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ORIGINAL ARTICLE

Disability in a memory clinic: Frequency and associations with low cognitive performance

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Abstract
Background and objective: To document the frequency of disability in a Psychiatry Memory Clinic (MC); to test the conjecture that there is an association between low cognitive performance and disability, even when controlling by dementia and clinically significant depression.
Methods: A sample of 158 individuals referred to a Psychiatry MC were assessed with a full clinical protocol. Instruments used: *Mini-Mental Status Examination (MMSE); Semantic verbal fluency; the Clock Drawing test;* Katz Index; Lawton and Brody Scale. DSM-IV criteria were used for diagnosing depression and dementia. The statistical analysis included logistic regression models.
Results: The frequency of disability was 71.6%. MMSE score was significantly associated with moderate-severe disability on instrumental activities of daily living (ADL's) (OR 0.83; 95%CI 0.72–0.96) and with social ADL's (OR 0.87; 95%CI 0.79–0.95)). Orientation, attention and language MMSE subscores were the cognitive domains most significantly associated with disability.
Conclusions: Disability in patients referred to a Psychiatry MC with a heterogeneous clinical population is associated with low cognitive performance. The probability of having moderate-severe disability is related to the degree of impairment on MMSE global scores.
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Introduction

The rates of disability are increasing in the community, in part due to the aging population and the rising chronic health conditions.[1] Disability, following World Health Organization directions, International Classification of Functioning, is conceptualized as an overarching term that contains three types of dysfunction: compromised body function or structure, impairment in activity, and cessation in participation.[2] This concept has been used to describe functional problems in elderly patients with dementia and/or depression, [3,4] but in such cases it should be important to clarify that disability occurs regardless of the presence of physical disease. Disability among older people, in conditions such as dementia or depression, is considered to be a crucial factor contributing to economic, public health and caregiver burden.[5,6] Therefore, an improved understanding of the factors associated with disability may provide useful information in the formulation of interventions aiming to maintain independence.[7]

Memory clinics (MC) are important care centers related to disability, since individuals referred may include not only those eventually diagnosed of dementia, but also a heterogeneous population such as those diagnosed of depression or cognitive impairment without dementia.[8,9] Depressive symptoms are frequent in subjects with cognitive complains and they are a strong predictor of disability.[10] Current diagnostic criteria for Mild Cognitive Impairment (MCI) include preservation of functional abilities;[11] however, patients with all MCI subtypes show more difficulties in everyday activities than cognitively normal elders.[12] In fact, disability may influence the reason for referral and it may be a confounding diagnostic factor. In this context, a study in a MC could be timely from the clinical perspective, to evaluate the disability and associated factors, particularly if the assessment includes the disability for social activities, which has not been addressed in most previous studies but is considered to capture major domains on an individual's level of functioning.[13]

Cognitive impairment may be crucial in relation to disability, since it is a core criteria in the present concept of dementia and is also commonly associated with depression, particularly in the elderly.[14] Therefore, it is relevant to study the association of low cognitive performance and disability in a MC, although dementia and depression should both be controlled to understand the specific role of cognitive performance. Some previous studies controlled by symptoms of depression measured by self-reported questionnaires,[12,15,16] but clinically diagnosed depression requires special attention. Some investigations controlled by dementia,[16,17] but they were based on specific, and non-heterogeneous samples. In the assessment of cognitive performance, time-saving procedures are frequently recommended in busy MC's.[18] The MMSE is commonly used for this assessment and several previous studies have reported the association of MMSE scores with disability in different activities[19] and settings,[18,20,21] including MCs.[22,23] However, none of these studies controlled by dementia or clinically diagnosed depression, and none explored the social dimension of disability.

While general cognitive screening tests have been shown to correlate strongly with functional status,[12,24,25] the relevance of studying the association of disability with low performance in specific cognitive domains has also been reported,[15–17,24] and may have clinical implications. Two studies suggested that orientation and attention subscores of the MMSE correlated most significantly with functional abilities[18,23] but these reports focused on subjects with dementia, and studies in a heterogeneous clinical population such as the ones expected in a MC are still needed to validate their results.

In this context, this study is intended to (1) document the frequency of disability, including impairment on social activities, in a MC; (2) to test the conjecture that an association between low cognitive performance and disability exists, even when dementia and clinically significant depression are controlled; (3) to try to confirm, in the previous circumstances, the preferential association between both orientation and attention scores and disability.

Method

Sample

All the individuals referred to the Psychiatry Memory Clinic (MC) in the Hospital Clínico Universitario, Zaragoza (Spain) in the period between the years 2005 and 2012 were initially recruited for the study. A heterogeneous population of individuals with suspected cognitive impairment is referred to this MC. Among the 223 consecutive individuals assessed in the MC during that period, we excluded all the subjects younger than 55 years old and subjects with no information on the main variables, so finally, a sample of 158 subjects was analyzed in this study. Most of the excluded individuals were women, but there were no other statistical, significant differences in the demographic characteristics between the included subjects.

Procedure

All patients were initially assessed by psychiatrists, who previously completed pilot training to assure the homogeneity of the assessment methods. The assessment included a complete history and psychiatric examination, incorporating the MMSE and a standard, cognitive evaluation. A full neurological examination and ADL's assessment were also incorporated. Afterwards, a neuropsychological battery was given by an expert psychologist blind to the results. Then, the patients were referred for a full analytical medical protocol and neuroimaging. All the clinical information was systematically collected for an eventual analysis of results and to test hypothesis with a clinical interest. This study is based on the retrospective analysis of this information. All procedures have been approved by the hospital's Ethical Committee.

Cognitive measures

A clinical, psychiatric cognitive assessment was performed in each individual, as well as a neuropsychological

assessment with the standard MC battery. All measures come from cognitive instruments standardized in Spain. For the purpose of this study, the following instruments were used:

- *Mini-Mental State Examination (MMSE)*.[26] The Spanish version was validated in Spain in 1978, following an extensive process, and then was re-validated,[27] the population norms being very similar to the American norms reported by Crum et al.[28] For the purposes of this study, MMSE total score was analyzed as a continuous variable with a maximum score of 30. Additionally, MMSE items were clustered into the following subscores, following the procedures used by previous researchers[18,29]: (1) orientation: items assessing orientation in time and place; (2) registration: items requiring the ability to register words, and to accurately repeat three items; (3) attention: items requiring attentional skills by performing serial 3's; (4) recall: item which measures short-term verbal memory and requires recalling three previously registered words; and (5) language: items that specifically assess oral and written language reception, repetition, nomination and comprehension. Our group has previously documented the validity coefficients for individual items in the MMSE.[27]
- *Semantic verbal fluency*. This is a task considered by some authors to be a measure of ''executive functions''.[15,16,24] We assessed the most commonly used category, ''animals'', previously validated in Spain for the elderly.[30]
- *Clock Drawing Test*. Clock drawing performance taps numerous cognitive processes, including executive functioning, semantic knowledge, receptive language and visuo-constructional ability.[31] We evaluated the circle-shaped clock, the position of numbers and the time set on the clock. Dichotomous categories were used, and scores were computed as abnormal if one or more items were not correctly interpreted.

Activities of daily living (ADL) measures

Disability was scored when the subject had impairment in any assessed function not explained by physical causes. Instrumental ADL's (iADL's) were assessed by the 8 functions included in the Lawton & Brody Scale[32,33] (iADL). Basic ADL's (bADL's) were assessed by the 6 functions included in the Katz Index.[34,35] Disability in social activities of daily living (sADL's), was scored following two direct questions addressed to the subject and/or informant: (a) Have you (or him/her) decreased or ceased participation in social or community events?. And (b) Have you (or him/her) decreased or ceased participation in your (or his/hers) hobbies or likings? The inter-rater reliability of this assessment has previously been assured in pilot trials.

Disability in both iADL's and bADL's was categorized in three groups: (0) no disability, (1) mild disability (impairment in 1–3 functions), and (2) moderate-severe disability (impairment in 4+ functions). For the assessment of sADL's the scores were dichotomized into disability and no disability.

Clinical variables

Cases of dementia and depression were diagnosed according to DSM-IV criteria, NINDS-ADRA criteria[36] were used for the diagnosis of Alzheimer's disease, and Hachinski's criteria for the diagnosis of vascular dementia.[37] For the diagnosis of ''cognitive impairment-no dementia'' clinical criteria were used, including the score below the threshold point in the MMSE (23/24). According to the DSM-IV criteria, in order to diagnose ''comorbid dementia-depression'', the diagnosis of dementia plus the presence of major depression was required.

Statistical analysis

Statistical analysis was performed using SPSS STATISTICS v.19 (IBM Corp., New York, NY, USA, 2010) for Windows. To compare frequencies of disability by diagnostic group we used the Pearson chi-square test, and Fisher exact statistics for small sample sizes, using ''no cases'' as reference group.

In order to assess the association between cognitive performance and disability in each functional domain (iADL's, bADL's and sADL's), logistic regression models with disability as a dichotomous dependent variable were carried out. The unadjusted model included the cognitive score alone, while the multivariate model additionally included sociodemographic characteristics (age, sex and education), and clinical diagnosis (depression, dementia, other). Independent models were performed for iADL's, bADL's, and sADL's.

When an odds ratio (OR)<1 was observed in a logistic regression model, the probability of ''having disability'' decreases in a $((1-\mathrm{OR})\times 100)\%$ by each unit of increased score in the neuropsychological test. All statistical tests were two-tailed.

Results

Demographic characteristics of the recruited sample ($n=158$) are shown in Table 1. The mean age of the participants was 75.5 years (SD 8), and women predominated (58.9%). There was a high proportion of illiterate or those who did not complete primary studies (42.4%) (Table 1 shows the proportion of subjects who completed primary studies or a higher level of education). Table 1 also shows results of the cognitive assessment and assessment of ADL's variables. The MMSE was administered in the whole sample ($N=158$), the verbal fluency test in 107 subjects and the clock-drawing test in 97 subjects. Mean MMSE score in the full sample was 20.2 (SD 5.9), and mean scores by MMSE items and in the verbal fluency test are also shown. Thirty three individuals (34.4%) failed in the clock-drawing test. Thirty two participants (20.3%) had mild disability (impairment in 1–3 ADL's) and 81(51.3%) had moderate-severe disability (impairment in 4 or more ADL's). Compared to men, women had significantly lower scores) in the attention score, they also had less impairment on the clock-drawing test and more frequently moderate-severe disability for iADL'S (Table 1).

Most individuals in the MC were diagnosed with dementia or dementia with depressive comorbidity ($n=95$, 60.1%), but there was also a considerable proportion of individuals diagnosed of depression or ''cognitive impairment-no

Table 1 Demographic, cognitive and functional characteristics of the sample.

	All ($n = 110$) n (%)	Male ($n = 65$) n (%)	Women ($n = 93$) n (%)
Primary school or higher education	91 (57.6)	40 (62.5)	51 (58.6)
	All ($n = 110$) mean (SD)	Male ($n = 65$) mean (SD)	Women ($n = 93$) mean (SD)
Age	75.5 (8)	74.1 (8.3)	76.4 (7.6)
MMSE	20.2 (5.9)	21.2 (5.3)	19.4 (6.2)
Orientation-MMSE	6.4 (2.8)	6.7 (2.6)	6.1 (2.9)
Registration- MMSE	2.8 (0.5)	2.8 (0.6)	2.9 (0.4)
Attention- MMSE	2.7 (1.9)	**3.1 (1.8)**	**2.3 (1.9)**
Recall- MMSE	1.1 (1.1)	1.1 (1.1)	1.1 (1.1)
Language- MMSE	6.7 (1.9)	6.8 (1.3)	6.5 (2.3)
Verbal fluency	9.4 (4.4)	10.2 (4.5)	8.7 (4.3)
	All ($n = 110$) n (%)	Male ($n = 65$) n (%)	Women ($n = 93$) n (%)
Impaired clock drawing	33 (34.4)	**19 (45.2)**	**14 (25.9)**
Mild disability iADL's	43 (27.2)	19 (29.2)	24 (25.8)
Moderate-severe disability iADL's	67 (42.4)	**21 (32.3)**	**46 (49.5)**
Mild disability bADL's	36 (22.8)	13 (20.0)	23 (24.7)
Moderate-SEVERE disability bADL's	16 (10.1)	6 (9.2)	10 (10.8)
Impairment on sADL's	73 (46.2)	31 (47.7)	42 (45.2)
Mild disability ADL's	32 (20.3)	13 (20.0)	19 (20.9)
Moderate-severe disability ADL's	81 (51.3)	29 (44.6)	52 (56.0)

MMSE, Mini-Mental Status Examination; ADL's, activities daily living; iADL's, instrumental ADL; bADL's, basic ADL. sADL's, social ADL's; SD, standard deviation. On bold: statistically significant differences between sex ($p < 0.05$).

dementia'' (Table 2). In 19 individuals (12.0%) no clinically relevant psychiatric pathology was found (named ''non-cases''). Among the cases of dementia, most ($n = 49$, 51.6%) were classified as Alzheimer's Disease, 8 (8.4%) as Vascular Dementia, 35 (36.8%) as Mixed Dementia, and 3 (3.2%) as other types of dementia.

Frequencies of disability by functional domain and by diagnostic group are also shown in Table 2. Compared with non-cases, disability was more frequent in all diagnostic groups, the differences being statistically significant in all functional domains in cases of dementia, dementia plus depression and other psychiatric diagnosis. Social disability was also significantly more frequent in cases of depression.

The results of multivariate regression models of analysis of the association of cognitive measures with disability in instrumental ADL's are shown in Table 3. When sociodemographic characteristics (age, sex and education) and clinical diagnosis (depression, dementia, other) were controlled, only the attention-MMSE sub-score was marginally associated with mild disability in iADL's (OR = 0.72). However, in the final multivariate model, moderate-severe disability on iADL's was significantly associated with global MMSE score (OR = 0.83), and with sub-scores in both Orientation (OR = 0.73) and Attention (OR = 0.68), (Table 3).

Table 4 shows a different profile for the association between cognitive variables and bADL's. In the multivariate models, after controlling for all the possible confounders, a statistically significant association was observed for both attention-MMSE (OR = 0.75) and language-MMSE (OR = 0.69) sub-scores with mild disability in bADL's. However, no significant association was found for any cognitive variable with moderate-severe disability on bADL's.

Finally, Table 5 shows the ORs for the association between cognitive variables and impairment in sADL's. In the final multivariate model, MMSE total score (OR = 0.87), and both orientation-MMSE (OR = 0.74) and language-MMSE (OR = 0.77) sub-scores were significantly associated with impairment on sADL's.

While measures of both verbal fluency and clock drawing were significantly associated with some measures of instrumental and social ADL's, the significance was lost in the final, multivariate statistical analysis (Tables 3, 4 and 5).

Discussion

While only 60.1% of individuals referred to a MC were diagnosed of dementia, this study shows that the frequency of disability was quite considerable, since almost three quarters (71.6%) of the patients were considered to have some degree of difficulty in ADL's, the disability being of moderate-severe level in more than half (51.3%) of the sample. Moreover, disability for social activities, which is not usually considered in the evaluation of ADL's, was also frequent (46.2%) and particularly frequent in patients with dementia and comorbid depression (80%). While the

Table 2 Disability on ADL's by diagnostic groups and functional domain.

	No cases	Dementia	Dementia+ Depression	Cognitive Impairment	Depression	Other
	n=19	n=85	n=10	n=11	n=23	n=10
Instrumental ADL´s						
Mild	5 (26.3%)	**17 (20%)**	3 (30%)	5 (45.5%)	8 (34.8%)	5 (50%)
		3.9 (0.049)	2 (0.186)	1.6 (0.202)	1 (0.495)	2.7 (0.100)
Moderate-Severe	0	**54 (63.5%)**	**5 (50%)**	1 (9.1%)	4 (17.4%)	**3 (30%)**
		29 (0.001)	13 (0.001)	2.4 (0.300)	2.4 (0.123)	5.9 (0.010)
Basic ADL´s						
Mild	0	**29 (34.1%)**	**3 (30%)**	0	2 (8.7%)	2 (20%)
		9 (0.003)	8 (0.019)	n/a	0.7 (0.554)	2.5 (0.111)
Moderate-Severe	0	**11 (12.9%)**	2 (20%)	0	0	**3 (30%)**
		2.7 (0.030)	5.8 (0.065)	n/a	n/a	4.7 (0.010)
Social ADL´s						
	0	**51 (60%)**	**8 (80%)**	2 (18.2%)	**8 (34.8%)**	**4 (40%)**
		22 (0.001)	21 (0.001)	3.7 (0.126)	8.6 (0.004)	8.9 (0.009)
Any ADL´s						
Mild	5 (26.3%)	10 (11.8%)	0	5 (45.5%)	6 (26.1%)	**6 (60%)**
		1.3 (0.248)	0.7 (0.571)	1.6 (0.202)	0.5 (0.716)	5.2 (0.023)
Moderate-Severe	0	**62 (72.9%)**	**8 (80%)**	1 (9.1%)	**7 (30.4%)**	**3 (30%)**
		34 (0.001)	17 (0.001)	2.4 (0.300)	5.3 (0.022)	7.8 (0.005)

Cases and frequency of disability (%); on bold: Differences statistically significant on disability related to no cases (Chi-square Test); lines put in shading show Chi-square and (*p*) values; n/a: not applicable.

frequency of impairment in sADL's may appear to be relatively low in this study, moderate-severe disability in this functional domain was the most frequent impairment (46.2% vs 42.4% iADL's and 10.1% bADL's). Previous studies have also found a considerable frequency of disability in a MC, but contrary to our study in a mixed clinical population, they were focused in samples of patients with dementia[38] or cognitive impairment.[9]

This study also supports the conjecture that disability is associated with low cognitive performance, even after controlling by confounding factors, including diagnostic categories such as depression and, in particular after controlling by dementia. For example, for each unit of decreased MMSE global score the probability of having moderate-severe disability increased by 17%, the proportions being even higher in cases of decreased attention-MMSE or orientation-MMSE sub-scores (32% and 27% respectively). And, finally, in support of findings previously reported in the literature, the impairment in some specific cognitive domains, namely orientation, attention and language were significantly associated with disability measures.

The association of functional problems and cognitive difficulties has previously been reported,[24] and several studies also used the MMSE, both in different types of patients with dementia[18] and in elderly community-dwelling subjects.[20] However, those studies, contrary to ours, did not control by clinical conditions, namely dementia or depres-

Table 3 Logistic regression models. Association of cognitive measures with iADL's.

	Unadjusted Model			Multivariate Model		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Mild disability (1–3 ADL's)						
MMSE	0.95	0.88–1.02	0.182	0.92	0.82–1.03	0.156
Orientation-MMSE	0.89	0.74–1.07	0.212	0.82	0.62–1.07	0.150
Registration-MMSE	0.62	0.23–1.68	0.348	0.57	0.20–1.63	0.293
Attention-MMSE	0.84	0.67–1.07	0.155	**0.72**	**0.52–1.00**	**0.049**
Recall-MMSE	0.71	0.49–1.05	0.086	0.87	0.53–1.40	0.559
Language-MMSE	1.10	0.87–1.40	0.424	1.08	0.80–1.46	0.608
Verbal fluency	0.93	0.83–1.04	0.210	0.97	0.83–1.12	0.652
Clock drawing	**3.67**	**0.09–0.86**	**0.026**	1.84	0.29–11.88	0.520
Moderate-severe disability (4+ ADL's)						
MMSE	**0.82**	**0.75–0.89**	**<0.001**	**0.83**	**0.72–0.96**	**0.013**
Orientation-MMSE	**0.67**	**0.56–0.79**	**<0.001**	**0.73**	**0.55–0.97**	**0.033**
Registration-MMSE	0.32	0.09–1.16	0.088	0.58	0.11–2.94	0.510
Attention-MMSE	**0.71**	**0.58–0.87**	**0.001**	**0.68**	**0.49–0.95**	**0.022**
Recall-MMSE	**0.52**	**0.36–0.75**	**0.001**	0.86	0.50–1.47	0.576
Language-MMSE	**0.59**	**0.43–0.82**	**0.002**	0.68	0.43–1.09	0.109
Verbal fluency	**0.81**	**0.70–0.93**	**0.003**	0.98	0.78–1.23	0.870
Clock drawing	**6.61**	**2.12–20.62**	**0.001**	1.99	0.28–13.91	0.487

ADL's, activities of daily living; iADL's, instrumental ADL's; On bold, Statistically significant association; CI, confidence interval; Multivariate models include socio-demographical and clinical variables (dementia, depression, other).

Table 4 Logistic regression models. Association of cognitive variables with bADL's.

	Unadjusted model			Multivariate model		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Mild disability (1–3 ADL's)						
MMSE	**0.88**	**0.82–0.95**	**0.001**	0.91	0.83–1.01	0.078
Orientation-MMSE	**0.81**	**0.70–0.94**	**0.006**	0.97	0.79–1.18	0.751
Registation-MMSE	0.88	0.39–2.00	0.761	1.10	0.38–3.18	0.852
Attention-MMSE	**0.76**	**0.62–0.93**	**0.007**	**0.75**	**0.57–0.98**	**0.036**
Recall-MMSE	**0.65**	**0.45–0.96**	**0.028**	1.10	0.68–1.79	0.694
Language-MMSE	**0.67**	**0.52–0.87**	**0.003**	**0.69**	**0.51–0.94**	**0.018**
Verbal fluency	0.9	0.79–1.02	0.091	0.96	0.82–1.12	0.588
Clock drawing	2.81	0.85–9.27	0.089	1.03	0.22–4.79	0.973
Moderate-severe disability (4+ ADL's)						
MMSE	**0.9**	**0.82–0.99**	**0.023**	0.93	0.80–1.09	0.378
Orientation-MMSE	**0.82**	**0.68–0.99**	**0.04**	0.95	0.72–1.26	0.741
Registration-MMSE	**0.47**	**0.23–0.98**	**0.045**	0.38	0.13–1.13	0.081
Attention-MMSE	0.77	0.58–1.02	0.07	0.84	0.57–1.22	0.354
Recall-MMSE	0.87	0.54–1.42	0.585	1.45	0.76–2.76	0.254
Language-MMSE	**0.72**	**0.54–0.98**	**0.034**	0.64	0.40–1.02	0.059
Verbal fluency	0.87	0.73–1.03	0.111	0.83	0.63–1.09	0.18
Clock drawing	0.78	0.19–3.19	0.731	0.28	0.02–3.40	0.317

ADL's, activities of daily living; bADL's, basic ADL's; On bold, statistically significant association; CI, confidence interval; Multivariate models include socio-demographical and clinical variables (dementia, depression, other).

sion. While executive function has been reported to be an important component of everyday functioning,[15–17] previous studies found that functional status correlated better with general cognition in different types of patients.[12,25] We also found a significant association between social ADL's and global cognitive performance assessed with the MMSE, which was not attenuated after controlling by clinical depression and has not been reported previously. This documented association, as well as the high prevalence of impairment in sADL's suggest that social functioning measures might be added to commonly used instruments to assess disability in MC's, since social aspects are

Table 5 Logistic regression models. Association of cognitive variables with sADL's.

	Unadjusted model			Multivariate model		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Impairment on 1–2 ADL's						
MMSE	**0.86**	**0.81–0.92**	**<0.001**	**0.87**	**0.79–0.95**	**0.002**
Orientation-MMSE	**0.73**	**0.64–0.84**	**<0.001**	**0.74**	**0.61–0.89**	**0.002**
Registration-MMSE	**0.25**	**0.08–0.75**	**0.013**	0.39	0.13–1.15	0.087
Attention-MMSE	**0.83**	**0.70–0.98**	**0.027**	0.84	0.68–1.04	0.107
Recall-MMSE	**0.67**	**0.50–0.90**	**0.009**	0.99	0.68–1.45	0.98
Language-MMSE	**0.72**	**0.57–0.91**	**0.006**	**0.77**	**0.60–1.00**	**0.05**
Verbal fluency	**0.88**	**0.80–0.98**	**0.015**	0.96	0.84–1.09	0.491
Clock drawing	**3.27**	**1.34–8.02**	**0.009**	1.18	0.34–4.12	0.798

ADL's, activities of daily living; sADL's, social ADL's; On bold, statistically significant association; CI, confidence interval; Multivariate models include socio-demographical and clinical variables (dementia, depression, other).

considered to be major domains in an individual's level of functioning.[13]

Consistently with the study by Monaci and Morris,[23] we found that the MMSE global score is associated with instrumental ADL's, but not with basic ADL's scores. However, methodological questions may influence the results. Millán-Calenti et al.,[20] reported in a community sample an association between MMSE score and dependence in both basic and instrumental ADL's, but contrary to our study they did not control by mental health conditions. In fact, in the unadjusted statistical analysis, significant associations between bADL's measures and both global MMSE scores and scores in most MMSE items were observed in our study. It is understandable that the statistical significance disappears once the condition of dementia is controlled in the analysis, because as this study shows, the disability for bADL's is fundamentally limited to dementia. (Table 2).

The association of disability with some, but not all cognitive functions is noticeable, since clinical implications might be derived. The associations found between both orientation and attention MMSE sub-scores and disability on instrumental ADL's has been observed in some previous studies.[18,23] In addition, orientation MMSE was also associated with impairment in social ADL's in our study. Both orientation and attention are necessary key functions for cognition,[39] and orientation has been suggested to be one of the best predictors of different functional disabilities.[18,23] The association we have also documented here between social disability and language difficulties in the MMSE may be consistent with the report of Razani et al.,[18] who found a correlation between language MMSE and tasks such as communication and knowledge of transportation signs and rules, both related with the participation in social activities. It is remarkable, for example, that the association coefficients between attention-MMSE sub-score (OR = 0.68), and orientation-MMSE sub-score (OR = 0.73) with iADL's were even stronger than coefficients observed for global MMSE score (OR = 0.83). This suggests that even these specific cognitive domains might be used as a proxy for iADL's. On the contrary, it is also remarkable that, contrary to some authors,[40] we did not find associations between disability and memory items (recall-MMSE in our study) in a MC, although memory impairment is considered to be nuclear in dementia. The breaking down of the MMSE into its individual questions may produce some concern, since this instrument has approximately only one question per cognitive category. Some other instruments might offer a more suitable platform to study in more detail the relationships of cognitive impairment and disability.[41] However, in a clinical study such as this one, we had to analyze the results collected with the instruments applied in our practice in the MC, in this case the MMSE. Moreover, we have previously reported quite reasonable validity coefficients for the MMSE individual items when compared with the clinical diagnosis of dementia,[27] and therefore trust in our main conclusions may be supported.

Finally, in relation to clinical repercussions in this study, the fact that it was possible to find associations between cognition and disability with simple, cost-effective instruments used in routine clinical practice, should be emphasized. The addition of two well-known cognitive tests, such as the clock-drawing or the verbal fluency test did not add to the main results, since performance in either one was not associated with disability on multivariate analysis. Since this is a clinical type of study in a MC, we have used the available clinical data. While instruments such as the MMSE are systematically given to all patients, more specific instruments are given according to clinical criteria, to strengthen the diagnostic power (hypothesis-driven). We have done secondary analysis to test the possibility that the missing values in some cognitive tests might have biased the results in this study. Compared with subjects with complete cognitive assessment, individuals with missing values in the verbal fluency test were younger (73.2 vs 76.6 years; $p = 0.03$) had higher prevalence of depression (31.4% vs 16%; $p = 0.023$) and lower prevalence of impairment on iADL's (52.9% vs 77%; $p = 0.002$). Moreover, individuals with missing values in the clock drawing test had lower prevalence of impairment on iADL's (58.9% vs 77%; $p = 0.009$) No statistically significant differences were found in relation to educational level, MMSE global scores, prevalence of dementia or impairment in either bADL's or sADL's. On the bases of this analysis, while we cannot assure these differences did not influence the final results, we trust the main conclusions are not altered in a significant way.

A cross-sectional study such as this one cannot conclude about the direction of the associations found. Nevertheless, the fact that the assessment only considered disability due to cognitive impairment suggests the importance of focusing the clinical interest on improving cognitive function as a way to improve functionality.

We believe this survey has additional advantages. While studies such as this one cannot be a substitute for more controlled studies, they have a particular interest for clinicians. It has previously been argued that the heterogeneity of patients in real practice makes it easier to ensure the generalizability of findings.[42] Besides, while most of the previous studies used linear regression models, disability was analyzed here as a dichotomous measure, as it is usually done in clinical practice. Royall et al. proposed, as a possible explanation for the generally weak association they found between cognition and disability, that both variables might not be linearly related.[24]

The study also has other limitations. Sample size is rather small, although it is larger than in some previous reports in the field. Moreover, we cannot discard selection bias in the referrals, and cannot claim representativity. We believe the assessment instruments used here are reliable. Yet, the ADL scales used in this study might not be sensitive enough and/or may not detect change in daily routines not assessed, such as making financial-based decisions, driving, etc. This might explain why with the scales that were used we could not document disability in 15.3% of demented subjects, despite the fact that disability is a requirement for the diagnosis of dementia. A recent study[19] has found that MMSE score was also largely associated with complex activities such as economic activities, everyday technology and driving. Finally, in the statistical analysis we did not control for physical conditions, that are proven domains contributing to disability in ADL's.[43] However, some studies have reported that a low cognitive performance is associated with functional disability independently of health conditions.[20,44]

In conclusion, disability is frequent in patients referred to a Psychiatry Memory Clinic,; and might explain the reasons for referring ''non-dementia'' cases and even ''non-cases''. It was possible to document, and quantify the association between low cognitive performance or specific cognitive domains, measured by a simple instrument commonly used in clinical practice and disability in instrumental and social ADL's, even when the diagnosis of dementia or clinically significant depression were included in the analysis. Future, prospective studies in representative community samples could test to what extent the associations found here between disability and low cognitive performance may be generalized.

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