

1 **SUMMARY**

2 **Background:** Falls are the third leading cause of a bed-ridden state and are a major
3 cause of morbidity in elderly. Therefore, it is important to assess the fall risk in elderly
4 in a simple and reliable method. The aim of the present study was to examine whether
5 our newly developed index for the assessment of complex-task locomotion can predict
6 falls in robust elderly.

7 **Methods:** The new index was used to assess 780 community-dwelling elderly Japanese
8 (mean age of 76.0 ± 7.4 years, 300 men and 480 women) who could complete Timed
9 Up and Go test in less than 13.5 sec. The new index consists of 4 items (stand-up, turn,
10 walk, and trip tests). To validate the index, we used receiver operating characteristic
11 curves (ROC) to determine the cut-off point of the index to predict falls.

12 **Results:** The area under the curve was 0.15 ($p < 0.001$, 95% CI: 0.675-0.755). The ROC
13 curve analysis enabled the best cutoff (1 point) to discriminate fallers from non-fallers
14 (sensitivity 80.8%, specificity 60.6%).

15 **Conclusion:** We have demonstrated that the new index is a reliable indicator for falls in
16 elderly with higher levels of functional capacity. Our data suggest that a score of more
17 than 1 point by the new index can predict falls in robust elderly.

18

19

1 **INTRODUCTION**

2 In Japan, falls are the third leading cause of a bed-ridden state and are a major
3 cause of morbidity in elderly [1]. Falls are relatively common among elderly, with
4 approximately 30% of individuals aged 65 or older falling at least once a year [2].
5 Because falls tend to occur with activities of daily living, previous research has focused
6 on identifying age-related changes in locomotive function [3]. Several performance
7 measures, such as walking speed [4], Timed Up and Go (TUG) [5], one-leg stand (OLS)
8 [6], functional reach [7], five chair stand [8], and Tinetti balance [9] have been used to
9 evaluate the physical performance of community-dwelling older people.

10 Several studies have suggested that a cut-off point of 13.5 s in TUG serves as a
11 useful indicator of persons with an increased risk of falling [10]. However, as even
12 older adults with higher levels of functional capacity who complete TUG in less than
13 13.5 s are also susceptible to falls, it is important to develop accurate prediction systems
14 for these individuals. In daily-life situations, the requirements for locomotion typically
15 occur under complicated circumstances with cognitive attention focused on a particular
16 task. In recent years, numerous studies have evaluated complex-task locomotion for fall
17 prediction in older adults [11, 12, 13]. However, more simple and reliable methods are
18 necessary in the setting of community-dwelling elderly.

19 The aim of the present study was to examine whether our newly developed
20 index to assess complex-task locomotion was related to falls in robust elderly
21 population.

22

1 **METHODS**

2 **Participants**

3 We recruited 780 community-dwelling elderly Japanese people (mean age of 76.0 ±
4 7.4 years, 300 men and 480 women) for this study. We excluded participants based on
5 the following exclusion criteria: the presence of severe cardiac, pulmonary, or
6 musculoskeletal disorders, comorbidities associated with an increased risk of falls (i.e.,
7 Parkinson's disease or stroke), and a TUG score greater than 13.5 s. TUG is a simple
8 test developed to screen basic mobility performance and has been shown to be
9 significantly associated with activities of daily living function in frail older adults [5]. It
10 has been reported that elderly with a TUG score greater than 13.5 s have an increased
11 risk of falls [10].

12 **Questionnaire**

13 The new index was developed in our university by a working group of medical
14 doctors, physical therapists, occupational therapists, public health nurses, and an
15 epidemiologist. The index consisted of 4 items, which were rated as 0 or 1 by self-report.
16 The 4 items were following questions: (1) "Can you stand up without a support?" No =
17 1, (2) "Can you turn in the opposite way, while holding an empty glass?" No = 1, (3)
18 "Can you walk without dropping a glass of water?" No = 1, and (4) "Have you ever
19 tripped over an obstacle while going to the bathroom or picking up the telephone?" Yes
20 = 1. The response to each item in the index was designated as "yes" or "no". The
21 test-retest reliability for each item and total points using the Kappa coefficient (k-value)
22 and the inter-trial correlation coefficient (ICC [1.1]) between the two measurements
23 with a two-week interval in a sample of 312 participants was calculated as follows:

1 Question 1 (k-value=0.881), Question 2 (k-value=0.816), Question 3 (k-value=0.881),
2 Question 4 (k-value=0.882), and total point (ICC [1,1]=0.941).

3 **Data collection for other physical performance tests**

4 The participants were subjected to 5 other physical performance tests that are
5 widely used to identify high-risk elderly adults: 10 m walk under an single-task
6 condition (ST walking) [4], 10 m walk under dual-task (DT) condition (comfortable
7 walking while counting numbers aloud in reverse order starting from 50) (DT walking)
8 [2], TUG test [5], functional reach (FR) [7], one-leg stand (OLS) [6], and 5-chair stand
9 tests [8]. The tests were performed in a random order. For each performance task, the
10 participants performed 2 trials and the average score was calculated.

11 **Falls**

12 Information on fall incidents within the past year was collected from participants by
13 interview. A fall was defined as an event that resulted in a person unintentionally
14 coming to rest on the ground, floor, or other lower level with or without loss of
15 consciousness or injury [15]. We excluded falls resulting from extraordinary
16 environmental factors (e.g., traffic accidents or falls while riding a bicycle).

17 **Statistical analysis**

18 Differences in the data between the falls and non-falls were analyzed by Student's
19 t-test or chi-square test. To compare physical performance in the 2 groups, effect sizes
20 were determined. The effect size was calculated as: (Faller mean – Non-faller
21 mean)/standard deviation. The relationship between the total point and the 6 previously
22 validated tests was assessed using Spearman's correlation coefficient. The utility of the
23 total points used to distinguish fallers from non-fallers was tested using receiver
24 operating characteristic (ROC) curves for cut-off points on the index. Data were

1 registered and analyzed using the Statistical Package for Social Science (Windows
2 version 18.0).

3

1 **RESULTS**

2 At least one or more falls had occurred in 203 of the study participants (26.0%)
3 within one year of administering the new index. Based on these self-reported incidences
4 of falling, the participants were divided into two groups: fallers and non-fallers.
5 Demographic characteristics in the 2 groups are summarized in Table 1. No significant
6 differences were observed between the groups for age, body weight, height, and
7 prevalence of females. Fallers showed significantly higher points in “Question 1” (odds
8 ratio=2.79, 95%CI; 1.94-4.03), “Question 2” (odds ratio=3.20, 95%CI; 1.64-6.24),
9 “Question 3” (odds ratio=2.14, 95%CI; 1.46-3.15), “Question 4” (odds ratio=3.46,
10 95%CI; 2.50-4.87), and total points than non-fallers ($p<0.001$).

11 All physical performance tests demonstrated that the elderly participants in the
12 non-faller group had significantly lower scores than those in the faller group. The
13 largest effect size was the total point in all measurements. The results for total point was
14 weakly, but significantly correlated with those for ST walking time ($r=0.179$, $p<0.001$),
15 DT walking time ($r=0.421$, $p<0.001$), OLS ($r=-0.154$, $p<0.001$), and functional reach
16 ($r=-0.083$, $p=0.021$)

17 The ROC curve for the total points for the classification of fall incidents is shown in
18 Figure 1. The area under the curve was 0.715 ($p<0.001$, 95% CI: 0.675-0.755). The
19 ROC curve analysis enabled us to indicate the positive value of 1 point (sensitivity
20 80.8%, specificity 60.6%) and negative value of 2 point (sensitivity 0.394%, specificity
21 83.4%).

22

23

1 **DISCUSSION**

2 In this study we have demonstrated that the new index which we developed is a
3 reliable indicator for falls in elderly with higher levels of functional capacity. The
4 results of the total point on the new index were moderately correlated with those of DT
5 walking time. Moreover, the total new index score demonstrated statistically significant
6 difference between faller and non-faller groups. Therefore, the new index may be
7 considered a measurement that is related to walking ability under DT conditions. These
8 results implicate the role of the total point in the fall risk assessment. A score of 1 point
9 by the new index was considered to represent the fall-related cut-off value. In addition,
10 the total point on the new index had the largest effect size in the other screening tool for
11 falls. Therefore, the index may be useful as a screening tool for fall prediction in robust
12 community-dwelling elderly.

13 The total points on the new index were weakly correlated with previous validated
14 performance tests. The concept of new index was assessed to complex-task locomotion
15 related to falls. Therefore, it is no wonder that the new index was weakly correlated
16 with simple performance tests.

17 In addition to the benefits of the new index as a clinical assessment tool [4-8], we
18 assessed whether this index could be used as a tool for fall risk screening. The new
19 index has a number of advantages over conventional fall risk screening tests. First, it
20 takes a shorter time for the measurement. Second, it is easy to do the assessment in
21 non-clinical settings. However, there is a limitation in this study. The new index could
22 not predict falling in older adults as this study was based on the participants having
23 experienced falls in the previous year. A prospective cohort study to further evaluate the
24 relationship between fall incidents and the new index, in addition to a comparison with

1 existing indices is being planned in the future.

2

3 **ACKNOWLEDGMENTS**

4 We would like to acknowledge Nippon-Shooter Co. Ltd. for their contribution to
5 data collection and Mr. Minoru Ikeda for helpful advice.

6

7

1 **REFERENCE**

- 2 1. Aoyagi K, Ross PD, Davis JW, et al. Falls among community-dwelling elderly in
3 Japan. *J Bone Miner Res* 1998; 13: 1468-74.
- 4 2. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons
5 living in the community. *N Engl J Med* 1988; 319: 1701-7.
- 6 3. Chen HC, Schultz AB, Ashton-Miller JA, et al. Stepping over obstacles: dividing
7 attention impairs performance of old more than young adults. *J Gerontol A Biol Sci*
8 *Med Sci* 1996; 51: M116-122.
- 9 4. Lopopolo RB, Greco M, Sullivan D, et al. Effect of therapeutic exercise on gait
10 speed in community-dwelling elderly people: a meta-analysis. *Phys Ther* 2006; 86:
11 520–540.
- 12 5. Podsiadlo D, Richardson S. The timed “Up & Go”: a test of basic functional
13 mobility for frail elderly persons. *J Am Geriatr Soc* 1991; 39: 142–148.
- 14 6. Vellas BJ, Wayne SJ, Romero L, et al. One-leg balance is an important predictor of
15 injurious falls in older persons. *J Am Geriatr Soc* 1997; 45: 735–738.
- 16 7. Duncan PW, Weiner DK, Chandler J, et al. Functional reach: a new clinical
17 measure of balance. *J Gerontol* 1990; 45: M192–197.
- 18 8. Guralnik JM, Simonsick EM, Ferrucci L, et al. A short physical performance
19 battery assessing lower extremity function: association with self-reported disability
20 and prediction of mortality and nursing home admission. *J Gerontol* 1994; 49,
21 M85–M94.
- 22 9. Tinetti ME. Performance-oriented assessment of mobility problems in elderly
23 patients. *J Am Geriatr Soc* 1986; 34: 119-126.
- 24 10. Shumway-Cook A, Brauer S, Wollacott M. Predicting the probability of falls in

- 1 community-dwelling older adults using the Timed Up and Go Test. *Phys Ther*
2 2000; 80: 896-903.
- 3 11. Zijlstra A, Ufkes T, Skelton DA, et al. Do dual tasks have an added value over
4 single tasks for balance assessment in fall prevention programs? A mini-review.
5 *Gerontology*. 2008; 54: 40-9.
- 6 12. Beauchet O, Annweiler C, Dubost V, et al. Stops walking when talking: a predictor
7 of falls in older adults? *Eur J Neurol* 2009; 16: 786-95.
- 8 13. Yamada M, Aoyama T, Arai H, et al. Dual-task walk is a reliable predictor of falls in
9 robust elderly adults. *J Am Geriatr Soc* 2011; 59: 163-164.
- 10 14. Beauchet O, Dubost V, Allali G, et al. 'Faster counting while walking' as a
11 predictor of falls in older adults. *Age Ageing* 2007; 36: 418-423.
- 12 15. Koski K, Luukinen H, Laippala P, et al. Physiological factors and medications as
13 predictors of injurious falls by elderly people: a prospective population-based study.
14 *Age Ageing* 1996; 25: 29-38.

15
16
17
18

1 Table 1. Comparison of demographic characteristics and measurements in fallers and
 2 non-fallers

	Faller (n=203)	Non-faller (n=577)	Odds (95% CI)	<i>E/S</i>	<i>p-value</i>
Age	76.8±8.1	75.0±8.3			0.180 ^a
Weight, kg	57.9±9.9	54.3±11.6			0.406 ^a
Height, cm	155.7±10.3	157.4±11.6			0.071 ^a
Gender, female	122 (60.1%)	358 (62.0%)			0.560 ^b
Q1 (0, 1)	70 (34.5%)	91 (15.8%)	2.79 (1.94-4.03)		<0.001 ^b
Q2 (0, 1)	19 (9.4%)	18 (3.1%)	3.20 (1.64-6.24)		<0.001 ^b
Q3 (0, 1)	55 (27.1%)	85(14.7%)	2.14 (1.46-3.15)		<0.001 ^b
Q4 (0, 1)	115 (56.7%)	157 (27.2%)	3.46 (2.50-4.87)		<0.001 ^b
Total points (0-4)	1.27 ± 0.86	0.61 ± 0.88		0.77	<0.001 ^a
ST walking time, sec	10.45±2.46	9.48±2.59		0.39	<0.001 ^a
DT walking time, sec	14.17±4.73	12.75±4.76		0.30	<0.001 ^a
TUG, sec	9.90±2.26	9.05±2.22		0.37	<0.001 ^a
OLS, sec	6.43±8.67	9.82±12.60		0.39	<0.001 ^a
Functional reach, cm	23.83±6.98	26.06±7.90		0.32	<0.001 ^a
3 Five chair stand, sec	11.45±5.94	9.92±3.63		0.26	<0.001 ^a

4 ^a: Student's t-test, ^b: chi-square test

5 ST: single-task, DT: manual-task, TUG: Timed Up and Go test, OLS: one leg standing

6 Q1: "Can you stand up without a support?" Yes=0, No = 1

7 Q2: "Can you turn in the opposite way, while holding an empty glass?" Yes=0, No = 1

8 Q3: "Can you walk without dropping a glass of water?" Yes=0, No = 1

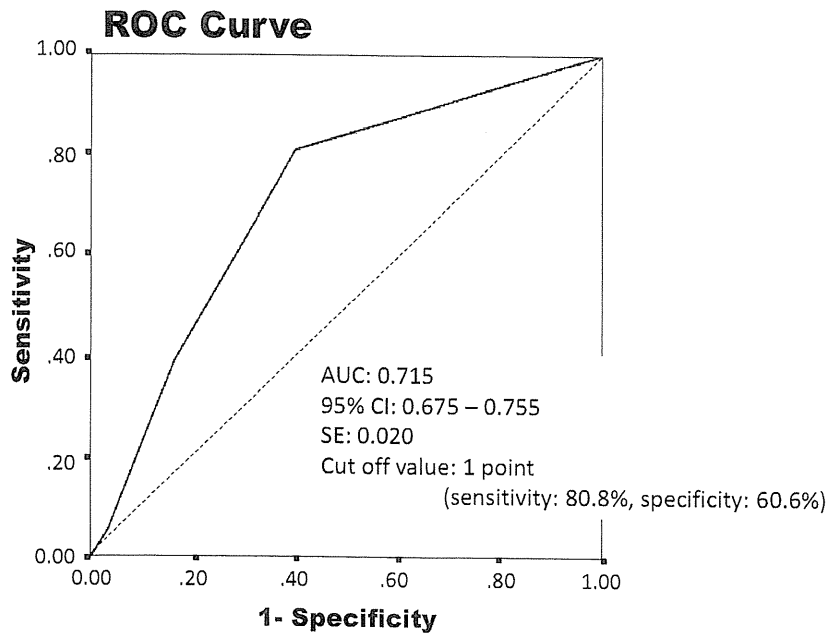
9 Q4: "Have you ever tripped over an obstacle while going to the bathroom or picking up
 10 the telephone?" Yes = 1, No=0,

11

12

13

14



1

2 Fig 1. The ROC curve for the total points used for the classification of fall risk. The
3 area under the curve (AUC) was 0.715. Concerning the total points, the cut-off value
4 was determined at 1 point (sensitivity, 80.8%; specificity 60.6%).

5

COMMISSION REPORT

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

Hidenori Arai,¹ Yasuyoshi Ouchi,² Masayuki Yokode,¹ Hideki Ito,³ Hiroshi Uematsu,⁴ Fumio Eto,⁵ Shinichi Oshima,⁶ Kikuko Ota,⁷ Yasushi Saito,⁸ Hidetada Sasaki,⁹ Kazuo Tsubota,⁷ Hidenao Fukuyama,¹ Yoshihito Honda,¹ Akihisa Iguchi,¹⁰ Kenji Toba,⁶ Takayuki Hosoi⁶ and Toru Kita¹¹ for the Members of the Subcommittee for Aging

¹Kyoto University Graduate School of Medicine, Kyoto, ²Graduate School of Medicine and Faculty of Medicine, The University of Tokyo, ³Tokyo Metropolitan Geriatric Hospital, ⁴Tokyo Medical and Dental University Graduate School, Tokyo, ⁵National Rehabilitation Center for Persons with Disabilities, Tokorozawa, ⁶National Center for Geriatrics and Gerontology, Obu, ⁷Keio University, Fujisawa, ⁸Chiba University, Chiba, ⁹Sendai Tomizawa Hospital, Sendai, ¹⁰Aichi Shukutoku University, Nagakute, and ¹¹Kobe City Medical Center General Hospital, Kobe, Japan

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

Accepted for publication 3 October 2011.

Correspondence: Professor Hidenori Arai MD PhD, Department of Human Health Sciences, Kyoto University Graduate School of Medicine, 53 Kawahara-cho, Shogoin, Sakyo-ku, Kyoto 606-8507, Japan. Email: harai@kuhp.kyoto-u.ac.jp

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.¹ 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;² 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.³ 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",⁴ 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,⁵ 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.⁶

(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 hyperlipidemia 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.

Acknowledgment

This article is a translation of the proposal by The Subcommittee for Aging in The Science Council of Japan.

Disclosure statement

The authors declare no conflict of interest.

References

- 1 Sasaki H. Medical Economy, Geriatrics Textbook (Japanese), 2008; 248–249.
- 2 Akishita M, Teramoto S, Arai H *et al.* Incidence of adverse drug reactions in geriatric wards of university hospitals. *Jpn J Geriatr (Jpn)* 2004; **41**: 303–306.
- 3 Guidelines for medical treatment and its safety in the elderly, edited by the Japan Geriatrics Society, 2005.
- 4 Iguchi A. Terminal care of the elderly. *Jpn J Geriatr (Jpn)* 2005; **42**: 285–287.
- 5 Proposal by the end-of-life care research group. The Scientific Council of Japan (Japanese), 2008.
- 6 Ito H. Perspective of geriatric medicine. *Kagaku (Jpn)* 2010; **80**: 68–72.

Management of Type IIb Dyslipidemia

Hidenori Arai¹, Shun Ishibashi², Hideaki Bujo³, Toshio Hayashi⁴, Shinji Yokoyama⁵, Shinichi Oikawa⁶, Junji Kobayashi⁷, Koji Shirai⁸, Takao Ota⁹, Shizuya Yamashita¹⁰, Takanari Gotoda¹¹, Mariko Harada-Shiba¹², Hirohito Sone¹³, Masaaki Eto¹⁴, Hiroaki Suzuki¹⁵ and Nobuhiro Yamada¹⁶: The Research Committee for Primary Hyperlipidemia, Research on Measures against Intractable Diseases by the Ministry of Health, Labour and Welfare in Japan

¹Department of Human Health Sciences, Kyoto University Graduate School of Medicine, Kyoto, Japan

²Division of Endocrinology and Metabolism, Diabetes Center, Department of Medicine, Jichi Medical University Graduate School of Medicine, Tochigi, Japan

³Department of Genome Research and Clinical Application, Chiba University Graduate School of Medicine, Chiba, Japan

⁴Department of Geriatrics, Nagoya University Graduate School of Medicine, Nagoya, Japan

⁵Department of Biochemistry, Nagoya City University Graduate School of Medical Sciences, Nagoya, Japan

⁶Division of Endocrinology and Metabolism, Department of Medicine, Nippon Medical School, Tokyo, Japan

⁷Department of Lipidology, Kanazawa University Graduate School of Medical Science, Kanazawa, Japan

⁸Internal Medicine, Sakura Hospital, School of Medicine, Toho University, Chiba, Japan

⁹Department of Child Health and Welfare (Pediatrics), Faculty of Medicine, University of the Ryukyus, Okinawa, Japan

¹⁰Department of Cardiovascular Medicine, Osaka University Graduate School of Medicine, Osaka, Japan

¹¹Department of Clinical and Molecular Epidemiology, 22nd Century Medical and Research Center, University of Tokyo Hospital, Tokyo, Japan

¹²Department of Molecular Innovation in Lipidology, National Cerebral and Cardiovascular Center Research Institute, Osaka, Japan

¹³Department of Internal Medicine, University of Tsukuba Institute of Clinical Medicine, Ibaraki, Japan

¹⁴School of Pharmaceutical Sciences, Ohu University and Department of Medicine, Ohu University Hospital, Fukushima, Japan

¹⁵Department of Endocrinology and Metabolism, Graduate School of Comprehensive Human Sciences, University of Tsukuba, Ibaraki, Japan

¹⁶University of Tsukuba, Ibaraki, Japan

Although the Japan Atherosclerosis Society guideline for the diagnosis and prevention of atherosclerosis cardiovascular diseases for the Japanese population provides targets for low-density lipoprotein (LDL) cholesterol, triglycerides, and high-density lipoprotein (HDL) cholesterol to prevent cardiovascular disease in patients with dyslipidemia, there is no guideline specifically targeting the treatment of type IIb dyslipidemia, which is one of the most common types of dyslipidemia, along with type IIa and type IV dyslipidemia. Type IIb dyslipidemia is important because it sometimes accompanies atherogenic lipid profiles, such as small, dense LDL, remnants, low HDL cholesterolemia. It is also associated with type 2 diabetes mellitus, metabolic syndrome, and chronic kidney disease (CKD), and most patients with familial combined hyperlipidemia (FCHL) show this phenotype; therefore, it is assumed that patients with type IIb dyslipidemia have a high risk for cardiovascular disease. Thus, the management of type IIb dyslipidemia is very important for the prevention of cardiovascular disease, so we have attempted to provide a guideline for the management of type IIb dyslipidemia.

J Atheroscler Thromb, 2011; 18:000-000.

Key words; Atherogenic dyslipidemia, Cardiovascular disease, Diabetes, Metabolic syndrome, Lifestyle modification

Address for correspondence: Hidenori Arai, Department of Human Health Sciences, Kyoto University Graduate School of Medicine, Kyoto, Japan

E-mail: harai@kuhp.kyoto-u.ac.jp

Received: August 8, 2011

Accepted for publication: August 18, 2011

Epidemiology

Atherosclerotic Disease and Combined Dyslipidemia

Type IIb dyslipidemia is defined by elevated low-density lipoprotein (LDL) cholesterol and triglycer-