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Association between cognition and daily life functioning in dementia subtypes

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SUMMARY

Objective To investigate the association between cognition and daily life functioning in dementia subtypes.

Methods Cross-sectional data were used from 615 patients with dementia who were referred to the Maastricht Memory Clinic of the Maastricht University Medical Centre. Pearson correlation coefficients were calculated between the Mini-Mental State Examination (MMSE; to measure cognitive status) and the Blessed Dementia Scale (BDS; to measure daily life functioning) for the following types of dementia: Alzheimer's Disease (AD, $n = 442$); Vascular dementia (VaD, $n = 113$); frontotemporal dementia (FTD, $n = 18$); Parkinson's dementia (PD, $n = 21$); and primary progressive aphasia (PPA, $n = 21$). One-way ANOVA was used to test differences in age, MMSE scores and BDS scores across dementia subtypes.

Results Scores on the MMSE showed strong correlation with BDS scores in cases of FTD ($r = -0.80$); moderate correlation in cases of AD, VaD, and PD (range $r = -0.50$ – 0.60); while no correlation was found in PPA cases.

Conclusions The association between cognition and daily life functioning varied among dementia subtypes for AD, VaD, FTD and PD. Furthermore, the overall scores on both domains differ between dementia subtypes, indicating that different types of dementia are characterized by a specific pattern of cognitive status and daily life functioning. These findings underline the need for multidomain assessment in patients with dementia. Copyright © 2009 John Wiley & Sons, Ltd.

KEY WORDS—cognition; daily life functioning; dementia; relationship; MMSE; BDS

INTRODUCTION

Dementia characterized by multidomain impairment is a common disease in old age, and it can become manifest in several forms. Alzheimer's disease (AD) is the most common dementing disorder, followed by vascular dementia (VaD) (Qiu *et al.*, 2007). Other forms like frontotemporal dementia (FTD) (including primary progressive aphasia), and Parkinson's dementia (PD) are less frequent. The severity of dementia is traditionally measured with cognitive tests (O'Connor *et al.*, 1989; Zhang *et al.*, 1990; Fratiglioni *et al.*, 1991). However, the assessment of functional impairment due to cognitive impairment is a crucial element

in the diagnosis of dementia (Hendrie *et al.*, 2006; Bouwens *et al.*, 2008).

Various instruments are used to measure one or more domains of dementia, such as the Mini-Mental State Examination (MMSE) (Folstein *et al.*, 1975) and the Blessed Dementia Scale (BDS) (Blessed *et al.*, 1968); both of which are recommended by the National Institute of Neurological Diseases and Communicative Disorders and Stroke, as well as the Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA) (McKhann *et al.*, 1984).

Several studies have found that on average there is a strong association between cognition and daily functioning in people with dementia in general (Skurla *et al.*, 1988; Reed *et al.*, 1989; Barberger-Gateau *et al.*, 1992). The association between cognitive status and daily life functioning in people with specific types of dementia has received less attention until now. Identifying the relation between

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cognitive status and daily life functioning for a specific dementia subtype may, however, be of diagnostic importance in practice. Furthermore, a better understanding of this association with regard to each dementia subtype is important, since it may improve insight into the different characteristics of the subtypes and may provide information about the presence of compensatory strategies for a patient's lack of abilities (i.e. daily life functioning may not be impaired if cognitive impairments are compensated adequately).

The aim of this study is to investigate the association between cognitive status and daily life functioning in people with different dementia subtypes.

METHODS

Participants

Participants were patients with dementia from the Maastricht Memory Clinic (MMC) register of the Maastricht University Medical Centre (MUMC). Patients were referred by general practitioners, neurologists, psychiatrists, and community mental health teams, or by others who were mainly internists or geriatricians (Verhey *et al.*, 1993). The study was based on the cross-sectional data of those people who met the criteria indicating one of the following subtypes of dementia: Alzheimer's Disease (AD) (McKhann *et al.*, 1984); Lewy body dementia (LBD) (McKeith *et al.*, 1996); vascular dementia (VaD) (Roman *et al.*, 1993); frontotemporal dementia (FTD) (The Lund and Manchester Groups, 1994); Parkinson's dementia (PD) (McKeith *et al.*, 1996); or primary progressive aphasia (PPA) (The Lund and Manchester Groups, 1994). Participants included also had to have an informant who could answer questions about their condition. Furthermore, their diagnostic phase data had to be complete and their informed consent obtained. The Ethics Committee of the MUMC approved the procedure.

Measures

The Mini-Mental State Examination (MMSE) (Folstein *et al.*, 1975) is a bedside test that measures cognitive status. The MMSE covers orientation in place and time, memory, attention, language, concentration, visuo-spatial skills, and praxis. The maximum score is 30, with a higher score reflecting a better global cognitive status. The cut-off score is 25 (Braekhus *et al.*, 1995).

The Blessed Dementia Scale (BDS) (Blessed *et al.*, 1968) is a 30-min, structured interview with an

informant who is close to the patient about daily functioning, cognition and behaviour in people with dementia. The scale is based on the Dementia Scale (DS) and the Information-Memory-Concentration (IMC) Test. The former tracks changes in performance of everyday instrumental activities (items 1–8) and everyday basic activities (items 9–11), as well as changes in personality, interests and drive (items 12–22). The latter assesses orientation, memory and concentration.

For this study, we used items 1–11 of the DS, covering changes in performance of everyday instrumental and basic activities. The DS consists of items measuring both basic activities of daily life (BADL) and instrumental activities of daily life (IADL) functions (Erkinjuntti *et al.*, 1988; Pena-Casanova *et al.*, 2005). Changes in three BADL functions (eating, dressing and continence) are scored 0–3 and eight items assessing changes in IADL, such as performing household tasks, coping with money or finding one's way, are scored 0 (never), 0.5 (sometimes) or 1 (nearly always). The total score ranges from 0 (independent) to 17 (dependent), with a higher score reflecting a deterioration in daily life functioning. The MMSE and the BDS were both recommended by the NINCDS-ADRDA (McKhann *et al.*, 1984).

Procedure

Clinicians working at the Maastricht Memory Clinic (MMC) were trained in order to administer the MMSE and the BDS at the Maastricht University Medical Centre (MUMC) as part of the diagnostic phase at the MMC. Both rating scales were administered at the same visit. The caregiver was present during both assessments.

Statistical analyses

All analyses were calculated for dementia subtypes with an $n > 15$. Demographic characteristics of the participants and descriptive statistics of the MMSE and the BDS were calculated. Normality tests were performed for the MMSE and the BDS. To test if dementia subtypes differed according to mean age, mean MMSE and mean BDS, One-Way ANOVAs were calculated with age, MMSE, and BDS as dependent variables and dementia subtypes as factor. Pearson correlation coefficients were calculated to examine the association between MMSE scores and BDS scores for dementia subtypes. Correlation coefficients between 0.30–0.49 were regarded as

low, those between 0.50–0.69 as moderate, and those between 0.70–0.89 as high (Hinkle *et al.*, 1998).

We hypothesized that the association between MMSE and BDS scores differed per dementia subtype with AD as reference group. To facilitate interpretation of the test result, the raw scores were converted into Z-scores because of large differences in score range (i.e. 0–30 for the MMSE and 0–17 for the BDS) and because the scoring of both tests is reversed (i.e. higher MMSE scores signify better performance, whilst higher BDS scores signify worse performance). A repeated measures ANOVA with test score (MMSE Z-score, BDS Z-score) as within-subject variable and dementia subtype as between-subject variable was conducted to test this hypothesis. Statistical analyses were performed with the Statistical Package for Social Sciences (version 16.0) with an alpha level set at 0.05 for all analyses.

RESULTS

Of the 965 people with dementia in the MMC register (Verhey *et al.*, 1993), 621 patients fulfilled the inclusion criteria of this study; 442 patients had AD, six patients had LBD, 113 patients had VaD, 18 patients had FTD, 21 patients had PD, and 21 had PPA. Since the number of patients with LBD was too low to perform meaningful analyses, we did not include these for further analyses, and 615 patients remained for the present study. Table 1 shows the patients' characteristics and mean scores on the MMSE and the BDS for the total group of people with dementia ($n = 615$) and for the groups per dementia subtype separately. Level of education did not differ between dementia subtypes.

The One-way ANOVAs for mean age, MMSE and BDS for dementia subtypes all show a significant effect of dementia subtype on these mean scores

($F = 11.578, p < 0.05$; $F = 2.954, p < 0.05$; $F = 9.974, p < 0.05$ respectively) indicating that age and MMSE and BDS scores differ with regard to dementia subtype.

Figure 1 shows the correlations between the MMSE and the BDS for the 5 different types of dementia. The Pearson correlation coefficient is -0.60 for AD, -0.56 for VaD, -0.80 for FTD, -0.50 for PD, and -0.00 for PPA. All correlations were significant ($p < 0.00$) except for PPA. This group showed no clear correlation.

The Z-scores for both the MMSE and the BDS were normally distributed. The repeated measures ANOVA for mean MMSE Z-scores and mean BDS Z-scores for dementia subtypes show a significant effect of dementia subtype on the association between the MMSE and the BDS ($F = 7.123, p < 0.05$). This indicates that the association between cognitive status and daily life functioning depends on the specific dementia subtype when considering AD as reference group.

DISCUSSION

We investigated the association between cognitive status (MMSE) and daily life functioning (BDS) of people with different types of dementia. We found that the association between cognitive status and daily life functioning is directly related to dementia subtype.

The extent of this association differs across dementia subtypes. This supports the importance of functional as well as cognitive assessment not only to assess patient care needs but also as a possible diagnostic tool. The moderate and high correlations between the MMSE and the BDS scores are expected since the interference of cognitive functioning on daily life functioning is part of the definition of dementia.

The absence of a significant correlation in the PPA group indicates that daily life functioning is not

Table 1. Patient characteristics and mean scores on the Mini Mental State Examination and the Blessed Dementia Scale

	<i>N</i>	Age	Female	MMSE	BDS
		Mean (SD, range)	<i>N</i> (%)	Mean (SD, range)	Mean (SD, range)
Diagnosis					
AD	442	72.3 (8.3, 49–95)	266 (60.2)	19.2 (5.7, 2–29)	3.5 (2.4, 0.5–14.0)
VaD	113	73.8 (7.2, 49–88)	51 (45.1)	18.9 (5.9, 5–30)	4.4 (3.1, 1.0–14.5)
FTD	18	63.0 (9.7, 49–77)	10 (55.6)	20.6 (6.9, 8–29)	2.9 (2.4, 0.5–8.5)
PD	21	73.9 (5.3, 59–82)	10 (47.6)	15.4 (4.7, 2–24)	5.9 (3.9, 1.5–15.0)
PPA	21	64.9 (6.8, 54–77)	10 (47.6)	20.6 (7.5, 4–28)	1.8 (1.4, 0.0–6.0)
Total	615	72.1 (8.3, 49–95)	347 (56.4)	19.1 (5.8, 2–30)	3.7 (2.7, 0.0–15.0)

AD = Alzheimer's disease; VaD = Vascular dementia; BDS = Blessed Dementia Scale; FTD = Frontotemporal dementia; MMSE = Mini Mental State Examination; PD = Parkinson's dementia; PPA = Primary progressive aphasia.

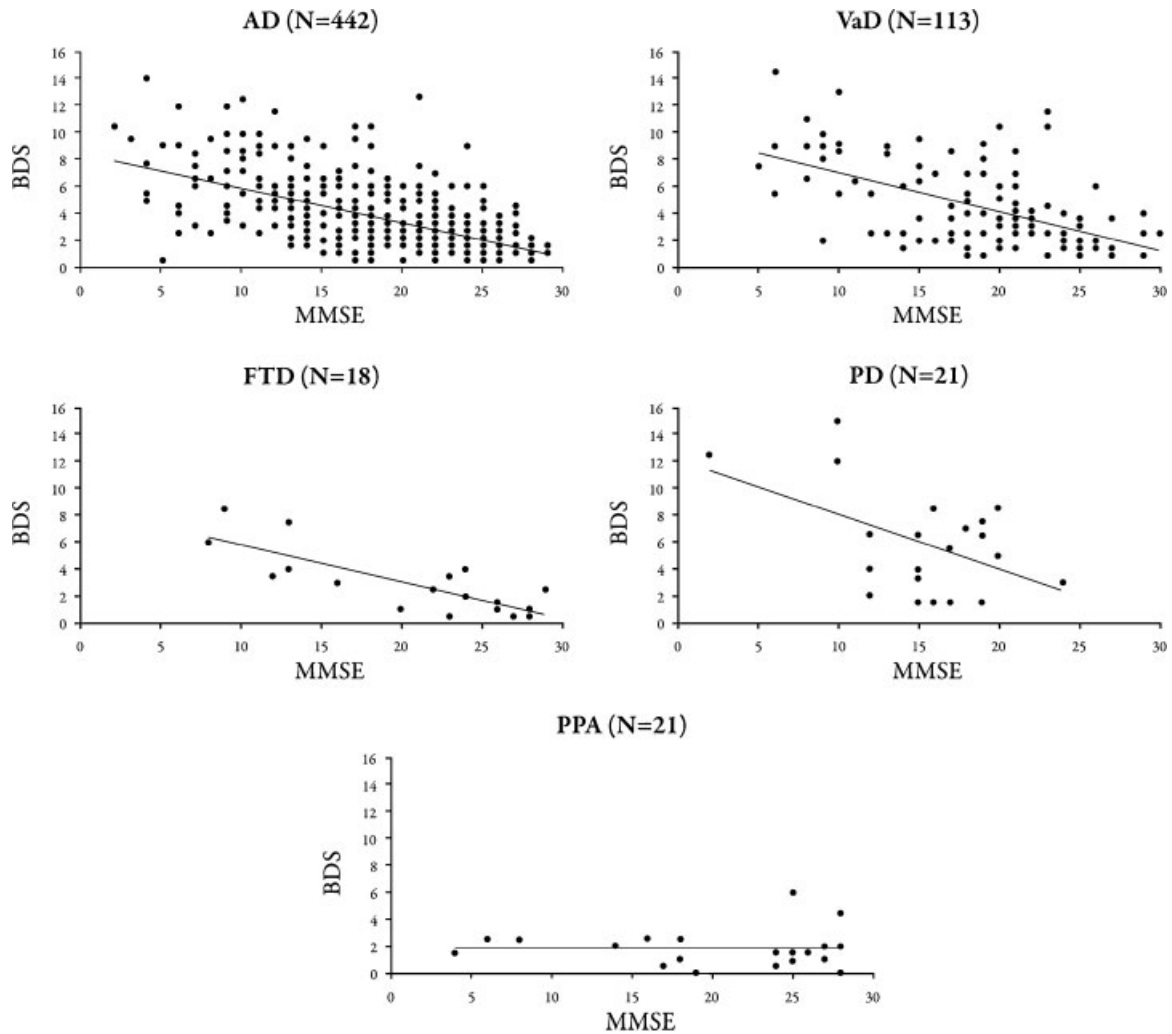


Figure 1. Association between the Mini Mental State Examination and the Blessed Dementia Scale for five dementia subtypes.

affected to the same extent as cognitive status, as indicated by the MMSE. An explanation for the absence of a significant correlation in this dementia subtype is that patients with aphasia score relatively worse on cognitive tests like the MMSE because most of the items in this test require verbal skills. However, these verbal skills do not affect the BDS because this is an informant-based rating of daily life functioning. Moreover, patients may have good compensatory abilities, which help them cope with aphasic problems in daily life. These findings are in line with Osher *et al.* (2008), and Mioshi *et al.* (2007). Clinicians should take this verbal handicap into account when testing cognitive status in people with aphasia and make

better use of non-verbal cognitive tests like the Aphasia Check List (ACL) (Kalbe *et al.*, 2005). The ACL is a 30-min test battery for the assessment of aphasic and associated cognitive disorders. It includes nonverbal screening tests for three neuropsychological domains: memory, attention, and reasoning.

Furthermore, Mioshi *et al.* (2007) also found that frontotemporal dementia has a negative effect on activities of daily living. Since other studies, including ours and that of Larner and Hancock (2008), have found different results, future research is necessary to study the effect of FTD on daily life functioning.

An unexpected result of our study was the comparable correlation between the MMSE and the

BDS for AD and PD. This may be due to overlap in old criteria for PD and AD (DSM III-R and DSM IV) (American Psychiatric Association, 1995), by which the specific characteristics of each dementia subtype were not taken into account. However, there is an emerging consensus that dementia subtypes differ in clinical characteristics, which is reflected in recent proposals for specific dementing disorders (Roman *et al.*, 1993; McKeith *et al.*, 1996; Dubois *et al.*, 2007).

The main strength of our study lies in the use of a large sample of clinical data. As a consequence, the dataset contained information on a heterogeneous population as it appears in everyday clinical practice, which may improve the general applicability of the results. Our data are representative according to distribution of dementia subtypes, gender in the total group and across subtypes, mean age per subtype, MMSE scores and BDS scores (Juva *et al.*, 1997; Neary *et al.*, 1998; Chow *et al.*, 2006; Qiu *et al.*, 2007; Starr and Loanie, 2007). Although our sample is in general large and representative, the number of patients with specific types of dementia, such as FTD, PD and PPA are relatively small. Therefore, these results must be interpreted with some caution.

Harwood *et al.* (2000) and Bouwens *et al.* (2008) found influences of neuropsychiatric symptoms on the cognitive status and daily life functioning of people with dementia. We did not take neuropsychiatric data into account. The association between cognition and functioning further depends on the type of IADL measures used, and whether they are based on informant-reporting, self-reporting or clinician ratings (Burton *et al.*, 2006). Nowadays, IADL (Lawton and Brody, 1969) is recommended instead of the BDS which was chosen on the basis of the NINCDS-ADRDA (McKhann *et al.*, 1984).

Discrepancies between cognitive tests and instruments for measuring activities of daily life, as is the case in our PPA group, provide important information that can guide the clinician in choosing the appropriate treatment. Since PPA, PD and FTD are relatively rare subtypes of dementia with different patterns between cognitive status and daily life functioning, clinicians must pay special attention to the possible presence of one of these three subtypes when finding relative discrepancies between cognitive status and daily life functioning.

CONCLUSIONS

Different types of dementia are characterized by different patterns of cognitive status and daily life functioning. These findings underline the need for

KEY POINTS

- The association between cognition and daily life functioning is directly related to dementia subtype.
- A multidomain approach to dementia is recommended.
- Discrepancies between cognition and daily life functioning have diagnostic relevance.

multidomain assessment in patients with dementia. Clinicians should take into account the different patterns between cognitive status and daily life functioning for each dementia subtype in order to provide appropriate care as well as adequate and accurate information. Discrepancies between cognition and daily life functioning have diagnostic relevance.

CONFLICT OF INTEREST

None known.

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