Table 2 Each content score for the entire sample ($n = 20$)

Contents	First administration				Second administration		
	Scale range	Mean	SD	Observed range	Mean	SD	Observed range
Memory							
Story memory-I (immediately) score	0–10	7.50	1.47	5–10	7.95	1.36	5–10
Story memory-II (delay) score	0–10	7.35	1.63	4–10	7.85	1.50	4–10
Word recognition (immediately) score	0–10	7.72	1.01	5.7–9.0	8.22	0.97	6.3–9.7
Word recall (delay) score	0–10	3.85	1.60	1–6	4.70	1.81	1–7
Attention/Executive function							
Tablet version of TMT-A (s)	0–90	19.80	5.48	13–32	19.25	3.96	12–27
Tablet version of TMT-B (s)	0–90	40.40	16.30	19–81	37.50	15.08	17–80
Processing speed							
Tablet version of SDST score	0–90	40.60	9.23	23–55	43.45	8.11	27–57
Visuospatial function							
Figure selection score	0–9	6.35	1.35	4–9	5.90	1.21	4–9

SDST, Symbol Digit Substitution Task; TMT, Trail Making Test.

Table 3 Pearson's correlation coefficients between each component and assessment instruments for validity and intraclass correlation coefficients of each measurement

Contents	Validity		Test-retest reliability		
	r	*P* value	ICC	95%IC	*P* value
Memory					
Story memory-I (immediately)	0.583	0.007	0.764	0.415, 0.906	0.001
Story memory-II (delay)	0.496	0.026	0.809	0.526, 0.924	<0.001
Word recognition (immediately)	0.550	0.012	0.793	0.486, 0.917	<0.001
Word recall (delay)	0.565	0.009	0.788	0.475, 0.916	0.001
Attention/executive function					
Tablet version of TMT-A	0.611	0.004	0.837	0.596, 0.935	<0.001
Tablet version of TMT-B	0.550	0.012	0.850	0.628, 0.940	<0.001
Processing speed					
Tablet version of SDST	0.842	<0.001	0.942	0.857, 0.977	<0.001
Visuospatial function					
Figure selection	0.723	<0.001	0.815	0.540, 0.926	<0.001

The following assessment instruments were used to test validity: the Wechsler Memory Scale-Revised (WMS-R) Logical Memory-I for the tablet version of story memory-I (immediately), the WMS–R Logical Memory-II for the tablet version of story memory-II (delay), the subtest of ADAS-cog (immediately recognition) for the tablet version of word recognition (immediately), the subtest of Alzheimer's Disease Assessment Scale-cognitive (ADAS-cog; delay recall, modified) for the tablet version of Word recall (delay), the written Trail Making Test-part A (TMT-A) for the tablet version of TMT-A, the written Trail Making Test-part B (TMT-B) for the tablet version of TMT-B, the Digit Symbol-Coding subtest of the Wechsler Adult Intelligence (WAIS)-III for the tablet version of SDST, and the Block Design subtest of the WAIS-III for the tablet version of Figure selection.

shows the test–retest reliability and validity of each component of the NCGG-FAT. For the test–retest reliability, all of the ICC for each task component were higher than 0.750, and those of eight task components (story memory-I, story memory-II, word recognition, word recall, tablet version of TMT-A, TMT-B, SDST, and figure selection) were 0.764, 0.809, 0.793, 0.788, 0.837, 0.850, 0.942 and 0.815, respectively. Thus, the test–retest reliability of each component of the developed multidimensional neurocognitive task battery were in an acceptable range.[18] Pearson's correlation coefficients were calculated to examine the validity of each component of the NCGG-FAT. In the validity assessment, we examined the WMS-R Logical Memory-I and -II, the Word Recognition subtest of the ADAS-cog, the TMT-A and -B, and the Digit Symbol-Coding subtest and the Block Design sub-test of the WAIS-III, which are used widely in clinical settings internationally.

Pearson's correlation coefficients between those widely used clinical neurocognitive tests and each task component of the NCGG-FAT ranged from 0.496 to 0.842, and the following relationships were statistically significant: story memory-I and the WMS-R Logical Memory-I ($r = 0.583$, $P = 0.007$), story memory-II and the WMS-R Logical Memory-II ($r = 0.496$, $P = 0.026$), word recognition and the Word Recognition subtest of the ADAS-cog ($r = 0.550$, $P = 0.012$), and word recall and the recall version of the Word Recognition subtest of the ADAS-cog ($r = 0.565$, $P = 0.009$), the tablet version of TMT-A and the original version of TMT-A ($r = 0.611$, $P = 0.004$), the tablet version of TMT-B and the original version of TMT-B ($r = 0.550$, $P = 0.012$), the tablet version of SDST and the Digit Symbol-Coding subtest ($r = 0.842$, $P < 0.001$), and figure selection and the Block Design subtest ($r = 0.723$, $P < 0.001$).

Discussion

The current study investigated the test–retest reliability and validity of our newly multidimensional neurocognitive task battery using a tablet PC. High test–retest reliability was found for each task component of the NCGG-FAT (the ICC ranged from 0.764 to 0.942). The results showed moderate and high validity values for all task components of the NCGG-FAT.

Older adults with memory impairment are at an increased risk for progression to dementia. Previous community-based longitudinal studies have shown that amnestic MCI is likely to convert to AD.[19,20] In contrast, non-amnestic MCI patients without memory impairment but with cognitive decline in other domains are expected to represent the early stages of non-AD dementia.[21] Therefore, measures for multidimensional neurocognitive function were required to examine the risk of developing dementia earlier among older populations. The NCGG-FAT consists of multiple tasks including memory, attention, executive function, processing speed and visuospatial function. We evaluated the validity of each task component using measurements that are commonly used in clinical settings. In the results of the present study, moderate to high correlations were shown between the NCGG-FAT items and conventional neurocognitive measures ($r = 0.496$ to 0.842), and the results support the external validity of the NCGG-FAT.

The Japanese public long-term care insurance system was launched in April 2000 in response to the growing elderly population.[22] The rapid aging of the population has also increased the demand for formal long-term care services in Japan, and it is important to prevent conditions related to age-related physical and cognitive decline, such as frailty and MCI. The current results confirmed that the NCGG-FAT, which includes multidimensional cognitive domains, showed good test–retest reliability (ICC = 0.764 to 0.942), and moderate to high external validity ($r = 0.496$ to 0.842). The NCGG-FAT has several advantages over conventional neurocognitive assessments. First, the NCGG-FAT is easily administered using a tablet PC with instructions shown on the display. Therefore, it is not necessary for assessors to have a thorough knowledge of neurocognitive measures, and the particular assessor des not strongly affect the results. The simplicity and portability of the application permits assessment in the community and non-clinical settings by non-specialized persons. Participants were able to complete the NCGG-FAT battery in approximately 20–30 min. Administering an equivalent range of traditional psychiatric tests, including measures of memory, attention and executive function, processing speed, and visuospatial function using the original version would require twice this amount of time. The NCGG-FAT might be useful for cognitive screening in a population-based sample to assess the risk of cognitive decline on multidimensional functions. In addition, data collected from a large population using tablet PCs can be aggregated quickly, as the data is digital rather than paper-based.

A number of limitations were identified in the present study. Although the tablet version of the neurocognitive task battery was found to show good test–retest reliability and validity, it was not found to show predictive validity. This suggests that an operator might be required to support older participants in using a tablet PC, especially those showing cognitive decline. Importantly, our sample included community-dwelling older adults without cognitive impairment and did not include participants meeting the criteria for dementia and MCI. In addition, although story memory scores in the NCGG-FAT were significantly correlated with WMS-R Logical Memory scores, these two tasks differ in the terms of retrieval. The story memory scale in the NCGG-FAT is a recognition task, whereas WMS-R Logical Memory is a recall task. Therefore, studies using the NCGG-FAT require experimental design and cautious interpreting of results. Despite these limitations and the need for further research, our tool for assessing multidimensional neurocognitive function using a tablet PC appears to be helpful in evaluating cognitive decline among older adults in clinical settings.

In conclusion, the current results showed that the NCGG-FAT assessment for multidimensional neurocognitive function using a tablet PC was reliable and valid for a sample of community-dwelling older adults. The NCGG-FAT might be useful for cognitive screening in population-based samples and outcomes to assess intervention effects on multidimensional cognitive function among older adults.

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Disclosure statement

There are no financial and personal relationships with other people or organizations that may lead to a conflict of interest.

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Original Research Article

Cognitive Activities and Instrumental Activity of Daily Living in Older Adults with Mild Cognitive Impairment

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Key Words
Cognitive impairment · Dementia · Alzheimer's disease · Cognitive reserve

Abstract
Aims: This study aimed to identify differences in the implementation of cognitive activities and instrumental activities of daily living (IADLs) between healthy individuals and subjects with mild cognitive impairment (MCI). ***Methods:*** The study included 2,498 cognitively healthy subjects (mean age, 71.2 ± 5.1 years) and 809 MCI subjects (mean age, 71.8 ± 5.4 years). The subjects were interviewed regarding their participation in cognitive activities and the implementation of IADLs. ***Results:*** We found a significant association between participation in any cognitive activities ($p < 0.001$), using a bus or a train ($p < 0.001$), and MCI. After adjusting for covariates, cognitive activity of any type remained significantly associated with MCI ($p < 0.005$) but not with the implementation of IADLs. ***Conclusions:*** Our study revealed that greater participation in cognitive activity was associated with lower odds of MCI. Participation in cognitive activities may reflect differences between healthy and MCI subjects. To clarify the causal relationship between cognitive activities and MCI, further studies are required.

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Introduction

Alzheimer's disease (AD) is the most common cause of dementia. An estimated 33.9 million individuals worldwide have AD, and the prevalence is predicted to triple over the next 40 years [1, 2]. There is a lack of available treatments; therefore, research has focused on establishing strategies to prevent AD [1]. Mild cognitive impairment (MCI) is an early indication of cognitive disease and a crucial target for the prevention of AD [3, 4]. Focused modifiable risk factors for dementia and an active lifestyle, e.g., greater participation in a leisure activity involving physical and cognitive activity, play a potentially protective role against the progression from MCI to AD [1, 5].

A growing body of evidence suggests that participation in cognitive activities leads to a slower cognitive decline [6, 7] and reduces the risk of incident AD [6, 8] and dementia [9]. Engagement in cognitive activity, even in mid-life adults, is associated with a reduced risk of AD [10, 11]. Cognitive activity is generally regarded as a leisure activity [9] and contributes to an enhanced cognitive reserve, restricting cognitive decline and progression to dementia [12]. The cognitive reserve is thought to withstand the burden of the neuropathologic condition of AD and to maintain cognitive function [12]. In fact, a low degree of participation in cognitive activities is associated with the risk of amnestic MCI [13], while more frequent participation in leisure activities, especially intellectual ones, accelerates cognitive decline in patients with AD [14]. The role of these activities against the progression of AD may be varied and dependent on the disease course. Although cognitive activities have the potential to be related to MCI, few population-based studies with small samples have investigated the association between cognitive activities and MCI [13, 15]. As a result, our current understanding of the association between cognitive activity and MCI is insufficient.

Elderly activities range from activity in daily living (ADL) in order to live independently to complex activity such as instrumental activity of daily living (IADL). IADL is associated with the development of dementia [16, 17] as well as cognitive inactivity. Furthermore, deficits in IADL are characteristic of older adults with MCI [18–21]. However, the results are dependent on the measurement of IADL and therefore vary between different studies. Based on the Lawton and Brody IADL scales [22], MCI subjects were similar to subjects without MCI in the implementation of conventional IADL [18, 23]. However, the deficits in the other IADLs were more likely in subjects with MCI [19–21]. There is insufficient evidence regarding the specific activities associated with MCI.

The purpose of this study was to examine whether the implementation of cognitive activity and/or IADL was different between healthy and MCI subjects. We hypothesized that participation in cognitive activities and IADLs is lower in MCI subjects as compared to healthy older adults. To confirm this hypothesis, we conducted a cross-sectional study to examine differential associations of MCI with specific cognitive activities and IADL tasks.

Methods

Participants

Subjects eligible for this study were participants of a population-based cohort study (Obu Study of Health Promotion for the Elderly; OSHPE) that was conducted from August 2011 to February 2012. Participants aged ≥65 years at the time of examination and who lived in Obu were eligible for the OSHPE (n = 15,974). Prior to recruitment, 1,661 subjects were excluded because (a) they had participated in another study; (b) they were hospitalized or in residential care, or (c) they were certified as grade 3–5 cases and required support or care by the Japanese public long-term care insurance system. Recruitment was conducted via a mail sent

to 14,313 individuals, and 5,104 of these individuals underwent a health check. In addition, to be included in our study, participants had to be independent with basic ADL, could not be certified as any grade needing support or care by the Japanese public long-term care insurance system and had to be cognitively healthy (i.e., without subjective and objective cognitive impairment) or have MCI. In total, 3,307 participants (cognitively healthy: n = 2,498, MCI: n = 809) were eligible for inclusion and participated in all assessments.

MCI was classified according to Petersen's criteria [3]. The criteria involve the following: (a) subjective memory complaint; (b) objective cognitive decline; (c) general cognitive health (Mini-Mental State Examination score >23 [24]); (d) independence in ADL, and (e) absence of clinical criteria for dementia. Objective cognitive decline was defined as a cognitive function 1.5 standard deviations below the reference threshold of any of the tests. Cognitive function was comprehensively assessed using the National Center for Geriatrics and Gerontology functional assessment tool (NCGG-FAT). NCGG-FAT contains cognitive tests, and measurement has been described in detail in a previous study [25]. The test consists of tasks to assess memory (story memory, word recognition, and word recall), attention, processing speed (symbol digit substitution task), and visuospatial cognition (figure selection). Cognitively healthy participants were defined as not having both subjective memory complaints and objective cognitive impairment. Informed consent was obtained from all participants before their inclusion in the study. The Ethics Committee of the NCGG approved the study protocol.

Cognitive Activities and IADL

Subjects were interviewed regarding participation in cognitive activities such as reading books or newspapers, using a personal computer, going to an unknown location with a map, and operating a video or DVD player. IADL was assessed using the following items: using a bus or a train, grocery shopping, management of finances, housekeeping, and telephone use. The items of cognitive activities were selected according to previous studies [6, 9, 26], and the domains of IADL were based on the Lawton and Brody IADL scales [22]. Subjects were asked whether they had performed each activity during the past month; responses were 'yes (did)' or 'no (did not)'. In addition, we totaled the number of activities for which each participant answered 'yes' for both cognitive activities and IADL.

Other Measures

Participants completed a questionnaire on medical conditions, current medications, and lifestyle habits. The medical questionnaire captured information on various diseases (hypertension, stroke, heart disease, diabetes mellitus, respiratory disease, and others) and medication use. Weight and height were measured, and BMI was calculated. The questionnaire also inquired about age, gender, educational history, smoking status, and alcohol consumption, and the Geriatric Depression Scale (GDS) score was measured [27]. Walking speed was measured as an indicator of physical performance. Participants were asked to walk on a straight, flat walkway 6.6 m in length 5 times faster than their usual walking speed. Walking time was measured over a 2.4-meter distance between marks at 2.1 and 4.5 m from the start of the walkway, and the mean walking speed (m/s) was calculated. The total amount of time spent walking in a day was assessed using a subscale of the International Physical Activity Questionnaire [28, 29].

Statistical Analysis

Medical history, lifestyle habits, and cognitive function measures were compared between healthy controls and MCI subjects using t tests and χ^2 tests where appropriate. Multiple logistic regression analysis was performed to explore independent associations between participation in cognitive activity or IADL ability and MCI, while controlling for potential

Table 1. Characteristics of subjects by cognition group

Variables	Cognitively healthy (n = 2,498)	MCI (n = 809)	p
Age, years	71.2±5.1	71.8±5.4	0.008
Women, %	52.6	52.8	0.935
Educational level, years	11.9±2.5	10.8±2.4	<0.001
BMI	23.3±3.1	23.4±3.1	0.670
Medical illness, %			
Hypertension	43.8	48.6	0.018
Heart disease	15.3	19.3	0.008
Diabetes mellitus	13.3	14.7	0.289
Respiratory disease	11.2	10.5	0.651
Medications, n	1.8±1.9	2.2±2.1	<0.001
Walking speed, m/s	1.31±0.20	1.26±0.22	<0.001
GDS, score	2.5±2.4	3.3±2.6	<0.001
Cognitive functions			
MMSE, score	27.4±1.8	26.6±1.8	<0.001
TMT-A[1], s	19.0±4.1	23.6±7.8	<0.001
TMT-B[1], s	35.8±10.6	51.5±19.8	<0.001
SDST[1], score	41.3±7.0	35.2±7.8	<0.001
Figure selection[1], score	11.6±1.7	11.2±1.7	<0.001
Story memory[1], score	7.6±1.5	6.4±1.8	<0.001
Word recognition[1], score	7.7±1.2	7.0±1.3	<0.001
Word recall[1], score	4.4±1.7	3.1±2.0	<0.001
Smoking, %	9.0	9.8	0.530
Alcohol consumption, %	46.8	46.4	0.839
Physical activity, min/day	289.5±162.0	274.7±154.7	0.022

Values are means ± SD or percentage. p values for scales and tests were calculated by the t test or χ^2 test. MMSE = Mini-Mental State Examination; TMT = trail making test; SDST = symbol digit substitution task. [1] The assessment was conducted using the tablet version of the NCGG-FAT.

confounding factors. We calculated the odds ratio (OR) and 95% confidence intervals (95% CIs). Covariates were added sequentially to the logistic model (model 2) if they were significantly associated with MCI. In addition, a multiple logistic regression analysis was performed to compare subjects who did not participate in any cognitive activity to those who did participate in cognitive activities, adjusting for confounding factors. This logistic regression analysis regarding the number of activities was also conducted for the implementation of IADL. All analyses were performed using commercially available software (IBM SPSS statistics software, version 20; IBM Corp., Chicago, Ill., USA). Statistical significance was set a priori at $p < 0.05$.

Results

Comparisons between characteristics of cognitively healthy subjects and MCI subjects are summarized in table 1. Gender, smoking status, and alcohol consumption were not significantly different between cognitively healthy and MCI subjects. Significant differences were found for age ($p = 0.008$), education ($p < 0.001$), medications ($p < 0.001$), walking speed ($p < 0.001$), GDS score ($p < 0.001$), and physical activity ($p = 0.022$). In addition, MCI subjects had a lower performance on tests for cognitive function ($p < 0.001$).

Prevalence of participation in cognitive activities varied (table 2). Reading was the most frequent cognitive activity that participants engaged in (cognitively healthy, 97.4%; MCI,

Table 2. Logistic analysis of MCI according to participation in individual cognitive activities

Cognitive activities	Cognitively healthy, n (%)	MCI, n (%)	Model 1 (crude)			Model 2 (adjusted)		
			OR	95% CI	p	OR	95% CI	p
Reading	2,434 (97.4)	759 (93.8)	0.41	0.28–0.59	<0.001	0.53	0.35–0.78	0.002
Computer	1,044 (41.8)	213 (26.3)	0.50	0.42–0.59	<0.001	0.65	0.53–0.80	<0.001
Map	1,696 (67.9)	450 (55.6)	0.59	0.51–0.70	<0.001	0.74	0.62–0.89	0.002
Video or DVD	1,462 (58.5)	379 (46.9)	0.63	0.53–0.73	<0.001	0.72	0.61–0.86	<0.001

Participation in cognitive activities was dummy coded, with no participation as the reference category. Model 2 was adjusted for age, sex, BMI, education, medications, alcohol, smoking, walking speed, physical activity, and GDS.

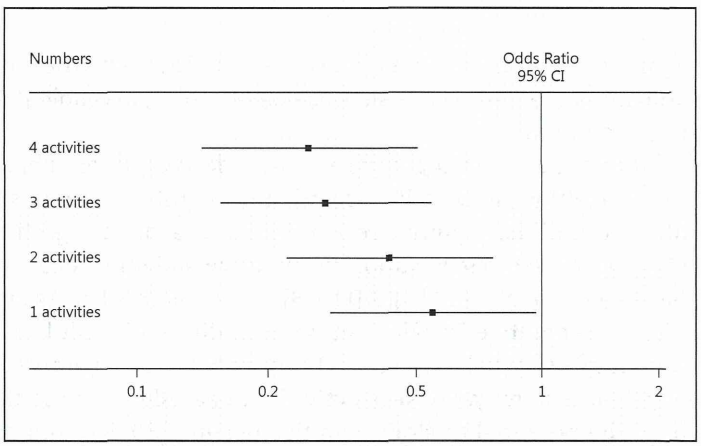

Fig. 1. OR of the number of cognitive activities and MCI. No participation was the reference category for any cognitive activity.

93.8%). Use of a personal computer was the cognitive activity that was engaged in the least (cognitively healthy, 41.6%; MCI, 26.3%). Every cognitive activity was significantly associated with MCI, even after adjusting for covariates ($p < 0.01$; table 2). Figure 1 shows that increased participation in cognitive activities was also associated with MCI [OR (95% CI): 1 activity: 0.54 (0.30–0.97), $p = 0.039$; 2 activities: 0.42 (0.23–0.76), $p = 0.004$; 3 activities: 0.29 (0.16–0.53), $p < 0.001$, and 4 activities: 0.27 (0.14–0.49), $p < 0.001$]. Among both cognitively healthy individuals and MCI subjects, more than 85% had all IADL items (table 3). Using a bus or a train was more common in cognitively healthy subjects than in MCI patients, but it was only significantly associated with MCI in univariate analysis ($p = 0.002$). Other activities in IADL were not significantly related to MCI. The number of implemented IADLs were not associated with MCI either.

Discussion

This study revealed that greater participation in cognitive activities was associated with lower odds of MCI. Among MCI subjects, participation in cognitive activities ranged from 26 to 94%, and fewer MCI subjects participated in these activities than healthy subjects did. IADL participation was ≥87% in each activity for both healthy controls and MCI subjects. Signif-

Table 3. Logistic analysis of MCI according to the implementation of individual IADLs

IADLs	Cognitively healthy, n (%)	MCI, n (%)	Model 1 (crude)			Model 2		
			OR	95% CI	p	OR	95% CI	p
Bus or train	2,314 (92.6)	721 (89.1)	0.65	0.50–0.85	0.002	0.90	0.67–1.19	0.448
Grocery shopping	2,426 (97.1)	783 (90.4)	0.89	0.57–1.41	0.629	1.07	0.66–1.75	0.775
Finance	2,288 (91.6)	731 (90.4)	0.86	0.66–1.13	0.279	1.04	0.77–1.40	0.796
Housekeeping	2,185 (87.5)	707 (87.4)	0.99	0.78–1.26	0.993	1.08	0.82–1.41	0.586
Telephone	2,362 (94.6)	760 (93.9)	0.89	0.64–1.25	0.510	1.06	0.74–1.52	0.737

The implementation of IADL was dummy coded, with no participation as the reference category. Model 2 was adjusted for age, sex, BMI, education, medications, alcohol, smoking, walking speed, physical activity, and GDS.

icant associations remained between cognitive activities and MCI but not IADL, even after adjustment for covariates such as demographic, psychological, and physical factors including physical activity.

Participation in cognitive activities decreased for subjects with MCI compared to cognitively healthy subjects. Participation in cognitive activities is believed to support an active lifestyle, and the cognitive reserve protects against cognitive decline and progression to AD [12]. Decreased participation in cognitive activities leads to cognitive decline [6, 7] and an increased risk of MCI [13], AD [6, 8], and dementia [9]. Associations between cognitive activities and cognitive impairment were confirmed for MCI subjects in our large study sample. Our results showed that the relationship between cognitive activities and MCI is independent of physical activity. Physical activities in parallel with cognitive activities were confirmed to have the potential to slow cognitive decline [30, 31] and reduce the risk of progression to dementia [5, 9]. In addition, each cognitive activity was significantly associated with MCI and the number of cognitive activities. Our results suggest that participation in cognitive activities in daily life decreases along with cognitive impairment and even MCI.

Our results were similar to those of other studies, although the types of cognitive activities were slightly different. Geda et al. [15] suggested that engagement in specific activities such as reading books, computer activities, craft activities, and playing games were associated with decreased odds of having MCI. We also found that reading and computer activities were associated with being cognitively healthy. Reading is generally regarded as a cognitive activity [6, 8, 9] and is significantly related to the incident risk of dementia even as a single item [9]. Operation of a home appliance such as a computer, DVD, or video equipment requires adequate understanding of the appliance (e.g., selecting a button). For older adults, operating home appliances in daily life is difficult and requires adequate cognitive function [32].

In our study, cognitive activities other than reading showed a lower participation of both healthy controls and MCI subjects. Using a map to reach a location requires planning ability as well as formulation and execution components [33]. A study testing the map usage of elderly participants suggests that some have problems in spontaneously developing logical strategies, whereas they are able to execute complex predetermined plans [34]. Using a map may be even more difficult for older adults with cognitive impairment. Participation in cognitive activities requires a certain level of cognitive functioning and decreases with the increase in cognitive impairment.

Participation in IADL was higher than participation in cognitive activities, with more than 87% of the subjects participating in IADLs. Univariate analysis showed an association between

the use of a bus or a train and MCI. However, multivariate analysis revealed that no activity was significantly related to MCI. The functional deficits of IADL were predictors of the development of dementia [16, 17] and were frequent among older adults with MCI [18–23, 35]. One of the commonly used measurements for assessing IADL was developed by Lawton and Brody [22] in 1969. A few previous studies on subjects with MCI used IADL domains similar to those used by Lawton and Brody [18, 23, 35]. Our results showing a high prevalence of the implementation of IADLs among MCI subjects were consistent with the results of other studies [18, 23]. MCI was defined as a very early stage of functional decline between normal aging and AD [3]. Thus, the assessment of functional abilities itself, but not implementation, in IADL by items related to the Lawton and Brody IADL scales [22] can be used in order to detect functional decline in subjects with MCI earlier [23, 35]. Future studies using measurements evaluating the degree of deficits in IADL are required to clarify the association between IADL and MCI. More complex activities of IADL than the Lawton and Brody IADL scales [22] have also been used in studies of MCI [19–21]. Reppermund et al. [19] suggest that difficulties in IADL, especially those with a higher demand on cognitive capacities, are associated with MCI and cognitive function. Although IADL is defined as a more complex activity than ADL [22], it is unclear which activities for the assessment of MCI subjects are the most appropriate ones. To clarify the heterogeneity of the activities in IADL, each activity should be investigated independently and the classification of activities should also be investigated.

Our study had several limitations. First, it was cross-sectional. For a detailed examination of the relationship between participation in cognitive activities and MCI, a prospective or longitudinal study is needed. In addition, there is the potential of residual confounding for factors that we did not collect. Future studies should include these potential confounders, e.g., the burden of amyloid in the brain, structural changes in the brain, or APOEε4 as a genetic factor. Thus, additional studies on activities and cognitive impairment are required.

In conclusion, our study revealed that reduced cognitive activities are independently associated with MCI in older adults. Lower participation in cognitive activities may be characteristic of MCI subjects. Although our study has several limitations, it provides additional evidence that participation in cognitive activities may be useful for the detection of cognitive decline. The causal relationship between specific activities and cognitive impairment should be further investigated.

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Disclosure Statement

None declared.