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Associations of executive functioning, coping behaviour, psychiatric symptoms and depressive symptoms with treatment motivation in patients with acquired brain injury.

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Abstract

Aim: Low motivation to engage in treatment is often seen in patients with acquired brain injury (ABI). The aim of the current study was to find factors that are associated with treatment motivation. Therefore, associations of executive functioning, coping behaviour, neuropsychiatric symptoms and depressive symptoms with treatment motivation were examined.

Methods: In this cross-sectional study, patients with ABI and neuropsychiatric symptoms (*N*=92) were acquired from Dutch mental health institutions. Executive functioning was measured with the Trail Making Test and the Stroop test, coping styles were measured with the Utrechtse Coping List, neuropsychiatric symptoms were measured with the Neuropsychiatric Inventory Questionnaire, and depression was measured with the Patient Health Questionnaire. Treatment motivation was measured with the Motivation for Traumatic Brain Injury Rehabilitation Questionnaire. Regression analyses were used to examine associations.

Results: After correction for age, gender, educational level and type of brain injury, significant associations were found between a lower cognitive flexibility (regression coefficient, B= -4.598, *p*=.007) and lower treatment motivation. In addition, greater use of a passive coping style (B= 1.112, *p*= .006) and more depressive symptoms (B= .614, *p*= .032) were associated with higher treatment motivation. No other associations with treatment motivation were found. Cognitive flexibility was the strongest predictor of the three significant predictors (standardised regression coefficient, β= -.271, *p*= .011).

Conclusion: Current findings suggest that clinicians must be aware of a lower treatment motivation in patients with lower cognitive flexibility. For future research, a longitudinal study is suggested to examine causal relationships.

Keywords: Treatment motivation, executive functioning, coping behaviour, neuropsychiatric symptoms, depressive symptoms

Introduction

A problem that is often observed in patients with acquired brain injury (ABI) is low motivation, which can affect patient's commitment and maintenance in treatment (Al-Adawi, Powell & Greenwood, 1998). Therefore, motivation is an important predictor of treatment outcome in patients with ABI (Boosman, Van Heugten, Winkens, Smeets & Visser-Meily, 2015). For example, dropout, relapse and nonconformity are common features of negative treatment outcome in ABI patients with low treatment motivation.

Dysfunction of the motivational process includes a reduction in goal-directed motor behaviour, emotional activity and cognitive activity (Arciniegas, Held &Wagner, 2002). Some conceptual ambiguity exists for motivation and treatment motivation. Motivation can be seen as the initiation to engage in a particular behaviour. Since treatment is no specific behaviour but a procedure, this causes ambiguity about the concept motivation for treatment (Drieschner, Lammers & van der Staak, 2004). In order to prevent ambiguity, the current study will define treatment motivation as the motivation to enter treatment or to engage in treatment (Drieschner et al., 2004).

Brain imaging studies have shown neural connections between brain structures involved in motivation, emotion and cognition (Arnsten & Rubia, 2012). A lower treatment motivation is often seen in patients with brain damage in the frontal structures (Chervinsky, Ommaya, deJonge, Spector, Schwak & Salazar, 1998). The prefrontal cortex, orbitofrontal cortex and anterior cingulate cortex are involved in motivation, but also in cognitive functions, personality and emotion (Mega & Cummings, 1994). This suggests that brain damage in these areas will lead to motivational problems, cognitive dysfunctions and alteration of personality and emotion (Mega & Cummings, 1994).

Researchers have examined the association between cognitive functioning and treatment outcome (Fals-Stewart & Lucente, 1994), and suggested a negative effect of cognitive problems on treatment outcome. However, fewer studies focused on treatment motivation of the patient (Severtson, von Thomsen, Hedden & Latimer, 2010). Knowledge about factors that are potentially associated with treatment motivation can be helpful in adapting treatment to the patient's motivational characteristics. Therefore, studying treatment motivation, particularly factors that may be associated with treatment motivation, is important because clinicians can adapt treatment to the patient's motivation. Several factors have been associated with treatment motivation. For example, distress, outcome expectancy, willingness to participate actively and awareness of deficits (Drieschner et al., 2004; Smeets et al., 2014).

In addition, personal loss and psychological trauma events may have an influence on treatment motivation (Marin & Wilkosz, 2005). As motivation is mainly located in the frontal brain structures, which has connections to cognition, personality and emotion (Arnsten & Rubia, 2012), factors that are related to these areas may be important to examine. Therefore, in the current study we focused on the following factors: executive functioning, coping styles, neuropsychiatric symptoms, and depression.

The association between executive functioning and treatment motivation can be explained by psychological mechanisms, such as flexible adjustment behaviour which is important for reward anticipation (Ridderinkhof, van den Wildenberg, Segalowitz & Carter, 2004). In addition, the neural structures for executive functions and motivation both have close connections with the anterior cingulate cortex (Braver et al., 2014), this reinforces the suspicion to the link between executive functioning and treatment motivation. Previous research has shown that executive functions responsible for adapting, including abstract reasoning, cognitive flexibility and planning, negatively influence the motivation for treatment in patients with psychiatric disorders (Blume, Davis & Schmaling, 1999). This suggests that problems in adapting are related to a lower motivation. Furthermore, monitoring and control are components of executive functioning, that form a basis for adaptive learning and thinking which are engaged in motivation (Borkowski, Chan & Muthukrishna, 2000). According to Severtson and colleagues (2010), conceptual reasoning is another executive function that is related to treatment motivation. Deficits in response inhibition can have a negative effect on the self regulation of motivation for task performing (Carlson & Tamm, 2000). Deficits in reward processing were underlying to problems in response inhibition that were related to a lower motivation to engage in tasks (Sonuga-Barke, 2005). As was shown, response inhibition is associated with the motivation to engage in tasks (Carlson & Tamm, 2000; Sonuga-Barke, 2005), but research for the associations with the motivation to engage in treatment is lacking to our knowledge. Therefore, the current study is interested in examining the association between response inhibition and treatment motivation.

Another factor that is often affected by brain injury and may be associated with treatment motivation is coping behaviour (Wells, Fisher, Myers, Wheatley, Patel & Brewin, 2012). A study showed that frontal lobe injury ensured a poorer coping ability (Stuss, 2011). Motivation and coping ability both have neural connection with the frontal lobe, which makes an association between coping behaviour and motivation plausible. Patients with ABI often use a passive emotion focused coping style instead of an active problem-focused coping style, while an active coping style predicts a higher quality of life (Wolters Gregório et al., in press;

Wolters, Stapert, Brands & Van Heugten, 2010). Little research has been done on associations of coping behaviour with treatment motivation, however passive coping strategies seem to negatively affect engagement in treatment in depressive patients (Wells et al., 2012). In addition, Duivenvoorden (1982) suggested that the improvement of coping strategies may cause a higher treatment motivation. Therefore, it is interesting to examine the association between coping styles and treatment motivation.

About one third of traumatic brain injury patients also have psychiatric disorders (Wolters Gregório et al., in press). Presence of neuropsychiatric disorders in patients with brain injury may have an influence on patient's treatment motivation. For example, irritability, apathy and impaired initiative often occur after frontal brain damage and these symptoms may be related to the participation in treatment (Chervinsky, Ommaya, deJonge, Spector, Schwak & Salazar, 1998). These examples are troublesome in the treatment of patients with ABI (Alderman, 2003). Low treatment motivation in patients with traumatic brain injury is often seen in patients with apathy, and is common in depression as well (Marin & Wilkosz, 2005). Therefore, it is expected that depression is associated with treatment motivation (Beck & Alford, 2009). One problem that people with depression encounter is that they know what they should do, but don't feel the urge to do it (Beck & Alford, 2009). The lack of an adequate response to reward is a feature of depression that predicts a low motivation in patients (Austin, Mitchell & Goodwin, 2001). Furthermore, depressive patients may blame themselves for their depression which causes a decrease in self-esteem and motivation for treatment (Yohannes & Alexopoulos, 2014). To our knowledge, the association between depression and treatment motivation has not yet been examined in patients with ABI.

It is important to find factors that are associated with treatment motivation, because of the negative effect of treatment motivation on treatment outcome (Boosman et al., 2015). This may help clinicians to adapt their treatment by taking the factors causing a low treatment motivation into account and may lead to better treatment outcomes, and eventually to a better quality of life of ABI patients (Johnston & Miklos, 2002). However, only a few studies have focused on factors that may be associated with treatment motivations; especially in ABI patients with neuropsychiatric symptoms research on this topic is scarce. Therefore, the current study examined the association of executive functioning, coping behaviour, neuropsychiatric symptoms and depression with treatment motivation in patients with ABI and neuropsychiatric symptoms. The first hypothesis was that executive dysfunctions were associated with lower treatment motivation. Second, greater use of a passive coping style was

expected to associate with lower treatment motivation. A higher amount of neuropsychiatric symptoms was expected to be associated with a lower treatment motivation. Finally, the last hypothesis was that more depressive symptoms were associated with a lower treatment motivation.

Methods

Participants:

In this study 92 patients with ABI and neuropsychiatric problems were included. Inclusion was based on the completion of the MOT-Q. The patients were acquired from several Dutch mental health institutions Vesalius (*N* = 62), Huize Padua (*N* = 22), Bavo (*N* = 5) and Thalamus (*N* = 3). These institutions have a shared database for acquired brain injury patients, called the SINAH (Samenwerkende Instellingen Niet-Aangeboren Hersenletsel) database.

Measurements

Independent variables:

Executive functions:

The Trail Making Test (TMT) was used as a test for executive functioning (Armitage, 1946), and requires functions as attention and cognitive flexibility. The test consists of two parts. In part A the patient has to connect the numbered circles, and in part B the patient has to connect numbered circles and lettered circles based on the alphabet as fast as possible (Lezak, Howieson, Bigler & Tranel, 2012). Scores on task A and B of the TMT, higher than 300 seconds were reduced to 300 seconds. A high TMT B/A ratio score indicates lower cognitive flexibility (Kortte, Horner & Windham, 2002; Arbuthnott & Frank, 2000). The ratio was used as a measure of executive functioning.

The Stroop test (Stroop, 1935) can be used to measure response inhibition, selective attention and concentration. The task was regarded as a test of executive functioning because it needs inhibitory control to execute the test (Lezak et al., 2012). The test consists of three cards. On the first card, the patient has to read black inked colour names, on the second card the patient has to name the coloured patches and on the third card the patient has to name the colour of an incongruent coloured written word (Lezak et al., 2012). Individuals are instructed to work as fast as possible. A cut-off score was used for the performance on the three tasks of the Stroop test, scores higher than 300 seconds were reduced to 300 seconds. An important measure is the Stroop-interference for response inhibition (Van der Elst, Van Boxtel, Van

Breukelen, & Jolles, 2006), computed by card 3 minus the average of the first two cards, which is used in the current study. Scores on the TMT and Stroop test were included as continuous variables.

Coping style:

The Utrechtse Coping List (UCL) is a self-reporting questionnaire that measures coping styles and shows how patients cope with stressful events (Schreurs, 1993). The questionnaire consists of 47 Likert scale items about coping behaviour, which are scored in seven subscales. The subscales of the UCL can be divided into active coping style and passive coping style. The subscale 'active problem solving' was used to measure active coping styles and the subscale 'passive reactions' was used to measure passive coping styles (Wolters, Stapert, Brands & Van Heugten, 2010). Higher scores on the active or passive subscale indicate greater use of an active or passive coping style. Retest reliability with Cronbach's alpha for active problem solving is .62 and for passive reactions .74, which is moderately high (Schreurs et al., 1993). Patients were scored for each coping style on a continuum.

Neuropsychiatric symptoms:

The total score of the Neuropsychiatric Inventory Questionnaire (NPI-Q) was used to measure the degree of neuropsychiatric symptoms (Cummings, 1994). The questionnaire consists of 12 domains: delusions, hallucinations, agitation/aggression, dysphoria/depression, anxiety, apathy, irritability, euphoria, disinhibition, aberrant motor behaviour, nighttime behaviour disturbances, and appetite and eating abnormalities. The participant was scored on each domain for frequency, severity and emotional burden. The total score is the sum of the multiplied frequency and severity of each neuropsychiatric symptom. A higher total score indicates more neuropsychiatric symptoms and a higher severity. The questionnaire was filled out by a family member or a nurse, depending on the living situation of the patient. The reliability and validity of the NPI-Q is good in a population with ABI patients (Smeets et al., 2014). The total score on the NPI-Q is a continuous variable.

The Patient Health Questionnaire (PHQ-9) is used for diagnosing depression (Kroenke, Spitzer, & Williams, 2001). The questionnaire consists of nine items that evaluate the nine DSM-IV criteria (American Psychiatric Association, 2000) of depression. The PHQ-9 is a self-report measure. Higher total scores indicate the presence of more depressive symptoms. In a previous ABI sample (Smeets et al., 2014), the internal consistency of the test was good (Cronbach's alpha = .83). The amount of depressive symptoms was scored on a continuum.

Dependent variable:

The Motivation for Traumatic Brain Injury Rehabilitation Questionnaire (MOT-Q) was used to measure motivation for participation in revalidation after ABI (Chervinsky, Ommaya, deJonge, Spector, Schwak & Salazar, 1998). The questionnaire uses 31 items of self-report, to measure the motivation to participate in rehabilitation. Higher total scores on the MOT-Q indicate a higher treatment motivation and the total score can range from -62 to 62. The MOT-Q consists of four subscales: interest in rehabilitation, lack of anger, lack of denial and reliance on professional help (Boosman et al., 2015). In the current study, the total MOT-Q score was used as a dependent variable. A previous study shows an acceptable internal consistency for the MOT-Q (Cronbach's alpha = .63) used in patients with ABI (Smeets et al., 2014).

Covariates:

Age, gender and educational level are demographic variables that will be used as covariates, these variables are often used covariates in this research field, like in a similar study of Smeets and colleagues (2014). Educational level is divided into eight levels: 1) primary education, 2) lower vocational education, 3) intermediate general secondary education, 4) intermediate vocational education, 5) higher general secondary education, 6) higher vocational education, 7) higher general education and 8) university. These levels were divided into low education (1-2) and high education (3-8). This is based on the standardized Dutch schooling system (De Bie, 1987). Type of brain injury (vascular, traumatic and other) and time since brain injury will be added as covariates in case of a significant relation with treatment motivation. It is expected that different types of brain injury can have different effects on treatment motivation and predictors, because types of brain injury can vary in the effect on neural processes. More time since brain injury is interesting because it indicates a poorer treatment motivation (Stevens, Verdejo-García, Roeyers, Goudriaan & Van der Plasschen, 2015) and possibly influences the predictors as well.

Procedure:

This study is a cross-sectional study. Patients completed an informed consent before neuropsychological assessment. Patients were included if they sufficiently mastered the Dutch language, if they were able to execute the questionnaires according to clinical judgment and when there was no degenerative brain disease or whiplash. Demographic information and

injury-related information was collected from the patient's file. The assessments were conducted by a neuropsychologist or a test-assistant. There was no specific order in which the tests were executed. The questionnaires were completed after neuropsychological assessment. Neuropsychological tests were administered for clinical use and questionnaires were administered for research purposes. A selection of tests and questionnaires was made for the current study. Ethics Committee of Maastricht University Medical Centre and the research committees of each of the participating institutions approved the procedure.

Analyses:

All hypotheses were tested with a Linear Regression analysis. The two measurements of executive functioning were included separately in the analysis, because of the different executive functions they measure. A Square Root transformation was used for the Stroop interference score to meet the assumptions of normality and linearity. Associations with scores on the active and passive coping style and treatment motivation were investigated separately. Age, gender and level of education were used as covariates in a Multiple Regression. A one-way Analysis of Variance (ANOVA) tested the association between type of brain injury and treatment motivation. Correlational analysis tested the association of the time since brain injury with treatment motivation. In case of a significant relation of 'type of brain injury' or 'time since brain injury' with treatment motivation, the variable was added to the model as a covariate.

Three models were created. In the first model, no covariates were included. Only the associations between the independent and dependent variables were shown in this model. In the second model, the independent variables were corrected for age, gender and educational level. The variable 'type of brain injury' was added to the covariates in the third model.

After correcting predictors for potential covariates, significant predictors were tested with a Multiple Regression analysis to find the most predicting factor.

All analyses were executed in IBM SPSS Statistics 21. To determine if results were significant, an alpha of .05 was used. Z-scores higher than 3 or lower than -3 were regarded as outliers. After the first examination, the outliers were excluded from analysis to control for the influence of the outlier.

Results

Sample characteristics

Table 1 presents information about demographic variables, potential covariates, scores of patients on the neuropsychological tests and questionnaires. The TMT and the Stroop Test were completed by 89 patients, the UCL and the PHQ-9 were completed by 92 patients and the NPI-Q was completed by 53 patients. The most reported neuropsychiatric symptoms were irritability (53%), depression (42%), agitation (28%) and apathy (28%).

Table 1. Characteristics of the population.

	Patient information
Age (years)	45.49 (12.75)
Gender, male, N (%)	62 (67.4)
Educational level, low, N (%)	26 (28.3)
Type of brain injury, vascular/traumatic/other, N (%)	26 (27.2)/41(44.6)/26(28.3)
Time since brain injury (years)	10.97 (10.93)
TMT b/a ratio (score)	2.45 (1.09)
Stroop interference (seconds), median (IQR)	38 (26 to 54.5)
UCL active scale (score)	16.84 (4.23)
UCL passive scale (score)	15.17 (6.17)
NPI-Q (score)	20.75 (13.95)
PHQ-9 (score)	8.85 (5.89)
MOT-Q (score)	16.46 (15.46)

Values are the mean (SD) score unless stated otherwise. The NPI-Q was available for only 53 patients.

Covariates

The association of type of brain injury and time since brain injury with treatment motivation was examined. Type of brain injury was divided into vascular, traumatic and other. ANOVA analysis showed a significant difference in scores on the MOT-Q for the three types of brain injuries (F (2, 89) = 5.251, p = .007). Therefore, the variable 'type of brain injury' was used as a covariate. A post-hoc Least Significant Difference (LSD) with a 95% confidence interval showed that patients with traumatic brain injury were significantly ($p < .05$) more motivated for treatment (M = 21.73, SD = 12.18) than patients with vascular or other type of brain injuries (M = 14.41, SD = 14.89 for vascular brain injury; M = 10.1, SD = 18.12 for other brain injury). These results are presented in Figure 1.

There was no significant correlation between the time since brain injury and treatment motivation (r = .014, N = 92, p = .896). Therefore, the variable 'time since brain injury' was not added as a covariate.

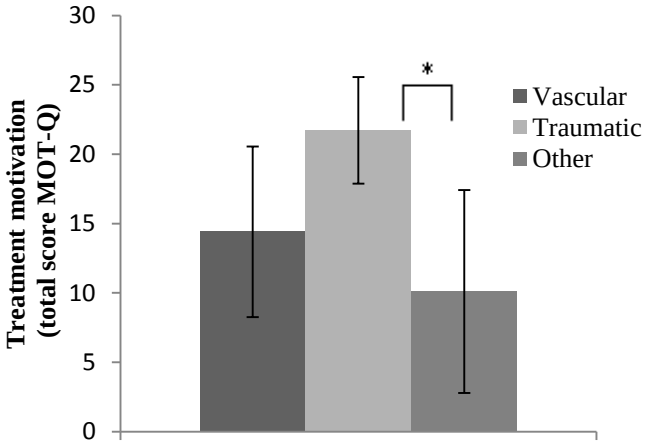

Figure 1. This figure presents the mean score on the MOT-Q for different types of brain injuries. * p < .05

The association of executive functioning, coping behaviour, neuropsychiatric symptoms and depression with treatment motivation.

The first model of Table 2 presents the associations of executive functioning, coping styles, neuropsychiatric symptoms and depression with treatment motivation. A significant association of the TMT B/A ratio with treatment motivation was found (regression coefficient B = -5.011, standardized regression coefficient *ß* = -.321, p <.05). In Table 2 (Model 2), the covariates age, gender and educational level were added to model 1. The association between the TMT B/A ratio score and the score on the MOT-Q was slightly changed by the correction (B = -4.238, *ß* = -.272). In Table 2 (Model 3), the covariate type of brain injury was added to model 2. The association between the TMT B/A ratio score and the MOT-Q score did not change by the correction (Table 2, Model 2-3). One extreme low score on the MOT-Q was found (Z = -4.358). Analysis without this outlier still showed a significant association, albeit somewhat attenuated (B = -3.658, *ß* = -.260, p < .05). Therefore, a higher TMT B/A ratio, indicating worse cognitive flexibility, was related to a lower motivation for treatment. As seen in Table 2 (model 1), the Stroop interference score was no significant predictor for treatment motivation (B = -1.315, *ß* = -.132, p = .125). The correction in the second model showed a slight attenuation of the association (B = .900, *ß*= -.130). After adding the covariate 'type of brain injury' to the second model, the association did not change.

No significant association between an active coping style and treatment motivation was found (B = .375, *ß* = .103, p = .330) in the first model (Table 2, Model 1). The association did not change after correction for covariates (Table 2, Model 2-3). After

controlling the active coping style for age, gender, educational level and type of brain injury for type, there was a significant change of the model (*Δ R2* = .077, F change = .026, $p < .05$). The association between an active coping style and the MOT-Q showed a slight change by the correction (Table 2, Model 3). In the first model a passive coping style was significantly associated with treatment motivation (B = 1.230, *ß* = .332, $p < .05$) (Table 2, Model 1). The association did not change after correction for covariates (Table 2, Model 2-3). This suggests an association between a higher score on the passive coping scale and a higher score on the MOT-Q.

There was no significant association between the total NPI-Q score and treatment motivation (B = .200, *ß* = .224, $p = .106$) (Table 2, model 1). No big changes were found after the correction in the second and the third model (Table 2, Model 2-3). The total score on the PHQ-9 was significantly associated with treatment motivation (B = .832, *ß* = .317, $p < .05$), as was shown in Table 2 (Model 1). No big changes were found after the correction in the second and the third model (Table 2, Model 2-3). A higher severity of depressive symptoms was therefore associated with a higher treatment motivation.

Table 2. A Linear Regression analysis with treatment motivation (MOT-Q) as a dependent variable and executive functions, coping styles, neuropsychiatric symptoms and depression as predictors.

		B	*SE*	*B*	*p*	R^2	95% CI
Executive functioning							
TMT B/A ratio (*n* = 89)	Model 1	-5.011	1.584	-.321	.002	.103	-8.160 to -1.863
	Model 2	-4.238	1.732	-.272	.016	.122	-7.681 to -.794
	Model 3	-4.598	1.664	-.295	.007	.215	-7.908 to -1.287
Stroop interference	Model 1	-1.315	.847	-.191	.125	.036	-3.007 to .377
(*n* = 89)	Model 2	-.900	.886	-.130	.314	.079	-2.672 to .871
	Model 3	-1.152	.895	-.167	.203	.157	-2.943 to .639
Coping style							
UCL active (*n* = 92)	Model 1	.375	.383	.103	.330	.011	-.386 to 1.136
	Model 2	.277	.392	.076	.481	.062	-.501 to 1.056
	Model 3	.236	.386	.065	.541	.139	-.530 to 1.003
UCL passive (*n* = 92)	Model 1	1.230	.369	.332	.001	.110	.497 to 1.963
	Model 2	1.259	.395	.339	.002	.155	.474 to 2.044
	Model 3	1.112	.391	.300	.006	.210	.334 to 1.890
Neuropsychiatric symptoms							
NPI-Q (*n* = 53)	Model 1	.200	.122	.224	.106	.050	-.044 to .445
	Model 2	.232	.123	.260	.066	.123	-.016 to .480
	Model 3	.200	.123	.223	.111	.187	-.047 to .446
PHQ-9 (*n* = 92)	Model 1	.832	.262	.317	.002	.100	.311 to 1.353
	Model 2	.768	.277	.293	.007	.133	.218 to 1.318
	Model 3	.614	.281	.234	.032	.181	.055 to 1.174

*p<.05 Model 1= crude model; Model 2= Model 1 corrected for age, gender and educational level; Model 3= Model 1 corrected for age, gender, educational level and type of brain injury.

All significant predictors from Table 2 (Model 3) were used in the analysis. Table 3 shows that the TMT B/A ratio score was the only significant predictor for treatment motivation (ß = -.271, t (89) = -2.589, $p < .05$), when analysed together with a passive coping style (ß = .219, t (89) = 1.607, $p > .05$) and depression (ß = .063, t (89) = .468, $p > .05$).

Table 3. A Multiple Regression analysis with the significant predictors for the MOT-Q, corrected for age, gender, educational level and type of brain injury.

Predictor	B	*SE*	β	*p*	95% CI
Executive functioning					
TMT B/A ratio	-4.224	1.631	-.271	.011	-7.471 to -.977
Coping style					
UCL passive	.820	.510	.219	.112	-.195 to 1.834
Depression					
PHQ-9	.167	.356	.063	.641	-.542 to .876

Discussion

The aim of the current study was to examine whether executive functioning, i.e. cognitive flexibility and response inhibition, coping style, neuropsychiatric symptoms and depression were associated with treatment motivation. In this study, we found that cognitive flexibility was significantly associated with treatment motivation. Patients with worse cognitive flexibility were less motivated for treatment. In contrast, response inhibition was not related to treatment motivation. Considering coping style, an active coping style was not associated with treatment motivation while greater use of a passive coping style was associated with a higher treatment motivation. Furthermore, the total neuropsychiatric symptoms were not associated with treatment motivation. However, more depressive symptoms were associated with a higher motivation for treatment. Cognitive flexibility was the strongest associated with treatment motivation, out of the three significant predictors.

In line with our hypothesis, a significant association of a lower cognitive flexibility with lower treatment motivation was found. Earlier, a study by Blume and colleagues (1999) showed a negative effect for cognitive flexibility on treatment motivation. The psychological mechanism underlying to the association between cognitive flexibility and treatment motivation, may be due to reduced reward anticipation. Reward anticipation is the capacity to consider a prospective reward, which implicates flexible adjustment behaviour. A flexible

adjustment of behaviour is needed for the assessment of action outcomes. Therefore, cognitive inflexibility may be related to reduced reward anticipation and insight in the usefulness of treatment, which can lead to a lower treatment motivation. Against our expectations, no association between response inhibition and the motivation to engage in treatment was found. Previous studies did find a negative effect of problems in response inhibition on treatment motivation, but this was for components during treatment such as engaging in tasks and tasks performing (Carlson & Tamm, 2000; Sonuga-Barke, 2005). Deficits in reward processing were underlying to problems in response inhibition that were related to a lower motivation (Sonuga-Barke, 2005). The difference between earlier findings and the findings of the current study can be explained by the difference in the measurement of treatment motivation, Carlson and Tamm (2000) used a behavioural motivation measure and the current study used a questionnaire which could have outlined different views of treatment motivation.

This study expected an association of active coping behaviour with a higher treatment motivation and of passive coping behaviour with a lower treatment motivation. Against our expectations, there was no association between an active coping style and treatment motivation. However, greater use of a passive coping style was associated with a higher treatment motivation. The results of the current study are inconsistent with the study of Wells and colleagues (2012), which suggested that the use of passive coping strategies, i.e. scanning for negative symptoms and reduced activity, causes a reduced engagement in therapy. Conversely, other suggestions about how a passive coping style can be associated with the motivation to engage in treatment have also been made in other studies.

One previous study reported that using an emotion-focused coping style, another term for a passive coping style (Wolters, Stapert, Brands & Van Heugten, 2010), in the acute phase (between 0 to 6 months after brain injury) is most beneficial for adjustment to acquired disabilities (Dawson, Catanzaro, Firestone, Schwartz & Stuss, 2006). Furthermore, a longitudinal study found an increase of adopting emotional support between 2 and 8 years after brain injury in patients with a passive coping style (Tomberg, Toomela, Ennok & Tikk, 2007). In addition, people who had a greater use of an emotion-focused coping style had a more positive psychological adjustment to physical illness (Roesch & Weiner, 2001). This may lead to more motivation for treatment, because the disabilities are considered to be improvable. Emotion-focused coping strategies include strategies as seeking for emotional support, to reduce the emotional reaction (Roesch & Weiner, 2001). Patients who seek for more emotional support may be more motivated for treatment. This may explain the

association between a greater use of a passive coping style and a higher treatment motivation. Our initial expectations were different, but the previous mentioned studies may indicate that other associations are also possible. It suggests that people with a greater use of a passive coping style more often seek for emotional support, perhaps by entering therapy.

We further hypothesised that more neuropsychiatric symptoms were associated with a lower treatment motivation. Against expectations, no association between neuropsychiatric symptoms and treatment motivation was found. When looking more specific at depressive symptoms, it was expected that more depressive symptoms were associated with a lower treatment motivation. This expectation was not confirmed in the current study, which found an association between more depression symptoms and a higher treatment motivation. An explanation for this unexpected finding may involve the influence of awareness of deficits. The study of Fleming and colleagues (1998) found a relationship between more self-awareness and a higher treatment motivation. Furthermore, Smeets and colleagues (2014) found that more depressive symptoms were associated with a higher awareness of deficits after brain injury. It may be that more self-awareness of deficits is more common in depressive patients because they focus on negative outcomes such as their deficiencies (Pyszczynski & Greenberg, 1987), a result of this awareness of deficits can be more motivation to enter treatment. This suggestion should be taken into further research.

A strength of the current study is the focus on a group of patients with ABI and neuropsychiatric symptoms that is not often investigated. Furthermore, the association of executive functioning, coping style, neuropsychiatric symptoms and depression with treatment motivation has not been previously reported.

The current study also has some limitations that should be discussed. It is suggested that the MOT-Q should only be used together with clinical judgment because a higher score on the MOT-Q does not necessarily imply a better motivation (Boosman et al., 2015). However, the MOT-Q is valid for research purposes because it is highly correlated with the Visual Analogue Scale (VAS) for treatment motivation. The VAS is known as a reliable and valid measurement tool for research and clinical purposes (Wewers & Lowe, 1990). The high correlation underlines the quality of the MOT-Q for research purposes. However, it would have been interesting to measure treatment motivation with real treatment behaviour, for example treatment compliance. A limitation of this study is that the Behavioural Assessment of the Dysexecutive Syndrome (BADS) has a better ecological validity compared to the TMT (Norris & Tate, 2010), which is used in the current study. Therefore, the BADS could be an interesting measure for future research because it may be even a better measure for real-life

executive functioning, and it provides a more complete picture of executive functioning which is integrated by several executive functions (Norris & Tate, 2010). However, the ecological validity of the TMT trail B and the Stroop test is higher compared to the Wisconsin Card Sorting Test and the Controlled Oral Word Association Test (Chaytor, Schmitter-Edgecombea & Burrc, 2006). It is important to discuss the non-inclusion of the location of brain injury, through insufficient information. Looking at previous research about neural correlates, location of brain injury will be an important factor for future research. In addition, the current study uses educational level and not the Intelligence Quotient (IQ) score, because IQ score was only known for the patients of Huize Padua. The IQ score would have been better in reflecting current cognitive functioning, however it is shown that IQ score produced overcorrected findings for neurocognitive functions (Dennis, Francis, Cirino, Schachar, Barnes & Fletcher, 2009). Finally, a limitation of this study is the cross-sectional design. With this design, causal relations could not be inferred and reverse effects could not be ruled out. For example, previous research found that motivation can also have an influence on executive functioning and coping behaviour (Graham & Golan, 1991; Litt, Kadden, Cooney & Kabela, 2003). It is suggested that a lower motivation is associated with a less efficient organization and retrieval of information (Graham & Golan, 1991). In addition, high motivation to engage in treatment could lead to adopting active coping strategies to achieve a good treatment outcome (Litt, Kadden, Cooney & Kabela, 2003).

The goal of the current study was to find factors that are associated with treatment motivation, so clinicians can take these factors into account when making a treatment plan. Results of the current study show an interesting association between executive functioning, specifically cognitive flexibility, and treatment motivation. For future research it is suggested to further examine the association between executive functioning and treatment motivation, by using tests that measure other domains than cognitive flexibility and response inhibition. As Blume and colleagues (1999) already suggested, planning could have an interesting association with treatment motivation. Furthermore, it would be interesting to investigate the influence of awareness of deficits on the association of executive functioning and depressive symptoms with treatment motivation. This was supported by previous findings which suggested that a higher awareness of deficits is associated with more depression symptoms and with a higher treatment motivation (Smeets et al., 2014; Fleming et al., 1998). Furthermore, the association between a greater unawareness of deficits and more executive dysfunctions (Bogod, Mateer & Macdonald, 2003) also supports future research into the

effect of awareness of deficits on the association of executive functioning with treatment motivation. Finally, a longitudinal study is recommended to examine causal relationships.

Clinical implications

The findings of this study suggest that clinicians must be aware of a lower treatment motivation when patients have a lower cognitive flexibility. Clinicians may consider investigating patient's treatment motivation when they have problems in executive functioning. Against expectations, a passive coping style and more depressive symptoms were associated to a higher treatment motivation. Although patients who use a more passive coping style seem to be motivated to engage in treatment, a higher quality of life is predicted in patients with a more active coping style (Wolters et al., 2010), which suggests a better treatment outcome in this patient group. Different findings for the associations of a passive coping style and depression with treatment motivation are shown in previous studies and the current study, more research is needed to give clinical implications.

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