Original Research Article

Qualitative Assessment of Instrumental Activities of Daily Living in Older Persons with Very Mild Dementia: The Kurihara Project

Yoshitaka Ouchi Mari Kasai Kei Nakamura Masahiro Nakatsuka
Kenichi Meguro

Division of Geriatric Behavioral Neurology, Tohoku University CYRIC, and Department of Geriatric Behavioral Neurology, Tohoku University Graduate School of Medicine, Sendai, Japan

Key Words

Instrumental activities of daily living · Clinical dementia rating · Very mild dementia · Qualitative assessment · Community-dwelling elderly

Abstract

Background/Aims: We investigated quantitative/qualitative changes of instrumental activities of daily living (IADL) in people with a Clinical Dementia Rating (CDR) of 0.5. **Methods:** IADLs were evaluated in older residents: CDR of 0 (healthy) and CDR 0.5 (questionable/very mild dementia). The subjects with CDR 0.5 were divided into 2 types: the very mild Alzheimer's disease (vmAD) type and the other type including very mild subcortical vascular dementia. IADLs were evaluated quantitatively using the Lawton and the original qualitative IADL scales. **Results:** CDR 0.5/vmAD type subjects had impairment of only one Lawton item (Shopping) compared to CDR 0 subjects. However, the CDR 0.5/vmAD type group and the CDR 0.5/other type group showed impairment of 3 items in the qualitative assessment (Shopping, Food preparation, and Mode of transportation). **Conclusion:** We suggest using both quantitative/qualitative IADL scales for assessing older adults with very mild dementia.

© 2016 The Author(s)
Published by S. Karger AG, Basel

Introduction

Impairment of Instrumental Activities of Daily Living (IADL) has been shown in several recent studies of functional restriction in people with a Clinical Dementia Rating (CDR) of 0.5 (questionable/very mild dementia) [1, 2] or mild cognitive impairment (MCI) [3]. The rate of progression of MCI to dementia has been found to be 10–15% annually in a longitudinal

Kenichi Meguro, MD, PhD
Division of Geriatric Behavioral Neurology, CYRIC, Tohoku University
4-1, Seiryō-machi, Aoba-ku, IDAC
Sendai 980-8575 (Japan)
E-Mail k-meg@umin.ac.jp

survey [4], and IADL impairment is a predictive factor for dementia, in addition to an advanced age and a low score on the Mini-Mental State Examination (MMSE) [5–8]. Mariani et al. [9] used the Lawton IADL scale [10] to show impaired abilities to go shopping and to manage medication and money in 132 patients with amnesic MCI, compared to 249 healthy elderly subjects without cognitive disorder. Kim et al. [11] found no significant difference in the Amnesic MCI-Single domain between 311 healthy elderly subjects without cognitive disorder and 255 patients with MCI subtypes using 15 items of the Seoul IADL, but impaired use of the telephone, home appliances, and transport and financial management were found in the patients.

In a retrospective analysis of subjects in our previous study [12, 13], the Tajiri project, we analyzed the influence of IADL impairment on the progression of MCI to dementia using the Social Activities scale [14], with initial exclusion of subjects who answered ‘I do not do this’ for a given IADL item to eliminate the influence of lifestyle. The results showed that the risk of dementia was significantly higher in all MCI patients with IADL impairment for ‘making the bed’ and ‘use of transport’ and in female patients with IADL impairment for ‘making the bed’ and ‘cleaning’, compared to MCI patients without impairment. We also found that these IADL impairments, excluding ‘use of transport’, may serve as predictive factors independent of the MMSE score and age. We used the Lawton IADL assessment [10] to assess the ‘quantitative’ abilities based on the degree of independence or help [14] as an informant-rated scale. The Social Activities scale used in the Tajiri project [14] and the Lawton IADL scale [10] mainly evaluate IADL quantitatively based on the scope of activities. Therefore, both the qualitative and quantitative aspects of IADL require evaluation.

In this study, the meaning of ‘the qualitative’ changes include ‘functions in usual activities but with some failures’. For example, the qualitative mistake in cooking is as follows: ‘Grandma, I feel that today’s seasoning of this soup is different from usual, too salty.’ The qualitative changes may also be important, as exemplified by a case reported in a community survey, in which a public health nurse noticed a change in the taste of cooked food while visiting a community-dwelling elderly woman who was independent with regard to cooking at home; this subsequently led to the diagnosis of early Alzheimer’s disease (AD) at a visit to a physician [15]. However, there has been no report using the ‘qualitative’ IADL assessment for very mild dementia.

The purpose of this study was to survey quantitative and qualitative aspects of IADL in community-dwelling elderly subjects with a CDR of 0.5 for which the neurological backgrounds are well established. Quantitative (scope) and qualitative (performance) assessments of IADL in very mild dementia were investigated in patients with these conditions.

Methods

Subjects (Summary of the Kurihara Project and Subjects in This Study)

A project on stroke, dementia, and bed confinement prevention was performed for 3 years from 2008 in Kurihara City, in the population aged ≥ 75 years old living in 10 districts, which were defined as model districts by the city before the start of the project [16]. The project was explained to the subjects in each community, and written consent was obtained. Living conditions were surveyed by public health nurses in home visits, and the CDR [1, 2], magnetic resonance imaging (MRI), blood tests, urinalysis, psychological tests, and physician consultations were performed. All subjects underwent MRI, excluding 14 subjects due to physical reasons. We used the MMSE as a global intelligence scale (score range, 0–30) [7].

The project was explained to 1,254 elderly residents, and 590 agreed to participate (consent rate: 47.0%). These residents included 221 subjects with a CDR of 0 (healthy), 295

Table 1. Demographic data

	CDR 0	CDR 0.5	
		vmAD type	other type
n	221	91	204
Gender (M/F)	91/130	24/67 ^a	84/120 ^b
Age, years	79.0 (3.6)	80.0 (4.1)	80.5 (4.4) ^c
Education, years	9.3 (2.0)	8.6 (1.8) ^c	8.5 (1.7) ^c
MMSE score	25.4 (2.6)	23.1 (3.3) ^c	22.7 (3.4) ^c

Shown are the mean (SD). ^a Significantly lower rate of male than the CDR 0 group ($p < 0.05$). ^b Significantly lower rate of male than the CDR 0.5/other type group ($p < 0.05$). ^c Significantly lower (age; higher) than the CDR 0 group ($p < 0.05$).

with a CDR of 0.5 (questionable/very mild dementia), and 74 with CDR ≥ 1 (dementia). For the current study, those with CDR 0 and CDR 0.5 were selected, and a transverse survey was performed. We excluded CDR ≥ 1 patients in this study. Of the CDR 0.5 subjects, 91 had CDR 0.5/very mild AD (vmAD) type, and 204 had CDR 0.5/other type including 55 subjects with very mild subcortical vascular dementia (SVD).

The diagnostic criteria for CDR 0.5/vmAD were based on the NINCDS-ADRDA [17] clinical criteria for possible AD as CDR 0.5, CDR memory score ≥ 0.5 , absence of neurological signs (excluding bilateral diabetic sensory neuropathy) on examination by a physician, absence of features of cerebral infarction on MRI, and absence of any other abnormality on MRI (such as hydrocephalus or a tumor) [18]. The CDR 0.5/other type group consisted of subjects excluded from vmAD, but included very mild SVD. The criteria for very mild SVD were based on those established by Erkinjuntti [19] as CDR 0.5, CDR memory score ≥ 0.5 , presence of executive dysfunction (we used mean performance time +1 SD of Trail Making Test A or B [20, 21] by age and educational levels), ≥ 5 lacunar infarctions along with white matter lesions, presence of neurological signs, and absence of cortical infarction (≥ 8 mm) on MRI [18].

The demographic data of this study are shown in table 1. There was a significant difference between the 3 groups in gender [χ^2 (2) = 6.9, $p = 0.031$]. In the post hoc tests, the CDR 0.5/vmAD type group showed a significantly lower rate of males compared with the CDR 0 group [χ^2 (2) = 6.1, $p = 0.014$] and the CDR 0.5/other type group [χ^2 (2) = 5.9, $p = 0.015$]. There was a significant difference between the 3 groups in age [ANOVA, F (2, 513) = 7.6, $p < 0.001$], educational levels [ANOVA, F (2, 513) = 12.5, $p < 0.001$], and MMSE scores [ANOVA, F (2, 513) = 46.7, $p < 0.001$]. In the post hoc tests, the CDR 0.5/vmAD type group showed significantly lower education levels and MMSE scores compared with the CDR 0 group (ANOVA with Bonferroni test as a post hoc test; $p < 0.01$). In the post hoc tests, the CDR 0.5/other type group showed significantly higher age and lower education levels and MMSE scores compared with the CDR 0 group (ANOVA with Bonferroni test as a post hoc test, $p < 0.001$).

Evaluation

Clinical Dementia Rating

A team comprising of doctors (board-certified neurologists and a psychiatrist) and public health nurses determined the CDR [1, 2] in the following manner, and independently of neuropsychological assessment. (1) Before participants were interviewed by the doctors, public health nurses visited their homes to evaluate their daily activities. (2) Family members observed the participants' daily activities, and a public health nurse visited the participants frequently to evaluate their daily lives. (3) The participants were interviewed by doctors to

assess episodic memory, orientation, and judgment. (4) Finally, with reference to the information provided by the family members, the CDR was determined at a meeting of the doctors and public health nurses. A reliable Japanese version of the CDR scale has been established. Dementia (CDR 1) was diagnosed according to the DSM-IV criteria [22].

IADL Assessment

The Lawton IADL Assessment. This scale was comprised of 8 evaluation items of IADL: (A) Use of telephone, (B) Shopping, (C) Food preparation, (D) Housekeeping, (E) Laundry, (F) Mode of transportation, (G) Medication, and (H) Finances [10]. Each IADL item was assessed based on information provided by family members living with the subject and by the public health nurse using a questionnaire. According to the original scoring of the Lawton IADL, scoring range is 0–8 in women (all items), and 0–5 in men (except for items C, D and E) [3]. We analyzed both the original scoring method (scoring range 0–5) and the 8 items method (scoring range 0–8) in men. In IADL, activities such as preparation and planning are not necessarily performed. This is in contrast to ADL, which include a series of physical motions that are commonly repeated every day by all persons. In IADL, part of or all of some activities may be left to family members: for example, in Cooking, (1) the subject cooks, including planning of a menu and preparation of ingredients, (2) the subject cooks, but family members plan the menu and prepare ingredients, or (3) the subject leaves all cooking to others. We evaluated the extent to which the subjects performed activities necessary for each IADL item and defined this as the quantitative assessment.

The Qualitative IADL Assessment. Elderly with a CDR of 0.5 may also show changes in the quality of IADL within the activity range, such as loss of taste in cooking. These may range from a condition requiring no assistance by others (e.g., taste was lost but the dish is edible) to that requiring assistance, such as redoing. We evaluated the change of IADL within the activity range and the need for assistance. This was defined as the qualitative assessment. To perform this evaluation, we prepared a qualitative IADL scale for community-dwelling elderly persons, based on the Social Activities scale [14]. This scale evaluates the qualitative aspect of IADL corresponding to the living conditions of each person, and ‘performance’ and ‘independence’ are assessed within the range of activity actually performed by the person.

Assessment of ‘performance’ was evaluated as (1) No problem, (2) Performed in some way, but fails sometimes, and (3) Redoing is necessary. Assessment of ‘independence’ was evaluated as (1) Independent, (2) Calling for help, (3) Needing some assistance, (4) Unable to perform alone, and (5) Activity not originally performed. The scale was comprised of 3 evaluation items: (1) Shopping, (2) Food preparation, (3) Mode of transportation. Each IADL item was assessed based on information provided by family members living with the subject and by the public health nurse, using a questionnaire.

Analysis

Comparisons of CDR 0 Subjects with Subjects with CDR 0.5/vmAD Type and CDR 0.5/Other Type

In this study, we used two IADL scales: the Lawton IADL assessment as a quantitative evaluation, and the qualitative IADL assessment as a qualitative evaluation for all subjects. Subjects who answered ‘I do not do this’ were excluded from the analysis of that item in the qualitative IADL assessment to decrease the influence of division of roles in the family and lifestyle. In the Lawton IADL assessment, based on the original scoring method [10], 0 and 1 points indicate with and without IADL impairment, respectively, for each item. In the qualitative IADL assessment, classifications of ‘no problem’ and ‘independent’ in the Performance and Independence assessment, respectively, were regarded to indicate ‘without IADL impairment’, and other classifications were regarded as ‘with IADL impairment’. IADL

impairment in patients with CDR 0.5/vmAD type or CDR 0.5/other type was compared with that in the CDR 0 (healthy) group by one-way ANOVA (total scores of the Lawton IADL assessment) and χ^2 test (each item of the Lawton assessment and the qualitative assessment).

Ethics

Written informed consent was obtained from each of the participants with CDR 0 and 0.5 and from the family of those with CDR 0.5. The study was approved by the ethical committees of the Kurihara city government and Tohoku University Graduate School of Medicine.

Results

Comparisons of CDR 0 Subjects with Subjects with CDR 0.5/vmAD Type and CDR 0.5/Other Type

The Lawton IADL Assessment

Total Scores. In total scores of the Lawton IADL assessment, there was a significant difference between the 3 CDR groups [one-way ANOVA, F (d.f. = 2, 505) = 19.2, $p < 0.001$]. In the Bonferroni test as a post hoc test, the CDR 0.5/other type group had a significantly lower score than the CDR 0 ($p < 0.001$) and CDR 0.5/vmAD type ($p = 0.013$) groups for both genders. In males, there was a significant difference between the 3 CDR groups [one-way ANOVA, F (d.f. = 2, 196) = 1.8, $p = 0.005$]. In the Bonferroni test as a post hoc test, the males of the CDR 0.5/other type group had a significantly lower score than the males in the CDR 0 ($p = 0.005$) group. We found that the original scoring method (range 0–5) gave a statistically identical result as the 8 items scoring method (range 0–8) in males on the total scores of the Lawton assessment. In females, there was a significant difference between the 3 CDR groups [one-way ANOVA, F (d.f. = 2, 314) = 13.6, $p < 0.001$]. In the Bonferroni test as a post hoc test, the females of the CDR 0.5/other type group had a significantly lower score than the females of the CDR 0 ($p < 0.001$) and CDR 0.5/vmAD type ($p = 0.025$) groups.

Individual Items. In the Lawton IADL assessment, there were significant differences in 3 items (Shopping, Food preparation, Mode of transportation) between three groups: the CDR 0 group, the CDR 0.5/vmAD type group, and the CDR 0.5/other type group (χ^2 test, $p < 0.05$). In the post hoc tests, for the item Shopping on the Lawton IADL assessment, impairment was significantly greater in subjects with CDR 0.5/vmAD type and CDR 0.5/other type than in the CDR 0 group (χ^2 test, $p < 0.05$). In both Food preparation and Mode of transportation on the Lawton IADL assessment, impairment was significantly greater in subjects with CDR 0.5/other type, but not with CDR 0.5/vmAD type, than in the CDR 0 group (χ^2 test, $p < 0.05$). However, there was no significant difference between the CDR 0.5/vmAD type group and the CDR 0.5/other type group in all items on the Lawton IADL assessment (χ^2 test, $p < 0.05$). These differences were found in 3 items of the Lawton IADL assessment, and not in all items (table 2).

The Qualitative IADL Assessment

In the qualitative IADL assessment, there were significant differences in all items (Shopping, Food preparation, and Mode of transportation) between the three groups: the CDR 0 group, the CDR 0.5/vmAD type group, and the CDR 0.5/other type group (χ^2 test, $p < 0.05$). In the post hoc tests, for all items on the qualitative IADL assessment, impairment was significantly greater in subjects with CDR 0.5/vmAD type and CDR 0.5/other type than in the CDR 0 group (χ^2 test, $p < 0.05$). However, there was no significant difference between the CDR 0.5/vmAD type group and the CDR 0.5/other type group in all items on the qualitative IADL assessment (χ^2 test, $p < 0.05$) (table 3). We separated the subjects with very mild SVD from

Table 2. Rate (%) of participants with IADL impairment in the Lawton IADL assessment

Items of the Lawton IADL assessment	CDR 0 n = 221	CDR 0.5		χ^2 value (d.f.)			
		vmAD n = 91	other n = 204	main effect (group)	CDR 0 vs. CDR 0.5/vmAD	CDR 0 vs. CDR 0.5/other	CDR 0.5/vmAD vs. CDR 0.5/other
A Telephone	0.0	1.1	1.5	n.s.			
B Shopping	7.2	17.6*	27.6*	30.9 (2) p < 0.001	7.5(1) p = 0.006	31.1 (1) p < 0.001	n.s.
C Food preparation	24.3	34.1	43.3*	17.1 (2) p < 0.001	n.s.	17.1 (1) p < 0.001	n.s.
D Housekeeping	7.7	4.4	8.3	n.s.			
E Laundry	8.3	8.8	13.7	n.s.			
F Mode of transportation	11.3	17.8	26.5*	16.2 (2) p < 0.001	n.s.	16.1 (1) p < 0.001	n.s.
G Medication	0.9	2.2	4.4	n.s.			
H Finances	0.0	0.0	0.0	n.s.			

* p < 0.05 (χ^2 test, compared to CDR 0). n.s. = Not significant (p > 0.05).

Table 3. Rate (%) of participants with IADL impairment in the qualitative IADL assessment

Items of the qualitative IADL assessment	CDR 0 n = 221	CDR 0.5		χ^2 value (d.f.)			
		vmAD n = 91	other n = 204	main effect (group)	CDR 0 vs. CDR 0.5/vmAD	CDR 0 vs. CDR 0.5/other	CDR/vmAD vs. CDR 0.5/other
1 Shopping	6.0	19.8*	16.4*	15.2 (2) p < 0.001	13.1 (1) p < 0.001	11.2 (1) p < 0.001	n.s.
2 Food preparation	8.7	20.3*	19.4*	7.4 (2) p = 0.025	5.2 (1) p = 0.022	6.0 (1) p = 0.014	n.s.
3 Mode of transportation	18.2	31.5*	34.4*	13.3 (2) p = 0.001	5.6 (1) p = 0.018	12.4 (1) p < 0.001	n.s.

* p < 0.05 (χ^2 test, compared to CDR 0). n.s. = Not significant (p > 0.05).

the subjects with CDR 0.5/other type, and the results of subjects with very mild SVD were the same as the results of subjects with CDR 0.5/other type in both the Lawton IADL assessment and the qualitative IADL assessment (data not shown).

Discussion

Subjects with CDR 0.5/vmAD type had impairment of only one item (Shopping) on the Lawton IADL assessment compared to CDR 0 (healthy) subjects. The subjects with CDR 0.5/other type had impairment of three items (Shopping, Food preparation, and Mode of transportation) on the Lawton IADL assessment compared to CDR 0 subjects. On the other hand, in the qualitative IADL assessment, subjects with both CDR 0.5/vmAD type and CDR 0.5/other type showed impairment of 3 items (Shopping, Food preparation, and Mode of transportation). Therefore, quantitative (scope of activities) impairment was not marked in CDR 0.5/vmAD type, but impairment of qualitative IADL in terms of performance and indepen-

dence was observed in community-dwelling elderly persons with both CDR 0.5/vmAD type and CDR 0.5/other type including very mild SVD.

The qualitative IADL scales were impaired in both CDR 0.5/vmAD type and CDR 0.5/other type rather than CDR 0 subjects. In Shopping and Food preparation, the main reasons of disabilities were related to memory, based on answers such as ‘Old food remains in the refrigerator because he/she forgot the food is there’, and ‘Because he/she forgot that she bought something, he/she bought the same thing many times’. In Mode of transportation, the main reasons for disabilities were related to executive function and judgment based on answers such as ‘He/she cannot choose the appropriate transportation such as a taxi, bus, and train’. Therefore, certain IADL items with qualitative impairment differed between subjects with CDR 0.5/vmAD type and CDR 0.5/other type including very mild SVD, suggesting an association with differences in the main impaired cognitive functions.

There are several limitations to this study. The first limitation concerns the Lawton IADL scale. We defined the extent to which a subject performed activities for each IADL as a quantitative measurement and used the Lawton IADL scale for assessment. As a result, quantitative impairment of certain items was not observed in patients with CDR 0.5/vmAD type, but was noted in those with CDR 0.5/other type including very mild SVD. However, in the sub-items of the Lawton IADL scale, planning (preparation) and level of motion are included in Food preparation, whereas only the level of motion is used for the other sub-items, including Shopping, and planning (preparation) assumed to involve execution function is not clearly stated. Thus, the content differs from that of the qualitative IADL scale for community-dwelling elderly persons, and it is possible that the sub-items of the Lawton IADL scale do not necessarily evaluate the same aspects of IADL.

Second, the IADL assessment items include many activities of domestic work that is divided between family members, and substitution by others is possible, unlike basic ADL such as food ingestion and excretion. Thus, IADL is readily influenced by lifestyle and gender differences and varies between individuals. To exclude these influences as far as possible, subjects who answered ‘I do not do this’ were excluded from the evaluation of a particular item. This suggests that the range of daily living activities may be narrowed due to a transfer of roles in elderly persons aged ≥ 75 years old, and further investigation of the evaluation items may be necessary.

Based on our results, we propose an additional assessment of ‘quantitative’ IADLs for examining CDR 0.5 subjects in the community: ‘Is he/she able to perform household tasks at the level of functions in usual activities but with some failures?’ An additional assessment of the item Shopping would be: ‘He/she makes some mistakes, but can do shopping.’ An additional assessment of the item Food preparation would be: ‘The seasoning is different from usual.’ An additional assessment of the item Mode of transportation would be: ‘He/she gets on the wrong train, but reaches his/her destination’.

In conclusion, we investigated quantitative and qualitative changes of IADL in subjects with CDR 0.5. Quantitative impairment was not marked in CDR 0.5/vmAD type, but impairment of qualitative IADL in terms of performance and independence was observed in community-dwelling elderly persons with both CDR 0.5/vmAD type and CDR 0.5/other type including very mild SVD. We suggest using both quantitative and qualitative scales of IADL for assessing older adults with very mild dementia in a community.

Disclosure Statement

The authors declare that they have no conflicts of interest.

References

- 1 Hughes CP, Berg L, Danziger WL, Coben LA, Martin RL: A new clinical scale for the staging of dementia. *Br J Psychiatry* 1986;140:566–572.
- 2 Morris JC: The Clinical Dementia Rating (CDR): current version and scoring rules. *Neurology* 1993;43:2412–2414.
- 3 Jekel K, Damian M, Wattmo C, Hausner L, et al: Mild cognitive impairment and deficits in instrumental activities of daily living: a systematic review. *Alzheimers Res Ther* 2015;7:17–37.
- 4 Petersen RC, Doody R, Kurz A, Mohs RC, Morris JC, Rabins PV, Ritchie K, Rossor M, Thal L, Winblad B: Current concepts in mild cognitive impairment. *Arch Neurol* 2001;58:1985–1992.
- 5 Pérès K, Chrysostome V, Fabrigoule C, Orgogozo JM, Dartigues JF, Barberger-Gateau P: Restriction in complex activities of daily living in MCI: impact on outcome. *Neurology* 2006;67:461–466.
- 6 Purser JL, Fillenbaum GG, Pieper CF, Wallace RB: Mild cognitive impairment and 10-year trajectories of disability in the Iowa established populations for epidemiologic studies of the elderly cohort. *J Am Geriatr Soc* 2005;53:1966–1972.
- 7 Folstein MF, Folstein SE, McHugh PR: ‘Mini-mental state’: a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975;12:189–198.
- 8 Maioli F, Coveri M, Pagni P, Chiandetti C, Marchetti C, Ciarrocchi R, Ruggero C, Nativio V, Onesti A, D’Anastasio C, Pedone V: Conversion of mild cognitive impairment to dementia in elderly subjects: a preliminary study in a memory and cognitive disorder unit. *Arch Gerontol Geriatr* 2007;44:233–241.
- 9 Mariani E, Monastero R, Ercolani S, Rinaldi P, Manqialasche F, Costanzi E, Vitale DF, Senin U, Mecocci P, ReGAI Study Group: Influence of comorbidity and cognitive status on instrumental activities of daily living in amnesic mild cognitive impairment: results from the ReGAI project. *Int J Geriatr Psychiatr* 2008;23:523–530.
- 10 Lawton MP, Brody EM: Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist* 1969;9:179–186.
- 11 Kim KR, Lee KS, Cheong HK, Eom JS, Oh BH, Hong CH: Characteristic profiles of instrumental activities of daily living in different subtypes of mild cognitive impairment. *Dement Geriatr Cogn Disord* 2009;27:278–285.
- 12 Meguro K, Ishii H, Kasuya M, Akanuma K, Meguro M, Kasai M, Lee E, Hashimoto R, Yamaguchi S, Asada T: Incidence of dementia and associated risk factors in Japan: The Osaki-Tajiri Project. *J Neurol Sci* 2007;260:175–182.
- 13 Ouchi Y, Akanuma K, Meguro M, Kasai M, Ishii H, Meguro K: Impaired instrumental activities of daily living affect conversion from mild cognitive impairment to dementia: the Osaki-Tajiri Project. *Psychogeriatrics* 2012;12:34–42.
- 14 Meguro K, Shimada M, Yamaguchi S, Sano I, Inagaki H, Matsushita M, Sekita Y: Neuropsychosocial features of very mild Alzheimer’s disease (CDR 0.5) and progression to dementia in a community: The Tajiri Project. *J Geriatr Psychiatr Neurol* 2004;17:183–189.
- 15 Meguro M, Meguro K: Activated thalamic glucose metabolism after combined donepezil and psychosocial intervention. *Br J Neurosci Nurs* 2010;6:176–180.
- 16 Meguro K, Tanaka N, Kasai M, Nakamura K, Ishikawa H, Nakatsuka M, Satoh M, Ouchi Y: Prevalence of dementia and dementing diseases in the old-old population in Japan: the Kurihara Project. Implications for Long-Term Care Insurance data. *Psychogeriatrics* 2012;12:226–234.
- 17 McKhann G, Drachman D, Folstein M, Katzman R, Price D, Stadlan EM: Clinical diagnosis of Alzheimer’s disease: report of the NINCDS-ADRDA Work Group under the auspices of Department of Health and Human Services Task Force on Alzheimer’s Disease. *Neurology* 1984;34:939–944.
- 18 Nakamura K, Kasai M, Ouchi Y, Nakatsuka M, Tanaka N, Kato Y, Nakai M, Meguro K: Apathy is more severe in vascular than amnesic mild cognitive impairment in a community: the Kurihara Project. *Psychiatry Clin Neurosci* 2013;67:517–525.
- 19 Erkinjuntti T, Inzitari D, Pantoni L, Wallin A, Scheltens P, Rockwood K, Roman GC, Chui H, Desmond DW: Research criteria for subcortical vascular dementia in clinical trials. *J Neural Transm* 2000;59:23–30.
- 20 Lezak MD, Howieson DB, Loring DW: *Neuropsychological Assessment*, ed 4. New York, Oxford University Press, 2004, p 21.
- 21 Hashimoto R, Meguro K, Lee E, Kasai M, Ishii H, Yamaguchi S: Effect of age and education on the Trail Making Test and determination of normative data for Japanese elderly people: the Tajiri Project. *Psychiatr Clin Neurosci* 2006;60:422–428.
- 22 American Psychiatric Association: *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)*, ed 4. Washington, American Psychiatric Association, 1994.