Memory Self-efficacy after Stroke

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INHOUDSOPGAVE

Chapter 1

General Introduction

Stroke is a major health problem in Western countries. In the Netherlands each year, approximately 41 000 people suffer from a stroke and about some 75 percent will survive.[1] Stroke is the number one cause of long term disability and in the top ten of most expensive diseases in the Netherlands with a total cost of 1,5 billion euro's in 2005. Due to the aging population and improved acute care these numbers are expected to rise.

Memory complaints after stroke are a common and persistent problem. About 60 percent of patients after stroke suffer from forgetfulness in the sub-acute stage and 45-50 percent reported persisting complaints 6 to 36 months post onset.[2,3] Time post onset seems to be a determinant for memory complaints. Patients after stroke report memory complaints more frequently with time passing after stroke onset,[4] although a decline over time is reported as well.[5] Memory is a complex construct with subjective and objective determinants. One may have memory complaints without any memory deficits as measured with formal memory tests. This has been well established in healthy elderly persons. Memory complaints in healthy elderly persons are not primarily determined by objectively measured memory capacity but rather by the subjective evaluation of one's memory performance.[6]

The role of the subjective evaluation of memory after stroke has been poorly studied. There are few controlled trials to investigate the efficacy and effectiveness of memory rehabilitation programmes on the objectively measured and subjectively experienced memory capacity after stroke.[7] The common conclusions are that functional training aimed at restitution is ineffective after stroke and compensating techniques and mnemonics have the highest success rate.[7,8] This thesis focuses on the subjective evaluation of memory after stroke. Which factors determine subjective memory experience after stroke, can it be improved and if so, does this contribute to mood, quality of life and social participation?

METAMEMORY AND MEMORY SELF-EFFICACY (MSE)

The subjective evaluation of memory and memory performance in daily activities is defined as metamemory.[9] It is derived of the concept of metacognition, which is broadly described as 'thinking or knowing about cognitive processes or thinking itself'.[9]

The four dimensions of Metamemory are [1] knowledge about memory functioning in general, [2] the ability to use memory strategies, [3] the feelings related to memory functioning and [4] the feeling of mastery and control over one's memory functioning, also described as memory self-efficacy (MSE).[10,11]

The different dimensions of metamemory are intertwined. Feelings of anxiety could decrease effort (i.e. the use of strategies) in daily life situations and increase failures in memory demanding situations which in turn may cause a decrease in MSE. Common societal beliefs like 'memory deficits come with age' may be important for MSE as well.

A low MSE score is not necessarily related to the presence of memory deficits. For example, although healthy elderly subjects may experience memory complaints and related anxiety, while performing within normal ranges on memory tests.[6] This was

established in elderly people with a family history of dementia who seek help because of memory complaints. Most of them performed well on memory tests.[12] Memory complaints in healthy elderly who participated in the Maastricht Aging Study (MAAS) did not predict cognitive decline within six years.[13] Moreover, improvements in mood were related to decreased memory complaints in psychiatric depressed patients, while cognitive performance remained stable.[14]

MSE is not as much determined by objective memory capacity as by contextual factors like depression, societal views, active lifestyle, pain, coping style and personality.[6, 15-17] A low MSE or negative beliefs about one's memory may cause underachievement, resulting in not using compensation techniques or mnemonics to enhance remembering, while these strategies are regularly required even for healthy (young) people. Memory capacity is insufficiently used and situations that challenge memory performance are avoided thus causing decreased social participation and heightened (memory) anxiety.[18] The fear of forgetting may actually increase memory failures,[19] decreasing MSE and social activities.

Age appears an important determinant of MSE in healthy subjects.[20] Younger people attribute memory failures to contextual factors like being busy or lack of interest due to distracters. Older people consider less malleable factors such as high age itself, to underlie memory failure and fear the presence of possible disorders like dementia.[12, 18, 20, 21] As such, older age predisposes to lower MSE and avoiding memory-demanding situations. Coping style is an important determinant of MSE in healthy elderly.[6] A less active coping style is related to lower feelings of mastery and control regarding memory functioning.

Successful training programmes have been developed to decrease memory complaints and increase memory test performance and memory self-confidence in healthy elderly.[22] Older adults improved their sense of control over their memory functioning and thereby enhanced their memory functioning after attending an intervention aimed on MSE.[23] A possible explanation for this improvement may be a decrease of anxiety and anxiety-related behaviour. However, this study was not focused on the effects on quality of life and depressive symptoms, so the psychological impact of enhancing memory functioning, remained unknown.

Not only healthy elderly, but community dwelling older adults with various mild cognitive deficits benefit from an intervention aimed to increase MSE as well.[24] Memory performance increased as result of increased MSE scores and again, depression is a large mediating factor.

MSE AFTER TRAUMATIC BRAIN INJURY

The importance of MSE has been established in traumatic brain injured patients. In patients with traumatic brain injury (TBI), negative beliefs about memory functioning are related to depression.[25] In TBI patients, MSE may reflect an accurate self-evaluation of the severity of the memory deficits.[26-28] However, the awareness of memory deficits does

not depend as much on TBI severity, as on emotional adjustment.[29] Patients with mild TBI even tend to report more deficits. A high MSE score is positively related to treatment compliance and to rehabilitation outcome in patients with TBI.[30] These patients seem to evaluate their treatment in terms of adaptation and recovery, which is highly related to coping strategy. The relation between coping and MSE, which is established in healthy elderly, therefore seems to apply to patients with TBI as well, just as the contribution of depressive symptoms to negative beliefs about memory functioning in mild as well as in severe TBI patients.[25]

MSE AFTER STROKE

Little is known of MSE in stroke patients. Whereas many healthy elderly subjects with memory complaints perform within normal limits on memory tests, stroke patients may have actual deficits that could be reflected in their subjective experience of their memory functions. Nevertheless, subjective memory complaints early after stroke seem related to emotional complaints rather than to actual memory deficits, indicative of a similar relation as established in healthy elderly[31] and TBI patients.

More positive beliefs and self-evaluation may lead to an increase in quality of life and even social participation.[32] Quality of life ratings are generally low after suffering from stroke, even up to two years after stroke.[33-35] Depression, social activities and social support play an equally important role in decreasing these ratings as actual deficits.[33, 34, 36]

Depression rates are higher post stroke, probably due to organic changes in the brain and the major impact of disability in daily life.[37-39] The interrelation between depression, MSE and stroke may alter treatment effects of a MSE training programme for better or worse.[40, 41] A close relation exists between cognitive impairment and depression after stroke and when treating depression, cognitive deficits may be reversible to some extent.[42]

AIM OF THIS THESIS

The primary aim of this thesis is to evaluate the effect of a memory self-efficacy training programme for chronic stroke patients in a randomized clinical trial with long term follow-up measurements at 6 and 12 months post onset. In order to do so, the relation between MSE and psychosocial factors in stroke is investigated in the acute as well as the chronic stage of stroke. We aim [1] to study Memory Self-efficacy after stroke and [2] to evaluate the effects of an MSE training programme for stroke patients on MSE, depressive symptoms, quality of life and social participation. Finally, we want to [3] establish which patients benefit most from an intervention aimed to increase MSE after stroke.

The focus of **Chapter 2, 3** and **4** is to investigate the relation between MSE, psychosocial factors and memory test performance in patients after stroke. Since the training programme we studied in this investigation is based on a training programme for healthy elderly people, we first related MSE to factors such as depression and personality in patients after stroke, as these factors are predictors of MSE in healthy elderly.

In **Chapter 2** the relation between Memory Self-efficacy and memory test performance is described in a sample of 57 acute stroke patients. In this pilot study, depression is used as exclusion criterion. In C**hapter 3**, data are presented on the relation between MSE and psychosocial factors such as depression, coping and personality traits. This study included a sample of 23 patients in the acute stage of their stroke. In *chapter 4* we present the relation between MSE, memory test-performance, psychosocial determinants and the existence of reported subjective complaints. In the process of recruiting patients for the intervention, patients without complaints about their memory deficits, were asked to participate in the first measurement of the study. These data provided comparison material for the selected group of patients that reported memory complaints who participated in the intervention. In **Chapter 4**, both groups of patients are compared in a cross-sectional study.

In **Chapter 5** and **Chapter 6** the results of the randomized controlled trial are presented, evaluating the effectiveness of the MSE training programme. In *chapter 5*, the short term results of the intervention are discussed in comparison to the control group. Furthermore, the factors that predict which patients can benefit the most from the MSE training programme are discussed. In **Chapter 6**, the long term results of the intervention in comparison to the control group are presented. Patients were followed up after 6 months and 12 months after the intervention and effects on depressive symptoms, quality of life, social participation and strategy use are discussed. **Chapter 7** describes the satisfaction of all participating patients.

Chapter 8 presents a general discussion on the conclusions of this thesis, methodological issues are discussed and the clinical implementation of the MSE training programme is evaluated.

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Chapter 2

Metamemory and Memory Test Performance in Stroke Patients

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ABSTRACT

Background and purpose

Memory Self-Efficacy (MSE) has been shown to be related to memory-performance and social participation in a healthy elderly population. This relation is unclear in stroke. As about 30% of all stroke survivors report memory complaints, there is an urgent need for effective treatment strategies. Before implementing MSE as a potential target in memory training, it should be examined whether the association between MSE and memory performance demonstrated in healthy elderly people also applies in stroke patients. This study therefore explored the predictive value of MSE on two kinds of memory tests in stroke patients; adjusted and unadjusted for age, gender, education and location of stroke.

Methods

In 57 stroke patients, the Metamemory in Adulthood Questionnaire (MIA), an everyday memory test (Rivermead Behavioural Memory Test, RBMT) and a more traditional memory test (Auditory Verbal Learning Test, AVLT) were completed.

Results

The results show that MSE significantly predicts memory test performance on both memory tests (RBMT: ß =.34; *p*=.01 AVLT: ß=.28; *p*=.04). When adjusted for gender, age, education and location of stroke, the predictive value of MSE remained significant for the AVLT (RBMT: ß =.23; *p*=.07; AVLT: ß =.23; *p*=.05).

Conclusions

The results support the hypothesis that MSE predicts test performance in stroke patients and, by consequence, enables improving memory performance in post-acute memory rehabilitation after stroke.

INTRODUCTION

Metamemory is an important aspect of memory. Originally, metamemory was broadly conceived as cognitions about memory.[1,2] Later on, four dimensions were identified.[3] The first dimension, factual knowledge, is defined as knowledge about memory functions and the viability of strategic behaviours for tasks requiring memory processes. The second dimension, memory monitoring, is defined as an individual's awareness of the current state of his or her memory system. The third, memory-related affect, reflects emotional states, such as feelings of anxiety, depression and fatigue, in both daily life and formal testing. The fourth dimension is memory self-efficacy (MSE), which is defined as one's sense of mastery and capability to use memory effectively.

Memory self-efficacy is derived from the concept of self-efficacy, introduced by Bandura.[4,5] According to Bandura, the subjective evaluation of self-efficacy may not only determine people's choice of action and goal setting, but also affect coping, effort and persistence. Bandura[6] as well as Ponds[5] identifies a large number of factors upon which self-efficacy is thought to be based, including: performance accomplishments, vicarious experience, verbal persuasion and affective state. In addition, Bandura[7] states that these principles of self-efficacy are applicable to all kinds of domains, including memory.

Memory Self-efficacy has been mostly studied in healthy elderly people, resulting in conflicting conclusions. It has been reported to be able to predict memory test-performance, in which higher scores on MSE are related to higher scores on memory tests, and to be inversely related to increasing age.[8,9] Everyday memory tests seem to be more related to MSE than more traditional tests in some studies,[10,11] while others find no significant differences in memory tests related to MSE.[7] Other studies find a relation between metamemory and psychological characteristics, such as depression, activity level, coping and neuroticism.[5,12] Furthermore, metamemory may affect social participation and quality of life.[5] People who consider themselves as socially and physically active are not anxious about their memory functioning. They perceive their memory functioning relatively adequate.[12]

Despite these findings in healthy elderly people, metamemory has not been frequently studied in neurological populations. Earlier studies have focused on amnesia, neurodegenerative disorders, traumatic brain injury, multiple sclerosis or HIV.[13] In patients with Alzheimer's disease, a lowered MSE was found in five studies although not in six other studies.[13] One study on 49 patients with multiple sclerosis (MS) and 39 matched controls found that deficits in conscious memory and metamemory predicted performance on a memory task in MS patients, but it was not correlated to retrospective and prospective metamemory judgements on an inclusion task.[14] Philips and Stuifbergen[15] found that aspects of metamemory are related to quality of life, neurological disability and depressive symptoms in MS. In a TBI population, MSE scores on the Metamemory in Adulthood questionnaire (MIA) were lower than those in uninjured controls.[16] As in MS patients, MSE appeared to be related to depression in this TBI population.[16] Traumatic

brain injury (TBI) patients seem to overestimate memory performance while control subjects seem to underestimate their performance.[17,18] These findings suggest that MSE could play a role in neurological populations to improve memory performance as well as in healthy elderly people.

Little is known about whether and how metamemory is related to memory performance in stroke patients. In stroke patients, subjective and objective memory-performances are related.[19,20] According to the best of our knowledge, metamemory in stroke has not been studied since then. However, stroke is the primary cause of long-term disability and one-year post onset about 30% of all stroke survivors suffer from memory complaints with a negative impact on quality of life.[21-24] Depressive symptoms frequently emerge post stroke which are related to poorer quality of life and lowered functional outcome.[25-28] Therefore, effective and efficient interventions tailored for memory complaints after stroke are urgently needed.

The importance of involving metamemory in memory training has been illustrated in previous studies.[29,30] A group therapy on MSE improved memory performance in healthy elderly adults.[31,32] In cognitively impaired nursing home residents, a metamemory enhancing intervention was effective in improving MSE and immediate story recall assessed with the Rivermead Behavioural Memory Test.[33]

By integrating memory self-efficacy aspects into conventional memory training programmes, memory complaints may be reduced in stroke. This clinical empirical study is the first to explore the value of MSE in predicting performance on two kinds of memory tests in stroke patients. The strength of this predictive value of MSE will be estimated both unadjusted and adjusted for age, gender, education and location of stroke.

MATERIALS AND METHODS

Patients

A convenience sample of 57 stroke patients was recruited from an inpatient rehabilitation centre (see Table 1). Inclusion criteria were a recent ischaemic or haemorrhagic stroke, the presence of memory deficits and the anticipation of being able to return home after inpatient treatment. Illiteracy, aphasic disorders, visual inattention, and or any other disorder of the central nervous system were exclusion criteria. A qualified neuropsychologist based his diagnosis of depression on the DSM-IV-R criteria.[34] In case of a positive diagnosis the patient was excluded from the study. Location and type of stroke were extracted from the patient's medical file.

Assessments

Metamemory was tested with an abbreviated and translated version of the Metamemory in Adulthood Questionnaire (MIA), originally developed and validated by Dixon, Hultsch & Hertzog.[35] Ponds and Jolles[36] translated, shortened and validated

the MIA for the Dutch healthy population. The shortened version, comprising the same subscales, turned out to be of comparable psychometric qualities as the original MIA. The decrease in the number of questions has not substantially influenced the factor structure or lowered the internal consistencies of the subscales. The test-retest stabilities of these subscales ranged from .72 to .85, being comparable to the original version.[35,36] The shortened MIA consisted of seven subscales: (1) knowledge of memory processes (Task), (2) perceived memory capacity (Capacity), (3) perceived memory stability (Change), (4) perceived feelings of stress and anxiety related to memory performance (Anxiety), (5) perceived importance of performing well in memory demanding situations (Achievement), (6) perceived control over memory (Locus), and (7) use of memory strategies (Strategy). As in the original version of MIA, the subscales Capacity, Change, and Anxiety reflect a higher-order factor MSE.[37] To compensate for possible visual perception disorders, the lay-out of the questionnaire has been adjusted. We enlarged the font size and turned the pages sideways. No other adjustments were made.

Different memory tasks seem to be differently influenced by metamemory aspects.[9,11] We therefore used two kinds of memory tests. Everyday memory was measured with a prose task, a translated and validated version of the Rivermead Behavioural Memory Test (RBMT).[38,39] This test consists of 11 items, all reflecting everyday memory demanding situations. For example, remembering a person's name, a route, a short story, faces and pictures of some common objects. All items were scored and summed on a Standard Profile Score (score 0, 1 or 2 with a maximum score of 24) and on a Total Screening Score (score 0 or 1 with a maximum score of 12). A score of 0 indicates impaired, 1 borderline and 2 unimpaired. The reliability is high (r= .83 - .88) for the profile score. This test is used frequently in post-acute stroke rehabilitation. Because of its low difficulty level, ceiling effects may occur. However, the population included in the current study is biased towards cognitive impairments, thereby reducing the likelihood of ceiling effects.

The Dutch version[40,41] of the Auditory Verbal Learning Test (AVLT) was used as a more traditional memory test.[42] Fifteen low associative words were administered five times. After each presentation, the participant was asked to remember as many words as possible (immediate recall) and the total number of words correctly remembered after a 20-minute interval was used as the delayed recall score. The maximum score in the delayed recall is 15 correctly remembered words. The B version or the 'no-image'-version was used because it decreases the possibility of subjects making associations with everyday objects/situations, thereby increasing the contrast with the RBMT.[40] Due to the difficulty of the AVLT for stroke patients, this test is expected to induce anxiety at administration, which may bias the test results. To restrict this, experienced test assistants administered all tests in comparable settings.

Procedure

After signed informed consent was obtained, all subjects were tested twice. First,

the subjects filled out the MIA questionnaire. In a second test session, administered within a maximum time span of two weeks, but preferably within two days, the 15-word test was administered. The RBMT had been administered as part of a standard neuropsychological examination for stroke patients in the rehabilitation centre and these data were taken from the medical file.

Both memory tests were administered in a session after the MIA questionnaire. This order was used to prevent interference of test results on the scoring of the MIA.

Statistical analysis

Analyses were performed using SPSS 15.0 for Windows. The predictive value of MSE, both unadjusted and adjusted for gender, age, education and location of stroke was estimated using a multiple multivariate regression analysis. Dependent variables were the profile score of the RBMT and the recall score of the AVLT. Based on previous studies, higher MSE is expected to be associated with a higher memory test performance, effects are tested at a 0.05 level of significance (one-sided).

As a measure of statistical performance the standardised regression coefficient (*ß*) was used. Non-parametric Spearman's correlations were used to investigate the relation between subtests of the RBMT and the MSE score of the MIA and to analyse the relations between the seven subscales of the MIA and the two memory tests at a 0.05 level of significance (two-sided). Demographic variables are also correlated to MSE.

RESULTS

Descriptive data for the subjects are given in Table 1. The average level of education in our sample is comparable to the level of education in The Netherlands.[38] Due to the fact that some patients had long hospital stays or had been transferred from nursing homes, the range in time post-onset is relatively large. All patients had been asked to participate, preferably within two weeks of admission to the inpatient ward.

The intercorrelation matrix of memory tests, MSE, age, gender, location of stroke, type of stroke, time post-onset and education is shown in Table 2. As expected, MSE was significantly correlated with both memory tests (RBMT: r= .36, p= .01; AVLT: r= .36, p= .01) and age (r= -.28, p= .03). MSE is not correlated with location of stroke, type of stroke or gender. There was no significant difference between the mean MSE score of left-sided and right-sided stroke patients. The AVLT was significantly correlated with location of stroke (r= .37; p< .01). Correlations between the several subscales of the MIA and both memory tests were estimated (see Table 3).

Table 1. Demographic variables.

	n	Mean	sd	Range
Gender				
Male	36			
Female	21			
Age (in years)		55.04	11.60	32 to 78
Localization of stroke				
Left hemisphere	17			
Right hemisphere	35			
Brainstem	5			
Type of stroke				
Haemorrhagic	20			
Ischemic	37			
Time post onset in days		46.98	26.34	21 to 146
Education[1]				
1-3	7			
4-5	42			
6-7	8			

[1]Education coded as in the Auditory Verbal Learning Test (AVLT)

Table 2. Inter-correlation matrix of demographic neuropsychological and neurological data (N=57)[1].

	1	2	3	4	5	6	7	8
1. Age								
2. Education[2]	.02							
3. MSE[†]	-.28*	.18						
4. RBMT[†]	-.23	.32*	.33**					
5. AVLT[†]	-.29*	.23	.36**	.56**				
6. Time post onset	-.33*	-.10	-.26	-.22	-.02			
7. Type of stroke	.27*	-.17	-.09	-.05	.12	-.27*		
8. Location of stroke	-.07	.12	-.16	.05	.31*	.24	-.14	

[1] Spearman ranking correlations. [2] Education: 1-3= low education; 4-7= high education. [†] MSE=(sum of the subscales capacity, change en (6-anxiety))/3; RBMT: Rivermead Behavioural Memory Test; AVLT: Auditory Verbal Learning Test (Dutch version). * 0.01< p-values <0.05 (two-tailed). ** p-values ≤0.01 (two-tailed)

Table 3. Inter-correlation matrix of memory test scores, MIA subscales and MSE (n=57)[1].

	1	2	3	4	5	6	7	8	9	10
1. MSE[2]										
2. RBMT[†]	.33**									
3. AVLT[†]	.36**	.56**								
4. Task	-.38**	-.16	-.03							
5.Capacity	.91**	-.10	-.14	-.02						
6. Change	.35**	.39**	.39**	-.39**	.18					
7. Anxiety	-.83**	-.31*	-.36**	.70**	-.02	-.65**				
8. Achievement	-.28*	-.27*	-.28*	.37**	.37**	-.40**	.36**			
9. Locus	-.35**	-.31*	-.13	.03	.36**	-.23	.17	.42**		
10. Strategy	-.09	-.02	-.04	.41**	-.14	-.31*	.36	.21	-.04	

[1] Spearman ranking correlations. [2] MSE=(sum of the subscales capacity, change en (6-anxiety))/3.
[†] RBMT: Rivermead Behavioural Memory Test; AVLT: Auditory Verbal Learning Test (Dutch version). * 0.01< p-values <0.05 (two-tailed); ** p-values ≤0.01 (two-tailed)

Both memory tests and MSE were strongly intercorrelated and in addition, MSE was correlated to all subscales of the MIA, except for Strategy. Capacity was not correlated to the other subscales, albeit strongly to MSE (see Table 3). Anxiety and Change were strongly intercorrelated. In order to keep the number of variables in the regression analysis limited, only the factor MSE was included in the further analyses.

A multiple multivariate regression analysis was performed in order to examine the predictive value of MSE on both memory tests. Additionally, the predictive value of MSE was measured when age, gender, education and location of stroke were taken into account (see Table 4).

Table 4. Importance of predictable quality of MSE for the outcome variables (n=57).[1]

	unadjusted			adjusted[2]		
Outcome variable	**b[3]**	**ß[4]**	**p-value**	**b[3]**	**ß[4]**	**p-value**
RBMT[†]	1.11	0.34	.01	0.70	0.23	.06
intercept	6.98		.08	10.72		.02
AVLT[†]	0.13	0.28	.02	0.10	0.23	.05
intercept	1.30		.03	1.23		.06

[1] MSE=(sum of the subscales capacity, change and (6-anxiety))/3/ [2] Adjusted for age, gender, education and location of stroke. [3] b= unstandardized regression coefficient. [4] ß= standardised regression coefficient. [†] RBMT: Rivermead Behavioural Memory Test; AVLT: Auditory Verbal Learning Test (Dutch version)

Table 5. Inter-correlation matrix[1] of subtests RBMT[†] and MSE.[2]

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. MSE													
2. Name	.24												
3. Belonging	.08	.34*											
4. Appointment	-.04	.45**	.43**										
5. Picture recognition	.08	.28*	.18	.49**									
6. Immediate story recall	.16	.25	.33*	.43**	.34*								
7. Delayed story recall	.17	.38**	.17	.54**	.33*	.75**							
8. Face recognition	.41**	-.01	-.09	.04	.00	.00	.00						
9. Immediate route	.20	.23	.41**	.17	.23	.28*	.17	-.04					
10. Delayed route	.12	.39**	.33*	.18	.42**	.26	.18	-.00	.71**				
11. Message	.14	.35**	.24	.21	-.01	.31*	.30*	-.14	.32*	.18			
12. Orientation	.20	.32*	.31*	.30*	.27	.36**	.36**	.26	.43**	.41**	-.01		
13. Date	.37**	.09	.28*	.23	.22	.09	.13	.03	.37**	.20	.20	.27*	

[1] Spearman ranking correlations. [2] MSE=(sum of the subscales capacity, change en (6-anxiety))/3. * 0.01< p-values <0.05 (two-tailed).
[†] RBMT: Rivermead Behavioural Memory Test. ** p-values ≤0.01 (two-tailed)

Approximately 34% of the standardised profile score of the RBMT was predicted by MSE (ß=.34; p=.004) and about 28% of the recall score of the AVLT (ß=.28; p=.02). Thus, performance on both everyday and traditional memory tests was partly explained by the height of the MSE score.

If age, gender, education and location of stroke are taken into account, the adjusted value of MSE remained significant for the AVLT (RBMT; ß=.23; p=.06, ALVT; ß=.23; p=.05). This finding is not in line with the hypothesis that MSE influences everyday memory performance more than performance on a traditional memory test like the AVLT. The subscales of the RBMT were correlated with MSE (see Table 5). MSE was only strongly correlated with the subscales face recognition and date of the RBMT.

DISCUSSION

MSE predicts a sizeable amount of variance in the AVLT and the RBMT in a sample of inpatient stroke patients. This confirms that MSE and memory performance are inter-related in stroke patients, which was already demonstrated in a healthy elderly population. When adjusted for age, gender, education and location of stroke, this only holds for the AVLT. This is not in line with other findings of previous studies,[11,36] in which MSE was related to an everyday memory test more than to a word list task. The setting of an inpatient rehabilitation ward may have induced a selection bias and a low statistical power may be another explanation. Location of stroke is related to outcome on the AVLT, which may be explained by the fact that this task requires more verbal capacity than the RBMT. Left-sided lesions could result in more aphasic deficits, influencing the outcome on the AVLT. However, due to the lack of a significant relationship between location of stroke and any of the other variables, it is difficult to draw firm conclusions.

MSE is a major determinant of memory performance and memory complaints in healthy individuals and possibly this is also the case in stroke patients. However, the current study is explorative and has considerable limitations. The operationalisation of the concept of memory self-efficacy in stroke is difficult due to the common occurrence of awareness deficits in stroke.[43] Metamemory and awareness are closely related.[44] Since there is no objective measure used for awareness in this sample, results may be influenced by awareness deficits of the patients.

Another limitation of the study is the exclusion of patients with depression. Depression is a common symptom after stroke and there is substantial evidence that depression interferes with metamemory.[45,46] In future studies depression should not be an exclusion criterion and should be assessed with a validated measure. Future research should further address the psychometric properties of the MIA in stroke patients and the influence of location of stroke and aphasia on memory performance and MSE.

With these shortcomings in mind, MSE seems to relate to memory test performance in stroke patients. Although this relation needs to be investigated further, it is a promising finding with regard to metamemory research in stroke. Besides further research on the psychometric characteristics of Dutch version of the MIA in a stroke population, the effects of an intervention targeted at improving metamemory in post-acute stroke rehabilitation patients is a relevant field of research.[47]

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Chapter 3

Memory Self-efficacy and Psychosocial Factors in Stroke

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ABSTRACT

Background and purpose

To explore whether Memory Self-efficacy (MSE) is related to depression, neuroticism and coping in patients after stroke, as it is in healthy elderly subjects.

Methods

Seventeen male and 6 female patients after stroke from an inpatient rehabilitation setting were included. The relationship between Memory Self-efficacy and psychosocial factors was analysed using a Mann-Whitney U test and non-parametric Spearman correlations. Memory Self-efficacy, depression, neuroticism and coping were assessed with validated questionnaires. Patients with severe aphasia, subarachnoidal haemorrhage or subdural haematomas were excluded.

Results

As in healthy elderly subjects, higher depression ratings are significantly related to lower Memory Self-efficacy ratings (Z= -2,13; p=.033). Lower Memory Self-efficacy seems related to higher neuroticism ratings and a more passive coping style score (resp. Z= -1,54; p=.123; Z= -1,42; p=.155), The Spearman correlations confirm these findings ($p<.10$).

Conclusions

This study replicated the relationships between Memory Self-efficacy and depression and neuroticism found in a healthy population, in an inpatient stroke population. Future research on Memory Self-efficacy in patients after stroke should focus on other potential determinants such as awareness and, ultimately, on the effectiveness and efficacy of interventions aimed at Memory Self-efficacy to improve participation and quality of life.

INTRODUCTION

Metamemory is broadly defined as 'cognitions about memory' and can be divided in four dimensions.[1,2] One of these dimensions is memory self-efficacy (MSE), defined as one's sense of mastery and capability to use memory effectively in memory demanding situations.

Several studies have shown MSE to be related to psychosocial factors like depression, neuroticism and coping, rather than to actual memory functioning and it may affect social participation and quality of life in elderly subjects.[3,4] Several studies on healthy elderly subjects established the importance of including MSE in memory training programmes.[5,6] MSE improves memory test performance in healthy subjects.[7] In a study performed by Valentijn et al.,[7] an intervention aimed to improve MSE in healthy elderly subjects, was shown to improve memory performance without traditional memory training.

MSE has rarely been studied in stroke patients[8] and the relation between MSE and memory functioning in patients after stroke has been established only in preliminary data.[9] About 60% of patients after stroke complain about forgetfulness 9 months post-stroke.[10] Thus there is a need for effective interventions to enhance MSE in patients after stroke. To successfully integrate MSE concepts in memory training programmes for patients after stroke, the underlying psychosocial determinants first need to be studied. Therefore, this study aims to explore whether the relationships between MSE and depression, coping and neuroticism as established in healthy subjects[4] also apply in patients after stroke. Based on the results in healthy elderly subjects, we presume that higher ratings of MSE are correlated with less depressive symptoms and lower levels of neuroticism. In addition, lower ratings of MSE are expected to be correlated with a less active coping style.

METHODS

After informed consent, 23 consecutive patients after stroke admitted to the inpatient stroke department of Rijndam Rehabilitation Center, Rotterdam, the Netherlands, were included. Inclusion criteria were between 18 and 75 years of age, time post-onset 6 weeks or less and subjective memory complaints. Subarachnoidal haemorrhage, subdural haematoma and clinically observed severe aphasia were considered as exclusion criteria. Memory disorders were objectified using the Rivermead Behavioural Memory Test (RBMT).[11] Level of education is listed using the 7-level system of Saan en Deelman.[12] During the study, all patients received regular an individually tailored multidisciplinary treatment suitable for severely impaired stroke patients.

MSE was assessed using the Metamemory-in-Adulthood questionnaire (MIA).[13] This questionnaire consists of 68 questions relating to 7 factors of metamemory. Of these 7 factors of metamemory, Change, Capacity and Anxiety form the higher order factor MSE. The questionnaire is validated for a Dutch population and frequently used in

metamemory research in elderly subjects.[13,14]

Coping is measured using the validated Dutch Utrecht CopingLijst (UCL), which consists of 47 questions, relating to different kinds of coping styles rated on a four-point scale.[15,16] In the present study, active coping and passive coping are used as determinants. Neuroticism is measured using the Symptom Checklist 90 (SCL90), a questionnaire designed to measure psychological and psychosomatic change.[17] Psycho-neuroticism is an overall score of the SCL-90 and is used as an indication for neuroticism. Depression is measured using the Beck Depression Inventory (BDI).[18] Patients filled in the questionnaires during 2 supervised sessions of 1 hour. The sessions were held on consecutive days. Due to a small number of subjects and the use of ordinal measures, non-parametric tests are used to analyze the correlation between psychosocial factors and MSE. The Mann-Whitney U test is applied to determine the relation between "High" or "Low" MSE and psychosocial factors. Spearman's correlations are used to determine similarities with studies in healthy subjects. A significance level of 0.1 two-sided is used, in anticipation of the relative modest number of subjects and the confirmative aim of this research, to replicate previous results in large studies in other populations.[4]

RESULTS

Seventeen males and 6 females with a mean age of 55 years, participated in this study. Mean time post-onset was 50 days. Six patients were diagnosed with left hemispheric lesions, 14 with right hemispheric lesions and in 3 cases, lesions occurred in the brainstem area. In 5 cases a haemorrhagic stroke was diagnosed, all other cases were ischaemic. Level of education was comparable to the average of the Dutch population. The "Low" MSE group (n=11) has significantly higher scores on depression in comparison with the "High" MSE group (Z= -2.13; *p*= .033). On average, patients in the "Low" MSE group have a score of 15 on the BDI in comparison to a mean score of 9 in the "High" MSE group. Also, neuroticism is higher in the "Low" MSE group in comparison to the "High" MSE group (Z= -1,54; *p*= .123), though non-significant. An active coping style is not related to the "High" MSE group in this sample (Z= -, 773; *p*= .440). Patients in the "Low" MSE group tend to have a higher mean ranking on passive coping style in comparison to patients in the "High" MSE group (Z= -1,421; *p*= .155).

As can be expected, when more powerful statistical measures of correlation are used, these findings are confirmed at lower p-values (table 1).

Table 1. Correlation matrix.

	MSE	Depression	Active coping	Passive coping	Neuroticism
MSE					
Depression	-.557**				
Active coping	-.045	-.233			
Passive coping	-.383	.659**	-.277		
Neuroticism	-.467*	.735**	-.025	.705**	

* Correlation is significant at the .05 level (two-tailed). ** Correlation is significant at the .01 level (two-tailed).

DISCUSSION

This study confirms that MSE in patients after stroke is similarly related to depression and, to a lesser degree, to neuroticism and coping, as in a healthy elderly population. Based on this study, depression is negatively correlated to MSE in patients after stroke. Neuroticism and, to a lesser degree, passive coping style also seem to be related with low MSE ratings, although results only show a trend, probably due to small sample size. This opens the venue of interventions on MSE in stroke, as integration of MSE concepts in memory training programmes is effective in healthy aged adults, resulting in decreased anxiety and perceived memory deficits and enhancing social participation.[19]

However, there are a number of limitations to our findings. The external validity of the study is limited as only 10% of all patients after stroke are transferred to a rehabilitation clinic in The Netherlands. Furthermore, due to small sample size, only a limited number of determinants of MSE could be evaluated. Due to this fact, patients not meeting the "6 weeks or less" criteria were included. Although the sample therefore has a large spread regarding time post-onset, this was not correlated with any of the outcome measures (data not presented). Finally, this cross-sectional design does not provide evidence that depression is causally related to MSE.

In conclusion, our study is first ever to identify depression and neuroticism as determinants of MSE in patients after stroke. Effectiveness studies investigating whether these psychosocial factors indeed change MSE and memory functions when incorporated in memory training programmes should be performed.

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Chapter 4

Memory Complaints in Chronic Stroke Patients are Predicted by Memory Self-efficacy rather than Memory Capacity

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ABSTRACT

Background and purpose

Memory Self-efficacy (MSE) is the belief about one's mastery of memory functioning. In healthy elderly memory complaints are related to MSE rather than to objectively measured memory capacity. MSE has scarcely been studied in patients that suffered a stroke. The aim of this study was twofold: [1] to examine whether memory capacity and MSE can predict the presence of memory complaints in stroke patients and [2] to study which variables are the best predictors of MSE.

Methods

In a cross-sectional study 136 stroke patients (>18 months post onset) were recruited from April 2008 to November 2009. MSE was measured using the Metamemory in Adulthood questionnaire. Depression, coping and personality were measured using validated questionnaires and memory performance was measured using the Rivermead Behavioural Memory Test (RBMT) and the Auditory Verbal Learning Test (AVLT). Patients were divided in a 'complaints' and a 'no complaints' group.

Results

A lower MSE score was an independent predictor of having memory complaints (relative odds ratio .41; p=.000), adjusted for age and depression. The RBMT and AVLT scores did not predict the presence of memory complaints (p>0.345). Presence of memory complaints and depression were the strongest predictors of MSE (resp. B=-1.86, p=.000; B= -.05, p=.000) followed by word fluency, not having a partner and side of stroke (resp. B=0.04, p=.006; B= -0.54, p= .068; B=-0.47, p=.088).

Conclusions

Memory complaints are predicted by MSE rather than memory capacity. MSE memory training might be an effective training strategy in reducing memory complaints in selected chronic stroke patients.

INTRODUCTION

Stroke is a major cause of disability in modern Western countries with an incidence of 182 and 205 per 100 000 per year in middle-aged men and women, respectively.[1] In the chronic stage after stroke, cognitive and contextual factors in addition to somatosensory deficits determine activity levels, participation and quality of life.[2,3] Especially memory deficits may have a profound impact.[4,5] About 11 to 30% of all stroke patients suffer from memory deficits one-year post onset.[6,7] Even years post onset, stroke survivors report memory complaints, without having efficient memory training programmes available.[8]

In healthy elderly there is no one-to-one relationship between (subjective) memory complaints and (objectively measured) memory capacity.[9,10] Memory complaints rather than impaired memory capacity seem to be related to reduced levels of activity and participation, quality of life and mood disorders.[11-15] Apparently, the subjective evaluation of one's memory performance is not only determined by objectively measured memory capacity. The subjective evaluation of one's memory performance is captured in the concept of Memory Self-efficacy (MSE).[9,16] MSE reflects the level of confidence people have in their memory.[16-18] A high MSE implies a strong sense of control and mastery of one's memory. A higher MSE score may be related to the use of memory strategies and one's task expectations in memory demanding situations.[19] Thus, MSE refers to the feeling of control and mastery about one's memory functioning in general and does not focus only on complaints, but also on certain beliefs about capacity, changeability of memory functioning and anxiety about performing memory tests or being in memory demanding situations. Memory complaints that are more related to the event of the stroke overlap with the concept of MSE. Although patients may experience deficits, they do not always report complaints. Especially in stroke, the relation between complaints, MSE and capacity is not clear. Patients with deficits who are able to compensate for their deficits, may report no complaints and it is also possible that patients without complaints, may in fact have other deficits in awareness, which can affect the ability to judge their metamemory.

MSE has also been studied extensively in healthy elderly.[11,16,17,20,21] Group therapy aimed at improving MSE in healthy elderly improves the feeling of memory stability, decreases anxiety in memory related tasks and improves actual memory performance in healthy elderly.[12,22,23] Dellefield and McDougall[22] did find that MSE could be improved but could not prove that this results in increased actual memory performance.

In healthy elderly, MSE and memory complaints are interrelated to psychosocial factors like depression, coping and personality. MSE is hardly studied in stroke patients.[23-25] If the same relationships found in healthy elderly could also be found in patients who suffered a stroke, MSE may become a target in treatment for stroke patients with memory complaints. Therefore, the present study explores whether MSE or objectively measured memory capacity predict the presence of subjective memory complaints in patients in the chronic stage after a stroke. A secondary aim is to evaluate the potential predictors for MSE. Such predictors might provide clues on how MSE could be improved.

METHODS

Study design

Stroke patients, who were discharged from Rijndam Rehabilitation Centre in Rotterdam in the Netherlands between 1998 and 2006, were approached for participation in this cross sectional study. Patient medical charts were used to decide whether patients were eligible for the study. Inclusion criteria were first and only stroke; a minimum of 18 months post onset and living independently. Exclusion criteria were progressive neurological disorders, such as Multiple Sclerosis or dementia; excessive drinking or drug abuse, insufficient grasp of the Dutch language and subarachnoid haemorrhage or subdural haematomas. The study was approved by the Medical Ethical Committee.

Measurements

A trained research assistant performed all measurements during visits at the patients' home. Memory Self-efficacy was measured using the Metamemory In Adulthood (MIA) questionnaire. This questionnaire is translated into Dutch and validated by Ponds and Jolles.[26] This questionnaire consists of 74 questions relating to metamemory. The items are answered on a five-point Likert scale. The MIA consists of seven subscales, Task, Capacity, Change, Achievement, Anxiety, Locus of control and Strategy. The subscales Change, Capacity and Anxiety together form the concept of MSE, which is used as dependent variable in the analyses.[27]

We measured subjective memory complaints using a single question stating: "Do you experience problems in your memory functioning due to your stroke?" Patients stating to have deficits but who did not experience problems due to these deficits were assigned to a 'no-complaints' group. Patients stating to have problems due to their memory deficits were assigned to a 'complaints' group.

Depression was measured using the Center of Epidemiological Studies-Depression questionnaire (CES-D).[28] Higher scores indicate more depressive symptoms; a score of 16 or higher is indicative for actual depression.

Personality was measured using the Eysenck Personality Questionnaire Brief Version (EPQ-BV). This questionnaire measures the personality factors neuroticism and extraversion. The EPQ-BV has shown good internal consistency, test-retest reliability and concurrent validity.[29]

Coping was measured using the assimilative-accommodative coping scale. This scale measures two styles of coping; the assimilative tendency (adjusting developmental circumstances to personal preferences) and the accommodative tendency (adjusting personal preferences to the situation). The assimilative-accommodative coping scale consists of two subscales; which can respectively be described as a 'Persistent' and a 'Flexible' attitude towards problems. Higher scores on one of the subscales indicates more use of that attitude.[30] The Dutch translation of this questionnaire[31] has previously been used in a stroke population.[32,33] We adjusted the wording for stroke patients by rephrasing certain difficult sentences.

Memory capacity was measured using the two short stories of the Rivermead Behavioural Memory Test (RBMT)[34] and the Dutch translation of the Auditory Verbal Learning Test (AVLT): the 15-word test (15-WT).[35] The first test consists of two stories, that the patient should reproduce immediately and after 15 minutes (delayed recall). The 15-WT consists of reproducing a list of 15 spoken words that is offered 5 times. After an interval of 20 minutes, the number of words correctly remembered is scored.

Aphasia was measured with the Token Test and the Boston Naming Test (BNT).[36,37] A core of 29 or lower on the Token test indicates aphasic features. The maximum score on the BNT is 180.

Executive functioning was measured using the Behavioural Assessment of the Dysexecutive Syndrome (BADS) Zoo-map and Key search test. These tests are validated for a Dutch population.[38] We also used the Word Fluency Test[39] and the Trail Making Test.[40] In the Word Fluency Task, patients are asked to mention as much animals as possible within a minute and as much professions as possible. Similar tests are recommended by Lezak[41] to measure executive functioning. We chose these specific pen and paper tasks, since they are all easy to perform in a home setting.

Level of education was classified using a seven-level system, in which 1 stands for some years of basic primary education and 7 is equivalent to a university degree or higher.[35] Demographic information as well as side and type of stroke were obtained using patient files and by means of a structured interview prior to the measurements.

Statistical analysis

We evaluated the study sample for demographic characteristics. Patients were asked if they experienced any problems in memory functioning at the time of inclusion and were divided into a 'complaints' and a 'no-complaints' group as described above. For both the 'complaints' and 'no-complaints' group mean outcome scores and standard deviations were calculated. Differences between the two groups were analysed using independent samples t-tests for continuous variables, Mann-Whitney U tests for ordinal variables and chi-square tests for categorical variables.

Logistic regression analysis was performed to study which variables were the best predictors for having memory complaints. A multivariable logistic regression analysis with backward stepwise selection from the variables that were significantly different between the groups was used. We calculated odds ratios and the Nagelkerke R2 to compare the predictive strengths of the variables.

Linear regression analyses were performed to study potential predictors of MSE. Significant predictors from univariable analyses were assessed in a multivariable regression model using backward stepwise selection. Regression coefficients with the adjusted R2 were calculated to explain the variance in the model.

Significance levels of $p<.05$ for entry and $p<.10$ for removal of variables were used in the multivariable regression analyses. All analyses were performed using SPSS version 17.0. (SPSS Inc., Chicago, Illinois, USA).

RESULTS

In total, 579 patients were sent an invitation letter, of which 149 were willing to participate and signed informed consent. After inclusion, nine patients withdrew from the study due to illness (n = 5) or other causes (n = 4). Four patients were excluded after measurements due to lack of comprehension of the questionnaires and inadequate yes/no responses. Consequently, 136 out of 579 patients participated. The mean age of the participating patients was 58.8 years (SD 10.22) and 70 of them (51.5%) were male. We collected complete data on all questionnaires in 136 cases. Due to aphasia, only 127 patients completed the verbal memory tests, 130 the Word Fluency test, 124 the Token test, 134 the Zoo map test and 132 patients completed the Boston Naming test. Descriptive data are presented in Table 1.

The mean age of the 434 non-responding patients was 60.9 years (SD 11.9 years) and 56.4% were male. We were able to determine type of stroke and localization in approximately 65% of the non-responders: 70.1% suffered from ischemic stroke and 25% suffered from a haemorrhagic stroke. The side of stroke was in 50% the left-side, in 43% the right side, and in 7% either in the brainstem or an unknown localization. The mean time post onset of the non-responders was 76.5 months (SD 38.2 months), which is significantly longer than in participating patients ($p<.001$).

We compared patients with and without complaints on all measurements. Patients with complaints differed significantly in age, depression scores, Memory Self-efficacy, and neuroticism; but not in actual memory performance (Table 1). Stroke patients with memory complaints were significantly younger, had lower MSE scores, higher depression scores, and higher neuroticism scores than patients without memory complaints. Multivariable logistic regression analysis showed that MSE score remained an independent predictor of having memory complaints, when adjusting for age, depression score and neuroticism, with this last variable dropping out of the model (Table 2).

Univariable analyses showed that MSE was significantly predicted by age, having no partner, left sided stroke, the presence of complaints, depression, a “flexible” coping style, extraversion, neuroticism, the delayed recall score of the RBMT and Word Fluency. In the multivariable regression model not having a partner, a left-sided stroke, the presence of complaints, higher depression scores, and less word production on the word fluency task remained independent predictors of lower MSE scores (Table 3).

Table 1. Descriptive variables and group comparisons

Variable	Total sample (n =136)		Patients with complaints (n=100)		Patients without complaints (n=36)		
	n	%	n	%	n	%	p-value
Gender (male)	70	51.5	50	50	20	55.6	.571
Educational level (<high)	106	77.9	81	81	25	69.4	.152
Partner (yes)	99	72.8	70	70	29	80.6	.189
Side of stroke (left)	76	55.9	58	58	18	50	.407
Type of stroke (ischemic)	91	66.9	66	66	25	69.4	.903
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**p-value**
Time post onset	51.3	38.6	48.5	35.82	54.7	45.13	.415
Age	58.8	10.22	57.5	9.89	62.7	10.26	.008
MSE[†]	8.91	1.87	8.31	1.63	10.57	1.45	.000
Depressive symptoms (29%> 16)	12.15	10.37	14.11	10.81	6.72	6.56	.000
Coping							
Flexible	2.59	0.51	2.55	0.52	2.73	0.46	.068
Persistent	2.24	0.42	2.25	0.43	2.20	0.38	.552
Personality							
Neuroticism	3.92	3.46	4.46	3.56	2.42	2.67	.002
Extraversion	6.49	3.08	6.19	3.14	7.31	2.79	.062
Delayed recall AVLT[†]	7.41	3.42	7.55	3.64	7.00	2.66	.437
Delayed recall RBMT[†]	12.7	6.74	12.36	6.55	13.67	7.29	.263
Executive functioning							
BADS[†] Zoo	8.66	4.75	8.30	4.88	9.74	4.25	.129
Key (no deficit)	72	52.9%	56	56%	16	44.4%	.325
Word Fluency	30.15	11.61	29.87	11.36	30.91	12.38	.652
TMT[†] A (no deficit)	115	84.6%	84	84%	31	86.1%	.516
TMT B (no deficit)	63	46.3%	48	48%	15	41.7%	.737
Aphasia							
Token test	30.22	6.98	29.97	7.25	30.86	6.31	.525
BNT[†]	149.00	32.73	149.76	30.81	146.97	37.96	.667

[†] MSE: Memory Self-efficacy; AVLT: Auditory Verbal Learning Test; RBMT: Rivermead Behavioural Memory Test; BADS: Behavioural Assessment of Dysexecutive Syndromes; TMT: Trail Making Test; BNT: Boston Naming Test.

Table 2. Multivariable logistic regression analysis, dependent variable: presence of memory complaints.

Predictors	Multivariable logistic regression analysis Nagelkerke R^2=0.470	
	Relative Odds Ratio	p-value
MSE	0.42	.00
Age	0.96	.11
Depressive symptoms	1.06	.07
Neuroticism	dropped out	n.s.

Table 3. Univariable and multivariable linear regression analyses, dependent variable: Memory Self-efficacy

Predictor	Univariable analyses		Multivariable analyses R^2=0.463	
	B	p-value	B	p-value
Age	0.04	**0.02**	0.08	0.28
Gender (male)	-0.55	0.08		
Educational level (<5 vs >=5)	0.75	0.05		
Partner	-0.74	**0.04**	-0.52	0.08*
Type of stroke (ischemic)	0.22	0.62		
Side of stroke (left vs right + brain stem)	-0.69	**0.03**	-0.48	0.09*
Time post onset	0.00	0.47		
Aphasia				
Token test	0.03	0.27		
BNT†	0.00	0.75		
Memory complaints (yes/no)	-2.26	**0.00**	-1.75	0.00*
Depressive symptoms	-0.08	**0.00**	-0.05	0.00*
Delayed recall AVLT†	0.07	0.17		
Delayed recall RBMT†	0.06	0.02	0.06	0.44
Coping				
Flexible	0.78	**0.01**	0.06	0.50
Persistent	0.39	0.32		
Personality				
Neuroticism	-0.21	**0.00**	-0.09	0.36
Extraversion	0.16	**0.00**	0.09	0.21
Executive functioning				
BADS† Zoo	0.03	0.47		
Key (no deficit)	-0.35	0.28		
Word Fluency	0.03	**0.03**	0.04	**0.01***
TMT† A (no deficit)	0.57	0.21		
TMT† B (no deficit)	-0.54	0.10		

† BNT: Boston Naming Test; AVLT: Auditory Verbal Learning Test; RBMT Rivermead Behavioural Memory Test; BADS: Behavioural Assessment of Dysexecutive Syndromes; TMT: Trail Making Test.
* included in multivariable regression model.Bold digits are significant at a p-value of 0.05

DISCUSSION

After suffering a stroke, patients with and without memory complaints differ in MSE scores, depression, age and neuroticism. Patients who are younger, more depressed or have lower MSE scores more frequently report memory complaints; regardless of the severity of the actual memory deficits. Memory capacity, but also cognitive functioning in the executive and language domains, is similar in patients with and without memory complaints after stroke. These results are in line with findings in healthy elderly adults, except for the finding that after stroke, younger patients report more complaints. Perhaps this finding could be explained by the impact of stroke in younger patients' life. These patients are more often working and their environment may demand more memory capacity. Also, older stroke patients may attribute there deficits to their age instead of their stroke and may therefore be more accepting of their deficits. This belief is generally held in society as well.

We further found that in addition to patients with memory complaints, patients without a partner, with left-sided stroke, with more depressive symptoms or less word production on the Word Fluency test had a significantly lower MSE. Possibly these factors are predictive for the effectiveness of a MSE training programme for stroke patients.

Depressive symptoms negatively impact cognitive functioning after stroke.[42] The prevalence of depression in this sample was substantial as in other stroke populations.[43] The importance of depressive symptoms on negative cognitions is clear.[44,45] By changing these cognitions in addition to improving their general beliefs about memory in a MSE training programme, patients may experience less depressive feelings, improve their MSE ratings and as a result experience less memory complaints. Targeting depression as well as general memory beliefs in a training programme may be more effective than targeting memory beliefs alone. It is known that left sided stroke is related to depressive symptoms.[42] Interestingly, in addition to depressive symptoms, the side of stroke was also predictive of MSE; left sided stroke patients scored lower compared to right sided stroke patients. It could be that right sided stroke patients may have less awareness of their deficits,[46] and thus score higher on MSE than left sided stroke patients. Deficits at the right side are also known to influence motivational aspects of therapy.[47,48]

A lower score on the Word Fluency test reflects impairments on several cognitive domains impacting daily life activities, which could lead to lower MSE scores that in turn may lead to experiencing more memory complaints.

The absence of a partner may be related to loneliness or less social reflection. Patients may dwell on their own negative cognitions without sufficient feedback and support. Joining a group therapy on MSE may improve their self-reflection and decrease the influence of not having a partner. The predictive value of these factors on MSE should be verified longitudinally in an intervention study.

A surprising finding is the lack of additive value of neuroticism and coping in the final regression models. Neurotic people may have a tendency to gloominess and worrying is also part of MSE, which contains anxiety towards memory functioning. Therefore, these

aspects of neuroticism may be reflected in the depression scores, which affect both memory complaints and MSE. A passive coping style may be reflected by depressive symptoms as well. An alternative explanation is that stroke dominates neuroticism and coping as it occurs in 'normal' memory loss in healthy elderly. On the other hand, our findings on depression and having no partner are in line with findings in healthy elderly subjects, which may indicate that (parts of) effective interventions for healthy elderly could be used in a stroke population.

The current study may have suffered from information as well as selection bias. Missing data in neuropsychological tests (due to aphasia or motor deficits) may have caused information bias. Patients without memory complaints are underrepresented in our study sample. It is possible that patients without memory complaints were less prone to participate causing selection bias. Patients who were treated more recently, participated more in the study. However, time post onset is of no influence on either memory complaints or MSE. Furthermore, in the Netherlands only about 10-15 percent of all stroke patients are referred to in- or outpatient rehabilitation clinics. Especially the elderly patients that suffered a stroke are not represented in this study. Since we included only patients who were 18 months post onset or more, our results should not be generalized to patients who are in the more acute stages of stroke.

Conclusion

Our study is the first to establish that memory complaints in patients in the chronic phase after stroke are determined by MSE rather than memory capacity. This suggests that stroke patients with memory complaints can benefit from enhancing MSE. This could be done using cognitive behavioural therapy aimed on memory experience. Moreover, addressing negative cognitions might support a successful MSE training programme.

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Chapter 5

Training Memory Self-Efficacy in the Chronic Stage after Stroke: a Randomized Controlled Trial

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ABSTRACT

Background and purpose

Stroke patients with a low memory self-efficacy (MSE) report more memory complaints than patients with a high MSE. The aim of this study was to examine the effect of a memory-training program on MSE in the chronic phase after stroke and to identify which patients benefit most from the MSE training program.

Methods

In a randomized controlled trial the effectiveness of an MSE training program (experimental group) was compared to a peer support program (control group) in chronic stroke patients. Primary outcome was MSE, measured using the Metamemory-In-Adulthood Questionnaire. Secondary outcomes included depression, quality of life, and objective verbal memory capacity. Changes in outcomes over the intervention period were compared between both groups. Demographic and clinical variables were studied as potential predictors of MSE outcome in the experimental group.

Results

In total, 153 patients were included, aged 58 years (SD=9.7), 54.9% male, and 54 months (SD=37) after stroke. Of these, 77 were assigned to the experimental and 76 to the control group. Improvement of MSE (B=.40; p=.019) was significantly greater in the experimental than in the control group. No significant differences were found for the secondary outcomes. An increase in MSE after training was predicted by a younger age (B=-.033; p=.006) and a better memory capacity (B=.043; p=.009), adjusted for baseline MSE.

Conclusions

MSE can be improved by the MSE training program for stroke patients. Younger patients and patients with a better memory capacity benefit most from the MSE training program. (Dutch Trial Register: NTR-TC 1656).

INTRODUCTION

Cognitive disorders frequently occur as a result of stroke with long term consequences for physical as well as cognitive functioning and quality of life.[1-4] Memory deficits occur in about 30% of all stroke patients and may persist for one to even ten years post-onset.[5-8] Current memory training programs in rehabilitation for traumatic brain injured (TBI) patients focus on compensatory strategies and on errorless learning.[9] These approaches are effective in TBI patients. However, in stroke patients these programs seem insufficient because patients fail to apply the compensatory techniques they learned in training programs, in their daily life.[9,10]

We earlier studied the relation between the subjective experience of memory and actual memory deficits in stroke patients.[11,12] The subjective experience of memory functioning is an important aspect of metamemory.[13] Metamemory is broadly described as 'cognitions about memory', and entails the use of memory strategies and 'Memory Self-efficacy' (MSE).[14] MSE is the feeling of mastery and control of the way your memory functions. Metamemory has not been studied frequently in stroke patients. A study on metamemory after TBI concluded that TBI patients have a negative view of their memory functioning which contributes to depressive symptoms.[15] Stroke patients also cope differently with their memory deficits if they have elevated depression scores and neurotic personality traits.[11,16,17] These patients may be less able to come to an accurate judgment of their actual memory deficits if they have a significantly lower Memory Self-efficacy, independent of existing memory deficits.[12] This is a familiar phenomenon in elderly subjects who visit memory clinics in the Netherlands. About 17-20% of these elderly experience memory complaints but do not have an objectively decreased memory test performance.[18] An intervention focusing on improving the subjective experience of memory functioning through psycho-education, was found to be effective in reducing memory complaints and improving memory test performance in healthy elderly subjects.[19]

Although there are obvious differences between these healthy elderly people and stroke patients in terms of cognitive functioning, there appear to be similarities in the way of managing their memory complaints.[12,17] It is therefore possible that stroke patients with memory complaints could be trained to increase their MSE to overcome the negative way in which they experience their memory deficits. If Memory Self-efficacy could be improved by a training program, other psychosocial aspects such as quality of life and mood of these patients might improve as well.[20] It is questionable whether actual memory functioning can be improved after stroke, but this is not the intention of this study.

The current study is a Randomized Controlled Trial on the effects of a MSE training in a sample of patients in the chronic stage after stroke, compared to a peer support program. The aim of this study was to evaluate the effect of MSE training on MSE, depression and quality of life. We expected MSE to increase in the experimental group but not in the control group. As a result of increased self-confidence in memory functioning, effects

on depression and quality of life were also expected. In view of the long period since the stroke, we did not expect to find any changes in verbal memory tests. The second aim of the study was to explore factors which might predict which patients benefit most from the MSE training program.

METHODS

Participants

Patients were recruited in the Rijndam Rehabilitation Centre, Rotterdam and the Heliomare Rehabilitation Centre, Wijk aan Zee, the Netherlands. Patients were included in the study if 18 months or more had elapsed since their first and only stroke, if they were between 18 and 80 years old, living independently and if they reported subjective memory complaints. Subjective memory complaints were assessed using a semi-structured telephone interview. Memory complaints were rated using several questions such as "Do you experience hindrance from your memory deficits in daily life?" "Do you think your memory could be improved?" and "Do you feel ashamed or embarrassed if you forget appointments or information?". Patients who experienced memory complaints were included, but patients who did not report complaints were excluded, even if they reported the presence of memory deficits. These patients felt they were able to adequately deal with their deficits e.g. by using memory aids. Other exclusion criteria were progressive neurological disorders such as dementia or Multiple Sclerosis, insufficient knowledge of the Dutch language, alcohol or drug abuse, and subdural haematomas or subarachnoid haemorrhages. The Medical Ethics Committee of the Erasmus University Medical Centre in Rotterdam, the Netherlands, approved the study. All patients signed an informed consent form.

Intervention

The MSE training was adapted from a program developed by Ponds and Verhey[21] which aimed at improving subjective memory experience in healthy elderly subjects in order to improve memory functioning. This training focuses on altering negative beliefs regarding memory functioning in general. Participants are taught to use memory strategies and are educated on the influence of negative perceptual bias in memory demanding situations. The effort put into situations demanding memory function is partly determined by subjective beliefs and this relationship is discussed as well. These concepts are used to optimize goal setting in situations demanding memory function. This MSE training for stroke patients consisted of three parts (1) a general introduction on memory and stroke, including the consequences of actual memory deficits and how to cope with these (2) a training in internal and external memory strategies to improve compensating abilities (e.g. visualization, diary use, taking notes) and (3) psycho-education on the influence of beliefs, anxiety, memory-related worries and motivation on memory performance such as realistic goal setting regarding memory demanding tasks; using cognitive behavioral

therapeutic aspects. The training program involved 9 twice-weekly group sessions of 1 hour. Patients were encouraged to discuss the information during the sessions and to relate to familiar situations. Patients received a booklet with information about the sessions. At the end of each session, homework assignments were given which took about half an hour to complete. These were discussed in the next session.

The control group also followed a schedule of 9 twice-weekly, 1 hour sessions. It was a peer support group in which general education on causes and consequences of stroke was provided. Patients were invited to share problems experienced in their daily life. No active therapeutic interventions were performed in the control group. A psychologist was present to provide basic information on stroke and to moderate the sessions. After completing the 9 sessions, patients received a booklet with handouts of the sessions. The patients did not receive homework assignments in the control group. Both groups were moderated by a trained psychologist.

Study design

Patients were randomly allocated to either the MSE training or the peer support group. All patients were informed on the scope of the study, without details on the contents of both interventions. Thus patients were not informed on the type of intervention (MSE training versus peer support group) they had been allocated to. All patients were assessed at home within three weeks prior to the intervention (T0) and within 10 days after the intervention (T1) by trained research psychologists who were blinded for group allocation. The data were entered into a database by the blinded research psychologists.

Measurement instruments

MSE was measured using three subscales of the 'Metamemory In Adulthood questionnaire' (MIA).[22] This questionnaire was translated and validated for a Dutch population by Ponds and Jolles.[23] The questionnaire consists of 74 questions related to subjective memory experiences in daily living. The items are entered on a 5-point Likert scale. The score range for each subscale is 1 to 5. The subscales Change, Capacity and Anxiety are used to compute an MSE score (range 3-15). A higher score on the MSE subscale indicates more confidence in capacity and change and lower anxiety regarding memory functioning. The MIA has been used in a large cohort study in the Netherlands, studying cognitive aging.[11] The questionnaire was previously used in neurological populations.[15,24]

Depression was measured using the Center of Epidemiological Studies-Depression scale (CES-D).[25] This scale is used to measure reactive depression. The score ranges from 0-60. Higher scores indicate more depressive symptoms. A score of 16 or higher is regarded as a probable clinical depression.

Health-related quality of life was measured using the EuroQol EQ5D questionnaire. This scale consists of 5 questions, which can be transformed to a 'utility score' and a Visual Analogue Scale (VAS). Both the utility score, which represents the social perspective

on quality of life; and the VAS score, which represents the patient's perspective on quality of life, are used as outcome measures. The utility score has a range score from 0 (worst possible health) to 1 (best possible health). The VAS score ranges from 0-100, higher scores indicating a better health perception. Besides these uni-dimensional measures, quality of life was also measured using the multi-dimensional WhoQol Bref questionnaire.[26] This questionnaire consists of 26 questions on the quality of life in four dimensions, physical quality of life, psychological quality of life, social factors of quality of life, and environmental factors of quality of life. Psychological quality of life and social factors of quality of life were used as outcome measures in this study. These domains can be transformed into a scale ranging from 4 to 20, higher scores indicate a better perception of quality of life in the specific domain.

To assess actual memory capacity, we used the Dutch version of the Auditory Verbal Learning Test (AVLT)[27] and Story Recall from the Rivermead Behavioural Memory Test (RBMT).[28] The AVLT was used prior to, and immediately after the intervention in the same form. The score of the AVLT ranges from 0 to 75 in the immediate recall condition and from 0 to 15 in the delayed recall condition (maximum number of remembered words). Parallel versions of the Story Recall of the RBMT were used before and after the intervention. The score of the RBMT stories ranges from 0 to 42 (maximum number of story elements of two stories). We used the delayed recall score of the AVLT and the delayed recall score of the RBMT as outcome measures.

Other measurements

We used several measurements to determine predictive factors of MSE in the experimental group. Based on previous findings, we identified potentially predictive factors including demographic variables, coping, personality traits, and executive functioning.[8,9] Patient charts were obtained and semi-structural interviews were performed to gather information on age, gender, type and localization of stroke, co-morbidity, time post onset (time from stroke until baseline measurement), education level, marital status, and work status. Coping was measured using the Assimilation-Accommodation coping scale.[29] Personality was measured using the Eysenck Personality Questionnaire Brief version, using the subscales which measured extraversion and neuroticism.[30] The presence of aphasia was assessed using the Token Test, Boston Naming test (BNT) and Word Fluency Test (WFT).[31-33] The latter was also used to assess executive functioning. The Trail Making Test (TMT), a visual scanning task and two subtests (zoo map and key finding) of the Behavioural Assessment of the Dysexecutive Syndrome (BADS) were used to assess executive functioning as well.[34,35]

Procedure

All tests and questionnaires were administered in a fixed order, starting with the MIA in order to minimize the effect of the memory tests on subjective memory experiences. All neuropsychological tests were performed in the same order during both

measurements. Patients were randomized following a block design per group and per centre in fixed blocks of 10 groups. When patients enrolled in the study, they were placed on a waiting list. If at least 4 patients had been included, a new group was started. The allocation of the group to either experimental or control condition was performed by an independent investigator, who was not otherwise involved in this study. If more patients were included prior to the start of the group, a maximum of two patients could be added to the group, resulting in a maximum group size of 6 patients. All groups consisted of 4 to 6 participants, allowing sufficient interaction but also limiting distraction. The time per session was set at a maximum of one hour taking into account possible attention deficits.

Statistical analyses

All statistical analyses were performed using SPSS PASW version 18 for Microsoft Windows. Potential differences between groups in the baseline characteristics were analyzed using independent T-tests for continuous variables and Chi-square tests for categorical variables. Changes over time in continuous outcome measures were studied for each group using paired T-tests. The differences between the groups over the intervention period were analyzed using linear regression analyses. Each outcome after the intervention period was entered as a dependent variable in the regression model, adjusted for the baseline measurement, which was entered as a covariable. For the group comparisons, a second covariable was added to the model that indicated to which group the subject was allocated to (1 for the experimental, 0 for the control group), following the intention-to-treat principle. Significance of this grouping variable indicates a statistically significant difference in outcome between the two groups. In case of missing follow-up data, the data of the T0 measurement was imputed at T1, according to the intention-to-treat principle (Last Observation Carried Forward method, LOCF). A p-value of $<.05$ was used for statistical significance.

Predictors for MSE outcome after the intervention were determined using multivariable regression analyses with backward variable selection, adjusted for MSE at baseline. Only baseline determinants that predicted MSE outcome in a bivariable analysis adjusted for baseline MSE, were entered in the multivariable model if the p-value was $<.10$. Potential predictors included patient and stroke characteristics, time post onset, aphasia, executive functioning, personality, depressive symptoms, coping style, quality of life, participation and memory capacity, all measured at baseline. Only patients who entered the intervention group were included in these analyses. A p-value $<.05$ was used as significance level for inclusion of variables and $>.10$ for removal of variables.

RESULTS

Study population

The inclusion of patients is described in Figure 1. Six patients decided to withdraw from the study after providing informed consent, and 5 patients were excluded due to the existence of dementia (n=2) or severe language disorders (n=3). 153 patients enrolled in either the experimental or the control condition.

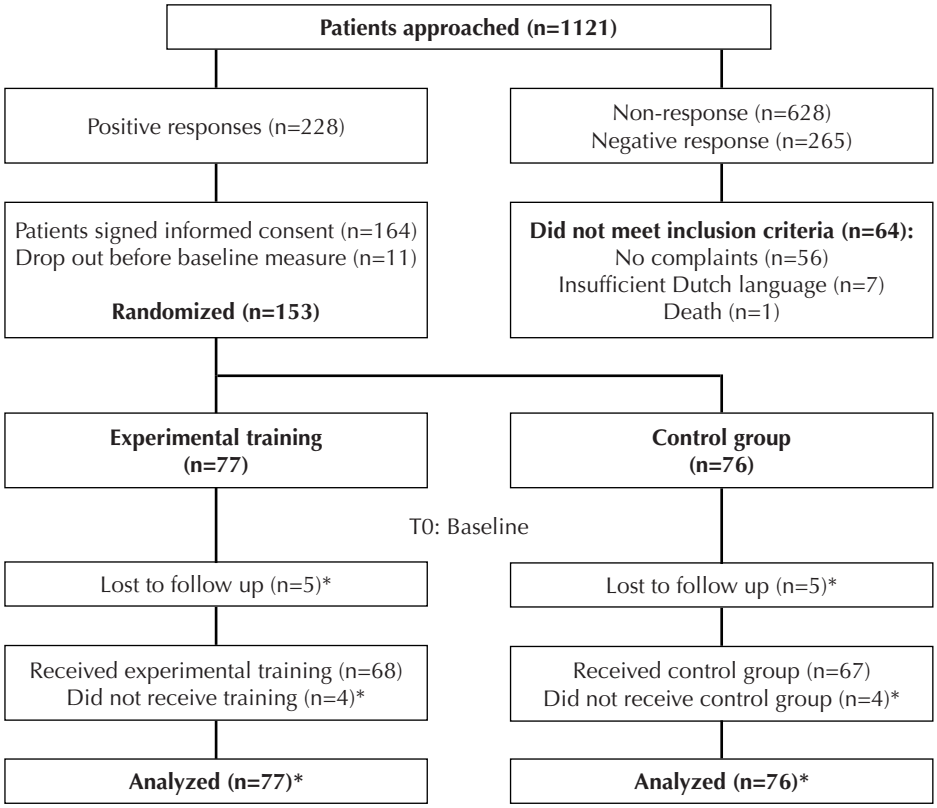

Figure 1. Flow chart of patient inclusion.
* Analyzed as randomized according to 'intention to treat' principle

Patient characteristics

The mean age of the total study population was 58 years and 54.9 percent were male. Mean time post onset was 53.9 months (SD=37.2 months). In 57% of the population the stroke was left-sided and the type of stroke was ischemic in 68% of the population.

Table 1. Baseline characteristics

Variable	Experimental group (n=77)		Control group (n=76)		p-value
	n	%	n	%	
Gender (male)	44	57.1	40	52.6	.58
Educational level (<high)	61	79.2	59	77.6	.68
Partner (yes)	54	70.1	59	78.7	.29
Work (yes)	12	15.6	13	17.1	.80
Side of stroke (left)	42	54.5	45	59.2	.56
Type of stroke (ischemic)	54	70.1	50	65.8	.55
	Mean	**SD**	**Mean**	**SD**	**p-value**
Age	58.30	10.36	57.86	9.00	.78
Time post onset (months)	52.41	39.38	55.34	35.08	.63
Memory Self-efficacy (MSE)	8.50	1.76	8.39	1.62	.70
Depression score	14.69	10.78	12.04	10.39	.12
Quality of Life					
Utilityscore EQ5D	0.74	0.25	0.75	0.23	.75
VAS†	66.60	17.77	68.04	18.97	.63
Psychological QoL†	13.71	2.91	14.16	2.46	.31
Social factors QoL†	13.65	3.47	14.70	2.51	.04
Delayed recall AVLT†	7.58	3.68	6.43	3.51	.06
Delayed recall RBMT†	13.02	7.73	11.30	5.70	.13
Coping					
Flexible	2.52	0.50	2.58	0.43	.40
Persistent	2.23	0.44	2.22	0.41	.86
Personality					
Neuroticism	4.58	3.46	4.21	3.30	.50
Extraversion	5.97	3.19	6.20	2.81	.65
Aphasia					
Token test	30.19	7.02	30.27	7.03	.95
BNT†	149.20	28.94	154.20	26.48	.28
Word fluency	31.39	11.99	28.96	11.92	.22
Executive functioning					
BADS† zoo	7.96	4.72	7.63	5.23	.68
BADS key	10.56	3.99	10.54	3.75	.98
TMT† (B/A index)	2.85	1.11	2.80	1.44	.81

SD: standard deviation, p-value of <0.05 is used as statistical significance; † BNT: Boston Naming Test; BADS: Behavioural Assessment of Dysexecutive Syndromes; TMT: Trail Making Test; VAS: Visual Analog Scale; QoL: Quality of Life; AVLT: Auditory Verbal Learning Test; RBMT: Rivermead Behavioural Memory Test.

Table 1 presents the patient characteristics and baseline outcomes of the two separate groups. There were no significant differences between the experimental and the control group in any of these variables, except for the social component of quality of life (p<.04).

Effects of MSE training

Over the intervention period, the MSE score, the psychological health component of quality of life, and the delayed recall score of the AVLT significantly improved in the experimental group (Table 2). In the control group, the delayed recall score of the AVLT and the RBMT improved significantly over time. Comparing the changes over the intervention between both groups, we found that MSE increased significantly more in the experimental group than in the control group (Table 2).

Table 2. Mean differences over the intervention period in the experimental and control group and differences between the groups.

	Experimental group Difference T1-T0*			Control group Difference T1-T0*			Group comparison adjusted for baseline#		
	Mean	s.e.	p-value	mean	s.e.	p-value	Beta	s.e.	p-value
MSE†	0.48	0.14	.00	0.12	0.12	.31	0.40	0.17	.02
Depression score	-1.79	1.02	.08	-0.09	0.74	.90	-0.81	1.26	.52
Quality of Life									
Utility score EQ5D	0.02	0.02	.23	0.00	0.02	.91	0.02	0.03	.46
VAS†	0.96	1.33	.47	2.96	2.08	.16	-2.29	2.23	.31
Psychological QoL†	0.17	0.05	.00	0.00	0.05	.86	0.47	0.28	.09
Social Rel. QoL†	0.16	0.09	.06	-0.05	0.07	.49	0.55	0.43	.20
Delayed recall AVLT†	1.01	0.26	.00	1.22	0.29	.00	-0.11	0.42	.80
Delayed recall RBMT†	-0.01	0.49	.98	0.97	0.46	.04	-0.63	0.71	.38

s.e.: Standard Error of the mean. † MSE: Memory Self-efficacy; VAS: Visual Analog Scale; QoL: Quality of Life; AVLT: Auditory Verbal Learning Task; RBMT: Rivermead Behavioural Memory Test. * A positive (or negative) number means an increase (or decrease) in outcome score over the intervention period. # A positive (or negative) number means that the experimental group scored higher (or lower) than the control group at T1 adjusted for baseline.

Predictors of MSE outcome

Significant predictors of MSE outcome in bivariable analyses adjusted for MSE at baseline were age (B=-.026; p=.037), delayed recall score of the RBMT (B=.039; p=.021), and stroke located in the brainstem (B=-.855; p=.030). In the multivariable regression analyses, we found that patients with a better delayed recall score of the Story Recall of the RBMT (B=.043; p=.009) and patients who were younger (B=-.033; p=.006) had a significantly higher MSE score after the MSE training (Table 3). All other demographic and clinical variables had no predictive value for MSE outcome after the MSE training when adjusted for MSE scores at baseline.

Table 3. Multivariable prediction model (final) for MSE outcome after the intervention period (R^2=.574).

Predictor variable	B	CI	p-value
Intercept	5.34	3.45 - 7.23	.00
MSE† baseline score	0.60	.46 - .74	.00
RBMT† delayed recall score	0.04	.01 - .08	.01
Age	-0.03	-.06 - -.01	.01

B= regression coefficient, CI: Confidence Interval, p-value significant at 0.05.
† MSE: Memory Self-efficacy; RBMT: Rivermead Behavioural Memory Test.

DISCUSSION

This study showed that the MSE training program in patients in the chronic stage after stroke is effective in improving MSE. The psychological component of quality of life also improved significantly in the experimental group but not in the control group. This suggests that improving MSE may result in a better psychological quality of life, although no group difference was found. Even so, these findings support further development of the MSE training program for stroke patients.

The second aim of the study was to identify potential predictors of MSE outcome. Both the baseline delayed recall score of the Story Recall of the RBMT and age predicted MSE outcome in the experimental group, adjusted for MSE scores at baseline. These findings are useful in targeting patients for a MSE-intervention: younger patients and/or those with a better verbal memory capacity may benefit more from attending the MSE training program. Based on our study, it is unclear whether elderly patients might need additional sessions, individual attention or different training forms to achieve the same results as younger patients; or whether age is a limiting factor. Similar changes in the training program might be needed for patients with more memory deficits.

Other studies on memory training show contradictory results in the effectiveness of memory rehabilitation for brain injured patients. Cicerone and others[9] recommend a combination of strategy training, errorless learning and metacognitive training for TBI patients to enhance memory performance. For stroke patients, external compensation strategies are recommended as a practice standard for remediation of memory deficits.[9] Nair and Lincoln, however, state that there is insufficient evidence for memory rehabilitation for stroke patients because of the low methodological quality of current studies.[36] Our study is, to our knowledge, the first large trial on metacognitive memory training for stroke patients.

Except for MSE, no significant improvement in depression and quality of life was found between both groups. Several factors may explain this. First, long term results might be needed to show improvements on the domains of psychological and social quality of life. More time might be needed to integrate newly learned information into daily life routines in order to have an effect on depression or quality of life. Second,

the used quality of life measurement is a self-report scale and subject to response shifts. Including other measurements for social participation or other domains of daily functioning may broaden the effects of the MSE-training in future research.

There are several limitations of the study. The inclusion criteria resulted in a heterogeneous study population, as shown in the large standard deviations of the mean values of the outcome measurements. Small improvements are difficult to detect in such a heterogeneous population. Possibly, training effects increase if treatment is targeted at specific subpopulations. Furthermore, we did not perform a Bonferroni or other correction method for multiple testing, since the use of these methods would increase the chance of a type two error: missing actual treatment effects. We did use a conservative way of data-analysis with the LOCF method, assuming that MSE training in drop-outs would not have been effective. If we had performed a per protocol analysis, the group differences would have been more significant. Finally, the effect size of MSE is small, which could suggest a marginal clinical relevance and therefore, the transfer of the effect to other areas such as quality of life and depression can be questioned. However, these patients are in a chronic stage after stroke, in which no change or even decline of functioning may be expected, so the change in MSE, however small, may be considered as relevant. Taking all limitations into account, these findings should be interpreted with caution and do not allow us to draw definite conclusions about the use of MSE training in stroke patients in the chronic stage.

Conclusion

This study is the first to investigate the integration of MSE into memory programs for stroke patients in a large randomized trial and to show that MSE can be improved in a chronic stroke population. The training seems particularly effective in younger patients and in patients with a reasonable level of cognitive functioning and also seems to improve the psychological component of quality of life. Long-term investigations should reveal whether the effects fade out over time, or whether other aspects of functioning and quality of life may improve.

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Chapter 6

Long Lasting Effects of a New Memory Self-Efficacy Training for Stroke Patients: a Randomized Clinical Trial

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ABSTRACT

Background and purpose

This study aims to determine the long-term effects of a new Memory Self-efficacy (MSE) training program for stroke patients on MSE, depression and quality of life.

Methods

In a randomized controlled trial, patients were allocated to a MSE training or a peer support group. Outcome measures were MSE, depression, and quality of life; measured with the Metamemory-In-Adulthood questionnaire, Center of Epidemiological Studies - Depression (CES-D) and the WhoQol-bref questionnaire, respectively. We used linear mixed models to compare the outcomes of both groups immediately after training, after 6 and after 12 months, adjusted for baseline.

Results

In total, 153 former inpatients from 2 rehabilitation centres were randomized; 77 to the experimental and 76 to the control group. MSE increased significantly more in the experimental group and remained significantly higher than in the control group after 6 and 12 months (B=-.42; p=.010). Psychological quality of life also increased more in the experimental group, but not significantly(B=-.09; p=.077). However, in the younger subgroup of patients (<65), psychological quality of life significantly improved in the experimental group compared to the control group and remained significantly higher over time (B=-.14; p=.030). Other outcome measures were not significantly different between both groups.

Conclusions

A MSE training program improved MSE and psychological quality of life in stroke patients aged < 65 years. These effects persisted during twelve months follow-up.

INTRODUCTION

Memory Self-efficacy (MSE) is an important aspect of metamemory and is described as 'a sense of mastery and control about memory functioning'.[1] It is based on the theoretical construct of Self-efficacy, first introduced by Bandura.[2] It is the subjective experience of one's memory capacity (as measured with objective memory tests). A high sense of MSE reflects a high level of confidence in one's memory capacity.[2,3] In healthy elderly subjects[4], in traumatic brain injured patients[5] and in stroke patients,[6-8] MSE and memory complaints have been found to be related to psychological factors such as depression and neuroticism. The relationship between memory capacity and MSE seems to be less strong.[9] Subjective psychological factors rather than objectively measured memory capacity determine MSE and the presence of memory complaints. Effective training programs aimed to improve MSE have been developed for healthy elderly and nursing home residents.[10,11]

In the literature, no evidence is found to support or refute the effectiveness of memory rehabilitation on objective or subjective memory measurements in stroke patients.[12] The only memory rehabilitation program that is recommended for stroke patients with memory deficits is the use of external compensatory strategies.[13] Additional psycho-education may be more effective in reducing subjective memory complaints in stroke patients. The goal of psycho-education may be to understand and to be able to cope with memory complaints after stroke.

Many stroke survivors report symptoms of depression and reduced quality of life, factors that are related to MSE and functional outcome.[6,14-16] We hypothesized that if MSE can be improved after stroke, this may result in increased quality of life and less depressive symptoms. An improved MSE may translate into a better sense of psychological well-being and better participation in social activities in which memory capacity is challenged, such as playing cards, grocery shopping and attending birthday parties .

Therefore, we developed a new MSE training program for stroke patients, which focuses on improving MSE through psycho-education in addition to learning memory compensatory techniques. In this training program, patients are educated about memory in general and compensatory strategies are trained as is the current practice standard. Additionally, patients learn about the influence of other factors such as mood and self-confidence on memory functioning in a group therapy setting. This MSE training already proved to be effective in increasing MSE in chronic stroke patients immediately after training.[17] This study aims to determine the long-term effects of the MSE training program on MSE, depression, and quality of life assessed at 6 and 12 months follow-up. We also studied potential age effects by dividing the study population into an elderly stroke group (>= 65 years) and a younger stroke group (<65 years). Furthermore, we studied the effects of the MSE training on subjective general problem experience and social participation.

MATERIALS AND METHODS

Former patients from the Rijndam rehabilitation centre, Rotterdam and the Heliomare rehabilitation centre, Wijk aan Zee the Netherlands, were recruited between 2008 and 2010 if they were (1) 18 months or more post onset after their first and only stroke, (2) between 18 and 80 years of age, (3) living independently and if they reported (4) subjective memory complaints during a first semi-structured interview with the researcher. Exclusion criteria were progressive neurological disorders like dementia or Multiple Sclerosis, insufficient knowledge and comprehension of the Dutch language, alcohol or drug abuse, and subdural haematomas or subarachnoid haemorrhages.

The study design was a multicenter randomized controlled trial (RCT). Patients were approached by their former physician and informed about the scope of the study, without details about the contents of the experimental and control group. All patients that agreed to participate signed an informed consent form. The Medical Ethics Committee of the Erasmus Medical Centre in Rotterdam, the Netherlands, approved the study.

Groups of patients were randomized following a block design of 10 per centre. The allocation of the group to either experimental or control condition, was performed by an independent investigator using a randomization program. Group size was 4-6 patients. Patients were not informed to which group they were allocated. Blinded and trained research assistants assessed all patients at home within three weeks prior to the intervention (T0). Within 10 days after the last session of the intervention (T1), after 6 months (T2) and after 12 months (T3), patients were reassessed. All measurements were performed with a research assistant present. Research assistants assisted in the case of aphasia by for example reading questions aloud.

The MSE training was adapted for stroke patients from a memory self-efficacy training program developed by Ponds and Verhey.[18] The training aimed at improving subjective memory experience and memory functioning in healthy elderly with memory complaints. The MSE training has a strong focus on psycho-education and consists of three parts (1) a general theoretical introduction on memory and stroke, (2) a training on internal and external memory strategies to improve compensating abilities and (3) psycho-education on the influence that mood, anxiety, and memory-related worries have on memory complaints. The training program involved 9 sessions of 1 hour, given twice a week. Patients received a training booklet with information about the sessions and homework assignments were handed out after each session.

No therapeutic interventions were performed in the control group. Subjects in the control group were educated about causes and consequences of stroke and shared their problems with peers. They followed the same schedule of 9 sessions of 1 hour. Handouts of the sessions were provided. No homework assignments were given. A trained psychologist moderated both conditions.

Patient charts were obtained and semi-structured interviews were performed to gather demographic information and characteristics of the stroke. Personality, coping, the presence of aphasia and executive disorders were assessed at baseline.

MSE was measured using three subscales of the 'Metamemory In Adulthood questionnaire' (MIA).[19] This questionnaire is translated and validated for a Dutch population by Ponds and Jolles.[20] The subscales Change, Capacity and Anxiety are used to compute a MSE score, ranging from 3 to 15. A higher score represents a higher level of confidence in one's memory capacity. The subscale Strategy was used to measure the use of memory strategies before and after the intervention, which ranges from 1 to 5. Examples of questions on internal and external memory strategies are "Do you try to visualize a face in order to remember a name?" and "Do you use a calendar to remember important dates such as birthdays or wedding days?". Depression was measured using the Center for Epidemiological Studies-Depression scale (CES-D).[21] A score of 16 or higher (range 0-60) is indicative for depression. Quality of life was measured using the multi-dimensional WhoQol-Bref questionnaire.[22] The mean scores ranging from 1-5 of the domains Psychological quality of life and Social factors of quality of life were used. In addition, the Visual Analogue Scale (VAS) of the Euroqol-5D (EQ5D), ranging from 0-100, which measures quality of life in general, was used as outcome measure in this study. The VAS is presented as a vertical line such as a thermometer, on which patients indicate their general quality of life; 0 represents the worst possible health situation and 100 represents the best possible health situation. Social participation was measured using the Social Support List.[23] The overall sum score is used as outcome measure for social participation, ranging from 12 to 48. The delayed recall score of the Dutch version of the Auditory Verbal Learning Test (AVLT),[24] ranging from 0 to 15, and the Story Recall of the Rivermead Behavioural Memory Test (RBMT),[25] ranging from 0-42, were used to assess verbal memory capacity. Problem experience was assessed using an abbreviated version of the Impact on Participation and Autonomy.[26] In this version the patient is asked to indicate the level of problem experience (ranging from 1 to 3 (no problems, minor problems, major problems) in each domain of the questionnaire (mobility, self care, finance, education, work, activities around the house, social contacts, leisure time and supporting others). We used the mean score on general problem experience as outcome measure.

Statistical analysis

Based on a study design with 2 groups and 4 repeated measurements with an estimated correlation of 0.70 within subjects, an alpha of 0.05, a power of 0.80, and an estimated effect size based on the variance explained, a partial Eta-squared of 0.055 (which corresponds to an effect size Cohen's f of 0.24 or a Cohen's d of 0.48),[27] we calculated that a total sample size of 140 patients would be needed to detect a significant difference between the groups.

All statistical analyses were performed using SPSS PASW version 18 for Microsoft Windows. Both groups were compared at baseline on demographic, clinical and (neuro)psychological determinants using independent T-Tests for continuous variables and Chi-square tests for categorical variables. We compared the baseline scores of MSE

to published norm values and calculated the z-scores and predicted scores for the AVLT and the RBMT delayed recall scores based on age and educational level.

Cohen's d effect size was calculated based on the means and standard deviations of the change scores over the intervention period. The proportion of patients improving at least 1 SD on the MSE scale was compared between the groups.[27] We performed repeated measures analyses using linear mixed models for each of the outcome measures to compare both groups over three time points (T1, T2, and T3), adjusted for baseline measures (T0). We started with unstructured correlation matrices and simplified if possible to compound symmetry matrices. Fixed factors in the analyses were group, measurement time point and baseline values. Interaction effects of these variables were taken into account. Non significant variables were removed from the full model to simplify the model. We used a p-value of <.05 for statistical significance. Additional to these analyses, we repeated all mixed models in subgroups of age, based on the previous finding that the effect of the MSE training is larger in younger patients than in older patients.[17] In the Netherlands, people typically retire at the age of 65; therefore, we divided the study population into a younger group of <65 years and an older group of ≥65 years.

RESULTS

Patient population

In total, 153 patients were randomized to either the experimental or the control group. Patient inclusion is described in the flow chart (Figure 1). The mean age of the total population was 58 years (SD= 9.7 years) and 55% was male. Mean time post stroke was 54 months (SD=37 months). In 57%, the stroke was left sided and in 68%, the type of stroke was ischaemic.

The study population was divided into 2 age groups: 38 (27%) patients were >= 65 years and 115 (73%) patients were < 65 years (Table 1). Older patients were more often men, and had lower depression scores and lower memory capacity scores than the younger patients at baseline. There were no significant baseline differences between the experimental and control group in either subgroup (Table 1), except for the delayed recall score (AVLT) in the younger group.

Baseline MSE scores (Table 1) were below average in the younger age group compared to a Dutch norm population (age<65: MSE norm 9.86, SD 0.71) and low compared to a subpopulation without memory complaints (age<65: MSE norm 10.15, SD 0.56). In the older age group the baseline scores were on average compared to the norms (age>=65: MSE norm 8.65, SD 0.76), but low compared to a subpopulation without memory complaints (age >=65: MSE norm 10.01, SD 0.63).[20] Baseline delayed recall scores of the AVLT and RBMT (Table 1) were also low compared to norm scores based on age and educational level (age<65: AVLT 9.73, RBMT 16.70; age>=65: AVLT 8.11, RBMT 14.87).

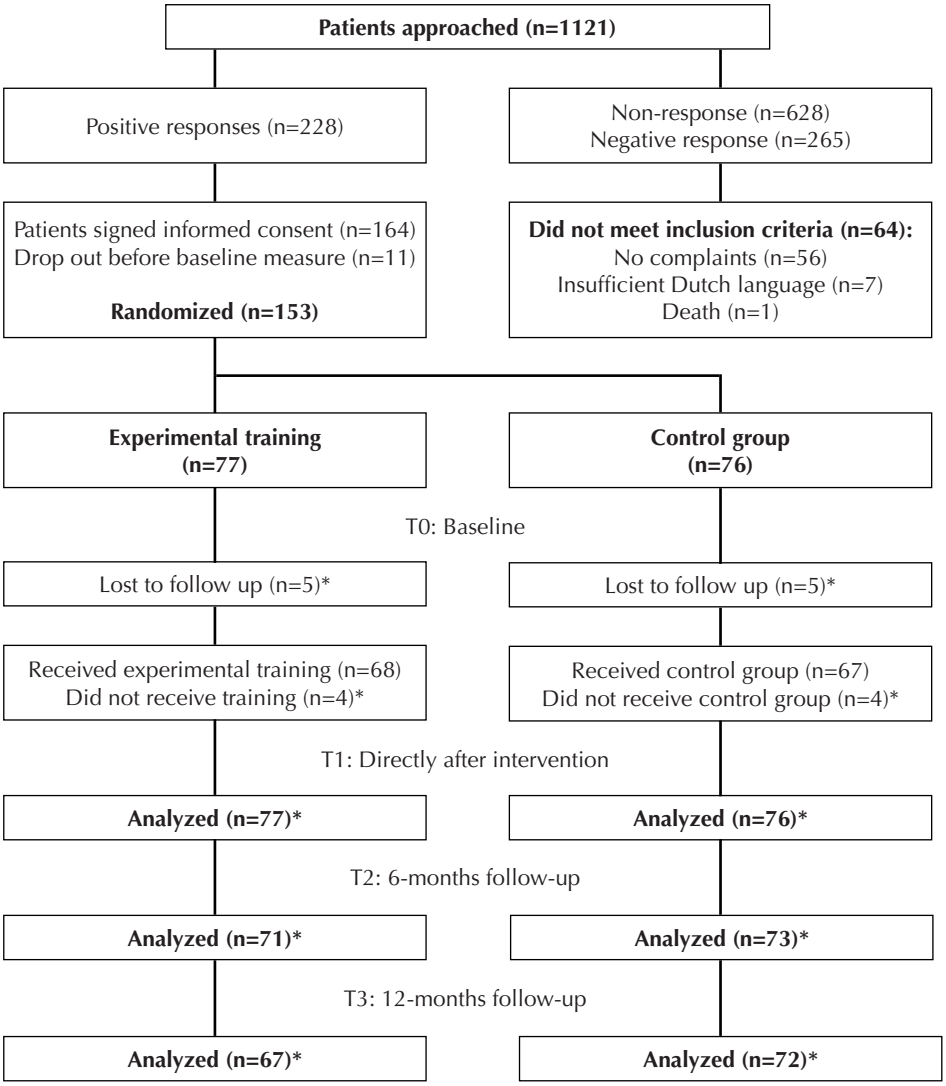

Figure 1. Flowchart patient inclusion.
* Analyzed as randomized

Table 1. Baseline characteristics of the experimental and control group by age group

	Age<65 years old					Age>=65 years old				
	Therapy		**Control**		**p-value**	**Therapy**		**Control**		**p-value**
	n=57		**n=58**			**n=20**		**n=18**		
	n	%	n	%		n	%	n	%	
Gender (male)	30	52.6	27	46.6	.514	14	70.0	13	72.2	.880
Education (<high)	46	82.1	46	80.7	.844	15	75.0	13	72.2	.846
Partner (yes)	39	68.4	45	77.6	.268	15	75.0	14	77.7	.841
Left-sided stroke	30	52.6	36	62.1	.306	12	60.0	9	50.0	.536
Ischemic stroke	42	76.4	40	71.4	.554	13	68.4	10	62.5	.713
Aphasic	6	11.1	5	9.4	.775	3	15.8	3	16.7	.942
	Mean	**SD**	**Mean**	**SD**	**p-value**	**Mean**	**SD**	**Mean**	**SD**	**p-value**
Age	54.00	8.42	54.36	7.11	.804	70.00	4.66	69.11	3.43	.511
Time post stroke (months)	50.66	38.34	55.11	34.99	.523	57.30	42.81	56.06	36.35	.924
Memory Self-efficacy	8.61	1.81	8.23	1.67	.242	8.21	1.64	8.92	1.36	.155
Depression score	16.81	11.12	12.67	11.30	.050	8.65	7.00	10.00	6.46	.542
Quality of Life-VAS†	65.95	18.55	65.97	19.65	.996	68.70	15.15	74.72	15.19	.230
Psychological QoL†	3.33	0.75	3.53	0.60	.113	3.62	0.56	3.61	0.66	.978
Social QoL†	3.42	0.93	3.67	0.67	.100	3.38	0.54	3.65	0.48	.121
Problem experience	1.18	0.53	1.24	0.45	.507	1.29	0.50	1.40	0.49	.513
Social participation	27.49	5.82	29.12	5.96	.141	26.35	5.53	26.89	4.54	.746
Strategy use	3.24	0.70	3.34	0.70	.422	3.49	0.72	3.26	0.69	.324
Delayed recall AVLT†	8.17	3.60	6.75	3.73	.045	6.00	3.51	6.06	2.70	.955
Delayed recall RBMT†	13.24	7.74	11.49	5.59	.183	12.40	7.91	10.66	6.21	.481

SD: standard deviation, p-value of <0.05 is used as statistical significance
† VAS: Visual Analog Scale; QoL: Quality of Life; AVLT: Auditory Verbal Learning Test; RBMT: Rivermead Behavioural Memory Test.

Comparison between experimental and control group

MSE improved significantly over the intervention period in the experimental group compared to the control group (p=0.010) and this effect sustained after 6 and 12 months in the total study population. The Cohen's d effect size was 0.37 over the intervention period. In the experimental group, 15% of the patients improved at least 1 SD on the MSE scale, which is significantly more than the 4% in the control group (p<.024). Depression scores declined in both groups, but group difference did not reach significance (p=.148). Psychological QoL improved more in the experimental than in the control group, but this result was not statistically significant either (p=.077). Other quality of life measures did not differ between groups (Table 2).

Table 2. Effects of MSE training in intervention group compared with the control group

	Estimated Group difference Exp-control	**S.E.**	**p-value**
MSE†	0.42	0.16	.010
Depression score	-0.35	0.85	.683
QoL†			
Psychological QoL	0.09	0.05	.077
Social QoL	0.11	0.08	.174
VAS† score	0.66	1.09	.549
Strategy use	-0.01	0.07	.934
Social participation	0.52	0.55	.341
Problem experience	0.03	0.05	.572
Delayed recall AVLT†	0.06	0.36	.877
Delayed recall RBMT†	-0.39	0.61	.526

S.E. standard error. † MSE: Memory Self-efficacy; QoL: quality of life; VAS: Visual Analogue Scale AVLT: Auditory Verbal Learning Test; RBMT: Rivermead Behavioural Memory Test.

Subjects in both groups reported a decrease of problem experience (p=.014) over the follow-up period of 12 months, but no differences between the experimental and control group were found. Self reported strategy use remained unchanged in either group (p=.934). No differences in social participation were found between the experimental and the control group over time (p=.341).

Subgroup analyses

In younger patients in the experimental group, MSE improved significantly more than the MSE score in the control group (B=0.56; p<.003) and this effect remained stable over 12 months time (Figure 2). After adjustment for the difference in baseline memory capacity (measured with the AVLT), the group difference in MSE effect was equivalent (B=0.61; p<.001). Adjustment for depression score did not alter these results. In older patients, the experimental group did not differ significantly from the control group in MSE scores over time (p=.913). The psychological domain of quality of life also

improved significantly more in younger patients in the experimental group (B=0.14; p<.030) than in the control group. These findings remained stable over 12 months (Figure 3), and did not alter after adjustment for baseline depression score (B=0.16; p<.016).

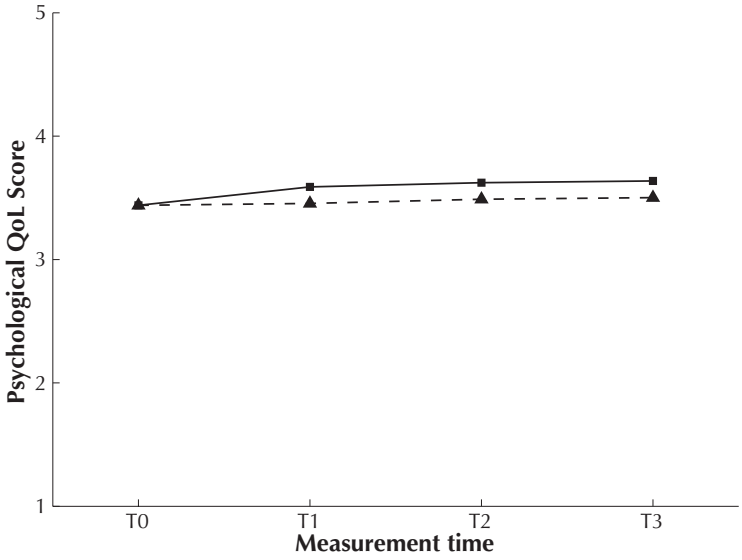

Figure 2. Training effect of MSE in patients aged 65 and younger.
Experimental group, Control group

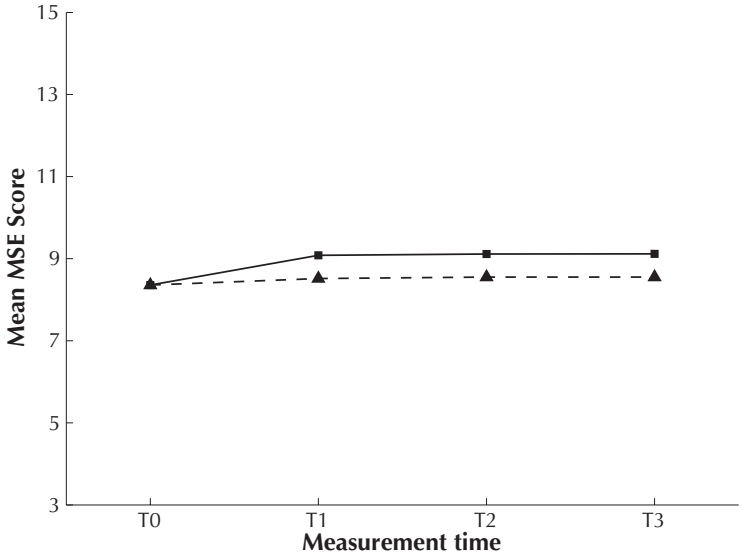

Figure 3. training effect of psychological quality of life in patients age 65 and younger.
Experimental group, Control group

Further adjustment for baseline memory capacity did not change these results. The older patients showed no improvement in psychological quality of life in either group (p=.829; Table 3). Other outcomes did not differ between the experimental and control group over time in subgroups of age.

Table 3. Effects of MSE training per age group: <65 years (n=105) and >65 years (n=38).

	Age	Estimated group difference Exp-control	S.E.	p-value
MSE	≤ 65	0.56	0.18	.003
	> 65	-0.04	0.32	.913
Psychological QoL	≤ 65	0.14	0.06	.030
	> 65	0.02	0.09	.829

†MSE: Memory Self-efficacy; QoL: quality of life; VAS: Visual Analogue Scale. S.E. Standard Error.

DISCUSSION

To our knowledge, this study is the first RCT on MSE training in patients after stroke in the chronic stage. The newly developed MSE training program improved MSE in chronic stroke patients and this effect continued over a period of one year after the intervention, and was particularly present in younger patients. With this training, we were able to improve the confidence that patients have in their memory functioning. In addition, the MSE training improved psychological quality of life, which lasted over the 12 months follow-up time, in patients of younger than 65 years.

Cicerone and others[13] reviewed the available treatment methods for memory deficits after traumatic brain injury and stroke. External strategy use seems to be the only effective rehabilitation treatment for memory deficits after stroke.[13,28] This new MSE-training provides an additional treatment method to decrease memory complaints after stroke using three main components; compensatory techniques, Memory Self-efficacy and psycho-education. This combination seems to be of additional value to existing memory rehabilitation treatment. In other studies, improvements in memory functioning did not sustain after training in stroke patients.[29] We found long lasting improvements in MSE as well as in the psychological domain of quality of life.

Chronic memory complaints after stroke provide a large problem for memory rehabilitation, which should be addressed by additional training such as the MSE training. The long lasting effects of the MSE training increase the relevance of the effects we found.

Although the effect size seems relatively small on the group level, we found that our effect size of 0.37 is comparable to effect sizes (0.24) found in other studies using the MIA.[30] Furthermore, we found that 15% of the patients in the intervention group improved at least 1 SD on the MSE scale, which is, in our opinion, a clinically relevant

effect in a chronic stroke population. An effect on actual memory performance is difficult to achieve and was not found in this study besides a practice effect. The fact that psychological aspects of quality of life can be improved in younger stroke patients by means of this new MSE training, appeals to further investigating the possibilities to bring this training into clinical practice.

Despite the fact that learning compensatory strategies in this MSE training program did not have an effect on strategy use, patients reported a higher confidence in their memory functioning. In other studies, the use of external strategies is recommended as treatment although the use of external strategies is not always consolidated after training.[12,29] As this study was carried out in a chronic stroke population, strategy use may already have reached its maximum in this population, especially since these patients received standard memory training during their admission in a rehabilitation centre. If this study was done in the active rehabilitation phase in patients after stroke in the sub-acute stage, it may be possible that compensatory strategies are learned easier if the MSE training is provided than after standard memory rehabilitation programs. This should be studied in future effect studies of the MSE training program in an earlier stage of rehabilitation.

Mood was not significantly affected in either the experimental or the control group. Depressive symptoms decreased on average in both groups, but due to heterogeneity within the groups, this decrease did not reach significance. Furthermore, social participation did not change over the intervention and follow-up period. The SSL is mainly about social relationships, which may not change as a result of a higher MSE. Offering the MSE training program earlier in rehabilitation may have a larger effect on mood and social participation as well.

A drawback of the MSE training is that the effects are not found in elderly stroke patients. As the stroke population is growing and age of the population is increasing, we did not want to exclude elderly patients. The older patients differed form the younger patients in gender (more men), lower depression scores and lower memory capacity scores, which may explain why the MSE training was less effective in older patients. Furthermore, the baseline MSE score of the older group was equivalent to an elderly norm population, whereas the baseline MSE of the younger group was low compared to the norm score. Furthermore, the baseline MSE score of the older group was equivalent to an elderly norm population, whereas the baseline MSE of the younger group was low compared to the norm score. Also, the quality of life scores tended to be higher in the elderly compared to the younger subgroup and in combination with the lower depression scores there was less to gain for the elderly patients. In the Netherlands elderly patients with multiple physical and cognitive deficits are mostly referred to nursing homes. Thus, only the relatively healthy elderly stroke patients are referred to rehabilitation centers and could therefore be included in this study.

Regardless of group or age, only problem experience decreased over the intervention period. The MSE training could be further adapted to better fit the elderly stroke population with low MSE scores. Changes in duration of the training, increasing the

number of sessions, decreasing the information load in individual sessions or age related examples of memory demanding situations, are all examples of possible adaptations for elderly patients.

A limitation of the study may have been the influence of the same psychologist moderating all sessions in the experimental and control group, which might have decreased the contrast between both groups. However, possible trainer effects between groups were ruled out by this study design.

In conclusion, the newly developed MSE training is a valuable addition to current memory training programs. The current program is particularly useful for younger patients. Offering the program in an earlier phase after stroke and further adaptations for older patients may have an additional beneficial effect on the clinical relevance of the training.

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Chapter 7

Patient Satisfaction after MSE Training and Peer Support Group

SUMMARY

Patient satisfaction questionnaires are frequently used in rehabilitation and other health care facilities to improve health care on the short term. In order to give direction to future research on MSE training in stroke patients, we included a patient satisfaction questionnaire in this project, which was administered directly after the intervention period. Both patients from the experimental as the control group filled in a questionnaire. The response rate in the experimental groups was 71% and in the control group 70%. Most important findings were that overall, both groups are positive about the followed group. However, the experimental group has a higher satisfaction rate in comparison to the control group. Main points for improvement were the duration of the training and the amount of information during each session.

INTRODUCTION

We studied the effects of an MSE training programme for patients in the chronic stage after stroke. The training resulted in increased MSE scores and improved psychological quality of life of patients younger than 65 years who enrolled in the experimental group. However, the effect sizes are relatively small and improvements of the training programme may be needed to increase its effectiveness. To anticipate this need, we asked patients about their opinion of the training they participated in. Patient satisfaction questionnaires are frequently used in health care facilities to improve care.[1,2] In this chapter, we describe the qualitative results of the administered satisfaction questionnaires.

Satisfaction questionnaire

We developed a satisfaction questionnaire based on a satisfaction questionnaire for the 'Stap voor Stap' (Step by Step) programme. This programme is based on a neurobehavioral intervention for patients with acquired brain injury[3] and aimed at increasing knowledge of functioning after suffering a stroke. The step by step programme was adapted and translated into Dutch by Michiel Koops and Bianca van Baalen. After attending this programme, patients are asked to rate the 'Steps' of the course in general and separately for each 'Step'.

The satisfaction questionnaire used for our population consists of 17-23 questions. Patients are asked to rate the training with a grade from 1 to 10, according to the Dutch school ratings. Grade 1 represents an extremely bad score, while grade 10 represents an excellent score. After this general score, patients rated the training on four separate parts. The first part was on likeability of the training programme. The second part is on the usability of the training book. The third part focused on trainer skills. The fourth part was on perceived benefits after training. The questions were answered on a five point scale, 1 indicating total agreement and 5 indicating total disagreement. None of the questions was asked in reversed rating (i.e. mirrored items). On the second part of the questionnaire, patients indicated if they would share the training book with others. If this question was answered negatively, they were asked about the reason. Additionally, patients were asked about the length of the training sessions; if they would recommend the training to other stroke patients; about information they missed during the training; about directions for improvement and asked for general remarks.

The questionnaire for patients in the control group was slightly different from the questionnaire used for patients in the experimental group, because the control group had no training book during the course. Therefore, the second part about usability of the training book was excluded from the questionnaire for patients who attended the control group, resulting in a 17-item questionnaire in comparison to 23 questions for patients in the experimental condition.

Patients received the satisfaction questionnaire by mail directly after attending the training sessions. Each patient was asked to fill in the questionnaire and return it by mail.

After a period of several months, patients received a reminder. The response rate in the experimental group was 71% (55 out of 76 patients) and the response rate in the control group was 70% (53 out of 76 patients).

RESULTS

General rating

In the experimental group, 42 patients rated the training with a grade ranging from 7 to 10. The mean general rating in this group was 8.0. All ratings were above 7.0, which is an indication equal to above average. In the control group, 53 patients rated the training. The mean rating in this group was 7.6, which is also above average. However, 19.2 percent of the ratings were below 7.0 and are considered as below average to poor. No ratings below 5.0 were given in either group. See Table 1 for the distribution of the ratings in each group.

Table 1. Ratings for each intervention type.

	Experimental group (n=55)	Control group (n=53)
Ratings	**%**	**%**
5.0	0	3.8
6.0	0	15.3
7.0	40.5	25.0
8.0	31.0	34.6
9.0	14.3	17.3
10.0	14.3	3.8

Part 1: general training programme

This part of the questionnaire included questions such as 'I liked the training programme' or 'I liked attending the training'. A cumulative percentage of 87.3 to 92.7 of the experimental group agreed (strongly) with the questions of this part of the questionnaire. In comparison, 66.7%-87.3% of the patients in the control group agreed (strongly) with these questions.

Part 2: usability of the training book

This part included questions such as 'The training book is easy to use' and 'The topics of the training book are well explained'. Only patients in the experimental condition filled in these questions. 66.7% to 90.9% of the patients agreed (strongly) with these questions. Almost all patients who answered the questionnaire in the experimental group would show the training book to other people (90.7%). 4 patients responded negatively to this question. Although there was an opportunity to explain why patients would not

show the book, only one patient filled in the open question after a negative answer: "The content is more often than not irrelevant to others". Some patients who responded positively, gave explanations, ranging from, "If I did not understand the training book, maybe someone else would" to "Sure I would, why not".

Patients in the control group received a training book after the sessions, therefore only the last open question was included in the control version of the questionnaire. 4 patients of the control group responded negatively to this question (7.5%). No clarifications for these responses were given.

Part 3: trainer skills

This part consisted of questions such as "The teacher of the training was skilled". Both groups were predominantly positive about the attending trainer. See also Table 2.

Part 4: benefits of the training

This part contained questions such as "I worry less about my memory because of the training" and "Because of the training, I better understand the consequences of my stroke". Although the answers were frequently positive again, patients responded more in the 'disagree' categories than in other parts of the questionnaire. 38.9% of the patients in the experimental group felt better about their memory functioning after the training compared to 19.6% of the patients in the control group. Another important aspect of MSE, feeling more confident as a result of the training, increased in 61.1% of the patients in the experimental group, in comparison to 45.1% of the patients in the control group. See also Table 2.

Part 5: Remaining questions

Patients were asked about the duration of the sessions. Of the experimental group, 70.9% of the patients rated the duration as 'exactly right'. 25.5% rated the sessions as 'too short' and the remaining 2 patients (3.6%) rated the sessions as 'too long'. Of the control group, 72% of the patients rated the duration as 'exactly right', 26% rated the sessions as 'too short' and 1 patient (2%) as 'too long'. 98.2% of the experimental group and 78.4% of the control group would recommend the training to other stroke patients.

Part 6: Open questions

67% of the patients in the experimental group missed something during the training. 46% of the comments were suggestions for improvement. Not all patients made use of the option to make suggestions. Most suggested improvements were the addition of practical aspects to the rather theoretical content of the training. Patients in the experimental group argued that they would have liked more actual practical training instead of the theoretical information. 74% of the patients in the control group missed something during the training. 59% of the comments were suggestions for improvement.

Table 2.

		Experimental Group %						Control group %				
Please indicate your level of agreement with the following statements	**n**	**Totally agree**	**Agree**	**Neutral**	**Disagree**	**Totally disagree**	**n**	**Totally agree**	**Agree**	**Neutral**	**Disagree**	**Totally disagree**
Part 1: Sessions in general												
I liked the training	55	36.4	50.9	12.7	0	0	51	25.5	45.1	21.6	3.9	3.9
I found the training educational	55	41.8	50.9	3.6	3.6	0	51	25.5	41.2	19.6	11.8	2.0
I liked going to the lessons	55	45.5	47.3	7.3	0	0	51	29.4	56.9	9.8	2.0	2.0
Part 2: usability of the training book												
The training book is easy to use	54	29.6	46.3	16.7	5.6	1.9	-	n/a	n/a	n/a	n/a	n/a
The training book is nice to look into	54	24.1	42.6	29.6	1.9	1.9	-	n/a	n/a	n/a	n/a	n/a
The topics in the training book are well explained	55	30.9	60.0	7.3	1.8	0	-	n/a	n/a	n/a	n/a	n/a
The training book is synoptic	54	25.9	53.7	16.7	1.9	1.9	-	n/a	n/a	n/a	n/a	n/a
I used the training book a lot during the lessons	55	21.8	45.5	23.6	9.1	0	-	n/a	n/a	n/a	n/a	n/a
Part 3: trainer skills												
The teacher of the training was skilled	55	43.6	54.5	1.8	0	0	53	32.1	60.4	5.7	1.9	0
The explanations of the trainer were clear	55	40.0	54.5	5.5	0	0	53	35.9	54.7	5.7	3.8	0

Table 2. Continued

		Experimental Group %					Control group %					
Please indicate your level of agreement with the following statements	**n**	**Totally agree**	**Agree**	**Neutral**	**Disagree**	**Totally disagree**	**n**	**Totally agree**	**Agree**	**Neutral**	**Disagree**	**Totally disagree**
Part 4: benefits from the training												
It helped me to hear how other participants felt about the topics	55	30.9	47.3	18.2	3.6	0	53	26.4	39.6	26.4	7.5	0
I liked the other participants of my group	55	38.2	49.1	12.7	0	0	53	28.3	47.2	20.8	3.8	0
Because of the training, my memory improved	54	5.6	33.3	53.7	7.4	0	51	0	19.6	49.0	19.6	11.8
The training helped me to better understand the consequences of my stroke	55	14.5	61.8	18.2	3.6	1.8	51	7.8	60.8	19.6	7.8	3.9
I use the information of the training during my daily life	55	16.4	50.9	25.5	5.5	1.8	50	4.0	34.0	42.0	16.0	4.0
I worry less about my memory because of the training	55	21.8	43.6	27.3	5.5	1.8	50	6.0	28.0	34.0	26.0	6.0
I accept my deficits (beperkingen)	53	34.0	49.1	9.4	1.9	5.7	51	17.6	49.0	15.7	13.7	3.9
I think I will use the training book at home	55	20.0	52.7	21.8	5.5	0	-	n/a	n/a	n/a	n/a	n/a
I feel more confident because of the training	54	20.4	40.7	29.6	5.6	3.7	51	11.8	33.3	33.3	15.7	5.9

Patients in the control group missed the actual memory training, or training in general, the most. Some patients commented on group size (4-6 patients, regardless of group). These comments were in both directions, both asking for smaller groups as well as larger groups. When aphasic patients were part of the group, patients more frequently asked for more time, or smaller groups. Practical issues such as the space in which the training was given was commented on and also on the use of beamers and laptops. Training for fatigue was also among the suggestions for improvement of the training as well as suggestions for the improvement of group dynamics.

Conclusions

Due to the high response rate in both groups, we accept these results as representative for the whole study sample. In general, patients are positive about both trainings, but patients in the experimental group score higher on all parts of the satisfaction questionnaire. High evaluations are common in patient satisfaction studies.[4] Therefore, the use of open ended questions is advised. Of the patients of the experimental group, 46% had suggestions for improvements on missing information during the groups. These comments are considered useful for improving the training before implementation. Patients would like more practical training, next to the theoretical information and lessons. More time is needed according to the patients, which may be realized by increasing the number of sessions or by increasing the duration of the sessions. Due to the deficits of these patients, we expect that a longer duration of the groups could have negative effects on the level of fatigue of the participants. Since fatigue was frequently mentioned by patients in both groups, the extension of the number of sessions would probably be more beneficial. However, reasons for extending the training were not given. It might be possible that patients would like to have longer and fewer sessions, which would decrease traveling.

Group dynamics are essential in any training. Unfortunately, this is highly dependent on the participating patients in each group. Dynamics should continue to be observed during the training. The number of participants plays an important role in group dynamics.

Based on the multiple choice questions, a fair amount of the patients reported changes that we aimed to reach with this training programme. The fact that patients in the control group reported these changes in a lesser degree as well may be an explanation for the small effect sizes.

Because of the relatively few negative answers, response tendencies must be taken into account. Patients were asked to fill in their name on the questionnaire, so we were able to relate the answers to their measurement results. Lack of anonymity may have influenced responsiveness. However, differences between the patients from the experimental and the control group are still found, which may be attributed to the training patients evaluated. The outcome of the satisfaction questionnaire survey is valuable for possible implementation of the MSE training.

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Chapter 8

General Discussion

After stroke, memory problems occur commonly, varying between 30% and 60%.[1,2] These problems are difficult to treat, may persist over years and interfere with daily activities.[3-5] To decrease the occurrence of memory problems, compensatory techniques are taught in post-stroke rehabilitation.[6]

In healthy elderly people, metamemory aspects such as Memory Self-efficacy (MSE) seem to influence daily activities, mood and actual memory performance,[7, 8] but the use of MSE after stroke has hardly been studied before. Therefore, the aim of this thesis is [1] to study whether Memory Self-efficacy aspects after stroke and [2] to evaluate the effects of the MSE-training programme on MSE, depressive symptoms, quality of life and social participation in patients that experience memory complaints in the chronic stage after stroke. Finally, we [3] aimed to establish which patients benefit most from the MSE training programme.

Main findings

Cross-sectional studies

In our first study, we found a relationship between MSE and the delayed recall of a traditional memory test (AVLT) in non-depressed patients in the sub-acute stage after stroke (**Chapter 2**). Non-depressed patients after stroke seem to be capable of making a correct judgment about their actual memory functioning. These findings should be interpreted cautiously since awareness deficits were not measured in this small study sample.

In healthy elderly subjects, depressive symptoms are an important determinant of MSE.[9-11] Depressive symptoms occur frequently after a stroke[12] and may interfere with cognitive functioning.[13] Therefore, in our second study, depression was taken into account as a determinant rather than an exclusion criterion and we focused on the relationship between psychological aspects and MSE after sub-acute stroke (**Chapter 3**). We found a relationship between MSE, depressive symptoms and neuroticism, similar to the findings in healthy elderly people. Patients with lower MSE had more depressive symptoms and more neurotic personality traits. Passive coping style also seemed to be related to lower MSE, although this finding did not reach significance. However, in this small sample (n=23) actual memory performance was not taken into account and therefore no statements about the accuracy of the subjective judgments can be made.

In a chronic stroke population, we combined and repeated the objectives from the previous studies (**Chapter 4**). Stroke patients with memory complaints (n=100) were compared to stroke patients without memory complaints (n=36). We found that the presence of memory complaints is predicted by a lower MSE score, higher depression scores and neurotic personality traits. In patients without complaints, MSE is predicted by actual test performance; indicating accurate judgments. On average, both groups score similarly on the administered memory tests. These findings are comparable to healthy elderly subjects[9] and indicate that patients who feel depressed and worry about their memory functioning, report more complaints about their actual memory

performance, irrespective of existing memory deficits.

Effectiveness of Memory Self-efficacy training

Apparently, MSE after stroke is similarly related to memory performance as it is in healthy elderly.[14] Possibly, MSE may thus serve as a treatment target in memory rehabilitation programmes after stroke. Irrespective of actual functioning, a low MSE may cause avoidance of memory demanding situations leading to social isolation, which in turn can lead to a further decrease of MSE.[9, 15] If memory demanding situations are avoided, actual memory performance may decrease as well. Depressive feelings and neurotic personality traits may magnify this vicious cycle after stroke as is the case in healthy elderly subjects (Figure 1).[16]

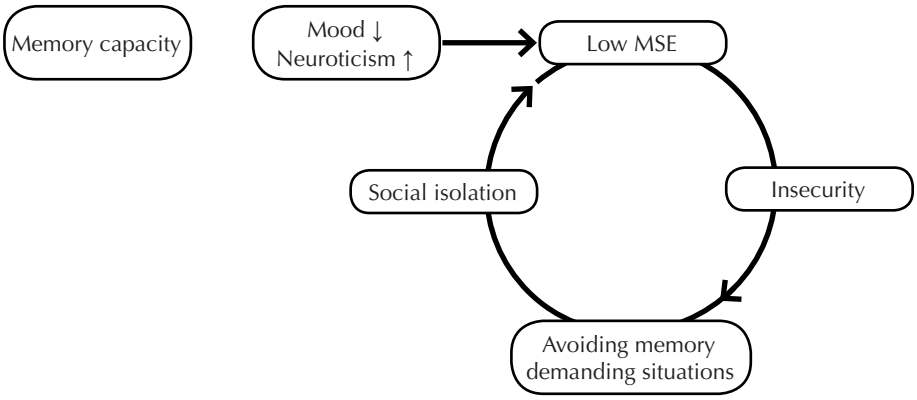

Figure 1. The vicious cycle of MSE

Therefore, we developed and evaluated a stroke-adapted MSE training programme. Patients in the chronic stage after stroke who experienced memory complaints were invited to participate in this randomized controlled trial (n=153). Participants were randomly allocated to either the MSE-training or a peer support group. Level of MSE, depressive symptoms, quality of life ratings and social participation were defined as outcome measures. Use of memory strategies and actual verbal memory performance were measured as well.

MSE increased significantly directly after the MSE training programme in comparison to the peer support group (**Chapter 5**). The other outcome measures did not change significantly. The improvement of MSE may be regarded as a validation of the training content. Furthermore, younger patients and patients with a higher score on the delayed recall of the two stories test of the Rivermead Behavioural Memory Test (RBMT) had a larger increase of MSE after the MSE training. This implies that the MSE training programme may be more useful for a younger population and that a certain baseline level of memory functioning enhances training effects. These findings may be useful in further adapting and specifying the MSE training for subgroups of stroke patients.

The long term effects of the MSE training programme on the defined outcomes (MSE, depressive symptoms, strategy use, quality of life and social participation) were studied in **Chapter 6**. In patients aged younger than 65 years, the MSE-training was effective in improving MSE scores and the psychological domain of quality of life. These effects remained significant after 6 months and 12 months after the intervention. Furthermore, on average, patients experienced fewer problems in daily life, social interaction, or work over time. Although depressive symptoms tended to decrease in patients after the MSE training programme and the peer support group both, these findings did not reach significance. The MSE training programme is effective in improving subjective memory experience even years after suffering a stroke.

Methodological considerations

Selection bias

Although the findings in this thesis are consistent and comparable to the findings in healthy elderly people, the studies were performed in different stages after stroke and in a rehabilitation setting. This might be considered to be a serious selection bias that reduces the generalizability of our findings to other stroke patients. In the Netherlands, only a minority of all stroke patients is referred to an inpatient rehabilitation setting.[17] Most patients after stroke recover in an outpatient facility or return home without specialized care. A small part of the patients is referred to nursing home geriatric rehabilitation settings. Therefore, the patients who participated in our studies may not have been representative for the total stroke population in the Netherlands. We were able to include about 20% of the former rehabilitation patients. 24% of the approached patients declined to take part and 56% did not respond. We compared the non-responders with the included sample and found that on average, participating patients were younger and their stroke had occurred more recently. These patients may experience more problems due to their memory deficits, adding to the necessity of training for this population.

Awareness, metamemory and stroke

The small sample sizes of the explorative studies and the inpatient rehabilitation setting may have influenced these findings (**Chapter 2, 3**). In the sub-acute stage after stroke, awareness deficits are known to occur which might decrease the capability to make an accurate judgment about one's own (memory) functioning.[18, 19] Stroke is a disabling event with large impact on daily life.[20-23] However, when still admitted to a rehabilitation ward, patients may find it difficult to conceive the consequences of their stroke.[24] Response shifts are known to occur after this stage of rehabilitation, when patients start to encounter problems in daily life.[25] As awareness deficits are known to decrease in later stages of stroke[26, 27] we included patients in the chronic stage after stroke. In this stage, patients may become more accepting of their deficits, which improves perceived quality of life.[25] The included patients indeed tended to have relatively high quality of life ratings, leaving less potential for improvements due to the intervention.

Power of the group

Although the effect-sizes of MSE and psychological quality of life are small to moderate (Cohen's effect size=0.30), the clinical importance is evident based on the additional value of the MSE-training in comparison to the control group. Even years after stroke, younger patients are able to improve their subjective memory experience and psychological quality of life after 9 sessions of group therapy. The beneficial effects of the peer support group appeared to be larger than expected. Possibly, the attention and information as provided in the control group may decrease the presence of depressive symptoms and increase general quality of life, although non-significant. The effectiveness of the MSE training would have been larger if compared to a waiting list control condition. With the control condition, we proved that the additional value for quality of life and MSE cannot be explained by effects of a-specific group dynamics, which are known to occur in every therapeutic group.

A future for MSE training after stroke

The need for a training programme is illustrated by the number of memory complaints and deficits still present in stroke patients, even four years after stroke. MSE training improves subjective feelings about memory deficits, and in younger patients, quality of life in the psychological domain can be improved persistently until one year after training. However, based on the findings of the RCT and a satisfaction survey amongst participants, changes in the content of the MSE-training might be necessary to increase its effectiveness.

MSE training programme

The MSE training was based on the 'Geheugensteun' training developed by Ponds and Verhey.[28] This training for healthy elderly subjects is aimed at reducing memory complaints and anxiety, which in turn could lead to increased memory performance, if no deficits exist. We altered the MSE training programme by including more stroke oriented examples and by focusing on the differences and similarities between the healthy population and the stroke patients. Furthermore, we decreased the amount of information for each session and made sure that language use was suitable for stroke patients. Homework assignments were given, and in some sessions, memory games were played. Despite these efforts to adapt the training to suit our study sample, the training programme still seemed too intensive for part of the participating patients, as reported on the satisfaction questionnaires (**Chapter 7**).

Although older patients who participated appeared more accepting of their deficits (**Chapter 5**), altering the training may improve the accessibility for elderly patients who do have acceptance problems after stroke. Alterations could be made in terms of duration and the amount of information during each session. Regardless of age, patients sometimes experienced difficulties with the amount of information and the theoretical character of the MSE training. Increasing the duration of each session and adding

additional sessions may increase the positive effects of the MSE training. Additional time may promote the active interaction between participants which seems a beneficial effect of the peer support group. Another useful suggestion by the participating patients was to use more real life examples during the training sessions. Offering the training in an earlier stage (for example when finishing outpatient rehabilitation treatment) may fit the integration into daily life more timely. Patients, who had a longer time post onset, benefit less from the MSE training, which further underlines these suggestions.

Influence of deficits

We found no influence of aphasic disorders or executive deficits on the questionnaires used. However, the training had a verbal disposition which may have hampered the benefits for aphasic patients. Patients with aphasia mentioned the verbal nature of the training in the satisfaction study and changes as to the verbal content may enhance the accessibility of the MSE training accessible for a broader range of aphasic patients. Nevertheless, given the intensity of the training sessions, drop out ratings were overall low and no differences in drop out amongst aphasic patients and other patients were observed. Nine patients dropped out of the training sessions in general. During the training, patients missed 2 sessions on average. 74 patients missed none of the sessions. 11 patients missed more than two sessions; most patients (36) missed only one session. These patients missed sessions due to illness, logistic problems or forgetfulness. The high attendance rates were most likely caused by the flexible nature of the training. Time and day were adjusted per session to the patients attending. After 6 months, 6 patients dropped out for the follow-up measurements in the experimental group and 3 patients dropped out of the control group. After 12 months, an additional 4 patients dropped out of the experimental group and 1 extra patient dropped out of the control group. Reasons for drop-out were usually illness, rarely this was caused by not being able to reach the patients and in one case after 12 months, the reason for drop-out was death. However, by adapting the training sessions, drop out may be decreased further. The low dropout ratings indicate that although patients mention the difficulty of the training, they apparently also felt motivated to take part. All patients who dropped out were analyzed using the intention to treat principle.

Future research

Future research should aim on the applicability of the training programme at an earlier stage of rehabilitation, preferably in an outpatient setting. Adding more possibilities for group interaction and dynamics, as was the case in the peer support control group may broaden the effects of the MSE training and increase the effect sizes. Including outpatient rehabilitation patients may cause less influence of awareness deficits while these patients are able to reference to daily life situations. Larger effect sizes may be expected within this time frame. Increasing the number of sessions and increasing the duration of the sessions may enhance the effects of the training. Two to three additional

sessions may be most effective, since a larger increase might lead to higher drop out ratings. Half an hour's extra time should be added to enhance the patients' interaction within the group sessions.

Methodological improvements

The content of the peer support group should follow a stricter protocol to decrease the interaction and thereby increase the contrast with the MSE training. The duration of the measurements may be decreased to fit the capacity of the participating patients and disease and deficit specific measures for quality of life may show greater improvements due to the MSE-training. Patients did report some difficulties with the used measures. Some questionnaires, especially the MIA, were reportedly long and difficult to understand. However, we were not able to include another equally validated measurement for metamemory suitable for the Dutch population. With guidance of research assistants, all patients were able to complete the questionnaires. Future research might aim on improving and designing relevant measurements for metacognitive functioning after stroke.

Cost effectiveness

Although we included a generic quality of life measure which is used to determine cost effectiveness, we were unable to reliably quantify all health care costs of the participating patients. This should be done in future research to further establish the clinical relevance of the training effects. Studying the effectiveness of the MSE-training on the reduction of health care use should be done as well.

GENERAL CONCLUSION

We have developed a useful new and low-cost MSE training programme for stroke patients and we have been able to establish its effect on MSE and psychological quality of life in patients of 65 years and younger. Given the resemblance of the determinants of MSE in stroke and healthy elderly, the use of the MSE training programme is justified to improve the way patients deal with their deficits and the need for this programme is demonstrated by the relatively large incidence of memory complaints and deficits in this chronic stroke sample.

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Summary

In the introductory **Chapter 1** discusses the impact of a stroke with a focus on cognition and especially memory. Post acute stroke rehabilitation aims at compensatory strategy use as practice standard for memory complaints. In healthy elderly people, metamemory is recognized as an important determinant of memory complaints. Metamemory is defined. can be described as 'cognitions about memory'. Memory Self-efficacy (MSE) is an important aspect of metamemory.

Healthy elderly people suffering from memory complaints without having any actual memory deficits, benefit from a training programme aimed at improving MSE.

The central theme of this thesis is the question whether after stroke, metamemory and Memory Self-efficacy are equally important in dealing with memory complaints as in the healthy elderly.

The aim of this thesis is to evaluate the effects of a MSE-training in patients after stroke. To develop the training, first the relation between MSE, psychosocial factors and actual memory capacity is studied in patients in the sub acute and chronic stage after stroke.

In **Chapter 2** the relationship between MSE and objective memory functioning is described in non depressed patients in the sub-acute stage after stroke. In healthy elderly people, MSE is more strongly related to everyday memory than to more traditional memory tests such as the AVLT. In a cross sectional study, we tested whether the same relations would be found in patients in the sub-acute stage after stroke. Fifty-seven patients after stroke were included . The results showed that contrary to the hypothesis, MSE is related more strongly to a traditional memory test (AVLT) than to an everyday memory test (RBMT), when adjusted for age, gender, education and localization of stroke. It is discussed that the clinical setting in which the patients were treated may have influenced this relationship. Furthermore, depression was not taken into account as a possible confounder in this study, while depression seems to be an important determinant for the level of MSE in healthy elderly.

Depression, neuroticism and a less active coping style predict MSE in healthy elderly subjects. In **Chapter 3**, these relations in a sub-acute stroke sample are studied. We performed a cross-sectional study including 23 sub-acute stroke patients. Lower MSE scores in this sample are significantly predicted by depression and in a lesser degree by neuroticism and a passive coping style. These findings are in line with earlier studies in healthy elderly.

We combined and repeated the studies of **Chapter 2** and **3** in a sample of 136 patients in the chronic stage after stroke, as described in **Chapter 4**. In this cross sectional study, patients were divided into a group with memory complaints (n=100) and a group without memory complaints (n=36). The results show that MSE scores, rather than actual memory performance predict the existence of memory complaints. MSE score is predicted by depressive symptoms and neuroticism. In patients that do not report complaints, MSE score is predicted by actual memory capacity. Both groups score

on average the same on the verbal memory tests.

The MSE training program for stroke patients was adapted from an existing program for healthy elderly people. **Chapter 5** describes a randomized controlled trial on the immediate effects of this program. In total, 164 stroke patients (> 18 months post onset) were randomly allocated to either the MSE training (n=77) or a peer support group (n=76). MSE score, quality of life, depressive symptoms and social participation were the primary outcomes. Outcome measures were analyzed using the Intention-to-treat principle and a Last Observation Carried Forward procedure was used to analyze drop-outs. The MSE score increased significantly in the experimental group compared to the control group. Other outcome measures did not differ significantly between both groups. Age and the delayed recall score of the RBMT were found to be of predictive value for the increase of MSE after training.

In **Chapter 6**, we studied the long term follow-up effects of the MSE training program and the control group. Using repeated measurement analyses, we studied the effects of the MSE training immediately after (T1), after 6 months (T2) and 12 months (T3) after the intervention. The sample consisted of 153 stroke patients after T1; after 6 months 144 patients participated and after 12 months 139 patients remained in the analyses. The effect on MSE score sustained after 6 and 12 months in the experimental group. Psychological quality of life improved in the experimental group, without reaching significance. Post hoc stratification showed that in patients aged 65 years and younger, both MSE and psychological quality of life increased significantly in the experimental group compared to the control group over time.

In **Chapter 7**, the results of a patient satisfaction survey are presented. After training, all participants were asked for their opinion about the content and duration of the group sessions. Participants from both groups were generally satisfied with the training they were offered. Suggestions for improvement were noted.

Finally, in **Chapter 8**, the main findings of this thesis are summarized and a conceptual model of the relation between MSE, psychosocial factors and actual memory performance is described in a vicious cycle of avoidant behavior. Methodological aspects are discussed. The clinical implications of the RCT are described. What should be necessary to make the MSE training useful in current memory programmes for stroke patients and which future directions in research are warranted?

Samenvatting

In het inleidende hoofdstuk *(***Hoofdstuk 1***)* wordt de impact van een CVA besproken waarbij de focus ligt bij cognitie en meer specifiek geheugen. De gouden standaard voor geheugenstoornissen in de cognitieve revalidatie is bedoeld om te leren compenseren voor de bestaande stoornissen. Bij gezonde ouderen is het belang van metageheugen vastgesteld voor het bestaan van geheugenklachten. Metageheugen wordt gedefinieerd. Een belangrijk domein van metageheugen is Memory Self-efficacy (MSE), of vrij vertaald, geheugenzelfvertrouwen. Bij gezonde ouderen is aangetoond dat het hebben van geheugenklachten, zonder het bestaan van objectiveerbare geheugenstoornissen, verminderd kan worden met behulp van een training die gericht is op het verbeteren van MSE.

Een centraal thema in dit proefschrift is of MSE een vergelijkbare rol speelt bij CVA-patiënten zoals bij de gezonde ouderen. Het primaire doel van dit proefschrift is het evalueren van het effect van een MSE-training voor CVA-patiënten in de chronische fase na hun beroerte. Om de training te ontwikkelen is de relatie tussen MSE, psychosociale factoren en objectief geheugenfunctioneren onderzocht bij CVA-patiënten in de subacute en chronische fase.

In **Hoofdstuk 2** wordt de relatie tussen MSE en objectief geheugenfunctioneren op twee verschillende verbale geheugentaken onderzocht bij CVA-patiënten in de subacute fase. In gezonde ouderen is MSE sterker gerelateerd aan geheugentaken die het alledaagse geheugenfunctioneren meten dan aan meer traditionele geheugentaken zoals de 15 woordentest. In een cross-sectionele studie hebben we onderzocht of dit verschil ook bestaat bij CVA-patiënten in de subacute fase. 57 CVA-patiënten werden geïncludeerd. Uit de resultaten blijkt dat in tegenstelling tot de genoemde hypothese, MSE sterker gerelateerd is aan de traditionele 15 woordentest dan aan de alledaagse geheugentaak (de Rivermead Behavioural Memory Test, RBMT) in CVA patiënten, als er gecorrigeerd wordt voor leeftijd, geslacht, opleidingsniveau en de locatie van het CVA. In de discussie staat de mogelijke invloed van de klinische setting waarin de patiënten waren opgenomen beschreven. Het excluderen van patiënten met een depressie wordt als een limitatie van de studie beschreven, aangezien depressie een belangrijke determinant is van MSE in gezonde ouderen.

Depressie, neuroticisme en passieve coping stijl zijn determinanten van MSE in gezonde ouderen. In **Hoofdstuk 3** wordt de relatie tussen deze determinanten en MSE in CVA-patiënten in de subacute fase beschreven. Er werd een cross-sectionele studie verricht in een steekproef van 23 CVA-patiënten in de subacute fase na hun beroerte. Lage MSE scores in deze steekproef werden significant voorspeld door de aanwezigheid van depressieve kenmerken en in mindere mate door de persoonlijkheidstrek neuroticisme en passieve coping stijl. Deze bevindingen zijn vergelijkbaar met de bevindingen in gezonde ouderen.

De onderzoeksvragen uit het tweede en derde hoofdstuk zijn verenigd en opnieuw getoetst in een steekproef van 136 CVA-patiënten in de chronische fase na de beroerte, zoals beschreven in **Hoofdstuk 4**. In deze cross-sectionele studie werden patiënten ingedeeld in een groep met subjectief gerapporteerde geheugenklachten (n=100) en een groep zonder subjectief gerapporteerde geheugenklachten (n=36). Uit de resultaten blijkt dat MSE, in plaats van de aanwezigheid van daadwerkelijke geheugenstoornissen, van voorspellende waarde is voor het hebben van geheugenklachten. Daarnaast blijkt dat de MSE score voorspeld wordt door depressieve kenmerken en neuroticisme. In de groep patiënten zonder subjectief gerapporteerde geheugenklachten, is de prestatie op een geheugentaak (de 15 woordentest) van voorspellende waarde voor de MSE score. De groep met geheugenklachten en de groep zonder geheugenklachten scoren gemiddeld gezien hetzelfde op de afgenomen geheugentaken.

Er werd een MSE-training ontwikkeld voor CVA-patiënten, gebaseerd op een bestaande training 'Geheugensteun' voor gezonde ouderen. **Hoofdstuk 5** beschrijft de gerandomiseerde gecontroleerde effectstudie gericht op de evaluatie van de korte termijn effecten van deze training. In totaal werden 164 CVA-patiënten (>18 maanden post onset) willekeurig toegewezen aan of de MSE-training (n=77) of een lotgenotencontact groep (n=76). MSE, kwaliteit van leven, depressieve kenmerken en sociale participatie waren de primaire uitkomstmaten. De uitkomstmaten werden geanalyseerd gebaseerd op het 'intention to treat' systeem en met behulp van het imputeren van de laatste observatie in het geval van uitval (LOCF methode). De MSE score verbeterde significant in de experimentele groep in vergelijking tot de controle groep. De overige uitkomstmaten lieten geen significante verandering zien in vergelijking tussen beide groepen. Leeftijd en de score op de uitgestelde herinnering van de RBMT geheugentaak werden gevonden als significante voorspellers voor therapie succes na de MSE-training.

In **Hoofdstuk 6** worden de lange termijn effecten van de MSE-training voor CVA-patiënten beschreven. Met behulp van een mixed models analyse, werden de effecten van de MSE-training en de controle groep direct na de interventie(T1), na 6 maanden(T2) en na 12 maanden(T3) geëvalueerd. De steekproef in dit hoofdstuk bestond uit 153 CVA-patiënten op T1, 144 CVA-patiënten op T2 en 139 CVA-patiënten op T3. De toename van het MSE in de experimentele groep blijft bestaan na 6 en 12 maanden. De psychologische component van kwaliteit van leven verbeterde in de experimentele groep, maar dit effect is niet significant. Post hoc stratificatie voor leeftijd wijst uit dat patiënten jonger dan 65 jaar een significante verbetering lieten zien van MSE en psychologische kwaliteit van leven na het volgen van de experimentele training in vergelijking tot de controle groep.

In **Hoofdstuk 7** worden de uitkomsten van een patiënt tevredenheidonderzoek beschreven. Na beide trainingen werden de deelnemers gevraagd de groepen te evalueren op basis van inhoud en duur. Deelnemers uit beide groepen waren over het algemeen tevreden met de gevolgde trainingen. Suggesties voor verbetering werden geregistreerd.

Tot slot wordt in **Hoofdstuk 8** de belangrijkste bevindingen van het proefschrift samengevat. Er wordt een conceptueel model geschetst waarin de relatie tussen MSE, objectief geheugenfunctioneren en psychosociale factoren wordt beschreven in een neerwaartse spiraal van vermijding. Vervolgens worden methodologische aspecten besproken. We gaan in op de klinische implicaties van de MSE training: wat moet er gebeuren voordat de training bruikbaar is voor de dagelijkse praktijk en welke vervolgstappen zijn daar voor nodig.

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ABOUT THE AUTHOR

Laurien Aben was born on July, 28th 1981 in Alkmaar, the Netherlands. She attended secondary school at the Jan van Scorel college (VWO) and the Horizon college in Alkmaar, where she graduated in 2000. The same year, she started her training in psychology at the University of Amsterdam, with Clinical Neuropsychology as her major. After obtaining her degree as a psychologist in January 2006, she worked as a junior researcher at Rijndam rehabilitation centre to write a grant for a PhD study on Metamemory. During this period, she was also active as a psychologist within the national project of electronic patient files for Rehabilitation. In October 2007, she started the research described in this thesis at the department of Rehabilitation Medicine and Physiotherapy of the Erasmus MC, Rotterdam as part of the research line of Rotterdam Neurorehabilitation Research (RoNeRes). During her research, she was active as a psychologist on both in- and outpatient departments of Rijndam rehabilitation centre, diagnosing and treating patients with acquired brain injury and chronic pain. At present, she is being trained as healthcare psychologist (GZ-psycholoog) at Rijndam rehabilitation centre.

LIST OF PUBLICATIONS

Aben L, Heijenbrok-Kal MH, Ponds RWHM, Busschbach JJV, Ribbers GM. Long Lasting Effects of a New Memory Self-efficacy Training for Stroke Patients: a Randomized Controlled Trial. Neurorehabilitation and Neural Repair, accepted for publication.

Aben L, Heijenbrok-Kal MH, van Loon EMP, Groet E, Ponds RWHM, Busschbach JJV, Ribbers GM. Training Memory Self-efficacy in the chronic stage after stroke: A Randomized Controlled Trial. Neurorehabilitation and Neural Repair. 2013;27:110-117.

Aben L, Ponds RWHM, Heijenbrok-Kal MH, Visser MM, Busschbach JJV, Ribbers GM. Memory complaints in chronic stroke patients are predicted by memory self-efficacy rather than memory capacity. Cerebrovascular Diseases. 2011;31:566-572.

Aben L, van Kessel MA, van Duivenvoorden HJ, Busschbach JJV, Eling PA, Bogert MA, Ribbers GM. Metamemory and memory test performance in stroke patients. Neuropsychological Rehabilitation. 2009;19:742-753.

Aben L, Ponds RWHM, Busschbach JJV, Ribbers GM. Memory self-efficacy and psychosocial factors in stroke. Journal of Rehabilitation Medicine. 2008;40:681-683.

PHD PORTFOLIO SUMMARY

Summary of PhD training and teaching activities

Name PhD student: Laurien Aben
Erasmus MC Department: Rehabilitation Medicine
Research school: none

PhD period: 2007-2012
Promotors: Prof. Dr. GM Ribbers
Prof. Dr. RWHM Ponds
Prof. Dr. JJV Busschbach

	1. PhD training	Year	Workload (Hours/ ECTS)
General academic skills			
-	Introduction for beginning PhD candidates	2008	4 hours
-	Biomedical English Writing and Communication	2009	2 ECTS
-	CPO course	2009	8 hours
-	Course 'Good Clinical Practice'	2009	8 hours
-	BROK course	2010	30 hours
-	PhD day 10th of may	2010	5 hours
Research skills			
-	Biostatistics for clinicians; NIHES	2009	30 hours
-	Methods of Clinical Research; NIHES summer programme	2010	20 hours
-	Clinical trials; NIHES summer programme	2010	20 hours
-	Regressietechnieken; EpidM VU	2010	56 hours
In-depth courses (e.g. Research school, Medical Training)			
-			

Presentations

- Oral presentation 'Metamemory and memory test performance' at the VRA congress, Ermelo	2007	20 hours
- Poster presentation 'Metamemory intervention in stroke patients: A pilot study on effects on memory' at the VRA congress, Ermelo	2007	8 hours
- Oral presentation 'Metamemory and stroke' at the research meeting, dept. of Rehabilitation Medicine, Rotterdam	2008	8 hours
- Oral presentation 'Metageheugen en CVA' at the patiënten verenigingendag Rijndam revalidatiecentrum, Rotterdam	2008	20 hours
- Oral presentation 'Metamemory and stroke' at the research meeting, dept. of Medical Psychology and Psychotherapy, Rotterdam	2008	8 hours
- Oral presentation 'Metamemory and memory test performance', at the regional meeting for rehabilitation physicians, Rotterdam	2008	8 hours
- Oral presentation 'Metamemory and Memory test performance' at the research meeting, dept. of Rehabilitation Medicine, Rotterdam	2008	20 hours
- Oral presentation 'Metageheugen bij chronisch CVA-patiënten' at the NvN fallconference, Nijmegen	2008	20 hours
- Oral presentation 'Memory Self-Efficacy and psychosocial factors in stroke' at the FESN congress in Edinburgh	2008	20 hours
- Oral presentation 'Memory Self-Efficacy and psychosocial factors in stroke' at the dept. of Rehabilitation medicine, Rotterdam	2008	8 hours
- Oral presentation 'Patiënten evaluaties van de groepsbijeenkomsten' at the dept. of Medical Psychology and Psychotherapy, Rotterdam	2009	20 hours
- Oral presentation 'Memory Self-efficacy and psychosocial factors in chronic stroke' at the International Symposium on Neurorehabilitation, Valencia	2009	20 hours
- Oral presentation 'metageheugeninterventie bij chronisch CVA-patiënten: deelname PBA3' at the department meeting of PBA3, Rijndam rehabilitation centre, Rotterdam	2010	20 hours
- Poster presentation 'Memory Self-efficacy and psychosocial factors in chronic stroke' at the WCNR congress, Vienna	2010	15 hours
- Poster presentation 'Memory Self-efficacy and psychosocial factors in chronic stroke' at the ESN meeting, Amsterdam	2010	24 hours
- Oral presentation 'Memory Self-efficacy and memory complaints in Stroke' at the regional meeting for rehabilitation physicians, Rotterdam	2010	8 hours
- Oral presentation 'Cognitieve Revalidatie' at the regional meeting for rehabilitation physicians, Bergen op Zoom, Zeeland	2010	15 hours
- Oral presentation 'Training Memory Self-Efficacy in the chronic stage after stroke' at the Dept. of rehabilitation medicine and physiotherapy, Rotterdam	2010	20 hours

- Poster presentation 'Training Memory Self-efficacy in the chronic stage after stroke' at the ACRM-ASNR meeting, Atlanta	2011	15 hours
- Poster presentation 'Memory Self-efficacy training after stroke: predictors of success' (second author) at the ACRM-ASNR meeting , Atlanta	2011	24 hours
- Oral presentation 'Geheugen In Zicht: een training om het omgaan met geheugenklachten te verbeteren' at the Hersenletselcongres, Ede	2011	10 hours
- Oral presentation 'Effectiviteit van een MSE interventie in de chronische fase van een CVA' at the WCN bijeenkomst, Apeldoorn	2011	20 hours
- Oral presentation 'Memory Self-efficacy training in stroke patients' at the MUSC meeting, Erasmus MC, Rotterdam	2012	15 hours
- Oral presentation 'Long lasting effects of a MSE training programme in chronic stroke' at the IBIA congress, Edinburgh	2012	15 hours
- Oral presentation 'Memory Self-efficacy training after chronic stroke' as part of a symposium on metacognitive rehabilitation in the Netherlands at the ACRM-ASNR meeting, Vancouver	2012	20 hours
- Oral presentation 'Memory Self-efficacy training after chronic stroke' at the Masterclass of George Prigatano, organized by the NvN, Amsterdam	2012	20 hours

International conferences

- The first meeting of the Federation of European Societies of Neuropsychology, Edinburgh, Scotland	2008	24 hours
- International Symposium on Neurorehabilitation: from basics to future, Valencia, Spain	2009	24 hours
- The 6th World Congress for Neurorehabilitation, Vienna, Austria	2010	36 hours
- Second meeting of the Federation of European Societies of Neuropsychology, Amsterdam, the Netherlands	2010	24 hours
- American Congress of Rehabilitation Medicine ACRM-ASNR annual conference, Atlanta, USA	2011	36 hours
- International Brain Injury Association's ninth world Congress on Brain Injury, Edinburgh, Scotland	2012	24 hours
- American Congress of Rehabilitation Medicine ACRM-ASNR annual conference, Vancouver, Canada	2012	36 hours

Seminars and workshops

- Revalidatie in Zicht, teamdag RCA Amsterdam	2007	8 hours
- Workshop neuropsychological evaluation, WCNR, Vienna, Austria	2010	4 hours
- Early Career workshops, ACRM Atlanta, USA	2011	8 hours
- Workshop 'Rehabilitation of challenging behaviour' IBIA Edinburgh, Scotland	2012	5 hours
- Workshop BICS ACRM, Vancouver, Canada	2012	4 hours
- Masterclass George Prigatano, VUmc, Amsterdam	2012	3 hours

Didactic skills

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Other		
- Research meetings, dept. of Rehabilitation Medicine, Rotterdam	2007-2010	160 hours
- Research meetings, dept. of Medical Psychology and Psychotherapy, Rotterdam	2007-2010	60 hours

2. Teaching activities	**Year**	**Workload (Hours/ ECTS)**
Lecturing		
- Presentation 'Metamemory in Stroke' at High schools for the Brain Awareness Week, the Netherlands	2008	30 hours
- Coping and rehabilitation, ANIOS teaching	2009	20 hours
Supervising practicals and excursions		
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Supervising Master's theses		
- Supervising of psychology student (thesis Memory Self-efficacy and psychosocial factors, cross-sectional study)	2008/2009	50 hours
- Supervising of psychology student (thesis Memory Self-efficacy and quality of life, cross sectional study)	2011/2012	50 hours
Other		
- Supervising of medical students (internship)	2009	30 hours
- Supervising of medical students with review assignments	2009	16 hours
- Supervising AIOS research project	2010-2011	30 hours
Total		**1290 hours**