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# Complex obstacle negotiation exercise can prevent falls in community-dwelling elderly Japanese aged 75 years and older

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**Objectives:** The aim of the present study was to evaluate whether a complex course obstacle negotiation exercise (CC), a 24-week exercise program, can reduce falls and fractures in older adults, as compared with a simple course obstacle negotiation exercise (SC).

**Methods:** This trial was carried out on older adults, aged 75 years and above in Japan. In total, 157 participants were randomized into the CC group ( $n = 78$ ) and the SC group ( $n = 79$ ). Participants were enrolled in the exercise class using the CC program or the SC program for 24 weeks. The outcome measure was the number of falls and fracture rates in CC and SC groups for 12 months after the completion of the 24-week exercise class.

**Results:** Two participants (2.8%) in the CC group and 19 (26.0%) in the SC group experienced falls during 12 months. During the 12-month follow-up period after the intervention, the incidence rate ratio (IRR) of falls in the SC group against the CC group was 9.37 (95% CI = 2.26–38.77). One participant (1.4%) in the CC group and eight (10.9%) in the SC group had experienced fractures during 12 months after the exercise class. The IRR of fractures in the SC group compared with the CC group was 7.89 (95% CI = 1.01–61.49).

**Conclusions:** The results of the present trial show that the participants who received individualized obstacle avoidance training under complex tasks combined with a traditional intervention had a lower incidence rate of falls and fractures during the 12 months after the intervention. *Geriatr Gerontol Int* 2012; 12: 461–467.

**Keywords:** fall prevention, obstacle negotiation exercise, older adults, randomized controlled trial.

## Introduction

Falls are relatively common events in older people. One-third of community-dwelling people, aged 65 years and older, and up to 50% of those aged 80 years and older

experience a fall each year.<sup>1,2</sup> A previous study also reported that in community-dwelling elderly individuals, over 50% of the falls are a result of trips and slips that usually occur during walking.<sup>3</sup> In many of these cases, there is an external factor, such as an obstacle, that provokes and contributes to the fall.<sup>4</sup> In addition, the incidence of osteoporotic fractures is reported to increase with age,<sup>5</sup> and more than 50% of all fragility fractures in the community arise in women aged 75 years and older.<sup>6</sup> A recent systematic review of fall prevention programs has convincingly shown that exercise interventions are effective for reducing the risk of

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falls and fall injuries.<sup>7,8</sup> However, the kind of exercise intervention most effective for fall prevention is not fully addressed.

Concurrent cognitive or motor tasks, such as talking or carrying objects, are crucial for mobility in daily life. Because of the increasingly recognized role of cognition in postural control and gait, many researchers have used complex task paradigms incorporating a concurrent cognitive task to improve their studies investigating fall risk.<sup>9</sup> Changes in performance during multitasking are significantly associated with an increased risk for falls in older adults.<sup>9</sup> The ability to modulate attention might also play an important role in the acquisition of complex task coordination skills. Therefore, we developed a trail walking exercise (TWE), in which a person walks from numbered flags in either an ascending or descending order, to evaluate cognitive and motor function simultaneously.<sup>10</sup> Our previous randomized controlled trial (RCT) showed that TWE has the benefit of decreasing the incidence of falls in community-dwelling elderly adults.

In everyday life, when walking in a challenging and distracting environment, older people might have to avoid ground level obstacles when their attention is divided. In this instance, obstacle-avoidance performance is likely to be further impaired, as shown by most multitask research among older adults.<sup>11–13</sup> In addition, Jasmine *et al.* reported that when their attention is divided, older people negotiate obstacles more slowly and contact more obstacles.<sup>14</sup> Therefore, in the present study, we added obstacles to the area of TWE (complex course obstacle negotiation) to mimic a “real world” walking environment with a high fall risk.

The present RCT examined the effect of fall and fall-related fracture prevention programs on attention demands of obstacles during walking under complex task conditions in community-dwelling elderly Japanese adults aged 75 years and older. The aim of the present study was to evaluate whether the complex course obstacle negotiation exercise (CC), a new 24-week exercise program, would be effective in reducing falls and fall-related fractures in community-dwelling older adults. We hypothesized that complex task walking is improved to a greater extent with the CC program than with the simple course obstacle negotiation exercise (SC). From these results, we can assume that the CC program is more effective in preventing falls and fall-related fractures than is the SC program.

## Methods

### Participants

Participants were recruited using an advertisement in the local press. The following criteria were used to screen participants in an initial interview: age 75 years

and older, community-dwelling, had visited a primary care physician within the past 3 years, had no severe cognitive impairment (Rapid Dementia Screening Test [RDST] score of 4 or less),<sup>15</sup> can walk independently (or with a cane), willingness to participate in group exercise classes for at least 6 months, has access to transportation, has no significant hearing and vision impairments, and had no regular exercise in the past 12 months.

The interview was also used to exclude participants based on the following exclusion criteria: severe cardiac, pulmonary or musculoskeletal disorders; comorbidities associated with greater risk of falls, such as Parkinson disease and stroke; and use of psychotropic drugs. Written informed consent was obtained from each participant for the trial in accordance with the guidelines approved by the Kyoto University Graduate School of Medicine and the Declaration of Human Rights, Helsinki, 1975.

### Study design and randomization

Participants were randomized into two groups. Opaque envelopes bearing group names were numbered and the 157 participants were then randomly assigned to either the CC ( $n = 78$ ) or SC ( $n = 79$ ) group.

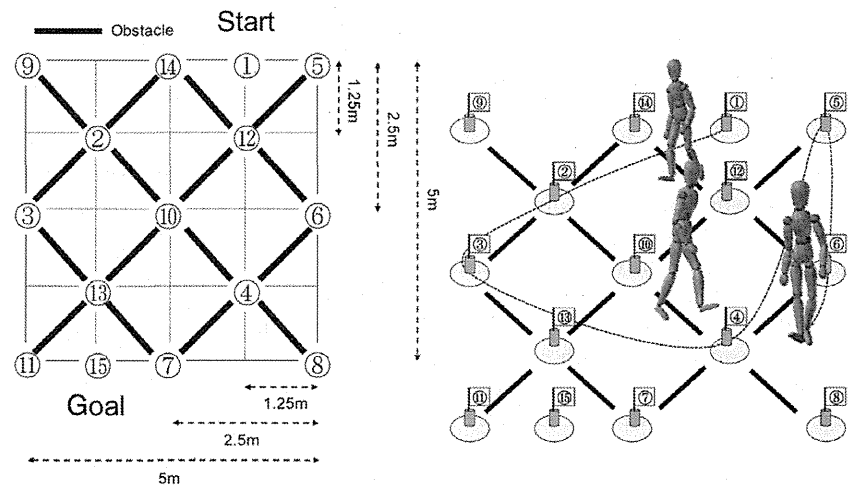
### Intervention

All participants received 45 min of group training sessions once a week for 24 weeks. Participants were randomly assigned to one of the two training groups: standardized training with CC and standardized training with SC.

The exercise class was individualized for each group and supervised by a physiotherapist. Each exercise class used a standardized format that included 10 min of moderate-intensity aerobic exercise, 15 min of progressive strength training, 10 min of flexibility and balance exercises, and 10 min of cool-down activities. The aerobic exercise consisted of movement of the legs, trunk and arms to involve all joints and major muscle groups in activities, such as dancing. Strength training consisted of progressive resistive exercises using an elastic band. A sequence of progressively more difficult exercises was also carried out to improve static and dynamic balance. Although exercises could be carried out in a sitting position, the importance of carrying the exercises out in a standing position to improve balance was stressed. Physiotherapists evaluated the participants twice during the study period to ensure adherence with exercise protocols during classes.

### Complex course with obstacle negotiation exercise

In the CC training field, the flags and obstacles were positioned as shown in Figure 1.<sup>10</sup> Flags were randomly



**Figure 1** Schematic representation of the complex course obstacle negotiation exercise. Participants were asked to pass sequentially from numbers 1 to 15 as quickly and as correctly as possible during obstacle avoidance.

moved for each trial. Participants in the CC group were asked to sequentially pass from number 1 to 15 while avoiding the obstacles (Fig. 1). A 30-cm diameter circle was drawn on the ground around each flag, and the participants were required to step in the circle to pass the flag. The height of the flag was 30 cm. The tester gave the following instructions to participants, "Please move to flag number 15 as quickly and correctly as possible while avoiding obstacles". Throughout the weeks, the obstacles were made increasingly more difficult for participants to notice. The obstacles consisted of 16 wooden white (contrasting the floor colour) blocks (3, 100 and 1 cm in height, length and width, respectively) in weeks 1–6, wooden black blocks (2, 100 and 1 cm in height, width and depth, respectively) in weeks 7–12, wooden dark brown blocks (1, 100 and 1 cm in height, length and width, respectively) in weeks 13–18 and wooden brown (matching the floor colour) blocks (0.5, 100 and 1 cm in height, length and width, respectively) in weeks 19–24. Flag and obstacle positions were changed on each day of training. Participants carried out two sets of the CC program per training session.

#### *Simple course with obstacle negotiation exercise*

Participants were asked to walk along a walkway at a self-selected speed and to avoid contact with the obstacles. These sessions were designed as controls for the additional physical activity in the CC session. Participants walked along a level walkway, 15 m in length. The obstacles used in the simple course were as follows: six wooden white (contrasting the floor colour) blocks (3, 100 and 1 cm in height, length and width, respectively) in weeks 1–6, wooden black blocks (2, 100 and 1 cm in height, length and width, respectively) in weeks 7–12, wooden dark brown blocks (1, 100 and 1 cm in height, width and depth, respectively) in weeks 13–18,

wooden brown (matching the floor colour) blocks (0.5, 100 and 1 cm in height, length and width, respectively) in weeks 19–24. These obstacles were placed across the walkway at intervals randomly ranging from 30 to 150 cm for each day of training. Each participant carried out six walking trials.

#### *Falls and fall-related fractures*

The primary outcome of this trial was the occurrence of falls and fall-related fractures during the follow-up period of 12 months after the intervention was completed. Falls were defined as all situations in which a participant suddenly and involuntarily came to rest on the ground or at a surface lower than their original station.<sup>16</sup> Falls resulting from extraordinary environmental factors (e.g. traffic accidents or falls while riding a bicycle) were excluded. The participants were asked to record any falls in fall diaries mailed every month by research assistants. If participants failed to send the fall diaries, research assistants collected data on falls over the telephone. All participants who had fallen were interviewed during these calls using a structured questionnaire about a fall event and its consequences. The diagnosis of fractures was based on radiological evidence of fracture.

#### *Secondary outcome measures*

For all participants, the following six measurements were obtained: 10-m walking time,<sup>17</sup> the timed up and go (TUG) test,<sup>18</sup> the functional reach (FR) test,<sup>19</sup> the one-leg stand (OLS) test,<sup>20</sup> the SC test, and the CC test. A physiotherapist blinded to group allocation administered these measures at baseline, on completion of the 24-week intervention. All baseline measures were completed before randomization. Before the study started,

all staff members received training on correct protocols for administering all assessment measures included in the study from one of the authors (MY). If a walking aid was normally used at home, this aid was used during the TUG test, 10-m walking, SC test and CC test.

In the 10-m walking, participants walked 15 m at a speed at which they felt comfortable. A stopwatch was used to record the time required to reach the 10 m point that was marked in the middle of this walk. The time recorded in two trials was averaged as the walking score.

In the TUG test, participants were asked to stand up from a standard chair with a seat height of 40 cm, walk a distance of 3 m at a maximum pace, turn, walk back to the chair, and sit down. The time recorded from two trials was averaged to obtain the TUG score.

In the FR test, each participant was positioned next to a wall with one arm raised at 90° and fingers extended. A meter stick was mounted on the wall at shoulder height. The distance that a participant could reach while extending forward from an initial upright posture to the maximal anterior leaning posture without moving or lifting the feet was visually measured in centimetres according to the position of the tip of the third finger against the mounted meter stick. The distances measured in two trials were averaged to obtain the FR score.

In the OLS test, participants were instructed to start from a standing position with a comfortable base as support with eyes open and arms at their sides. They were then instructed to stand unassisted on either leg. OLS was measured in seconds from the time one foot was lifted from the floor to when it touched the ground or the standing leg.

In the SC test, participants were asked to walk along the walkway at a self-selected speed and to avoid contact with the obstacles. Participants walked along a level walkway, 10 m in length. The simple course consisted of six wooden white (contrasting the floor colour) blocks (3, 100 and 1 cm in height, length and width, respectively). These obstacles were placed across the walkway at intervals of 2 m. Time to complete each walking trial was recorded using a stopwatch. The number of obstacles contacted was recorded. The SC test was carried out only once for each participant at each time-point.

In the CC test, the field test was the same as that used for the CC exercise (Fig. 1). The complex course consisted of 16 wooden white (contrasting the floor colour) blocks (3, 100 and 1 cm in height, length and width, respectively). The test-retest reliability using the intraclass correlation coefficient was 0.935. The positions in which the flags and obstacles were placed are shown in Figure 1. The tester gave the following instruction to the participants: "Please move to number 15 as quickly and as correctly as possible while avoiding obstacles". Time to complete each walking trial was recorded using

a stopwatch. The number of obstacles contacted was recorded. The CC test was carried out only once for each participant at each time-point.

### *Required sample size*

A previous study showed that approximately 30% of the Japanese community-dwelling adults, 65 years of age or older, fall at least once a year. This result was consistent with a previous report.<sup>2</sup> We designed the current study to detect a 30% difference in fall rate between the groups (CC group = 10% and SC group = 30%), for which a sample size of 72 per group ( $\alpha = 0.05$  and power = 80%) was necessary. With an estimated dropout rate of 5%, a final sample size of 76 per group was required.

### *Statistical analysis*

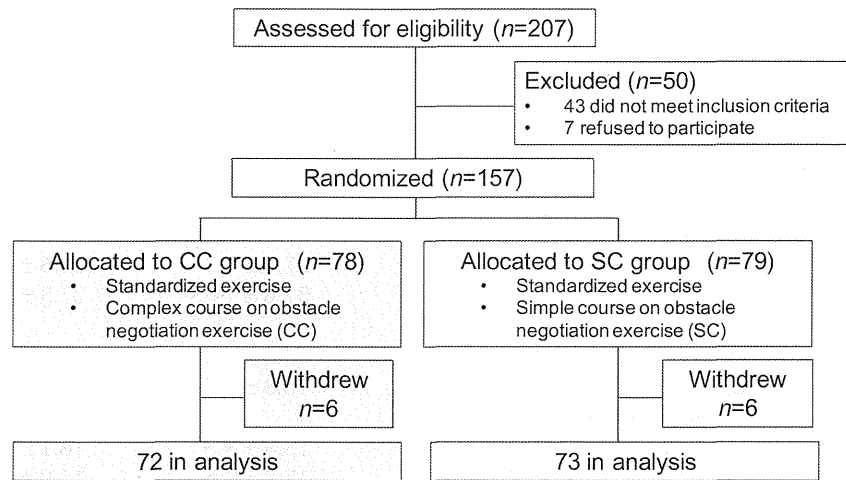
Baseline characteristics of CC and SC groups were compared to examine the comparability of the two groups. Differences in the physical function variables between the two groups were analyzed using the Student's *t*-test or  $\chi^2$ -test.

The number of falls and fall-related fractures was calculated from the beginning of the study to the participant's death, withdrawal from the trial or the end of the 12-month follow-up period. Confidence intervals (CI) for the falls and fall-related fracture rates were calculated assuming that the number of falls and fall-related fractures followed a negative binomial distribution. Incidences of falls and fall-related fractures with 95% CI were calculated for participants in the CC and SC groups, and compared using negative binomial regression analysis. Results were presented using incident rate ratios (IRR) with their 95% CI. The effect of exercise on outcome measurements was analyzed using a mixed  $2 \times 2$  (group [CC and SC groups]  $\times$  time [pre-training, post-training]) analysis of variance. Post-hoc Tukey tests were used to assess which group or time periods showed significant differences.

Data were entered and analyzed using the SPSS (Windows version 18.0, SPSS, Chicago, IL, USA). A *P*-value of  $<0.05$  was considered statistically significant for all analyses.

## **Results**

Overall, 207 people were screened, and 157 (75.8%) who met the inclusion criteria for the trial and agreed to participate were enrolled (Fig. 2). Of the individuals not meeting the inclusion criteria ( $n = 50$ ), most were excluded because they had exercised regularly in the 6 months before screening. Seven people who were eligible for the study withdrew their participation after a



**Figure 2** A flow chart showing the distribution of participants throughout the trial.

**Table 1** Baseline characteristics of the study participants in complex course obstacle negotiation exercise and simple course obstacle negotiation exercise groups

Characteristic	CC group <i>n</i> = 72	SC group <i>n</i> = 73	<i>P</i>
Age (years)	85.8 ± 5.9	85.3 ± 5.7	0.71
Bodyweight, (kg)	44.9 ± 9.8	47.8 ± 9.4	0.36
Height (cm)	145.1 ± 9.0	147.8 ± 9.2	0.22
Female, <i>n</i> (%)	63 (88.7%)	64 (86.5%)	0.59
RDST (points)	7.5 ± 2.2	7.6 ± 2.5	0.80
Medication ( <i>n</i> )	3.7 ± 2.9	3.8 ± 3.3	0.89
Walking aids, <i>n</i> (%)	34 (47.2%)	30 (41.1%)	0.28
Falls in the last year, <i>n</i> (%)	28 (38.9%)	29 (39.7%)	0.59

CC, complex course obstacle negotiation exercise; RDST, Rapid Dementia Screening Test; SC, simple course obstacle negotiation exercise.

telephone screening. Of the 157 individuals selected for the study, 145 (92.3%) completed the 12-month follow up: 72 in the CC group (92.3%) and 73 in the SC group (92.4%).

All 24 scheduled intervention sessions were completed. The median relative adherence was 96% (25<sup>th</sup> to 75<sup>th</sup> percentile, 88–100%) in the CC group and 96% (88–100%) in the SC group. No fall incidents occurred during training sessions or testing. No health problems, including cardiovascular or musculoskeletal complications, occurred during training sessions or testing. Minor problems observed in both groups were muscle ache after the first training sessions and fatigue. All problems were managed easily using adjustment of the intervention, and they improved during the intervention. Participants in the CC and SC groups were comparable and well matched with regard to their baseline characteristics (Table 1).

Two participants (2.8%) in the CC group and 19 (26.0%) in the SC group had experienced falls during the 12 months after the exercise program. During the 12-month follow-up period, the IRR of falls in the SC group against the CC group was 9.37 (95% CI 2.26–38.77). One participant (1.4%, distal radius *n* = 1) in the CC group and 8 (10.9%, distal radius *n* = 2; proximal humerus *n* = 3; hip *n* = 3) in the SC group experienced fall-related fractures during the 12-month follow-up period. The IRR of fall-related fractures in the SC group against the CC group was 7.89 (95% CI 1.01–61.49).

Participants in the CC group had significantly greater improvements in secondary outcome measures including the performance time and the number of obstacles contacted under the CC condition (*P* < 0.05) (Table 2). However, other secondary outcome measures were not significantly different between the two groups (*P* > 0.05).

**Table 2** Functional fitness items in each group at pre- and postintervention

Item	Pre-intervention	Postintervention	Group × Time <i>F</i> -value	Interaction <i>P</i> -value
10-m walking time (s)				
CC group	16.2 ± 7.4	14.1 ± 4.4	0.01	0.91
SC group	18.6 ± 10.0	15.1 ± 6.2		
10-m walking step ( <i>n</i> )				
CC group	27.5 ± 8.1	26.6 ± 7.2	1.08	0.30
SC group	31.6 ± 14.3	27.3 ± 9.9		
TUG (s)				
CC group	13.6 ± 5.2	13.7 ± 5.3	0.18	0.67
SC group	18.3 ± 9.4	14.8 ± 7.1		
Functional reach (cm)				
CC group	15.9 ± 9.3	16.1 ± 8.2	3.21	0.08
SC group	13.8 ± 7.5	14.0 ± 6.8		
One leg standing (s)				
CC group	6.0 ± 7.4	5.1 ± 5.7	2.56	0.12
SC group	3.2 ± 3.6	4.9 ± 6.1		
Performing time under simple course (s)				
CC group	15.9 ± 8.8	14.5 ± 4.0	0.28	0.60
SC group	17.2 ± 7.9	15.5 ± 5.9		
Performance time under complex course (s)				
CC group	132.6 ± 36.9	105.7 ± 18.7	5.63	0.02
SC group	152.0 ± 54.1	140.9 ± 53.8		
No. obstacles contacted under simple course (times)				
CC group	1.0 ± 1.1	0.3 ± 1.1 <sup>†</sup>	0.60	0.44
SC group	1.2 ± 1.4	0.2 ± 0.6 <sup>†</sup>		
No. obstacles contacted under complex course (times)				
CC group	1.9 ± 2.1	0.1 ± 0.4 <sup>†</sup>	5.62	0.02
SC group	1.7 ± 2.0	1.8 ± 2.8 <sup>†</sup>		

<sup>†</sup>As calculated by group comparison  $P < 0.05$ . Columns indicating pre- and postintervention values are expressed as mean (SD). CC, complex course obstacle negotiation exercise; SC, simple course obstacle negotiation exercise; TUG, timed up and go test.

## Discussion

The SC exercise is an obstacle-avoidance program under simple task conditions. The CC exercise is an obstacle-avoidance program under complex task conditions, and is designed to address multiple domains, such as attention, short-term memory and balance, which when impaired have been shown to increase fall risk.<sup>21</sup> The present results show that the CC program can improve the performance time of the CC test. This result is consistent with our previous study.<sup>10</sup>

In the CC program, the obstacles were organized to gradually increase the level of difficulty. Therefore, it is possible that the CC program improves the participants' performance by decreasing the number of obstacles contacted under the CC conditions. This result suggested that the obstacle-avoidance program, which increases attention demands for obstacles during

walking under complex task conditions, is useful for the improvement of obstacle-avoidance capability. Previous studies have shown that the obstacle-avoidance success rate was decreased by the presence of a secondary task.<sup>22,23</sup> Furthermore, elderly individuals with a high risk for falls chose an early transfer of gaze strategy when challenged with an obstacle under dual-task conditions.<sup>13</sup> The present study showed that our CC program could improve divided attention under complex task conditions.

The differences in fall and fall-related fracture rates between CC and SC groups were significant during the 12 months after the intervention. The improvement in the number of obstacles contacted and the performance time of the CC test became apparent in increased capacity in a real-life environment.

There were several limitations of the present study that warrant mention. First, the participants were

probably more motivated and showed greater interest in health and fall risk than the general population of older adults. Second, the information about the medications for osteoporosis was not included in the analysis. It is possible that such medications have an effect on the fracture incidence.

The results of this RCT suggest that the CC program is more effective in improving the number of obstacles contacted and the performance time of the CC test than the SC program. In addition, participants who received individualized obstacle-avoidance training under complex tasks combined with a traditional intervention showed a lower incidence rate of falls and fall-related fractures during the 12-month follow-up period. These results implicated the importance of population-based prevention programs to reduce falls and fall-related fractures in older adults (75 years and older). This is the first study to show that the obstacle-avoidance program, focusing on attention demands of obstacles during walking under complex task conditions, is useful in preventing falls and fall-related fractures in older adults. A larger study is needed to confirm the present results and to evaluate the most effective exercises for the prevention of falls and fall-related fractures.

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## Disclosure statement

The authors declare no conflict of interest.

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## COMMISSION REPORT

# Toward the realization of a better aged society: Messages from gerontology and geriatrics

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**1. Background:** Recent medical advancements, and improvements in hygiene and food supply have led to Japan having the longest life expectancy in the world. Over the past 50 years, the percentage of the elderly population has increased fourfold from 5.7% in 1960 to 23.1% in 2010. This change has occurred at the fastest rate in the world. Compared with France, where the percentage of the elderly population has increased just twofold in the past 100 years, Japanese society is aging at an unprecedented rate. In addition, the percentage of the very elderly (aged 75 years and over), comprising more frail people, exceeded 10% of the nation's population in 2008. In such a situation, many elderly Japanese wish to spend their later years healthy, and wish to achieve great accomplishments in their lives. To achieve that, rather than considering an aging population as a negative social phenomenon, we should create a society where elderly people can enjoy a healthy, prosperous life through social participation and contribution.

Factors that hamper the elderly from leading a healthy life include various psychological and social problems occurring in older age, as well as a high incidence of diseases. Therefore, gerontology, which focuses on health promotion of the elderly by encompassing the study of social welfare, psychology, environment and social systems; and geriatrics, which focuses on health care of elderly people and carried out research, education and practices to promote health in the elderly, are becoming more important. Furthermore, along with a need for multidisciplinary care to support geriatric medicine, the development of a comprehensive education system for aged-care professionals is awaited. Thus, we should now recognize the importance of gerontology and geriatrics, and a reform of medical-care services should be made in order to cope with the coming aged society.

Population aging is a global phenomenon. The actions being taken by Japan, the world's most aged society, have been closely watched by the rest of the world. Japan's aged society has been posing not only medical, nursing and welfare problems, but also complex problems closely associated with economy, industry and culture. Therefore, to solve these

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Proposal from The Subcommittee for Aging, The Science Council of Japan



problems, a macroscopic integration and cooperation among industries, education institutions, administration and community through an interdisciplinary approach including medical science, nursing science, nursing care, study of social welfare, social science, engineering, psychology, economics, religion and ethics should be made. Regarding the promotion of gerontology, the “Committee for Establishing a Scientific Community for Sustainable Aged Society” of the Science Council of Japan also prepared a proposal and this was announced on 20 April 2011.

## 2. Current situation and problems

### (1) Promotion of social participation and contribution of elderly people

In Japan, the overall labor force rate is expected to decrease in the near future as a result of the low birth rate and high life expectancy. In contrast, many elderly people, particularly the young-old, have sufficient physical strength to fulfil their job duties and make a social contribution. For these people, a social structure where elderly people can work should be developed through re-educating the elderly and providing various job types. Promotion of social participation and contribution of the elderly is expected to cause a substantial increase in the labor force. Furthermore, it is also expected to contribute to not only the upturn of national economic activity through an increase in total consumption, but also a decrease in the number of elderly people who are likely to be in need of care. Therefore, in order for elderly people to be engaged in various social activities, strategies for developing a social structure for re-education, various employment statuses and employment opportunities should be prepared. However, as the total number of jobs is fixed, consideration should also be given to young workers.

### (2) Fostering medical specialists for aging

Older people often suffer from many diseases, together with geriatric syndromes with multiple etiologies. Signs and symptoms vary according to each individual, and are often atypical; therefore, the patients visit different hospitals and receive many screening tests and prescriptions at the same time. To solve this problem, an effective screening system carried out by a primary-care doctor, and privacy-preserving medical data sharing among hospitals and clinics are needed. In a geriatric clinical setting, health-care professionals should be aware of the physical traits of older people who often develop not only dementia, but also geriatric syndromes, such as depression, falls and urinary incontinence, so that a holistic approach with consideration of nursing care is required. However, the existing Japanese medical education system is not prepared for medical professionals enabled to respond to the aforementioned requirements. Thus, the fostering of medical professionals who can provide comprehensive care – especially for the oldest-old – such as geriatric specialists and medical professionals who understand the principles of elderly care, is urgently needed.

### (3) Diagnosis of elderly-specific diseases and reform of medical-care services

In Japan, the diagnostic system for elderly-specific diseases, including dementia, and reform of medical care services are markedly delayed. The current status concerning diagnosis, care and nursing should be investigated to collect academic data. In order to accumulate evidence for providing safe elderly care and nursing, the promotion of clinical research and a marked expansion of geriatric medical centers with high-level medical services are eagerly awaited.

### (4) Promotion of home-based care and multidisciplinary care

To reduce the length of stay in acute hospitals, to reduce the physical burden of health-care professionals working at acute hospitals and to meet the demand of older people who prefer to remain in their own homes, further promotion of home-based care is needed. In addition, “multidisciplinary care” is increasingly needed to meet various demands in the medical care and welfare of the elderly. It is considered important to share countermeasures against the problems of disease prevention, medicine, care and welfare among health-care professionals in medicine, care and welfare, and cooperate by making the best use of health-care professionals’ specialties.

## 3. Contents of the proposal

The subcommittee for aging, thus, provided the following proposal:

- 1 Development and promotion of systems that enable elderly people to participate socially and make a contribution using an interdisciplinary approach among the various areas,

- including nursing science, nursing care, study of social welfare, social science, psychology, economics, religion and ethics, as well as medical sciences;
- 2 Promotion of gerontology, reform and enhancement of geriatrics in undergraduate, postgraduate and lifelong education;
  - 3 Building geriatric medical centers in each area, and accumulating large-scale evidence of geriatric diseases and geriatrics; and
  - 4 Structural development and promotion of home-based care and multidisciplinary care.
- Through implementation of the above measures, Japan is expected to function as a successful example for the rest of the world. *Geriatr Gerontol Int* 2012; 12: 16–22.

**Keywords:** education, elderly, geriatrics, gerontology, multidisciplinary approach.

## 1. Preface

Over the past 50 years, the percentage of elderly people in the population of Japan has increased fourfold from 5.7% in 1960 to 23.1% in 2010. Japanese society is aging at an unprecedented rate. According to the National Institute of Population and Social Security Research, the percentage the elderly population is estimated to continue increasing, reaching 26.0% in 2015 and further increasing rapidly. After 2020, the percentage of elderly people in the population is expected to stabilize; however, as a result of a decrease in the total population, the percentage will further increase to 40.5%, peaking in 2055. Japan will face a super-aged society, in which 40% of the population will be over 65 years-of-age. Unless appropriate countermeasures are taken, such as a rapid improvement in clinical skills and knowledge among physicians involved in geriatrics, marked advances in the prevention of lifestyle-related diseases, prevention of geriatric syndromes including dementia, and marked expansion of home-based care or local-care, we cannot avoid a situation where many frail elderly people have to live with no support. However, many issues remain; that is, a marked reduction of long-term care facilities, a reduction in length of hospital stay in acute hospitals and a delay in expanding home-based care system, and whether thanatology reflects a social change. We should also consider social issues, such as ageism, caregiver burnout, dignified death and the appropriateness of placing gastrostomy tubes in elderly patients with dementia. To provide dignified care, particularly for older people, appropriate care should be carried out in not only the terminal phase, but also during the last few years before death.

However, despite the challenge, little is known about gerontology and geriatrics in Japan, and they are not fully used in clinical settings or education. To solve this problem, a macroscopic integration and cooperation are needed, using an interdisciplinary approach involving medical science, nursing science, nursing care, study of social welfare, social science, engineering, jurisprudence, economics, psychology and ethics. Furthermore, along with the reform and enhancement of geriatrics in

undergraduate and postgraduate education, fostering specialists who can practice geriatrics is needed. Also, for non-geriatricians or general practitioners who currently and prospectively provide care in clinical settings, an educational system should be prepared to deepen their understanding of geriatric medicine.

## 2. Current situation and measures

### *(1) Social contribution of the elderly and the medical economy*

As a result of the low birth rate, the percentage of the total labor force (aged 20–64 years) is expected to decrease in Japan. Elderly people are usually divided into two groups based on age: 65–84 years (young-old) and 75 years and older (old-old). Although many elderly people, particularly the young-old, have sufficient physical strength to fulfil their job duties and a make social contribution through productive activity, they are not fully utilized. The promotion of social participation and the contribution of the elderly is expected to contribute to creating purpose in their lives, as well as an increase of a substantive productive population, financial stability and self-sustainability for the elderly, and an upturn of national economic activity through an increase of total consumption. Therefore, for elderly people to be engaged in various social activities, strategies for developing a social structure for re-education, volunteer activity, various employment statuses and employment opportunities should be prepared using an interdisciplinary approach involving study of social welfare, social science and economics. However, as the total number of jobs is fixed, consideration should also be given to young workers.

Life expectancy in Japan is the highest in the world. Japan also has the highest healthy life expectancy. In 2008, USA health expenditures accounted for 16% of the nation's gross domestic product (GDP), twice the Japanese rate. Compared with other countries, Japanese health expenditures as a percentage of GDP accounted for two-thirds of that of France and Germany, suggesting that we have the most cost-effective health-care

systems. In addition, the annual cost of health care has been approximately 670 000 yen per elderly person for the past 10 years. However, the aging of the population is expected to impact on future spending growth. Sasaki compared life-long medical costs between the longevity and non-longevity groups, and found that longevity decreases medical costs and has positive economic impacts.<sup>1</sup> Thus, it is important to enhance preventive medicine to achieve longevity, make continuous efforts for cost-effective medicine and improve satisfaction with the health-care systems. Discussion of geriatric medicine should be made after disclosing the aforementioned facts to the public.

Problems in geriatric medicine are closely linked to social structures, including care, welfare and dwelling surrounding the health-care system. To reveal and solve problems regarding the elderly and an aged society, the promotion of gerontology using an interdisciplinary approach is increasingly needed.

Regarding employment opportunities for older workers and future directions of medicine, care and welfare, discussion should be made among specialists from various health-care specialties. The Japan Geriatrics Society and the Japan Gerontological Society, as a core organization, should expand their activities to achieve a "society where elderly people can enjoy their lives" with the cooperation of the National Center for Geriatrics and Gerontology, Tokyo Metropolitan Geriatric Hospital and Institute of Gerontology, the Institute of Gerontology the University of Tokyo, and J. F. Oberlin University.

## ***(2) The current state of geriatric medicine and its direction***

Geriatric disorders have several features.

First, diseases occur as a result of a decline in organ systems associated with aging. Therefore, even if a disease is not so severe, a patient might have been developing an unexpectedly marked decline in organ systems. In addition, homeostatic function with aging, biophylaxis capacity and nutritional absorption capacity often decrease, and symptoms become chronic and refractory.

In terms of clinical symptomatology, older people often complicate many diseases together with a geriatric syndrome with multiple etiologies. Signs and symptoms vary according to each individual, and are often atypical. Response to drugs is different in elderly compared with non-elderly people.

Older people are more likely to develop multiple diseases, and visit different hospitals and receive many screening tests and prescriptions at the same time;<sup>2</sup> thus, total expenditures on the elderly become inevitably high, which has been said to cause financial collapse of the Japanese health insurance system. However, regarding this issue, we should focus on the medical

cost required for a single disease between elderly and non-elderly people, and we should be aware that restricting the increasing financial burden on patients to receive screenings or prescriptions for each disease would be ageism for elderly people and uncontroversial. However, unnecessary duplication of the screening given at each hospital should be avoided. To achieve this, an effective screening system carried out by primary-care physicians, and privacy-preserving medical data sharing of test results and medication among hospitals and clinics are needed. Regarding medications, the Japan Geriatrics Society has prepared the "Guidelines for medical treatment and its safety in the elderly" as an outcome of the sponsored research in Japan Foundation on Aging and Health.<sup>3</sup> The guideline explained standard medical treatments mainly for the elderly by giving examples of low priority, such as making an easy prescription or non-evidence-based prescription to prevent deterioration of chronic disease. In either retrospective fee-for-service or a prospective payment system (fixed amount), physicians should provide the same level of prescription to each patient. To carry out effective screening for the elderly or evidence-based medical treatment, a constructive research system should be developed separately from health-care reform in terms of medical economy. The Japanese government has decided to abolish the existing medical insurance system for those aged 75 years and older; however, the following principles stated in the existing medical insurance system should be included in the next system for the elderly: (i) elderly disease prevention; (ii) comprehensive geriatric assessment; and (iii) incentives to promote discharge planning.

Older people often develop functional disorders associated with chronic disease or aging. Functional disorders not only jeopardize the independence of people and pose social disadvantage, but also lead to secondary disease. This often makes elderly people fully dependent, resulting in lower quality of life. Therefore, in the treatment of geriatric disorders, priority should be given to functional outcomes, as well as life expectancy and the prognosis of organ systems. In addition, because a psychological change associated with an environmental change often leads to a deterioration of symptoms in elderly people, treatment policy and discharge planning should be prepared with a holistic consideration of the patient using the comprehensive geriatric assessment (CGA). In geriatric medicine, it is important not only to protect organ systems, but also to maintain physical function to prevent assisted living.

To maintain independent living, a person needs to have sustained function, including daily life functions, cognitive function, emotion and sociality (family, friends, job). CGA is used to determine the aforementioned functional status both comprehensively and systematically. The results of CGA give us a clue of what kind of

support can help maintain independent living or assisted living with minimum care for elderly people. However, CGA is not a popular tool. Therefore, we should examine ways of increasing the awareness of CGA to promote its use for the improvement of geriatric medicine.

End-of-life care for elderly patients is an extremely important issue in geriatric medicine; however, very few elderly people in Japan have made advance directives to show their wishes about their health care during the end-of-life period. In geriatrics, there are so many issues to discuss, including confirmation of patient's wishes, the need of a health-care representative, and the relationship between the patient and their physician. Therefore, we should investigate the awareness of end-of-life care for elderly patients among health-care professionals, including physicians and nurses, people involved in care, patients, and their families, to discuss future direction of care. Regarding end-of-life care in elderly people, "Attitudes toward end-of-life care in elderly patients",<sup>4</sup> which was announced in 2000 by the ethics committee of the Japan Geriatrics Society and is currently under revision, and a proposal prepared by the end-of-life care research group,<sup>5</sup> should be referred.

### **(3) Fostering health-care professionals involved in geriatric medicine**

Despite the growth of the elderly population, physicians with special geriatric training are not expected to increase under the present system of medical education. In order to solve the problem of care for the growing elderly population, the educational system should be restructured to provide an understanding of geriatric medicine for non-geriatricians, general practitioners and physicians working at care facilities that provide care for elderly patients. This might be an effective and practical approach for fostering physicians taking care of the elderly. To provide sufficient geriatric knowledge to general practitioners and non-geriatricians, the education program should include basic geriatrics contents to retain quality of geriatric care, which would be required even for non-geriatricians. The Japan Geriatrics Society has published *Clinical Handbook for Active Aging and Geriatric Care* for physicians, which aims to provide basic knowledge of elderly-specific symptoms, assessment, treatment and care. It is expected that using this handbook for students, residents, practitioners and non-geriatricians might contribute to the expansion of geriatric medicine. In the USA, in order to deal with a shortage of geriatric specialists, medical students are required to receive a minimum geriatrics education.<sup>6</sup>

### **(4) Promotion of geriatric disease clinical research**

In Japan, a system for making diagnosis and providing treatment and care for patients with elderly diseases,

including dementia, has not been fully developed. In elderly care, it is important to make an accurate diagnosis and collect clinical evidence to reflect diagnosis and evidence in clinical settings. To accumulate evidence of geriatric medicine and nursing, the promotion of clinical research and a marked expansion of geriatric medical centers with high-level medical services are eagerly awaited.

Currently, there are just two geriatric medical centers in Tokyo and Nagoya. Therefore, the number of centers should be increased and should be placed in each district (Hokkaido, Tohoku, Hokuriku, Kanto, Koshinetsu, Tokai, Kinki, Chugoku, Shikoku and Kyushu). The National Center for Geriatrics and Gerontology, as a core facility, is required to examine the efficacy of geriatrics-related activities and consistency with countermeasures, supervise multicenter studies and clinical research projects, and strive to enhance geriatric medicine through the standardization of geriatric medicine and care, and preparation of medical guidelines. In this process, each center, as a platform of geriatric medicine, should accumulate clinical data, and is also required to function as a facility to educate non-geriatricians.

The Japan Geriatrics Society has been carrying out clinical research on the treatment of hyperlipemia involving the elderly aged 75 years and over. An establishment of a support system for such clinical research and an accumulation of evidence on the efficacy of nutrition and exercise are also considered important.

### **(5) Promotion of home-based care and multidisciplinary care**

Based on the demand of older people who prefer to remain at home, and a government policy that aims to shorten the length of hospital stay and the number of beds to decrease the growing burden of health-care expenditure, the promotion of home-based care has been provided. However, the medical structure of home-based care has not been fully devised, requiring further development of a medical and nursing structure where older people can receive continuing treatment and care, including rehabilitation, within the local community, while not being too dependent on the hospital stay, or not being forced to choose home-based care. Enhancement of home-based care might contribute to reducing the burden on physicians and nurses at acute hospitals, and might also compensate for other care services, such as emergency care and obstetrics.

One of the concerns of home-based care among physicians, patients and their families is the difficulty with hospital admissions in the event of sudden illness or deterioration. To solve this problem, the National Center for Geriatrics and Gerontology has established a "Home-based care unit". Preregistration from both a general practitioner and the patient is necessary for

admission to this unit, with the intention to continue home-based care. The patient can be admitted any time by referral of a general practitioner. The outcome of this program is eagerly awaited.

In home-based care settings, a group of professionals from diverse disciplines mutually cooperate to provide care for a patient. For such a multidisciplinary approach, it is important to choose appropriate professionals according to the condition and disease stage of the elderly patient. However, this multidisciplinary approach involves some problems. One is the legislative "gap" between health-care providers registered under the Medical and Dental Practitioners Acts and the Act on Public Health Nurses, Midwives and Nurses, and nursing care providers registered under the Long-Term Care Insurance. The other is the discrepancy in the principle between health-care and nursing-care providers. To solve these problems, it is essential to examine them along with the legislative issues, and promote home-based care, particularly at universities offering courses in geriatrics and local community hospitals where there are accumulating results of a multidisciplinary approach to caring for elderly patients, to further promote the cooperation between medical-care and social-welfare services.

### 3. Proposals

We make the following proposals as countermeasures against various issues in geriatrics:

(1) Development and promotion of a system that enables elderly people to participate socially and make a contribution using an interdisciplinary approach among the various areas, including nursing science, nursing care, study of social welfare, social science, engineering, psychology, economics, religion and ethics, as well as medical sciences.

Promotion of social participation and contribution of the elderly, while considering the total number of jobs and young workers, is expected to contribute to creating purpose in their lives, and reduce the growing number of older people who become frail or in need of care. It is also expected to bring about an increase in a substantial productive population, financial stability and self-sustainability for the elderly, and an upturn of the national economic activity through an increase of total consumption.

(2) Promotion of gerontology, reform, and enhancement of gerontology and geriatrics in undergraduate, postgraduate and lifelong education.

To solve problems associated with elderly people or an aged society, gerontological and geriatric research and education should be enhanced. By fostering medical professionals who understand the physical and mental traits of older adults, and those who can provide a

holistic approach with consideration to organic integration with nursing care, provision of reliable care and nursing services is expected.

(3) Build geriatric medical centers in each area, and accumulate large-scale evidence of geriatric diseases and geriatrics.

For system reform of diagnosis, treatment and nursing care, evidence should be accumulated through large-scale clinical studies.

(4) Structural development and promotion of home-based care and multidisciplinary medicine and care.

Promotion of home-based care and multidisciplinary medicine and care, particularly at universities offering courses in gerontology and local community hospitals where there are accumulating results of a multidisciplinary approach to care for elderly patients, can be expected to help reduce the burden of physicians and nurses, and meet the demand of older people.

Through implementation of the aforementioned measures, Japan is expected to function as a successful model for the rest of the world.

### 4. Summary

The phenomenon of an aging population is often considered within a negative spectrum; however, elderly people in need of care only account for 13% of the total elderly population, and this is not being expected to further increase. We should rather focus on the fact of an increasing number of "healthy elderly individuals with rich experience and knowledge", which would not become a negative factor in the future. The restructuring of these healthy elderly resources for social development is believed to bring a permanent bright future, and it is expected that medical-care and social-welfare services will make a significant contribution within this framework. The realization of healthy longevity in society is possible; however, we should be aware that it is only possible by the integration of geriatric medicine and social welfare.

To cope with the problems that come with a rapidly aging society as the world-leading model, the development of elderly-friendly medical devices and nursing-care equipment to avoid a labor shortage is considered essential. Taking the lead in the development of medical equipment for elderly people enables us to provide other countries with aging populations with a model for success, and is also expected to contribute to the creation of new employment and an increase in export as one of the main industrial products in Japan.

The task given to the country with the longest healthy life expectancy is to try to achieve the highest level of elderly satisfaction. As a result of a community change, "roles" and "presence with respect" of the elderly have become weakened, and a medical- and nursing-care "burden" for the younger population has been casting

a dark shadow over the society. As the baby boomer generation ages into elderly status, new roles, including a future health-care workforce and volunteer activities, and community satisfaction should be rebuilt. Gerontology and geriatrics ought to take the lead in showing a practical approach to the industry and the administration to create new images of the elderly.

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### Disclosure statement

The authors declare no conflict of interest.

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# Comparison of the psychosocial quality of life in hemodialysis patients between the elderly and non-elderly using a visual analogue scale: The importance of appetite and depressive mood

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**Aim:** The number of hemodialysis (HD) patients is increasing along with their mean age in Japan. The assessment of their psychosocial status and quality of life (QOL) is therefore becoming more and more important along with laboratory data or comorbidities.

**Methods:** We examined the psychosocial status of 211 HD patients (72 elderly and 139 non-elderly) and compared the difference between elderly and non-elderly patients using a visual analogue scale (VAS). We then examined how QOL affected mortality rate in 3-year prospective follow up. We assessed 10 items of QOL: health condition, appetite, sleep, mood, memory, family relationships, friendship, economical status, life satisfaction in daily life, and happiness with qualified self-evaluating questionnaires along with laboratory data and comorbidities. Furthermore, we investigated the correlation between the scores of mood and geriatric depression scale (GDS)-15.

**Results:** There was no difference in VAS scores between elderly and non-elderly patients. Lower VAS scores for appetite and mood correlated with higher mortality in HD patients, especially in the non-elderly. VAS scores for mood correlated with GDS-15 in HD patients.

**Conclusions:** More attention should be paid to appetite and the diagnosis and therapy of depressive mood to improve the prognosis of HD patients, especially for the non-elderly. *Geriatr Gerontol Int* 2012; 12: 65–71.

**Keyword:** appetite, depressive mood, hemodialysis, quality of life, visual analogue scale.

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## Introduction

With the advance of dialysis technology, the number of dialysis patients along with the proportion of older patients is increasing in Japan. According to the annual statistical survey by the Japanese Society for Dialysis Therapy from the end of 2003 to 2009, the mean age of the whole dialysis population rose from 61.5 to 65.8 years old, much older than in 1985 (50.3 years old).

In the years 2003 and 2009, there were about 220 000 and 290 000 dialysis patients in Japan, respectively. It is likely that these dialysis patients live with more mental stress, including anxiety from comorbidities, conflict with their family and social restrictions.<sup>1</sup> It is reported that mental and physical health-related quality of life (QOL) in hemodialysis (HD) patients is lower than that in the general population,<sup>2</sup> and that depression is one of the most important predictors of patients' prognosis,<sup>3</sup> which is one of the main QOL factors used to evaluate patients with end-stage renal disease (ESRD).<sup>4</sup> Therefore, we should pay more attention to QOL and the psychological problems of dialysis patients in addition to medical factors. In terms of QOL, assessment of HD patients' self-evaluation for psychosocial status (subjective QOL) is very important. Although there are some reports on psychosocial QOL in HD patients, few studies have addressed the comparison between elderly and non-elderly patients.<sup>5</sup>

The aim of this study, therefore, was to evaluate psychosocial QOL of HD patients and to compare it between the elderly and non-elderly. Furthermore, we investigate how QOL affects the mortality of HD patients in a 3-year prospective follow up.

## Patients and methods

This study was performed at Taigenkai Hospital and Kita-Eijinkai Hospital, located in Japan from 2000–2003. All HD outpatients in the dialysis units (231 patients) of these two hospitals were given questionnaires. Patients 65-years-old or older were defined as "elderly", those under 65-years-old as "non-elderly". On the basis of this definition, the HD population consisted of 83 elderly and 148 non-elderly patients. This study was approved by the Ethical Committee of Kita-Eijinkai Hospital and Taigenkai Hospital and conforms to the provisions of the Declaration of Helsinki. Written informed consent for the study was obtained from each patient. Participants were given a brief explanation of the questionnaire by a medical technician or the attending physician and were asked to complete the questionnaire.

QOL assessment of subjects was carried out using a visual analogue scale (VAS). VAS is frequently used as a subjective scale of pain in the field of anesthesiology. Each VAS questionnaire ended with a summing-up graph in the form of a 100 mm bar, graded with

subjectively the worst condition on the left and best one on the right. The participant was asked to mark on the 100 mm bar how they evaluated their condition. We defined the distance (mm) from the left to the marked position as the score of VAS (0–100), with high scores indicating high QOL.<sup>6</sup> We assessed 10 QOL items: health condition; appetite; sleep; mood; memory; family relationships; friendship; economical status; life satisfaction in daily life; and happiness, as described by Matsubayashi *et al.*<sup>6</sup> The VAS (10 items of QOL) has been validated for use in the Japanese population.<sup>7</sup> Demographic data including age, gender, and duration of HD therapy, laboratory data, which included cardiothoracic ratio (CTR), plasma level of blood urea nitrogen (BUN), hemoglobin (Hb), albumin (Alb), and comorbidities including blood access trouble, ischemic heart disease, diabetes mellitus, infectious diseases, bone fracture, cerebrovascular disease were simultaneously collected. After patients rested in the supine position for at least 5 min, systolic blood pressure was measured twice by medical staff at the bedside and the average of those was calculated. Patients were examined at the beginning of their first HD session of the week, as is done in routine medical care.

We followed these patients for 3 years prospectively. The end point for patients was the trial end or death from any cause. At first, we examined the survival analysis in elderly and non-elderly HD patients. We then investigated how QOL affects the mortality of HD patients. At the end of the 3-year observation period we also screened for depression using the geriatric depression scale (GDS)-15 with a self-assessed questionnaire (0 [good] – 15 [very depressed])<sup>8</sup> and investigated the correlation between the scores of the GDS-15 and QOL item mood, which was also examined simultaneously.

Data were analyzed using JMP v. 6.0.0 (SAS Institute Inc., Cary, NC, USA). For patient age, duration of HD and laboratory data, means were analyzed using *t*-test. For patient gender and comorbidities, frequencies were analyzed using  $\chi^2$  for independence test. Medians of QOL scores were calculated and analyzed using Mann-Whitney *U*-test. According to the average score of each VAS from all patients, a survival rate curve was analyzed by Kaplan-Meier analysis followed by log-rank test. Correlation between each score of QOL and mortality rate was analyzed using multivariate Cox regression analysis corrected for age, gender, duration of HD therapy, laboratory data and comorbidities. Correlation between the scores of GDS-15 and mood was analyzed using univariate regression analysis. Statistical significance was considered to be a *P* value of <0.05.

## Results

Questionnaires were given to 231 patients and the response rate was 100%. However, answers from 211



**Table 1** Characteristics, laboratory data and comorbidities in hemodialysis (HD) patients

	Elderly patients ( <i>n</i> = 72)	Non-elderly patients ( <i>n</i> = 139)	<i>P</i> value
Age (years, means ± S.D.)	71.8 ± 5.6	52.4 ± 9.3	<0.0001
Sex (male)	58.3%	64.7%	0.3613
Duration of HD (years, means ± S.D.)	6.9 ± 5.0	8.5 ± 6.9	0.0696
SBP (mmHg, means ± S.D.)	155 ± 23	153 ± 22	0.6046
CTR (% , means ± S.D.)	50.2 ± 4.9	48.0 ± 5.0	0.0025
BUN (mmol/L, means ± S.D.)	26.0 ± 6.5	28.4 ± 5.8	0.0073
Hb (g/L, means ± S.D.)	87.8 ± 14.4	94.7 ± 15.6	0.0033
Alb (g/L, means ± S.D.)	38.5 ± 5.7	42.4 ± 4.9	<0.0001
Blood access trouble	58.5%	57.6%	0.9175
IHD	28.6%	25.7%	0.7410
DM	53.1%	42.7%	0.2567
Infectious diseases	18.4%	5.7%	0.0549
Bone fracture	17.1%	23.8%	0.4111
CVD	13.3%	17.4%	0.5614

Patient characters were compared between elderly and non-elderly. Data are expressed as means ± S.D. or incidence of each disease (%). Alb, albumin; BUN, blood urea nitrogen; CTR, cardiothoracic ratio; CVD, cerebrovascular disease; DM, diabetes mellitus; Hb, hemoglobin; IHD, ischemic heart disease; SBP, systolic blood pressure.

**Table 2** Median of quality of life (QOL) scores in hemodialysis patients

Items of QOL	Elderly patients ( <i>n</i> = 72)	Non-elderly patients ( <i>n</i> = 139)	<i>P</i> value
Health condition	50	49	0.3047
Appetite	76.5	82	0.2415
Sleep	53	54	0.8906
Mood	62	60	0.6133
Memory	45	51	0.0948
Family relationships	91.5	89	0.1982
Friendship	88	80	0.3215
Economical status	70.5	51.5	0.0512
Satisfaction in daily life	68	57	0.0903
Happiness	71	67	0.4419

QOL scores were compared by Mann–Whitney *U*-test between elderly and non-elderly hemodialysis patients for each item of QOL. There was no significant difference between elderly and non-elderly hemodialysis patients.

patients (91.3%) were used for the analysis, because the rest were incomplete. Table 1 demonstrates patient characteristics, laboratory data, and comorbidities. The mean age of elderly and non-elderly HD patients was 71.8 ± 5.6 and 52.4 ± 9.3, respectively (*P* < 0.0001). There was no significant difference in the proportion of gender or the duration of HD between the two groups. For the 10 items of QOL, there was no significant difference in VAS scores between elderly and non-elderly HD patients (Table 2).

In the 3-year prospective follow up, the number of deceased patients was 44 and the mortality rate was 21.8%. We also investigated the correlation between VAS scores in the QOL items and survival rate by

univariate analysis according to the average score of each QOL. The Kaplan–Meier analysis according to the VAS score of each QOL item in elderly and non-elderly HD patients is shown in Table 3. We found that higher VAS scores of health condition, appetite, sleep, mood and satisfaction in daily life were associated with better survival in non-elderly patients, but not in elderly patients.

On the other hand, higher VAS scores in appetite, mood, friendship, and satisfaction in daily life were significantly associated with better survival in non-elderly HD patients according to multivariate Cox regression analysis adjusted for age, gender, and duration of HD therapy, clinical data including CTR, BUN, Hb, Alb

**Table 3** Kaplan–Meier analysis by each item of quality of life (QOL) in hemodialysis patients in elderly and non-elderly

	Cut-off point	Elderly patients ( <i>n</i> = 72) <i>P</i> value	Non-elderly patients ( <i>n</i> = 139) <i>P</i> value
Health condition	50 ≤ vs 49 ⇒	0.4824	0.0138
Appetite	75 ≤ vs 74 ⇒	0.6832	0.0021
Sleep	59 ≤ vs 58 ⇒	0.8158	0.0059
Mood	62 ≤ vs 61 ⇒	0.8342	0.0047
Memory	53 ≤ vs 52 ⇒	0.7448	0.1317
Family relationships	78 ≤ vs 77 ⇒	0.4242	0.3575
Friendship	74 ≤ vs 73 ⇒	0.3438	0.5439
Economical status	54 ≤ vs 53 ⇒	0.5022	0.1990
Satisfaction in daily life	61 ≤ vs 60 ⇒	0.5047	0.0420
Happiness	66 ≤ vs 65 ⇒	0.7771	0.4040

Correlation between mortality and each item of QOL was analyzed by Kaplan–Meier analysis, followed by log–rank test. Cut off point (according to the average score of each QOL) is shown.

and comorbidities (appetite: relative risk [RR] = 0.931,  $P = 0.0041$ ; mood RR = 0.938,  $P = 0.0005$ ; friendship: RR = 0.949,  $P = 0.0317$ ; satisfaction in daily life: RR = 0.967,  $P = 0.0178$ ) (Table 4, right). Statistical significance was also found in family relationships (RR = 0.967;  $P = 0.0009$ ) and friendship (RR 0.977;  $P = 0.0180$ ) for all HD patients (Table 4, left), and appetite in elderly patients (RR = 1.048;  $P = 0.0247$ ) (Table 4, center).

We then assessed the correlation between mood and GDS-15 in HD patients. There was an inverse correlation between VAS scores for mood and GDS-scores among all HD patients ( $r = -0.585$ ,  $P < 0.0001$ ), and when divided into elderly ( $r = -0.603$ ,  $P < 0.0001$ ) and non-elderly patients ( $r = -0.610$ ,  $P < 0.0001$ ).

## Discussion

In this study we have shown that there is no difference between elderly and non-elderly HD patients in 10 psychosocial QOL items. However, better appetite, mood, and satisfaction in daily life were associated with better survival in non-elderly HD patients by Cox regression analysis and Kaplan–Meier analysis; no relationship was found between the scores of those QOL items and laboratory data/comorbidities (data not shown). These results indicate more attention should be paid to appetite, depressive mood, and satisfaction in daily life to improve the survival especially in non-elderly HD patients.

We found no significant difference in QOL between elderly and non-elderly HD patients. Few reports have addressed the relationship between age and QOL in HD patients. Tovbin *et al.* demonstrated that age is not associated with self-evaluated individualized QOL according to life domains including health, family, work/studies,

economic situation and leisure.<sup>5</sup> Kutner *et al.* reported that prevalence of sleep disorders is not clearly associated with an increasing age of patients, and that elderly patients often report better psychosocial adjustment to dialysis than younger patients.<sup>9</sup> Leinau *et al.* reported that the prevalence of depression is not restricted to older participants ( $\geq 60$  years 31%;  $\leq 60$  years; 22%).<sup>10</sup> These studies are consistent with our study showing no difference in QOL assessments between elderly and non-elderly HD patients.

Quite a number of studies have been reported in terms of QOL in HD patients. Most of the studies used the Kidney Disease Quality of Life (KDQOL) or Short Form 36 (SF-36) questionnaire and have reported that QOL of HD patients is markedly disturbed compared to that of the general population in both physical and mental components.<sup>2</sup> In Japan, a study using SF-36 reported that QOL scores of HD patients were lower than the national standard in all of eight scales, indicating disturbed physical and psychosocial QOL.<sup>11</sup> However, in the KDQOL and SF-36 questionnaires the participants need to answer as many as 36 questions, which might be time consuming and require them to be patient to some extent. Japanese people, especially the elderly, are not used to multiple choice questionnaires and may have some difficulties responding to 36 questions. Therefore, we used a VAS that can be completed quickly, because participants only have to put a mark on the 100 mm bar.<sup>12</sup> Inter-rater reliability ( $r = 0.74$ ,  $P < 0.05$ ) and test–retest reliability ( $r = 0.82$ ,  $P < 0.05$ ) of the VAS score has been already confirmed.<sup>6</sup> For the VAS examination we assessed 10 items of QOL, and the rate of available answers was as high as 91.3% in HD patients. Previous studies have reported that VAS scores of health conditions in dialysis patients were 58.<sup>13</sup> Although more tests might be needed to prove further

**Table 4** Correlation between mortality and each visual assessment scale (VAS) score of quality of life (QOL) items in hemodialysis patients in total, elderly, and non-elderly patients

	Relative risk	Total patients (n = 211) 95% CI	P value	Relative risk	Elderly patients (n = 72) 95% CI	P value	Relative risk	Non-elderly patients (n = 139) 95% CI	P value
Health condition	0.983	(0.956–1.008)	0.1866	0.987	(0.932–1.048)	0.6430	0.982	(0.939–1.026)	0.4116
Appetite	1.004	(0.988–1.023)	0.6087	1.048	(1.006–1.103)	0.0247	0.931	(0.871–0.980)	0.0041
Sleep	0.993	(0.976–1.011)	0.4511	1.029	(0.973–1.093)	0.3112	0.975	(0.936–1.009)	0.1462
Mood	0.982	(0.963–1.000)	0.0516	1.013	(0.971–1.053)	0.5270	0.938	(0.895–0.973)	0.0005
Memory	0.986	(0.966–1.005)	0.1393	1.020	(0.965–1.071)	0.4506	0.974	(0.937–1.004)	0.0881
Family relationships	0.967	(0.948–0.986)	0.0009	1.006	(0.945–1.076)	0.8544	0.965	(0.918–1.006)	0.0979
Friendship	0.977	(0.958–0.996)	0.0180	0.994	(0.916–1.067)	0.8763	0.949	(0.898–0.996)	0.0317
Economical status	1.001	(0.985–1.016)	0.9219	0.993	(0.940–1.035)	0.7229	0.990	(0.964–1.014)	0.4187
Satisfaction in daily life	0.990	(0.974–1.005)	0.1762	1.015	(0.982–1.046)	0.3423	0.967	(0.936–0.994)	0.0178
Happiness	0.988	(0.967–1.008)	0.2371	1.013	(0.972–1.052)	0.5097	0.997	(0.950–1.042)	0.8848

Correlation between mortality and each item of VAS score of QOL was analyzed by multivariate Cox regression adjusted for age, gender, duration (years) of hemodialysis therapy, cardio-thoracic ratio (CTR), blood urea nitrogen (BUN), hemoglobin (Hb), albumin (Alb), and presence or absence of comorbidities including blood access trouble, ischemic heart disease (IHD), diabetes mellitus (DM), infectious diseases, bone fracture and cerebrovascular disease (CVD).

validation, our investigation is the first study to use VAS to assess psychosocial QOL in HD patients.

Anemia is considered to be an important factor for QOL and survival. As reported in western countries, there was a recent report from Japan that lower mortality risk was associated with higher Hb levels and that lower Hb levels were associated with lower QOL scores.<sup>14</sup> In contrast, the relationship between anemia and depression has been controversial.<sup>10</sup> In this study we did not find any correlation between the Hb level and VAS score of any QOL items using multivariate regression analysis. It has been reported that diminished appetite is associated with a higher mortality rate from a viewpoint of malnutrition–inflammation complex syndrome (MICS).<sup>15</sup> In this study, we analyzed data such as Alb (for nutritional status) and presence or absence of comorbidities such as infectious diseases (for inflammatory state). However, we did not find any relationship between comorbidities and Alb. These negative results might be ascribed to the small sample size in this study.

In terms of mood, a previous study found 10–35% prevalence of depression among ESRD patients.<sup>16</sup> In this study, we assessed depressive mood by measuring the VAS score for mood. However, the score did not necessarily mean that the patients had depression. Therefore, we used GDS-15 in the third year of the prospective follow up, because it is validated for Japanese subjects<sup>17</sup> and is a self-assessed questionnaire composed of 15 yes or no questions, requiring only a few minutes to complete and score.<sup>18</sup> As expected, the score of mood and that of GDS-15 was inversely correlated by univariate regression analysis in HD patients in both elderly and non-elderly patients. This indicates that the VAS of mood could be used as a relative score to assess depression to some extent. The correlation coefficient (r) was about –0.6, which means there is some discrepancy between mood and GDS. One reason that explains this discrepancy is that feelings such as anxiety might have been included in mood in our study.<sup>19</sup> The prevalence of depression (GDS scores 6 or more) was found to be 54.5% in our study. This relatively high prevalence of depression may be due to the screening method. In our study, little, if any, antidepressive agent was prescribed to patients with depressive mood. Therefore, a prospective study to test the effect of antidepressants on QOL in HD patients needs to be investigated.

It has been reported that the prevalence of depression is increasing with age in the general population.<sup>20</sup> However, according to a patient survey performed by the Ministry of Health, Labor and Welfare in Japan in 2005, patients with depression were distributed widely between the ages of 30 to 70. This could account for the lack of difference in mood between elderly and non-elderly HD patients.

To investigate whether poor QOL reflects a poor health condition, we assessed the relationship between health condition and QOL in elderly and non-elderly patients using regression analysis. In non-elderly patients there was a correlation between health condition and appetite, sleep and mood ( $r = 0.28$ ;  $P = 0.0008$ ,  $r = 0.29$ ;  $P = 0.0006$  and  $r = 0.51$ ;  $P < 0.0001$ , respectively). However, the  $r$  value was relatively low ( $r < 0.30$ ) except in relation to mood. In elderly patients, there was correlation between health condition and appetite, sleep and mood ( $r = 0.41$ ;  $P = 0.0004$ ,  $r = 0.38$ ;  $P = 0.0012$  and  $r = 0.65$ ;  $P < 0.0001$ , respectively) and the  $r$  value was relatively high ( $r > 0.30$ ). These results indicate that the QOL items appetite and sleep would be better markers of the health condition of elderly HD patients than non-elderly HD patients and that the QOL item mood would be a better marker of the health condition of both elderly and non-elderly HD patients. In contrast, we showed that better appetite and mood were associated with better survival in non-elderly HD patients. Furthermore, there was no relationship between the scores of these QOL items and laboratory data/comorbidities (data not shown). These data indicate the importance of QOL assessment in HD patients.

The relationship between depression and mortality rate is reported to be controversial.<sup>21</sup> Husebye *et al.* reported that psychosocial variables are prognostically important for the survival of dialysis patients over the age of 70, but depression is not associated with mortality rate.<sup>22</sup> Drayer *et al.* reported that depressed HD patients are younger and depression is associated with decreased QOL including sleep and increased mortality rate.<sup>23</sup> In terms of psychological factors, Kimmel *et al.* reported that there is an inverse relationship between the number of symptoms (pain, trouble with sleep, tiredness and shortness of breath) and QOL including psychological items and that no clinical parameter (duration of ESRD, serum Alb, Hb, Kt/V and Karnofsky Performance Status Scale) correlates with any measure of QOL.<sup>24</sup> Moreover, Leinau *et al.* demonstrated that non-ESRD-specific conditions such as fatigue, pain, and depression are as prevalent as ESRD-specific conditions (use of a catheter for access, Hb, intact parathyroid hormone, phosphorous, and Kt/V) and highlighted the importance of diagnosing and treating non-ESRD-specific conditions to improve the health and QOL of persons with ESRD.<sup>11</sup> As reported in these latter two literatures, QOL factors such as sleep disturbance, depression and so on should be paid as much attention as clinical parameters as suggested in the guidelines for ESRD.

We have highlighted the need for assessment of elderly HD patients using self-evaluation for psychosocial status (subjective QOL). In this study, however, a higher QOL score for appetite, sleep, mood and satisfaction in daily life was associated with better survival

by both of univariate analysis (Kaplan–Meier analysis; Table 3) and multivariate analysis (Cox regression analysis; Table 4), in non-elderly HD patients only. These negative results in elderly patients might be ascribed to the small sample size. Actually, among the laboratory data that showed differences between elderly and non-elderly patients (Table 1), higher levels of Alb were associated with better survival in elderly patients, but there was no relationship between Alb and the scores of any QOL item (data not shown).

In conclusion, there was no difference in 10 psychosocial QOL items between elderly and non-elderly HD patients. Paying attention to appetite and depressive mood may lead to the improvement of the mortality rate of HD patients, especially for the non-elderly.

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