



## Which two questions of Mini-Mental State Examination (MMSE) should we start from?

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### Abstract

The MMSE is a simple and commonly used instrument to evaluate cognitive impairment. With the aim of enabling the examiner to skip a large portion of the MMSE when screening subjects with lower possibility of cognitive impairment, we examined the internal distribution of the MMSE scores among 792 older adults visiting a teaching hospital, a long-term care hospital, nursing homes, and a geriatric clinic. The correlation coefficients between the summed scores of any two items of MMSE and the total score were compared. A receiver operating characteristic (ROC) curve was drawn to show the sensitivity and the specificity of predicting cognitive impairment, which was defined by the total MMSE score being less than 24. The mean MMSE score was  $20.5 \pm 6.9$  ( $\pm$ S.D.). A good predictor for cognitive impairment was the summed scores of the time orientation and serial sevens with a sensitivity of 98.2% and a specificity of 69.2% if cut-off was set at 7/7+. This finding appears to help streamline the screening process for cognitive impairment in general elderly population.

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**Keywords:** Cognitive impairment; Mini-Mental State Examination; Sensitivity and specificity; Mass screening of aged subjects

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## 1. Introduction

The MMSE (Folstein et al., 1975) is the most widely used tool for screening and evaluating cognitive impairment. It is commonly included in the dataset of comprehensive geriatric assessment as an index to represent cognitive status of elderly subjects. According to Tombaugh and McIntyre's review (1992), the majority of previous studies using the 23/23+ cut-off points reported sensitivity for dementia in the range from 80 to 90%. Although the MMSE is a simple instrument, which normally takes less than 15 min to administer, it is not necessarily suitable for screening mass populations. Thus, it would be ideal if subjects with possible cognitive impairment could be primarily screened before implementing full-scale MMSE. With an aim of developing a method to skip a large portion of the MMSE when screening subjects from the general elderly population, we extracted two questions from the MMSE by examining the internal distribution of the MMSE scores and assessed the validity of the short-form MMSE for predicting the total MMSE score.

## 2. Subjects and methods

### 2.1. Subjects

We collected the results of the MMSE administered to older adults (60-years and over) visiting a teaching hospital, a long-term care hospital, nursing homes, and a geriatric clinic. Data from older adults with the MMSE scores being less than six, and incomplete data due to examinees' hearing or writing difficulties were excluded. We analyzed the results of the MMSE in 792 older adults. Patients admitted to a teaching hospital ( $n = 362$ ), those admitted to a long-term care hospital ( $n = 65$ ) and outpatients of a geriatric clinic ( $n = 76$ ) had the MMSE administered by their attending physicians. Residents of four nursing homes ( $n = 289$ ) had the test administered by nurses.

### 2.2. Statistical analyses

The internal reliability of the MMSE was calculated by Cronbach's method. Spearman's rank test was used for calculating the correlation coefficients between the summed scores of any two items of the MMSE and the total score of the MMSE. An ROC curve was drawn to show the sensitivity and the specificity of predicting a cognitive impairment, which was defined by the total MMSE score being less than 24. All statistical analyses were performed on a personal computer with the statistical software package SPSS for Windows Version 11.0 (SPSS Inc., Chicago, IL).

## 3. Results

Females comprised 65.5% and the mean age was  $80.7 \pm 7.9$ . The mean MMSE score was  $20.5 \pm 6.9$ , and the median was 21.0. The proportion of the patients with the MMSE

Table 1  
Items of MMSE and summed score, the correlation with the total score

Summed items	Full score	Mean score ( $\pm$ S.D.)	Spearman's $\rho$
1+2	10	6.7 $\pm$ 3.2	0.879
1+3	8	5.8 $\pm$ 2.2	0.858
1+4	10	5.2 $\pm$ 3.4	0.933
1+5	8	4.5 $\pm$ 2.7	0.873
1+6	7	4.9 $\pm$ 2.0	0.825
1+7	6	3.8 $\pm$ 2.1	0.843
1+8	8	5.5 $\pm$ 2.3	0.867
1+9	6	3.9 $\pm$ 2.0	0.845
1+10	6	3.7 $\pm$ 2.2	0.859
1+11	6	3.6 $\pm$ 2.1	0.856
2+3	8	6.4 $\pm$ 1.8	0.858
2+4	10	5.8 $\pm$ 3.0	0.922
2+5	8	5.2 $\pm$ 2.4	0.867
2+6	7	5.6 $\pm$ 1.6	0.833
2+7	6	4.5 $\pm$ 1.7	0.849
2+8	8	6.2 $\pm$ 2.0	0.863
2+9	6	4.5 $\pm$ 1.6	0.857
2+10	6	4.3 $\pm$ 1.8	0.865
2+11	6	4.2 $\pm$ 1.8	0.861
3+4	8	5.0 $\pm$ 2.3	0.826
3+5	6	4.3 $\pm$ 1.6	0.720
3+6	5	4.7 $\pm$ 0.8	0.447
3+7	4	3.6 $\pm$ 0.9	0.512
3+8	6	5.3 $\pm$ 1.3	0.585
3+9	4	3.6 $\pm$ 0.9	0.561
3+10	4	3.4 $\pm$ 0.9	0.665
3+11	4	3.4 $\pm$ 1.0	0.623
4+5	8	3.7 $\pm$ 2.9	0.890
4+6	7	4.1 $\pm$ 2.0	0.817
4+7	6	3.0 $\pm$ 2.1	0.827
4+8	8	4.7 $\pm$ 2.4	0.836
4+9	6	3.1 $\pm$ 2.1	0.821
4+10	6	2.9 $\pm$ 2.2	0.846
4+11	6	2.8 $\pm$ 2.2	0.836
5+6	5	3.5 $\pm$ 1.3	0.694
5+7	4	2.4 $\pm$ 1.3	0.726
5+8	6	4.0 $\pm$ 1.7	0.753
5+9	4	2.4 $\pm$ 1.3	0.731
5+10	4	2.2 $\pm$ 1.4	0.773
5+11	4	2.1 $\pm$ 1.4	0.779
6+7	3	2.7 $\pm$ 0.5	0.460
6+8	5	4.4 $\pm$ 1.0	0.515
6+9	3	2.8 $\pm$ 0.5	0.446
6+10	3	2.6 $\pm$ 0.6	0.612
6+11	3	2.5 $\pm$ 0.6	0.569
7+8	4	3.3 $\pm$ 1.1	0.581
7+9	2	1.7 $\pm$ 0.6	0.539
7+10	2	1.5 $\pm$ 0.7	0.649
7+11	2	1.4 $\pm$ 0.7	0.619
8+9	4	3.4 $\pm$ 1.1	0.566

Table 1 (Continued)

Summed items	Full score	Mean score ( $\pm$ S.D.)	Spearman's $\rho$
8 + 10	4	3.2 $\pm$ 1.2	0.665
8 + 11	4	3.1 $\pm$ 1.2	0.641
9 + 10	2	1.5 $\pm$ 0.7	0.648
9 + 11	2	1.5 $\pm$ 0.7	0.616
10 + 11	2	1.3 $\pm$ 0.8	0.675

1, orientation to time; 2, orientation to place; 3, registration of three items; 4, serial sevens; 5, recall of three items; 6, naming; 7, repetition of a sentence; 8, read and obey the command; 9, follow a 3-stage command; 10, writing; 11, visual construction.

scores less than 24 was 59.2%. The standardized mean score of each question was lowest in naming serial sevens ( $0.44 \pm 0.39$ ), followed by recall of three items ( $0.51 \pm 0.39$ ), drawing pentagon ( $0.59 \pm 0.49$ ), and exhibiting time orientation ( $0.60 \pm 0.38$ ). The internal reliability of MMSE was high, as shown by Cronbach's alpha of 0.793. The summed scores of any two items of MMSE were highly correlated with the total score of MMSE (Table 1). In particular, the summed scores of time orientation and serial sevens showed the highest correlation with the total score (Spearman's  $\rho = 0.933$ ,  $p < 0.001$ ). The mean summed score of time orientation and serial sevens was  $(5.2 \pm 3.4)/10$ . The summed score was a good predictor for the total MMSE score less than 24, with a sensitivity of 98.3% and a specificity of 69.3% if cut-off was set at 7/7+. The ROC curve is shown in Fig. 1. The area under the ROC curve was extremely great, at 0.971 (95% CI: 0.962–0.980).

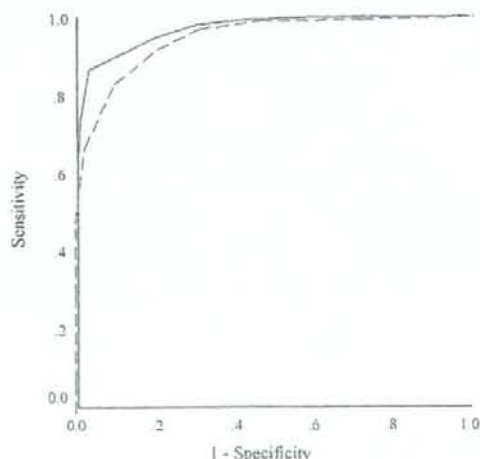


Fig. 1. The ROC curves of the summed score of time orientation and serial sevens (—), and of the summed score of registration/recall of three items and seven series (- -) for identifying subjects who scored less than 24 on MMSE.



#### 4. Discussion

Many researchers have tried to develop brief methods to screen mass population for cognitive impairment, such as the Short Test of Mental Status (Kokmen et al., 1987), the Six-item Screener (Callahan et al., 2002), the General Practitioner Assessment of Cognition (Brodaty et al., 2002), or the Mini-Cog (Borson et al., 2003). But these primary screening assessments are usually followed by the implementation of the MMSE, which would substantially increase the examiners' time burden.

Klein et al. (1985) previously reported that serial sevens and recall of three items demonstrated high diagnostic sensitivity but orientation items did not in the study of 72 patients with dementia (mean age: 72 years) and 144 patients without dementia (mean age: 66 years). In the present study, summed scores of serial sevens and recall of three items showed predicting values for the total MMSE score less than 24 with a sensitivity of 98.5% and a specificity of 53.9% if cut-off was set at 6/6+ (the area under the ROC curve: 0.941). Even after the score of registration of three items, which is required before the recall, being added for analysis, the values improved only slightly with a sensitivity of 98.7% and a specificity of 53.6% if cut-off was set at 9/9+ (the area under the ROC curve: 0.943). Meanwhile, the summed scores of time orientation and serial sevens exceeded in those parameters relative to any other pairs of MMSE subcategory. In fact, when the examiner administers serial sevens and recall of three items to subjects, seven series need to be carried out between registration of three items and their recall, in which case, how far the subjects can score in seven series may possibly affect their performance of the recall. However, we cannot deny a possibility that the patients' age, the proportion of patients with dementia and the clinical settings where the study performed may contribute to the difference.

According to the present results, an MMSE examiner may be advised to start with the two questions of time orientation and serial sevens. For those who have a summed score of the two questions being more than seven, there is no need to further administer the rest of the MMSE, because it is highly likely that such subjects would score more than 24 if they completed the full-scale MMSE. On the other hand, the examiners should administer the remaining MMSE test items when the summed score of the two questions is below seven. Thus, we believe that this stepwise strategy would substantially shorten the screening process for cognitive impairment.

In conclusion, we confirmed that the summed score of time orientation and serial sevens is a valid subscale for predicting the total MMSE score. Thus, we believe that this finding will help streamline the screening process for cognitive impairment.

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ORIGINAL ARTICLE

# Multiple consultations and polypharmacy of patients attending geriatric outpatient units of university hospitals

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**Background:** Multiple consultations in older patients may increase the chance of overlapping prescriptions or inappropriate drug prescribing.

**Methods:** We carried out a survey investigating the status of multiple consultations and the polypharmacy of patients attending geriatric outpatient units of five university hospitals.

**Results:** The patients who received multiple consultations did not have a different number of diagnosed disorders and drugs prescribed by geriatricians compared with the patients who received a single consultation.

**Conclusions:** No significant difference in diagnostic and prescribing profiles between the patients with referrals and those without, together with the relatively smaller incidence of inappropriate prescriptions by referrals to non-geriatric specialists, suggest that multiple consultations per se may not necessarily increase the risk for adverse drug events in clinical settings.

**Keywords:** adverse drug reactions (ADR), multiple consultations, polypharmacy, university hospitals.

## Introduction

Because of comorbidity and the presence of various clinical manifestations, elderly patients are often characterized by their multiple consultations across specialties. Under the existing health care system in Japan, free access to specialists is granted to all patients even though consultations to specialists are encouraged only through primary care physicians' referrals, without which patients have to pay an extra fee for specialist

consultations. Multiple consultations in older patients may not be desirable in terms of preventing inappropriate drug prescribing. They may increase the chance of overlapping prescriptions or unexpected drug interactions caused by polypharmacy, leading to an elevated risk of adverse drug reactions (ADR) or poor compliance to pharmacotherapeutics. Despite suggestions that ADR in older patients are commonly observed<sup>1,2</sup> and can become a cause of hospital admission,<sup>3–9</sup> inappropriate drug prescribing has been reported in various care settings for older adults.<sup>10</sup> In terms of optimal drug therapy for older patients, physicians must always take into consideration the unique aspects of age-related changes in pharmacokinetics/pharmacodynamics and the potential harm of prescribing inappropriate medication.<sup>11</sup> Since the Beers criteria for determining potentially inappropriate medication use by the elderly and its

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revised version,<sup>12,13</sup> much attention has been paid to the potential harm of prescribing drugs inappropriate for older adults, but awareness of this problem is mainly shared within geriatric specialists, and there has been insufficient outreach on this problem across specialties. Therefore, in terms of referring older patients to non-geriatric specialists, not all specialists may be aware of possible ADR in considering pharmacotherapy. University hospitals in particular have many clinical departments and sections, and the clinical environment thus encourages the referral of geriatric outpatients to other specialists, which may increase the risk of inappropriate drug prescribing. In this study, we carried out a survey investigating the status of multiple consultations and the polypharmacy of patients being treated at geriatric outpatient units of five university hospitals.

## Methods

### Subjects

We randomly sampled 660 patients who had been attending geriatric outpatient units of five university hospitals (Kanazawa Medical University Hospital, Kyoto University Hospital, Nagoya University Hospital, University of Tokyo Hospital, Kyorin University Hospital) from October 2003 to December 2003, and surveyed the patients' clinical background (age, identified diagnoses), prescribed drugs and consultations to other specialists within the university hospitals by chart reviews. Differences in continuous variables among the five institutions were determined by a one-way analysis of variance (ANOVA). Correlation coefficients between each of the variables were calculated by Pearson's method. The patients were divided into two groups, one group in which patients had received multiple consultations and one group in which they had not, and differences in the variables between the two groups were tested using the Student's *T*-test. Values of  $P < 0.05$  were considered to indicate statistical significance. Inappropriate drug prescribing was identified based on the 2002 Beers criteria,<sup>13</sup> an updated version of the original Beers criteria,<sup>12</sup> which is an explicit criteria for determining potentially inappropriate medication use by the elderly. The origi-

nal Beers criteria constructs guidelines on the inappropriate use of medications based on consensus from a panel of six nationally recognized experts in the US on the appropriate use of medication in the elderly. The updated Beers criteria review covered two types of statements: (i) 48 individual medications or medication classes that should generally be avoided in persons 65 years or older because they are either ineffective or they pose unnecessarily high risk for older persons and a safer alternative is available; and (ii) 20 diseases/conditions and medications that should not be used in older persons known to have specific medical conditions.

## Results

The mean age of the subjects sampled was  $77 \pm 9$  (Male: 37%). The clinical profiles of all the study subjects are shown in Table 1. Table 2 compares the mean age, number of diagnosed disorders, and number of drugs prescribed in the patients attending the five geriatric outpatient units. There were no differences in all the parameters examined among the five institutions. Regarding the correlations between the parameters, although correlations of all the pairs showed statistical significance ( $P < 0.001$ ), the correlation between the number of diagnosed disorders and that of prescribed drugs showed a much stronger correlation coefficient ( $r = 0.768$ ) relative to the other pairs (age  $\times$  number of diagnosed disorders:  $r = 0.246$ , age  $\times$  number of

**Table 1** Clinical profile of the study subjects

Cardiovascular disorders (including hypertension)	406 (61.5%)
Cerebroneurologic disorders	373 (56.5%)
Gastrointestinal disorders	286 (43.3%)
Endocrine and metabolic disorders	264 (40.0%)
Joint and muscle disorders (including osteoporosis)	139 (21.1%)
Pulmonary disorders	64 (9.7%)
Disorders of the genitourinary system	54 (8.2%)

**Table 2** Comparison of variables surveyed in five institutions

	Number of cases	Age	Number of disorders	Number of drugs
Total	660	$77 \pm 9$	$3.5 \pm 1.9$	$4.4 \pm 2.8$
Kanazawa	217	$77 \pm 10$	$4.1 \pm 1.9$	$4.5 \pm 2.5$
Kyoto	120	$76 \pm 6$	$2.7 \pm 1.5$	$4.1 \pm 2.5$
Nagoya	120	$78 \pm 7$	$3.3 \pm 1.8$	$5.0 \pm 3.4$
Kyorin	88	$74 \pm 11$	$3.0 \pm 1.6$	$3.2 \pm 2.3$
Tokyo	115	$76 \pm 8$	$3.5 \pm 2.0$	$5.0 \pm 2.9$

All data except number of patients are expressed as mean  $\pm$  SD.



prescribed drugs:  $r = 0.191$ ). Regarding multiple consultations, 148 patients (22%) were referred from geriatricians to specialists within the same institution. The distribution of specialist referrals is shown in Figure 1. Patients who received multiple consultations did not have a different number of diagnosed disorders and number of drugs prescribed by geriatricians than the patients who received a single consultation (geriatrician only) (Table 3). Because patients who had multiple consultations were prescribed with a mean of  $1.8 \pm 2.1$  drugs by other specialists, their total number of drugs prescribed was greater than that of the patients who had received a single consultation. As for overlapping prescriptions across specialties, only one case, in which vitamin B12 was prescribed by both the geriatrician and otorhinolaryngologist at the same time, was found in this survey.

Regarding inappropriate drug prescribing based on the Beers criteria,<sup>13</sup> 98 inappropriate cases (14.8% of all the patients) were prescribed by geriatricians, while 14 cases (9.4% of all the patients with referrals) were prescribed by other specialists. The number of identified inappropriate prescribing of drugs included in the Beers criteria is shown in Table 4.

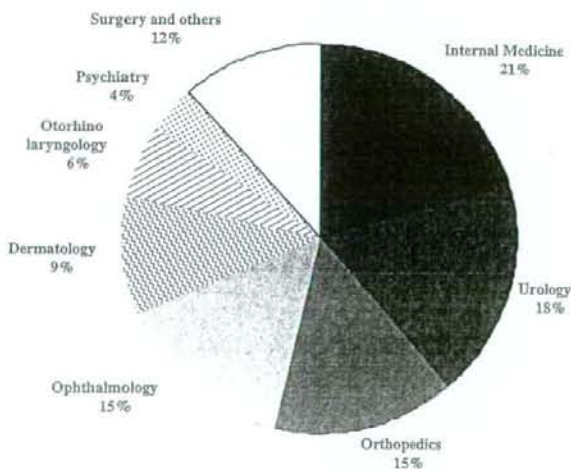
## Discussion

Although the recent dissemination of electronic chart review systems in general hospitals would seem to

enable physicians to find out what medications are being prescribed to their patients, the inaccuracy of computerized medication histories can be suggested given the substantial numbers of omissions for over-the-counter products or a variety of supplements available elsewhere.<sup>14</sup> Under the current health care system in Japan, older patients enjoy free access to medical practitioners at their own discretion. Unless older patients are placed in certain types of care facilities such as nursing homes, where prescribing is sometimes restricted, presumably because of financial reasons, they can easily be at risk for polypharmacy, which has recently been identified as a medication safety issue. It has been reported that the risk for ADR increases as the number of medications a patient takes increases.<sup>15</sup> Although multiple definitions are used in the literature to define polypharmacy, if the most stringent criteria is applied,<sup>16</sup> the medication profiles of the patients being treated at all five institutions in the present survey fall into the category of polypharmacy, in which more than three drugs are prescribed regularly. However, as reported by Arai *et al.*<sup>17</sup> who investigated the incidence of ADR in geriatric inpatients of six university hospitals, the average incidence rate (9.2% of all cases) was lower than would be expected from the average number of medications, which exceeded five. Underestimations or neglect by attending physicians of symptoms related to adverse drug events might account for the discrepancy in the results from a previous report by Prybys *et al.*

**Table 4** Number of inappropriate prescribing for the drugs listed in the Beers criteria

Prescriber	Geriatricians	Other specialists
Ticlopidine	47	
Mid-long acting benzodiazepines	20	5
Oxybutynine	13	3
Dipyridamole	6	1
Alfacalcidol	5	1
Digoxin	5	
Tricyclic antidepressant	4	1
Disopyramide	3	1
Diclofenac		1
Indometacin		1
Phenobarbital		1



**Figure 1** Distribution of specialist referrals.

**Table 3** Comparison of variables with or without referral to non-geriatric specialists

	Number of cases	Age	Number of disorders	Number of drugs
Referral (-)	511	$77 \pm 9$	$3.5 \pm 1.9$	$4.5 \pm 2.7$
Referral (+)	148 (22%)	$76 \pm 8$	$3.3 \pm 1.8$	$4.1 \pm 2.9$

All data except number of patients are expressed as mean  $\pm$  SD.

showing that the risk for ADR increases to 58% for five medications.

Apart from cases of referrals within the same institution, physicians do not always monitor prescriptions made by other doctors, and because prescriptions can be changed over time, there is a possibility of medications overlapping or the inappropriate use of drugs. Contrary to our expectations, there was only one overlapping prescription in the present survey. Even though this study surveyed subjects who were attending geriatric outpatient units of university hospitals, where most of the referrals usually take place within the same institutions and medication records are shared across specialties by computerized prescription systems, a survey for tracking the record of consultations outside of each institution (e.g. consultation with local general practitioners) has not been implemented, and thus some overlapping or inappropriate use of drugs might have been overlooked.

As shown in Figure 1, referrals of the patients from the geriatric outpatient unit vary across specialties depending on the needs of each patient. Other than Internal Medicine, the majority of referrals are to specialists, whose expert knowledge and skills are helpful for the management of the common symptoms older patients exhibit (e.g. urinary incontinence, osteoporosis and related fractures, cataract, decubitus ulcers). Considering the circumscribed cases of referrals confirmed in the present survey, older patients attending geriatric outpatient units seem to regard geriatricians as their primary physicians responsible for the overall management of various clinical symptoms. To gain a view of this from the opposite perspective, it would be interesting to survey the status of referrals from other specialists to geriatricians. Regarding the adequacy of medications, geriatricians seem to prescribe more inappropriate drugs for older patients than other specialists in this survey. However such conclusions cannot readily be drawn, given the limited number of referral cases and drugs prescribed by other specialists. Comparing prescribing status to older patients by geriatricians with those by non-geriatric attending physicians under the matched clinical settings would address the question of whether geriatricians are more aware of potential ADR in older patients relative to other general/specialist physicians.

In conclusion, our results showing no significant difference in diagnostic and prescribing profiles between the patients who were referred and those who weren't, together with the relatively smaller incidence of inappropriate prescriptions by referrals to non-geriatric specialists, suggests that multiple consultations per se may

not necessarily increase the risk for ADR in clinical settings.

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## Behavioral, psychological and physical symptoms in group homes for older adults with dementia

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### ABSTRACT

**Background:** Despite the recent dissemination of group homes in Japan for older adults with dementia, the behavioral and psychological features of the residents remain unknown. To clarify the association of such features with the levels of difficulty encountered by caregivers in coping with these symptoms, we have conducted a survey to compare the frequencies of the symptoms among group homes, nursing homes and a long-term care hospital.

**Methods:** Five hundred and eighty-six older adults aged 65 years or more were sampled. Data were consecutively collected from questionnaires given to the caregivers. The questionnaire included basic activities of daily living, the Mini-mental State Examination, frequencies of behavioral, psychological and physical symptoms, and the levels of difficulty in coping with the symptoms.

**Results:** In group homes, requests to go home, urinary incontinence and frequent complaining were the most commonly observed symptoms. The symptoms associated with disorientation, anxiety and depression were frequently observed in all three care settings. Most of the symptoms were more frequently observed in group homes than in the other two care settings. However, the levels of difficulty in coping with most of the symptoms were the highest in the long-term care hospital, followed in order by the group homes and nursing homes. In group homes, inappropriate sexual behavior was the symptom creating the most

stress for the caregivers, followed by verbal and nonverbal abuse and changeable mood.

**Conclusions:** The symptomatic traits of residents in group homes were clarified in the present study. These findings could be helpful in considering desirable placement or the improvement of eligible service provision for older adults with dementia in care facilities.

**Key words:** aged, dementia, behavioral and psychological symptoms, group home

## Introduction

The percentage of individuals aged more than 64 years in Japan reached 19.5% in 2004, making this country a clear forerunner in the aged society worldwide. The number of older adults with dementia who are unable to continue living in their home has been steadily increasing. Despite the recent dissemination of group homes for older adults with dementia, the behavioral, psychological and physical features of the residents remain unknown. A group home in Japan is defined as a care facility that accommodates a smaller (5–9 persons) number of older adults with mild to moderate dementia, and is characterized by participation of the residents in daily housekeeping if possible, with the assistance of the care staff. Most of the group homes are privately owned but the services are provided based on the public long-term care insurance policy. There were 270 group homes when this insurance system was implemented in 2000, but this number had risen to 4775 at the last measurement in 2004. Despite this rapid dissemination of group homes, their concept is not well understood by healthcare professionals, much less by the society as a whole. In terms of choosing an optimal care environment for older adults with dementia, it is important to identify symptomatic traits in those who are admitted to care facilities. However, there is a dearth of information regarding the relationship between the symptoms and care settings.

In this study, we surveyed the frequencies of behavioral, psychological and physical symptoms in group homes and the levels of difficulty in coping with the symptoms. We also compared the results obtained from group homes with those in nursing homes and in a long-term care hospital.

## Methods

This study involved 586 older adults aged 65 years or older. Ninety-one older adults were living in 10 group homes, 411 were in five nursing homes, and 84 were admitted to a long-term care hospital. Data were collected consecutively from questionnaires given to the caregivers in charge of the older adults. The



questionnaire included questions about the residents' age, gender, basic activities of daily living (BADL) evaluated by the Barthel Index (Mahoney and Barthel, 1965), frequencies of behavioral, psychological and physical symptoms, and the levels of difficulty in coping with the symptoms. The Mini-mental State Examination (MMSE; Folstein *et al.*, 1975) was administered in two of the group homes to a total of 17 residents.

The behavioral, psychological and physical symptoms of the older adults were assessed using the original list given in Table 1. The list consisted of: 16 symptoms (numbers 1–16) included in the primary assessment dataset of the public long-term care insurance system; and 16 symptoms (numbers 17–32) selected from the lists applied in previous studies (Baumgarten *et al.*, 1990; Greene *et al.*, 1982; Sanford, 1975; Teri *et al.*, 1992). Behavioral and psychological symptoms of dementia (BPSD) are usually defined as symptoms of disturbed perception, thought content, mood or behavior that occur frequently in patients with dementia (Finkel and Burns, 2000). We included not only behavioral and psychological but also physical symptoms, such as urinary/fecal incontinence, dysphagia and walking disturbance, as some previous reports suggested that the physical problems strongly affect the caregivers' burden (Dunkin and Anderson-Hanley, 1998; Onishi *et al.*, 2005). The frequencies of observed symptoms were scored with the following values: 0 = none, 1 = less than once a week, 2 = a few times a week, 3 = almost every day, and 4 = always. When the symptoms were observed, the staff was asked to estimate the level of difficulty in coping with each symptom on a scale of 1 to 5, with 1 representing "easy" and 5 representing "extremely difficult."

Differences in the frequencies of observed symptoms and the levels of difficulty in coping with symptoms among group homes, nursing homes and the long-term care hospital were tested using a one-way analysis of variance (ANOVA). Tukey's test was used for multiple comparisons. A *p*-value of < 0.05 was considered to indicate statistical significance, and all tests were two-tailed. All statistical analyses were performed on a personal computer with the statistical package SPSS for Windows, Version 11.0 (SPSS Inc., Chicago, IL, U.S.A.).

## Results

Table 2 shows gender, age and BADL for the residents in the three care settings. There were no significant differences in gender or age among the three groups, but the mean BADL was significantly higher in group homes than in the other two groups. The mean MMSE score was lower in the long-term hospital than in the nursing homes, but the score in the group homes did not differ significantly from the other two care settings.

**Table 1.** List of behavioral, psychological and physical symptoms

Symptoms from the list included in a primary assessment dataset of the public long-term care insurance policy	
1	Delusion of being robbed
2	Fabrication
3	Hallucination
4	Changeable mood
5	Sleep disturbance
6	Verbal and nonverbal abuse
7	Repeated story
8	Loud voice or screaming
9	Resistant to care
10	Wandering
11	Restlessness
12	Request to go home
13	Hording useless things
14	Destroying property
15	Filthy behavior
16	Allotriophagy
Items selected from lists applied in previous studies	
17	Inappropriate sexual behavior
18	Hiding things
19	Compulsive behavior
20	Hanging around persistently, repetitive questions
21	Lack of interest
22	Abnormal appetite
23	Urinary incontinence
24	Fecal incontinence
25	Reluctance to contact with others
26	Monology
27	Self-mutilation
28	Walking disturbance
29	Obsessed with loneliness
30	Dysphagia
31	Bradykinesia
32	Complaint

**Table 2.** Gender, age and basic activities of daily living (BADL)

	FEMALE	AGE	BADL*	MMSE
Group homes ( <i>n</i> = 91)	80.7	81.4 ± 7.4	16.2 ± 3.4	13.2 ± 6.1
Nursing homes ( <i>n</i> = 411)	70.5	81.3 ± 6.2	10.8 ± 5.7	14.4 ± 8.3
Long-term care hospital ( <i>n</i> = 84)	71.2	80.8 ± 9.8	6.3 ± 6.2	11.4 ± 10.3
Total ( <i>n</i> = 586)	72.0	81.1 ± 8.6	10.4 ± 6.3	14.0 ± 8.5

Values are % or mean ± SD.

\*BADL was evaluated by the Barthel Index (/20).

MMSE = Mini-mental State Examination (/30).

Table 3. Behavioral, psychological and physical symptoms of older adults in different care settings\*

	GROUP HOMES		NURSING HOMES		LONG-TERM CARE HOSPITAL	
	%	MEAN $\pm$ SD	%	MEAN $\pm$ SD	%	MEAN $\pm$ SD
Request to go home	57.8	1.34 $\pm$ 0.14	14.2	0.35 $\pm$ 0.91	38.9	0.59 $\pm$ 1.32 <sup>a,b</sup>
Obsessed with loneliness	56.7	1.23 $\pm$ 1.30	15.5	0.36 $\pm$ 0.85	23.3	0.36 $\pm$ 0.89 <sup>a,b</sup>
Complaint	50.0	1.26 $\pm$ 1.39	18.8	0.43 $\pm$ 0.96	20.0	0.33 $\pm$ 0.82 <sup>a,b</sup>
Delusion of being robbed	48.9	1.02 $\pm$ 1.25	13.5	0.29 $\pm$ 0.80	17.8	0.29 $\pm$ 0.82 <sup>a,b</sup>
Changeable mood	47.8	1.12 $\pm$ 1.36	23.6	0.59 $\pm$ 1.04	28.9	0.43 $\pm$ 0.94 <sup>a,b,c</sup>
Urinary incontinence	46.7	1.26 $\pm$ 1.49	45.7	1.54 $\pm$ 1.58	72.2	2.49 $\pm$ 1.89 <sup>b,c</sup>
Attaching to things	40.0	0.98 $\pm$ 1.31	18.5	0.52 $\pm$ 1.10	11.1	0.51 $\pm$ 0.75 <sup>a,b,c</sup>
Restlessness	36.7	1.02 $\pm$ 1.37	17.0	0.51 $\pm$ 1.10	33.3	0.51 $\pm$ 1.07 <sup>a,b</sup>
Reduction of interest or morale	34.4	0.76 $\pm$ 1.14	35.5	1.05 $\pm$ 1.39	42.2	0.67 $\pm$ 1.27 <sup>c</sup>
Reluctance to contact with others	33.3	0.72 $\pm$ 1.10	14.5	0.32 $\pm$ 0.82	11.1	0.33 $\pm$ 0.63 <sup>a,b,c</sup>
Monology	32.2	0.89 $\pm$ 1.32	18.5	0.52 $\pm$ 1.10	26.7	0.56 $\pm$ 1.06 <sup>a,b</sup>
Hoarding useless things	30.0	0.88 $\pm$ 1.32	6.9	0.27 $\pm$ 0.88	4.4	0.30 $\pm$ 0.43 <sup>a,b,c</sup>
Confabulation	28.9	0.79 $\pm$ 1.33	9.4	0.26 $\pm$ 0.82	6.7	0.13 $\pm$ 0.52 <sup>a,b,c</sup>
Verbal and nonverbal abuse	28.9	0.60 $\pm$ 1.04	11.7	0.26 $\pm$ 0.75	7.8	0.12 $\pm$ 0.53 <sup>a,b,c</sup>
Wandering	28.9	0.72 $\pm$ 1.20	11.9	0.37 $\pm$ 1.02	6.7	0.11 $\pm$ 0.53 <sup>a,b,c</sup>
Fecal incontinence	28.9	0.66 $\pm$ 1.17	94.3	1.06 $\pm$ 1.47	74.4	2.36 $\pm$ 1.92 <sup>b,c</sup>
Hiding things	26.7	0.68 $\pm$ 1.22	7.1	0.15 $\pm$ 0.65	2.2	0.02 $\pm$ 0.20 <sup>a,b</sup>
Resistant to care	25.6	0.52 $\pm$ 0.99	14.2	0.31 $\pm$ 0.80	10.0	0.19 $\pm$ 0.69 <sup>b</sup>
Walking disturbance	25.6	0.79 $\pm$ 1.33	41.9	1.33 $\pm$ 1.58	86.7	3.50 $\pm$ 1.71 <sup>a,b,c</sup>
Sleep disturbance or reversion of day and night	23.3	0.60 $\pm$ 1.11	12.4	0.27 $\pm$ 0.72	16.7	0.29 $\pm$ 0.81 <sup>a,b</sup>
Compulsive behavior	20.0	0.62 $\pm$ 1.24	8.9	0.23 $\pm$ 0.82	7.8	0.17 $\pm$ 0.70 <sup>a,b</sup>
Loud voice	20.0	0.45 $\pm$ 0.94	13.2	0.25 $\pm$ 0.78	17.8	0.26 $\pm$ 0.80
Hallucination	17.8	0.53 $\pm$ 1.12	5.6	0.11 $\pm$ 0.51	5.6	0.06 $\pm$ 0.29 <sup>a,b</sup>
Filthy behavior	16.7	0.32 $\pm$ 0.76	8.4	0.20 $\pm$ 0.73	15.6	0.30 $\pm$ 0.89
Hanging around persistently	13.3	0.36 $\pm$ 0.90	4.3	0.08 $\pm$ 0.43	5.6	0.12 $\pm$ 0.57 <sup>a,b</sup>
Dysphagia	10.0	0.19 $\pm$ 0.63	8.6	0.23 $\pm$ 0.84	24.4	1.15 $\pm$ 0.16 <sup>c</sup>
Bradykinesia	8.9	0.21 $\pm$ 0.73	10.2	0.32 $\pm$ 0.97	1.1	0.53 $\pm$ 1.23
Destroying property	7.8	0.13 $\pm$ 0.52	4.3	0.07 $\pm$ 0.45	3.3	0.08 $\pm$ 0.47
Abnormal appetite	5.6	0.17 $\pm$ 0.71	7.4	0.14 $\pm$ 0.62	1.1	0.01 $\pm$ 0.21
Allotriophagy	4.4	0.06 $\pm$ 0.28	3.0	0.04 $\pm$ 0.37	1.1	0.01 $\pm$ 0.07
Inappropriate sexual behavior	2.2	0.03 $\pm$ 0.24	2.8	0.07 $\pm$ 0.25	0.0	0.01 $\pm$ 0.00
Self-mutilation	0.0	0.00 $\pm$ 0.00	2.5	0.01 $\pm$ 0.20	6.7	0.16 $\pm$ 0.70 <sup>b,c</sup>

\* Scored with 0 for none, 1 for less than once a week, 2 for a few times a week, 3 for almost everyday, and 4 for always.

<sup>a</sup> Significant difference between group homes and other healthcare facilities ( $p < 0.05$ ).<sup>b</sup> Significant difference between group homes and a long-term care hospital ( $p < 0.05$ ).<sup>c</sup> Significant difference between healthcare facilities and a long-term care hospital ( $p < 0.05$ ).

**Table 4.** Difficulties coping with the observed behavioral, psychological and physical symptoms\*

	GROUP HOMES	NURSING HOMES	A LONG-TERM CARE HOSPITAL
Inappropriate sexual behavior	4.50 ± 0.71	1.64 ± 1.29	
Verbal and nonverbal abuse	3.27 ± 1.19	2.39 ± 1.34	4.14 ± 0.90 <sup>a,c</sup>
Changeable mood	3.21 ± 1.25	2.65 ± 1.27	3.04 ± 1.43 <sup>a</sup>
Sleep disturbance or reversion of day and night	3.14 ± 1.32	2.31 ± 1.29	3.33 ± 1.45 <sup>a,c</sup>
Loud voice	3.00 ± 1.37	2.50 ± 1.35	3.94 ± 1.18 <sup>c</sup>
Hanging around persistently	3.00 ± 1.13	2.12 ± 1.41	4.60 ± 0.89 <sup>c</sup>
Request to go home	2.96 ± 1.19	2.30 ± 1.17	2.03 ± 1.15 <sup>a,b</sup>
Wandering	2.85 ± 1.12	2.43 ± 1.30	3.33 ± 1.63
Hallucination	2.81 ± 1.56	2.27 ± 1.24	3.40 ± 1.14
Abnormal appetite	2.80 ± 1.64	1.69 ± 1.44	1.00 ± 0.00
Restlessness	2.79 ± 1.08	2.58 ± 1.21	3.53 ± 1.33 <sup>b,c</sup>
Delusion of being robbed	2.77 ± 1.33	2.53 ± 1.35	2.75 ± 1.34
Complaint	2.73 ± 1.16	2.23 ± 1.26	2.89 ± 1.61
Resistant to care	2.65 ± 1.11	2.63 ± 1.18	3.56 ± 1.59
Reluctance to contact with others	2.63 ± 1.13	2.12 ± 1.15	3.10 ± 1.29 <sup>c</sup>
Walking disturbance	2.61 ± 0.99	2.28 ± 1.26	3.05 ± 1.42 <sup>c</sup>
Attaching to things	2.58 ± 1.11	2.34 ± 1.17	2.20 ± 1.23
Confabulation	2.58 ± 1.47	2.19 ± 1.20	2.17 ± 1.84
Destroying property	2.57 ± 1.27	2.18 ± 1.43	4.00 ± 0.00
Fecal incontinence	2.54 ± 1.17	2.12 ± 1.11	4.28 ± 1.17 <sup>b,c</sup>
Reduction of interest or morale	2.45 ± 1.06	2.38 ± 1.12	3.55 ± 1.41 <sup>b,c</sup>
Dysphagia	2.44 ± 0.88	2.26 ± 1.31	3.41 ± 1.14 <sup>c</sup>
Hiding things	2.38 ± 1.14	2.14 ± 1.18	3.00 ± 1.41
Compulsive behavior	2.33 ± 1.14	2.40 ± 1.44	2.57 ± 1.62
Urinary incontinence	2.26 ± 1.01	2.02 ± 1.11	4.18 ± 1.32 <sup>b,c</sup>
Allotriophagy	2.25 ± 1.50	2.08 ± 1.68	2.00 ± 0.00
Hoarding useless things	2.22 ± 1.19	2.76 ± 1.38	4.50 ± 0.58 <sup>b,c</sup>
Obsessed with loneliness	2.16 ± 0.95	2.02 ± 1.06	2.70 ± 1.01 <sup>c</sup>
Filthy behavior	2.07 ± 1.03	2.48 ± 1.42	4.57 ± 0.94 <sup>b,c</sup>
Monology	2.03 ± 1.38	1.95 ± 1.04	2.33 ± 1.58
Bradykinesia	1.63 ± 0.74	2.30 ± 1.24	1.00 ± 0.00
Self-mutilation	NP	1.40 ± 0.84	4.83 ± 0.41

\* Scored from 1 for easy to 5 for extremely difficult to cope with the symptom.

NP, no patients had the symptom.

<sup>a</sup> Significant difference between group homes and other healthcare facilities ( $p < 0.05$ ).<sup>b</sup> Significant difference between group homes and a long-term care hospital ( $p < 0.05$ ).<sup>c</sup> Significant difference between healthcare facilities and a long-term care hospital ( $p < 0.05$ ).

The frequencies of observed symptoms and the levels of difficulty in coping with the symptoms are shown in Tables 3 and 4. Requests to go home, urinary incontinence and frequent complaining were the most common symptoms in the group homes. Most of the symptoms were more frequently observed in the



Table 5. Comparison with previous lists of behavioral, psychological and physical symptoms associated with dementia

	REISBERG ET AL (1987) BEHAVE-AD	BAUMGARTEN ET AL (1990) DED	TERI ET AL (1992) RMBPC	CUMMINGS ET AL (1994) NPI	PRESENT STUDY
<i>Behavior needs against intervention</i>					
-Aggressiveness		Makes physical attacks in verbally abusive, causes Destroys property or clothing	Aggressive to others verbally Destroys property Engages in behavior that is potentially dangerous	Aggression	Verbal and nonverbal abuse* Demeaning property* Self-mutilation
<i>Behavior needs intervention</i>		Screams for no reason Cries or laughs inappropriately Makes inappropriate sexual advances	Crying and tearfulness Talking loudly and rapidly		Loud voice or screaming*
<i>Resident needs monitoring</i>		Wanders aimlessly outside or in the house during the day Gets lost outside			Inappropriate sexual behavior Fidgety behavior* Aloof/oblivious*
<i>Activity disturbances</i>		Lozes, misplaces or hides things	Losing or misplacing things		Wandering*
		Is incontinent of urine Is incontinent of stool Dresses inappropriately	Threats to hurt others Threats to hurt oneself	Irritability Disturbances Troublesome behavior	Hiding things
<i>Resident needs help</i>					Dysphagia
<i>Resident causes stress to self</i>			Appears anxious or worried Talking about feeling lonely Appears sad or depressive Commenting about death of self or others		Urinary incontinence Fecal incontinence Walking disturbance Bradycardia
Hallucinations				Hallucinations Dysphoria Anxiety	Hallucination*
Affective disturbance					Obsessed with loneliness
Anxieties and phobias					

Table 5. Continued.

REISBERG ET AL (1987) BEHAVE-AD	BAUMGARTEN ET AL (1990) DED	TEH ET AL (1992) RMBPC	CUMMINGS ET AL (1994) NPI	PRESENT STUDY
Resident causes stress to others		Comments about feeling worthless or being a burden to others		
Delusions	Makes unwarranted accusations Refuses to be helped with personal care Wakes up at night Wanders in the house at night Sleeps excessively during the day Paces up and down	Expressing feeling of hopelessness or sadness about the future Anxiety, irritability, complaining Waking you or other family members up at night Difficulty concentrating on a task Doing things that embarrass you Asking the same question Starting, but not finishing, things	Delusions	Delusion of being robbed* Complaint Resistant to care* Sleep disturbance* Berkeasans Repeated story* Hanging around persistently Abnormal appetite Hoarding useless things
Diurnal rhythm disturbances	Asks the same questions repeatedly Empies drawers or closets Repeats the same action Refuses to eat Overeats Throws food Hunts things for no obvious reason Exposes private body parts	Comments about feeling like a failure or about not having any worthwhile accomplishments in life Forgetting what day it is Trouble remembering recent events Trouble remembering significant past events		
			Agathy Euphoria	Production of false or morale Request to go home Compulsive behavior Changeable mood* Reluctance to contact with others Fabrication Mnemoner

BEHAVE-AD = Behavioral Pathology in Alzheimer's Disease Rating Scale; DED = Behavior Disturbance Scale; RMBPC = Dementia Revised Memory and Behavior Problems Checklist; NPI = Neuropsychiatric Inventory.

\*Symptoms listed in the primary assessment dataset of Japanese public long-term care insurance system.

group homes than in the other two settings. Reduced interest or morale was observed more frequently in nursing homes, and symptoms related to physical disabilities were more frequently observed in the long-term care hospital than in the other two settings.

The overall levels of difficulty in coping with the symptoms were the most serious in the long-term care hospital. In group homes, inappropriate sexual behavior was the symptom that caused the greatest stress for the caregivers, followed by verbal and nonverbal abuse and changeable mood. Requests to go home produced greater stress in the caregivers of group homes than in the other two settings. Finally, changeable mood, sleep disturbance or diurnal rhythm disturbance, and verbal and nonverbal abuse were more stressful for the caregivers in group homes than for those in nursing homes.

## Discussion

Since the first report by Sanford in 1975 regarding BPSD that were mainly associated with physical disabilities, various scales to assess BPSD have been proposed. Table 5 summarizes the list of symptoms reported previously and the one used in the present study. For comparison, the symptoms are classified into the following categories: need an emergent stop, need to stop, need to watch, need to help, engenders stress for oneself, and engenders stress for surrounds. The classification presented in Table 5 needs to be validated by evidence based on psychosocial impact of the symptoms, such as caregiver's burden.

Schreiner *et al.* (2001) reported that 45.4% of Japanese nursing home residents with dementia manifested aggressive behaviors; however, few studies have addressed the frequency of symptoms associated with dementia in other care settings. In particular, because the group home for older adults with dementia is a novel type of care facility, little is known about the characteristics of residents living in these homes. According to Annerstedt *et al.* (1996), the residents of group homes had physical handicaps ranging from stage A (completely independent) to stage E (dependent on bathing, changing clothes and toileting), based on the ADL index of Katz *et al.* (1963). The present results using the Barthel Index showed some similarities in BADL. Cognitive status in group homes is also comparable to previous reports showing mean MMSE scores ranging from 9.0 to 16.7 (Colvez *et al.*, 2002; Elmstahl *et al.*, 1998a; Faxen-Irving *et al.*, 2002; Wimo *et al.*, 1995a). We initially speculated that the MMSE score of group home residents may be higher than other settings. However, study subjects in nursing homes and long-term hospitals include patients without dementia, which may have confounded the results in comparing their cognitive status. Annerstedt (1997) reported that depression and anxiety were observed more

frequently in group homes than in other types of care facilities. Elmstahl *et al.* (1998b) reported that disorientation was the most prevalent trait, and lack of vitality, dyspraxia-spatial disorientation, and depression-anxiousness followed. In this study, we also found that the symptoms associated with disorientation, anxiety and depression, such as requests to go home, obsession with loneliness, complaints, delusion of being robbed, and changeable mood, were observed frequently. One of the reasons why most of the behavioral and psychological symptoms were frequently observed in group homes seems to be that group homes enable the development of a more personal relationship between the residents and caregivers than do other facilities. Because of this closeness, caregivers become more sensitive to the residents' symptoms. In addition, some active behavioral symptoms, such as wandering or requests to go home, were observed more frequently possibly because the residents of group homes were more physically active than those in other settings. However, the observed difference in frequencies of behavioral and psychological symptoms cannot solely be attributed to either characteristics of each facility or patient's conditions from the findings in this study.

For most of the behavioral and psychological symptoms, the level of difficulty in coping with the symptoms was highest in the long-term care hospital. Long-term care hospitals usually admit many physically and mentally dependent patients with severe dementia due to stroke or other medical conditions. This finding may imply that long-term care hospitals tend to consider physical problems a higher priority, and may not be equipped to deal with the problems derived from the dementia of the patients. However, as there are likely to be many patients with behavioral and psychological symptoms and also with need of medical care, long-term care hospitals should become more responsible for the patients with these symptoms.

In group homes, the level of difficulty in coping with the symptoms was high for inappropriate sexual behavior, verbal and nonverbal abuse, changeable mood and sleep disturbance. As Wimo *et al.* (1995b) reported, the main reasons for patients' moving to institutions from group homes were behavioral disturbances and increasing demands for nursing. Thus, it may be essential to establish strategies for controlling the symptoms in order for the residents to continue to stay in group homes.

In summary, the current symptomatic traits of residents in group homes were clarified in the present study. Symptoms associated with disorientation, anxiety and depression were observed frequently, and sexual and aggressive behavioral disturbances caused a great deal of stress. The burden experienced by the caregivers as a result of the symptoms of residents was least in nursing homes. The present study clarified behavioral characteristics and the burden of coping with the symptoms of residents in different care facilities; thus it is hoped