Ⅲ　研究成果の刊行に関する一覧表

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雑誌

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Kuzuya M Hirakawa Y	Increased caregiver burden associated with hearing impairment but not vision impairment in disabled community-dwelling older people in Japan.	Journal of the American Geriatrics Society	57 (2)	357-358	2009 Feb
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Hirakawa Y Kuzuya M Uemura K	Opinion survey of nursing or caring staff at long-term care facilities about end-of-life care provision and staff education	Archives of Gerontology and Geriatrics	49 (1)	43-48	2009 Jan-Aug
Kamioka Y Yoshino T Sugaya K Saito H Ohashi Y Iijima S	Goal-setting method and goal attainment measures in physical therapy for stroke patients: a system atic review.	Journal of Physical Therapy Science	21 (4)	399-415	2009
平川仁尚 葛谷雅文 植村和正	高齢者の終末期ケアに関する教育内容について	医学教育	40 (1)	61-64	2009
平川仁尚 植村和正	在宅介護家族の情報ニーズについて	日本老年医学会雑誌	46 (5)	462	2009
山口　潔 飯島　節	脳卒中、特に寝たきり患者の退院支援	Geriatric Medicine	47 (3)	305-309	2009
飯島　節	誰もが経験すべき老化と死	Geriatric Medicine	47 (4)	437-438	2009
飯島　節	高齢者の終末期の医療およびケアに関する日本老年医学会の立場表明とその後の展開	Geriatric Medicine	47 (4)	443－447	2009
小坂　陽一 佐藤　琢磨 佐々木英忠 荒井啓行	胃ろう造設と家族への教育	日本老年医学会雑誌	46	521-523	2009

樋口京子	高齢者の終末期における ケアマネジメント	ケアマネジメント学	8	31-38	2009
樋口京子	高齢者の終末期における ケアマネジメント	Geriatric Medicine	47 (4)	471-475	2009

Ⅳ　研究成果の刊行物・別刷

5. Penninx B, Pahor M, Cesari M et al. Anemia is associated with disability and decreased physical performance and muscle strength in the elderly. J Am Geriatr Soc 2004;52:719–724.
6. Smith DL. Anemia in the elderly. Am Fam Physician 2000;62:1565–1572.
7. Niranjan GV, Vasundhra MK. A study of health status of aged persons in slums of urban field practice area, Bangalore. Ind J Commun Med 1996;21:37–40.
8. Ahuja R, Swami HM, Bhatia V. Prevalence of anemia amongst the elderly in Chandigarh. Conference proceedings of the 3rd North Zone Conference of IAPSM. November 14–16, 2000, Patiala, Punjab, India.
9. Help Age India: Indian Scenario. Available at http://www.helpageindia.com/indiascene.html Accessed on September 18, 2006.

INCREASED CAREGIVER BURDEN ASSOCIATED WITH HEARING IMPAIRMENT BUT NOT VISION IMPAIRMENT IN DISABLED COMMUNITY-DWELLING OLDER PEOPLE IN JAPAN

To the Editor: It has been demonstrated that older people feel that hearing and vision impairments are substantially disabling, that these impairments are associated with lower-than-average quality of life, and that they predict future loss of functional abilities and independence.[1–5] However, whether these sensory impairments add to the burden of caregivers of disabled older people living in the community has not been evaluated.

The present study examined the association between vision or hearing impairment in community-dwelling older people with disabilities and the subjective burden of their caregivers. The study used baseline data on care recipient and family caregiver pairs in the Nagoya Longitudinal Study for Frail Elderly.[6,7] The study population consisted of 1,208 community-dwelling older people (448 men and 760 women; mean age ± standard deviation 80.9 ± 7.8, range 65–104) and paired caregivers (286 men and 922 women; mean age 64.7 ± 12.4, range 31–90). The baseline data included the recipients' demographic characteristics and basic activities of daily living (ADLs), physician-diagnosed chronic conditions including dementia, the presence of behavioral problems, living arrangement, and history of falls in the previous 6 months. Data were also obtained from caregivers concerning their own personal demographic characteristics, including caregiver relationship to care recipient, and the caregiver's subjective burden as assessed according to the Japanese version of the Zarit Burden Interview (ZBI),[8] which has an 88-point scale, with higher values indicating greater burden. The primary caregivers were also asked to rate their own current overall health in three categories of subjective health status. Recipients with vision or hearing impairment were identified according to a yes answer to the following question: "Do you have trouble seeing or hearing for daily life, even when wearing glasses or using a hearing aid?" When the recipients were unable to answer or had cognitive impairment, surrogates or caregivers were asked. The Student *t*-test and analysis of covariance (ANCOVA) were used to compare caregiver ZBI scores for recipients with and without sensory impairment. Covariates of ANCOVA included recipient sex, age, ADL score, presence or absence of dementia and behavior problems and caregiver sex, age, and subjective health status. To determine which variables were associated with ZBI score, a stepwise multiple linear regression analysis with a forward selection strategy was performed, using an *F* value with $P<.05$ as the selection criterion. All analyses were performed using SPSS version 16.0 (SPSS, Inc., Chicago, IL).

Table 1. Stepwise Multiple Linear Regression of Care Recipients' and Caregivers' Variables on Zarit Burden Interview Score

Variable	B	Standard Error	β	*P*-Value
Care recipient sex male	−2.610	1.063	−0.074	.01
Care recipient age	−0.181	0.072	−0.081	.01
ADL score (range 0–20)	−0.521	0.090	−0.176	<.001
Fall in previous 6 months	2.852	1.065	0.079	.008
Presence of behavioral problems	8.402	1.464	0.197	<.001
Presence of dementia	3.622	1.242	0.103	.004
Hearing impairment	3.645	1.160	0.100	.002
Health status of caregiver	3.344	0.773	0.130	<.001

Coefficient of determination (R^2) = 0.176; adjusted R^2 = 0.170.
The following variables were added to the analysis: care recipient age and sex, fall history in the previous 6 months, living arrangement, activity of daily living (ADL) scores, presence of dementia and behavioral problems, number of community-based services used, age and sex of caregiver, type of caregiver–care recipient relationship (spouse, child, daughter-in-law), and subjective health status of caregiver.

Of the care recipient participants, 334 (28.5%) had vision impairment and 387 (32.1%) had hearing impairment. Participants with impairment in vision or hearing were older on average. Although no difference in average caregiver ZBI score was observed between recipients with and without vision impairment (with vision impairment mean ± standard error, 29.8 ± 0.9; without 28.4 ± 0.6, $P=.22$ on Student *t*-test), a significantly higher average caregiver ZBI score was detected for recipients with hearing impairment than for those without (with hearing impairment, 31.3 ± 0.9; without 27.8 ± 0.6, $P<.001$). This statistical significance persisted even after adjusting for confounders (ANCOVA, with hearing impairment, 31.6 ± 0.9; without 27.4 ± 0.6, $P<.001$).

The stepwise multiple regression analyses revealed that the best set of predictors of caregiver burden was recipient sex, age, ADL score, fall history in the previous 6 months, presence or absence of dementia and behavioral problems associated with dementia, and hearing status and health status of caregiver (Table 1).

The present study demonstrated for the first time that hearing impairment of elderly care recipients is associated with greater caregiver burden. This association persists even after controlling for various possible confounding factors such as ADL status and the presence of chronic diseases, including dementia. However, vision impairment of recipients was not associated with caregiver burden. It has been reported that caregivers who desired more communication with patients had significantly higher caregiver burden scores than did caregivers who did not.[9] It is possible that hearing impairment of care recipients may affect recipient–caregiver communication more strongly than vision impairment.

There are potential limitations in this study. Hearing ability and visual activity were not evaluated using audiometry or direct measurement of visual acuity. Therefore, the evaluation of impairments may not be accurate. The present findings may not be generalizable to other populations given that health practices, a variety of social and economic factors, ethnic attitudes about caring for very old people, and the cost of health care may have influenced these results.

In conclusion, these results suggest that hearing impairment of care recipient is associated with caregiver burden in Japan, even after adjusting for potential confounders. It is possible that improvement in hearing or correcting hearing impairment may lead to reduced caregiver burden.

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REFERENCES

1. Dargent-Molina P, Hays M, Bréart G. Sensory impairments and physical disability in aged women living at home. Int J Epidemiol 1996;25:621–629.
2. Keller BK, Morton JL, Thomas VS et al. The effect of visual and hearing impairments on functional status. J Am Geriatr Soc 1999;47:1319–1325.
3. Chia EM, Mitchell P, Rochtchina E et al. Association between vision and hearing impairments and their combined effects on quality of life. Arch Ophthalmol 2006;124:1465–1470.
4. Lin MY, Gutierrez PR, Stone KL et al. Study of Osteoporotic Fractures Research Group. Vision impairment and combined vision and hearing impairment predict cognitive and functional decline in older women. J Am Geriatr Soc 2004;52:1996–2002.
5. Wallhagen MI, Strawbridge WJ, Shema SJ et al. Comparative impact of hearing and vision impairment on subsequent functioning. J Am Geriatr Soc 2001;49:1086–1092.
6. Kuzuya M, Hirakawa Y, Suzuki Y et al. Association between unmet needs for medication support and all-cause hospitalization in community-dwelling disabled elderly people. J Am Geriatr Soc 2008;56:881–886.
7. Kuzuya M, Masuda Y, Hirakawa Y et al. Day care service use is associated with lower mortality in community-dwelling frail older people. J Am Geriatr Soc 2006;54:1364–1371.
8. Arai Y, Kudo K, Hosokawa T et al. Reliability and validity of the Japanese version of the Zarit Caregiver Burden interview. Psychiatry Clin Neurosci 1997;51:281–287.
9. Fried TR, Bradley EH, O'Leary JR et al. Unmet desire for caregiver-patient communication and increased caregiver burden. J Am Geriatr Soc 2005;53:59–65.

STROKE IN ELDERLY PEOPLE: A GREAT CHALLENGE FOR THE 21ST CENTURY

To the Editor: The recent population-based epidemiological studies covering the end of the 20th and the beginning of the 21st centuries have largely contributed to emphasizing the burden of stroke in elderly people in developed countries.[1–3] Their findings have provided clear evidence of a dramatic increase in the absolute number of cerebrovascular events in people aged 80 and older over the last past 20 years due to the aging of the population of these countries. Hence, the profile of patients admitted to stroke units and emergency departments has changed considerably, because the mean age at stroke onset is now significantly older than in the past.[1–3] Nevertheless, randomized clinical trials conducted so far have systematically excluded elderly people from enrollment. As a result, these patients have been denied the opportunity to benefit from therapeutic strategies, including thrombolysis, whose efficacy in reducing mortality and handicap after ischemic stroke has been demonstrated in younger patients.[4] Consequently, for physicians, there is currently a lack information concerning evidence-based acute therapeutic strategies to use in patients aged 80 and older in day-to-day practice of vascular neurology. The problem is similar for secondary prevention, which is consequently limited in this age group, particularly concerning the use of anticoagulants in elderly patients with stroke with atrial fibrillation.

The absence of such strategies is alarming, given that demographic projections clearly indicate that the number of elderly people is expected to increase. Hence, in Europe, the proportion of the population aged 65 and older, in which most stroke events occur, will increase from 20% in 2000 to 35% in 2050, leading to continued growth in the number of older stroke patients in the community.[5] Therefore, the improvement in stroke outcome observed between the end of the 20th century and the beginning of the 21st,[3] which is related, at least in part, to better acute management of patients, will probably be rapidly annihilated if elderly people continue to be excluded from large randomized trials. Furthermore, such a scenario would inevitably be associated with a considerable socioeconomic effect, because older stroke patients have a longer hospital stay and are less likely to be discharged to their original place of residence.[6]

Epidemiological studies have played their role by pointing out the threat of the increasing burden on healthcare systems of stroke in elderly people. It is now essential and urgent for scientists to design new clinical trials recruiting patients aged 80 and older to provide the means to respond to this demographic evolution.

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Urinary incontinence and behavioral symptoms are independent risk factors for recurrent and injurious falls, respectively, among residents in long-term care facilities

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ABSTRACT

Numerous risk factors of falls, including urinary incontinence and behavioral symptoms have been identified among elderly people in long-term care settings. However, it remains uncertain whether incontinence or behavioral symptoms are associated with recurrent falls and injurious falls. The purpose of this research was to examine the association between various types of falls and urinary incontinence or behavioral symptoms among the residents of long-term care facilities using the Cox proportional hazards models. The participants were 1082 older people (327 men and 755 women) who were admitted to facilities between 1 April 2003 and 31 March 2004. Fall experience, urinary incontinence, and behavioral symptoms were followed for up to 6 months or until death or discharge. The functional status, comorbidity, and prescribed medications were determined at the baseline. Multivariate analysis revealed that urinary incontinence and behavioral symptoms were independent risk factors of falls during the follow-up period. However, urinary incontinence was a risk factor for recurrent falls but not for injurious falls. In contrast, behavioral symptoms were an independent risk factor for injurious but not for recurrent falls. The results suggested that treatment or management of urinary incontinence and behavioral symptoms should be considered to prevent falls in long-term care settings.

1. Introduction

In older people, falls are associated with mortality and morbidity, functional decline, and loss of independence. About one-third of older people living in the community and more than 50% of those living in resident care facilities or nursing homes fall every year, and about half of those experience recurrent falls (Tinetti et al., 1988; Nevitt et al., 1989). Therefore, falls are a major health concern in elderly care not only in the community, but also in residential facilities.

Unintentional injury due to falls is a serious health problem among elderly people. Fall-related injuries represent one of the common causes of longitudinal pain, functional impairment, disability, and death in older people (Kannus et al., 2005a). Injury is the fifth cause of death in older people (Kannus et al., 2005b), and falls are responsible for two-thirds of the deaths resulting from unintentional injuries (American Geriatrics Society et al., 2001). Older people who fall even without injury often limit their activity, which leads to further functional decline, muscle weakness, disability, and risk of further falls.

Urinary incontinence and behavioral symptoms, which are common problems among residents in long-term care settings, have been demonstrated as risk factors for falls (Kiely et al., 1998; Brown et al., 2000; Kron et al., 2003). However, among the various types of falls that the elderly experience, including falls with or without injuries and single fall or recurrent falls, it remains uncertain whether urinary incontinence or behavioral symptoms are associated with those various types of falls.

The purpose of this research was to examine the association between various types of falls and urinary incontinence or behavioral symptoms among the residents of long-term care facilities using Cox proportional hazards models.

2. Methods

2.1. Study participants

The study population was a cohort of all residents newly institutionalized to 13 randomly selected long-term care facilities in Nagoya city and in the suburbs of Nagoya city, Japan, between 1 April 2003 and 31 March 2004. The participants were 1082

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disabled older people (327 men and 755 women) of mean age 82.5 ± 8.5 (mean ± SD) years who were admitted to facilities between 1 April 2003 and 31 March 2004, and were followed for up to 6 months or until death or discharge. Elderly people who are institutionalized in long-term care facilities are eligible for the long-term care insurance program, which was established in 2000 in Japan. These elderly people all have at least some physical or mental impairment. The present study included all long-term care residents, including older persons who were bed-bound. The study was conducted according to procedures approved by the Institutional Review Board of Nagoya University Graduate School of Medicine.

2.2. Data collection

One physician collected outcomes, including falls, fall-related injuries, and the day the fall occurred, from long-term care facility charts, mainly through review of physician order sheets, physicians' progress notes and nurses' notes. In this study, a fall was defined as a sudden, unexpected descent from a standing, sitting, or horizontal position, and slipping from a chair or wheelchair. Patients found down on the floor were also included in falls (Fischer et al., 2005). A fall-related injury was defined as fractures, joint dislocations, head injuries, or soft tissue injuries resulting in the loss of consciousness and hospitalization.

The following data at admission were also obtained from long-term care facility charts as the participant background. The data included the physical status of patients and the following diagnosed chronic diseases: non-traumatic all fractures, arthritis, cerebrovascular disease, dementia, hypertension, ischemic heart disease, chronic heart failure, diabetes mellitus, and events during placement (e.g., urinary incontinence and behavioral symptoms). The behavioral symptoms included wandering, agitation, verbally or physically abusive behavior, and resistance to care. The physical functional status was divided into three categories: well, very independent for basic activities of daily life (ADL); moderate, partially dependent on assistance for basic ADL; poor, poor or almost completely dependent for all items of basic ADL, a category which included bed-bound participants.

The data also included the prescribed medications, including antiplatelets, all antihypertensive drugs (e.g., antiplatelets, diuretics, nitrates, calcium channel blockers (CCBs), angiotensin-converting enzyme inhibitor (ACEI)), benzodiazepine, hypnotics/anxiolytics, antipsychotics, and antidepressants.

2.3. Statistical analysis

Patients were assigned to three categories according to their status with respect to falls: those with or without falls during the follow-up period, those with falls with or without serious injury, and those with single fall or with multiple falls.

The χ^2-test or Student t-test was used to compare the background of the two groups. A Cox proportional hazards regression models or the Kaplan–Meier method were used to compare time (days) from institutionalization to first fall, injury occurrence, or second fall (for multiple falls analysis) and to determine the factor associated with these events. The covariates included in the multivariate Cox hazards analysis were variables to be associated with various types of falls with $p < 0.1$ in univariate

Table 1
Participants characteristics at baseline and the Cox proportional hazards model for falls.

	Non-faller	Faller	p	Univariate		Multivariate[a]	
	n = 818	n = 264		HR	95% CI	HR	95% CI
Men (% of total)	30.4	29.5	0.783	1.05	0.80–1.36	1.00	0.76–1.32
Age, mean ± SD	82.4 ± 8.5	82.8 ± 8.5	0.554	1.01	0.99–1.02	1.01	0.99–1.02
Physical function (% of total)[b]							
Well	33.0	30.8		1.00		1.00	
Moderate	42.0	58.6	<0.001	1.52	1.16–1.99	1.51	1.15–1.98
Poor	24.9	10.6		0.55	0.36–0.84	0.62	0.40–0.95
Chronic diseases (% of total)							
Non-traumatic all fracture	22.4	24.2	0.529	1.06	0.80–1.41		
Arthritis	15.0	18.2	0.647	1.20	0.88–1.64		
Cerebrovascular disease	45.4	47.0	0.647	1.12	0.88–1.42		
Dementia	45.1	46.6	0.674	1.13	0.89–1.44		
Hypertension	47.8	50.4	0.466	1.06	0.83–1.35		
Ischemic heart disease	16.1	17.0	0.729	1.02	0.74–1.41		
Congestive heart failure	28.9	27.3	0.614	0.95	0.73–1.25		
Diabetes mellitus	14.5	12.5	0.405	0.81	0.56–1.17		
Events during placement (% of total)							
Incontinence	12.1	30.7	<0.001	2.38	1.83–3.09	2.14	1.63–2.79
Behavioral symptom	7.2	13.3	0.002	1.67	1.17–2.38	1.45	1.00–2.09
No. of medication, mean ± SD[b]	3.7 ± 2.5	4.2 ± 3.0	0.007	1.06	1.01–1.11		
Medication use (% of total)							
Antiplatelets	22.0	23.1	0.708	1.10	0.82–1.46		
Antiplatelets	19.6	17.8	0.528	0.94	0.69–1.29		
Nitrates	13.0	12.1	0.723	0.91	0.63–1.32		
Calcium channel blocker (CCB)	24.6	32.6	0.010	1.32	1.02–1.71	1.20	0.92–1.56
Angiotensin-converting enzyme inhibitor (ACEI)	10.5	10.6	0.966	0.92	0.62–1.37		
Antihypertensive drug others than CCB and ACE I	10.0	14.8	0.033	1.46	1.04–2.06	1.24	0.88–1.76
Benzodiazepines (BZP)	18.0	24.2	0.025	1.45	1.09–1.92	1.31	0.98–1.75
Non-BZP	3.9	3.8	0.928	0.99	0.53–1.86		
Hypnotics/anxiolytics	20.8	26.5	0.051	1.38	1.05–1.81		
Psychotropics	9.5	11.7	0.300	1.23	0.84–1.79		
Antipsychotics	6.4	7.6	0.490	1.19	0.76–1.88		
Antidepressants	4.2	5.3	0.431	1.25	0.73–2.14		

[a] All of the listed variables were entered in the model.
[b] Student t-test. Others were analyzed by χ^2-test.

analysis. The risk of a variable was expressed as a hazard ratio (HR) with a corresponding confidence interval (CI). All analyses were performed using SPSS Version 15.0J (SPSS, Inc., Chicago, IL). p-Values less than 0.05 were considered significant.

3. Results

Table 1 shows the comparison of the characteristics of the baseline data of participants with or without fall experience during the 6-month interval. There were 264 fallers, which is 24.4% (264/1082) of the study population. A higher rate of moderate physical function, experiences of incontinence and behavioral symptoms, and higher average number of prescribing medications at institutionalization were observed in participants with fall experience during the follow-up periods. A higher rate of CCB and benzodiazepines use was observed in participants who had experienced falls. However, there were no significant differences between groups in gender, age, and prevalence rates of various chronic diseases including hypertension, congestive heart failure, cerebrovascular disease, arthritis, dementia, and diabetes mellitus. In addition, there were no differences in the prevalence rates of the history of non-traumatic fractures between groups.

Table 1 also shows the univariate and multivariate Cox proportional hazards models to identify the factors associated with fall experiences and time after institutionalization. In univariate analysis, various factors, including moderately impaired physical function levels, presence of urinary incontinence or behavioral symptoms, use of CCB, other anti-hypertensive medications besides CCB and ACEI, benzodiazepines, or hypnotics/anxiolytics use was associated with fallers. However, multivariate analysis revealed that only moderately impaired physical function and the presence of urinary incontinence or behavioral symptoms during the follow-up period were associated with fallers.

Table 2 shows the baseline characteristic of different categories according to their status with respect to falls: those with falls with or without injury, and those with single fall or with recurrent falls. A higher prevalence of ischemic heart disease and congestive heart failure, higher prevalence of behavioral symptoms during the follow-up period, and higher rate of use of diuretics, nitrates, benzodiazepine, and hypnotics/anxiolytics were observed in participants with injurious falls. In contrast, there was a difference in the prevalence of incontinence between participants with a single fall and those with recurrent falls.

Kaplan–Meier curves of the cumulative incidence of injurious falls and recurrent falls among fallers during a 180-day period according to participants with or without urinary incontinence or behavioral symptoms demonstrated that the presence of incontinence increased recurrent falls (log rank test, $p = 0.036$), but not injurious falls ($p = 0.101$), whereas behavioral symptoms increased injurious falls (log rank test, $p < 0.001$) but not recurrent falls ($p = 0.929$) (Fig. 1).

Table 3 provides the results of the crude and multivariate Cox proportional hazards models to examine the HR of participants who reported urinary incontinence or behavioral symptoms for injurious fall experience or recurrent fall experience. In the crude

Table 2
Comparison of fallers according to with or without injuries, and single or recurrent falls.

	Faller, n = 264					
	Injury (−) n = 195	Injury (+) n = 69	p	Single n = 157	Recurrent n = 107	p
Men (% of total)	30.3	27.5	0.6704	28.0	31.8	0.5120
Age, mean ± SD[a]	82.1 ± 8.6	84.8 ± 8.1	0.0238	82.4 ± 8.8	83.3 ± 8.1	0.3960
Physical function (% of total)						
Well	32.0	27.5		33.8	26.4	
Moderate	58.8	58.0	0.4430	53.5	66.0	0.1104
Poor	9.3	14.5		12.7	7.5	
Chronic diseases (% of total)						
Non-traumatic all fracture	23.6	26.1	0.6774	27.4	19.6	0.1485
Arthritis	19.0	15.9	0.5746	17.2	19.6	0.6154
Cerebrovascular disease	48.2	43.5	0.4989	47.8	45.8	0.7521
Dementia	46.7	46.4	0.9669	50.3	41.1	0.1414
Hypertension	50.3	50.7	0.9467	46.5	56.1	0.1265
Ischemic heart disease	12.8	29.0	0.0021	19.1	14.0	0.2803
Congestive heart failure	22.1	42.0	0.0014	26.1	29.0	0.6088
Diabetes mellitus	14.4	7.2	0.1247	11.5	14.0	0.5379
Events during placement (% of total)						
Incontinence	33.3	23.2	0.1163	24.2	40.2	0.0057
Behavioral symptom	8.7	26.1	0.0003	14.0	12.1	0.6612
No. of medication at admission (mean ± SD)[a]	4.1 ± 2.9	4.2 ± 3.0	0.8298	4.0 ± 2.9	4.4 ± 3.0	0.2067
Medication use (% of total)						
Antiplatelets	21.5	27.5	0.3097	24.2	21.5	0.6082
Diuretics	14.4	27.5	0.0139	17.8	17.8	0.9871
Nitrates	8.7	21.7	0.0044	12.7	11.2	0.7095
Calcium channel blocker (CCB)	33.8	29.0	0.4590	30.6	35.5	0.4004
Angiotensin-converting enzyme inhibitor (ACEI)	10.8	10.1	0.8849	10.8	10.3	0.8872
Antihypertensive drug others than CCB and ACE I	15.4	13.0	0.6376	14.0	15.9	0.6734
Benzodiazepines (BZP)	21.0	33.3	0.0403	22.3	27.1	0.3706
Non-BZP	3.1	5.8	0.3090	2.5	5.6	0.2011
Hypnotics/anxiolytics	23.1	36.2	0.0334	24.2	29.9	0.3027
Psychotropics	10.8	14.5	0.4090	10.8	13.1	0.5761
Antipsychotics	6.2	11.6	0.1422	7.0	8.4	0.6719
Antidepressants	5.1	5.8	0.8313	5.7	4.7	0.7060

[a] Student t-test. Others were analyzed by χ^2-test.

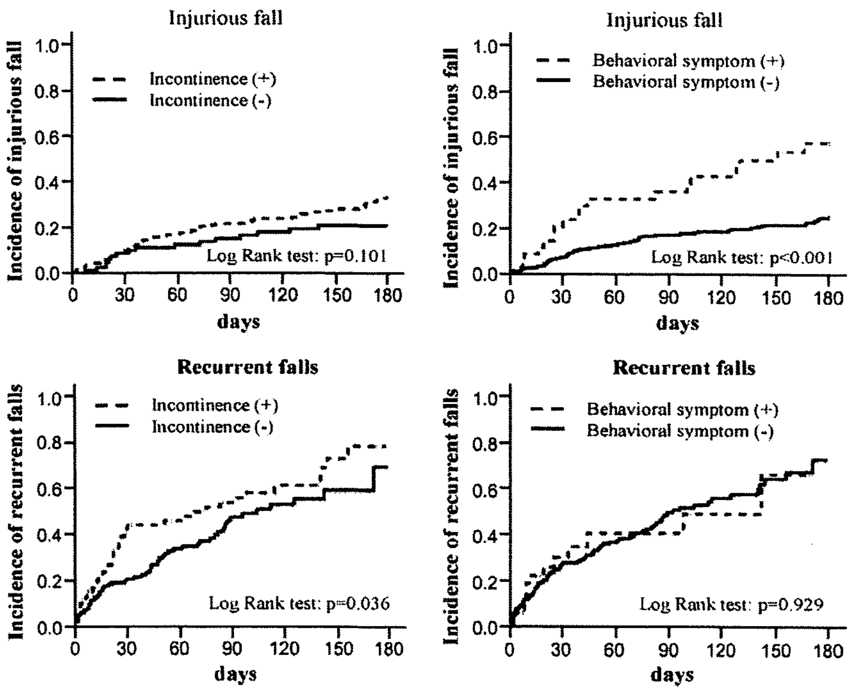

Fig. 1. Kaplan–Meier curves of the cumulative incidence of injurious falls and recurrent falls among fallers (n = 264) during a 180-day period according to participants with or without urinary incontinence or behavioral symptoms.

models, participants with incontinence were significantly associated with injurious falls when compared with non-fallers, but not associated with injurious falls when compared with non-injurious fallers among fallers. However, an adjustment with confounders lost this association. Urinary incontinence was associated with participants with recurrent falls in crude as well as in multivariate models compared both with non-fallers and with single fallers among fallers. In contrast, the presence of behavioral symptoms during the follow-up period was associated with injurious falls in the crude models compared both with non-fallers and with non-injurious falls among fallers. These associations persisted even after adjustment with potential confounders. However, the presence of behavioral symptoms was not associated with recurrent falls in the multivariate models or in the crude models.

Table 3
Cox proportional hazards models for injurious and recurrent falls.

Falls	Incontinence			Behavioral symptom		
	HR	95% CI	p	HR	95% CI	p
Injurious fall						
Vs. non-fallers						
Unadjusted	1.90	1.09–3.33	0.0243	3.81	2.22–6.52	<0.001
Adjusted[a]	1.48	0.82–2.67	0.1925	2.96	1.65–5.33	<0.001
Vs. non-injury among fallers						
Unadjusted	0.63	0.36–1.10	0.1049	2.93	1.71–5.01	<0.001
Adjusted[b]	0.67	0.38–1.18	0.1627	2.24	1.24–4.06	0.0077
Recurrent falls						
Vs. non-fallers						
Unadjusted	3.55	2.41–5.22	<0.001	1.55	0.87–2.78	0.1365
Adjusted[c]	3.07	2.05–4.61	<0.001	1.09	0.59–2.03	0.7740
Vs. single fall						
Unadjusted	1.51	1.02–2.22	0.0386	1.03	0.57–1.84	0.9297
Adjusted[d]	1.61	1.08–2.40	0.0206	0.91	0.50–1.66	0.7667

[a] Adjusted for gender, age, physical function, presence of ischemic heart disease, congestive heart failure, delirium (incontinence), use of diuretics, nitrates, CCB, or antihypertensive drug other than CCB and ACEI, benzodiazepines and antipsychotics.

[b] Adjusted for gender, age, presence of confusion (incontinence), use of diuretics, nitrates, or antipsychotics.

[c] Adjusted for gender, age, physical function, presence of delirium (incontinence), use of CCB, or antihypertensive drug other than CCB and ACEI, and benzodiazepines.

[d] Adjusted for gender, age, physical function, presence of confusion (incontinence), and use of benzodiazepines.

4. Discussion

In the present study, we identified various factors associated with fall experience during a 6-month period among a first-time institutionalized cohort of long-term care residents. This study analyzed three different outcome measures of falls in an elderly institutionalized population: at least one fall (>1 fall) vs. no falls, injurious falls vs. non-injurious falls among fallers or no falls, and recurrent falls (>2 falls) vs. one fall or no falls.

Although early studies suggested that increased age and female sex were risk factors for falls (Haga et al., 1986; Rubenstein et al., 1994), age and gender were not independent predictors of falls in this study, in agreement with most recent studies which, regardless of the setting, have not reported age as a predictor of fall and gender.

Benzodiazepines or hypnotics/anxiolytics use was associated with falls in the crude model in agreement with previous observations in the community and in long-term care settings (Lawlor et al., 2003; Avidan et al., 2005). However, after adjustment for confounders, no association was observed between the use of these medications and falls in this cohort. The number of chronic diseases, such as dementia (Van Doorn et al., 2003), coronary heart disease, arthritis (Lawlor et al., 2003), diabetes mellitus (Maurer et al., 2005), and cerebrovascular disease (Salgado et al., 2004) have been demonstrated as fall risks among older people. However, in this cohort there was no association between these chronic diseases and falls. Although we do not know the reason for these differences, it is possible that our participants were older and more frail than those in other studies.

We observed that moderate physical impairment was a predictor of falls but lowest physical function was not. Lower physical function and the use of an assistive device were both associated with an increased risk of falling (Rubenstein et al., 1994). However, we also found that the incidence of falls and injurious falls among persons who could not walk or stand was less than those who could. Nonambulatory residents might have reduced exposure to opportunities to fall (Thapa et al., 1996; Lord et al., 2003).

Urinary incontinence has been demonstrated as the predictor of falls among institutionalized frail elderly and community-dwelling older people (Brown et al., 2000; Kron et al., 2003). Behavioral symptoms, including wandering and agitation, have been demonstrated to be associated with an increased risk of falls in long-term care facilities (Kiely et al., 1998; Kron et al., 2003). We consistently observed a significant association between urinary incontinence and behavioral symptoms, and fall experience among institutionalized elderly people. However, when we examined the HR of urinary incontinence and behavioral symptoms for various types of falls, injurious falls and recurrent falls, urinary incontinence was an independent predictor for recurrent falls but not for injurious falls. In contrast, behavioral symptoms were an independent predictor for injurious falls but not for recurrent falls. These relationships were similar when HR was compared between non-faller participants and participants with non-injurious or single falls. These results may indicate that behavioral symptoms such as wandering may be related to serious falls leading to injury among disabled older persons, whereas urinary incontinence may not lead to serious falls, but contribute to the number of falls among institutionalized older people. It should be noted that it is possible that antipsychotics may be involved in the association between behavioral symptoms and injurious falls. However, the association persisted even after adjusting for antipsychotic use, indicating that behavioral symptoms are an independent predictor of injurious fall, at least in this cohort.

There are potential limitations in this study. Because of the observational design, the significance of the incontinence and behavioral symptoms for injurious or recurrent fall risk in the present study could be due to unmeasured factors, including the use of physical restraints, visual and balance impairment, and the presence of dizziness or orthostatic/postprandial hypotension. In the analysis, baseline data of medication use was included, but changes in medication during the follow-up period were not considered. Another limitation of this study was that there was no information on the circumstances of the fall, such as the activity being performed before the fall and during the fall, both of which may be informative in establishing the cause of a fall.

5. Conclusions

The findings of this study will be of assistance in identifying intervention strategies for subgroups of residents in residential aged care facilities. Urinary incontinence and behavioral symptoms are potential risk factors of recurrent falls and injurious falls, respectively, among elderly people in long-term care settings. Urinary incontinence and behavioral symptoms are potentially modifiable. Treatment or management of urinary incontinence and behavioral symptoms should be considered to prevent falls in long-term care settings.

Conflict of interest statement

None.

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References

American Geriatrics Society, British Geriatrics Society, American Academy of Orthopaedic Surgeons Panel on Falls Prevention, 2001. Guideline for the prevention of falls in older persons. J. Am. Geriatr. Soc. 49, 664–672.

Avidan, A.Y., Fries, B.E., James, M.L., Szafara, K.L., Wright, G.T., Chervin, R.D., 2005. Insomnia and hypnotic use, recorded in the minimum data set, as predictors of falls and hip fractures in Michigan nursing homes. J. Am. Geriatr. Soc. 53, 955–962.

Brown, J.S., Vittinghoff, E., Wyman, J.F., Stone, K.L., Nevitt, M.C., Ensrud, K.E., Grady, D., 2000. Urinary incontinence: does it increase risk for falls and fractures? Study of Osteoporotic Fractures Research Group. J. Am. Geriatr. Soc. 48, 721–725.

Fischer, I.D., Krauss, M.J., Dunagan, W.C., Birge, S., Hitcho, E., Johnson, S., Costantinou, E., Fraser, V.J., 2005. Patterns and predictors of inpatient falls and fall-related injuries in a large academic hospital. Infect. Control Hosp. Epidemiol. 26, 822–827.

Haga, H., Shibata, H., Shichita, K., Matsuzaki, T., Hatano, S., 1986. Falls in the institutionalized elderly in Japan. Arch. Gerontol. Geriatr. 5, 1–9.

Kannus, P., Sievänen, H., Palvanen, M., Järvinen, T., Parkkari, J., 2005a. Prevention of falls and consequent injuries in elderly people. Lancet 366, 1885–1893.

Kannus, P., Parkkari, J., Niemi, S., Palvanen, M., 2005b. Fall-induced deaths among elderly people. Am. J. Public Health 95, 422–424.

Kiely, D.K., Kiel, D.P., Burrows, A.B., Lipsitz, L.A., 1998. Identifying nursing home residents at risk for falling. J. Am. Geriatr. Soc. 46, 551–555.

Kron, M., Loy, S., Sturm, E., Nikolaus, T., Becker, C., 2003. Risk indicators for falls in institutionalized frail elderly. Am. J. Epidemiol. 158, 645–653.

Lawlor, D.A., Patel, R., Ebrahim, S., 2003. Association between falls in elderly women and chronic diseases and drug use: cross sectional study. Br. Med. J. 327, 712–717.

Lord, S.R., March, L.M., Cameron, I.D., Cumming, R.G., Schwarz, J., Zochling, J., Chen, J.S., Makaroff, J., Sitoh, Y.Y., Lau, T.C., Brnabic, A., Sambrook, P.N., 2003. Differing risk factors for falls in nursing home and intermediate-care residents who can and cannot stand unaided. J. Am. Geriatr. Soc. 51, 1645–1650.

Maurer, M.S., Burcham, J., Cheng, H., 2005. Diabetes mellitus is associated with an increased risk of falls in elderly residents of a long-term care facility. J. Gerontol. A: Biol. Sci. Med. Sci. 60, 1157–1162.

Nevitt, M.C., Cummings, S.R., Kidd, S., Black, D., 1989. Risk factors for recurrent nonsyncopal falls. A prospective study. J. Am. Med. Assoc. 261, 2663–2668.

Rubenstein, L.Z., Josephson, K.R., Robbins, A.S., 1994. Falls in the nursing home. Ann. Intern. Med. 121, 442–451.

Salgado, R.I., Lord, S.R., Ehrlich, F., Janji, N., Rahman, A., 2004. Predictors of falling in elderly hospital patients. Arch. Gerontol. Geriatr. 38, 213–219.

Thapa, P.B., Brockman, K.G., Gideon, P., Fought, R.L., Ray, W.A., 1996. Injurious falls in nonambulatory nursing home residents: a comparative study of circumstances, incidence, and risk factors. J. Am. Geriatr. Soc. 44, 273–278.

Tinetti, M.E., Speechley, M., Ginter, S.F., 1988. Risk factors for falls among elderly persons living in the community. N. Engl. J. Med. 319, 1701–1707.

Van Doorn, C., Gruber-Baldini, A.L., Zimmerman, S., Hebel, J.R., Port, C.L., Baumgarten, M., Quinn, C.C., Taler, G., May, C., Magaziner, J., 2003. Epidemiology of Dementia in Nursing Homes Research Group. Dementia as a risk factor for falls and fall injuries among nursing home residents. J. Am. Geriatr. Soc. 51, 1213–1218.

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The longitudinal change in anthropometric measurements and the association with physical function decline in Japanese community-dwelling frail elderly

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Although anthropometric parameters have been extensively studied regarding their relationship to physical function status, the association between these parameters and the activity of daily living (ADL) function remains controversial. We investigated whether BMI or mid-upper arm circumference (AC) is an indication of variation in the physical functioning of the frail elderly. The present study was a prospective cohort analysis of 543 community-dwelling frail elderly. Data included the participants' demographic characteristics, basic ADL, comorbidity and anthropometric measurements at baseline and at 2-year follow-up. Logistic regression models were used to investigate the association between ADL status and anthropometric measurements during the study period. Among the 543 participants, 418 maintained or improved their ADL status, while 125 showed an ADL decline during the study period. Multivariate logistic regression analysis showed that BMI and AC levels or ADL status at baseline were not independent predictors of the loss of ADL function or the decline in these anthropometric measurements during the study period, respectively. However, the decline in BMI and AC levels and the loss of ADL function were associated with each other during the study period. There is an association between the negative changes in anthropometric measurements during the follow-up period and the decline in ADL function during a 2-year follow-up in community-dwelling frail elderly.

Activities of daily living: Declining anthropometric measurement: Declining activity of daily living score: Elderly

The decline in physical performance is directly linked to the negative consequences of the reduced health and quality of life of elderly people. A number of studies have demonstrated relationships between physical disability and nutritional status, including anthropometric measurements, in the elderly[1,2]. Among anthropometric parameters, weight and BMI have been extensively studied in terms of their relationship with physical function status. In cross-sectional analysis, community-dwelling older people with BMI 30 kg/m^2 or higher than 30 kg/m^2 were associated with a greater probability of functional limitation[3–6]. In contrast, severe disability in institutionalised elderly subjects was associated with low waist/hip ratio[7]. Longitudinal studies have demonstrated that weight loss is associated with an increase in the risk of becoming disability compared with weight stability in community-dwelling elderly[8–11]. In contrast, it has been reported that obesity (BMI: 35 kg/m^2 or greater) and weight gain are risk factors for functional decline between 3 and 4 years later in mean aged 71 years participants[12]. Thus, the causal relationships between anthropometric measurements and physical functional ability remain controversial.

Most prior studies utilise body weight or BMI as an anthropometric parameter to examine the relationships between nutritional status and functional ability. We recently reported that the height and weight of older people with activity of daily living (ADL)[13,14] impairment are not likely to be measured at home or to be regularly measured in the community[15]. In fact, approximately one-third of disabled elderly living at home lack recent height or weight measurements[15]. We proposed that anthropometric measurements of the mid-arm may be a more practical and suitable index not only for nutritional assessment but also for capturing the vulnerable subset of older people living in the community[16]. However, no data were available concerning the relationships between mid-arm measurements and ADL status.

In the present study, we investigated whether anthropometric measurements such as the BMI and mid-arm circumference (AC) of frail elderly individuals are an accurate indication of variation in their physical functioning using a prospective cohort study of community-dwelling frail elderly.

Methods

Subjects

The present study employed baseline data for the subgroup of participants in the Nagoya Longitudinal Study for Frail Elderly and data on the mortality and hospitalisation of these participants during the 2-year follow-up period. Details

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Abbreviations: AC, arm circumference; ADL, activity of daily living; AMA, arm area; TSF, triceps skin fold.

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of the participants and the Nagoya Longitudinal Study for Frail Elderly have been published elsewhere[17,18]. The study population consisted of 952 community-dwelling frail elderly (men: 355, mean age 78·5 years (range: 65–101); women: 597, mean age 81·6 years (range: 65–102)) with physical or mental disability in some degree. They were eligible for long-term care insurance[19,20], lived in Nagoya City, and were provided visiting nurse services by the Nagoya City Health Care Service Foundation for Older People, which has seventeen visiting nursing stations associated with care-managing centres. Eligibility of long-term care insurance is strictly a matter of age, physical and mental status, and whether or not the individual has undergone medical procedures. These Nagoya Longitudinal Study for Frail Elderly participants, who were enrolled between 1 December 2003 and 31 January 2004, were scheduled to undergo comprehensive in-home assessments by trained nurses at the baseline, and at 6, 12 and 24 months. At 3-month intervals, data were collected about any important events in the lives of the participants, including admission to the hospital, long-term care facilities placement and mortality. In the present study, a fall was defined as a sudden, unexpected descent from a standing, sitting or horizontal position, and slipping from a chair or wheelchair. Participants found down on the floor were also included in falls. After 1 year, the participants or family member caregivers were asked the fall experience by trained nurses. Written informed consent for participation, according to procedures approved by the institutional review board of Nagoya University Graduate School of Medicine, was obtained from the patients or, for those with physician-diagnosed substantial cognitive impairment, from a surrogate (usually the closest relative or legal guardian), and from family member caregivers.

Data collection

The data were collected at the clients' homes using structured interviews with patients or surrogates and caregivers, and from care-managing centre records taken by trained nurses. The data included clients' demographic characteristics, depressive symptoms as assessed by the short version of the Geriatric Depression Scale[21], and ADL was assessed by the 20-point Barthel Index with some modification (feeding, mobility on bed, bathing, grooming, dressing, using the toilet, walking inside and outside, transferring and using stairs) using summary scores ranging from 0 (total disability) to 20 (no disability). For each ADL task, nurses rated participants as independent (a score of 2, able to perform the activity without help), partially dependent (a score of 1, requiring some assistance) or completely dependent (a score of 0, needing help for the entire activity). Nurse ratings were based on direct observation, questioning of patients and speaking with family members and caregivers. Information obtained from care-managing centre records included data on the following physician-diagnosed chronic conditions: IHD; congestive heart failure; cerebrovascular disease; diabetes mellitus; dementia; cancer; neurodegenerative disorders including Parkinson's disease; other diseases comprising the Charlson comorbidity index[22], which represents the sum of weighted indices taking into account the number and seriousness of pre-existing comorbid conditions.

Anthropometry

Height and weight data were generally measured at home and collected by trained nurses using the methods described by the World Health Organization[23]. The visiting nurses were asked to measure the height or weight of participants at home as much as possible. If body weight measurements could not be taken at home for some reason, recorded or self-reported weight data obtained sometime within the last month were used. If the participants have some cognitive impairment, weight data were obtained form a surrogate or family member caregivers. Weight was measured in light clothing without shoes using a portable weight scale at home. Height was generally measured in an upright position using a tape measure attached to the wall. However, when participants could not maintain an upright position, height measurements were obtained in a prone position. Although there are surrogate methods for obtaining height using estimation equations based on body segment lengths, these methods have not been validated in the Japanese elderly. Height measurements were unavailable for subjects (*n* 342, 35·9 %) with severe kyphosis (defined as any subject whose kyphosis made it impossible for the visiting nurse to make a convenient or reliable height measurement) or severe muscle and arterial contracture.

Measurement[23] of the triceps skin fold (TSF) thickness (to the nearest 0·1 mm) was made using skinfold callipers and AC (to the nearest 0·1 cm) using a flexible measuring tape on the right side of the participant's body, unless affected by disability or disease. Arm area (AMA) was calculated using the standard formula[24]: $AMA = (AC\ (cm) - 0{\cdot}3142 \times TSF\ (mm))^2/4\pi$. These measurements were taken at least twice by each trained nurse according to the instruction sheet, and the reported values were the means of the repeated measurements.

Among the 952 participants, 207 (21·7 %) subjects died, 41 (4·3 %) were admitted to hospitals, 78 (8·2 %) had long-term care placement and 83 (8·7 %) declined to participate at some point during the 2-year follow-up.

Therefore, the ADL levels of a total of 543 participants (men: 201; women: 342) were assessed after the 2-year period and were used for the analysis in the present study. The subjects who died during the 2-year follow-up were older (mean age: 82·1 years *v.* 79·8 years, $P=0{\cdot}001$), and mean scores of BMI, AC, TSF, AMA and basic ADL at baseline were significantly lower than those of 543 participants analysed in the present study (BMI: 18·8 *v.* 21·2, $p < 0{\cdot}001$; AC: 21·8 *v.* 24·0, $P<0{\cdot}001$; TSF: 1·3 *v.* 1·6, $P<0{\cdot}001$; AMA: 26·6 *v.* 30·3, $P<0{\cdot}001$; basic ADL: 7·7 *v.* 10·7, $P<0{\cdot}001$). The 50th percentile of ADL scores at baseline (range: 0–20) was 12. There were seventy-five participants who had an ADL score of 0 at baseline, and 291 participants who had ADL scores of 12 or more at baseline among all participants (*n* 543). Out of 543 participants, 280 (51·6 %) and 471 (86·7 %) were available for their BMI and mid-arm measurements at both baseline and at 2 years, respectively.

Statistical analysis

The Student's *t* test and χ^2 test were used to compare differences between participants with ADL decline and those without decline (improved or stable ADL function).

The main dependent variable was a change in the ability to perform ADL tasks over the 2-year follow-up period. We distinguished two levels of categorical change: (i) participants with no change or improved ADL score at the 2-year endpoint compared with baseline; (ii) participants with a decline in ADL score from baseline to the 2-year endpoint.

Univariate and multivariate logistic regression models were used to assess the following two questions: (1) Do the anthropometric measurements (BMI or AC) at baseline predict ADL status change during the 2-year follow-up? (2) Does baseline ADL status predict the loss of these anthropometric parameters during the study period? To avoid the floor effect of ADL score, the analysis was also conducted with participants with ADL scores of 12 (the 50th percentile of basic ADL at baseline) or higher at baseline. The following baseline data were used in univariate analysis: the sex; age; ADL score; Charlson comorbidity index; living arrangement; the presence or absence of chronic diseases; BMI; AC; TSF; AMA; Geriatric Depression Scale score; the fall and hospitalisation experience during the 2-year period. The covariates included in the multivariate analysis were variables associated with dependent variables with $P<0.05$ in univariate analysis. The risk of a variable was expressed as an OR with a corresponding 95 % CI.

We also examined the association between ADL score decline and the change in anthropometric measurements change during the study period using logistic regression analysis. The ADL score changes were categorised into three groups: improved/stable; 1 point change; ≥2 points change. The changes in BMI or AC were categorised into three or four groups: BMI, increase/stable, <1·0 and ≥1·0 kg/m^2; AC, increase/stable, ≤0·5, 0·6–1·5 and ≥1·6 cm. Again the covariates included in the multivariate analysis were variables associated with dependent variables in univariate analysis.

To evaluate the relationship between the decline in BMI and AC levels and the decline in ADL scores during the study period, Spearman's rank correlation coefficient was used. Partial rank correlation coefficients adjusted for age and sex were also used to measure the relationships between the decline in BMI and AC levels and the decline in ADL scores during the study period.

All analyses were performed using the Statistical Package for the Social Sciences (SPSS, Inc., Chicago, IL, USA) Version 15.0. A probability value of 0·05 or less was considered significant.

Results

At the baseline, total dependent participants (basic ADL score of 0) were 143 (15·0 %) and total independent participants (basic ADL score of 20) were 61 (6·4 %), among the 952 participants. Among the 543 participants, 418 (77·0 %) participants maintained (*n* 390) or improved (*n* 28) their ADL status, while 125 (23 %) showed an ADL decline during the study period.

Table 1 shows the comparisons of baseline characteristics of participants with or without ADL decline during the 2-year period. No differences were observed in baseline BMI, AC, TSF and AMA between participants in the two groups. A higher prevalence of hypertension and neurodegenerative disease and a higher ADL score at baseline were observed in participants with ADL decline. The prevalence rates of hospitalisation and falls during the 2-year period were significantly higher for those with ADL decline

Table 1. Baseline characteristics of the 543 care recipients
(Mean values and standard deviations)

	Change in basic ADL scores during 2-year follow-up				
	Improved/stable (*n* 418)		Declined (*n* 125)		
	Mean	SD	Mean	SD	*P*
Men/women, *n* (% of men/total)	150/268 (35·9)		51/74 (40·8)		0·318
Age (years)*	79·6	7·8	80·5	9·5	0·285
BMI (kg/m^2)*	21·2	4·0	21·2	3·6	0·973
Mid-arm circumference (cm)*	24·0	4·3	24·0	4·1	0·854
Triceps skin fold (cm)*	1·6	0·9	1·5	0·9	0·168
Arm muscle area (cm^2)*	30·0	11·8	31·0	12·2	0·399
Basic ADL (range 0–20)*	10·1	7·2	12·8	4·7	<0·001
GDS-15 (range, 0–15)*	6·7	3·6	7·3	3·6	0·138
Charlson comorbidity index*	2·2	1·6	2·1	1·6	0·602
Living alone (% of total)	19·1		16·9		0·590
Chronic diseases (% of total)†					
IHD	11·6		10·5		0·757
Congestive heart failure	11·0		10·5		0·884
Cerebrovascular disease	43·5		43·9		0·947
Diabetes mellitus	11·9		13·2		0·713
Dementia	33·3		31·6		0·729
Cancer	6·8		9·6		0·311
Hypertension	23·2		32·8		0·031
Pressure sore	11·7		6·4		0·089
Neurodegenerative disorders	9·8		19·2		0·005

ADL, activity of daily living; GDS-15, geriatric depression scale.
* Student's *t* test, others were analysed by χ^2 test (changeless improvement *v.* decline).
† Chronic diseases: physician-diagnosed chronic conditions.

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(40·0 %, $P<0·012$ and 46·6 %, $P<0·002$, respectively) than for those who were stable or showed improvement in ADL (28·2 and 31·3 %, respectively).

Table 2 shows the average changes in ADL scores and the average changes in the BMI and AC levels of participants with or without ADL score decline during the 2-year period. Significant decreases in BMI and AC during the 2-year period were observed in participants with loss of ADL function compared with those with a stable or improved ADL score, although there was no difference in TSF or AMA change during the 2-year period between two groups (data not shown).

To examine whether the anthropometric measurements (BMI or AC) at baseline may predict ADL status change during the 2-year follow-up, logistic regression analysis was conducted. As shown in Table 3, BMI or AC levels at baseline were not an independent predictor of the loss of ADL function during the study period not only in univariate analysis but also in multivariate analysis. When the analysis was conducted for participants with ADL scores of 12 or higher at baseline, again there was no association between the decline in ADL status and BMI and AC at baseline.

During the 2-year period, 94 among 280 participants (33·6 %) and 165 among 471 participants (35·0 %) experienced a decline in their BMI or AC levels, respectively. The multivariate logistic analysis demonstrated that baseline ADL status was not associated with the loss of these anthropometric parameters during the study period (BMI: OR, 1·02; 95 % CI, 0·97, 1·08 and AC: OR, 0·981; 95 % CI, 0·95, 1·01).

There were correlations between the levels of decline in BMI and AC and changes in ADL score during the study period in all participants, as well as those excluded for having an ADL score 0 or with an ADL score of 12 or higher at baseline. These correlations persisted after adjusting for the age and sex of the participants (Table 4).

We next examined the association between the decline in ADL performance and BMI or AC change during the study period using logistic regression analysis (Table 5). Univariate as well as multivariate analysis showed that a larger decline in BMI ($\geq 1·0\,kg/m^2$) and the highest level of AC decline ($\geq 1·6$ cm) compared with stable or increasing BMI and AC measurements were associated with the loss of ADL performance during the 2-year period. Conversely, a decline in ADL score during the 2-year period of ≥ 2 points was associated with a loss of BMI or AC scores in univariate analysis. These associations persisted after adjustments for potential confounders were made in multivariate models (Table 5). When multivariate analysis was conducted among participants with an ADL score of 12 or higher, similar associations were detected between the decline in BMI and AC levels and the loss of ADL function (model 2 in Table 5).

Discussion

The present study examined the association between anthropometric measurements at baseline or longitudinal changes in those measurements and the degree of disability or longitudinal physical function decline during a 2-year follow-up in community-dwelling frail Japanese elderly. Although, as far as we know, there has been no report demonstrating that AC acts as a predictor of physical functional impairment, a previous report has demonstrated that greater BMI (BMI: 35 kg/m^2 or greater) at baseline was associated with physical function decline in community-dwelling frail elderly[12]. In contrast, in the present study, we clearly showed that baseline BMI or AC was not a predictor for the decline in ADL performance. These differences may be due to the different ethnicity of the participants or the presence of participants with lower BMI (mean BMI: 21·2 kg/m^2) and lower physical function in the present study compared with those in previous studies. However, it showed be noted that the means of BMI and AC levels at baseline in the participants of the present cohort study were similar to those of the standard Japanese older population as previously reported[16,25]. It is possible that poor nutritional status, which reflects anthropometric parameters, contributes to the development of functional disability; likewise, it is also plausible that disability at baseline may lead to lifestyle changes, which in turn result in the decline in anthropometric parameters. However, we also demonstrated that lower ADL function at baseline was not a risk for the loss of BMI or AC levels during the follow-up period. These results suggested that there are neither causal relationships between basal lower anthropometric

Table 2. Change in anthropometric measurements and basic activity of daily living (ADL) scores during the 2-year period
(Mean values and standard deviations)

	A change in basic ADL scores				
	Improved/ stable (*n* 418)		Declined (*n* 125)		
	Mean	SD	Mean	SD	*P*
Basic ADL score (range 0–20)*					
Change during 2 years	0·1	0·5	−3·5	3·43	<0·001
BMI (kg/m^2)*					
Baseline	21·2	4·0	21·3	3·5	0·788
After the 2-year period	21·2	4·1	20·7	3·5	0·399
Change during 2 years	−0·005	1·2	−0·60	1·8	0·010
Mid-arm circumference (cm)*					
Baseline	24·1	4·2	24·1	4·0	0·916
After the 2-year period	23·6	4·5	23·1	3·9	0·327
Change during 2 years	−0·3	1·9	−1·0	2·7	0·015

* Student's *t* test.

Table 3. Logistic regression analysis to identify independent predictors of declining basic activity of daily living (ADL) score
(OR values with 95 % CI)

	OR	95 % CI	*P*
BMI (kg/m^2)			
Unadjusted	1·00	0·94, 1·07	0·972
Adjusted*	0·98	0·91, 1·06	0·625
Adjusted†	0·97	0·89, 1·06	0·558
Mid-arm circumference (cm)			
Unadjusted	1·00	0·95, 1·04	0·853
Adjusted*	0·98	0·93, 1·04	0·467
Adjusted†	0·96	0·90, 1·04	0·327

The 50th percentile of basic ADL scores at baseline was 12 in the present study.
* Adjusted includes sex, age, presence or absence of hypertension and neurodegenerative disease, hospitalisation and fall experience during the 2-year study period and the score of basic ADL at baseline.
† Analysis was conducted for participants with basic ADL score of 12 or higher at baseline.

Table 4. Correlations between changes in basic activity of daily living (ADL) score during 2-year study period and anthropometric measurements during 2-year study period

	Change of ADL score during 2-year follow-up		
Changes in levels during 2-year period	All participants (*n* 543)	Excluded basic ADL score of 0 at baseline (*n* 468)	Basic ADL score of 12 or higher† at baseline (*n* 291)
BMI (kg/m²)			
Crude	0·123*	0·117	0·134
Adjusted‡	0·149*	0·137*	0·191**
Mid-arm circumference (cm)			
Crude	0·157**	0·169**	0·099
Adjusted‡	0·152**	0·158**	0·169**

Mean values were significantly different: *$P<0·05$, **$P<0·01$.
† The 50th percentile of basic ADL scores at baseline was 12 in the present study.
‡ Adjusted for age and sex.

measurements and ADL function decline nor between basal poor ADL performance and a decrease in anthropometric parameters.

Previous prospective cohort studies emphasised that weight loss is a risk factor for the functional decline[8–12]. However, no studies allow the evaluation of causal relationships between weight loss and the functional decline. In the present study, we showed that physical functional change was well correlated with change in anthropometric parameters. In addition, logistic regression models demonstrated that the decline in anthropometric parameters was a predictor of the decline in ADL performance, and that, conversely, the decline in ADL performance was also a predictor of anthropometrics decline. These results may indicate that these factors, anthropometric parameters and ADL status, influence each other and decline simultaneously. BMI and AC are parameters of nutritional status in older adults[26,27]. Therefore, the results may indicate that nutritional status and ADL performance were well correlated and changed simultaneously through causal and consequential relationships. Theoretically, inadequate intake of nutrients, one of the manifestations of undernutrition, which can lead to loss of muscle protein as well as body mass, may explain the association between weight loss and decline in physical function. In contrast, physical functional decline may be a cause of weight loss through difficulties in eating, provisioning and cooking, which can be reflected by a decline in the food-related items of the ADL.

It is possible that there are third factors that might produce the association between the loss of anthropometric parameters and the decline in ADL performance during the follow-up period. The occurrence of new diseases or poor control of chronic disease during the follow-up period might be a candidate for the third factor. However, the association persisted even after adjusting for hospitalisation for acute illness during the study period, which suggests that poor health outcomes leading to hospitalisation did not contribute to these relationships.

The present study has several limitations. The results of the present study cannot be transferred to non-frail-independent

Table 5. Logistic regression analysis to identify independent predictors of declining basic activity of daily living (ADL) score, declining BMI and arm circumference
(OR values with 95 % CI)

	Unadjusted			Multivariate Model 1			Multivariate Model 2		
	OR	95 % CI	*P*	OR	95 % CI	*P*	OR	95 % CI	*P*
Basic ADL decline *v.* improve/stable*									
Change in BMI levels during 2-year period									
Increase or stable	1·00	Reference		1·00	Reference		1·00	Reference	
Decline (<1·0 kg/m²)	1·09	0·50, 2·39	0·833	0·90	0·31, 2·09	0·810	0·89	0·30, 2·58	0·822
Decline (≥ 1·0 kg/m²)	3·86	1·96, 7·59	<0·001	3·64	1·73, 7·65	0·001	4·69	1·89, 11·67	0·001
Change in AC levels during 2-year period									
Increase or stable	1·00	Reference		1·00	Reference		1·00	Reference	
Decline (≤ 0·5 cm)	1·55	0·66, 3·65	0·319	1·52	0·60, 3·83	0·373	1·00	0·31, 3·25	0·998
Decline (0·6–1·5 cm)	1·77	0·91, 3·45	0·092	2·54	1·20, 5·38	0·015	2·80	1·02, 7·69	0·045
Decline (≥ 1·6 cm)	2·75	1·63, 4·64	<0·001	3·45	1·88, 6·35	<0·001	3·18	1·40, 7·20	0·006
Loss of BMI levels *v.* increase/stable†									
Change in basic ADL score during 2-year period									
Improved or stable	1·00	Reference		1·00	Reference		1·00	Reference	
Decline (1 point)	1·95	0·87, 4·42	0·107	1·94	0·77, 4·84	0·158	2·67	0·93, 7·70	0·069
Decline (≥ 2 points)	2·33	1·20, 4·55	0·013	3·28	1·50, 7·17	0·003	3·28	1·32, 8·16	0·011
Loss of AC levels *v.* increase/stable‡									
Change in basic ADL score during 2-year period									
Improved or stable	1·00	Reference		1·00	Reference		1·00	Reference	
Decline (1 point)	1·40	0·74, 2·66	0·307	1·17	0·55, 2·49	0·678	1·01	0·40, 2·58	0·981
Decline (> 2 points)	2·90	1·72, 4·89	<0·001	3·62	1·95, 6·73	<0·001	2·94	1·35, 6·38	0·007

The 50th percentile of basic ADL scores at baseline was 12 in the present study.
* Multivariate analysis includes sex, age, presence or absence of hypertension and neurodegenerative disease, hospitalisation and fall experience during the 2-year period and the score of basic ADL at baseline. BMI: *n* 135. mid-arm circumference (AC): *n* 416. Model 2 participants that had a basic ADL score of 12 or higher at baseline. BMI: *n* 182. AC: *n* 245.
† Multivariate analysis includes sex, age, living alone, regular medical checkups, cerebrovascular disease, hospitalisation during the 2-year period and the score of BMI at baseline. Participants had a basic ADL score of 2 or higher at baseline (*n* 225). Model 2 participants that had a basic ADL score of 12 or higher at baseline. *n* 172.
‡ Multivariate analysis includes sex, age, living alone, regular medical checkups, cerebrovascular disease, hospitalisation during the 2-year period and the score of AC at baseline. Participants had a basic ADL score of 2 or higher at baseline. *n* 342. Model 2 participants that had a basic ADL score of 12 or higher at baseline (*n* 228).

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older individuals, since there are many differences between the participants in Nagoya Longitudinal Study for Frail Elderly and standard non-frail older people, including differences in ADL levels and comorbidity. There was a possibility that the presence of lower BMI levels and fewer obese individuals in our cohort may have affected the present results. In addition, these findings may not be generalisable to other populations, given that they may have been influenced by cultural differences, health practices and a variety of social and economic factors. The mechanisms underlying the association between the decline in BMI/AC levels and declining ADL score during the 2-year follow-up period are unclear in the present study. Future study is needed to examine whether the ADL scores and anthropometric measurements of these frail elderly with functional limitations in the community decrease concurrently.

The present study showed that anthropometric measurements at baseline were not a predictor of physical function decline during a 2-year follow-up in community-dwelling elderly. An association was found between negative changes in anthropometric measurements during the follow-up period and the decline in ADL function.

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References

1. Stuck AE, Walthert JM, Nikolaus T, *et al.* (1999) Risk factors for functional status decline in community-living elderly people: a systematic literature review. *Soc Sci Med* **48**, 445–469.
2. Topinková E (2008) Aging, disability and frailty. *Ann Nutr Metab* **52**, Suppl. 1, 6–11.
3. Zoico E, Di Francesco V, Guralink JM, *et al.* (2004) Physical disability and muscular strength in relation to obesity and different body composition indexes in a sample of healthy elderly women. *Int J Obes Relat Metab Disord* **28**, 234–241.
4. Larrieu S, Pérès K, Letenneur L, *et al.* (2004) Relationship between body mass index and different domains of disability in older persons: the 3C study. *Int J Obes Relat Metab Disord* **28**, 1555–1560.
5. Friedmann JM, Elasy T & Jensen GL (2001) The relationship between body mass index and self-reported functional limitation among older adults: a gender difference. *J Am Geriatr Soc* **49**, 398–403.
6. Chen H & Guo X (2008) Obesity and functional disability in elderly Americans. *J Am Geriatr Soc* **56**, 689–694.
7. Romagnoni F, Zuliani G, Bollini C, *et al.* (1999) Disability is associated with malnutrition in institutionalized elderly people. The I.R.A. Study. Istituto di Riposo per Anziani. *Aging (Milano)* **11**, 194–199.
8. Launer LJ, Harris T, Rumpel C, *et al.* (1994) Body mass index, weight change, and risk of mobility disability in middle-aged and older women. The epidemiologic follow-up study of NHANES I. *JAMA* **271**, 1093–1098.
9. Tully CL & Snowdon DA (1995) Weight change and physical function in older women: findings from the Nun Study. *J Am Geriatr Soc* **43**, 1394–1397.
10. Al Snih S, Raji MA, Markides KS, *et al.* (2005) Weight change and lower body disability in older Mexican Americans. *J Am Geriatr Soc* **53**, 1730–1737.
11. Ritchie CS, Locher JL, Roth DL, *et al.* (2008) Unintentional weight loss predicts decline in activities of daily living function and life-space mobility over 4 years among community-dwelling older adults. *J Gerontol A Biol Sci Med Sci* **63**, 67–75.
12. Jensen GL & Friedmann JM (2002) Obesity is associated with functional decline in community-dwelling rural older persons. *J Am Geriatr Soc* **50**, 918–923.
13. Mahoney F & Barthel DW (1965) Functional evaluation: The Barthel Index. *Md State Med J* **14**, 61–65.
14. Collin C, Wade DT, Davies S, *et al.* (1998) The Barthel ADL Index: a reliability study. *Int Disabil Stud* **10**, 61–63.
15. Izawa S, Enoki H, Hirakawa Y, *et al.* (2007) Lack of body weight measurement is associated with mortality and hospitalization in community-dwelling frail elderly. *Clin Nutr* **26**, 764–770.
16. Enoki H, Kuzuya M, Masuda Y, *et al.* (2007) Anthropometric measurements of mid-upper arm as a mortality predictor for community-dwelling Japanese elderly: the Nagoya Longitudinal Study of Frail Elderly (NLS-FE). *Clin Nutr* **26**, 597–604.
17. Kuzuya M, Masuda Y, Hirakawa Y, *et al.* (2006) Underuse of medications for chronic diseases in the oldest of community-dwelling older frail Japanese. *J Am Geriatr Soc* **54**, 598–605.
18. Kuzuya M, Masuda Y, Hirakawa Y, *et al.* (2006) Day care service use is associated with lower mortality in community-dwelling frail older people. *J Am Geriatr Soc* **9**, 1364–1371.
19. Campbell JC & Ikegami N (2000) Long-term care insurance comes to Japan. *Health Aff (Millwood)* **19**, 26–39.
20. Tsutsui T & Muramatsu N (2005) Care-needs cerfication in the long-term care insurance system of Japan. *J Am Geriatr Soc* **53**, 522–527.
21. Arai Y, Kudo K, Hosokawa T, *et al.* (1997) Reliability and validity of the Japanese version of the Zarit Caregiver Burden interview. *Psychiatry Clin Neurosci* **51**, 281–287.
22. Charlson ME, Pompei P, Ales KL, *et al.* (1987) A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis* **40**, 373–383.
23. World Health Organization (1986) Use and interpretation of anthropometric indicators of nutritional status: report of a WHO working group. *Bull World Health Organ* **64**, 929–941.
24. Heymsfield SB, McManus C, Smith J, *et al.* (1982) Anthropometric measurement of muscle mass: revised equations for calculating bone-free arm muscle area. *Am J Clin Nutr* **36**, 680–690.
25. Japanese Anthropometric Reference Data (2002) JARD 2001, Japanese Anthropometric Reference Data (in Japanese). *Jpn J Nutr Assess* **19**, Suppl., 45–81.
26. Gariballa S & Forster S (2007) Malnutrition is an independent predictor of 1-year mortality following acute illness. *Br J Nutr* **98**, 332–336.
27. Izawa S, Kuzuya M, Okada K, *et al.* (2006) The nutritional status of frail elderly with care needs according to the mini-nutritional assessment. *Clin Nutr* **25**, 962–967.

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Opinion survey of nursing or caring staff at long-term care facilities about end-of-life care provision and staff education

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ABSTRACT

Although long-term care facilities are expected to assume a growing responsibility in caring for the dying elderly, research in this area is still in its early stages. The present study aims to explore the educational and support needs of nursing home care staff in comparison with geriatric hospital, which provide 24-h physician service. The subjects in this study were caring staff of 45 long-term care facilities in Nagoya City as of December 2006. Data was collected through questionnaires covering the following: (i) possible barriers to end-of-life care provision at own facilities and (ii) areas in which a need for education was perceived. One thousand and fifty nine staff responded. Approximately three-fourths of the staff felt that additional staff, physician or nurse available 24 h, and staff education were crucial in the provision of end-of-life care at their facilities. Dementia care, physical care, communication with residents and families, psychological aspects of dying, and pain/symptom control were listed as the five items deemed most important to address. This study indicated that nursing and caring staff recognize a need in 24-h medical service and hospital involvement of end-of-life care provision at their facilities, and that staff are eager to be educated concerning end-of-life.

1. Introduction

Due to the aging of the population, as well as the changing preferences of elderly patients and their families, a growing number of elderly people are opting to spend their last years of life at long-term care facilities (Keay et al., 2000; Miller and Mor, 2002; Vohra et al., 2004; Grbich et al., 2005; Hanson et al., 2005; Hirakawa et al., 2007a). As a result, long-term care facilities are expected to assume a growing responsibility in caring for the dying elderly.

There are three types of long-term care facilities in Japan: geriatric hospital (GH), geriatric health services facility (GHSF) (geriatric intermediate care facility), and nursing home (NH) (Hirakawa et al., 2007a). GHSFs are long-term care facilities for the elderly covered by public insurance (http://www.roken.or.jp/english.htm) that provide nursing care and rehabilitation services aimed at enabling the elderly who do not need hospitalization to return home, thereby assuming an intermediary position between GHs and NHs.

The shortage of physicians at these facilities makes it difficult for GHSFs and NHs to maintain a 24-h emergency call system (Hirakawa et al., 2007a). Because residents who enter the end-of-life phase of their life often require specialized resources, including 24-h medical service, especially for NHs, providing end-of-life care represents a challenge (Goodridge et al., 2005; Hirakawa et al., 2007a). Also, because NH care largely depends on non-medical caring staff, staff education is central to providing quality end-of-life care, along with a clearer grasp of caring staff's needs for end-of-life care (Goodridge et al., 2005; Parks et al., 2005). Thus, expanding our knowledge about end-of-life care provision and caring staff education will help point out areas that need improvement and ultimately contribute to enhancing facility care.

However, in Japan, research in this area is still in its early stages. Therefore, the present study aims to explore the educational and support needs of NH care staff in comparison with GH, which provide 24-h physician service.

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2. Methods

The subjects in this study were caring staff of 45 long-term care facilities in Nagoya City as of December 2006, which agreed to take part in our investigation. Data was collected through self-reported, structured questionnaires covering the following: (i) possible barriers to end-of-life care provision at own facilities, (ii) areas in which a need for education was perceived (see Tables 1 and 2). We drew up a questionnaire, referring to previous literatures on end-of-life care at long-term care facilities (Keay et al., 2000; Dickinson and Field, 2002; Henderson et al., 2003; Pan et al., 2005; Parks et al., 2005; Hirakawa et al., 2007b). Staff were asked to describe the perceived needs of each items (great, moderate, minimal).

To evaluate the differences according to type of long-term care facilities, we divided the facilities into the following groups: GH, GHSF, NH. We also divided the staff according to their profession, into nursing and caring staff. We then compared the responses according to profession and facility.

The data was analyzed using Statview-J5.0. Group differences were compared using the analysis of variance (ANOVA). The $p < 0.05$ levels were considered to be significant.

The research protocol was reviewed and approved by the Nagoya University School of Medicine Research Ethics Board.

3. Results

One thousand and fifty-nine staff responded. As shown in Table 1, the majority of respondents reported that they perceived a need for all of the items to provide adequate end-of-life care at their own facilities. Approximately three-fourths of the staff felt that additional staff, physician or nurse available 24 h, and staff education were crucial in the provision of end-of-life care at their facilities.

Table 2 shows staffs' perceptions of their own educational needs. All items were perceived as requiring attention, and dementia care, physical care, communication with residents and families, psychological aspects of dying, and pain/symptom control were listed as the five items deemed most important to address.

The differences in staff perceptions according to profession are shown in Table 3. Nursing staff perceived a greater need for additional time spent on end-of-life care and for a quiet environment/private room, but a lesser need for peer support than caring staff. Nursing staff also perceived a greater need for education on pain/symptom control and a lesser need for education on physical care than caring staff.

The differences in staff perceptions according to facilities are shown in Table 4. NH staff reported a greater need for physician or nurse available 24 h, staff education, hospital involvement, and

Table 1
Staff's perceptions regarding the need for improved/additional end-of-life care resources at their facilities

Improved/additional resources	Perceived need	Total (*N* = 1059) (%)	ANOVA		
			Profession	Facility	Profession × facility
Staff increase	Great	814	n.s.	n.s.	n.s.
	Moderate	224			
	Minimal	14			
24-h physician or nurse services	Great	766	n.s.	**	n.s.
	Moderate	264			
	Minimal	24			
Staff education	Great	754	n.s.	**	n.s.
	Moderate	282			
	Minimal	16			
Additional time to provide care	Great	731	*	n.s.	n.s.
	Moderate	307			
	Minimal	6			
Hospital involvement (incl. hospice, emergency hospital)	Great	714	n.s.	**	n.s.
	Moderate	313			
	Minimal	29			
Quiet environment/private room	Great	646	*	**	n.s.
	Moderate	375			
	Minimal	31			
Palliative care team	Great	601	n.s.	n.s.	n.s.
	Moderate	399			
	Minimal	45			
Professional counselling	Great	541	n.s.	n.s.	n.s.
	Moderate	449			
	Minimal	62			
Peer support	Great	505	*	n.s.	n.s.
	Moderate	470			
	Minimal	75			
Heightened use of volunteers	Great	402	n.s.	n.s.	n.s.
	Moderate	502			
	Minimal	148			
Additional social workers/social workers time	Great	346	n.s.	**	n.s.
	Moderate	562			
	Minimal	132			

Profession = nurse or care staff; facility = geriatric hospital, geriatric health services facility, or nursing home. Group differences were compared using the analysis of variance (ANOVA). $^{*}p < 0.05$; $^{**}p < 0.01$.

Table 2
Staff's perceptions of their own educational needs

Topic	Perceived need	Total ($N = 1059$) (%)	ANOVA		
			Profession	Facility	Profession × facility
Dementia care	Great	765	n.s.	**	n.s.
	Moderate	262			
	Minimal	12			
Physical care	Great	722	*	**	n.s.
	Moderate	305			
	Minimal	14			
Communication with residents and families	Great	660	n.s.	**	n.s.
	Moderate	367			
	Minimal	14			
Psychological aspects of dying	Great	647	n.s.	**	n.s.
	Moderate	366			
	Minimal	30			
Pain/symptom control	Great	633	*	**	*
	Moderate	385			
	Minimal	18			
Decision-making/advance directives	Great	624	n.s.	**	n.s.
	Moderate	402			
	Minimal	12			
Artificial nutrition	Great	528	n.s.	**	n.s.
	Moderate	471			
	Minimal	41			
Grief care for the bereaved family	Great	520	n.s.	n.s.	n.s.
	Moderate	476			
	Minimal	41			
Legal systems	Great	514	n.s.	n.s.	n.s.
	Moderate	489			
	Minimal	35			
Meeting social needs	Great	460	n.s.	n.s.	n.s.
	Moderate	526			
	Minimal	51			
Domestic and foreign affairs	Great	361	n.s.	n.s.	n.s.
	Moderate	581			
	Minimal	103			

Profession = nurse or care staff; facility = geriatric hospital, geriatric health services facility, or nursing home. group differences were compared using the analysis of variance (ANOVA). $^{*}p < 0.05$; $^{**}p < 0.01$.

Table 3
Differences in staff's perceptions according to their profession

	Perceived need	Nurse ($N = 366$) (%)	Care staff ($N = 693$) (%)	ANOVA
Required resources				
Additional time to provide care	Great	73.2	66.8	*
	Moderate	26.0	30.6	
	Minimal	0.0	0.9	
Quiet environment/private room	Great	64.2	59.3	*
	Moderate	32.5	36.9	
	Minimal	2.7	3.0	
Peer support	Great	45.4	48.9	*
	Moderate	43.4	44.9	
	Minimal	10.1	5.5	
Educational need				
Physical care	Great	61.5	71.7	*
	Moderate	35.5	25.3	
	Minimal	1.1	1.4	
Pain/symptom control	Great	61.7	58.7	*
	Moderate	34.2	37.5	
	Minimal	1.6	1.7	

Group differences were compared using the analysis of variance (ANOVA). $^{*}p < 0.05$. Variables which is not $p < 0.05$ are not shown in the table.