

Table 4. Correlation Coefficients Between the Scale Scores of the Factors Extracted From GDS-15 and Age, Basic ADL, and MMSE Score

Item	Factor I Unhappiness	Factor II Apathy and Anxiety	Factor III Loss of Hope and Morale	Factor IV Energy Loss
Age	.065 <i>P</i> = .131	.273* <i>P</i> < .001*	.043 <i>P</i> = .322	-.095* <i>P</i> = .027*
Basic ADL	-.374* <i>P</i> < .001*	-.167* <i>P</i> < .001*	-.169* <i>P</i> < .001*	.108* <i>P</i> = .010*
MMSE	-.263* <i>P</i> < 0.001*	-.098* <i>P</i> = .017*	-.164* <i>P</i> < .001*	.083* <i>P</i> = .043*

Note: GDS = Geriatric Depression Scale; ADL = activities of daily living; MMSE = Mini-Mental State Examination. Correlation coefficients between age and the factors were calculated by Spearman's method, and those between basic ADL, MMSE and the factors were calculated by Pearson's method.

**P* < .05.

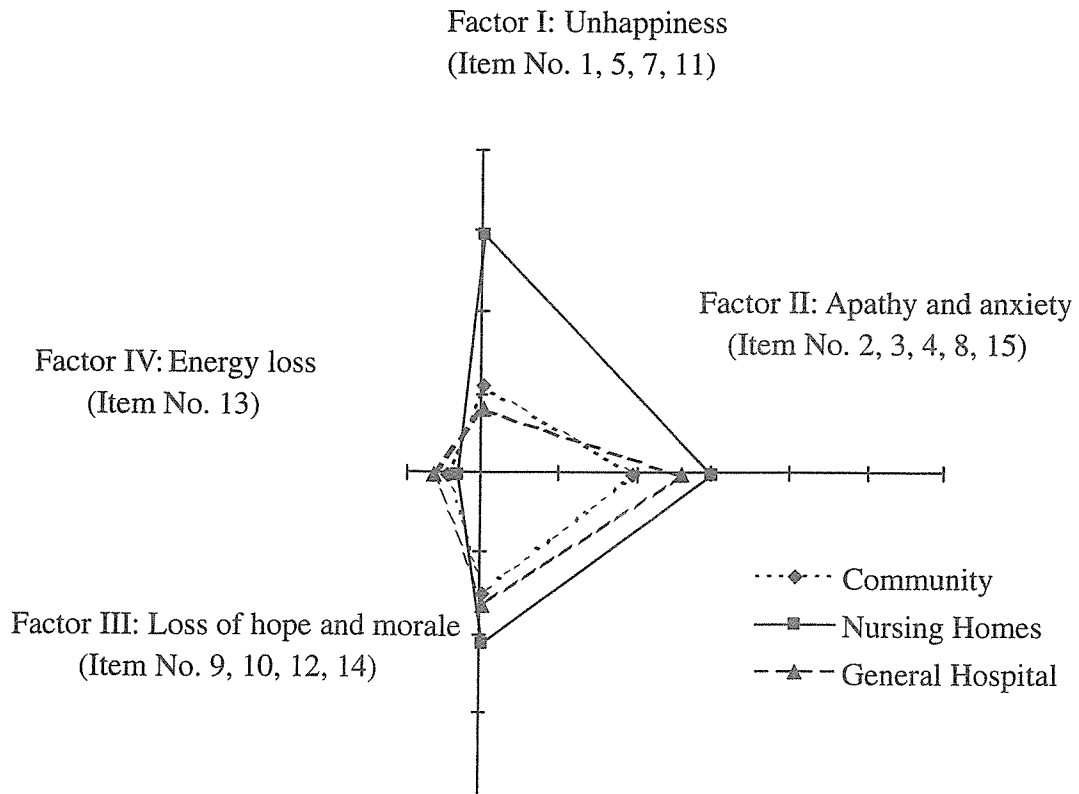


Figure 1. The factorial pattern on a Geriatric Depression Scale (GDS)-15 radar chart for the participants in a community, nursing homes, and a general hospital.

On the other hand, Casarett's samples had higher cognitive abilities (mean MMSE score 27.4 ± 1.7 SD) than our participants. Thus, higher average GDS-15 score in the present study relative to the above reports may be attributable to variability of participants' cognitive status. Another explanation for the discrepant results may be that because there was a wide range in the residents' length of stay, our study may have included participants who were still in their transitional period trying to adjust to the nursing home environment. Therefore, our results may not necessarily reflect persistent psychological status of nursing home residents. On the other hand, hospital patients showed significantly higher GDS-15 scores than the community residents, which is consistent with the

previous findings suggesting that acute medical conditions or exacerbations of chronic illnesses may be associated with depressive mood.¹³⁻¹⁵

The present study revealed that depressive symptoms in older adults are common in long-term care settings. The factorial analysis demonstrated clear associations of physical/cognitive status with depressive mood. The results of this study showed a similar factorial structure of GDS-15, which is comparable to the results of a previous Japanese study^{6,16} as well as those reported from countries with different ethnicities.¹⁷⁻¹⁹ All of the factors extracted from GDS-15 had rather weak but significant correlations with basic ADL and MMSE scores. In particular, Factors I (unhappiness) and III (loss of hope and morale) showed

stronger negative correlations with basic ADL and MMSE scores than the other factors. These findings indicate that Factors I and III can be especially enhanced by physical and/or mental disabilities; thus, these factors may be associated with secondary depression.

As shown in the radar chart, it is interesting that the pattern of GDS-15 scores in the nursing homes was vertically wide, indicating strong contributions by Factors I (unhappiness) and III (loss of hope and morale) to depressive moods, whereas the pattern in the hospital was extended far out to the right relative to other factors, indicating a relatively strong contribution by Factor II (apathy and anxiety). Thus, when older adults show the nursing-home type depressive pattern with dominant factors influenced highly by functional handicaps, clinicians should endeavor to alleviate the handicaps—for example, by improving the care environment through more adequate care services or extending the patient's remaining functional abilities. On the other hand, when older adults show the hospital-type depressive pattern, clinicians should pay attention to the temporary nature of depressive moods derived from acute physical or mental deterioration. An understanding of the differences in depressive patterns can be useful in formulating clinical interventions. However, a limitation of this study is that it did not take the time course of functional disabilities of the study sample into consideration. Ormel et al²⁰ clarified that basic ADL/instrumental ADL disability and depression are mutually reinforcing over time in a community-based cohort study. Therefore, a speculation arises, regarding the structural difference of depressive mood in different care settings, that it may be the length of time participants have been suffering from functional disabilities, not their environment of care, that explains the difference we observed in this study. Longitudinal studies tracking hospital inpatients who move into nursing homes for the assessment of changes in their depressive mood would be necessary to address this issue. The other limitation is that the findings do not address the influence of quality of care or treatment on depressive mood of the study participants. An interventional approach may clarify whether the environment of care can affect depressive mood of older adults with functional disabilities.

In summary, we carried out a factorial analysis of GDS-15 in older adults in a community, nursing homes, and a geriatric ward of a general hospital and extracted 4 factors, labeled unhappiness, apathy and anxiety, loss of hope and morale, and energy loss. Among the 3 settings, depressive mood was observed most frequently in the nursing homes. The depressive patterns of GDS-15 scores were classified into 2 types, 1 fitting the nursing home residents and the other fitting the hospital patients. The dominant factors of the nursing-home type depressive pattern were unhappiness and loss of hope and morale, which were influenced highly by the participants' func-

tional handicaps, and the hospital-type depressive pattern was highly related to apathy and anxiety. The results indicate an extended utility of the GDS-15 for a deeper understanding of depressive mood in different care settings; this instrument may help staff and clinicians to more accurately identify those who are depressed and initiate an appropriate treatment intervention.

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ORIGINAL ARTICLE

Bowel incontinence is related to improvement in basic activities of daily living in residents of long-term health care facilities for the elderly in Japan

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Background: The purpose of the present study is to clarify the target criteria for care in long-term health care facilities for the elderly in Japan and to investigate the relationship between changes in basic activities of daily living (BADL) over 1 year and the comprehensive geriatric assessment (CGA) scale.

Methods: An observational study was conducted in a facility in Nagoya, Japan. The participants consisted of 54 residents. The following four scales of comprehensive geriatric assessment were administered to the residents in both 2000 and 2001: Barthel index (BI), Lawton scale, mini-mental state examination and geriatric depression scale 15.

Results: The Barthel index was significantly improved in 2001 compared with 2000 ($P = 0.007$). The Lawton scale was significantly lower in 2001 ($P = 0.029$). Neither the mini-mental state examination nor geriatric depression scale 15 scores changed significantly. To determine the factors that influenced the change in BADL, logistic regression analyses were performed using the above four scales as independent variables and the BI change as a dependent variable. In multivariate analysis, a BI score of less than 75 approached significance for improvement in BADL ($P = 0.094$, odds ratio = 2.79). Other logistic regression analyses were also performed using each ADL task in BI as an independent variable and the change in BI as a dependent variable. In multivariate analysis, bowel incontinence was a significant independent variable ($P = 0.006$, odds ratio = 10.9).

Conclusion: As bridging facilities between acute-care hospitals and home, long-term health care facilities are a reasonable choice for the elderly with bowel incontinence.

Keywords: aged, geriatric assessment, incontinence, nursing homes.

Introduction

In Japan, the number of elderly who require long-term care because they are bedridden or suffering from

dementia or frailty is estimated to be about 2.8 million and is increasing. To address the needs of those requiring long-term care, a long-term nationwide care insurance system was started in April 2000. Long-term health care facilities for the elderly ('Kaigo Rojin Hoken Shisetsu' in Japanese) are among the services this insurance system provides.¹ These intermediate facilities are established to provide residents with both appropriate medical care and assistance with the activities of daily living (ADL), and to facilitate their return home.² They

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are equipped with rehabilitation equipment and a trained staff. The elderly eligible for residence in these facilities are in a stable medical condition and do not require acute medical treatment; their main requirement is assistance with ADL. Rehabilitation improves their ADL skills, and they are able to return home with or without in-home services. To obtain beneficial outcomes for residents in these facilities in Japan, clear target criteria of care must be established. However, these criteria have not yet been fully established.

The comprehensive geriatric assessment (CGA) program is a systemic multidimensional approach to improving quality of life and planning care for frail elderly. Many reports, including controlled trials, have supported the many benefits of a CGA program for improving living location, functional status and risk of hospitalization and mortality.³⁻⁵ Such programs have been increasingly introduced in hospitals, care facilities, and in-home care in Japan.

The purpose of the present study was to clarify the target criteria of care in long-term health care facilities in Japan. We investigated (i) evaluation of one-year changes in CGA scales in long-term care health facilities in Japan and (ii) which CGA scales are suitable for predicting residents' basic ADL (BADL) after 1 year.

Methods

Participants

Subjects in this study were elderly residents in a long-term care facility in Nagoya City, Japan. All participants provided oral informed consent prior to participating in the study. We attempted to perform a comprehensive geriatric assessment of each participant. Finally, the subject group included 54 residents (14 men and 40 women, mean age 82.5 years) who had completed a CGA for 2 consecutive years.

Measurements

In the spring of 2000 and 2001, all of the residents except those who could not communicate underwent CGA. The CGA scales analyzed in this study were as follows: the Barthel index (BI) of basic ADL,⁶ the Lawton scale of instrumental ADL (IADL),⁷ the mini-mental state examination (MMSE) for cognitive function and the geriatric depression scale 15 (GDS15) for screening for depression.^{8,9} Because the staff in the facility prepares food and does the housekeeping and laundry, a full score on the Lawton scale in this study was five points instead of eight; these three tasks were excepted.

As possible confounding factors, we checked the following: hospitalization history for the study periods, length of each resident's stay in the facility and where he/she was before admission to the facility.

Statistical analyses

Data were analyzed using StatView 5.0 (SAS Institute, Inc., Cary, NC). First, Wilcoxon tests for changes in CGA scores over 1 year were performed. Then, to determine the factors that influenced the change in BADL, univariate logistic regression analyses were performed. In these analyses, the dependent variable was the change in BI, which was described as 'better' or 'unchanged or worse', and the independent variables were age, hospitalization history, length of stay, where he/she had been prior to admission and CGA scale scores in 2000. Of these independent variables, age and length of stay were presented in years and days, respectively. The others were presented as categories of data as described below.

- Hospitalization history during the year (yes or no)
- Where he/she had been prior to admission (hospital or elsewhere (home, other facilities, and so on))
- BI score (< 75 or ≥ 75)
- Lawton scale score (< 3 or ≥ 3)
- MMSE score (< 19 or ≥ 19)
- GDS15 score (< 7 or ≥ 7).

Next, multivariate logistic regression analysis was performed with the independent variables that had shown statistical significance in univariate analyses.

To further estimate the factors that influenced the change in BADL over the period of that year, another logistic regression model was made. Procedures of these analyses were the same as those mentioned above. In this model, the change in BI was a dependent variable, and 10 ADL tasks in BI in 2000, which were divided into two categories of data (i.e. dependent or independent), were used as independent variables.

Statistical significance for all analyses was determined by $P < 0.05$. Statistical tendency was determined by $P < 0.10$.

Results

Subjects' characteristics in 2000

The subject group in this study was comprised of 54 residents who completed the CGA in 2000 and 2001, and included 14 men and 40 women, with a mean age of 82.5 years (Table 1). The number of residents who had a history of hospitalization in the course of that year, the length of stay in the facility, and where he/she had been prior to admission to the facility are also shown in Table 1.

Changes in CGA scores between the years 2000 and 2001

The means and standard deviations of CGA scores in 2000 and 2001 are shown in Table 2. Wilcoxon tests

were performed to evaluate changes in each pair of CGA scores. On these tests, BI was found to be significantly improved ($P = 0.007$) and Lawton scale significantly lower in 2001 ($P = 0.029$). Neither the MMSE score nor GDS15 score changed significantly between 2000 and 2001 ($P = 0.730$ and 0.404 , respectively; Table 2).

Analyses to determine the relationship between change in BADL and CGA score in 2000

To determine the factors that influenced the change in BADL, univariate logistic regression analyses were performed. The dependent and independent variables are

described in the Methods section. In these analyses, BI scores less than 75 in 2000 and GDS15 scores seven or above in 2000 were significant variables for improvement in BADL between the beginning and end of the year ($P = 0.027$ and 0.031 , odds ratio = 3.64 and 3.46, respectively). Age, length of stay, hospitalization history, Lawton scale and MMSE were not significant variables (Table 3).

Multivariate logistic regression analysis was performed with BI and GDS15, which had been statistically significant in univariate analyses, used as independent variables. In this analysis, BI scores less than 75 approached significance as independent variables ($P = 0.094$, odds ratio = 2.79; Table 4).

Table 1 Subject characteristics in 2000

Number of subjects (male : female)	54 (14 : 40)
Mean age in years (SD)	82.5 (4.7)
Number of residents who had a history of hospitalization during the study year	26
Mean length of stay in the facility in days (SD)	452.8 (233.5)
Location prior to admission	
Acute-care hospital	21
Long-term care medical facilities	9
Long-term care health facilities	3
Their own home	19
Other	2

SD, standard deviation.

Table 2 Changes in comprehensive geriatric assessment scores between the years 2000 and 2001

	2000	2001	P-value
Barthel index (/100)	67.5 (25.0)	73.5 (24.0)	0.007
Lawton scale (/5)	2.7 (1.1)	2.3 (1.2)	0.029
Mini-mental state examination (/30)	18.4 (6.7)	18.2 (6.9)	0.730
Geriatric depression scale 15 (/15)	6.5 (3.4)	6.8 (3.4)	0.404

Shown as means (SD). P-values were calculated by Wilcoxon test.

Table 3 Univariate logistic regression analyses with change in basic activities of daily living and comprehensive geriatric assessment score in 2000

	Odds ratio	95%CI	P-value
Age (year)	1.00	0.89–1.12	0.954
Length of stay in the facility (days)	1.00	1.00–1.00	0.326
Hospitalization history (no)	0.96	0.32–2.93	0.949
Barthel index (< 75 points)	3.64	1.16–11.44	0.027
Lawton scale (\geq three points)	0.36	0.12–1.12	0.078
Mini-mental state examination (\geq 19 points)	0.56	0.19–1.67	0.301
Geriatric depression scale 15 (\geq seven points)	3.46	1.12–10.64	0.031

Odds ratios are shown for improvement in basic activities of daily living between the years 2000 and 2001. CI, confidence interval.

Analyses to determine the relationship between change in BADL and BI on each task in 2000

To further estimate the factors that influenced the change in BADL, other univariate logistic regression analyses were performed. In these, the change in BI was a dependent variable and 10 ADL tasks in BI in 2000 were independent variables. Bowel incontinence and urinary incontinence were significantly independent variables ($P < 0.001$, $P = 0.011$, odds ratio = 11.11, 4.60, respectively) for improvement of BADL (Table 5). Multivariate logistic regression analysis was performed with bowel function and bladder function, which had been statistically significant in univariate analyses, used as independent variables. In this analysis, only bowel incontinence was a significantly independent variable ($P = 0.006$, odds ratio = 10.9)(Table 6).

Discussion

Long-term care health facilities are established to provide residents with both appropriate medical care and assistance with the activities of daily living (ADL), and to facilitate their return home. To this end, it is important to clarify the factors that influence their BADL and target criteria that, if met, can enable them to return home. Improvement of BADL may be influenced by their diseases or their medical status as presented by laboratory data. However, it is worth noting that in general, reliable data is rarely obtained on residents in these facilities. Thus, we chose the CGA scale for use in this study.

In this study, the Lawton scale slightly changed for the worse for the subject group as a whole. The reason this for trend is not clear, but one possible reason is that

Table 4 Multivariate logistic regression analysis

	Odds ratio	95%CI	P-value
Barthel index (< 75 points)	2.79	0.84–9.29	0.094
Geriatric depression scale 15 (≥ seven points)	2.61	0.79–8.55	0.114

Odds ratios are shown for improvement in basic activities of daily living between the years 2000 and 2001. CI, confidence interval.

Table 5 Univariate logistic regression analyses with change in basic activities of daily living (BADL) and Barthel index (BI) for each task in 2000

	Odds ratio	95%CI	P-value
Feeding (dependent)	0.38	0.03–4.46	0.441
Bathing (dependent)	3.00	0.66–13.57	0.154
Grooming (dependent)	1.52	0.39–5.97	0.547
Dressing (dependent)	1.88	0.60–5.80	0.287
Bowels (dependent)	11.11	2.94–42.06	< 0.001
Bladder (dependent)	4.60	1.42–14.86	0.011
Toilet use (dependent)	0.97	0.32–2.93	0.950
Transfer (dependent)	1.04	0.32–3.38	0.947
Mobility (dependent)	0.90	0.31–2.66	0.854
Stairs (dependent)	1.13	0.34–3.74	0.839

Table 6 Multivariate logistic regression analysis

	Odds ratio	95%CI	P-value
Bowels (dependent)	10.9	2.01–59.23	0.006
Bladder (dependent)	1.03	0.20–5.18	0.974

Odds ratios are shown for improvement in basic activities of daily living between the years 2000 and 2001. CI, confidence interval.

most residents in these facilities seldom perform some of the tasks on the Lawton scale, such as shopping and handling finances, and their ability to perform these tasks may therefore show a decrease. The Barthel index showed significant improvement between 2000 and 2001. To determine the factors that influence the change in BADL, logistic regression analyses were performed. In these, a BI of less than 75 in 2000 approached significance as an independent variable. In this study, residents unable to communicate were excluded; they often had low BI scores because they were bedridden. Thus, BI score of these study subjects may be relatively higher than that of the other residents. BI scores of less than 75 in this study may represent moderately impaired BADL. On the other hand, for those residents who had BI scores of 75 and above, there may be a ceiling effect. Then, this result is reasonable. However, it is worth showing with data, because long-term care health facilities are intermediate ones and it is important to identify residents for whom rehabilitation will be effective.

On the other hand, the steps of BI may be rough and this index may be not sufficiently sensitive to small changes for residents with high BI scores. Harwood *et al.* reported the limited applicability of BI for day-hospital attendance.¹⁰ Though this result indicates that residents with moderate impairment in BI tend to improve in BI after a year, it does not exclude the effects of rehabilitation on residents with high BI scores.

Moderate impairment in BI in 2000 approached significance, not definite significance, as an independent variable. We suspect that this index is not sufficiently sensitive to predict a one-year outcome because BI consists of so many different tasks. Thus, logistic regression analyses with each task in BI in 2000 and change of BI for a year were performed. Bowel incontinence was a significant independent variable in multivariate analysis. One notable finding in this study was that bowel incontinence was a positive factor for improving BADL in this facility after a year. In univariate analysis, bladder function was also significant, though it was not significant in multivariate analysis. This may be due to the multicollinearity of these two variables; because urinary incontinence and bowel incontinence had a strong correlation ($r = 0.75$) in this study (data not shown). Therefore, excretory functions of both urination and defecation, not only defecation, are likely factors that influence BI score after a year. Cho *et al.* reported that urinary incontinence was associated with significant declines in BADL after three years in community-dwelling elderly.¹¹ The reason for this discrepancy is unclear. One possible explanation is that anxiety about incontinence causes patients to decrease activities in their community and home, and that once the staff provides assistance and instruction – rehabilitation – in this regard, improvement in BADL occurs. On the other hand,

Umegaki *et al.* reported that bowel incontinence in elderly patients in a university hospital in Japan was related to the facilities' administration after discharge from the hospital.¹² Long-term health care facilities are established to provide residents with assistance with ADL and to facilitate their return home. According to our report and the report by Umegaki *et al.*, it is reasonable that elderly with bowel incontinence habits are especially eligible for residence in these facilities in Japan.

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Influence of behavioral and psychological symptoms of dementia (BPSD) and environment of care on caregivers' burden

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Abstract

With increasing population of older adults in need of care, caregiver's burden is becoming a major concern. We investigated the relative contributions of BPSD of care recipients, caregiver's background and the care environment to caregiver's burden assessed by using Zarit burden interview (ZBI). Among BPSD, inability of finding the way home, inability of managing money and fecal incontinence were the most difficult symptoms to cope with. A path analysis, by which we constructed a network model to clarify the contributions of the factors examined to the caregiver's burden, indicated that the severity of dementia, the feeling of "would rather die than be in the same condition" and the physical pain of the caregivers showed great direct influences on the score of the ZBI. In conclusion, we clarified kinetic and dynamic interactions of factors affecting caregiver's burden by using a path analysis. The model indicates that the caregiver's burden can be affected not merely by the illness of the care recipients but by the caregiver's background and the care environment.

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Keywords: Care burden; Path analysis; Behavioral and psychological symptoms of dementia (BPSD)

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1. Introduction

The proportion of the population made up of individuals aged 65 and older in Japan exceeded 19.0% in 2003 (MHLW, 2003). Among the elderly population, 13% were estimated to be in need of care due to their physical or mental disabilities (MHLW, 2000). According to the MHLW (2001), 71.1% of elderly care recipients who live at home are receiving care primarily from their family members. The Japanese government launched public long-term care insurance in the year 2000, with an aim of providing care recipients with the relevant care services according to their level of disability. Because the present system for evaluating the level of disability is still in its developmental stage, further revisions are required with particular reference to the adequate assessment of dementia and related behavioral disturbances, which must be reflected in the evaluation of relevant care needs. Previous reports have demonstrated an association between the caregiver's burden and both the BPSD and the care environment, but how these factors contribute to the increase of the caregiver's burden remains to be clarified. Because the caregiver's burden is a multi-layered phenomenon involving various factors on both sides (care recipients and caregivers), clarification of the complicated relationship between these factors and the caregiver's burden should lead to a better understanding of how the burden increases, and thus of what interventions might help to reduce it.

In this study, in an attempt to clarify the structure of the caregiver's burden and how it develops, we here applied a network model using path analysis.

2. Subjects and methods

2.1. Subjects

A total of 116 caregivers of elderly patients were enrolled in this study. All patients were care recipients who either attended the geriatric outpatient of the Nagoya University Hospital or used in-home care services from community service providers. Written informed consent was obtained from all participants.

2.2. Measurements

A structured questionnaire was handed or sent to the caregivers of the care recipients. The questionnaire asked about the care recipient's and caregiver's background, clinical conditions, care environment, familial and economic status, and the caregiver's burden was sent to each of the caregivers. The severities of physical disability and dementia were evaluated according to the criteria shown in Tables 1 and 2. These criteria are normally used for evaluating the level of disability when care recipients apply for services provided for by the public long-term care insurance policy. Respondents were also queried in regard to the types of services provided and the presence or absence of an intimate counselor and an alternative caregiver. In addition, the caregivers were asked whether or not they had to relocate in order to provide care, whether the demands of providing care had forced them to

Table 1
Criteria of the severity of physical disability

1	Almost independent in daily living despite some disabilities and able to go out of home by self, going out of home by self using public transportation
2	Almost independent in daily living despite some disabilities and able to go out of home by self, going out of home by self within neighborhood
3	Almost independent in domestic daily living but unable to go out of home without assistance, spending most of day time out of bed and able to go out of home with assistance
4	Almost independent in domestic daily living but unable to go out of home without assistance, spending a considerable day time in bed and seldom go out of home
5	Spending most of day time in bed and require any assistance in daily activities but able to keep sitting position, able to move to a wheel chair from bed and do eating and toileting out of bed
6	Spending most of day time in bed and require any assistance in daily activities but able to keep sitting position, require assistance to move to a wheel chair
7	Bed ridden all the time and require assistance for toileting, eating and dressing, unable to roll over without assistance
8	Bed ridden all the time and require assistance for toileting, eating and dressing, unable to roll over without assistance

quit their job, whether they found their role rewarding, and whether they ever took time off from providing care.

The BPSD of the patients were assessed using an original list (Table 3). The lists consisted of 18 symptoms (nos. 1–18) included in the primary assessment dataset of the public long-term care insurance and 17 symptoms (nos. 19–35) selected from the lists applied in previous studies (Sanford, 1975; Greene et al., 1982; Baumgarten et al., 1990). For each applicable symptom, the caregivers were asked to rate the degree of difficulty in coping with the symptom by providing a score ranging from 0 (none) to 10 (very severe).

The caregiver's burden was assessed by the Zarit burden interview (ZBI) (Zarit et al., 1980). The ZBI has 21 questions with four choices for each item, and the total score (full score: 84) was used for the analyses. We also asked the caregivers to self-rate their overall sense of burden and life satisfaction on a scale of 0 (extremely low) to 100 (extremely high).

Table 2
Criteria of the severity of dementia

0	Not demented
1	Almost independent both domestically and socially despite some dementia symptoms
2	Hampered in daily living with mental symptoms, abnormal behaviors and communication disorders, but barely maintain independence with close supervision by others
3	In constant need for assistance because of incapacity due to mental symptoms, abnormal behaviors and communication disorders. Problematic symptoms or behaviors are observed
4	Incapacitated in daily living with frequent mental symptoms, abnormal behaviors and communication disorders, and unable to maintain independence without assistance by others
5	In need of specialized medical care because of extreme mental disorders, problematic behaviors or severe physical ailments persistent manifestation of psychiatric symptoms such as delirium, delusion, agitation, or self-inflicting injury

Table 3
The list of BPSD

1	Delusion of being robbed
2	Confabulation or spread around
3	Hallucination
4	Changeable mood
5	Sleep disturbance
6	Verbal and non-verbal abuse
7	Repeated story
8	Loud voice
9	Resistant to care
10	Wandering
11	Restlessness
12	Inability in finding the way home
13	Request to go home
14	Hording useless things
15	Inability of managing the hot things
16	Destroying property
17	Filthy behavior
18	Allotriophagy
19	Confusion between present and past
20	Misrecognition for family
21	Misrecognition of acquaintance
22	Inability of managing money
23	Inappropriate sexual behavior
24	Hiding things
25	Compulsive behavior
26	Misinterpretation for caregivers' contact
27	Hanging around persistently, repetitive question
28	Disturbing conversation
29	Waking caregiver up
30	In need to be watched out
31	Reduction of interest
32	Appears unhappy or depressed
33	Abnormal appetite
34	Urinary incontinence
35	Fecal incontinence

In addition to the above assessment of caregiver's burden, with an aim to clarify relative contributions of caregiver's feeling to the burden, two questions asking a sense of loss as the care recipient's cognition declines and whether or not he/she would rather die than be in the same condition were included in the questionnaire. Also, a covert wish if the care recipient would disappear and a latent desire for dying to escape from the burden were asked.

2.3. Statistics

Pearson's correlation coefficients (r) were calculated for parametric data and Spearman's rank of order correlation coefficients (ρ) were calculated for non-parametric data. We used the chi-square test with Yates correction, and Fisher's exact test for

categorical comparisons of the data. Differences in the means of continuous measurements among the groups were tested using the Student's *t*-test and one-way analysis of variance (ANOVA). Tukey's test was performed for multiple comparisons when ANOVA showed a significant difference. The internal consistency of the ZBI was calculated by Cronbach's alpha. Multiple regression analysis, using the step-wise method with the variables of significant measures detected in the univariate analyses, was conducted to identify the factors contributing to the ZBI. Patients whose relevant data was missing were excluded from the multivariate analysis. To clarify the process by which the caregiver's burden develops, a path analysis was performed for the variables which had a significant relationship with the ZBI, using multiple regression method as described by Munro (2001) and Polit (1996). Path analysis is an extension of the regression model, used to test the fitness of the correlation matrix. A *p*-value of <0.05 was considered to indicate statistical significance; all tests were two-tailed. All statistical analyses were performed on a personal computer with the statistical package SPSS 11.0 and Amos 4.02 for Windows (SPSS Inc., Chicago, IL).

3. Results

3.1. Attributes of the care recipients

Seventy-four percent of the care recipients were female. The mean age of the recipients was 79.8 ± 9.1 years (here and in all other cases \pm S.D.), and the mean duration of receiving care was 46.6 ± 42.1 months. The numbers of cohabitants were: none (6.4%), one (14.7%) and more than two (78.9%). The mean severity of physical disability was 3.2 ± 2.0 , and the mean severity of dementia was 2.0 ± 1.3 . A majority (94.4%) of all the care recipients surveyed used some care services as follows: day service (73.8%), respite care (25.2%), home visit care (25.2%), use of supporting instruments of care (21.5%), home visit nursing (10.3%), home visit by physician (8.4%), bathing service (3.7%), home visit dentistry (2.6%) and in-home rehabilitation (0.9%).

3.2. Attributes of the caregivers and the care environments

A majority (84%) of the caregivers were female. The caregivers' relationships to the care recipients were: spouse (30.4%), daughter (30.4%), daughter-in-law (27.8%), son (8.7%) and others (2.6%). The mean age of the caregivers was 60.8 ± 11.5 months and the duration of providing care was 45.3 ± 42.2 months. A majority (79.3%) of the caregivers experienced some physical pain of their own, and many of them had to either retire from their work (19.5%) or change their residence for care (13.2%). Meanwhile, 27.2% of the caregivers answered "poor" or "mildly poor" to the question about a premorbid interpersonal relationship with the care recipients. Seventy-eight percent of caregivers had an intimate counselor, and 56% of them had an alternative caregiver. The caregivers found their roles rewarding at the following rates: always, 4.5%; often, 4.5%; sometimes, 28.2%; rarely, 24.5%; none, 38.2%. The frequencies of physical pain felt by the caregivers were: always, 22.1%; often, 8.0%; sometimes, 30.1%; rarely, 18.6%; never, 21.2%. The

frequency of respite from the care was: more than once a week, 41.1%; a few times per month, 23.4%; never, 35.5%.

Twenty-five percent of the caregivers had a strong sense of loss due to the deterioration of cognitive function of the care recipient, and 46.0% of them thought they would rather die if they were in the same status as the care recipient.

3.3. The BPSD

Fig. 1 shows the frequencies of observed BPSD and the difficulties in coping with the BPSD. The mean number of BPSD reported by the caregivers was 11.7 ± 7.9 . The mean of the cumulative score of difficulties was 63.5 ± 52.1 .

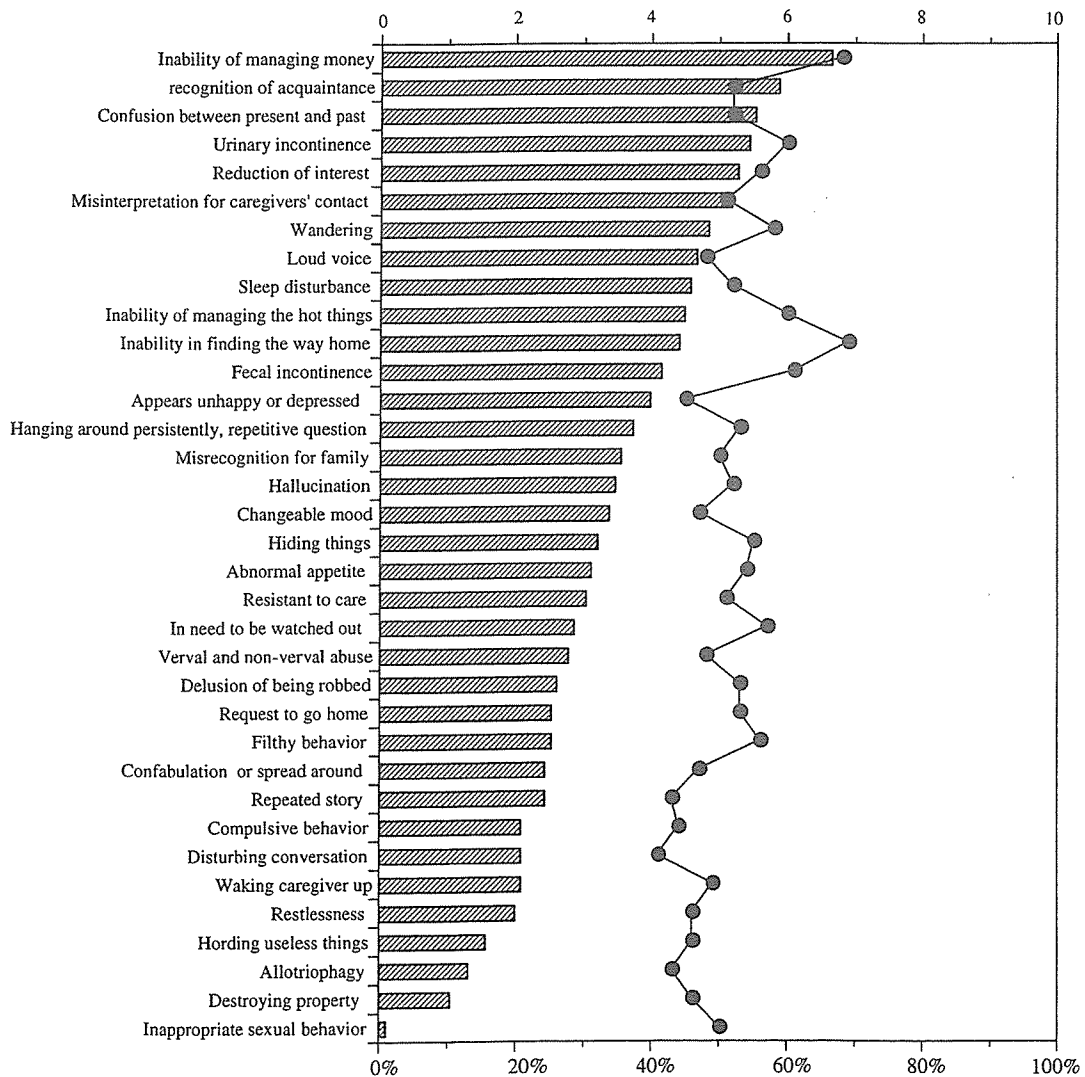


Fig. 1. The frequency of BPSD to be observed, and the difficulties of coping with each symptom. The horizontal bar chart shows the frequencies of BPSD to be observed, and the kinked line shows the difficulties to cope with the symptoms.

3.4. Caregivers' burden

The mean ZBI score was 35.3 ± 15.6 . The reliability was high, with a Cronbach's α of 0.915, and the alpha was also high ($\alpha = 0.918$) when it was calculated only for the care recipients with dementia. The overall burden score was 56.6 ± 25.8 , and the score was strongly correlated with the ZBI score ($r = 0.623$, $p < 0.001$). When the subjects were limited to the care recipients with dementia, Cronbach's α of the ZBI score remained high, with $\alpha = 0.918$, and the ZBI score was also strongly correlated with the burden score with an r of 0.528 ($p < 0.001$).

The severity of dementia was related with the ZBI ($r = 0.334$, $p = 0.003$), but it did not have a significant association with the burden score ($r = 0.154$, $p = 0.163$). Meanwhile, the severity of physical disability showed no significant correlation with the ZBI or the burden score.

The ZBI and the burden score were significantly associated with the duration of care (ZBI: $r = 0.223$, $p = 0.021$; burden score: $r = 0.219$, $p = 0.018$, respectively), the presence of an intimate counselor ($t = -3.685$, $p < 0.001$; $t = -2.179$, $p = 0.024$), and the frequency of physical pain in the caregivers ($\rho = -0.311$, $p = 0.001$; $\rho = 0.293$, $p = 0.002$). The presence of an alternative caregiver made the burden score slightly higher ($t = -1.988$, $p = 0.049$), but did not affect the ZBI ($t = -1.581$, $p = 0.117$). No significant difference of the ZBI or the burden score was seen depending on the caregiver's gender, age or economic status. There was no significant difference of the ZBI or the burden score depending on a familial relationship. The ZBI and the burden score were the highest if the caregiver was daughter-in-law (mean ZBI score: 38.1 ± 13.8 , mean burden score: 65.0 ± 23.6 , respectively). The premorbid interpersonal relationship between the caregiver and the care recipient was not significantly related with the ZBI score ($\rho = 0.034$; $p = 0.730$) or the burden score ($\rho = -0.170$; $p = 0.071$).

Multiple regression analysis for the ZBI showed that the significant variables were the severity of dementia (standardized $\beta = 0.740$), the presence of an intimate counselor (standardized $\beta = 0.289$), and the BPSD of disturbing conversation (standardized $\beta = 0.294$), appears unhappy or depressed (standardized $\beta = 0.304$) and urinary incontinence (standardized $\beta = 0.205$) with an adjusted R^2 of 0.401.

3.5. The influence of burden on the caregivers' mental status

The covert wish if the care recipient should disappear was observed consistently in 5.2% of the caregivers, often in 1.7% of them, sometimes in 17.2%, occasionally in 31.0%, and 44.8% of the caregivers never had the wish. The wish was highly related with the ZBI and the burden score (ZBI: $\rho = 0.431$, $p < 0.001$; burden score: $\rho = 0.391$, $p < 0.001$). The caregivers' latent desire to die in order to escape from the burden was observed consistently in 0.9% of caregivers, often in 2.6% of them, sometimes in 5.3%, occasionally in 17.5%, and 73.7% of them never had the desire. The desire was also related with both the ZBI and the burden score (ZBI: $\rho = 0.442$, $p < 0.001$; burden score: $\rho = 0.396$, $p < 0.001$).

Furthermore, the caregivers' satisfaction score was highly associated with the ZBI and the burden score (ZBI: $r = -0.490$, $p < 0.001$; burden score: $r = -0.343$, $p < 0.001$). The overall satisfaction was related with the presence of an intimate counselor ($p = 0.006$), but

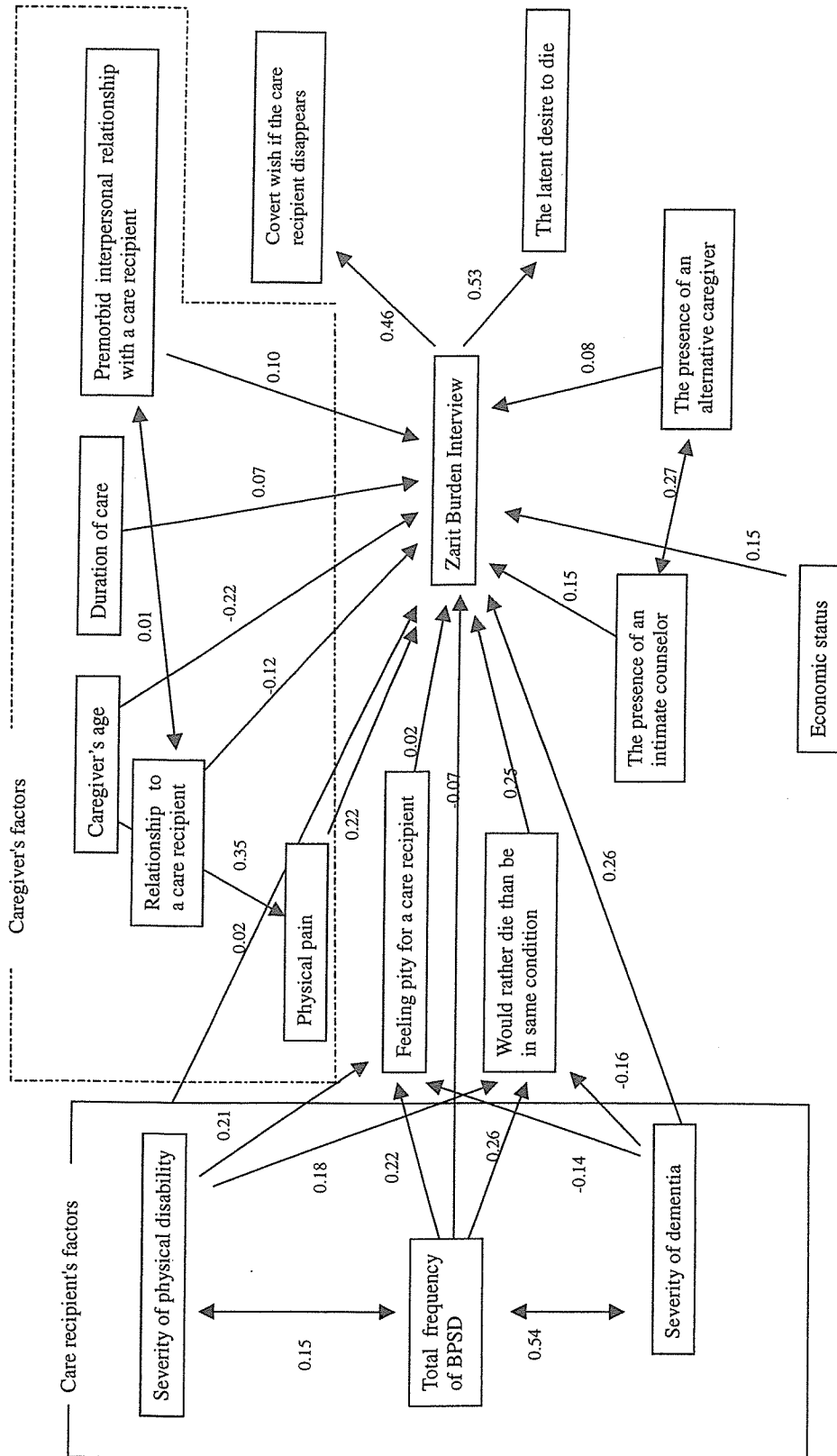


Fig. 2. The path model of the ZBI and the variables. The numbers show the standardized direct effects.

no significant association was found with the age of the caregivers, the relationship, the duration of care, annual income, the presence of an alternative caregiver, the presence of physical pain or the premorbid interpersonal relationship between the caregiver and the care recipient.

3.6. Path analysis (Fig. 2)

A path analysis indicated a significant network model of the relationship around the caregiver's burden, showing an adjusted R^2 of 0.370. The severity of dementia, the sense of "would rather die than be in the same condition" and physical pain of the caregivers showed large direct influences on the score of ZBI. The total frequency of BPSD significantly affected both pity for the care recipients and the sense of "would rather die than be in the same condition", but the burden was significantly influenced only by the sense of "would rather die than be in the same condition".

4. Discussion

In the present study, the ZBI was used to assess the caregivers' burden. The reliability and the validity of ZBI for the Japanese population have already been examined by Arai et al. (1997). However, despite the fact that the ZBI was originally developed for the caregivers of care recipients with dementia, none of the reports had adequately addressed the utility of the interview in assessing caregiver's burden in dementia care.

Caring for a patient suffering from dementia tends to keep caregivers bound at home, thereby increasing the caregiver's burden. The difficulty of coping with such unpredictable patient behavior as sudden tantrums or wandering often distresses the caregiver (Haley, 1997). The strong association of urinary and fecal incontinence with caregivers' burden observed in this study is consistent with previous reports demonstrating that incontinence is a strong predictor for collapse in caregiving at home (Ouslander et al., 1990; etc.). Moreover, the results demonstrated that patients' urinary and fecal incontinence make it difficult for caregivers to continue their regular job or to take time away from caregiving due to the time required for this special care. Hence, it may be essential to pay particular attention to the management of a patient's continence in terms of reducing caregivers' burden. In addition to incontinence, we confirmed strong associations of various BPSD, such as nocturnal delirium, hallucination, interfering with family conversation, and appears unhappy or depressed, with the caregiver's sense of burden.

Pearlin et al. (1990) constructed a model in which the primary stressor can be added to and modified by the care environment and the caregivers' background as secondary stressors. The present study showed that the duration of care, the presence of an intimate counselor, and the presence of physical pain in caregivers were strongly associated with the burden.

In the present study, regression analyses could not construct models with a high, adjusted R^2 for the ZBI and the burden score. But the path analysis indicated a network model with a higher adjusted R^2 , which yielded abundant information of the variables involved with care burden. The path analysis showed strong direct effects of severity of

dementia, the sense of “would rather die than be in the same condition”, and physical pain on the caregiver. The fact that pity for the care recipient has only little direct effect for the ZBI might suggest that the caregiver’s sense of burden stems from concerns of the caregiver’s own rather than from his/her compassion for the care recipient. We believe that the network model clarifies the relative involvement and kinetics of various factors influencing the caregiver’s burden. In particular, the presence of an intimate counselor to the caregivers and physical pain had substantial impact on caregiver’s burden. The overall frequency of BPSD had a significant effect on the caregivers’ sense of pity or the desire that they would rather die than be in the same condition. Meanwhile only the feeling that they would rather die than be in the same condition had the largest effect on the caregiver’s burden. These results may imply that it is the depreciation of demented care recipients as human, not the sympathy for them that loads the caregivers’ mind with the burden.

The caregiver’s burden is a complicated concept because it has a multi-layered structure. The structure consists of various factors such as the care recipients’ illness, and physical, psychological, and social stress for the caregiver.

In conclusion, the path analysis in the present study revealed the kinetic and dynamic interactions of factors affecting caregiver’s burden. The results indicate that caregiver’s burden can be affected by physical and psychological status of caregivers, as well as by medical conditions of care recipients. The application of this analytical method may help to establish strategies to reduce caregivers’ burden by a better understanding of how the burden develops.

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7 **Cognitive dysfunction associates with white matter hyperintensities and**
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9 **subcortical atrophy on magnetic resonance imaging of the elderly**
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11 **diabetes mellitus**

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14 **Japanese Elderly Diabetes Intervention Trial (J-EDIT)**

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18 A short title

19 Diabetic cognitive dysfunction (J-EDIT)

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Abstract

Background. Type 2 diabetes mellitus is associated with cognitive dysfunction and increases the risk for dementia in the elderly. The aim of this study was to explore, by means of magnetic resonance (MR) imaging, possible relationships among clinical profiles of diabetes, cognitive function, white matter hyperintensities (WMHs) and subcortical brain atrophy.

Methods. Data were obtained from 95 non-demented type 2 diabetic participants aged 65 years or over, enrolled in an intervention trial for Japanese elderly diabetics. Cognitive function was measured with neuropsychiatric tests, including mini-mental state examination (MMSE), verbal memory, digit symbol substitution and Stroop tests. Hyperintensity was classified into periventricular, deep white matter, thalamic and basal ganglia. Four ventricle-to-brain ratios were used to measure subcortical atrophy. To identify clinical features of diabetes, indices of glycemic control, lipid metabolism, blood pressure and complications were examined. Canonical correlation analysis was used to assess correlation.

Results. Score for digit symbol substitution, MMSE and memory negatively correlated with PVH, and to a lesser extent with WMHs in temporal and parietal lobes and in the thalamus. Lower scores for memory, digit symbol substitution and Stroop showed positively association with enlarged subcortical atrophy