

## Factors associated with decline in activities of daily living in home-based medical care

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### ABSTRACT

We sought to explore factors associated with changes in activities of daily living (ADL) in home-based medical care (HBMC). We used data from the Observational Study of Nagoya Elderly with Home Medical Care 2, in which HBMC was provided for physical and/or mental disability. ADL were assessed using the Barthel Index and its mobility and self-care categories. Of 40 eligible participants, half were classified into an ADL decline group. The percentage with a decreased Mini-Nutritional Assessment-Short Form (MNA-SF) score was significantly higher in the ADL decline group. Worsening of MNA-SF was significantly associated with a decline in the mobility category but not in the self-care category. ADL decline was frequently observed and was associated with worsening of nutritional status in HBMC.

Keywords: home-based medical care, activities of daily living, nutritional status, mobility, self-care

#### Abbreviations:

ADL: activities of daily living

BI: Barthel Index

HBMC: home-based medical care

MNA-SF: Mini-Nutritional Assessment-Short Form

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### INTRODUCTION

Home-based medical care (HBMC) systems have been expanding in aging societies worldwide. These systems have been shown to improve patient satisfaction, care burden, and costs.<sup>1</sup> In Japan, more than 60% of the population wishes to receive terminal care at home, and the government has promoted HBMC. However, older adults receiving HBMC often have declining cognitive and physical function and multimorbidity, and they tend to have poor prognostic outcomes such as hospitalization or death. The main goal of HBMC is often “to live in a familiar place until

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the end of life” rather than to improve prognosis. For this reason, maintaining activities of daily living (ADL) is considered one of the most important aspects in achieving this aforementioned goal of HBMC. Although ADL have been linked to changes in quality of life scores in the home-care setting,<sup>2</sup> few studies have evaluated ADL assessment longitudinally. The components of basic ADL have mainly been classified into mobility and self-care.<sup>3</sup> Longitudinal evaluation of these ADL categories may also be useful for improving the quality of HBMC. Therefore, in this study we sought to explore factors associated with changes in ADL in HBMC.

## METHODS

### *Participants*

We used data from the Observational Study of Nagoya Elderly with Home Medical Care 2 (ONEHOME2), which followed the ONEHOME study.<sup>4</sup> ONEHOME was an observational cohort study with participants who received HBMC for physical and/or mental illnesses. All participants received medical care from physicians affiliated with cooperating institutions and were eligible for long-term care insurance in Japan. The study protocol of ONEHOME2 was approved by the Ethics Committee of the Nagoya University Graduate School of Medicine (approval No. 2019-0175) and was carried out in accordance with the Declaration of Helsinki and its amendments. Written informed consent was obtained from all participants or their family members if the participants themselves were unable to provide consent.

### *Data collection*

Registration in ONEHOME2 started in February 2020 and follow-up has been performed every 6 months. The current study included participants enrolled through August 2023 from whom basic ADL were evaluated both at baseline and the 6-month follow-up. Comprehensive geriatric assessments were performed by the patient’s physician, and these data were collected by trained nurses. Data were collected using a structured questionnaire administered to patients and their family/caregiver and from medical records. The structured questionnaire covered patients’ demographic characteristics, including age, sex, height, weight, living environment, insurance premium levels, nursing care service usage, meals, swallowing function, muscle strength, oral and sensory conditions, cognitive status, psychological status, nutritional status, ADL, frailty, comorbid conditions, history of hospitalization, falls and bone fractures, excretory function, prescribed medications, advance care planning, and blood test data. The questionnaire also covered demographic characteristics of family members and/or caregivers, including the burden of nursing care, quality of life, health competence, depressive status, and their social network.

The Charlson Comorbidity Index<sup>5</sup> was calculated based on comorbid conditions collected at baseline, and cognitive status, psychological status, nutritional status, and body mass index (BMI) were evaluated both at baseline and the 6-month follow-up. Cognitive status, psychological status, and nutritional status were evaluated using a dementia-independent scale,<sup>6</sup> the Geriatric Depression Scale-5,<sup>7</sup> and the Mini-Nutritional Assessment-Short Form (MNA-SF),<sup>8</sup> respectively. ADL were assessed using Barthel Index (BI),<sup>9</sup> which ranges from 0 to 100 with higher scores indicating greater independence. BI can also be divided into a mobility category (moving, walking, and stairs) and a self-care category (eating, grooming, toileting, bathing, dressing, defecating, and bladder).<sup>10</sup> In the present study, ADL decline was defined as a lower BI score at the 6-month follow-up compared with baseline, and worsening of MNA-SF was defined as a lower MNA-SF score at the 6-month follow-up compared with baseline.

*Statistical analysis*

Background characteristics were compared between an ADL decline group and an ADL maintenance group, using t-tests and Mann-Whitney U tests for continuous variables and  $\chi^2$  tests for categorical variables. Multivariate logistic regression analysis was performed to examine the association between ADL decline and exposures that were significant in univariate analysis. All statistical analyses were carried out using SPSS version 29 (IBM Corp, Armonk, NY), and a p-value of <0.05 was considered statistically significant.

**RESULTS**

Background characteristics are shown in Table 1. Of 40 participants, half were classified into the ADL decline group, and there were no significant differences in age, sex, baseline BI score, or MNA-SF score between the two groups. However, lower MNA-SF scores at 6 months and higher percentage with worsening of MNA-SF were found in the ADL decline group. Multivariate logistic regression analysis (Table 2) showed that worsening of MNA-SF was significantly associated with ADL decline (odds ratio [OR], 6.32; 95% confidence interval [95% CI], 1.14–35.06;  $p = 0.035$ ). When BI was categorized into mobility and self-care, worsening of MNA-SF was associated with a decline in the mobility category (OR, 6.85; 95%CI, 1.33–35.44;  $p = 0.022$ ) but not in the self-care category (OR, 4.95; 95%CI, 0.80–30.61;  $p = 0.085$ ).

**Table 1** Comparison of patient characteristics between the ADL maintenance group and ADL decline group

	Total (n=40)	ADL maintenance (n=20)	ADL decline (n=20)	p-value
Age (years)	88.1 $\pm$ 6.3	86.8 $\pm$ 7.0	89.5 $\pm$ 5.4	0.19
Male (%)	14 (35.0%)	5 (25.0%)	9 (45.0%)	0.19
Charlson Comorbidity Index	2 (1–3)	2 (1–4)	2 (1–3)	0.64
Barthel Index				
Baseline	85 (53–94)	85 (35–94)	80 (60–94)	0.74
6 months	70 (34–89)	85 (35–95)	55 (30–70)	0.017
Body mass index				
Baseline (n=36)	20.9 $\pm$ 4.2	21.9 $\pm$ 4.9	19.7 $\pm$ 2.8	0.11
6 months (n=35)	20.5 $\pm$ 3.0	20.9 $\pm$ 3.3	20.0 $\pm$ 2.8	0.40
Dementia independent scale				
Baseline	2 (1–3)	2 (0–3)	2 (1–3)	0.80
6 months	2 (1–3)	2 (0–3)	2 (1–3)	0.60
Geriatric Depression Scale-5				
Baseline (n=37)	1 (0–3)	1 (0–3)	1 (0–2)	>0.99
6 months (n=36)	2 (0–3)	1 (0–4)	2 (0–3)	0.57
MNA-SF				
Baseline (n=39)	9.2 $\pm$ 2.7	9.6 $\pm$ 2.7	8.9 $\pm$ 2.6	0.45
6 months (n=39)	9.1 $\pm$ 2.8	10.2 $\pm$ 2.7	8.1 $\pm$ 2.4	0.012
Worsening of MNA-SF (%) (n=38)	15 (39.5%)	4 (21.1%)	11 (57.9%)	0.045

Data are presented as the mean  $\pm$  standard deviation, median (interquartile range), or number (percentage).

ADL: activities of daily living

MNA-SF: Mini-Nutritional Assessment-Short Form

**Table 2** Multiple logistic regression analysis of ADL decline according MNA-SF score and worsening of MNA-SF at the 6-month follow-up

	Crude		Model 1		Model 2	
	Odds ratio	p-value	Odds ratio	p-value	Odds ratio	p-value
MNA-SF scores at 6 months	0.71 (0.53–0.95)	0.021	0.75 (0.55–1.01)	0.059	0.74 (0.53–1.01)	0.059
Worsened MNA-SF	5.16 (1.23–21.55)	0.025	6.32 (1.14–35.06)	0.035	5.91 (1.03–34.00)	0.047

Model 1 was adjusted by age and sex. Model 2 was adjusted by age, sex, and Charlson Comorbidity Index.

ADL: activity of daily living

MNA-SF: Mini-Nutritional Assessment Short Form

## DISCUSSION

This study showed that ADL decline was frequently observed and was associated with worsening of nutritional status, which in turn was associated with decline in the mobility category of ADL in particular. This result may be explained by the fact that declines in mobility are often related to sarcopenia, which is caused by malnutrition. Decreased energy intake may cause acute illnesses or exacerbate chronic illnesses, which could easily lead to further ADL decline. A decline in mobility can also be expected to potentially hinder appropriate eating behaviors, thereby worsening nutritional status; for example, food consumption may be reduced because of fewer opportunities to go shopping and the need to simplify cooking tasks. The relationship between declines in self-care and nutritional status might have the explanation in common that cognitive decline interferes with meal preparation, leading to worsening of nutritional status. However, the lack of a difference in cognitive status between the two groups might have weakened this putative relationship in the present study.

This study also showed that the MNA-SF score was worsened in the ADL decline group, even though BMI remained unchanged from baseline to 6 months. This result may be explained by the fact that BMI is not necessarily related to nutritional status, such as in the case of muscle replacement by fat in sarcopenic obesity or increased edema due to heart failure.

Combined interventions such as nutritional, physical, and self-care guidance programs may be required individually to improve the quality of HBMC. Comprehensive medical and long-term care services would be needed to ensure the continuity of such interventions.

This study revealed some meaningful findings, but some limitations should also be considered. First, the MNA-SF is generally regarded as a screening tool rather than a diagnostic tool. The use of other nutritional indicators may be necessary to confirm our results. Second, MNA-SF includes an item on mobility which might have affected our results, though the association between ADL decline and worsening nutritional status remained unchanged when that item was excluded. Third, the sample size in this study was small due to the COVID-19 pandemic, and we could not adjust for some potential confounders. Thus, there is the possibility of selection bias in this study. Lastly, participants in this study were much older and had poorer general conditions than in previous studies, so their background may have influenced the results for the relationship between decline in ADL and nutritional status. Further research will be needed to address these issues in the future.

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## CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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## DATA AVAILABILITY

The questionnaire used in this study (in Japanese) is available upon reasonable request by the authors.

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