Table 3

Baseline and 2-yr follow-up characteristics of participants with improved/stable or deteriorating MNA-SF status

	MNA-SF change during 2-year period								
	improved/stable status (n 224)				deteriorating status (n 108)				
	n	% of total	mean	SD	n	% of total	mean	SD	P value
Men/Women	50/174	22.3/77.7			11/97	10.2/89.8			0.007†
Age (years)	224		83,9	7,3	108		85,0	7,3	0.183*
Body Mass Index (kg/m2)	224		21,1	3,8	108		20,5	3,7	0.120*
Charlson Comorbidity Index	224		2,3	1,6	108		2,2	1,6	0.589*
Basic ADL (range, 0-100 points)	224		44,3	30,0	108		35,0	29,1	0.007*
first tertile (55-100points)	98	43,8			27	25,0			0.003†
second tertile (20-50points)	65	29,0			46	42,6			
third tertile (0-15 points)	61	27,2			35	32,4			
Chewing ability									
good	91	41,0			32	29,9			0.026†
fair	107	48,2			53	49,5			
poor	24	10,8			22	20,6			
MNA-SF score (max. 14 points)	224		10,0	2,0	108		9,8	1,9	0.523*
Hospitalization during the 2-year period	60	26,8			43	39,8			0.022†

* Student's t-test was used to compare differences between participants with the MNA-SF stage decline and those without decline; † Chi-square test was used to compare differences between participants with the MNA-SF stage decline and those without decline

Table 4

Stepwise logistic-regression procedure to identify independent predictors of deteriorating MNA-SF status

	crude			multivariate					
				model 1			model 2		
	OR*	95% CI	p	OR*	95% CI	p	OR*	95% CI	p
Women (vs men)	2,53	1,26 -5,10	0,009	2,54	1,25-5,17	0,010	2,41	1,18 -4,92	0,016
Age (continuous variable)	1,02	0,99 -1,06	0,183						
The score of basic ADL (range:0-100)									
first tertile (55-100points)	1,00			1,00			1,00		
second tertile (20-50points)	2,57	1,45 -4,54	0,001	2,60	1,46-4,63	0,001	2,62	1,47 - 4,69	0,001
third tertile (0-15 points)	2,08	1,15 -3,78	0,016	2,01	1,10 -3,68	0,024	2,02	1,10 -3,72	0,024
Chewing ability									
good	1,00								
fair	1,41	0,84 -2,37	0,197						
poor	2,61	1,29 -5,28	0,008						
Hospitalization during the 2-year period									
no	1,00						1,00		
yes	1,81	1,11 -2,94	0,017				1,80	1,09 -2,97	0,023

OR* Odds Ratio; P values ; logistic regression variables; model 1 using stepwise selection; adjusted includes gender, age,the score of ADL at baseline, and chewing ability at baseline; model 2 using stepwise selection; adjusted includes gender, age, the score of ADL at baseline, chewing ability at baseline, and hospitalization during the 2-year period

observed in age, Charlson Comorbidity Index score, BMI, or the MNA-SF score at baseline between participants in the two groups. The basic ADL score (range, 0-100) at baseline of the stable/improved MNA-SF group (44.3, SD 30.0) was significantly higher than that of the deteriorating MNA-SF group (35.0, SD 29.1) (P = 0.007). The prevalence rates of hospitalization during the 2-year period were significantly higher for those with decline in MNA-SF status (39.8%) than for those with improved/stable MNA-SF status (26.8%) (P = 0.022). There was also a significant difference in the chewing ability between two groups (P = 0.026).

To identify the factors associated with categorical decline of MNA-SF during the study compared to stable/improved MNA-SF status, stepwise logistic-regression procedure was

conducted. As shown in Table 4, women, lowest basic ADL status, poor chewing ability, and hospitalization during the 2-year period were independent predictors of a decline in MNA-SF status in univariate analysis.

We used two different models to conduct multivariate analysis, in which the variables with $P < 0.05$ in univariate analysis were further examined. In model 1 the covariates included were gender, age, basic ADL status, and chewing ability. In model 2, hospitalization during the 2-year period was added in the analysis. Stepwise logistic- regression procedure indicated a lower and lowest basic ADL status in model 1, and a lower and lowest basic ADL status and hospitalization during the follow-up period in model 2 were associated with deteriorating MNA-SF status (OR 2.60, 95%CI 1.46, 4.63, OR 2.01, 95%CI 1.10, 3.68, OR 2.62, 95% CI 1.47, 4.69, OR 2.02, 95% CI 1.10, 3.72, OR 1.80, 95% CI 1.09, 2.97, respectively).

Discussion

The aim of the present study was to identify the factors associated with deterioration of MNA-SF status of nursing home residents during a 2-year period. We showed that 27.6% of subjects had deteriorating MNA-SF status during the 2-year period and that basic ADL impairment and hospitalization experience during the study period were associated with this decline. Severity of comorbidity was not related with deteriorating MNA-SF status in this study.

At the baseline of this study, 19.9% and 60.2% of the participants were categorized by MNA-SF as malnourished and at risk of malnutrition, respectively. One review article has summarized the 13 studies in which MNA has been used for nutritional assessment in nursing homes, and reported that malnutrition was observed in 2 to 38% and a risk of malnutrition in 37 to 62% of nursing home residents (11). The combined database providing information on 1586 nursing home residents from 7 countries demonstrated that 32.9%, 53.4%, and 13.8% of residents were well-nourished, at risk of malnutrition, and malnourished, respectively (12). Recent study in which MNA has been used for nutritional assessment in 286 nursing home residents reported, malnourished (18.2%)and at risk of malnutrition (42.0%) (13). There have been only few studies to assess nutritional status of nursing home residents using MNA-SF. One study reported that 39.9% nursing home residents were assessed as well-nourished, 41.9% at risk of malnutrition, and 18.1% malnourished (14). In another study reported 66% of the screened by MNA-SF individuals were at risk of malnutrition and the prevalence of malnutrition is higher in women, in nursing homes and in older age groups (15). From these observations the prevalence rates of malnutrition classified through MNA/MNA-SF vary among various nursing homes. Compared with previous observations from nursing homes, fewer malnourished residents and more at risk of malnutrition were observed in the present cohort.

Most of the prospective studies using MNA/MNA-SF have demonstrated the predictive values of these nutritional screening tools for mortality or functional decline in various geriatric settings (16-18). However, there was no prospective studies to identify the risk of deterioration of MNA/MNA-SF status during a follow-up period. In the present study, we demonstrated that 3 variables at baseline—female gender, basic ADL impairment, and hospitalization—were associated with deterioration in MNA-SF status during a 2-year period. We do not know why women were associated with nutritional decline compared with men. Although women in nursing homes are on average older than men, the association persisted even if when age was incorporated in the analysis. It is possible that unmeasured factors might mediate this gender difference.

The odds ratio of dereriorating MNA-SF scores for participants in the third tertile (worst function) was lower than those in the second tertile. In the present study, the participants of the third tertile contained lower levels of mobility including bed ridden situation. It was possible there were the lower total energy expenditure among participants with advanced dysfunction compared with those with mid dysfunction.

There have been a number of cross-sectional studies demonstrating an association between physical function impairment/ADL dependence and poor nutritional status as assessed by MNA/MNA-SF (19-21). Although these studies suggest that there is an interrelationship between the nutritional status of the elderly in various settings and reduced functional capacity (22-24), the exact causal relationships remain controversial. The prior studies demonstrated that weight loss predicts the development of disability in older people (22-24). However, it remains unknown whether physical function/ADL status may influence the development of malnutrition or risk of malnutrition (25). The present study clearly indicated that the lowest basic ADL status was associated with a decline in MNA-SF status. This association persisted after adjusting for gender, age, and hospitalization during study periods.

There have been several cross-sectional studies showing that chewing problems are associated with malnutrition (26-28). Again, these results did not reveal the causal relationships between chewing ability and poorer nutritional status in the older people. The present study showed that poor chewing ability at baseline was associated with declining MNA-SF status during the study period in the crude model, although the ability was not selected by stepwise regression procedure, indicating that more attention should be paid to the impact of oral health, which imposes dietary restrictions on older people with consequences for their nutritional status.

The present study showed that hospitalization during the 2-year period was associated with a decline in MNA-SF status. In consisted with the previous studies demonstrated an association between hospitalization and malnutrition (3,29). It should be noted that there is one item asking about the presence or absence of psychological stress or acute disease in the past 3 months in MNA-SF. This may influence the association.

The present study has several limitations. The subjects of the

present study were dependent elderly people who had chronic diseases and needed help in everyday life at the nursing home. The results of the present study cannot be transferred to community-dwelling independent elderly individuals. These findings may not be generalizable to other populations given that they may have been influenced by health practices and a variety of social and economic factors.

In conclusion, this study showed that poor basic ADL status and hospitalization of nursing home residents during a 2-year follow-up period were associated with malnutrition and risk of malnutrition as assessed by MNA-SF.

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ORIGINAL ARTICLE: EPIDEMIOLOGY, CLINICAL PRACTICE AND HEALTH

Accumulation of geriatric conditions is associated with poor nutritional status in dependent older people living in the community and in nursing homes

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Aim: To clarify the association between nutritional status and the prevalence of geriatric conditions in dependent older adults.

Methods: A cross-sectional observational study of dependent older adults aged 65years or older who were living either in the community ($n = 511$, mean age 81.2years) or in nursing homes ($n = 587$, mean age 85.2years) was carried out. Data included the participants' demographic characteristics, basic activities of daily living, Charlson Comorbidity Index and the prevalence of eight geriatric conditions (visual impairment, hearing impairment, falls, bladder control problems, cognitive impairment, impaired mobility, swallowing disturbance and loss of appetite). Nutritional status was assessed by the Mini Nutritional Assessment short form (MNA-SF).

Results: Of 1098 participants, 21.4% ($n = 235$) were categorized as "malnourished", according to the MNA-SF classification. Participants in the "malnourished" group had a greater number of geriatric conditions than those in the other two groups. A higher prevalence of all the geriatric conditions except for falls was detected in the group with poorer nutritional status. Multivariate logistic regression analysis showed that malnutrition was associated with the number of geriatric conditions, but not with that of comorbidities, even after controlling for confounders.

Conclusions: Malnutrition was confirmed to have significant associations with geriatric conditions in dependent older adults. **Geriatr Gerontol Int 2014; 14: 198–205.**

Keywords: dependent elderly people, geriatric conditions, nutritional status.

Introduction

In most affluent societies, the aged population is growing. Economic restraints have instituted changes in the care of elderly individuals. One consequence of the recent reduction in hospital beds and the shorter hospital stays in Japan, as well as in other countries, is that hospital care, such as long-term geriatric care, for many older adults is no longer being provided; instead, those who require such care are now residing in various forms of assisted housing in both the community and long-term care facilities.[1]

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Geriatric conditions are used to describe complex clinical conditions or signs that are common in frail older people and do not fit into specific diseases or syndrome categories. Such conditions are highly prevalent, multifactorial, and associated with multiple comorbidities and poor outcomes, such as increased disability and decreased quality of life (QOL).[2] Nutrition is an important factor in health and functional ability, and the impact of nutritional state on physical and psychological well-being is especially high in older people.[3] Furthermore, older people are more likely than younger adults to have an impaired nutritional status and to be at high risk for nutritional deficiency when they become ill. In fact, malnutrition is common in geriatric populations, especially in nursing homes or among community-dwelling dependent older adults.[4,5] Poor nutritional status is directly linked to the negative consequences of reduced health and QOL among older people. A

number of studies have shown relationships between nutritional impairment and morbidity, functional decline, and mortality in older people.[6–8] Nonetheless, few studies have examined the relationships between nutritional status and geriatric conditions among older people in various settings.

To answer these questions, in the present study we examined whether or not nutritional status might be associated with the accumulation of geriatric conditions or which conditions might be associated with poor nutritional status among dependent older people living in the community and in nursing homes.

Methods

Participants

The present study consisted of baseline data of the participants in two different prospective cohort studies. One was a multidisciplinary intervention care program trial of community-dwelling older adults (age 65years or older) who were eligible for Japanese long-term care insurance program, lived in Nagoya City, Japan, and were receiving various home care services from the Nagoya City Health Care Service Foundation for Older People, which has 16 visiting nursing stations associated with care-management centers (control $n = 511$, intervention $n = 601$, total participants $n = 1112$). The participants enrolled between 1 June 2009 and 30 November 2009 were scheduled to undergo comprehensive in-home assessments by trained nurses to constitute baseline data. Among those participants, participants allocated to an intervention group were enrolled in the present study, as the nutritional evaluation was carried out only in the intervention group at baseline. The second group was an observational prospective cohort based on the residents of 12 nursing homes ($n = 657$) located in Nagoya City, Japan. The participants were enrolled between 1 May 2009 and 30 June 2009.

In community-dwelling and nursing home cohorts, 90 and 70 participants were excluded, respectively, because of the lack of nutritional evaluation data. Thus, baseline data on 511 (male $n = 216$, female $n = 295$, mean age 81.2 ± 7.9 years [SD]) community-dwelling participants and 587 (male $n = 108$, female $n = 479$, mean age 85.1 ± 7.8 years [SD]) nursing home participants were used for the analysis.

Written informed consent for participation was obtained from all participants or, for those with substantial cognitive impairment, from a surrogate (usually the closest relative or legal guardian) according to the procedures approved by the institutional review board of Nagoya University Graduate School of Medicine.

Data collection

The data were collected by trained nurses at the participants' homes or nursing homes from standardized interviews with patients or surrogates and caregivers, and from the records of care-management centers or nursing homes. The data included participants' demographic characteristics and the Barthel Index, a rating for 10 basic activities of daily living (bADL; bathing, bladder function, bowel function, dressing, feeding, grooming, mobility, stairs, toilet use and transfers) using summary scores ranging from 0 (total disability) to 100 (no disability). Information on the number of drugs that participants were taking, and the following physician-diagnosed chronic conditions were also obtained from care-management center records and from nursing home medical records: ischemic heart disease, heart failure, chronic obstructive pulmonary disease, cerebrovascular disease, diabetes, dementia, cancer, hypertension and other diseases comprising the Charlson Comorbidity Index,[9] which represents a sum of weighted indexes taking into account the number and seriousness of pre-existing comorbid conditions (range 0–19, with a higher value indicating higher comorbidity). To obtain the greatest possible uniformity of data collection in different settings, the nurses were trained in the interviewing of participants and in the collection of data with standardized questionnaires.

Evaluation of nutritional status

In the present study, nutritional status was assessed at baseline by the Mini Nutritional Assessment short form (MNA-SF), one of the most valid and most frequently used nutritional screening tools for older persons.[10,11] MNA-SF consists of six items: food intake, weight loss, mobility, psychological stress or acute disease, neuropsychological problems and body mass index (BMI). The maximum score of MNA-SF is 14. A score equal to or less than 7 points is regarded as an indicator of malnutrition, 8–11 points indicate a risk for malnutrition and equal to or more than 12–14 points indicate that the person is well nourished.[12] We previously validated MNA and MNA-SF in Japanese older people.[13]

Definition of geriatric conditions

We defined geriatric conditions as collections of symptoms common in older adults, not necessarily associated with a specific disease, that increase in prevalence with age.[14,15] In the present study, we used the following eight symptoms as geriatric conditions: (i) vision impairment (poor eyesight or blindness despite use of corrective lenses); (ii) hearing impairment (poor hearing despite use of hearing aids); (iii) falls (at least one fall in the past 12 months); (iv) bladder control problems including not only urinary incontinence, but also catheterization, and

an inability to control urination alone; (v) cognitive impairment (dementia diagnosed by a physician or the presence of apparent cognitive impairment); (vi) impaired mobility (requiring person assistance to walk or an inability to walk); (vii) swallowing disturbance (presence of abnormal volitional cough, abnormal gag reflex, dysphonia, dysarthria, cough after swallowing and voice change after swallowing); and (viii) loss of appetite (self-reported loss or reduced intake not attributable to specific reasons). The presence of geriatric conditions was self-reported by the participants in the standardized interview carried out by the nurses; or, for those with substantial cognitive impairment, it was reported by a surrogate, caregiver or trained nurses. The accumulation of geriatric conditions was defined by the number of symptoms that a patient had among eight symptoms as described. For the analysis, we also used six of the eight symptoms; that is, we excluded "swallowing disturbance" and "loss of appetite", which are closely related to nutritional status. Low BMI or low bodyweight was frequently included in geriatric conditions. These two conditions were not used in the present study, as they are directly involved in nutritional status.

Statistical analysis

Continuous variables were described by the use of statistical characteristics (means, SD). Discrete variables were described as counts and percentages. Analysis of variance or the χ^2-test was used to determine the differences among the MNA-SF classifications. Pearson's linear correlation coefficient and partial rank correlation coefficients adjusted for age and sex were used to measure the relationships between the MNA-SF score and the accumulated number of geriatric conditions. A *P*-value of <0.05 was taken to define statistical significance. We used univariate and multivariable logistic regression to determine which variables, including the presence of geriatric conditions, predicted malnourished versus well-nourished status evaluated with MNA-SF. For the multivariable logistic regression analysis, two models were used. Model I included sex, age, living settings (community or nursing home), the number of geriatric conditions among eight or six symptoms, and chronic diseases, such as diabetes mellitus and hypertension, which were significantly associated with malnutrition in univariate analysis. Model II included sex, age, living settings (community or nursing home) and all of the geriatric conditions. SPSS 15.0 (*SPSS*, Chicago, IL, USA) statistical software was used to analyze the data.

Results

The baseline characteristics of a total of 1098 participants aged 65years or over were compared among MNA-SF categories (Table 1). According to the MNA-SF classification, 21.4% ($n = 235$), 54.3% ($n = 596$) and 24.3% ($n = 267$) were categorized as "malnourished", "at risk of malnutrition" and "well nourished", respectively. The distribution of classifications differed significantly between institutionalized and community-dwelling participants. Compared with community-dwelling participants, the institutionalized older people had a higher prevalence of malnutrition and a lower rate of good nutrition when compared among the three groups of participants with different nutritional status classified by MNA scores. Significant differences were also detected in age, sex, prevalence of artificial nutrition, and scores of bADL and Charlson comorbidity index. Regarding the prevalences of chronic diseases, only those of diabetes mellitus and hypertension were found to be different among the three groups. There was also a significant difference in the number of geriatric conditions among MNA-SF classifications (Table 2). Poorer nutritional status according to the MNA-SF classification increased the number of geriatric conditions. Accumulation was higher in the malnourished group than in the "at risk of malnourishment" (among eight symptoms, among six symptoms) and in the "well-nourished" group (among eight, among six). There were significant differences among classes with regard to the prevalence of all the individual components of geriatric conditions. A higher prevalence of all of the components except falls was found in the poorer nutritional status.

As shown in Table 3, a significant negative correlation was detected between the number of accumulated geriatric conditions and the MNA-SF score. These correlations persisted after adjusting for age and sex. Similar results were observed when the accumulation of geriatric conditions was based on a total of six rather than eight symptoms. These results showed that participants suffering poorer nutritional status were more likely to have geriatric conditions.

Logistic regression analyses were carried out to evaluate the associations of variables including geriatric conditions with malnourished status evaluated with MNA-SF (Table 4). Unadjusted univariate analysis suggested that women, older age, lower bADL score, nursing home residence, the use of artificial nutrition, the number of drugs which participants were taking, the number of accumulated geriatric conditions (among eight symptoms OR 2.62, 95% CI 2.22–3.10; among six OR 2.36, 95% CI 2.00–2.78) and the presence of all of the components of geriatric conditions were associated with malnourishment. However, no association was observed with the Charlson Comorbidity Index or with the presence of chronic diseases, except diabetes mellitus and hypertension. Participants with either of these two lifestyle-related diseases were less likely to be malnourished.

Table 1 Nursing homes and community: baseline characteristics of participants by Mini Nutritional Assessment

	MNA (0–7) Malnourished	MNA (8–11) At risk of malnutrition	MNA (12–14) Well nourished	*P*-value
Nursing homes, *n* (% of total)	151 (25.7)	337 (57.4)	99 (16.8)	
Community, *n* (% of total)	84 (16.2)	259 (50.5)	168 (33.3)	<0.001
Nursing homes and community, *n* (% of total)	235 (21.4)	596 (54.3)	267 (24.3)	
MNA-SF score, mean (SD): nursing home*	6.1 (1.2)	9.2 (1.11)	12.5 (0.68)	<0.001
MNA-SF score, mean (SD): community*	5.8 (1.5)	9.6 (1.1)	12.5 (0.7)	<0.001
MNA-SF score, mean (SD): nursing home and community*	6.0 (1.3)	9.4 (1.1)	12.5 (0.7)	<0.001
Age, mean (SD)*	84.6 years (8.2)	83.8 years (8.1)	81.0 years (7.5)	<0.001
Men, *n* (% of men/total)	60 (25.5)	163 (27.3)	101 (37.8)	0.002
Artificial nutrition (% of total)	30 (12.8)	30 (5.0)	2 (0.7)	<0.001
Mean basic ADL, range 0–100 (SD)*	25.3 (27.0)	46.5 (30.9)	71.2 (23.9)	<0.001
No. drugs, mean (SD)*	5.0 (3.1)	5.6 (3.4)	7.2 (3.9)	<0.001
Charlson Comorbidity Index, mean (SD)*	2.6 (1.8)	2.4 (1.6)	2.6 (1.8)	0.045
Chronic diseases, *n* (% of total)				
Ischemic heart disease	36 (15.3)	99 (16.6)	47 (17.6)	0.790
Congestive heart failure	44 (18.7)	97 (16.3)	51 (19.1)	0.512
COPD	28 (12.0)	55 (9.2)	33 (12.4)	0.283
Cerebrovascular disease	104 (44.4)	270 (45.5)	118 (44.2)	0.929
Diabetes mellitus	32 (13.6)	88 (14.8)	76 (28.5)	<0.001
Cancer	13 (5.5)	33 (5.5)	16 (6.0)	0.961
Hypertension	102 (43.4)	294 (49.3)	169 (63.3)	<0.001

*Analysis of variance; others were analyzed using the χ^2-test. ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; MNA, Mini Nutritional Assessment.

Table 2 Nursing homes and community: baseline characteristics of participants by Mini Nutritional Assessment

	MNA (0–7) Malnourished	MNA (8–11) At risk of malnutrition	MNA (12–14) Well nourished	*P*-value
Nursing homes, *n* (% of total)	151 (25.7)	337 (57.4)	99 (16.8)	
Community, *n* (% of total)	84 (16.2)	259 (50.5)	168 (33.3)	<0.001
Nursing homes and community, *n* (% of total)	235 (21.4)	596 (54.3)	267 (24.3)	
No. geriatric conditions, mean (SD)†				
Among 8	4.7 (1.6)	3.5 (1.6)	2.3 (1.5)	<0.001
Among 6	3.6 (1.3)	2.9 (1.4)	2.1 (1.3)	<0.001
Geriatric conditions, *n* (% of total)				
Vision impairment	115 (49.8)	220 (37.5)	71 (26.7)	<0.001
Hearing impairment	123 (53.0)	250 (42.4)	89 (33.5)	<0.001
Falls	36 (15.4)	118 (19.9)	78 (29.2)	<0.001
Bladder control problem	205 (87.6)	415 (70.3)	105 (39.3)	<0.001
Cognitive impairment	161 (69.1)	326 (55.3)	96 (36.4)	<0.001
Mobility impairment	210 (89.7)	413 (69.4)	115 (43.1)	<0.001
Swallowing problem	138 (59.5)	213 (35.9)	52 (19.5)	<0.001
Appetite loss	123 (56.2)	148 (25.2)	21 (7.9)	<0.001

†Analysis of variance; others were analyzed using the χ^2-test. The geriatric conditions among eight included vision impairment, hearing impairment, falls, bladder control problem, cognitive impairment, mobility impairment, swallowing problem and appetite loss; among six included vision impairment, hearing impairment, falls, bladder control problem, cognitive impairment, and mobility impairment.

Table 3 Association of the accumulation of the geriatric conditions in participants from nursing homes and community with MNA-SF score

	No. geriatric conditions Among 8†		No. geriatric conditions Among 6‡	
	r	*P*	*r*	*P*
MNA-SF				
Unadjusted	−0.495	<0.001	−0.392	<0.001
Adjusted§	−0.473	<0.001	−0.364	<0.001

†The geriatric conditions among eight included vision impairment, hearing impairment, falls, bladder control problem, cognitive impairment, mobility impairment, swallowing problem and appetite loss; ‡among six included vision impairment, hearing impairment, falls, bladder control problem, cognitive impairment, and mobility impairment. §Adjusted by age and sex. MNA, Mini Nutritional Assessment.

In multivariate analysis, the number of accumulated geriatric conditions was associated with malnourishment (in model I OR 2.51, 95% CI 2.11–3.00). When the number of accumulated geriatric conditions was based on a total of six rather than eight, similar results were observed (in model I, OR 2.21, 95% CI 1.86–2.64). In model I, diabetes mellitus and hypertension were no longer associated with malnourishment. It should be noted that, in model I, the significant association between the number of accumulated geriatric conditions and malnourishment persisted when the bADL score was included in the analysis (among eight OR 1.74, 95% CI 1.40–2.10; among six OR 1.26, 95% CI 1.01–1.57). Although nursing home residents were associated with malnourishment, there was no longer an association when the bADL score was included in the analysis (OR 1.32, 95% CI 074–2.35). In model II, which used each geriatric condition component instead of the number of accumulated conditions, the presence of a bladder control problem, cognitive impairment, mobility impairment, swallowing problem and appetite loss were each associated with malnourishment. In model II, sex, age and nursing home residence were not associated with malnourishment.

Discussion

The present study showed that nursing home residents had a higher prevalence of malnutrition (25.7%) than those living in the community (16.2%). Furthermore, both 16.8% and 33.3% of the institutionalized and community-dwelling older people, respectively, were well nourished. A study of elderly Germans estimated that 36.7% and 85.7% of institutionalized and community-dwelling participants, respectively, were well nourished, based on MNA-SF for nutritional evaluation.[16] In a study of elderly Taiwanese, 26.5% and 80.1% of institutionalized and community-dwelling participants, respectively, were considered well nourished according to MNA-SF categories.[17] The lower prevalence of well-nourished community-dwelling older people in the present study seems attributable to the multiple medical problems and the functional limitations among our participants.

Those with poorer nutritional status were older, had lower bADL scores and were more likely to use artificial alimentation. Although we do not know the exact reasons for the relationships between artificial nutrition and poor nutritional status, it is possible that those patients receive insufficient nutrients or that those receiving artificial nutrition have a background of a heavy disease burden.

It has been reported that functional disability in older people is associated with inadequate diet and weight loss.[18,19] Huang *et al.* compared the nutritional status of their functionally dependent and independent elderly patients, and found poor nutritional status with lower daily caloric intake in the former group.[20] Consistently in the present study, participants with lower classified MNA-SF were associated with a lower bADL score. We observed that presence of diabetes mellitus or hypertension is negatively associated with malnutrition, although these associations disappeared after adjustment. The participants with these chronic diseases had higher BMI levels than those without disease (diabetes mellitus 21.8 ± 3.6 *vs* 20.1 ± 3.7, $P < 0.001$; hypertension 21.1 ± 3.9 *vs* 19.6 ± 3.5, $P < 0.001$), consistent with MNA-SF evaluation, suggesting the participants with diabetes mellitus or hypertension seem to have better nutritional status compared with those without these chronic diseases.

We clearly showed that, among dependent older people in nursing homes and in the community, those with poorer nutritional status had more geriatric conditions. In fact, an increase of one geriatric condition among eight or six symptoms showed 2.62 or 2.36 OR of the risk of malnutrition in univariate analyses. It should be emphasized that the association persisted

Table 4 Nursing homes and community: factors associated with malnutrition

	Univariate			Multivariate model I			Multivariate model II		
	OR	(95% CI)	*P*	OR	(95% CI)	*P*	OR	(95% CI)	*P*
Women (*vs* men)	1.78	1.22–2.62	0.003	0.93	0.54–1.61	0.796	0.80	0.43–1.50	0.491
Age (continuous)	1.06	1.04–1.09	<0.001	1.00	0.97–1.03	0.946	1.03	0.99–1.06	0.194
Basic ADL (continuous)	0.95	0.94–0.96	<0.001						
Nursing home (*vs* community)	3.17	2.20–4.57	<0.001	2.25	1.34–3.77	0.002	1.31	0.68–2.52	0.413
Artificial nutrition (% of total)	19.30	4.56–81.68	<0.001						
No. drugs	0.84	0.79–0.88	<0.001	0.90	0.84–0.97	0.006	0.90	0.83–0.98	0.016
No. geriatric conditions									
Among 8	2.62	2.22–3.10	<0.001	2.51	2.11–3.00	<0.001			
Among 6	2.36	2.00–2.78	<0.001	2.21	1.86–2.64	<0.001			
Vision impairment	2.72	1.87–1.87	<0.001				1.57	0.87–2.85	0.137
Hearing impairment	2.22	1.55–3.19	<0.001				0.93	0.51–1.70	0.805
Falls experiences	0.45	0.29–0.70	<0.001				0.58	0.29–1.15	0.119
Bladder control problem	10.96	6.92–17.36	<0.001				3.27	1.72–6.21	<0.001
Cognitive impairment	3.94	2.71–5.72	<0.001				2.50	1.40–4.45	0.002
Mobility impairment	11.62	7.14–18.91	<0.001				4.73	2.39–9.37	<0.001
Swallowing problem	6.01	4.03–8.96	<0.001				2.59	1.43–4.69	0.002
Appetite loss	15.07	8.97–25.33	<0.001				16.45	7.84–34.54	<0.001
Chronic diseases, presence (*vs* absence)									
Charlson Comorbidity Index	0.99	0.90–1.09	0.844						
Ischemic heart disease	0.84	0.52–1.35	0.479						
Congestive heart failure	1.00	0.64–1.56	0.992						
COPD	0.96	0.56–1.64	0.879						
Cerebrovascular disease	1.00	0.70–1.43	0.989						
Diabetes mellitus	0.39	0.25–0.62	<0.001	0.62	0.34–1.13	0.118			
Cancer	0.91	0.43–1.94	0.816						
Hypertension	0.45	0.31–0.64	<0.001	0.92	0.55–1.56	0.766			

The geriatric conditions among eight included vision impairment, hearing impairment, falls, bladder control problem, cognitive impairment, mobility impairment, swallowing problem and appetite loss; among six included vision impairment, hearing impairment, falls, bladder control problem, cognitive impairment, and mobility impairment. ADL, activities of daily living; COPD, chronic obstructive pulmonary disease.

even after controlling for sex, age, bADL, living settings and comorbidities. Recently in a cross-sectional hospital-based observational study, Saka *et al.* also reported that patients who were malnourished or at risk of malnourishment according to the MNA full version had more geriatric conditions.[21] Although they reported that those with low MNA scores had more chronic diseases, in the present study comorbidity was not positively associated with malnutrition. This inconsistency seems to be related to the different settings of the

surveys. Saka *et al.* investigated hospital-based older patients, but our participants lived in the community or in nursing homes and did not have active diseases. Thus, nutritional status is closely related to the accumulation of geriatric conditions, but not to comorbidities, at least in dependent elderly people without acute illness.

We also observed that malnutrition was associated with various components of geriatric conditions. In the crude model, the presence of each component, except for falls, was more likely to be classified as malnutrition. In contrast, participants who had fallen were less likely to be malnourished. We observed that the bADL score of those who experienced falls was lower than that of those who did not experience falls (63.6 ± 24.4 *vs* 47.3 ± 34.3, $P < 0.001$). This relationship between falls and malnutrition appeared through bADL status, as this association disappeared after adjusting for bADL status (OR 0.82, 95% CI 0.47–1.41). Participants with the poorest bADL status (severe physical limitation, such as typically confined to bed) are less likely to fall.[22] The poorest bADL status is associated with poorer nutritional status, as described earlier.

After demographic adjustments, the presence of a bladder control problem, cognitive impairment, mobility impairment, a swallowing problem and appetite loss were each significantly associated with malnutrition. The exact reasons for the association between bladder control problems and malnutrition remain unknown. It is well documented that being overweight is a risk factor for urinary incontinence.[23] However, in the present study of dependent older people, we found the opposite result. One reason for this discrepancy might be the definition of bladder control problems, which in the present study included not only urinary incontinence, but also catheterization and an inability to control urination. There are many risk factors common to the development of both a bladder control problem and malnutrition. These common factors include bADL status, depression and multiple medical conditions.[24,25] It is also true for mobility impairment, which is also associated with malnutrition.

Many of the studies investigating the relationships between cognition and nutritional status focus on nutritional deficiencies as a consequence of dementia or cognitive decline. For instance, cognitive decline might impair the ability or desire to eat.[26] Weight loss and changed eating behavior are recognized characteristics of the progressive dementing process, and uncontrolled weight loss is almost inevitable in the latter stages.[27]

We showed the associations between malnutrition according to the MNA-SF classification, and both the presence of a swallowing problem and appetite loss. The impairment of swallowing function can have devastating health implications. These include not only aspiration pneumonia, but also malnutrition and dehydration, as well as changes in health status, including an increased need for care provision, especially for older adults. In fact, a recent large cross-sectional survey of geriatric wards of hospitals showed that swallowing difficulties were strongly associated with malnutrition.[28,29] How appetite control changes with age remains to be elucidated, but a loss of appetite is frequently observed with aging; in a phenomenon called the "anorexia of aging", the physiological reductions in appetite and food intake accompany normal aging or occur as a consequence of various diseases. Appetite loss and subsequent reduced oral intake are followed of course by weight loss and nutritional impairment.[30] However, it should be noted that despite the exclusion of these conditions that are directly linked to reduced energy intake, the accumulation of geriatric conditions (six items) is associated with poor nutritional status in dependent elderly.

In the present study, 42.3% and 18.4% of the participants in the community and nursing homes were male, respectively. One of the reasons for this difference of the ratio of males and females might be due to the different average age of the participants. The participants from nursing homes were much older than those from the community. The male gender ratio tends to reduce as age increases, and among the elderly there is usually an excess of females.

The present study had several strengths, including the relatively large number of participants in different settings: nursing homes and the community. Our analyses took into account potential confounders including age, sex, bADL status and comorbidity.

The present study had potential limitations, however. Data obtained from multiple nurses through standardized interviews might be inaccurate, although to minimize discordance in data collection, nurses were trained in interviewing older participants and caregivers before the start of the study. The degree of cognitive impairment was not included in the analysis, as cognitive function was not evaluated by a specific screening instrument. There is no consensus on the definition of a geriatric condition or what conditions that category should include. In the present study, potential key conditions/diseases, such as dizziness, delirium or pressure sores, osteoporosis, gastroesophageal reflux disease, chronic kidney disease and dyslipidemia, were not included in the analysis. Although mood, such as depression, might influence nutritional status, depressive status was not evaluated in the present study. The study used cross-sectional analysis, and we cannot draw conclusions about cause and effect. Further research is required to examine geriatric conditions and their longitudinal associations with nutritional status.

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Disclosure statement

The authors declare no conflict of interest.

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第54回日本老年医学会学術集会記録
〈シンポジウム4：生活自立を指標とした生活習慣病の検査基準値〉

2. 生活自立からみた生活習慣病の基準値
(5) 低栄養・高栄養

葛谷　雅文

Key words：低栄養，高齢者，栄養評価

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はじめに

栄養状態は栄養過多（高栄養），栄養欠乏（低栄養）状態と正常の3つに判別することが一般的である．過栄養状態は肥満や耐糖能障害・糖尿病や脂質異常症（高コレステロール血症・高中性脂肪血症），脂肪肝などの生活習慣病に関連する病態である．一方，高齢者では低栄養に陥るリスクが高く，特に要介護高齢者では20～40%に，入院中の高齢者においても30～50%程度に低栄養が存在すると言われている．高齢者の低栄養は健康障害に直結し，感染症，褥瘡，創傷治癒の遅延，骨格筋萎縮などを誘導する他，生命予後のみならず，身体機能障害にも関連しているため，定期的に栄養状態の評価を行うことが重要である．本項では主に低栄養にフォーカスする．

低栄養の分類

低栄養状態はマラスムスとクワシオルコルの二つに分けることができる[1]．

a．マラスムス

主としてエネルギー不足による低栄養状態で，摂取エネルギーの不足の結果，身体活動の低下，基礎代謝の低下などの適応が起こった状態．

b．クワシオルコル

主としてタンパク質不足による低栄養状態で，タンパク質不足に対して糖質の摂取が保たれている．

c．マラスミック・クワシオルコル

実際には上記のマラスムス，クワシオルコルは単独で起きることはむしろまれであり，多くはマラスムス・クワシロルコル型である．タンパク質ならびにエネルギーの摂取不足により，体重減少，成長障害，消耗がもたらされることをタンパク質・エネルギー欠乏症（protein-energy malnutrition，PEM）とも言う．

d．飢餓（Starvation）と悪液質（Cachexia）[1]

飢餓とは必要なカロリーが摂取できないことによる低栄養状態をさす．一方悪性腫瘍ならびに感染症，慢性炎症性疾患，さらには心不全，呼吸不全，肝，腎不全などの存在により，炎症性サイトカインの過剰産生による食欲低下ならびに筋蛋白を主体とする蛋白崩壊を伴う低栄養状態を「悪液質/カヘキシア」と呼ぶ．飢餓状態は適切な栄養療法により，栄養状態の改善が期待できるが，悪液質では栄養療法への反応が不良なケースが多い．

低栄養のアウトカム

表1に主要な高齢者の栄養障害に伴う病態を列挙した．その中で老年症候群と称される病態も多数存在している．さらに，昨今高齢者の転倒やインスリン抵抗性との関連で注目されているサルコペニアとも強く関連して

表1　高齢者栄養障害にともなう病態

免疫異常（感染症）	
創傷治癒の遅延（手術後の回復遅延）	
薬剤代謝の変動	
呼吸機能の低下	
貧血	
骨粗鬆症	老年症候群
褥瘡	老年症候群
筋萎縮（sarcopenia）	老年症候群
転倒	老年症候群
骨折	老年症候群
疲労感	老年症候群

Evaluation of nutritional status of older people
Masafumi　Kuzuya：名古屋大学地域在宅医療学・老年科学（老年内科）

表2　低栄養指標

1）身体計測

体格指数：body mass index（BMI）

＝体重（kg）÷［身長（m）］^{2}

18.5未満	やせ
18.5～25未満	標準
25～30未満	肥満
30以上	高度肥満

理想体重比：% ideal body weght

＝現体重（kg）÷理想体重（kg）×100（%）　理想体重（kg）＝身長（m）2×22

80～89	軽度栄養不良
70～79	中等度栄養不良
＜69	高度栄養不良

平常時体重比：% usual body weight（%UBW）

＝測定時体重÷平常時体重×100（%）

75%未満	高度栄養障害
75～85%未満	中等度栄養障害
85～95%未満	軽度栄養障害

体重減少率：% loss of body weight

（平常時体重－現在の体重）÷平常時体重×100（%）

期間	有意な体重減少	重度な体重減少
一週間	1～2%	2%以上
1カ月	5%	5%以上
3カ月	7.5%	7.5%以上
6カ月	10%	10%以上

2）血液データ

指標	半減期	低栄養基準
血清アルブミン	17～23日	3.5 g/dl未満
トランスサイレチン	2～3日	17 mg/dl未満
トランスフェリン	7～10日	200 mg/dl未満
レチノール結合蛋白	0.5日	3.0 mg/dl未満
血清総コレステロール		150 mg/dl未満
血清総コレステロール		1,500/μl以下

いる．サルコペニアの原因は多因子によるものと思われるが，その中でも低栄養が，特にタンパク質摂取欠乏との関連が注目されている．

低栄養評価

栄養評価はスクリーニングとアセスメントに分けることができる．栄養スクリーニングとは栄養障害に関連した特徴的所見について認識するプロセスであり，栄養不良のリスクを有する患者および栄養関連障害のリスクを有する患者を判定することを目的としている．一方アセスメントとは臨床データ，食物摂取データ，身体組成データ，生化学データなどを収集し，栄養不良状態の患者を判定し，適切な栄養療法を計画するプロセスである．ここでは栄養アセスメントに使用できる簡単な評価法ならびにその評価基準を表2に示した．

身体計測はもっとも簡便な方法であり，特に体格指数（BMI）はもっとも高頻度で使用される．しかし，身体機能障害があるため体重を在宅で測定できなかったり，極度の亀背や筋肉，関節の拘縮のため身長が測定できないケースがまれではない．体重の推移は最も簡便かつ鋭敏な栄養状態評価法である．

採血による検査も種々あるが，一般的にはアルブミン値が使用されている（表1）．しかし，これまた解釈には十分注意が必要である．以下に注意点を述べる．

1）半減期が比較的長いため栄養療法の介入を行ったとしても上昇を認めるには一カ月以上の猶予が必要である．

2）急性の外傷，手術，重症感染症などの身体的ストレスにより栄養状態とは無関係に1.0～2.0 g/dl程度数日の間に急激に低下することがある．

3）肝硬変，腎疾患（ネフローゼ症候群），心不全，腎不全などは当然低アルブミンになる．

表3　Mini Nutritional Assessment（MNA®）

スクリーニング

A　過去3ヶ月間に食欲不振、消化器系の問題、咀嚼・嚥下困難などで食事摂取が減少しましたか？
0=強度の食事量の減少
1=中等度の食事量の減少
2=食事量の減少なし　□

B　過去3ヶ月間の体重減少がありましたか？
0=3kgを越す減少
1=わからない
2=1-3kgの減少
3=体重減少なし　□

C　運動能力
0=寝たきりまたは車椅子を常時使用
1=ベッドや車椅子を離れられるが、外出はできない
2=自由に外出できる　□

D　精神的ストレスや急性疾患を過去3ヶ月間に経験しましたか？
0=はい　2=いいえ　□

E　神経・精神的問題の有無
0=高度の認知症またはうつ状態
1=中程度の認知障害
2=精神的問題なし　□

F　BMI指数
0=BMIが19より少ない
1=BMIが19以上、21未満
2=BMIが21以上、23未満
3=BMIが23以上　□

スクリーニング値：小計（最大14ポイント）　□

12ポイント以上：正常、危険なし→これ以上の検査必要なし
11ポイントまたはそれ以下：栄不良の疑いあり→検査続行

アセスメント

G　独立して生活（養護施設入所・入院していない）
0=いいえ　1=はい　□

H　1日に4種類以上の処方薬を内服
1=いいえ　0=はい　□

I　身体のどこかに褥瘡または皮膚潰瘍がある
1=いいえ　0=はい　□

J　1日に何回食事を摂っていますか？
0=1回　1=2回　2=3回　□

K タンパク質摂取状態を示す指標
・1日に少なくとも1品の乳製品
（牛乳、チーズ、ヨーグルト）を摂取
□はい　□いいえ
・1週間に豆類または卵を2品以上摂取
□はい　□いいえ
・肉類、魚のいずれかを毎日摂取
□はい　□いいえ
0.0=はい、0～1つ
0.5=はい、2つ
1.0=はい、3つ　□

L 1日に2品以上の果物または野菜を摂取
0=いいえ　1=はい　□

M 水分（水、ジュース、コーヒー、茶、牛乳など）を1日どのくらい摂取しますか？
0.0=コップ3杯未満
0.5=3～5杯
1.0=5杯以上　□

N 食事の状況
0=介護者なしでは食事不可能
1=多少困難ではあるが自分で食事可能
2=困ることなしに自分で食事可能　□

O 栄養自己評価
0=栄養状態は不良と思う
1=わからない
2=問題ないと思う　□

P 同年齢の他人と比べ自分の健康状態をどう思いますか？
0.0=良いとは思わない
0.5=わからない
1.0=同じだと思う
2.0=他人より良いと思う　□

Q 上腕（利き腕でない方）の中央の周囲値(cm):MAC
0.0=MACが21未満
0.5=MACが21以上、22未満
1.0=MACが22以上　□

R ふくらはぎの周囲値(cm):CC
0=CCが31未満　1=CCが31以上　□

アセスメント値：小計（最大：16ポイント）　□

スクリーニング値　□

総合評価（最大30ポイント）　□

栄養不良指標スコア
17～23.5ポイント：栄養不良の危険性あり
17ポイント未満：栄養不良

出典：http://www.mna-elderly.com/forms/MNA_japanese.pdf

4）ADL（activity of daily living）が低下した多くの高齢者ではたとえ栄養状態がよくても血清アルブミン値が3.5 g/dlに満たない例が多い[8]．ADL低下をともなう高齢者の低栄養判定を血清アルブミン値のみで行うのは危険である．

5）血清アルブミン測定法は主にブロムクレゾールグリーン（以下BCG法）とブロムクレゾールパープル（以下BCP法）がある．さらには最近では改良型BCP法が出てきている．BCG法に比較し，改良型BCP法では0.3～0.5 g/dl程度低値となる．しかし，3.5 g/dlのカットオフは多くがBCG法を使用して決定されたと思われ，今後再考される必要がある．

実際の臨床の現場，特に介護施設などでは採血をすることが困難であることもまれではない．栄養アセスメントツールとして最も汎用され，いわゆるゴールデンスタンダードになっているものとしてsubjective global assessment（SGA）が知られる[9]．また最近虚弱高齢者をターゲットとした簡便な栄養評価法としてmini-

nutritional assessment（MNA）が欧米では汎用されている（表3）[3]．我々の日本人高齢者を対象にした調査でも，MNAは低栄養高齢者をスクリーニングするのに有用であった[4]．この評価法の特徴は低栄養患者を選別するのみならず，低栄養のリスクがある群を判別できることである．

高齢者栄養評価に必要な視点

栄養不良のリスクを有する患者および栄養関連障害のリスクを有する患者を判定する方法は，高齢者に特有なものがあるわけではない．しかし，高齢者特有の問題もある．1）嚥下機能障害，2）多剤投与（高齢者では多くの薬剤を服用しているケースが多く薬剤の影響を受けやすい），3）高度な日常生活動作（ADL）障害の存在，4）認知症，5）うつ，6）介護状態・環境の問題などは要介護高齢者の栄養管理をする上で重要である．従って，栄養評価をする際にこれらの問題を同時に評価し，栄養状態への影響を考慮する必要がある．

No potential conflicts of interest were disclosed.

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高齢者の栄養障害

3）居宅における栄養状態ならびに栄養管理の実態

Reality of nutritional status and nutritional care management in community-dwelling dependent elderly

榎　裕美／葛谷雅文

SUMMARY

居宅療養中の要介護高齢者の低栄養は，日常生活活動能力とは関係なく起こりうるといえ，嚥下機能および食事量や身体計測値などの栄養状態を，早い段階から定期的に評価していくことが予後を良好に保つ重要なポイントといえる。そのためには，介護保険制度の見直しを含めた要介護高齢者のための栄養ケアのシステム化が急務である。

KEY WORDS

- 要介護高齢者
- 低栄養
- 居宅療養管理指導
- 栄養管理

I　はじめに

高齢者の栄養障害は，重篤な基礎疾患のほかにも加齢を含む身体的な要因，うつやストレスなどの心理的要因および独居，経済的困窮などの社会的要因と，多くの要因が絡み合って起こる[1][2]。本稿では，居宅療養している高齢者の栄養状態および栄養管理の実態について，これまでにわれわれが関わった要介護高齢者を対象とした調査研究結果を中心に述べ，考察を加えていく。

II　居宅療養高齢者の栄養状態の実態について

高齢者を評価する栄養指標はさまざまであるが，ここでは体重，体格指数（BMI）を用いた身体計測指標とMini Nutritional Assessment®（MNA®）を用いた包括的栄養評価を使った居宅療養高齢者の栄養状態の実態について述べる。

介護保険制度での「栄養ケア・マネジメント」のシステムにおいては，低栄養のリスク者の判定の手法として，血清アルブミン濃度およびBMIの指標が用いられ，BMIが18.5kg/m²未満を示した場合，低栄養の「中リスク」に分類される。われわれが実施した，訪問看護サービスを使用している居宅療養中の要介護高齢者520名を対象とした研究では，BMIが18.5kg/m²未満の割合は男性で26.5%，女性で33.2%であった。BMIと2年後の生命予後との関連は，BMIが18.5kg/m²以上と比較して18.5kg/m²未満の男性は2.54倍，女性では2.95倍生命予後が悪いという結果が示された（図1）[3]。また，半年間の体重減少を栄養評価の指標とした居宅療養高齢者613名を対象とした研究[4]においては，研究登録時とその半年前の体重の変化を調査し，3kg以上の体重減少の認められた体重減少群と3kg以上の体重減少がなかった体重維持群の2群の背景因子の比較を行った。体重減少群は全体の13.9%であったが，研究登録時のBMIの平均値は20.5kg/m²で，先に述べた18.5kg/m²をカットオフ値とした場合には，低栄養のリスク者としてリストアップされないことになる。つまり，ワンポイントでのBMIなどの身体計測指標の評価は，緩やかな体重減少を見逃してしまう危険性があるということである。次に，2群間の背景因子の違いをみると，慢性閉塞性肺疾患（chronic obstructive pulmonary disease；COPD），5年以内の悪性腫瘍の罹患，直近3ヵ月間に入院があったこと，食事摂取量が少ないこと，嚥下機能が障害されていることが有意な因子として示された（表1）[4]。これらの結果から食事摂取量や嚥下機能については，明らかに低栄養と判定されるよりも前から定期的に評価をしていくことにより，緩やかな体重減少が止められる可能性があることを示唆している。

次に，包括的栄養評価法の1つであるMNA®を用いた結果を示す。デイケアを利用する比較的日常生活活動能力が保たれている281名の要介護高齢者の栄養状態と要介護度との関連を検討した研究において，MNA®によるスクリーニングの結果，全体の8.9%が栄養障害，51.2%が低栄養のリスクがあると判定されたことは[5]，要介護度が軽いにもかかわらず栄養障害のリスクがある者が多く認められ，栄養状態が悪化していても見過ごされている可能性を示している。また同様に，われわれが2012年度に実施した愛知県の居宅療養中の要介護高齢者610名を対象としたコホート調査の登録時の結果

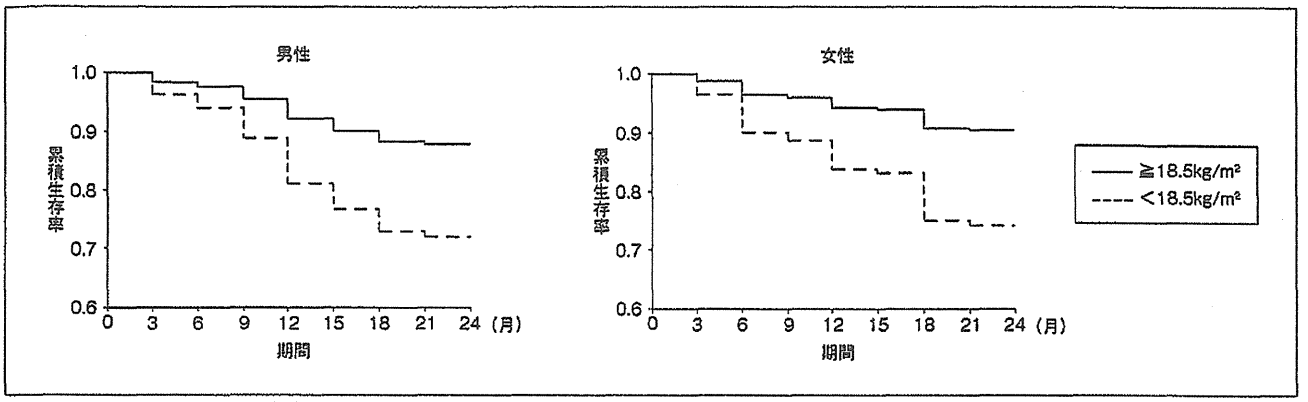

図1．BMIと生命予後との関連[3]

高齢者のBMI 18.5kg/m²以上と18.5kg/m²未満での生存率の比較を示す（年齢，基本的ADL，併存疾患，投薬法で調整，Kaplan-Meier法）。

表1．体重減少と関係する要因（ロジスティック回帰分析）[4]

	単変量		多変量（Model 1）		多変量（Model 2）	
	オッズ比（95%CI）	p値	オッズ比（95%CI）	p値	オッズ比（95%CI）	p値
食事摂取状況						
十分	1.00		1.00		1.00	
少し悪い	2.47（1.49～4.01）	<0.001	2.16（1.28～3.66）	0.004	1.99（1.16～3.40）	0.012
かなり悪い，摂取できない	3.24（0.98～10.7）	0.054	2.73（0.769～9.67）	0.120	2.57（0.72～9.15）	0.147
嚥下機能						
問題なし	1.00		1.00			
やや問題あり，問題あり	1.70（1.06～2.70）	0.027	1.69（0.99～2.85）	0.051	1.74（1.03～2.94）	0.040
直近3ヵ月の入院						
なし	1.00		1.00		1.00	
あり	2.17（1.13～4.16）	0.020	2.23（1.10～4.52）	0.026	1.88（0.91～3.90）	0.091

Model 1：性別，年齢，基本的ADL，併存疾患，CPSスコアで調整
Model 2：性別，年齢，基本的ADL，CPSスコア，悪性腫瘍・COPDの罹患で調整

において，要介護1，2の占める割合が全体の約60%であるにもかかわらず，MNA®の短縮版であるMNA®-Short Form（MNA®-SF）によるスクリーニングの結果，栄養状態に問題がなかったのは全体の約30%であった[6]。

以上より，居宅療養中の要介護高齢者の低栄養は，日常生活活動能力とは関係なく起こりうるといえ，食事摂取量や嚥下機能，身体計測値などの栄養状態を定期的に評価していくことが予後を良好に保つ重要なポイントといえる。

Ⅲ 居宅療養高齢者の栄養管理の実態について

ここまで述べたように居宅療養高齢者の栄養状態は，日常生活活動能力と関係なく，緩やかに悪化していると考えてよい。それでは，その栄養管理は今どのように行われているのか，行うためにはどのような介護保険の制度があるのか，またその制度の実施状況について述べる。

介護保険のもとでは，要介護高齢者が栄養ケアを受けるサービスは，「管理栄養士による居宅療養管理指導」のみである。この制度は，医師の指示により管理栄養士が栄養ケア計画に基づいて，栄養管理に係る情報提供および栄養相談または助言を30分以上行った場合に算定できるが，2009年に実施した加藤らの全国調査結果[7]では，回収率が10%と低いものの，回答のあった253病院と380診療所のうち，管理栄養士による居宅療養管理指導が算定されている施設は10病院，8診療所のみと，全体で約3%しか算定され

ておらず，今現在においても算定数が伸びていないのが現状である。一方，先に述べた2012年度にわれわれが実施したコホート調査[6]においては，調査を担当した介護支援専門員56名に対して栄養管理についてのアンケートを実施した。利用者のケアプランを立案する介護支援専門員がどのくらい利用者の栄養状態を把握しているか，また栄養管理を行っているか否かを調査するためである。栄養状態にリスクがある利用者の把握についての設問で，「すべて把握している」と回答した介護支援専門員は全体の12.5%，摂食・嚥下障害のある利用者の把握についても，「すべて把握している」との回答は14.3%であり，両者ともに「一部のみ把握している」という回答が最も多かった。このコホート調査で，栄養状態に問題がある利用者は約70%であったが，介護支援専門員の作成するケアプランに栄養管理，介入は盛り込まれていない。またわれわれの調査では，利用者の約1割が配食サービスを利用しており，これらに関しても栄養面はもちろん，食形態などの配慮がなされているかは疑問である。

また小山らの「管理栄養士による居宅療養管理指導」サービスを利用している要介護高齢者251名の調査[8]では，利用者の要介護4，5の割合が全体の50%を占め，基礎疾患として脳血管疾患の罹患が43%，片麻痺が38.4%に認められ，管理栄養士が介入を行うときには，すでに日常生活活動能力が低下しているうえに栄養状態が悪く，摂食・嚥下機能も極度に低下した状態であることが報告されている。したがって，早期に栄養評価を実施・介入できるような体制が求められている。

IV まとめ

本稿では，在宅で療養している高齢者の栄養状態と栄養管理の実態について，われわれが関与した要介護高齢者を対象とした調査研究結果をもとに概説した。今後，ますます高齢化が進む日本において，居宅ではもはや家族介護者などのマンパワーは得られないと考えられる。介護保険制度を有効に活用してもらうためには，栄養管理に関わる制度の見直しを含めた栄養ケアのシステム作りが必須である。

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〈原　著〉

在宅療養要介護高齢者の死亡場所ならびに死因についての検討

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要　約　目的：高齢社会の進行に伴い，高齢者の死亡者数の増加が想定されており，それに伴って死亡（看取り）場所についての議論もなされている．自宅死を規定する因子についての検討は，これまでいくつか報告されているが，いまだ明確な結論は出ていない．今回在宅要介護高齢者の死亡場所，死因について調査を行い，特に自宅死にかかわる因子について検討を行った．方法：自宅療養中の要介護高齢者を対象とした前向きコホート研究（NLS-FE）の参加者1,875名（65歳以上，平均年齢80.6歳，男性632名，女性1,243名）とその主介護者を3年間追跡し，死亡場所，死因について検討した．結果：3年間の観察期間中454名が死亡した（病院死347名，自宅死107名）．全体での死因は肺炎（22.7%），悪性腫瘍（14.5%），心不全（13.2%）の順で多く，自宅死では老衰（22.4%），心不全（18.7%）が多かった．病院死と比較すると，自宅死では女性の割合が多く，より高齢で，認知症が多く，悪性腫瘍が少なかった．また，主介護者因子としては，配偶者以外の主介護者が多かったが，主介護者の介護負担感，介護保険によるサービス（訪問看護，訪問介護，デイサービス）の利用率は両者で差を認めなかった．多重Cox比例ハザード分析により，自宅死に有意な関連を認めたものは，要介護者の年齢（より高齢）のみで糖尿病と悪性腫瘍の存在は負の関係を認めた．結論：今回の研究では，死亡場所を規定する因子としては，要介護者の年齢と，併存症として糖尿病ならびに悪性腫瘍の存在，また死因として肺炎や悪性腫瘍，老衰が抽出された．今回の調査では把握できなかった重要な因子が複数存在しており，今後更なる検討が必要である．

Key words：自宅死，病院死，死因，在宅高齢者

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緒　言

わが国では高齢化が進み，1974年に高齢化率が7%を突破し高齢化社会となり，その後世界に類を見ない速度で進行し，1994年には高齢化率14%に到達し高齢社会となった．その後2013年度の高齢社会白書では，平成23年度の日本における高齢者（65歳以上）の総人口の割合は23.3%と報告されるに至っている[1)]．高齢化の進行に伴い，高齢者死亡数の増加（多死社会）が想定されており，それに伴い，今後看取り場所が見つからない「看取り難民」の対応を含め，昨今死亡（看取り）場所についての議論も盛んに行われるようになってきている．

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これまで自宅死を規定する因子についての検討はいくつか報告されており，本人または介護者の意向[2)3)]や，疾患や介護環境などの因子[4)]が規定因子として挙げられているが，未だはっきりしたものはない．

今回我々は，在宅要介護高齢者の死亡場所，死因について調査を行い，特に自宅死にかかわる因子について検討を行った．

方　法

自宅療養中の要介護高齢者を対象とした前向きコホート研究（NLS-FE：Nagoya Longitudinal Study for Frail Elderly）の参加者1,875名（65歳以上，平均80.6歳，男性632名，女性1,243名）を対象とし，3年間追跡し，死亡場所，死因について調査した．NLS-FEは2003年から開始されたコホートで，65歳以上で要介護認定（要支援も含む）を受け，名古屋市高齢者療養サービス事業団に所属する訪問看護ステーション，または居宅介護支援事業所でケアプランまたは訪問看護サービスを受けている1,875名の要介護高齢者と主介護者により構成されている．本コホートの特徴として，訪問看護サービス利

用者と未利用者が約半数ずつ登録されている（訪問看護サービス利用者50.8%）．登録時に基本調査と，登録時から3カ月ごとにイベント調査として要介護者の入院，施設入所，死亡と介護者の罹患，入院を調査した．

検討項目としては，NLS-FEの登録時のデータ（要介護者の属性，社会的背景，基本的ADL(Barthel index)，併存症(Charlson Cormobidity index)，主要サービス(訪問看護サービス，訪問介護サービス，デイサービス）の使用状況，主介護者の属性，介護負担感(日本語版Zarit介護負担尺度))を基に，病院死と自宅死との要介護者，主介護者の背景を比較検討した．死亡原因に関しては3カ月毎に調査されたイベント調査（入院，施設入所，死亡，介護者の罹患，入院）を基にした．死因は訪問看護師または介護支援専門員（全員看護職）が家人またはかかりつけ医より得た情報を基にした．

解析法

本調査では介護施設への入所の時点で，登録者はそれ以後のフォローは中止している．したがって，本研究では施設（病院，自宅以外）での死亡または施設を経由しての病院での死亡は含まれていない．病院死群と自宅死群の比較にはカイ2乗検定，Student　t検定を用いた．自宅死に関連のある項目の検討にはCox比例ハザード分析を用いた．その際，死亡までの期間は登録から3カ月ごとのモニターのデータを使用した．要介護者の併存症としての「悪性腫瘍」は死亡原因に「悪性腫瘍」があるため，多変量解析のmodel 2には投入しなかった．また，死亡原因としての「老衰」は病院死群で1名だったため，多変量解析には投入しなかった．

倫理面への配慮

なお，本研究は名古屋大学倫理委員会の承認を得て実施した．十分なインフォームド・コンセントの後，必ず要介護者本人，主介護者の書面による同意書をもって登録とした．匿名化された情報は名古屋大学で厳重に管理し，全て集団的に分析し，個々のデータの提示などは行わず，個人のプライバシー保護に努めた．

結　果

3年間の観察中454人（病院死：347名，自宅死：107名）が死亡した．

病院死に比べ，自宅死では，女性の割合が多く，より高齢で，併存症では，認知症が多く，逆に糖尿病，悪性腫瘍は少なかった．介護環境の面では，自宅死では主介護者が配偶者の割合が病院死に比較して少なかった．介護負担感については，両群で差を認めなかった．介護保険サービスの使用状況は両者で差を認めなかった（表1）．在宅死の登録から死亡までの月数（3カ月毎の調査のため，正確な月数ではないことに注意）は16.3±11.1月，病院死は16.2±9.6月であり，2群間に統計的な有意差は認めなかった（p=0.930）．

図に死亡場所別主要な死因を示した．全死亡者数のうち，死亡原因は肺炎（22.7%），悪性腫瘍（14.5%），心不全（13.2%）の順で多く，自宅死では肺炎は少なく（病院死：92.2%：自宅死7.8%），悪性腫瘍も自宅での看取りは少なかった（病院死：97.0%：自宅死3.0%）．それに比較すると老衰では自宅死が多く（病院死：4.0%：自宅死96.0%），またその他死因に比較し心不全は比較的自宅での看取りが多かった（病院死：66.7%：自宅死33.3%）．

Cox比例ハザード分析（表2）では単変量解析で，自宅死に有意な関連を認めたものは，要介護者の性別（女性で自宅死が多い），高齢，高い要介護度，既往歴では認知症の存在であった．逆に既往症として糖尿病や悪性腫瘍の存在，主介護者が配偶者であることは自宅での看取りとは負の関連を認めた．一方，死因では老衰以外は肺炎，悪性腫瘍が自宅死の負の関連因子として抽出された．死因以外のこれらの因子を投入した多変量解析では，自宅死と関連があるものとして年齢（より高齢であること），糖尿病ならびに悪性腫瘍が存在していないことが有意な自宅死と関連していた（表2 model 1）．さらに死因である肺炎，悪性腫瘍（慢性疾患の悪性腫瘍の存在はこのモデルには投入せず）を投入すると，年齢，糖尿病の存在の関係は同様であり，死因の原因である肺炎，悪性腫瘍は自宅死とは負の関係にあった（表2 model 2）．

考　察

本研究は，在宅要介護高齢者とその介護者を対象とし，その死亡場所と死因についての検討を行ったものである．現在国の方針では，医療費削減，医療資源の適正配分を進めるため，自宅での死亡割合の目標を40%とし，在宅医療提供体制の充実や地域における高齢者の多様な居住の場を整備することを推進している[5]．しかし，2010年の厚生労働省人口動態調査では病院（診療所を含む）での死亡が80.3%，自宅が12.6%となっている[6]．それと比較すると今回の調査では，1,875名の対象のうち，454名が死亡し，そのうち347名（76.4%）が病院で死亡し，自宅での死亡は23.6%で，若干高い割合で自宅で看取られている．この結果は今回のコホート調査における対象の半数に訪問看護サービスの利用者が含まれており，