Utrecht University

Dutch Depressed Elderly and Performance on the Montreal Cognitive Assessment: an Outpatient Study.

Master thesis (*Words:* 4917)

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07-04-2018

Abstract

Background: The aim of the current study was to investigate the performance of outclinic Dutch depressed elderly on the Montreal Cognitive Assessment (MoCA) from the geriatric psychiatry department; depression is a possible risk factor for dementia, therefore screening for cognitive impairment is advisory. It concerns performance over time and compared to healthy controls and patients with a depression in remission. **Participants:** at most 65 patients (Mage = 73, 42% males, 58% females) and 81 controls (Mage = 72, 42% males, 58% females) participated, sample sizes varied among analyses. **Methods:** longitudinal and cross-sectional designs were used to test hypotheses. Partial correlation, regression analysis and ANOVAs were part of data analyses. **Results:** on average the total MoCA score of patients was 22, but over time, correlation between severity of depression and MoCA was non-significant, $p = .452$. Subjective cognitive complaints had no significant correlation to MoCA score, $p > .05$. Patients showed more errors on particular domains of the MoCA and in total compared to healthy controls, $p < .017$ (adj. α). **Conclusions:** The MoCA shows sensitivity for depression in total and on particular domains connected to depression. Further research is needed to confirm or reject other findings.

Keywords: Montreal Cognitive Assessment (MoCA), depression, mild cognitive impairment (MCI), geriatric psychiatry.

Introduction

It is common in older adults who suffer from depression to have subjective memory complaints (Lautenschlager, Flicker, Vasikaran, Leedman & Almeida, 2005; Wang et al., 2000). The prevalence of this phenomenon however has hardly been studied, only in a Spanish sample where the prevalence rate of subjective memory complaints among depressed elderly aged 65 and above was reported to be substantial: 53% (Montejo, Montenegro, Fernández & Maestú, 2011); prevalence rates in other countries are unknown. This may be a precedent of cognitive disorders, but one may have cognitive decline without having subjective complaints as well (Gauthier et al., 2006; Roberts, Clare & Woods, 2009). However, these studies did not focus on elderly people who suffer from a depression. Since negative self view is part of depression (Sadock & Sadock, 2011), it is reasonable to argue that depressed people will ore often doubt their own cognitive functioning, compared to healthy people. Indeed, a moderate correlation between subjective memory complaints and objective cognitive impairment among depressed elderly individuals has been reported (Zandi, 2004). Therefore it is important to measure cognitive decline objectively, especially in depressed older adults, as a depression is a possible risk factor for dementia (Byers & Yaffe, 2011). Logically this would also mean that one can have cognitive decline during a depression without dementia. In fact, there can be made a distinction between cognitive impairment with and without dementia (Baune & Renger, 2014; Plassman et al., 2008; Wright & Persad, 2007). One of the types of cognitive impairment is called Mild Cognitive Impairment (MCI), "an intermediate clinical state between normal cognitive aging and dementia" (Nasreddine et al., 2005, p. 695). According to a systematic review and meta-analysis (Rock, Roiser, Riedel & Blackwell, 2014), cognitive impairment represents a core feature of depression. In particular executive functions and attention are affected during depression and persist when in remission. Also memory is affected during depression, but not so much persisted during

remission.

Furthermore, people who suffer or have suffered from depression and also have MCI, have more than twice the risk of getting diagnosed with dementia, compared to people who have not suffered from depression (Duffy et al., 2014; Lee, Potter, Wagner, Welsh-Bohmer & Steffens, 2007). Lee et al. (2007) argue that, in particular, persistent impairment may pose a risk to the development of dementia. Therefore it is advisory to screen people who are depressed on existence of MCI. Screening routinely will give insight on the course of MCI in depressed older people, which will give a better prognosis and direction for treatment. When the impairment seems to be related to depression, treatment of depression will be sufficient to improve memory problems. Also a clear prognosis and diagnosis will give the patient more assurance about its mental state. This is important for the patient's well-being, as uncertainty gives people more stress than knowing their prognosis whether it is good or bad news – for it increases the onset of adaptive processes (Kahneman, Diener & Schwarz, 2003).

The relevance of screening for MCI rises with the increase of elderly people in The Netherlands, where the population aged 65 to 80 increased with 7,3% and 80 and above with 3,5% in the past 57 years (Centraal Bureau voor de Statistiek, 2017). Thereby based on the current trend, an increase of 72% of Dementia is predicted between 2010 and 2030, just for people aged 20 to 65. Risk for dementia increases by age; currently prevalence of dementia ranges from 10% above 65 to 40% above 90 (Alzheimer Nederland, 2011). This emphasises the need for efficient screening for risk factors for Dementia like MCI. The costs for neuropsychological test are high; therefore a screening tool for detection of MCI is desirable, so that unnecessary test costs can be prevented.

The Montreal Cognitive Assessment (MoCA) is a short screening tool with high sensitivity and specificity for detecting MCI (Nasreddine et al., 2005). This screening tool contains several domains: visuospatial and executive skills, memory, attention, language and

orientation. In case of depression, it is important to know if there are specific cognitive tasks affected. This could help monitoring and treating cognitive impairments related to depression. As mentioned before, mainly executive functions, attention and memory are affected in depressed people (Rock et al., 2014). Subsequently, in a MoCA subtask analysis (Blair et al., 2016) one can identify a pattern of executive and attentional dysfunction in depressed individuals. Also, people who suffer from depression often show total scores below the normal cutoff score (Blair et al., 2016), confirming the theory that depressed elderly people suffer from cognitive impairment.

Although there is already knowledge about depression and performance on the MoCA test in general, little research has been done among the Dutch elderly, especially when it comes to the geriatric psychiatry department. To find out how Dutch older adults suffering from depression perform on the MoCA screening tool, the current study focuses on the performance over time among older depressed individuals. Also it is interesting to investigate if most elderly people who suffer from depression question their cognitive functioning. The current study does not take into account the influence of sex/gender, for there is no mention in literature about difference in cognitive impairment. Also educational level is not taken into account, for the MoCA test already controls for this factor. Three questions will be investigated in this study: (1) course study: what scores do depressed patients of 65 years or older show over time; is there a correlation between course of severity of depression and the MoCA score? (2) In group comparison: is there a correlation between subjective memory complaints in depressed people and the MoCA score? (3) Between comparison: how do depressed older individuals perform on the MoCA test (total score and domain scores) compared to older individuals with depression in remission and healthy controls?

Based on previous research the following hypotheses are formulated: (1) depressed elderly initially score below the normal cutoff score on the MoCA. Over time with the

decrease of severity of depression, the MoCA score will increase. (2) There is a negative correlation between subjective memory complaints and the MoCA score. (3a) Most depressed older people show errors in executive, attention and memory tasks. (3b) Depressed older adults score lower on total score, also when in complete remission and especially perform worse on executive, attention and memory tasks than healthy older adults do.

Method

Design

A longitudinal design is chosen to measure performance and functioning over time. Patients who participated received the same assessments each measuring point for at least three different moments in time. A cross-sectional design was used to compare depressed patients to each other and this design was also used to compare depressed patients to healthy controls.

Participants and procedure

Depressed older adults

To recruit participants in the population of depressed older adults for the longitudinal study and to test the second hypothesis, records of the department Ouderenpsychiatrie of Altrecht in Utrecht, the Netherlands, were scanned on a DSM diagnose of Major Depression. This included older adults who are currently or recently have been patients of this department, with intake moments ranging from three to one year before the current study. Other diagnosed psychological disorders were excluded, except for cognitive impairment or degeneration. In their time of treatment several assessments were taken to measure subjective severity of depression (Geriatric Depression Scale-15/GDS-15), cognitive functioning (MoCA) and global mental health (Global Assessment of Functioning/GAF). The current study added another measure point by inviting … patients by letter to participate for a test, including an informed consent. Secondly people were called within two weeks to check if they received the

letter and were willing to participate. To ensure an optimal response people were allowed to choose a fitting time and place (at the department or at home). To confirm an appointment, people received a confirmation letter with the negotiated time and place. From all 140 invited people, 49 did not respond the phone call (12 deceased), 66 declined the invitation and 25 eventually participated. Given reasons for decline were: physically or psychologically too heavy (31) and dissatisfied with institution (1); 34 people did not give up a reason.

The test included five assessments to be taken with the participants and three more filled in by the research assistant without the presence of the participant. This included the GDS-15, MoCA, Functioning Assessment Short Test (FAST, cognitive domain) and the Global Assessment of Functioning (GAF). Other assessments taken were used for research by colleagues. All measurements were in Dutch language. The time spent for taking the assessments with the patient was 60 to 75 minutes.

Data from selected records were used for the cross-sectional study (hypotheses 3a and 3b) to enlarge the sample.

Control group

To recruit as many controls as possible, people from or via private network (of all research colleagues) or via patients were asked to participate for an interview. They received a letter and informed consent about the research including four criteria to ensure their healthy mental state. These criteria excluded influence by medication, alcohol, cognitive disorders, psychological disorders or other factors that could be of influence on cognitive functioning. To increase the response, people were asked for to investigate their own network for other healthy peers. A mean age of 75 was strived for by selecting half the group in the age between 60 and 75 years old and half the group in the age of 75 and above. Also education was selected on by dividing the group as equal as possible in a group of 12 years and less of education and a group who received above 12 years of education, starting from age six (thus

excluding kindergarten). The reason for a mean of 12 years of education is the scoring method of the MoCA test. The MoCA test compensates lower performance due to less education by adding one point when one has had 12 years or less of education. From all invited people 88 eventually participated.

The interview time for controls took between 45 to 60 minutes. The interview contained the MoCA test, GDS-15, FAST (cognitive domain) and the GAF.

General procedures

On beforehand participants got enough time to read through the informed consent. The informed consent could be signed and returned by mail or given at time of the test. All assessments were taken in a quiet room, either in an office or in the participants' living room. At the end of the test people were offered the possibility to know their scores and to receive a summary of their scores by mail.

Measuring instruments

All test forms are to be found in the appendix.

Geriatric Depression Scale - 15(GDS-15); this self report screening instrument for depression is specifically developed for the elderly. First of all, it is more suitable for the elderly due to its relative simple language and binary answering option (yes and no). Secondly, somatic items are reduced, because somatic complaints in general are more prevalent among the elderly population. Thus the GDS items are limited to symptoms related to depression (Van Dieren, Terluin, Boonstra & Dankers, 2016). The GDS-15 is a shorter form of the GDS-30, still highly correlating (Wancata, Alexandrowicz, Marquart, Weiss & Friedrich, 2006). The GDS-15 has a specificity and sensitivity of respectively 81% and 78% (Van Dieren et al., 2016) and a Cronbach's alpha of 0.79 (Smalbrugge, Jongenelis, Pot, Beekman & Eefsting,

2008). The questionnaire contains 15 items, with a cut-off score at 6; meaning a total score of 6 or higher indicates a depression, using Dutch psychiatry standards (Trimbos-Instituut, n.d.). The used GDS-15 is a Dutch translation by Bleeker, Frohn-de Winter and Cornelissen (1985). Item number 10 ('Do you feel you have more problems with memory than most?') will be used to represent subjective memory complaints.

Montreal Cognitive Assessment Dutch (MoCA-D); this screening tool is developed especially for detecting Mild Cognitive Impairment (MCI). Several screening instruments were already in use for detecting Dementia, like the Mini-Mental State Examination (MMSE), the most widespread test used by frontline physicians. However the MMSE has low (18%) sensitivity and high specificity (100%) for detecting MCI, whereas the original MoCA has high sensitivity (90%) and specificity (87%) at a cut off score of 26 (Nasreddine et al., 2005). A cut-off score of 26 meant detection of MCI at a score *lower* than 26. The version (MoCA-D) used in the present study is a Dutch translation by Dautzenberg and De Jonghe. The MoCA-D has been validated and tested in a memory disorder outpatient clinic and geriatric (outpatient) clinic, limited to patients with MCI and Dementia and healthy controls (Thissen, Van Bergen, De Jonghe, Kessels & Dautzenberg, 2010). Here the best specificity (73%) and sensitivity (72%) was found at a cut-off score of 25 (score $\leq$ 25 indicates MCI). The MoCA-D appeared to be linguistically equivalent to the original MoCA, when translated from English to Dutch and back. The highest achievable total score is 30 on twelve different tasks, covering the following domains (Nasreddine et al., 2005; Thissen et al., 2010): *visuospatial skills* (clock, 3 points and cube drawing, 1 point), *executive functions* (trail making, phoneme fluency task, verbal abstraction: 1, 1 and 2 points respectively), *language* (naming animals, repetition of complex sentences, phoneme fluency task: 3, 2 and 1 point respectively), *memory* (recall of words: 5 points), *attention and concentration* (target detection and tapping, serial count back, digits forward and backward: 1, 3 and 2 points) and *orientation* (time and place: 6 points). To

correct for years of education one point is added at years of education ≤ 12, not transcending a total score of 30. The higher the score the better the cognitive functioning. The MoCA-D can be administered in 10 minutes. Controls received version 7.1 and patients 7.2 (translation by Wester and Kessels) to prevent a learning effect.

Functioning Assessment Short Test (FAST-NL-P); The FAST is developed for clinical evaluation of functional impairment in people who suffer from a mental disorder, originally bipolar disorders. 24 items are divided by six domains: autonomy, occupational functioning, cognitive functioning, interpersonal functioning, financial issues and leisure time. Each item is rated using a 4-point scale: 0 = no difficulty, 1= mild difficulty, 2= moderate difficulty, 3 = severe difficulty. The questionnaire has high reliability (α=.91) and high negative correlation with the GAF score (*r*=-.90*).* Also the internal consistency is high, on total (Cronbach's alpha of 0.909) and for each item (Rosa et al., 2007). The clinician evaluates the limitations of the patients based on its presentation and the expected functioning of a person from the same sex, age and sociocultural status (Rosa et al., 2008). The FAST is translated to Dutch (FAST-NL-P) by Renes and Kupka (2010). In the current study, only the cognitive domain is used for objectifying the subjective cognitive functioning as presented by the patient.

Global Assessment of Functioning (GAF); The GAF is a rating scale for evaluation of psychological, social and occupational functioning listed as axis V in the third edition of the Diagnostic and Statistic Manual (DSM-III-R; American Psychiatric Association [APA], 1987), for the first time. It was also listed in the next two editions, DSM-IV (APA, 1994) and DSM-IV-TR (APA, 2000). Only minor revisions have been applied for the DSM-IV (Startup, Jackson & Bendix, 2002). The GAF has shown to be a reliable and quick tool, ready to use for there is no need for extensive training (Jones, Thornicroft, Coffey & Dunn, 1995; Hilsenroth et al., 2000). It provides a valid summary of symptoms and social functioning (Startup et al., 2002). Although the GAF is a widespread used instrument, relatively little research shows a

strong research-based development. However, the GAF "covers the range from positive mental health to severe psychopathology" (Aas, 2010, p.28). The rating scale has a range from 0 to 100, divided by ten parts, the lower the score the more severe the psychopathology or social/occupational dysfunction: for example 0-10 (severely impaired) and 81-90 (superior functioning) (Moos, McCoy & Moos, 2000). For the GAF is a global indication of mental health, the scale will be used as a global indicator to substantiate the difference in health between patients and healthy controls.

Analysis

The data of the current study were analyzed using the program IBM SPSS Statistics 24. First of all, entered data were double checked for errors by means of a formula in the excel sheet. Later on, using SPSS data were controlled for outliers and missing values. Table 1 shows the eventual data used for the analyses. To divide patients into depressed patients and patients with depression in remission ('remission' patients) the cutoff score of GDS-15 was used; patients with a GDS-15 total score of 5 or lower were allocated at 'remission' patients, patients with a total score of 6 or above were allocated at depressed patients. In case of data for hypothesis 3: missing data of measuring point 1 (T1), were replaced by data of the particular individual of measuring point 2 (T2), to optimize the sample size for 'remission' patients.

Initially the hypotheses would be tested by a partial correlation, hierarchical multiple regression analysis (MRA) and a multivariate analysis of variance (MANOVA). However, some assumptions were violated for hierarchical MRA and MANOVA leading to a bootstrapped hierarchical MRA and instead of a MANOVA Kruskal-Willis one-way ANOVAs and Mann-Whitney *U* follow ups. The group of depressed patients used for hypothesis 3, was also used to calculate an initial average total score on the MoCA (hypothesis 1), because of a larger sample size. Differences of sample sizes per analysis are

due to pair wise missing values. The GAF scores as shown in table 1 indicate actual differences between groups.

Table 1 *Demographic Characteristics of Patients and Controls*

	Patients hypothesis 1		Patients hypothesis 2	Patients hypothesis 3		Controls hypothesis 3
	T1 (n = 19) *M* (*SD*)	T2 (n = 19) *M* (*SD*)	T2 (n = 22) *M* (*SD*)	T1 Depressed (n = 42) *M* (*SD*)	T1/T2 Remission (n = 23) *M* (*SD*)	T2 (n = 81) *M* (*SD*)
Age in years	70.73 (5.78)	73.05 (5.81)	71.97 (6.28)	74.97 (6.38)	71.61 (7.63)	72.63 (8.70)
GAF score	44.21 (11.82)	65.42 (13.99)	64.68 (13.45)	44.76 (10.59)	59.22 (21.38)	84.36 (7.89)
Male %	47.4	47.4	40.9	35.7	47.8	42.0

Results

Correlation between course of depression and course of total MoCA score

First of all, to calculate the initial total MoCA score of depressed patients the data depressed patients of hypothesis 3 (n=42) were explored. The average total MoCA score for depressed was $M = 22.14$, $SD = 4.27$. Shapiro-Wilk indicated normal distribution, $W = .963$, $p = .183$,

To test for a correlation between course of depression (GDS) and the course of total MoCA score a partial correlation analysis conducted, after controlling for time. The difference in scores between T1 and T2 per individual was calculated in advance. Before running the analysis, several assumptions were checked for. The assumption of normality was met and also all three variables were normally distributed. Assumptions of linearity and homoscedasticity were approximately met.

Partial correlation was statistically non-significant, $r(16) = -.19$, $p = .452$. After partialling out Time, just 4% of the variability in MoCA scores could be accounted for by the variability in GDS score.

Relationship between subjective cognitive complaints and total MoCA score

To test if there is a linear relationship between subjective cognitive complaints and MoCA score, a hierarchical MRA is performed. The hierarchical MRA shows the added variance by adding a second predictor variable.

Before running the analysis, assumptions were tested and checks were performed. Firstly, stem-and-leaf plots and box plots indicated one outlier and a violation of normality. The outlier was deleted, which did not result in normal distribution. Secondly, no multivariate outliers and multicollinearity were of concern. Finally, assumptions of normality, linearity and homoscedasticity of residuals were met.

For assumption of normality was violated and the sample size was small (N = 22) a simple bootstrap (N = 1000) procedure was conducted, using a bias corrected accelerated (BCa) 95% confidence interval.

On step 1 of the hierarchical MRA, subjective memory complaints (GDS) accounted for a non-significant 0% of the variance in MoCA score, $R^2 = .00$, $F\ (1, 20) = .01$, $p = .942$. On step 2, objectified subjective cognitive complaints (FAST) was added to the regression equation, and accounted for a non-significant additional 6.7% of the variance in MoCA score, $\Delta R^2 = .067$, $\Delta F\ (1, 19) = 1.37$, $p = .257$.

The bootstrap coefficients also indicated non-significant results for step 1, $B = .111$, SE = 1.370, 95% CI = -2.518, 2.604, and step 2 for GDS, $B = -.078$, SE = 1.442, 95% CI = -2.910, 3.201, and for FAST, $B = -.295$, SE = .269, 95% CI = -.833, .384.

Comparison depressed patients, 'remission' patients and healthy controls on MoCA

To compare depressed patients, ´remission´ patients and healthy controls for performance on the MoCA, the data were checked on assumptions for a multivariate analysis of variance (MANOVA). Different assumptions (i.e. normality, multicollinearity, homogeneity of variance-covariance) were violated. The Kruskal-Wallis one-way ANOVA, a non-parametric test, was used instead. Assumptions (especially shape of distributions of variables) for the Kruskal-Wallis ANOVA were met.

The test indicated that there were statistically significant differences between the total performance on the MoCA of 'depressed patients', 'remission´ patients, and healthy controls, H (corrected for ties) = 40.956, df = 2, N = 146, p = .000, Cohen's f = .627. Furthermore, there was an indication for statistically significant differences between performance on the three MoCA domains and depressed patients,´ remission´ patients and healthy controls: executive functions, H (corrected for ties) = 12.770, df = 2, N = 146, p = .002, Cohen's f = .311; attention and concentration, H (corrected for ties) = 9.752, df = 2, N = 146, p = .008, Cohen's f = .268; memory, H (corrected for ties) = 29.908, df = 2, N = 146, p = .000, Cohen's f = .509. Mean Ranks are shown in table 2. The Mean Ranks mainly suggest a difference between healthy controls and the patient groups.

Table 2 *Kruskal-Wallis Mean Ranks for Performance on MoCA Test Total and Domains*

Performance on MoCA	Groups		
	Depressed patients (N = 42)	Remission patients (N = 23)	Healthy controls (N = 81)
Executive Functions	60.24	59.85	84.25
Attention	62.55	64.59	81.71
Memory	47.06	65.96	89.35
Total	46.24	53.39	93.35

Mann-Whitney *U* tests were conducted as follow ups – to clarify how groups in scores relate to each other – , evaluated by a Bonferroni adjusted alpha level of .017 to control for increased risk of Type I error.

Follow up Total MoCA Score

A Mann-Whitney *U* test indicated that the total MoCA scores of depressed patients (*Mean Rank* = 36.29, *n* = 42) were significant lower than those of the healthy controls (*Mean Rank* = 75.33, *n* = 81), *U* = 621.00, *z* = -5.80 (corrected for ties), *p* = .000, two-tailed. This effect can be described as "large" (*r* = -.52).

Total MoCA scores of 'remission' patients (*Mean Rank* = 29.57 *n* = 23) were significant lower than those of the healthy controls (*Mean Rank* = 59.01, *n* = 81), *U* = 404.00, *z* = -4.17 (corrected for ties), *p* = .000, two-tailed. This effect can be described as "medium" (*r* = -.38).

Total MoCA scores between depressed (*Mean Rank* = 31.45, *n* = 42) and 'remission' patients (*Mean Rank* = 35.83, *n* = 23) did not differ significantly, *U* = 418.00, *z* = -.90 (corrected for ties), *p* = .371, two-tailed.

Follow up Executive Functions

The test indicated that the scores on Executive Functions of depressed patients (*Mean Rank* = 48.57, *n* = 42) were significant lower than those of the healthy controls (*Mean Rank* = 68.96, *n* = 81), *U* = 1137.00, *z* = -3.15 (corrected for ties), *p* = .002, two-tailed. This effect can be described as "medium" (*r* = -.28).

Also scores on Executive Functions of 'remission' patients (*Mean Rank* = 39.15, *n* = 23) were significant lower than those of the healthy controls (*Mean Rank* = 56.29, *n* = 81), *U* = 624.50, *z* = -2.53 (corrected for ties), *p* = .011, two-tailed. This effect can be described as "small to medium" (*r* = -.23).

Score on Executive Functions between depressed (*Mean Rank* = 33.17, *n* = 42) and 'remission' patients (*Mean Rank* = 32.70, *n* = 23) did not differ significantly, *U* = 476.00, *z* = -.10 (corrected for ties), *p* = .922, two-tailed.

Follow up Attention

A Mann-Whitney *U* test indicated that the scores on Attention of depressed patients (*Mean Rank* = 51.35, *n* = 42) were significant lower than those of the healthy controls (*Mean Rank* = 67.52, *n* = 81), *U* = 1253.50, *z* = -2.89 (corrected for ties), *p* = .004, two-tailed. This effect can be described as "medium" (*r* = -.26).

Scores on Attention between depressed patients (*Mean Rank* = 32.70, *n* = 42) and 'remission' patients (*Mean* Rank = 33.54, *n* = 23) did not differ significantly, *U* = 470.50, *z* = -.19 (corrected for ties), *p* = .851, two-tailed.

Score on Attention between 'remission' patients (*Mean Rank* = 43.04, *n* = 23) and healthy controls (*Mean Rank* = 55.19, *n* = 81) did not differ significantly, *U* = 714.00, *z* = -2.14 (corrected for ties), *p* = .0.32, two-tailed.

Follow up Memory

A Mann-Whitney *U* test indicated that the scores on Memory of depressed patients (*Mean Rank* = 38.80, *n* = 42) were significant lower than those of the healthy controls (*Mean Rank* = 74.03, *n* = 81), *U* = 726.50, *z* = -5.31 (corrected for ties), *p* = .000, two-tailed. This effect can be described as "large" (*r* = -.48).

Also scores on Memory of 'remission' patients (*Mean Rank* = 39.04, *n* = 23) were significant lower than those of the healthy controls (*Mean Rank* = 55.32, *n* = 81), *U* = 622.00, *z* = -2.51 (corrected for ties), *p* = .012, two-tailed. This effect can be described as "small to medium" (*r* = -.23).

Score on Memory between depressed (*Mean Rank* = 29.76, *n* = 42) and 'remission'

patients (*Mean Rank* = 38.91, *n* = 23) did not differ significantly, *U* = 347.00, *z* = -1.93 (corrected for ties), *p* = .054, two-tailed.

Discussion

In order to detect cognitive impairment during and after depression – together an increased risk for dementia – (Duffy et al., 2014; Lee et al., 2007), the current study investigated the performance of depressed patients on a cognitive screening tool, the MoCA. Analyses were conducted for performance during depression, over time and between patients and healthy controls (depression vs. remission vs. healthy) on three predicted domains of the MoCA and the total score. Also the relationship between subjective cognitive complaints and performance on the MoCA was tested.

First of all, the average total MoCA score among depressed patients was about 22 at a sample size, corresponding to MCI (Nasreddine et al., 2005). However over time, no significant negative correlation between total GDS score and MoCA score was found, after controlling for time between T1 and T2: the decrease of a depression was thus not related to an increase of cognitive performance. Several explanations for the outcome are possible. There could really be no connection between depression and cognitive performance over time. Another possibility would be that the MoCA and GDS-15 do not present well enough the current state of cognitive functioning and severity of depression. For a systematic review and meta-analysis (Rock et al., 2014) did show a relationship between depression course and cognitive functioning, the current study is more likely to be less reliable, due to its limitations.

Secondly, the relationship between subjective cognitive complaints and MoCA score was investigated with an unexpected outcome. The analysis showed no significant predictability of subjective cognitive complaints (GDS-15 item nr. 10 and cognitive domain of FAST) for the total MoCA score. This finding is in line with previous research about subjective cognitive complaints and objective cognitive impairment (Gauthier et al., 2006;

Roberts et al., 2009).

Thirdly, both depressed and ‘remission’ patients scored lower than healthy controls on all three MOCA domains (executive functions, attention and concentration, memory) and on the total score. Follow ups showed a difference between healthy controls and patients, but no significant differences were found between patients (i.e. depression versus remission). This confirms previous findings about the impairment of executive functions and attention and concentration and in a lesser way for memory (Blair et al., 2016; Rock et al., 2014).

Overall strengths of the current study are the comparison with healthy controls and a well underpinned method, with presumably valid and reliable instruments used according to their strengths. Possibly the measurement of subjective memory complaints is less valid, for the combination of the two scales (GDS and FAST domain) is not validated. Unfortunately the operation of the study did not came out as expected, as the attendance of T2 was very low and records (T1) were not as complete as needed because of changes to the input of questionnaires. This resulted in small sample sizes and second choice analyses, leaving the relation between domains en total score as unknown. However, some sample sizes were large enough to draw more firm conclusions from.

Several recommendations can be made for future research. Because of the small sample sizes few firm conclusions can be drawn and so knowledge about the elderly depressed population in elderly psychiatry remains meagre. It would be interesting to investigate the performance on the MoCA over time again, but with a larger sample size and compared to other patients groups and healthy elderly over time. It would be advisory to select from a larger population and to invite peers of patients to volunteer as long term healthy controls. Also the influence of subjective memory complaints remains unclear and demands a validated instrument to measure subjective memory complaints more accurate. Furthermore it could be interesting to investigate the relationship between the three MoCA domains selected

for depression. And finally, the question rises whether impairments of executive functions, attention and concentration, and memory last for over a year. Previous research only mentioned follow ups of a year (Douglas & Porter, 2009), so it is recommended to test follow up for two years or more.

The MoCA has proven to be distinctive between depressed patients and healthy controls, showing its utility for clinical purposes as a screening tool in geriatric psychiatry. Caution should be exercised when using the screening tool to measure persistent cognitive impairment in depressed elderly, lasting with a rough indication for the course. By all means, it is especially important, depressed or not, to have a global view on persistent impairment, as this is an increased risk for developing dementia (Lee et al., 2007). Furthermore, it is advisory to use the cutoff score as an indicator for more elaborate neuropsychological testing in the geriatric psychiatry, also during depression. Depressed elderly may perform below the cutoff score, depression is still a risk factor for dementia (Byers & Yaffe, 2011), and therefore does not exclude dementia. Finally, the MoCA is considered to recognise cognitive impairment related to depression; it seems sensitive enough to show errors in executive functioning, attention and memory. This can help the clinician decide which psychopathology is related to the cognitive impairment, providing a direction for treatment.

In sum, conclusions have to be drawn with caution. The MoCA serves as an instrument sensitive to influence of depression, since the average total score is below the cut off score. Over time the MoCA might not be sensitive enough to changes in severity of depression, but further research is recommended to confirm this finding. Subjective complaints should always be taken seriously, for findings contradict each other, and the risk of dementia increases with higher age (Alzheimer Nederland, 2011). The MoCA seems sensitive enough to show a pattern of impairment in executive functions, attention and

concentration, and memory in depressed patients, regardless of remission. The MoCA is a recommended screening tool for the Dutch depressed elderly.

Literature

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Appendix

1. Geriatric Depression Scale – 15 (Dutch translation)
2. Montreal Cognitive Assessment-Dutch 7.1
3. Montreal Cognitive Assessment-Dutch 7.2
4. Functioning Assessment Short Test – NL (Dutch translation)
5. Invitation for patients
6. Informed Consent for patients
7. Invitation for healthy controls
8. Informed Consent for healthy controls