populations, time since injury, work status before ABI, and definition of RTW between studies exist, the best indicators of the possible success of the interventions are the results of studies performed earlier. In the systematic review that was described in chapter 2, it was concluded that 30 to 65% of the people who were working before ABI were able to return to work at some time after acquiring brain injury. However, not all of these people received a VR intervention. When looking at the results of studies investigating the effects of a VR intervention, 47 to 80% of the people receiving a VR intervention designed according to the vocational case coordination model like the EVR intervention were able to return to work, and 41 to 70% of the people receiving a VR intervention designed according to the supported employment model like the LVR intervention. So the 80 to 90% RTW that was found in our evaluation study is high and, therefore, acceptable.

However, the high RTW success rate that was found in our study can be an overestimation compared to the results of the studies performed earlier. First, because of the definition of RTW. In the evaluation study, readiness for RTW was reported: a person was assessed as successfully returned to work if they were working at least one hour a
week in own, adapted, or sheltered work after ABI. Compared to the strict RTW definitions that are used in other studies (like being able to maintain the work for at least a couple of months\textsuperscript{9,11}, returning for a minimal number of hours\textsuperscript{10}, or including competitive employment only\textsuperscript{13,14}), RTW is relatively easily achieved in our study. Secondly, a selection bias occurred whereas in the evaluation study only people who were admitted to rehabilitation and who were assessed as possibly able to return to work were included. Those people who did not receive rehabilitation – either because they had already recovered sufficiently or because the consequences of ABI were too serious and little or no effects of rehabilitation on recovery are expected – were not included. In addition, not all eligible patients were included, nor the people who received rehabilitation but did not receive the EVR or LVR intervention. Especially those people who experienced serious consequences of ABI are expected to experience more difficulties during their RTW process, leading to lower RTW results. Finally, maybe RTW is relatively easily achieved in our study because of the compulsory support of the employer in the Netherlands. The contributions of the employer (and employee) to the RTW process of the employee are assessed. If the contributions were insufficient, this has financial consequences for the employer. Consequently, the efforts of the employer to get an employee back to work are probably higher than the efforts of employers in other countries, resulting in more people achieving RTW in our study compared to the studies performed abroad.

On the other hand, an underestimation of the RTW success compared to the results of the earlier performed studies could also have occurred. After 2008, due to the worldwide economic crisis, the situation on the labour market changed, leading to fewer jobs being available. In addition, because fewer people become available for the same amount of work, the job (productivity) requirements are higher now. Not all people with ABI are able to fulfil these requirements. Consequently, fewer people with ABI were able to return to work than before 2008, leading to lower RTW percentages in our study compared to the results of the other studies that were performed before 2008.

Costs of vocational rehabilitation during standard rehabilitation

In the Netherlands, there is an ongoing discussion about whether or not vocational rehabilitation should be part of standard rehabilitation paid by health insurances. The main argument for not including VR in standard rehabilitation is that the employer is made responsible for the (main part of) the costs of the employee’s RTW process by law.\textsuperscript{15} Another argument that is heard is that the financial investments done by health insurances (i.e. society), return to the employer instead of society. So the employer would profit twice from the investments made by society.

However, arguments exist for the inclusion of VR in standard rehabilitation. First, the main purpose of the rehabilitation process is to regain normal life as much as possible. For those people who were working before ABI, return to normal life includes RTW. So providing VR support, should be seen as a healthcare responsibility. Moreover, by
focusing on the patient’s work, a clear significance is given to the provided therapy, increasing the patient’s motivation to train. It is expected that this will result in better overall rehabilitation outcomes. Secondly, the VR intervention in which the interdisciplinary knowledge of the rehabilitation professionals is used also helps to provide insight into the capacities of the person with ABI to RTW, thereby avoiding the experience of failure in the future. It is expected that, as a result, unnecessary losses of time and stays at home are avoided, finally leading to fewer disability pensions being paid by society. Third, it is known that being employed leads to a better quality of life and less usage of health services than not being employed\(^2\text{–}^5,^7\), also leading to lower healthcare costs for society in the long term. In 2007, a cost-benefit analysis of rehabilitation care was made. For people admitted to rehabilitation due to a stroke, the average costs of a rehabilitation treatment were €5300.\(^{16}\) However, in general the average societal benefits of a rehabilitation treatment were €26,700. So the investments made by society are also given back to society. Because absenteeism costs are avoided if people achieve RTW in an earlier stage after ABI, it can be expected that the financial benefits of a rehabilitation treatment increase even more when VR is included in standard rehabilitation. Finally, from the results of the evaluation study (Chapter 7), it became clear that the main part of the costs associated with the VR process are paid by the employer, due to the high absenteeism costs. So both the healthcare insurances and the employers are taking their responsibilities.\(^{15,17}\)

**Subjective evaluation of the EVR and LVR intervention**

Because higher compliance rates are expected if the actors are satisfied with an intervention, a subjective evaluation was also performed. Both the processes and the results of the EVR and the LVR intervention were positively reviewed by the participants of the evaluation study. For the EVR intervention the experiences of the professionals on the rehabilitation team were evaluated too (Chapter 6). Although some difficulties were encountered during the implementation of the EVR protocol, the rehabilitation professionals believed that the EVR protocol provides a structured way to focus on RTW during standard rehabilitation and that it is suitable for facilitating RTW after ABI. Overall, the professionals on the rehabilitation team were satisfied with the EVR protocol and its implementation.

**In conclusion**

The high number of people that become ready for work after EVR or LVR is promising and to the satisfaction of the actors. In addition, after balancing the above-mentioned arguments concerning the costs, investments associated with VR that are made during standard rehabilitation seem to provide sufficient (financial) benefits. In conclusion then, combining the effects of the interventions on RTW, costs, and the satisfaction of the actors, we can say that implementing the EVR and the LVR intervention is worth the
effort of implementing change, and that VR should be part of standard rehabilitation for the people of working age. Implementation is therefore to be encouraged. The results of the process evaluation presented in chapter 6 showed that it is possible to implement the EVR protocol on the ABI unit of a rehabilitation centre in the Netherlands. Although the implementation of the LVR intervention was not evaluated, this intervention had already been in use for a number of years. So implementation of the LVR protocol proved to be possible too. A context analysis will need to be carried out to fine-tune the VR protocol in the specific context of other rehabilitation institutes that wish to implement a VR intervention and to allow the protocol to become part of the existing routines.  

**Important contents of a vocational rehabilitation intervention**

Because VR interventions have to be fine-tuned if they are to be implemented elsewhere, it is possible that some elements of the EVR and the LVR interventions will fall by the wayside. A point to be discussed is whether there are essential elements that should always be part of a VR intervention. In my opinion, there are. An overview of the factors that I propose as essential elements will now be given and elucidated upon.

The proposal is based on the results of the systematic review on the prognostic factors, on the facilitating and limiting factors as mentioned in the qualitative study and the process evaluation, and on the results of studies performed earlier. The factors that were mentioned more than once as being important were considered as being essential elements. After presenting the proposed essential elements, it will be discussed whether these elements are part of the current EVR and LVR interventions.

The following factors are defined as essential elements of a VR intervention: 1) an early start of the intervention; 2) cooperation between the actors from inside and outside the rehabilitation institute; 3) insight into the job requirements and the individual’s capabilities; and 4) work training.

1. **Early start of the VR intervention**

Participants of the qualitative study stated that an insufficient or slow recovery of the results of their ABI over time limited their RTW process (Chapter 4). In addition, there is (weak) evidence that residual physical deficits and/or a high disability level influence RTW negatively (Chapter 3). Because the greater part of the recovery occurs during the first six months after injury and can be facilitated by training\(^2,5,19-21\), it is advised to start the VR intervention as early after ABI as possible.

It can be argued which start moment can still be considered as an early start. Malec and Moessner\(^11\) concluded in their study that those people who were admitted to the VR service within one year after ABI were more likely to become employed in a competitive job than people who were admitted to the VR service more than one year after ABI. At the same time, starting VR as soon after ABI as possible has the advantage that the two years during which the employer and the employee are responsible for the RTW process
according to the Dutch Improved Gatekeepers Act\textsuperscript{15} are used from the start and that the employer and occupational physician are informed and involved at an early stage of the RTW process. In addition, training can be started early after ABI. Even if the specific work training starts later in the process, an early start gives the opportunity to focus on the skills necessary to perform the patient’s job during standard rehabilitation treatments. In conclusion, it is recommended to start VR as soon as possible after ABI in order to waste no time, but VR should be started at least within one year after ABI.

2. \textit{Cooperation between the actors from inside and outside the rehabilitation institute}

Both in the qualitative research (Chapter 4) and in the process evaluation (Chapter 6), cooperation between the professionals on the rehabilitation team and external actors like the employer and the occupational physician were specified as being essential by the participants. Cooperation is necessary in order to inform the external actors about ABI and its possible consequences on RTW, and to gain insight into the job requirements. In addition, the cooperation should guarantee a smooth continuation of the RTW process after the support from the rehabilitation institute has been ended.

The importance of the cooperation was confirmed by the Dutch guidelines on return to work after acquired brain injury.\textsuperscript{22} According to these guidelines, the rehabilitation physician, neuropsychologist, and occupational physician are the key professionals during the RTW process and communication between these actors is necessary. In addition, Gard and Larsson\textsuperscript{23} mentioned that earlier research has shown that employer participation, a supportive work climate, and cooperation between labour and management are crucial factors in facilitating RTW.

3. \textit{Insight into the job requirements and the individual’s capabilities}

While RTW is difficult when a gap exists between the job requirements and the individual’s capabilities (Chapter 4), tuning the VR process to the individual’s capabilities on the one hand and to the individual’s job requirements on the other hand should be part of a VR intervention. The importance of the connection between the VR process and the individual’s job was confirmed by the participants of the process evaluation (Chapter 6). A personalized approach is necessary to fine-tune the content of the VR intervention to each individual patient. The review of Fadyl and McPherson\textsuperscript{12} on approaches to VR after traumatic brain injury also states that there is consensus that an individualized intervention is important.

4. \textit{Work training}

To decrease the gap between the job requirements and the individual’s capabilities, and to facilitate recovery, work training should be provided. From the results of chapter 3 and 4, it is clear that from all domains of the ICF model\textsuperscript{1}, factors are influencing the RTW process (Figure 1). Not all of the factors mentioned in figure 1 can be used as input for a
VR intervention because some of them, like injury severity as classified by the Glasgow Coma Scale or having a family, are not trainable or can not be affected in other ways. Therefore, training should focus on the factors belonging to the body functions and structures and to the activities, and should be in balance with the environmental factors (like the nature of job tasks) and the personal factors (like education level).

With regard to the design of the work training, from the results of the thesis it remains inconclusive which design should be considered as best practice. In the EVR intervention, the work training is started at the rehabilitation centre. Training in the rehabilitation centre provides an opportunity to practice working skills within a safe environment with ABI specialists in attendance. As a result, confidence can be regained before returning to the workplace. Training can be started during inpatient rehabilitation, which is a practical solution since the patient is still engaged in the rehabilitation process. In addition, VR is started as soon as possible after ABI. Another advantage is that it is possible to give the training to groups, leading to lower costs compared to training on an individual basis. Despite these advantages, in the rehabilitation centre only a sample of the real work situation can be simulated, making it less generalizable to the patient’s own work. Another disadvantage is that the employer and colleagues of the person with ABI are not involved directly in the training.

In the LVR intervention, the work training is started at the patient’s workplace. The main advantages of training at the workplace are that the results of the training can be generalized to the real working situation and that the employer and colleagues are involved directly. In addition, the employee is able to perform useful tasks for the employer in an earlier stage of the VR intervention. However, if no skills are trained before returning to the workplace, a high burden is placed on the individual and his or her colleagues to find out which tasks can be performed and which not.

Which of the important elements are integrated in the EVR and LVR interventions?

When focusing on the EVR and LVR interventions, it can be concluded that all important elements are integrated in the EVR and LVR interventions, although differences between the interventions exist. The main differences were the start moment of the intervention (from rehabilitation start in the EVR intervention and after about five months in the LVR intervention), and the design of the work training. However, no differences in results between the interventions were found (Chapter 7), probably mainly due to the limited number of participants.

After weighting the advantages and disadvantages of the designs of the work training of both interventions, it is hypothesized here that training in the rehabilitation centre is perhaps beneficial for the individual who is still receiving inpatient rehabilitation, is facing a large RTW gap, and/or is less confident about his or her own abilities, while training on the workplace is more beneficial for the individual who is facing a smaller RTW gap. Future adequately powered research should be conducted to confirm this hypothesis and
to investigate which training method leads to the best RTW results in the short term and the long term.

Methodological considerations

The methodological considerations of the studies that were presented in this thesis are discussed in this section.

Number of participants

The most important limitation of the process evaluation and the effect evaluation (Chapters 6 and 7) was the small number of participants. A small number of participants makes it difficult to perform valid statistical analyses and to draw valid conclusions. Consequently, although the results of the evaluation study were promising, it was not possible to test our findings concerning the possible differences in RTW, costs, and satisfaction between the EVR and LVR intervention with sufficient power, leading to more uncertainty in the results.

Implementation of the VR intervention in other rehabilitation centres and extending the inclusion period would have been options to increase the number of eligible participants. However, implementation in other centres is easier to realize if the effects of an intervention are known. Therefore, in the current thesis it was decided to investigate the possibilities of implementing EVR in a pilot centre first. Additionally, an indication of the possible effects of the EVR and LVR interventions were gathered from two different rehabilitation centres (one centre per intervention), even though performing the research in one rehabilitation centre per intervention has the implication that the number of possible eligible participants is limited to the number of patients that are registered for rehabilitation in that rehabilitation centre. Now that it has been concluded that it is worth the effort to implement the EVR and LVR interventions, the next step is to implement them in other rehabilitation centres in the Netherlands or abroad. Extending the inclusion period would have increased the chance of a bias due to changes in laws and legislation or in the situation of the labour market. The internal validity of the study would then have been affected.

Missing data

In the process evaluation and the evaluation study, a substantial amount of data was missing from the questionnaires. Answers on a questionnaire (not totally completed) were missing, as well as some whole questionnaires. The latter missing data was mostly due to the dropping out of the participant, especially in the case of the employers and the occupational physicians. This may have led to an attrition bias. However, while known reasons for missing data were: no RTW expected within considerable time, RTW already
achieved, termination of the patient’s work contract, passing away of the participant, or a change of the corresponding employer or occupational physician who does not know the patient well enough (Chapter 7), the data seems to be missing completely at random.\textsuperscript{24} So it is expected that the occurrence of missing data did not differ between the observed and the unobserved data, and that the reasons are comparable between both intervention groups, thus decreasing the chance of an attrition bias.

Considering the cost-benefit analysis, the multiple imputation technique was used to fill in missing cost data. With the multiple imputation technique, multivariate regression techniques are used to predict missing values on the basis of observed factors. Multiple imputation of the missing cost data was of particular importance because the total costs were the sum of numerous cost components. Thus, if one cost component was missing, the patient’s total costs were missing as well. Because of the substantial amount of missing data, few patients had complete cost data. Another reason for using the multiple imputation technique is that cost data tend to follow a highly skewed distribution, therefore requiring relatively large sample sizes. The imputation technique is considered to be the most adequate and reliable method for minimizing the chance of variation in outcomes occurring in the case of missing data, so this was the best option.\textsuperscript{25,26}

**Comparison between different approaches of VR**

When planning to perform a study in which the effects of the EVR intervention were evaluated, an appropriate group had to be defined to which the effects could be compared. In the current thesis, it was decided to make a comparison between two different approaches of VR. The main benefit of this study design was that it was practice-based. The rehabilitation centres’ ways of working did not have to be changed, thereby decreasing the risk of the occurrence of a bias as a result of unfamiliarity with a new way of working, and increasing the generalizability of the results to the real-life situation.

A disadvantage of the selected option was that it was not possible to randomize the participants in order to control for differences between the groups. A randomized controlled trial is often seen as the best possible design to evaluate the effectiveness of an intervention.\textsuperscript{27} However, in our opinion, choosing that design was not the best option in our study. The main reason for this was that, because of geographical reasons, it is not possible to admit the patients at random to the EVR or the LVR centre. So both interventions had to be implemented in each rehabilitation centre in order to enable the patients to be randomized to the interventions within each centre. The way the professionals on the rehabilitation team were used to working had to be changed then, decreasing the generalizability to the real-life situations of the rehabilitation centres. In addition, contamination between both intervention groups was expected to occur because of the increased awareness in the team of rehabilitation professionals of the possible strengths and weaknesses of both interventions. This would have biased the
results of the study. Also in other studies, a randomized controlled trial has hardly ever been chosen as an appropriate design to investigate the effects of a VR intervention in the inpatient or outpatient rehabilitation. Just one randomized controlled trial was found in which the impact of resource facilitation on RTW of patients with ABI who were admitted to inpatient or outpatient rehabilitation was compared to standard care. However, the resource facilitation included only support in order to help people to make informed choices in order to meet their goals. The resource facilitation did not include a VR intervention. Some other randomized controlled trials that were performed investigated the effects of support (not specifically focused on RTW) on RTW. However, these studies were performed in a post-discharge situation.

Another disadvantage of the chosen study design was that it was not possible to determine the effects of the interventions in comparison with the situation in which no VR support was given. The extra costs of the intervention compared to the costs of a rehabilitation programme without the clear focus on work could not be determined either. Defining a control group from a historical cohort that did not receive a VR intervention during standard rehabilitation would have been another option. This is a classical way to evaluate the effects of interventions belonging to a social model in which the person with ABI and his or her social environment are the focus. The main disadvantage of that design is that detailed questions about the RTW process had to be asked retrospectively. Because a recall bias was then expected to occur, especially in people experiencing severe cognitive consequences of ABI, we did not choose this design. In addition, due to a worldwide economic crisis, the situation on the labour market changed after 2008, possibly leading to changes in the opportunities of RTW after ABI, and threatening the internal validity of the study if a comparison with a historical cohort was made.

**Assessment methods**

Self-designed questionnaires were used in the evaluations presented in chapters 6 and 7. Disadvantage of using self-designed questionnaires is that the reliability and the validity of the questionnaires were not tested. Consequently, it is unknown whether the questionnaires were valid for use. However, reliability and validity of most of the existing questionnaires were not tested in people with ABI either. Furthermore, existing questionnaires were not specific enough for the aim of the studies. Finally, most existing questionnaires were not adapted to people with ABI: because of the cognitive problems like aphasia, it is recommended to keep the communication simple and to use binary response choices if possible. Balancing these arguments, it was decided to design our own questionnaires that specifically focused on the population of people with ABI, the EVR and LVR interventions, and on the aim of the study.

In order to facilitate answering the questions, closed questions with binary response choices were used where possible. However, it is likely that the use of closed questions made it difficult for the responders to nuance their answers. Some questions seemed to
be difficult to answer. For example, in the evaluation study most patients reported that they received support from a relative but did not give an estimation of the number of hours. Because of these missing data, an underestimation of the amount of support provided by the relatives is expected. To avoid response problems occurring as much as possible, both the content and the layout of the questionnaires were checked by ABI rehabilitation professionals on their suitability for use with people with ABI before they were sent to the participants. It may have been better if they had also been checked by people with ABI.

A recall bias might have resulted from the choice of the three-monthly measurement intervals (Chapter 7). The interval of three months was chosen to ease the burden on the people who were asked to fill in the questionnaires. Shorter intervals would have probably decreased the number of completed questionnaires even more than when using the interval of three months. However, it can be argued whether the interval was too long now, leading to a recall bias. This applies especially to people with ABI experiencing memory problems. Since the interval was the same in both intervention groups, it is expected that the interval does not lead to differences between the two groups. A recall bias could also have occurred in the qualitative study (Chapter 4) in which the people were asked about their experiences with their RTW process about 32 (+/- 5) months after ABI. To decrease the risk of a recall bias, a direct relative of the participants was asked to participate during the interviews as well.

**The generalizability of the results**

The primary objective of the thesis was to provide insight into the RTW process of people with ABI. However, because no Dutch studies were available for inclusion in the systematic reviews (Chapter 2 and 3), it was not possible to generalize the results of the reviews to the Dutch situation directly. The fact that a qualitative research was performed to investigate the limiting and facilitation factors faced by people with ABI in the Netherlands (Chapter 4) was a strength of the thesis.

The second objective of the thesis was to study the possibilities of supporting the RTW process of people with ABI during rehabilitation. This was why it was decided to perform the research in two inpatient and outpatient rehabilitation centres in the Netherlands. However, this choice had consequences with regard to the generalizability of the results. First, the results of the thesis are not generalizable to all people who acquired brain injury while, in general, only people with moderate to severe ABI are admitted to inpatient or outpatient rehabilitation. This includes only a small percentage of the people who acquired brain injury. Moreover, only people who received the EVR or LVR interventions were included in the study. Both people who already started RTW and people who will not start RTW (at least not within a considerable amount of time due to medical reasons) did not participate. So the results of the study are generalizable to
people admitted to inpatient or outpatient rehabilitation because of ABI and who seem able to return to work but are expected to need some support.

Secondly, the staff of the rehabilitation centres in which the EVR and LVR interventions were implemented and evaluated was ‘work-minded’. It can be expected that implementation is more difficult in centres that are less ‘work-minded’ in their guidance of patients. Consequently, it is likely that an overestimation of the RTW results occurred in our study, making it less generalizable to patients who are supervised in less ‘work-minded’ rehabilitation centres.

Finally, it is not possible to generalize the results to other countries directly, due to differences in culture and social security systems. However, the benefits of an early, interdisciplinary approach of VR are expected to apply equally to persons with ABI in other countries.\textsuperscript{11} In addition, although a high degree of heterogeneity of consequences of ABI are found between persons with ABI, no differences in consequences are expected to occur between the countries. To improve the generalizability of the economic evaluation and to demonstrate the robustness of the findings of the economic evaluation, a sensitivity analysis was performed.

**Recommendations for research and practice**

Based on the results of the thesis, recommendations for research and practice are given here.

**Recommendations for research**

*Long-term effects of the EVR intervention and the LVR intervention*

A long-term evaluation has to be performed to investigate whether people treated according to the EVR intervention or the LVR intervention are able to return to work in a sustainable way. This evaluation should also include an evaluation of the interventions’ economic investments and benefits in the long term. Insight into the long-term effects and costs is expected to be helpful in the ongoing discussion about whether VR interventions should be part of the standard rehabilitation or not. It is recommended that a longitudinal, prospective cohort study be performed in which an EVR group and an LVR group are compared. To increase the number of possible eligible participants, the EVR and the LVR interventions should be implemented in other rehabilitation centres before the evaluation is started. In order to increase the validity of the study, it is recommended that questionnaires are validated for use in people with ABI first. In the Netherlands, the duration of the evaluation should be more than two years to see if people are able to retain their work after the compulsory support of the employer has ended.\textsuperscript{15}
**VR interventions: what works best for whom?**

Future research in which larger samples are included needs to be performed to investigate which approach works best for whom. One of the possible future studies could focus on the hypothesis expressed earlier that training in the rehabilitation centre is recommended to the individual who is still receiving inpatient rehabilitation, who is facing a large RTW gap, and/or who is less confident about his or her own abilities, while training on the workplace is recommended to the individual who is facing a smaller RTW gap. To realize this, a subgroup analysis had to be included in the above-mentioned longitudinal, prospective cohort study. It is proposed here that a distinction be made between the inpatient and the outpatient participants because it is expected that these groups are included at different stages of their RTW process and will be facing different problems: most inpatient participants have to become used to their changed abilities after ABI and have not tried to return to work before being admitted to the VR intervention, whereas probably most outpatient participants have tried to return to work but were encountering problems during their RTW process.

**Recommendations for practice**

*Implementation of a VR intervention in other rehabilitation settings*

Now that we have concluded that the EVR protocol is suitable for implementation on the ABI unit of a Dutch rehabilitation centre, and that the effects on RTW of the EVR and LVR interventions are promising, the next step is to implement it in other rehabilitation settings like other rehabilitation centres, rehabilitation departments of general hospitals or academic medical centres, or settings abroad. Additionally, it needs to be investigated whether the EVR and LVR protocols are also suitable for use in people with other diagnoses that are admitted to rehabilitation. A context analysis has to be carried out to fine-tune the VR protocol in the context of the specific rehabilitation centre and to allow the protocol to become part of the existing routines. At the same time, it can be checked whether (small) adaptations have to be made during implementation in other rehabilitation settings or diagnoses. Because of their importance, it should be guaranteed that the following four elements remain integrated in the intervention: 1) an early start of the intervention; 2) cooperation between the actors from inside and outside the rehabilitation institute; 3) insight into the job requirements and the individual’s capabilities; and 4) work training.

*An interdisciplinary organization of RTW support*

While the support provided during VR covers only a few weeks or months, an interdisciplinary structure should be available according to which long-term RTW support is organized. The support has to be started immediately after ABI by the neurologist in the hospital or by the general physician for example, and should last till the person with ABI gets retired or till the person with ABI or a professional decides that working is no
longer an option. All involved actors should be aware of potential problems with regard to RTW and should provide a transfer of information to the other actors involved. In addition, the centres with expertise on RTW after ABI should form a national network that provides long-term support. The network should be easily accessible and recognizable for people of working age with ABI, and for other persons who are involved in the work situation of people with ABI, like employers, occupational physicians, and relatives. Such an interdisciplinary organization of RTW support guarantees that the balance in the working life of people with ABI is maintained and that people are able to remain working, in situations adapted to their capabilities.

Epilogue

In the general introduction of this thesis, Luc and John were introduced. Both experienced problems during their RTW process after they acquired brain injury. In contrast to John, Luc did not receive support on RTW in a structured way during his rehabilitation and failed to return to work. Due to this failure, Luc’s sense of wellbeing deteriorated and he experienced problems with his relatives. His occupational physician heard about the implementation of a VR intervention in a rehabilitation centre just before the two-year period that is described in the Dutch Improved Gatekeepers Act expired. Because of the multidimensionality of his problems, a rehabilitation treatment was indicated. In cooperation with his employer and occupational physician, the VR intervention was started and after some weeks of work training Luc was able to regain some hours of work per week. Because the employer was willing to continue the work contract, Luc had the opportunity to continue his RTW process after the two years of sick leave and to find a balance between his working life and his private life. Luc, his employer, and his occupational physician evaluated this balance over time. As a result, Luc was able to continue working, like John. Just as the butterfly is able to eat and fly if it is treated with the right care.
References


