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Can a Direct IADL Measure Detect Deficits in Persons with MCI?

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Abstract

Objective—To determine if a direct measure of instrumental activities of daily living (IADL) scale designed for use with dementia patients can detect differences between persons with mild cognitive impairment (MCI) and normal elderly control subjects (NC).

Methods—This study used cross-sectional and longitudinal IADL scale data from MCI and NC subjects followed at an Alzheimer's Disease Center.

Results—On a 52-point scale, MCI subjects (n = 30) scored significantly lower than NC subjects (n = 30) on the IADL scale (total score 47.17 vs. 48.77 points; t (58) = 2.34, p = .011) and its Memory subscale (5.27 vs. 6.6 points; t (58) = 3.29, p = .002).Examination of annualized IADL scale change scores revealed that 50% of MCI subjects had declined by one point, compared with 29% of NC.

Conclusion—A direct IADL measure for dementia patients is able to detect small differences between MCI and NC and cross-sectionally and longitudinally, but does not distinguish between groups.

Keywords

Mild cognitive impairment; IADL; texas functional living scale

INTRODUCTION

For a number of reasons, considerable effort is being made to detect Alzheimer's disease (AD) before patients meet the full criteria for dementia that are now required for a formal diagnosis. This would not only facilitate research; it would also enable earlier intervention with greater preservation of function. Mild cognitive impairment (MCI) describes a level of cognitive impairment between that of normal aging and dementia. For many persons, it is a transitional period between normal cognition and AD or other dementia-causing conditions. For other persons, MCI appears to be an annoying, but non-disabling product of aging. The original criteria for mild cognitive impairment (MCI) proposed by [1] required (a) memory complaint, (b) normal activities of daily living (ADLs), (c) normal general cognitive function, (d) abnormal memory for age, and (e) absence of dementia. MCI diagnoses now include amnestic, multiple-domain and single non-memory-domain [2,3]. Amnestic MCI (aMCI) involves impaired learning and memory, with other cognitive domains intact or only slightly impaired.

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Multiple-domain MCI (mdMCI), involves mild impairment in memory and at least one other cognitive domain, such as executive functioning or language. Persons with impairment in only one domain (such as executive function) are considered single, non-memory domain MCI (sdMCI). Criterion b) above (normal activities of daily living) is typically based on self report and the report of informants. If a simple test of day-to-day function could help to distinguishing MCI from normal functioning, it could spare exhaustive (and exhausting) batteries of neuropsychological tests and extremely expensive imaging studies requiring the use of radiopharmaceuticals. To date, there has been little comparison of instrumental activities of daily living (IADLs) in MCI and normal control (NC) subjects with a direct performance-based measure. In the only study of which are aware, using the Financial Capacity Instrument [4], [5] found that NC performed significantly better than MCI on tasks requiring the application of financial concepts, understanding and using a bank statement, understanding bills, and preparing bills for mailing.

The current study employed the Texas Functional Living Scale (TFLS) [6]. In earlier studies with this instrument, TFLS scores were significantly lower in AD (31.0 ± 12.4) than NC subjects (45.4 ± 4.6; $p < 0.001$) and correlated highly with Mini-Mental State Examination [7] scores ($r = 0.89$, $p < 0.001$) [6]. Other studies showed that TFLS total score correlated highly in dementia patients with a lengthier, direct functional measure of IADLs ($r = 0.892$) [8] and was sensitive to the effects of cognition-enhancing drugs on IADLs in AD [9]. The TFLS has also been shown to differentiate between individuals in residential care communities living independently, in assisted living, and in dementia special care units [10].

METHODS

This was a retrospective study of data collected from 2003 to 2005 at the University of Texas Southwestern Medical Center Alzheimer's Disease Center. Subjects and/or their legal representatives had signed informed consent for use of their de-identified data on forms approved by the University of Texas Southwestern Medical Center IRB. All subjects were in longitudinal cohorts of AD, MCI, and NC subjects followed yearly with standardized examinations. Subject data were included only if subjects participants were fluent in English, were free of co-morbid conditions that could affect performance on cognitive tasks (e.g., major depression, alcoholism, delirium, systemic cancer, severe heart/ pulmonary disease, stroke). NC were free of cognitive impairment as judged by clinical assessment, neuropsychological testing, and Clinical Dementia Rating [11] = 0. MCI subjects were diagnosed using Petersen et al. criteria [2,3]. The 30 MCI subjects included 14 aMCI, 13 mdMCI, and 3 sdMCI. Normal controls were selected to be as similar as possible in age (± 7 years), gender, and level of education (± 5 years) (see Table 1 for demographics).

Test-retest data were available for a subset of 32 individuals (17 NC, 15 MCI) from the total sample. Individuals for whom Time 1 and Time 2 ($n = 3$) were less than 9 months apart were excluded to reduce practice effects, leaving 29 (17 NC, 12 MCI) subjects in whom to ascertain change over time. Annualized change over time was calculated by the formula (Score 2 − Score 1) / [(Time 2 − Time 1)/365.25) (see Table 2 for sub-sample demographics).

MEASURE

The Texas Functional Living Scale (TFLS) is a 21-item performance-based IADL measure originally designed for use with dementia patients [6]. It takes 15–20 minutes to administer and includes five functional domains: Dressing, Time, Money-related skills, Communication, and Memory. The maximum possible score is 52 points; higher scores indicate better function. Activities include using a calendar, telling time on a traditional clock, making change, paying

a bill, using a phone and phonebook, managing medications, and giving directions for making a snack.

PROCEDURES

Each subject had been evaluated by a neurologist or geriatric psychiatrist and a neuropsychologist; diagnoses were made by consensus. Evaluations included a clinical interview, history and physical examination, routine labs, neuro-imaging, and neuropsychological evaluation. The TFLS was administered and scored by trained psychometrists; TFLS data were not used in making a diagnosis.

STATISTICAL METHODS

For normally distributed, continuous data, means and standard deviations were used to describe subjects' demographic characteristics. Groups were compared using an independent t-test. For categorical or dichotomous variables, percentages were reported and Chi Square or Fisher's Exact Tests were performed for group comparisons. When Chi Square was used, continuity correction was performed. Data were analyzed with SPSS for Windows, Version 14.0. The probability for significance was set at $p < .05$.

RESULTS

Demographic information for the 60 total participants is presented in Table 1. Mean age at initial assessment was 73 years (range = 49–87; SD = 7.34); the sample was composed of equal numbers of men and women. The mean years of education for the sample as a whole was 15.07 (range = 8–20; SD = 2.40). There was no significant difference between the groups in age [t (58) = .43, p = .670], education [t (58) = .64, p = .520] or gender (NC M/F = 14/16; MCI M/F = 16/14; χ^2 (1, N = 60) = .07, p = .796). An independent-samples t-test revealed a small (1.6 points) but significant difference between mean (± SD) TFLS total scores for the NC group (48.77 ± 2.22) and the MCI group (47.17 ± 3.01; t [58] = 2.34, p = .012). When TFLS subtest scores were compared between groups, the only significant difference was on the Memory subscale (NC = 6.60 ± 1.40; MCI = 5.27 ± 1.72; t [58] = 3.29, p = .002). See Table 3 for independent-samples t-test results.

Mean annualized TFLS change scores for MCI and NC groups were compared using independent-samples t-tests. Total score increased in the NC subjects (0.98 ± 2.60), while MCI subjects showed a mild decline (− 0.42 ± 2.36), although this difference did not reach significance (t [27] = 1.48, p = .075). While only 29% of the NC group declined over time by at least one point (41% improved and 29% remained stable), 50% of the MCI group dropped at least one point at their second testing (33% improved; 17% remained stable).

There was no significant relationship between TFLS total score and MMSE total score in the MCI group (r = .26, n = 21, p = .253) or the NC group (r = .25, n = 28, p = .198), likely due to the narrow range of scores (See Table 3). However, there was a moderate correlation between the TFLS and MMSE when the two subject groups were combined (r = .34, n = 49, p = .019).

Additional analyses determined the sensitivity and specificity of the TFLS total score in predicting diagnosis. The sensitivity and specificity for the observed range of TFLS total scores (40 – 52) distinguishing MCI from NC subjects resulted in the area under the curve of 0.66 (p = .031, 95% CI: 0.52 – 0.80). A cut-off score of 48 was determined to represent the highest combination of sensitivity, specificity, and percent correct. This score yielded a sensitivity of 56.7% and a specificity of 63.3%, and percent accurate group classification of 60%.

DISCUSSION

Most existing measures to evaluate ADL/IADL performance are based on self- or informant reports, which may be less accurate than performance-based measures. Using a direct IADL measure, we found lower total scores in the MCI group than the NC group. However, the difference in total scores (1.6 points out of 52 possible points) was small. Examination of subscale scores revealed that this difference was solely due to the Memory subscale. Of note, the mean TFLS score for MCI subjects (47.17 points) was much higher than those seen in patients with mild AD (31 points) as reported previously by [6].

The difference in change in annualized TFLS scores may be due to an actual decline in IADL performance over time in MCI subjects, but could also reflect a stronger practice effect in NC than in MCI. Regardless, these findings suggest that serial evaluations with the TFLS may aid in the detection of MCI, as NC subjects do not tend to show declines on the simple tasks included in the measure.

Various cut-off scores were examined for sensitivity and specificity. The best yield was a cut-off score of 48, which accurately identified 56.7% of those with MCI and resulted in a specificity of 63.3%. [6] found that a TFLS total cut-off score of 45 yielded a sensitivity of 96% and a specificity of 71% in differentiating NC from AD, but the cognitive differences between the NC and AD subjects in the previous study were much greater than between the NC and MCI subjects in the present investigation.

The small sample sizes may have limited the strength of the primary findings, but the small absolute differences in baseline TFLS scores suggest that tests of relatively simple IADL functioning are not useful for differentiating MCI from NC subjects. Rather, test-retest evaluations over time may be needed in order to distinguish these groups, in the absence of other neuropsychological measures. Another potential limiting factor of this study may be the selection of the MCI population. Our MCI cases included a variety of subtypes, which may complicate results, as one recent study showed that individuals with aMCI may exhibit greater functional deficits than MCI subjects without primary memory impairment [12]. Thus, an even greater difference between MCI and NC might have been detected if our sample had been limited to aMCI.

CONCLUSIONS

Despite small differences in the expected direction, a brief direct IADL scale designed to quantify IADL skills in patients with dementia did not adequately distinguish between MCI and NC. Not unexpectedly, items comprising the memory subscale showed the only significant difference between groups, although this difference was small in an absolute sense. Tasks that have shown particular sensitivity in differentiating MCI from NC (by self-and informant report) include management of public transportation, food preparation, and management of finances and medications [13–17]. While the TFLS includes some such tasks, they are probably too simple for MCI subjects. Serial testing with brief performance-based IADL measures may be useful in tracking the development of significant cognitive decline and patterns of IADL performance may aid in characterizing subgroups of individuals with specific deficits, but they appear to lack the sensitivity needed to detect mild impairment when administered at only one point in time.

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Table 1

Demographic Results for MCI, NC, and Total Sample

	MCI n = 30	**NC n = 30**	**Total Sample n = 60**
Age M (SD)	72.84 (7.88)	73.65 (6.87)	73.24 (7.34)
Education M (SD)	14.87 (2.76)	15.27 (2.00)	15.07 (2.40)
Gender M/F (%Male)	16/14 (53)	14/16 (47)	15/15 (50)

Table 2

Demographic Results from Test-Retest Data for MCI, NC, and Total Subsample

	MCI n = 12	**NC n = 17**	**Total Sample n = 29**
Age M (SD)	71.13 (6.73)	72.92 (10.96)	72.18 (9.34)
Education M (SD)	13.67 (3.06)	15.00 (1.94)	14.45 (2.50)
Gender M/F (% male)	6/6 (50)	5/12 (29)	11/18 (38)

Table 3

Means, Standard Deviations, and Ranges for TFLS Total Score, TFLS Subscale Scores, and MMSE in MCI and NC

	Mean	MCI SD	Range	Mean	SD	Range	t	p-value (1-tailed)
TFLS Total Score	47.17	3.01	40–52	48.77	2.22	42–52	2.34	.023
Dressing	4.97	0.18	4–5	5.00	0.00	n/a	N/A	N/A
Time/Orientation	14.73	0.74	12–15	14.63	1.00	11–15	−.44	.661
Money	11.10	0.89	9–12	11.17	0.95	8–12	.28	.779
Communication	11.10	1.00	9–12	11.37	0.85	9–12	1.12	.269
Memory	5.27	1.72	1–8	6.60	1.40	3–8	3.29	.002
MMSE	27.30	2.15	21–30	29.21	0.96	27–30	3.54	.002