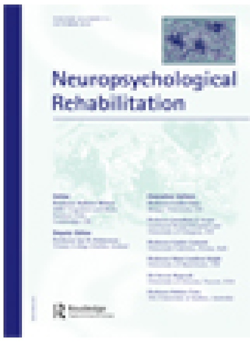

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The relationship between social cognition and participation in the long term after stroke

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ABSTRACT

Social cognitive impairments may play a role in participation restrictions after stroke. Understanding their relationship could inform treatment approaches to improve participation. We investigated the relationship between social cognition and participation in the long term after stroke. Of 395 patients participating in a large prospective cohort study, cross-sectional data were available at 3–4 years post-stroke of 118 patients on tests for emotion recognition, theory of mind, empathy, and behaviour regulation. Participation was assessed with the Utrecht Scale for Evaluation of Rehabilitation – Participation (USER-P). Bivariate and multivariate regression analysis were used to examine the relationship between social cognitive domains and participation. The majority suffered from minor stroke (83.1% scored NIHSS 0–4). Only behaviour regulation was related to participation restrictions in bivariate analysis, but social cognitive impairments did not predict participation restrictions in multivariate regression in this group. To conclude, in a sample of minor stroke patients with mild impairments in theory of mind, emotion recognition and behavioural control, there were no associations with restrictions in participation. Research should examine whether a relationship is present in patients with more severe stroke. In addition, measuring

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social aspects of participation is necessary to further unravel this relationship, to determine treatment targets for improving participation.

Introduction

Many patients with stroke experience difficulties with participating in work or social, community and recreational activities (Bergström, Guidetti, Tham, & Eriksson, 2017; Wolf, Brey, Baum, & Connor, 2012) and have a lower life quality as a result (de Graaf et al., 2018; Edwards, Hahn, Baum, & Dromerick, 2006). Established predictors of negative participation outcomes include cognitive deficits, physical sequelae and fatigue (Ezekiel et al., 2018; Fride et al., 2015). Social cognitive impairments – deficits in the ability to perceive, understand and adequately respond to social cues (Adolphs, 2001; Frith & Frith, 2012; Green et al., 2008) – underlie problematic social behaviour and interpersonal communication (e.g., lack of concern for others and poor social judgement). This, in turn, may affect participation (Narme, Roussel, Mouras, Krystkowiak, & Godefroy, 2017; Zupan, Neumann, Babbage, & Willer, 2015) as social and vocational participation usually require adequate social interactions.

In stroke patients, impairments in social cognition have been reported with regard to the ability to recognize emotions in others (Abbott, Wijeratne, Hughes, Perre, & Lindell, 2014; Leite, Guerreiro, Almeida, & Peixoto, 2017; Nijsse, Spikman, Visser-Meily, de Kort, & van Heugten, 2019b; Yuvaraj et al., 2013) and the ability to reason about one's own and others' beliefs, feelings, intentions and knowledge (theory of mind; ToM) (Hamilton, Radlak, Morris, & Phillips, 2017; Martín-Rodríguez & León-Carrión, 2010; Nijsse et al., 2019b; Yeh & Tsai, 2014). Findings are mixed for the domain of empathy, with some (Hillis, 2014; Leigh et al., 2013; Yeh & Tsai, 2014) but not all studies reporting a decrease in sharing of emotions and feeling with another's feelings (Nijsse et al., 2019b). Most research on social cognition after stroke aimed to determine its neural underpinnings, specifically lateralization of impairments (Baldo, Kacinik, Moncrief, Beghin, & Dronkers, 2016; Hamilton et al., 2017; Yeh & Tsai, 2014; Yeh, Lo, Tsai, & Tsai, 2015; Yuvaraj et al., 2013).

Studies in patients with moderate to severe traumatic brain injury (TBI) support the relationship between social cognition and participation (May et al., 2017; Ubukata et al., 2014) and indicate that social cognition is an even stronger predictor than executive functioning (Westerhof- Evers, Fasotti, van der Naalt, & Spikman, 2018). Despite evidence for the role of social cognition in participation in severe TBI, the literature on this relationship in stroke patients is limited to the study of Cooper et al. (2014), who report an association between emotion perception deficits and reduced participation, as well as a reduced quality of life. A greater understanding of the role of social cognitive impairments on participation limitations could inform rehabilitation approaches, since optimizing participation is the most important rehabilitation goal

(Bergström et al., 2017; Wood, Connelly, & Maly, 2010). Moreover, insight into the degree to which several social cognitive domains each predict restrictions in participation could further direct interventions aiming to improve participation outcomes. For example, studies in moderate to severe TBI patients suggest that ToM, in particular, should be assessed and targeted in rehabilitation, as ToM seems to be a stronger predictor for functioning and participation than emotion recognition (Ubukata et al., 2014; Westerhof-Evers et al., 2017). For stroke, it is not clear yet to what extent social cognitive impairments influence participation. Moreover, due to recent developments in acute stroke care, the number of patients with good neurological recovery is increasing and more patients are discharged directly home, where they need to reintegrate into society (Rai et al., 2019). This means that the population of mild stroke patients is increasing, but knowledge on the relation between social cognition and participation is lacking.

The current study, therefore, investigated to what extent there are serious social cognitive impairments and to what extent these influence participation by determining the contribution of several domains of social cognition (emotion recognition, ToM, empathy and behavioural control) to participation restrictions as measured with a broad scale (the Evaluation of Rehabilitation-Participation; USER-P (van der Zee, Visser-Meily, Lindeman, Jaap Kappelle, & Post, 2013)), in a large sample of patients at 3–4 years post-stroke. We expected greater social cognitive impairments, particularly in ToM, to be associated with more restrictions in participation.

Methods

Design

This study is an extension of the Restore4Stroke study, a prospective longitudinal cohort study in which patients of six hospitals in the Netherlands participated in assessments five times over the course of two years post-stroke (van Mierlo et al., 2014). Data for the current study were collected in an additional assessment three to four years after the stroke, taking place between July 2015 and October 2016. The Restore4Stroke study and its extension were approved by the Medical Ethics Committees of all participating hospitals.

Participants

Eligible for participation were adults with a diagnosis of ischaemic or haemorrhagic stroke which was confirmed with a computed tomography scan in the acute phase. Exclusion criteria were: having a serious condition other than stroke, likely to interfere with the study outcomes (e.g., neuromuscular disease), evidence of visual neglect and serious aphasia (since such problems are likely to bias results on the social cognitive tests), dependence in activities of daily living before stroke (Barthel Index (BI) (Collin, Wade, Davies, & Horne, 1988) of ≤17) or cognitive decline prior to the stroke (≥1 on the Hetero Anamnesis List Cognition (Meijer, Van Limbeek, & De Haan, 2006)) and insufficient command of the Dutch language.

Procedures

Demographic and stroke-related information was obtained by a trial nurse. Three to four years post-stroke, social cognitive functioning and participation were assessed as part of an assessment conducted by trained research assistants in the nearest hospital or at the patients' home. All patients gave informed consent.

Measures

Social cognition

To assess facial emotion recognition, the Ekman 60-Faces test of the Facial Expression of Emotion Stimuli and Tests (FEEST) (Young, Perrett, Calder, Sprengelmeyer, & Ekman, 2002) was used. A total of 60 faces were shown, displaying ten of each of the basic emotions of fear, disgust, anger, happiness, sadness or surprise for three seconds each. Scores range from 0 to 60, higher scores reflecting better emotion recognition.

ToM was assessed with the Cartoon test (Happé, Brownell, & Winner, 1999) and the shortened version of the Faux Pas (FP) test (Stone, Baron-Cohen, & Knight, 1998). In the Cartoon test, participants were asked to describe 12 cartoons of humorous situations. Half of the cartoons merely require mental state attribution of the cartoon artist to understand the humorous situation, the other half requires ToM to understand the joke, which is based on the false belief or ignorance of a character in the cartoon. Scores range from 0 to 36, higher scores indicate better ToM. Cronbach's α in this sample is 0.76. The FP test measures the ability to judge inappropriate behaviour in social situations. It requires participants to recognize when someone mistakenly says something awkward, hurtful or insulting to someone else without realizing one should not say it (a faux pas). We used the short version of the FP test, developed by our group. The test consists of 10 short stories (Spikman, Timmerman, Milders, Veenstra, & van der Naalt, 2012) requiring belief attribution and inferences about a person's feelings to detect the social faux pas present in five stories. The short FP test version A consists of Stone's items 1, 3, 5, 8, 12, 13, 14, 16, 18, 19; version B contains items 2, 4, 6, 7, 9, 10, 11, 15, 17, 20. Scores range from 0 to 10, higher scores reflecting better ToM. Cronbach's α cannot be calculated.

Empathy was measured by asking participants to describe the feelings of the faux pas victim in the FP test. Answers were scored using the scoring form developed for the 10-item short version. Scores range from 0 to 5, higher scores reflects greater emphatic ability. In addition, the Balanced Emotional Empathy Scale (BEES) (Mehrabian, 2000) was assessed. The BEES contains 30 statements such as "Unhappy movie endings haunt me for hours" or "I cannot feel much sorrow for those who are responsible for their own misery," rated on a scale of −4 (very strong disagreement) to +4 (very strong agreement); higher total scores (−120–120) reflect higher levels of emotional empathy. Cronbach's α in this sample is 0.77.

Behaviour regulation (inhibition) was assessed with the Hayling Sentence Completion test (Burgess & Shallice, 1997), in which participants are asked to fill in the last word of a total of 30 sentences. For the first 15 sentences, participants are asked to simply complete the sentence, with the goal of measuring response initiation speed. For the latter 15, participants are asked to suppress the expected word for sentence completion and to finish the sentence with a nonsense word. Response suppression ability and thinking time are measured on a scale ranging from 1 (impaired) to 10 (very superior). Cronbach's α in this sample is 0.75.

The mean scores on social cognitive tasks and the comparison with the performance of healthy controls have been described elsewhere (see Nijsse et al., 2019b). Briefly, differences between patients and healthy controls were small but significant for the FEEST, Cartoon Test and Hayling test. No significant differences were found for the empathy measures and faux pas detection.

Participation

The participation restrictions subscale of the Utrecht Scale for Evaluation of Rehabilitation-Participation (USER-P (van der Zee et al., 2013)) was used to measure participation limitations as a consequence of stroke. The subscale consists of 11 items involving work or study, housekeeping, mobility, physical exercise, going out, leisure indoors, leisure outdoors, partner relationship, visits to family or friends, visits from family or friends and contact with others. Items are rated on a scale ranging from 0 (not possible) to 3 (without difficulty) and a "not applicable" option. The total score ranges from 0 to 100 based on the number of applicable items, higher scores indicate less restrictions in participation. The scale has shown sufficient reproducibility and validity in terms of internal consistency, construct and discriminant validity in rehabilitation outpatients (Post et al., 2012; van der Zee et al., 2010).

Demographic and stroke-related characteristics

At the first assessment within four days after stroke, information on demographic information on age, gender and level of education (classification of Verhage (1964)) was collected. Severity of stroke was assessed with the National Institutes of Health Stroke Scale (NIHSS (Brott et al., 1989)) and functioning with regard to activities of daily living was assessed with the Barthel Index (BI) (Collin et al., 1988). Other stroke-related information was obtained from medical charts and included lateralization, type of stroke (ischaemic or haemorrhagic) and history of previous stroke(s). Cognitive impairment was assessed with the Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005) at 3–4 years post-stroke.

Statistical analysis

Characteristics of participants who completed the social cognitive measurements at 3–4 years post-stroke were compared to the complete cohort using Chi-square and *t*-tests. Bivariate regression analyses were used to determine which demographic (gender, age, education) and injury related characteristics (NIHSS, BI, MOCA) and which social cognition variables (FEEST, Cartoon test, faux pas detection, faux pas empathy, BEES, Hayling test) were significantly associated with participation (USER-P-R). Subsequently, hierarchical regression analyses were conducted to assess the ability of social cognition variables to predict participation, after controlling for the influence of demographic and injury-related factors, that were significant in bivariate analyses (alpha was set at 0.05). There was no evidence for violation of the assumptions of normality, linearity, multicollinearity (tolerance value >0.10, VIF <10, correlations between the variables <0.7) and homoscedasticity. Analyses were conducted using IBM SPSS statistics version 24.

Results

Participants

A total of 395 patients were included in the Restore4Stroke cohort study. At 3–4 years, 160 patients

(40.5%) were eligible for further testing. With respect to the 235 resigned patients, 33 patients died, 120 patients refused further participation, 47 patients could not be reached, and in 35 patients it was not possible to conduct the assessment at 3–4 years because of their general physical condition. Two patients had evidence of visual neglect according to the results of the Bells test, ten patients had evidence of a language disorder according to the results of the BNT or the clinical judgement of the neuropsychologist. They were all excluded, which resulted in a total of 148 patients. For 118 patients social cognition and participation data were available for analysis. Table 1 shows the demographic and stroke-related characteristics of the participants ($n = 118$). Patients who participated in the additional measurement at 3–4 years post-stroke were younger at baseline than those who did not (63.6 years versus 67.9 years, $p = 0.001$), but the groups did not differ otherwise. The age range of the participants was 30.3–86.4 years. Participants were generally mildly affected, 83.1% experienced no or minor stroke symptoms (NIHSS) and 60.2% were ADL independent (BI) 4 days post-stroke; 53.9% showed normal cognitive functioning (MoCA > 25) 3–4 years post-stroke. The USER-P restrictions score was 86.6 (19.4).

Table 1 . Characteristics of stroke patients ($n = 118$).

	Participants ($n = 118$) n (%)	Drop-outs ($n = 277$) n (%)	p-value
Demographic characteristics			
Sex, number of men	85 (72.0)	171 (61.7)	0.050
Age in years, mean (SD)			
At baseline	63.6 (11.2)	67.9 (13.0)	0.001
At 3–4 years	67.4 (11.1)	–	
Education level			
Low (1–5)	84 (71.2)	198 (74.4)	0.089
High (6–7)	34 (28.8)	68 (25.6)	
Stroke characteristics (baseline)			
Type of stroke			
Ischaemic	109 (92.4)	260 (93.9)	0.570
Haemorrhagic	9 (7.6)	17 (6.1)	
Location of stroke			
Left	38 (32.2)	122 (44.0)	0.062
Right	54 (45.8)	113 (40.8)	
Vertebrobasilar	26 (22.0)	42 (15.2)	
Recurrent stroke	18 (15.3)	29 (10.5)	0.179
Stroke severity	2.0 (±3.0)	2.0 (3.3)	0.474
NIHSS score at baseline, median (SD)			
No stroke symptoms (NIHSS 0)	29 (24.6)	65 (23.5)	
Minor stroke symptoms (NIHSS 1–4)	69 (58.5)	152 (54.9)	
Moderate stroke symptoms (NIHSS 5–12)	18 (15.3)	53 (19.1)	
Moderate to severe symptoms (NIHSS > 12)	2 (1.7)	7 (2.5)	
Indication of functioning			
Barthel Index at baseline, mean (SD)	17.3 (4.4)	16.7 (4.9)	0.232
ADL independent (BI 19–20)	71 (60.2)	157 (56.7)	0.520
ADL dependent (BI < 19)	47 (39.8)	120 (43.3)	
Long term functioning (3–4 years)			
Indication of cognitive functioning at 3–4 years, mean (SD)			
MoCA score	24.5 (3.6)	23.1 (4.1)	0.003
Participation at 3–4 years, mean (SD)			
USER-*P* restrictions	84.6 (19.4)	–	
Social cognition at 3–4 years, mean (SD)			
FEEST	43.0 (6.2)	–	
Cartoon test	21.4 (6.6)	–	
Faux pas detection	9.3 (1.1)	–	
Faux pas empathy	2.9 (1.2)	–	
BEES	32.4 (22.0)	–	
Hayling test	3.1 (1.8)	–	

Abbreviations: ADL: activities of daily living; BEES: balanced emotional empathy scale; BI: Barthel Index; FEEST: Facial Expressions of Emotion-Stimuli and Tests; MoCA: Montreal cognitive assessment; NIHSS: National Institutes of Health Stroke Scale, USER-*P*-R: Utrecht Scale for Evaluation of Rehabilitation-Participation.

Relationship between social cognition and participation

Results of the regression analyses with participation (USER-P restriction) as the dependent variable are shown in Table 2. Bivariate analyses showed that considering the social cognitive tests, only the Hayling test significantly explained variance in USER-P restriction scores (10.0%, $p = 0.001$), with higher Hayling scores (i.e., better behavioural control) indicating less participation restrictions. In addition, younger age, higher level of education, higher BI (at <4 days post-stroke) and higher MoCA scores at 3–4 years after stroke also indicated less participation restrictions. The demographics and injury-related factors of stroke (the significant determinants in the bivariate model) were then added to the regression

Table 2. Results of bivariate and multivariate hierarchical multiple regression analysis: determinants of USER-*P*-R at 3–4 years post-stroke ($n = 118$).

	Bivariate analyses					Multivariate analyses		
						Step 1	Step 2	Step 3
	N	*B*	*β*	R^2	*p*	*β*	*β*	*β*
Gender (female)	118	−0.592	−0.014	0.000	0.882	NE	NE	NE
Age	118	−0.412	−0.235*	0.055	0.010	−0.200*	−0.146	−0.068
Education (high)	118	9.982	0.234*	0.055	0.011	0.207*	0.166	0.127
NIHSS	117	−0.198	−0.031	0.001	0.736	NE	NE	NE
BI[a]	118	1.130	0.257**	0.066	0.005	0.205*	0.227*	0.224*
MoCA[b]	115	1.454	0.235*	0.055	0.012	–	0.161	0.114
FEEST	107	0.289	0.092	0.008	0.348	–	–	−0.072
Cartoon test	113	0.509	0.174	0.030	0.065	–	–	0.022
Faux Pas detection	109	2.938	0.161	0.026	0.094	–	–	0.056
Faux Pas empathy	109	3.062	0.183	0.034	0.056	–	–	0.110
BEES	111	0.143	0.162	0.026	0.090	–	–	0.094
Hayling	115	1.658	0.136**	0.100	0.001	–	–	0.126
Explained variance, R^2						0.148	0.170	0.211

Notes: Step 1: gender, education, BI; step 2: MoCA; step 3: FEEST, Cartoon test, Faux Pas detection, Faux Pas empathy, BEES, Hayling.

Abbreviations: USER-*P*-R: Utrecht Scale for Evaluation of Rehabilitation-Participation Restrictions subscale; NIHSS: National Institutes of Health Stroke Scale, BI: Barthel Index; MoCA: Montreal Cognitive Assessment; FEEST: Facial Expressions of Emotion-Stimuli and Tests; BEES: Balanced Emotional Empathy Scale; NE: not entered.

[a]Scores at <4 days after stroke.

[b]MoCA was administered together with the social cognitive tests at 3–4 years after stroke.

*$p < .05$; **$p < .01$.

model. Age, education and BI were entered in step 1 and the MoCA was added in step 2. In the third and final step, the social cognition variables were added. Here, only BI accounts for a significant proportion of variance ($p < 0.05$). The model explains 21.1% of the variance in participation restriction scores.

Discussion

This is the first study to investigate the relationship between several domains of social cognition and participation in patients with minor stroke. Contrary to our hypothesis, we found that theory of mind (ToM), empathy, emotion recognition and behavioural control were not associated with restrictions in participation three to four years after stroke. This is inconsistent with the reported relationship between emotion perception and participation in stroke in a previous study (Cooper et al., 2014) and with the literature on the relationship between social cognition and participation in moderate to severe TBI (May et al., 2017; Ubukata et al., 2014; Westerhof- Evers et al., 2018). Several factors may contribute to these contradictory findings.

A possible explanation for the lack of an association lies in the sample characteristics. Stroke usually occurs at a later age than TBI. The mean age of the sample was 67 years and thereby greater than the legal retirement age in the Netherlands, so a large proportion of the sample does not inherently experience vocational restrictions, which is one of the domains of the USER-P. The participants in our study were in general mildly affected in terms of stroke severity and dependence in activities of daily living (NIHSS and BI scores, respectively). As greater stroke severity is shown to be associated with more restrictions in participation (de Graaf et al., 2018; Desrosiers et al., 2009), mild stroke severity may not lead to social cognitive deficits to such a degree that they actually hamper participation. USER-P restriction scores were indeed higher in a sample with greater stroke severity (Groeneveld et al., 2019). Social cognitive deficits were mild as well; even though patients scored significantly lower compared to controls on emotion recognition, ToM and behavioural control, effect sizes were only small (Nijsse et al., 2019b) and a maximum of only 4.2% of the patients were impaired to a degree of two standard deviations or more below control mean. Support for the role of stroke severity in the relationship of social cognition and participation is found in the fact that social cognition does not predict community participation in healthy controls (Pijnenborg et al., 2009) and that studies reporting a relationship in TBI patients involved participants with moderate to severe TBI (Knox & Douglas, 2009; May et al., 2017; Struchen et al., 2008; Ubukata et al., 2014; Westerhof- Evers et al., 2018). Taken together, our results indicate that with mild stroke severity, social cognitive impairments and participation limitations are only mild and not associated. Based on the available literature, we cannot rule out an association between social cognition and participation in patients who suffered from greater stroke severity. In addition, other factors, such as executive functioning (Westerhof-Evers et al., 2018), may play a role in participation restrictions as well, considering the small amount of total variance explained by the variables included in our model.

Another issue to consider is that the USER-P involves a few social activities (for example work or study, visits to/from family or friends, partner relationship, contact with others) but also covers activities where social interactions are less important (such as housekeeping, mobility, physical exercise, going out or leisure indoors/outdoors). The contribution of daily life activities to participation is shown by the fact that in our sample the Barthel index is a significant predictor of USER-P scores. Some argue that social cognition is involved in activities of daily living, for example, adjusting self-care in response to someone increasing physical distance or facially expressing disgust (Couture, Penn, & Roberts, 2006) or performing housekeeping chores based on noticing that others are annoyed by a messy room (Pijnenborg et al., 2009). However, social cognitive deficits probably affect social aspects of participation more strongly, as social interactions arguably rely more heavily on an intact ability to recognize and respond to social information compared to performance of housekeeping chores, self-care or exercising. Indeed, the Cooper study (2014) showed that emotion perception (combined score of several tests, including the FEEST) was related to social participation ($r = 0.46$) but not to activity limitations ($r = -0.26$), even though the social participation categories involved mobility and household in addition to recreation, social interaction and work. While it is tempting to explore a selection of items of the USER-P that would seem to measure more social aspects of participation, construct validity of a subset of items cannot be confirmed at this time. The risk of biased results and the low number of patients showing social cognitive impairment in our study keep us from examining whether participation restrictions in the social items of the USER-P are predicted by social cognitive impairment. Relating social cognitive performance to instruments specifically aimed at measuring social participation might help us to move forward in unravelling the role of social cognition in participation restrictions after stroke. Others have recommended the use of performance-based assessment of social cognition, since performance-based test performance shows a person's capabilities, while actual functioning may be influenced by social support and personal resources, including finances or transportation (Couture et al., 2006; Fett et al., 2011).

Although social cognitive impairments were mild, their effects should not be underestimated. Even small changes can contribute to caregiver burden, as relatives and caregivers are often most affected by the emotional and social behavioural changes of their loved one (Gonzalez & Bakas, 2013; Pendergrass et al., 2017). In fact, a previous study using the same cohort of patients showed that poorer emotion recognition, empathy and behavioural regulation of the stroke patient was related to behavioural changes as reported by a person close to them (partner, family member, friend or acquaintance) (Nijsse, Spikman, Visser-Meily, de Kort, & van Heugten, 2019a). Together with the current study, results suggest that mild social cognitive deficits may have led to more subtle changes in social behaviour rather than limiting a broad area of participation activities. The impact of mild deficits on caregiver burden and the quality of relationships needs to be investigated further to determine whether support in dealing with those changes would be helpful for patient and caregiver well-being. Another approach could be to investigate to what extent the tests that are used to measure social cognition actually represent the emotional and social behavioural changes that are perceived as stressful by the caregivers.

Strengths of the study are the large sample size and participants being recruited from six general hospitals representing the general stroke population. A limitation may be found in the fact that social cognition was measured as an extension of the initial cohort study, patients willing to participate may differ from those who refused the additional measurements in terms of motivation and perhaps (social) cognitive performance, although demographics and injury-related characteristics were similar. Additionally, we chose a set of social cognition tests for which we have gathered data in different patient and control samples; one can always argue whether these were the most optimal tests. For instance, taking an emotion recognition test in which the emotion intensities are varied (such as the Amsterdam Dynamic Facial Expression Set – Bath Intensity Variations (ADFES-BIV)) may add to our understanding of subtler social cognition deficits in the mildly injured group.

To conclude, in a sample with a mild severity of stroke and mild social cognitive impairments, the domains of ToM, empathy and emotion recognition and behavioural control are not associated with restrictions in participation. Since participation restrictions are a commonly reported problem in stroke, likely depending on stroke severity, it is important to unravel the underlying causes to determine treatment targets. In light of the considerations mentioned above, recommendations for future research on the role of social cognition should involve samples with greater stroke severity. In addition, it is worth exploring the relationship between social cognition and participation with instruments focussed on more social aspects of participation. Attention should be paid to which social cognitive domains may relate to certain aspects of participation, to determine which domains may be worthwhile targets in treatments and what outcomes may be expected.

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Disclosure statement

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Data availability statement

Raw data were generated at six hospitals in the Netherlands. Derived data supporting the findings of this study are available from the corresponding author (CvH) on request.

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