# Self-efficacy and quality of life after low-intensity neuropsychological rehabilitation

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# Self-efficacy and quality of life after low-intensity neuropsychological rehabilitation: A pre-post intervention study

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**Abstract**.
**BACKGROUND:** Being highly self-efficacious is a key factor in successful chronic disease self-management. It is unknown whether neuropsychological rehabilitation improves self-efficacy in managing the consequences of brain injury.
**OBJECTIVE:** To investigate whether levels of general and brain injury specific self-efficacy and quality of life (QoL) increased after neuropsychological rehabilitation and whether cognitive performance was associated with self-efficacy.
**METHODS:** We conducted a retrospective clinical cohort study of 62 patients with acquired brain injury and cognitive complaints with measurements before start and after completion of treatment. QoL was measured with the visual analogue scale (EQ VAS) of the EuroQol (EQ-5D); self-efficacy with the TBI Self-efficacy Questionnaire (SEsx) and the General Self-efficacy Scale (GSES). Cognitive performance was measured as a compound score of tests for memory, attention and information processing speed.
**RESULTS:** Self-efficacy for managing brain injury-specific symptoms and QoL increased significantly after neuropsychological rehabilitation. Both general and brain injury-specific self-efficacy were positively associated with QoL after completion of the programme. Cognitive performance was not associated with self-efficacy for managing brain injury-specific symptoms nor with general self-efficacy.
**CONCLUSIONS:** Self-efficacy and QoL improve after treatment. Further research is needed to identify the specific ingredients responsible for improvement of self-efficacy in patients with cognitive complaints.

Keywords: Self-efficacy, neuropsychological rehabilitation, cognition, quality of life

## 1. Introduction

Self-efficacy refers to the belief in one's ability to achieve goals (Bandura, 1997). Efficacy beliefs influence the activities people choose to engage in, the level of effort they spend and their perseverance in the face of difficulties (Bandura, 1997). Self-efficacy beliefs are domain-specific but various and numerous experiences of success and failure in different domains of functioning may accumulate in a generalised belief of self-efficacy.

In patients with acquired brain injury (ABI) higher levels of general self-efficacy (Dumont, Gervais, Fougeyrollas, & Bertrand, 2004; Rutterford & Wood, 2006; Wood & Rutterford, 2006) and self-efficacy for managing brain injury-specific symptoms (Brands, Kohler, Stapert, Wade, & van Heugten, 2014; Cicerone & Azulay, 2007) have shown to be associated with better quality of life (QoL) and social participation. Furthermore, higher levels of

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self-efficacy for managing brain injury-specific symptoms in the sub acute stage after ABI were found to be predictive for better long-term general QoL (Brands et al., 2014). In addition, patients who were able, over the course of their first year after injury, to increase their level of self-efficacy for managing their brain injury-specific symptoms reported better general and health-related QoL (Brands et al., 2014).

In neuropsychological rehabilitation programmes the focus is on teaching patients to compensate for their cognitive deficits and to manage the social and emotional consequences of ABI. Other important therapy components are fostering the adaptation process and rebuilding the patient's perspective on life (Brands, Wade, Stapert, & van Heugten, 2012; Cicerone et al., 2011). As Cicerone and Azulay (Cicerone & Azulay, 2007) already noted, perceived self-efficacy may play a fundamental role in one's ability to reduce the discrepancy between achievements and expectations. An increased level of self-efficacy may reflect an increased sense of mastery and acceptance of one's limitations (Cicerone & Azulay, 2007). Furthermore, being highly self-efficacious in managing one's health issues is assumed to be a key factor in successful chronic disease self-management (Lorig & Holman, 2003). In stroke, it has been demonstrated that effective self-management interventions typically include components directed towards optimisation of self-efficacy and adequate goal setting (Johnston et al., 2007; Jones, Mandy, & Partridge, 2009; Jones & Riazi, 2011). The majority of these studies focussed on interventions to improve physical functioning and showed that improvement of self-efficacy was related to e.g. improvement of self-care, physical activity, and maintaining balance and walking. Memory self-efficacy and psychological QoL increased after a specific memory self-efficacy intervention (Aben, Heijenbrok-Kal, Ponds, Busschbach, & Ribbers, 2014). To the best of our knowledge, the effect of neuropsychological rehabilitation on self-efficacy in managing the cognitive problems, emotional and social consequences associated with brain injury has not been studied yet.

Patients needing neuropsychological rehabilitation suffer from cognitive deficits. However, it remains unclear whether cognitive performance affect one's level of self-efficacy. In patients with multiple sclerosis (MS), lower levels of self-efficacy were associated with lower scores on measures of attention (focused attention and fluctuations in attention) while the association with memory function was not significant (Jongen et al., 2015). Similarly, Aben et al. (Aben et al., 2011). observed in patients with stroke that only low word fluency predicted low levels of memory self-efficacy whereas scores on tests for memory and executive functioning did not contribute significantly.

So, the aims of the present study were to investigate (1) whether levels of general self-efficacy and self-efficacy for managing brain injury-related symptoms and QoL would increase after neuropsychological rehabilitation, (2) whether higher levels of general and brain injury-specific self-efficacy were associated with better QoL after neuropsychological rehabilitation, and (3) whether cognitive functioning was associated with initial self-efficacy for managing brain injury-related symptoms.

## 2. Methods

### 2.1. Study design

A retrospective clinical cohort study was conducted with measurements at two points in time: before start of the neuropsychological rehabilitation programme (T0: baseline) and directly after treatment (T1).

### 2.2. Patients

All patients who had been referred to our centre (Libra Rehabilitation Medicine & Audiology; Blixembosch Rehabilitation Centre) for outpatient neuropsychological rehabilitation between February 2013 and September 2015 were potential candidates for this study. Patients were included in the study if they had completed the self-report measurements at T0 and T1. Criteria for admission to our outpatient neuropsychological rehabilitation programme are: (1) presence of ABI confirmed by neurological or neuroimaging data; (2) being 18 years or older; (3) having cognitive, emotional, and/or behavioural problems interfering with personal daily life functioning. Patients are excluded from participation in the programme if they have progressive neurodegenerative illness (e.g. dementia, multiple sclerosis, Parkinson's disease), whiplash trauma, substance abuse and/or psychiatric disorders impeding the course of the rehabilitation process. Data collection was part of regular care. All patients were routinely asked for their permission to use their data anonymously and consented. For such proce-

Table 1
The different treatment modules

| Module | Discipline |
|---|---|
| Individual cognitive rehabilitation therapy | Cognitive rehabilitation therapist |
| Individual occupational therapy | Occupational therapist |
| Individual speech therapy | Speech Therapist |
| Individual physical therapy | Physiotherapist |
| "I have changed" (patient group therapy) | Two Neuropsychologists |
| Sports and relaxation (patient group therapy) | Physiotherapist and sports coach |
| Relatives' group (caregiver group therapy) | Neuropsychologist and Psychiatrist |

dure no separate ethical approval is needed in The Netherlands.

### 2.3. Intervention

The main purpose of this outpatient programme is to promote the adaptation process, which comprises managing the various cognitive, emotional and behavioural changes after ABI, adjusting expectations, rebuilding one's perspective on life and finding new values and setting long-term goals. To achieve this, we use a process-oriented approach. This approach implies that at any moment during treatment, the components of the programme fit closely to the actual stage of adjustment and are aimed at guiding the patient to the next step in the adaptation process (Brands et al., 2012; Brands, Bouwens, Wolters Gregório, Stapert, & van Heugten, 2013). Therefore, the different treatment modules are individually tailored and adapted to the patient's actual needs and goals. Consequently, between-patient variation in the duration and content of the programme is possible. The different therapy modules and the disciplines that are involved are listed in Table 1. Individual and/or group sessions are provided for patients. Relatives are involved in the patient's individual programme on a regular basis, and if necessary they participate in specific caregiver sessions. All group sessions are provided as open groups. All group modules are based on principles of group dynamics, cognitive behavioural therapy and psychotherapy (Prigatano, 1999). During treatment each patient makes a personal document with information about their brain injury, strategies, tips how to recognize a relapse in functioning and how to avoid pitfalls.

Individual modules (see Table 1) for patients comprise individual cognitive rehabilitation therapy, individual occupational therapy, individual speech therapy and individual physiotherapy. Content and frequency of therapy is tailored to individual needs and goals and targets everyday life individual problems. The cognitive rehabilitation therapy differs with respect to individual goals, however, common elements are psycho-education and teaching internal and external compensation strategies for various cognitive deficits. Individual occupational therapy focuses mainly on management of mental fatigue, guidance towards a well-balanced week structure and vocational rehabilitation. Communication problems stemming from aphasia and/or cognitive communication disorders are addressed during individual speech therapy.

Patient group sessions ("I have changed", see Table 1) are weekly sessions of 1.5 hours, which focus specifically on the general process of adaptation to the new and changed life with ABI. Three major themes are considered. First, recognising and facing the permanent character of the impairments, disabilities and changed self. Second, finding a way to deal with the losses. Third, re-establishing a new perspective on life in which finding a set of new, meaningful but realistic long-term goals is important. The format is adapted to group members with cognitive difficulties and accelerated mental fatigue. In every group session, by rotation, the focus is on one patient. His or her problems, experiences and expectations are discussed and placed in the context of the adaptation process. Progress in attainment of personal goals is evaluated. Timing of entry into these group sessions can differ: either from the very start of the treatment programme, or when stagnation is observed and further progress is expected through intensifying the approach by adding the group sessions to the individual treatment programme. A maximum of eight patients per group is allowed. These group sessions are offered in combination with the sports and relaxation group (60 minutes). The relatives' group sessions focus on psycho-education, facilitating emotional adjustment and readjusting expectations. The structure of the relatives' group is similar to that of the patient group. Relatives' group sessions are weekly sessions of one hour and 45 minutes. A maximum of ten relatives per group is allowed.

### 2.4. Measures

#### 2.4.1. Self-efficacy

To measure self-efficacy, we used the 13-item TBI Self-efficacy Questionnaire (SEsx) (Cicerone & Azulay, 2007), which contains four subscales: social (4 items), physical (1 item), cognitive (4 items) and emotional (4 items) measuring self-efficacy for obtaining help and emotional support, managing physical symptoms, managing and compensating for cognitive symptoms, and managing emotional symptoms respectively. Items are rated on a 10-point scale (1 = not at all confident, to 10 = totally confident). Subscale scores are summed to a total score. Higher scores indicate greater self-efficacy. We carried out a formal translation procedure, as there was no Dutch version of the questionnaire. Using our data, we found that internal reliability (Cronbach's alpha) of this Dutch version was good ($\alpha = 0.72$–$0.92$).

To measure general self-efficacy, we used the 12-item Dutch version (Bosscher, Smit, & Kempen, 1997) of the original General Self-efficacy Scale (GSES) (Sherer, 1982). Items are scored on a 5-point Likert scale. Higher scores indicate higher general self-efficacy (maximum score = 60). Using our data, internal reliability was good ($\alpha = 0.81$–$0.87$).

#### 2.4.2. Quality of Life

To measure QoL, the visual analogue scale (EQ VAS) of the EuroQol 3L (EQ-5D) (Brooks, 1996; EuroQuol, 1990) was used, which generates a self-rating of health-related QoL. Psychometric properties of the Dutch EuroQol showed to be good (Szende, Oppe, & Devlin, 2007).

#### 2.4.3. Neuropsychological functioning

Information processing speed was measured with the Processing Speed Index of the Fourth Wechsler Adult Intelligence Scale (WAIS-IV) (Wechsler, 2008). Higher scores indicate higher speed of information processing.

Focussed attention was measured with the Stroop Colour Word Test (Stroop, 1935). The Stroop Colour Word Test consists of three carts: I, colour names; II coloured patches; and III, colour names printed in incongruously coloured ink. The capacity to focus attention was calculated by comparing the amount of time needed to name colours on card II and card III with healthy adults from the same age, gender, and educational attainment. Less time needed to name colors on card III indicated better focused attention.

Immediate verbal memory was measured with the 15-Word Learning Test (15-WT) (Saan, Deelman, Bouma, Mulder, & Lindeboom, 1996), which is a Dutch version of the Rey Auditory Verbal Learning Testy (Rey, 1958). Total correct scores on the five learning trials is referred to as immediate recall (score range 0–75). The capacity to remember this verbally incoherent information was calculated by comparing the total amount of remembered words with the performance of healthy adults from the same age, gender, and educational attainment. Higher scores indicated better active verbal memory and short term memory.

#### 2.4.4. Other measures

Demographic data and lesion characteristics (gender, age, education, date of brain injury, type of lesion) were collected from the medical files. Level of educational attainment was classified according to a 2-level system: low (primary education, secondary education, and vocational education) and high (secondary professional education, higher professional education, and university education).

### 2.5. Procedure

Prior to the start of the neuropsychological rehabilitation programme, questionnaires concerning general self-efficacy, self-efficacy for managing brain injury-related symptoms, and QoL were send to participants by post to complete via self-report. Participants handed in the completed questionnaires during the intake procedure. After the treatment programme the same set of questionnaires was sent to complete via self-report.

At the start of the programme, the neuropsychologist considered the need for a neuropsychological test assessment based on the patient's individual treatment goals and availability of a recently executed assessment.

### 2.6. Data analysis

All scores of the neuropsychological assessment were transformed into standardized z-scores (test score minus the average score of the healthy norm group, divided by the standard deviation of the healthy norm group). A cognitive domain was considered impaired if one or more of the neuropsychological tests for that domain were below cut-off (z-score $\leq -2.33$ or percentile $\leq 1$). Next, z-scores of all neuropsychological tests were summed and divided by the total number of test to create an overall standardized score of cognitive functioning.

Paired sample *t*-tests were used to compare pre- and post treatment scores on measures of QoL and self-efficacy. Assumptions of normality were checked. EQ VAS scores of our study sample were compared with the EQ VAS score of the general Dutch population (EQ VAS = 81.36) using one sample *t*-tests. Associations between levels of general and brain injury-specific self-efficacy and QoL after neuropsychological rehabilitation, and between cognitive functioning and initial self-efficacy for managing brain injury-related symptoms were examined using Pearson or Spearman's correlations as appropriate. All analyses were carried out in Stata 12.1, using two-sided hypothesis testing with an alpha-level of 0.05.

## 3. Results

Sixty-two patients were included in the study. Neuropsychological assessments of 23 patients were available that allowed for calculation of a cognitive compound score. In Table 2 the demographic and injury-related characteristics of the sample at baseline are presented. Mean duration of the programme was 6,5 months (SD = 3.4 months; range 2.0–15.8). All self-reported clinical variables are described in Table 3. Compared with the general population in the Netherlands, our study sample showed lower EQ VAS scores for both measurements (T0: $t = -9.54$, $p < 0.001$; T1: $t = -6.62$, $p < 0.001$). In Table 4 the different components of the cognitive compound score are displayed.

Table 2
Patient characteristics at start of the programme (N = 62)

| | Mean | SD | Range |
|---|---|---|---|
| Age (years) | 46.6 | 14.7 | 19–51 |
| Time since injury (months) | 27.7 | 46.2 | 1.8–251.7 |
| | n | % | |
| Sex (male) | 34 | 54.8 | |
| Level of education | | | |
| Low | 17 | 27.4 | |
| High | 44 | 71.0 | |
| Unknown | 1 | 1.6 | |
| Type of lesion | | | |
| Infarction | 22 | 35.5 | |
| Diffuse vascular lesions | 1 | 1.6 | |
| ICH | 4 | 6.4 | |
| Subdural hematoma | 3 | 4.8 | |
| Subarachnoid haemorrhage | 1 | 1.6 | |
| TBI | 18 | 29.0 | |
| Tumour | 5 | 8.1 | |
| Encephalitis | 3 | 4.8 | |
| Other | 5 | 8.1 | |

Note. SD, standard deviation; ICH, intracerebral haemorrhage; TBI, traumatic brain injury.

### 3.1. Differences between pre- and post-treatment self-efficacy and QoL (Table 3)

A significant increase in QoL (EQ VAS scores) and in self-efficacy for managing brain injury-specific symptoms (SEsx scores) was observed over the course of the neuropsychological treatment programme. No significant difference was observed between initial and post-treatment general self-efficacy (GSES).

### 3.2. Associations between self-efficacy and QoL post-treatment

Post-treatment brain injury-specific self-efficacy (SEsx) scores correlated significantly with post-treatment QoL (EQ VAS) ($r = 0.66$, $p < 0.001$). Similarly, general self-efficacy (GSES) scores were significantly associated with post-treatment QoL ($r = 0.60$, $p < 0.001$).

### 3.3. Associations between cognitive performance and self-efficacy pre-treatment

We did not observe a significant correlation between the level of cognitive performance (compound score) and pre-treatment self-efficacy for managing brain injury-specific symptoms ($r = 0.15$, $p = 0.50$) or pre-treatment general self-efficacy ($r = 0.29$, $p = 0.19$).

Table 3
Descriptive data of all clinical variables

| | Pre-treatment | | Post-treatment | | Differences | | |
|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | 95% CI | *t* | *p* |
| SEsx | 69.4 | 16.5 | 84.9 | 19.3 | 9.6–20.5 | 5.6 | <0.001 |
| GSES | 41.0 | 10.1 | 41.5 | 8.3 | −1.5–2.9 | 0.6 | .5 |
| EQ VAS | 59.9 | 17.4 | 70.4 | 12.8 | 5.1–14.4 | 4.2 | <0.001 |

Note. SD, standard deviation; 95% CI, 95% confidence interval; SEsx, TBI Self-efficacy Questionnaire total score; GSES, General Self-efficacy Scale; EQ VAS, EuroQuol visual analogue scale.

Table 4
Standardized test scores for attention, memory and information processing speed

| | Mean | SD | Range |
|---|---|---|---|
| z-score attention | 0.06 | 1.05 | −1.28–2.33 |
| z-score memory | −0.16 | 1.07 | −2.20–2.33 |
| z-score information processing speed | −0.76 | 0.45 | −1.43–0.38 |
| Cognitive compound score | −0.29 | 0.52 | −1.32–0.53 |

Note. SD, standard deviation.

## 4. Discussion

This study of patients with ABI showed that self-efficacy for managing brain injury-specific symptoms and QoL increased significantly after neuropsychological rehabilitation. Both general and brain injury-specific self-efficacy were positively associated with QoL after completion of the programme.

In our treatment programme we make use of incremental learning strategies and individualized goal setting. Specific attention is paid to the role of interfering emotions in managing the cognitive deficits, dealing with the diverse consequences of brain injury and how to develop a sense of control and mastery. Emotional management and creating a new perspective on life is a major theme. Furthermore, individualized information and relapse prevention (personal document) are integrated into the programme. These elements have shown to be effective in previous research and interventions to improve self-efficacy. In a meta-analysis Sheeran et al. showed that interventions, which modify attitudes, norms and self-efficacy are effective in promoting health behaviour change (Sheeran et al., 2016). Warner et al. (Warner, Packer, Villeneuve, Audulv, & Versnel, 2015) conducted a systematic review to identify the strategies contributing to improvement of self-management after stroke. The most prominent strategies were goal-setting and follow-up, and an individualized approach using structured information and professional support (Warner et al., 2015). In brain injury, a physical activity behavioural change intervention resulted in greater weekly physical activity and self-efficacy (Driver & Woolsey, 2016). The intervention incorporated five active ingredients to facilitate the adoption and maintenance of physical activity behaviours which included (1) goal-setting and tracking progress towards goals; (2) creating social support for newly-established behaviours; (3) employing self-reward to reinforce positive behaviours; (4) using problem-solving strategies to overcome individual barriers and increase the likelihood of physical activity maintenance; and (5) maintenance of physical activity behaviours and prevention of relapse to a sedentary lifestyle (Driver, Irwin, Woolsey, & Pawlowski, 2012). In stroke patients in the chronic stage, a programme consisting of (1) theoretical information on memory and stroke; (2) training of internal and external memory strategies; and (3) psycho-education on the influence of worries, mood and anxiety on memory complaints had a short and long term positive effect on memory self-efficacy (Aben et al., 2013, 2014). As expected, a purely computer based training of cognitive functions in stroke patients did not show a significant effect on self-efficacy and QoL (Wentink et al., 2016).

Levels of brain injury-specific self-efficacy increased while general self-efficacy did not change. This might be explained by the fact that the focus of treatment is on dealing with brain injury-related changes in particular. Similar to our study, no change in general self-efficacy occurred during one year follow-up of patients with brain injury of which the majority received inpatient and/or outpatient rehabilitation (Brands, Köhler, Stapert, Wade, & van Heugten, 2014).

In contrast to a previous effectiveness study of this neuropsychological treatment programme (Brands et al., 2013), we now found a significant increase in QoL. This might be explained by the choice of measurement instrument. In the earlier study, we used the Stroke-Adapted Sickness Impact Profile (SA-SIP-30) in which the majority of questions address physical functioning and performing daily activities while this is not the primary focus of treatment. The EQ VAS measures general QoL and is a more intuitive instrument.

Cognitive performance was not associated with self-efficacy for managing brain injury-specific symptoms nor with general self-efficacy. Our findings are in line with Aben et al. who found that within a wider array of cognitive functions only word fluency contributed to self-efficacy (Aben et al., 2011). We suggest that the ability to control interfering emotions and worries, that otherwise have a negative impact on managing the consequences of brain injury, is more important in becoming self-efficacious. A possible explanation as to why no clear relation has been found in the current study might stem from the cognitive reserve hypothesis (Satz, Cole, Hardy, & Rassovsky, 2011). Cognitive reserve refers to the brain's ability to cope with damage to the brain while still functioning appropriately. Stern (Stern, 2002, 2012) has shown that individuals with higher levels of education have more cognitive reserve and are, therefore, more resilient to damage to the brain. Since the majority of patients with ABI in the current study had a high level of education (70.4%) and an average level of cognitive functioning, this might have influenced detection of associations.

Our study has several limitations. We cannot attribute conclusively the observed effect, i.e. an increase in QoL and brain injury-specific self-efficacy to our intervention as we lack a control group. Yet, most patients were in the chronic stage after brain injury in which a spontaneous change would seem unlikely. In addition, no other form of rehabilitation/treatment was offered in the study period. Furthermore, by including only the patients that completed both measurements a selection bias may have occurred in favour of highly motivated patients. To measure self-efficacy for managing brain injury-specific symptoms we used the SEsx, which, to date, is only validated for use in traumatic brain injury (Cicerone & Azulay, 2007).

In health care, promotion of self-management is an important issue, as well from the perspective of patients' autonomy as from an economical perspective i.e. controlling health care costs. Self-efficacy is essential in the development of self-management. We think that development of self-efficacy must be specifically addressed in neuropsychological rehabilitation. The presence of cognitive deficits is not an obstacle since no association was found between cognitive performance and self-efficacy. In clinical practice, we suggest to incorporate the treatment elements and techniques that have proven to be successful (see above) and to measure self-efficacy systematically. Further research should be conducted to identify the most active ingredients responsible for improvement of self-efficacy in patients with cognitive complaints.

## Conflict of interest

The authors have no competing interest to report.

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