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Geriatrics Gerontology International
Medline Indexed

Geriatr Gerontol Int 2014; **14:** *518–525*

ANNOUNCEMENT: SOCIAL RESEARCH PLANNING AND PRACTICE

Guidance statement on appropriate medical services for the elderly

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Preface: need for guidance statement

With the increase in the elderly population, particularly those aged over 75 years,[1] there is an increasing demand for geriatric medicine services. However, providing proper medical care for the elderly remains difficult for care providers. There are several reasons: compared with their younger counterparts, elderly patients tend to have different clinical symptoms of diseases and different responses to treatment as a result of underlying physiological changes associated with aging; elderly patients may have multiple chronic conditions[2–4] and require a higher number of medications, which increases the risk of unexpected drug interactions and adverse drug reactions;[5–8] clinical guidelines specifically developed for elderly patients are still scarce,[9] and the application of clinical guidelines intended for younger patients may not necessarily result in better outcomes for the elderly.[10–12] This guidance statement is aimed at helping care providers understand the basic concepts of geriatric medicine and provide proper medical care for the elderly, avoiding either over- or undertreatment.[13]

How to apply the guidance statement

The guidance statement outlines points to be considered on providing medical care to the elderly and the required basic competencies for care providers. Although the guidance statement was initially developed for physician use, other professions involved in the care of the elderly may utilize the guidance statement. The guidance statement is not intended to replace existing clinical guidelines for specific conditions, but to impart the basic principles underlying geriatric medical care in actual medical settings. We recommend applying the principles set out in this guidance statement when making treatment decisions, particularly when clinical guidelines are not aimed at elderly patients or guidelines are contradictory to each other.

1. Multiple morbidity and heterogeneity of the aged

- Care providers should understand biological, physical and social function, and the living environment.

1.1. There is considerable interindividual heterogeneity in the aging process, and the effects of aging on physical, mental and social function also vary greatly from person to person (aged heterogeneity).[14] The prevalence of many chronic conditions including lifestyle-related diseases increases with aging, and hence elderly persons may have multiple chronic conditions, or "multimorbidity".[2–4] Therefore, in providing medical care to elderly persons, care providers should focus more on their role as a primary care provider to offer comprehensive management, taking into account all relevant medical conditions.

1.2. The elderly have substantial individual differences in physical, mental and social functions, and may present with atypical signs and symptoms when they fall ill.[14–16] It is imperative to keep such heterogeneity in mind and carry out comprehensive geriatric assessment to evaluate physical, mental and social aspects individually.[17–20] In addition, medical and biological factors, as well as social-environmental factors, affect the course of medical conditions in the elderly, which highlights the importance of understanding the living environment, customs, financial situation, family and social relationships in order to weigh such factors and individualize medical care.[21–25]

Accepted for publication 7 April 2014.

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1.3. Elderly patients are at high risk of receiving fragmented and redundant medical care from multiple care providers because of multimorbidity.[10,26–28] Conversely, elderly patients are also at high risk of undertreatment because care provision, including admission to facilities and surgical treatment, tends to be limited for reasons of age, and decreased physical, mental and social function.[29–33] Care providers should keep in mind that there exist medical treatments for which beneficial effects in the elderly have been established in clinical trials, and make efforts to provide medical care balancing the benefit against the risk.[34,35]

2. Care towards maintenance and improvement of quality of life

- Care providers should try to maintain and improve quality of life (QOL) by preserving the remaining daily living functions and alleviating symptoms.

2.1. The decline in physiological reserve with aging makes elderly patients vulnerable. Conditions that are usually temporary and do not result in any long-term sequelae in younger patients, such as back pain or pneumonia, can cause long-term adverse outcomes, such as a decline in activities of daily living (ADL) in elderly patients, leading to poor QOL.[36–38] Because complete recovery is hard to achieve once ADL decline,[39,40] it is imperative to prevent diseases that can trigger ADL decline by measures such as fall prevention intervention,[41–44] vaccination programs[45–48] and oral hygiene.[49–51] It is also important to preserve ADL by early mobilization and rehabilitation to restore physical function when the patient has an illness.[52,53]

2.2. Geriatric syndromes;[54] that is, common medical conditions in the elderly, such as dementia, delirium, depression, frailty, sarcopenia, malnutrition, dysphagia, falls, urinary incontinence, constipation, decubitus ulcer and dehydration, frequently cause decreased ADL and poor QOL.[55–57] Comprehensive screening and assessment are required for prevention of these geriatric syndromes, and early detection and treatment are required once they occur. Dementia requires special attention and broad screening for early detection, diagnostic workup at specialized facilities if indicated, and early intervention is crucial.

2.3. Many conditions commonly observed in the elderly are chronic and unlikely to be cured completely.[3] In managing such chronic conditions, it is vital to focus on the alleviation of symptoms rather than futile, intensive treatment aiming towards a complete cure. To preserve and improve QOL, through integrated medical, public health and social welfare services, care providers should provide healthcare including environmental modification, mental health services, nutrition management and oral care in addition to palliative care, in order to alleviate symptoms that could worsen QOL.

3. Healthcare provision in daily life setting

- Care providers should understand the importance of where elderly patients spend their daily life in maintaining their QOL, and should provide support to enable elderly patients and their families to choose an appropriate place to live and receive healthcare.
- Care providers should understand issues that may occur during the transition between different healthcare settings and take appropriate preventive measures.

3.1. Care providers should provide comprehensive care in cooperation with Community General Support (*chiiki hokatsu shien*), integrating medical, nursing, long-term care and welfare services, so that an elderly patient can live in a place where they feel comfortable and are able to maintain their QOL.[58] In cases where elderly patients require admission to acute care medical facilities, care providers should initiate discharge support early, to help facilitate their return to their place of residence. Care providers should closely communicate with patients and their family members, and provide support to enable them to choose an appropriate setting where they receive healthcare, when the current healthcare setting is no longer appropriate.[59,60]

3.2. The quality of care may be compromised during patients' transition between different healthcare settings as a result of poor communication between care providers.[61,62] In addition, transition across sites of care is associated with an increased risk of psychological symptoms, such as delirium[63] and disuse syndrome, and subsequent functional decline.[36–38] Care providers should understand these risks associated with healthcare transition, promote communication between healthcare settings and take appropriate preventive measures.[64]

3.3. Care providers should consider medical care provision at long-term care facilities or at home, utilizing medical resources in the community, such as Home-visit Nursing Services (*houmonkango*) and Dementia Support Doctors (*nintishosapo-to i*), as a valid alternative to inpatient or outpatient care.

4. Basic concepts of pharmacotherapy for elderly patients

- Care providers should understand the principles of pharmacotherapy, which require consideration of

risk of adverse drug reactions, medication adherence and patients' priorities of healthcare outcomes, and put the principles into practice.

4.1. Elderly patients are at increased risk of adverse drug reactions.[65,66] Care providers should understand age-related changes in pharmacokinetics and pharmacodynamics,[67,68] and, as a general rule, start medication at the lowest feasible dose and titrate the dose upward slowly and gradually, monitoring the treatment response and adverse reactions to medication.[69,70] Polypharmacy, or use of multiple medications, should be avoided as much as possible, because polypharmacy, particularly when the number of medications is six or more, is associated with an increased risk of unexpected drug–drug reactions and adverse drug reactions.[6,71–76] In addition, several medications are known for their tendency to cause adverse drug reactions in elderly patients,[77,78] and particular attention should be paid to the indication and management of these medications.[79]

4.2. Various factors contribute to poor medication adherence, including cognitive impairment, fine motor impairment, dysphagia, limited access to pharmacy services, financial problems and polypharmacy.[80] Care providers should collect detailed information on medication adherence from patients as well as their family members and caregivers on a regular basis, and screen for factors that could lead to poor adherence in order to intervene and modify such factors, and prevent poor adherence.[81,82] Care providers should simplify medication regimens by use of combination drugs, single-dose packaging or changes in dosage forms.[83]

4.3. Although elderly patients often have multiple chronic conditions and geriatric syndromes, clinical guidelines for such elderly patients are still scarce.[9] However, application of clinical guidelines intended for younger patients may not necessarily result in good outcomes in the elderly.[10–12] It may also be inappropriate to consider pharmacological treatment separately for each medical condition and symptom. Care providers should evaluate the indications for medications and decide the priority of each medication depending on the therapeutic goals for patients and their family, comprehensively taking into consideration individual patients' medical conditions, their severity, organ function, physical, cognitive and daily function, and the family situation. Care providers should choose high-priority medications,[84] and consider discontinuing medications with low priority.[66,85,86]

4.4. Care providers should try non-pharmacological treatment first and avoid pharmacological treatment as long as alternative measures are available.[69,70] Care providers should regularly review medication using patients' medication records to identify all the medications patients take including vitamins, Chinese herbal medicines and over-the-counter drugs.[87,88] Care providers should avoid prescribing new medications if possible when a complete list of medications and dosages is not available. Care providers should understand that the absolute need for medications could alter over time as a result of age-related changes in pharmacokinetics and pharmacodynamics[67,68] or changes in healthcare settings, and should be re-evaluated regularly.[66,89–92]

5. Support for decision making

- Care providers should understand the importance of supporting the decision-making process and achieve a consensus on the treatment plan.

5.1. In geriatric medicine, the therapeutic goals may differ depending on the person's position and values. For example, a study on health outcome prioritization in geriatric medicine showed that the elderly considered effective treatment of diseases and improvement of physical function as the most important goals of care, whereas physicians prioritized improvement in QOL.[93] Therefore, it is essential to support the decision-making process by providing evidence regarding the treatment options and information on prognosis, and help build a consensus on the goals of care in line with values of both patients and their families.[94]

5.2. Care providers should respect and put the highest priority on the patient's personal wishes and values in the process of achieving a consensus on the treatment plan. Even if the patient is not able to express their wishes and values because of cognitive impairment or terminal illness, their family and the medical team should make an attempt to presume the patient's values and reach a decision on the treatment goals that best serve the patient's interests.

6. Providing support for caregivers, such as family members, as well

- Care providers should acknowledge the burden and distress experienced by caregivers, such as family members, and provide appropriate support for them from early on.

6.1. Caregivers experience mental and physical distress in care provision, and are at increased risk of developing depression and experiencing low QOL.[95–98] Therefore, care providers should actively provide information to help caregivers access social resources, such as long-term care services, and

propose interventions, such as respite care, to reduce their burden.[25,99–102] Caregivers should consider making a recommendation for caregivers to receive medical attention if they experience significant mental or physical distress.

6.2. Because of the low birth rate, the rapid aging population and the trend towards a nuclear family, the phenomena called "elderly living alone" in which an elderly person lives alone, "elderly-to-elderly care (*rou-rou kaigo*)" in which an elderly person provides care for another elderly person (usually a spouse) at home and "dementia-to-dementia care (*nin-nin kaigo*)" in which an elderly patient with dementia provides care to another patient with more severe dementia at home, are increasing in number and have become a public concern.[103] Such family situations warrant particular attention, and should prompt care providers to assess the caregiver's ability to provide care and initiate interventions, such as implementing long-term care insurance services.

7. Patient-centered team medicine

- Care providers should recognize that a patient is a part of the care team and provide patient-centered multidisciplinary care.

7.1. Team medicine is defined as "a care delivery system in which medical staff from diverse professional backgrounds work closely together and provide health services appropriate to the needs of patients, utilizing the expertise of each team member, while sharing common goals and information".[104] Team medicine in the care of elderly patients is effective in improving quality of care and safety, and reducing the burden on medical staff.[105–112] Care providers should understand and acknowledge the expertise of other team members from medical, nursing, long-term care and welfare fields, and engage in multidisciplinary team medicine.[113]

7.2. Team medicine should be patient-centered.[113] Care providers should encourage patients and their family members to participate in team meetings in addition to providing counsel and information. The active participation of patients and their family members in the care planning process may improve the quality of care,[114] and subsequently prevent functional decline and admission to acute care facilities.[59,60,115]

Conclusion

As society is facing the challenges of a "super-aged society", healthcare for the elderly is assuming greater importance, but is nonetheless fraught with problems. Inflating healthcare costs threaten to collapse the healthcare system. Opinions from care providers working in clinical settings will be increasingly considered important in order to establish a sustainable healthcare system for the elderly. Close collaboration between care providers, the local community and local government is crucial to foster a life environment conducive to the elderly population. In addition, evidence regarding the efficacy and safety of therapeutic interventions for elderly patients remains scarce, and only basic principles underlying geriatric medical care are presented in this guidance statement. It is paramount to promote clinical research, leading to establishment of evidence-based clinical guidelines.

In the practice of geriatric medicine, advanced medical skills are required to care for elderly patients with multimorbidity and heterogeneous nature in various care settings through multidisciplinary care teams while taking into account patients' values. Ideally, geriatricians with adequate experience and extensive knowledge in the field of geriatrics should provide care for elderly patients. However, the current number of geriatricians will not meet the continuous surge in demand for geriatric care. It is critical to improve the education system to produce more geriatricians, and create a framework to enlighten primary care physicians on the knowledge and skills of geriatric medicine.

Acknowledgments

This work was supported by a Health and Labour Sciences Research Grant (H22-Choju-Shitei-009) from the Ministry of Health, Labour, and Welfare of Japan.

This guidance statement was developed in cooperation with the Japanese Geriatrics Society, the Japan Association of Geriatric Health Services Facilities and Japan Association of Medical and Care Facilities, and also was supported by the Japan Medical Association.

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Financial disclosure

There is no conflict of interest to be disclosed for any of the authors regarding the manuscript.

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Geriatrics Gerontology INTERNATIONAL Medline Indexed

Association of hearing loss with behavioral and psychological symptoms in patients with dementia

Dear Editor,

Behavioral and psychological symptoms of dementia (BPSD) are associated with a number of adverse outcomes including decreased quality of life in patients and their caregivers, earlier institutionalization, and increased healthcare costs. Ishii *et al.* developed a conceptual framework to comprehensively capture factors associated with the development of rejection of care behavior, one type of BPSD.[1] The framework suggested that sensory impairment, such as hearing loss, could be a contributing factor of BPSD. Previous studies identified a positive association of hearing loss with cognitive dysfunction[2] and depressive symptoms.[3] However, the relationship between hearing loss, visual impairment and BPSD is unclear. We hypothesized that hearing loss might have an adverse influence on BPSD.

To test this hypothesis, a cross-sectional analysis was carried out between hearing loss and BPSD, using the medical records of our geriatric department. The data were drawn from the medical records of 99 consecutive patients (41 men, 58 women) who were admitted to the Department of Geriatric Medicine, The University of Tokyo Hospital, Tokyo, Japan, from October 2006 to October 2008 for evaluation of cognitive impairment. The present study was approved by the ethics committee of the Graduate School of Medicine, The University of Tokyo.

A total of 45 patients were diagnosed as Alzheimer's disease, 22 as mild cognitive impairment, six as diffuse Lewy body disease, six as mixed-type Alzheimer's disease and vascular dementia, four as vascular dementia, three as fronto-temporal dementia and 13 as other types of dementia, such as hydrocephalus or corticobasal degeneration, according to the diagnostic criteria of each disease.

The severity of hearing loss was ascertained based on the findings of doctors' examinations, and by asking patients and their family members about the impact of hearing loss on daily life (e.g. difficulty in normal conversation, social interaction or listening to TV).[4,5]

Assessment of BPSD was carried out using screening questions for neuropsychiatric symptoms, such as delusions, hallucinations, agitation, depression, anxiety, elation, apathy, disinhibition, irritability, motor disturbance, wandering, night-time behavior and refusal, that cause caregivers severe stress. A positive answer to a screening question was regarded as indicative of the presence of BPSD.

BPSD were present in 43 patients (43%). The observed symptoms were as follows: depression in eight, delusions in eight, aggression in six, hallucinations in five, agitation in five, wandering in four, night-time behavior in two, refusal in two and others in three patients.

BPSD were more frequently observed in patients with hearing loss than in those without (Table 1). Patients with hearing loss were older, although there was no significant difference in cognitive function measured by the Mini-Mental State Examination (MMSE) total score and depression score between patients with and without hearing loss (Table 1). The prevalence of some symptoms was significantly different between patients with and without hearing loss, but did not add important information because of the small number of each symptom.

Multiple logistic regressions with adjustment for age, sex, total MMSE score and self-reported visual impairment showed that hearing loss was independently associated with the presence of BPSD (odds ratio 4.65, 95% confidence interval 1.70–12.00).

Hearing loss is widespread in older patients, and is often unrecognized or even dismissed in clinical practice. However, the association between hearing loss and BPSD observed in the present study suggests the need to recognize and treat hearing loss when BPSD are observed. The effective treatment and management of hearing loss might help alleviate or resolve some BPSD symptoms. Further study is warranted to confirm the association between BPSD and hearing loss using a large number of participants, and to examine the effect

Table 1 Association between behavioral and psychological symptoms of dementia and hearing loss

	Hearing loss (–)	Hearing loss (+)	*P*
n	68	31	
Women	56%	65%	<0.01
Age (years)	77 ± 6	81 ± 5	<0.01
MMSE	22.0 ± 4.9	21.2 ± 4.8	0.45
GDS-15	5.6 ± 3.4	7.1 ± 4.4	0.22
BPSD	32%	68%	<0.01
Visual impairment	45%	70%	<0.01

Values are expressed as mean ± SD. BPSD, behavioral and psychological symptoms of dementia; GDS-15, Geriatric Depression Scale-15; MMSE, Mini-Mental State Examination.

doi: 10.1111/ggi.12185

of interventions on hearing loss on BPSD. Although it has been reported that visual impairment is associated with cognitive dysfunction,[2] no significant relationship was found between self-reported visual impairment and BPSD in the present participants (data not shown).

In conclusion, the present preliminary study showed that hearing loss was associated with BPSD in patients with mild to moderate dementia.

Disclosure statement

The authors declare no conflict of interest.

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COMMENTS

Associated factors with gender gap in life expectancy: Recommendation for the use of healthy life expectancy

Dear Editor,

Liu *et al.* reported a negative association between gender gaps in life expectancy (GGLE) and happiness, human development index (HDI) and Gender Empowerment Measure (GEM) in Organization for Economic Cooperation and Development (OECD) countries.[1] In addition, Liu *et al.* reported a positive association between GGLE and age-adjusted all-cause gender mortality ratio, but HDI had no significant association with GGLE in Japan.[2] The authors explained the recent decline of GGLE by the resemblance of lifestyles between gender, and HDI was not a significant contributor to GGLE in Japan. I have some concerns about their study outcome.

First, their study on OECD countries is a repeated cross-sectional ecological study, and their conclusion cannot simply be applied for the same relationship in Japan. There were many factors to be considered for the association, such as ethnic difference of lifestyles. The cause of GGLE should also be evaluated by using both demographic and health-related information.[3,4]

Second, gender differences in happiness, HDI and GEM cannot be considered in their analyses, and causality on the association between GGLE and happiness or HDI is difficult to be determined.

Third, life expectancy is an indicator of biological degree of longevity in life, and healthy life expectancy (HLE) is another indicator to understand the association between GGLE and happiness or HDI. HLE is defined as the "average number of years that a person can expect to live in 'full health' ". HLE calculation by Jagger *et al.*[5] is widely accepted in studies on health inequalities in European Union countries,[6] and HLE have been reported in almost all the countries.[7,8] HLE is affected by mortality and disability,[9] and HLE reflects successful aging. HLE in women is longer than men in many countries,[10] and GGLE by using HLE seems informative to understand the association with HDI.

Disclosure statement

The authors declare no conflict of interest.

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 doi: 10.1111/ggi.12170

JAMDA 15 (2014) 95–101

JAMDA

journal homepage: www.jamda.com

Review

Sarcopenia in Asia: Consensus Report of the Asian Working Group for Sarcopenia

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Keywords:
Sarcopenia
frailty
muscle mass
muscle quality
muscle strength
physical performance

A B S T R A C T

Sarcopenia, a newly recognized geriatric syndrome, is characterized by age-related decline of skeletal muscle plus low muscle strength and/or physical performance. Previous studies have confirmed the association of sarcopenia and adverse health outcomes, such as falls, disability, hospital admission, long term care placement, poorer quality of life, and mortality, which denotes the importance of sarcopenia in the health care for older people. Despite the clinical significance of sarcopenia, the operational definition of sarcopenia and standardized intervention programs are still lacking. It is generally agreed by the different working groups for sarcopenia in the world that sarcopenia should be defined through a combined approach of muscle mass and muscle quality, however, selecting appropriate diagnostic cutoff values for all the measurements in Asian populations is challenging. Asia is a rapidly aging region with a huge population, so the impact of sarcopenia to this region is estimated to be huge as well. Asian Working Group for Sarcopenia (AWGS) aimed to promote sarcopenia research in Asia, and we collected the best available evidences of sarcopenia researches from Asian countries to establish the consensus for sarcopenia diagnosis. AWGS has agreed with the previous reports that sarcopenia should be described as

The authors declare no conflicts of interest.

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http://dx.doi.org/10.1016/j.jamda.2013.11.025

low muscle mass plus low muscle strength and/or low physical performance, and we also recommend outcome indicators for further researches, as well as the conditions that sarcopenia should be assessed. In addition to sarcopenia screening for community-dwelling older people, AWGS recommends sarcopenia assessment in certain clinical conditions and healthcare settings to facilitate implementing sarcopenia in clinical practice. Moreover, we also recommend cutoff values for muscle mass measurements (7.0 kg/m^2 for men and 5.4 kg/m^2 for women by using dual X-ray absorptiometry, and 7.0 kg/m^2 for men and 5.7 kg/m^2 for women by using bioimpedance analysis), handgrip strength (<26 kg for men and <18 kg for women), and usual gait speed (<0.8 m/s). However, a number of challenges remained to be solved in the future. Asia is made up of a great number of ethnicities. The majority of currently available studies have been published from eastern Asia, therefore, more studies of sarcopenia in south, southeastern, and western Asia should be promoted. On the other hand, most Asian studies have been conducted in a cross-sectional design and few longitudinal studies have not necessarily collected the commonly used outcome indicators as other reports from Western countries. Nevertheless, the AWGS consensus report is believed to promote more Asian sarcopenia research, and most important of all, to focus on sarcopenia intervention studies and the implementation of sarcopenia in clinical practice to improve health care outcomes of older people in the communities and the healthcare settings in Asia.

Sarcopenia has been accepted as a new geriatric syndrome,[1] and the knowledge related to sarcopenia is growing rapidly worldwide. Over the past 20 years of sarcopenia research after the first introduction by Rosenberg et al,[2] the etiology, pathophysiology, risk factors, and consequences of sarcopenia have gradually become clearer.[3] Moreover, a number of therapeutic approaches and clinical trials have been developed and are still evolving.[4–7] Most importantly, the association of sarcopenia with poorer health status and adverse outcomes had triggered a new approach for health promotion and health care of older people. The escalation of elderly population worldwide further strengthened the clinical importance of sarcopenia, which is even more significant in Asia because of the rapid demographic transition in this highly populated continent.[8–10]

Sarcopenia has been described as an age-related decline in skeletal muscle mass as well as muscle function (defined by muscle strength or physical performance),[11] which may result in reduced physical capability,[12–14] poorer quality of life, impaired cardiopulmonary performance,[15,16] unfavorable metabolic effects,[17] falls,[18] disability, and mortality in older people,[19,20] as well as high health care expenditure.[21] Furthermore, sarcopenia is also associated with multimorbidity,[22,23] cigarette smoking,[22,24] low body mass index,[25] underweight,[26] physical inactivity,[12] and low serum levels of testosterone in men.[27,28] In general, the association between sarcopenia and functional decline is more significant in men than in women,[29,30] which deserves further research for therapeutic consideration. Since Asia is the most populated and fastest aging region in the world, sarcopenia will pose great impacts to Asian populations in the near future.[31,32] Therefore, experts and researchers of sarcopenia from China, Hong Kong, Japan, South Korea, Malaysia, Taiwan, and Thailand organized the Asian Working Group for Sarcopenia (AWGS) and had several meetings in Taipei, Seoul, and Kyoto to promote further research development of sarcopenia in Asia since March 2013. This article will focus on the epidemiology of sarcopenia in Asian countries and to propose a diagnostic algorithm based on currently available evidence in Asia.

Diagnosis of Sarcopenia and Its Impact to Asia

Asia is a huge and densely populated continent with a wide range of ethnicities, cultural, social, religious backgrounds, and lifestyles. Because of the rapid population aging and the population size, the impact of sarcopenia in Asia may be stronger than in other continents. However, the status of population aging and economic development varies extensively in different Asian countries. Therefore, developing a consensus for sarcopenia diagnosis and clinical approaches based on available evidence is of great importance for sarcopenia research in the future.

In 2010, European Working Group on Sarcopenia in Older People (EWGSOP) proposed an operational definition and diagnostic strategy for sarcopenia that had become the most widely used in the world.[33] The EWGSOP definition required measurements of muscle mass, muscle strength, and physical performance for the diagnosis of sarcopenia, which is compatible with current understanding about sarcopenia. Based on the discussion of the AWGS meetings, we decided to take similar approaches for sarcopenia diagnosis, but unlike EWGSOP, we recommended measuring both muscle strength (handgrip strength) and physical performance (usual gait speed) as the screening test (Figure 1). Although the recommended approaches for measurements of muscle mass, muscle strength, and physical performance by AWGS were similar to the EWGSOP definition, the cutoff values of these measurements in Asian populations may differ from those in Caucasians because of ethnicities, body size, lifestyles, and cultural backgrounds. Therefore, developing an Asian consensus in sarcopenia diagnosis based on the evidence derived from Asian populations is essential for research and therapeutic approaches to sarcopenia in Asia.

Strategy for Sarcopenia Screening and Assessment

In principle, AWGS followed the diagnostic approach of EWGSOP, and we added some Asian perspectives in sarcopenia diagnosis and research. In the previous studies from Western countries, the prevalence of sarcopenia in older people was around 20% among people aged 65 years and older and may reach 50%–60% in octogenarians.[34] EWGSOP recommends routine screening for sarcopenia among community-dwelling people aged 65 years and older. On the other hand, the International Working Group on Sarcopenia (IWGS) specifies certain conditions for sarcopenia assessment, including (1) noted decline in function, strength, "health" status, (2) self-reported mobility-related difficulty, (3) history of recurrent falls, (4) recent unintentional weight loss (>5%), (5) post-hospitalization, and (6) other chronic conditions (eg, type 2 diabetes, chronic heart failure, chronic obstructive pulmonary disease, chronic kidney disease, rheumatoid arthritis, and cancer).[35] Moreover, IWGS recommends assessing patients with reduced physical functioning (or weakness) or patients with habitual gait speed <1.0 m/s (by 4-m course) to assess body composition by dual x-ray absorptiometry (DXA). Nonambulatory patients or those who cannot rise from a chair unassisted should be considered to be sarcopenic without DXA measurements. Since sarcopenia is defined as an age-related condition, assessment of sarcopenia is limited to people aged 65 years and older only in the

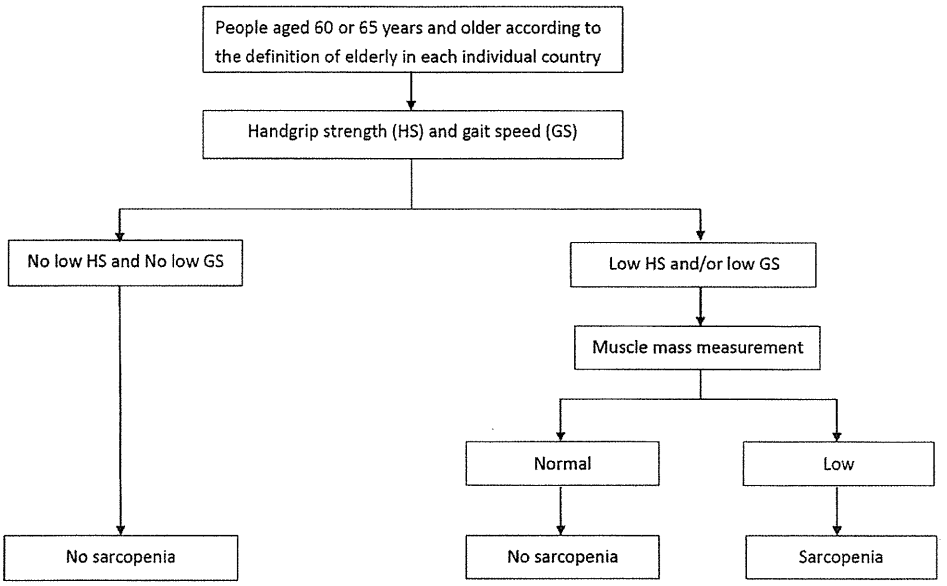

Fig. 1. Recommended diagnostic algorithm of Asian Working Group for Sarcopenia.

EWGSOP criteria, but IWGS does not specify the age for sarcopenia diagnosis.

In Asia, because of the different states of aging, not all countries use the same age cutoff to define elderly populations. Therefore, AWGS recommends using 60 or 65 years as the age for sarcopenia diagnosis according to the definitions of elderly in each country. Although muscle aging is a continuous process, most previous studies supported the idea that loss of muscle mass and muscle strength becomes pronounced around the age of 50,[36] progresses faster after the age of 60,[37] and accelerates even faster after the age of 75.[38] The overall benefits of sarcopenia screening or assessment programs are dependent on the outcomes of effective intervention programs. AWGS emphasizes the benefits of intervention programs in addition to sarcopenia screening and assessment; therefore, we recommend screening for sarcopenia among community-dwelling older people as well as older people with certain clinical conditions in all healthcare settings. Table 1 summarized the recommended strategy for sarcopenia screening and assessment of AWGS by dividing cases into 2 categories (ie, community settings and specific chronic conditions in all healthcare settings). From the perspective of public health, sarcopenia screening for community-dwelling older people would facilitate health promotion and disability prevention in their communities, and the assessment of sarcopenia in clinical settings would facilitate strategies for the intervention in clinical practice. AWGS would like to emphasize the prognostic significance of sarcopenia in clinical practice through assessment under certain clinical conditions. However, the benefits of identification of and interventions for sarcopenia remain to be determined.

Table 1
Strategy of Sarcopenia Screening and Assessment for Older People (60 or 65 Years of Age and Older) in Asia

Community Settings
People aged 60 or 65 years and older (according to the definitions of elderly in each individual country) living in communities
Specific Clinical Conditions in All Healthcare Settings
Presence of recent functional decline or functional impairment
Unintentional body weight loss for over 5% in a month
Depressive mood or cognitive impairment
Repeated falls
Undernutrition
Chronic conditions (eg, chronic heart failure, chronic obstructive pulmonary disease, diabetes mellitus, chronic kidney disease, connective tissue disease, tuberculosis infection, and other chronic wasting conditions)

Suggested Outcome Indicators in Sarcopenia Research

The EWGSOP definition suggests using physical performance, muscle strength, and muscle mass as the primary treatment outcome indicators for sarcopenia intervention trials, whereas activities of daily living, quality of life, metabolic and biochemical markers, inflammatory markers, global impression of change by subject or physician, falls, admission to nursing home or hospital, social support, and mortality as secondary outcome indicators.[33] While most epidemiologic studies in sarcopenia research to date have taken a static approach, the state of sarcopenia may change over time and this dynamic approach may provide different considerations in developing sarcopenia intervention programs. Therefore, AWGS also recommends a dynamic approach for sarcopenia research by measuring changes in (1) muscle mass, strength, and function, (2) physical performance, (3) frailty status, (4) instrumental activities of daily living, and (5) basic activities of daily living over a given period of time as outcome indicators for sarcopenia research. In addition to the above-mentioned outcome indicators, AWGS also recommends using fear of falling and incontinence as outcome indicators for sarcopenia research (Table 2).

Assessment Techniques and Suggested Cutoff Values

Assessment of sarcopenia in Asian populations presents a great challenge because of the lack of outcome-based studies. However, determining appropriate cutoff values for sarcopenia diagnosis in Asia is critical to promote further sarcopenia research and treatment in Asia. Consequently, AWGS focused on the best available evidence to determine cutoff values for the diagnosis of sarcopenia in Asia. If, however, no outcome-based data are available, AWGS would recommend standardized approaches for cutoff value determination.

Table 2
Outcome Indicators for Sarcopenia Research Recommended by AWGS

Static Approach
Activities of daily living
Quality of life
Inflammatory markers
Falls
Frailty status
Mobility disorders
Admission to hospitals
Admission to long term care facilities
Mortality
Dynamic Approach
Changes in muscle mass
Changes in muscle strength
Changes in physical performance
Changes in frailty status
Changes in instrumental activities of daily living
Changes in activities of daily living

AWGS, Asian Working Group for Sarcopenia.

Muscle Mass

EWGSOP recommends DXA, computed tomography (CT), magnetic resonance imaging (MRI), and bioimpedance analysis (BIA) for sarcopenia research. Currently, the precision of DXA, CT, and MRI has been well recognized, but the precision of BIA in measuring muscle mass is controversial. BIA was developed to estimate the volume of body fat and lean body mass, but not appendicular muscle mass. Although the accuracy of BIA in sarcopenia diagnosis has been validated,[39–41] it is heavily dependent on the accuracy of the equation of the equipment and the conditions of assessments, eg, temperature, humidity, skin condition, etc.[42] Nevertheless, the high cost, CT-generated radiation exposure, and inconvenience for community screening have limited the applications of CT and MRI despite both CT and MRI have both been considered gold standards for evaluation of body composition. On the other hand, DXA is also considered an appropriate alternative approach to distinguish between fat, bone mineral, and lean tissues. Currently, DXA may be the most widely used method for muscle mass measurement in sarcopenia research. Despite the minimal radiation exposure from DXA, using DXA in community screening of sarcopenia is still difficult. Newly developed models of BIA equipment may obtain measurements of appendicular muscle mass with precision.[43,44] Portability, reasonable cost, fast processing, noninvasiveness, radiation-free functions, and convenience of use made BIA suitable for community sarcopenia assessment. Results of multiple segment fat-free mass estimation using BIA are highly associated with that measured using DXA among elderly Taiwanese.[45] Although using BIA equipment with validated equations is recommended for sarcopenia research in EWGSOP criteria, the equations of BIA equipment in Western countries are not derived from Asian populations. Strasser et al[46] proposed measurement of muscle thickness, especially of musculus vastus medialis, by musculoskeletal ultrasound to be a reliable method for the estimation of sarcopenia, which deserves further research for applications in Asian studies. In current Asian studies, the most commonly used BIA machines were manufactured by only 2 companies, and the results were quite consistent. Because of its portability and reasonable cost, BIA may be considered the main approach in sarcopenia assessment in community-based screening programs. Therefore, AWGS supports using BIA for sarcopenia diagnosis and evaluation of the effect of intervention programs, but AWGS suggests researchers to provide coefficient of variance, inter- and intra-examiner reliability whenever possible to facilitate subsequent international comparisons.

In terms of cutoff value determination, most current Asian studies have adopted the classical approach for muscle mass measurement (ie, below 2 standard deviations of the mean muscle mass of young adults). However, Asian studies reported an extremely low prevalence of sarcopenia through this approach, especially in older women.[26,47,48] Lau et al[26] also found that the relative total skeletal muscle of Hong Kong Chinese (total skeletal muscle /height^2) was 17% lower among young Chinese men than that of Caucasian men.[26] A potential cohort effect may exist in this approach since younger people in Asia today leading a westernized or more urbanized lifestyle while older Asian people have carried out a traditional lifestyle since adulthood. This cohort effect may be derived from the economic development, urbanization, and development of public transportation in Asia in recent decades. Older Asian people today may have walked and performed more physical activities because of the underdevelopment of public transportation and living conditions since their early adulthood, so their muscle mass may be maintained better than that of the younger generation. On the other hand, because of the relatively higher adiposity of Asian people in comparison with Caucasians, appendicular muscle mass may be overestimated by DXA. Overall, AWGS recommends using 2 standard deviations below the mean muscle mass of young reference group or the lower quintile as the cutoff value determination. Moreover, AWGS recommends using height-adjusted skeletal muscle mass instead of weight-adjusted skeletal muscle mass, and the suggested cutoff values were 7.0 kg/m^2 in men and 5.4 kg/m^2 in women by using DXA. By using BIA, the suggested cutoff values were 7.0 kg/m^2 in men and 5.7 kg/m^2 in women, defined by appendicular skeletal muscle mass/height^2.

Muscle Strength

Measuring handgrip strength is considered a feasible and convenient measure of muscle strength because of cost, availability, ease of use, and its association with leg strength. Wu et al[49] presented the norm of handgrip strength in Taiwan, which disclosed that the mean grip strength of the study sample in Taiwan was significantly lower (male 25%, female 27%) than consolidated norms derived from largely Caucasian populations. Although some papers published in Taiwan using this adjusted cutoff value based on EWGSOP definition for sarcopenia research,[50] some unpublished papers from Japan, Hong Kong, and China recommended using 25 kg for men and 18 or 16 kg for women as the cutoff values for handgrip strength. Currently, handgrip strength is the most widely used measure for muscle strength in Asian sarcopenia research (Table 3), and AWGS also recommends using it for the measurement of muscle strength. Although knee flexion/extension and peak expiratory flow are also recommended for sarcopenia research in EWGSOP criteria, they are less commonly used. In Thailand, the cutoff points of quadriceps strength had been defined based on the outcome of mobility decline. The cutoff points of <18 kg in men and <16 kg in women can discriminate those had normal and abnormal various sarcopenia-related variables. Because of the lack of outcome-based cutoff values, AWGS recommends using the lower 20th percentile of handgrip strength of the study population as the cutoff value for low muscle strength before outcome-based data is available. Low handgrip strength is suggested to be defined as <26 kg for men and <18kg for women by AWGS.

Physical Performance

A wide range of tests for physical performance are recommended in EWGSOP criteria, including the Short Physical Performance Battery (SPPB), usual gait speed, the 6-minute walk test, the stair climb power test, and the timed-up-and-go test (TUG).[51] Timed usual gait is highly predictive for the onset of disability,[52] and other adverse health

Table 3
Measurable Variables and Cutoff Points in Asian Populations

Criterion	Measurement Method	Cutoff Points by Sex	Reference Group Definition	Prevalence of Sarcopenia	Country/ Ethnicity	Reference
Muscle mass	DXA	ASM/height^2 Class 1 and class 2 sarcopenia Men: 7.77 and 6.87 kg/m^2 Women: 6.12 and 5.46 kg/m^2	Based on values 1 and 2 SD below the sex-specific means of the study reference data (n = 529)	Class 1 and class 2 sarcopenia in subjects 70–85 years of age: Men: 6.7%, 56.7% Women: 6.3%, 33.6%	Japan	69
		ASM/height^2 Men <5.72 kg/m^2 Women <4.82 kg/m^2	Based on 2 SD below the mean of young Asians in study (n = 111)	In older Chinese ≥70 years of age Men: 12.3% Women: 7.6%	Chinese	26
		ASM/height^2 Men: 7.40 kg/m^2 Women: 5.14 kg/m^2	Based on 2 SD below the sex-specific mean of a younger population (n = 145)	In older subjects ≥ 60 years of age Men: 6.3% Women: 4.1%	Korea	70
		SMI (%)[†] Men: 35.71% Women: 30.70%	Based on 2 SD below the sex-specific mean of a younger population (n = 145)	Men: 5.1% Women: 14.2%		
		Using the residuals method		Men: 15.4% Women: 22.3%		
		ASM/height^2 Class I and class II sarcopenia Men: 7.50 and 6.58 kg/m^2 Women: 5.38 and 4.59 kg/m^2	Based on 1 and 2 SD below the mean of young adults in study (n = 2513)	Class I and class II sarcopenia Men: 30.8% and 12.4% Women: 10.2% and 0.1%	Korea	48
		ASM/body weight (%) Class I and class II sarcopenia Men: 32.2% and 29.1% Women: 25.6% and 23.0%	Based on 1 and 2 SD below the mean of young adults in study	Men: 29.5% and 9.7% Women: 30.3% and 11.8%	Korea	48
		ASM/body weight (%)[‡] Men: 29.53% Women: 23.20%	Based on 2 SD of sex-specific young normal people		Korea	71
		Use SMI (% of skeletal muscle index) but not mentioned the cutoff points in the manuscript	Based on 2 SD of sex-specific young normal people	Sarcopenia class I, II, overall Men: 32.5%, 15.7%, 35.33 % Women: 30.5%, 10%, 34.74 %	Thailand	72
		RASM index Men: 7.27 kg/m^2 Women: 5.44 kg/m^2	Based on the lower 20% of study group	Men: 10.8% Women: 3.7%	Taiwan	47
		SMI (% of skeletal muscle index) Men: 37.4% Women: 28.0%	Based on the lower 20% of study group	Men: 14.9% Women: 19%		
	BIA	SMI Men <8.87 kg/m^2 Women <6.42 kg/m^2	Based on 2 SD below the normal sex-specific mean for young people	18.6% in elderly women and 23.6% in elderly men age 65 and older	Taiwan	40
		ASM/height^2 Men <7.0 kg/m^2 Women <5.8 kg/m^2	Based on 2 SD below young adult values	Men: 11.3% Women: 10.7% using EWGSOP criteria	Japan	13
		ASM/height^2 Women ≤ 6.42 kg/m^2		Women: 22.1%	Japan	6
		ASM/height^2 Men <6.75 kg/m^2 Women <5.07 kg/m^2	Based on 2 SD below young adult values	Men: 21.8% Women: 22.1% using EWGSOP criteria	Korea/Health ABC data	15
Muscle strength	Handgrip strength	Men: 30.3 kg Women: 19.3 kg	Based on lowest quartile of study group		Japan	13
		Men <22.4 kg Women <14.3 kg	Based on EWGSOP recommendation and adjusted according to Asian data[49]		Taiwan	50
	Knee extension	Women ≤1.01 Nm/kg			Japan	6,73
Physical performance	Gait speed	Gait speed Men <1.27 m/s Women <1.19 m/s	Based on the lowest quartile of study group, gait speed obtained from the middle 5 m of a total of 11 m walking	Men: 11.3% Women: 10.7% using EWGSOP criteria	Japan	13
		Gait speed ≤ 1 m/s			Taiwan	50
		Gait speed ≤ 1.22 m/s		Women: 22.1%	Japan	6,73
	SPPB	SPPB scores <9			Korea	74

ASM, appendicular skeletal muscle mass; BIA, bioimpedance analysis; DXA, dual x-ray absorptiometry; EWGSOP, European Working Group on Sarcopenia in Older People; Health ABC, The Health Aging and Body Composition Study; RASM, relative appendicular skeletal muscle; SD, standard deviation; SPPB, Short Physical Performance Battery; SMI, skeletal muscle mass index.

[†]SMI (%) = total skeletal muscle mass (kg)/weight (kg) × 100.

[‡]The author also named it modified skeletal muscle mass index (SMI).

events like severe mobility limitation and mortality.[53] TUG is an assessment of ambulation and dynamic balance. Poorer TUG has been demonstrated to be associated with poorer physical and mental function and mood status, as well as low fat-free mass by BIA measurements.[54] Although TUG has been proposed as a suitable measurement for physical performance in EWGSOP, abnormal TUG may result from a great variety of underlying conditions. AWGS is more conservative in the use of TUG as a measurement for physical

performance, and we recommend using 6-meter usual gait speed for measurement of physical performance.

Ideally, determination of the cutoff values of these measurements should be based on longitudinal outcome-based studies instead of a simply statistical approach.[55] Although the association between sarcopenia and functional decline or even mortality has been established,[56] selection of universal outcome indicators in subsequent research may facilitate international comparisons. Table 3 summarized the epidemiology and proposed cut-off points in different cases of Asian sarcopenia research. EWGSOP has developed a suggested algorithm based on gait speed measurement with a cutoff point of <0.8 m/s.[33] The association of slow usual gait speed in the elderly with adverse clinical outcomes has been reported extensively, but the application was also dependent on the determination of appropriate cutoff points. Meanwhile, the prevalence of low muscle mass in the Asian population as determined using the classical approach is very low, which is confusing. The potential cohort effect may partially explain the phenomenon of older people today engaging in more physical activities than younger people, which made the prevalence of sarcopenia lower than expected. Specific consideration of this potential cohort effect deserves further attention in the diagnosis of sarcopenia in Asia. Although there is a potential gender difference in the cutoff value of usual gait speed and a wide range of walking speed (from 0.6 to 1.2 m/s) being reported in this special issue, AWGS suggested using ≤0.8 m/s as the cutoff for low physical performance after extensive consideration of data available in Asian studies.

Therapeutic Implications

Physical activities, including aerobics, endurance exercise,[57] and resistance exercise training[58,59] have been demonstrated to significantly increase muscle mass and strength in sarcopenic older people. Although the recommended frequency of exercise training to improve muscle strength and functional performance has been shown,[60] a consensus has not yet been reached concerning the content of the prescribed exercise and the most optimal frequency and intensity. Inappropriate exercise training in the elderly may result in unfavorable adverse outcomes such as musculoskeletal complaints,[61] which is not uncommon. Further research should be focused on the development of suitable exercise prescription, especially for older people at risk of functional decline or sarcopenia. The Society for Sarcopenia, Cachexia, and Wasting Disease developed nutritional recommendations for the prevention and management of sarcopenia, which combined exercise with adequate protein and energy intake.[62] A leucine-enriched balanced essential amino acid or balanced amino acid supplementation is suggested for sarcopenia. Recently, Kim et al[6] demonstrated that exercise and amino acid supplementation (3 g of a leucine-rich essential amino acid mixture twice a day) together may actually be effective in enhancing muscle strength, variables of muscle mass, and walking speed in sarcopenic women. Aside from exercise and nutritional supplementation, the pharmaceutical approach to sarcopenia is still under development. Growth hormone replacement was not successful because the effect of increased muscle mass by growth hormone replacement was not associated with the improvement of muscle performance,[63–65] unless it is used for growth hormone deficiency patients for a period longer than 12 months.[66–68] In addition, the effects of antimyostatin antibodies on sarcopenia have been demonstrated and may be marketed in a few years. Therefore, sarcopenia should be treated through a multilevel approach employing combined physical activities and nutritional supplementation. Currently, there is no well-established evidence for pharmaceutical approach for sarcopenia intervention, but a few agents may be available in future.

Future Challenge and Conclusion

Sarcopenia significantly impacts daily activities, functional status, disability, and quality of life in older populations. Although Asian populations are rapidly ageing, from the clinical practice or public health points of view, the understanding of and preparation for sarcopenia remain inadequate. Hence, this consensus collected as many Asian studies as possible and offers a working diagnosis of sarcopenia for Asian people. The main aims of AWGS were to promote sarcopenia research in Asian countries through providing recommended diagnostic strategies and cutoff values based on Asian studies, and to foster the importance of implementing sarcopenia in clinical practice and in community health promotion programs.

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Geriatrics Gerontology INTERNATIONAL Medline Indexed

Geriatr Gerontol Int 2014; **14 (Suppl. 1):** *1–7*

EDITORIAL

Growing research on sarcopenia in Asia

We, the Guest Editors of this special issue, are proud to publish 16 articles on sarcopenia from six Asian countries, including seven articles from Japan, four from Taiwan, two from Hong Kong, and one each from Korea, China, and Thailand. We searched PubMed using the key words "sarcopenia" and "human," and found 97 original articles that were published in English in 2013 (from January to November). Among the articles, 17 were from Asian countries. Thus, researchers in Asian countries have contributed significantly to sarcopenia research.

Aging is an inevitable phenomenon, and the aging of skeletal muscle is no exception. It has been more than 20 years since Rosenberg first coined the term "sarcopenia,"[1] indicating that age-related muscle decline is associated with poor health status and adverse health outcomes in older adults. Along with the tremendous increase in the older population in Asia, sarcopenia has exerted a great impact on Asian populations. However, until recently, Asian researchers have not given great attention to sarcopenia research. Additionally, factors such as population aging, economic development and ethnic background vary extensively in Asian countries. Therefore, sarcopenia experts and researchers from China, Hong Kong, Japan, Korea, Malaysia, Taiwan, and Thailand organized the Asian Working Group for Sarcopenia (AWGS). Since March 2013, this working group has held several meetings in Taipei, Seoul and Kyoto to promote further sarcopenia research development in Asia. The AWGS also aims to focus on the epidemiology of sarcopenia in Asian countries, and has proposed a diagnostic algorithm based on currently available evidence in Asia. As a result of the efforts of AWGS, we are happy to announce that our consensus paper on the diagnostic algorithm and a systematic review of Asian evidence was published in the *Journal of the American Medical Directors Association*.[2] We hope that all of the articles in this special issue and the consensus paper will further inspire sarcopenia research in Asia.

In terms of the definition of sarcopenia, the European Working Group on Sarcopenia in Older People (EWGSOP) proposed an operational definition and diagnostic strategy that have become the most widely used in the world.[3] The EWGSOP definition requires measurements of muscle mass, muscle strength and/or physical performance for the diagnosis of sarcopenia. Based on discussions at the AWGS meetings, we decided to take similar approaches to sarcopenia diagnosis. However, unlike the EWGSOP definition, we recommend measuring both muscle strength (grip strength) and physical performance (usual gait speed) as the initial screening test. For the usual gait speed, we recommend using 6-m usual gait speed without deceleration. Although the cut-offs of these measurements in Asians might differ from those in Caucasians because of variations in ethnicities, body size, lifestyles and cultural backgrounds, we utilize the EWGSOP definition of slow gait speed (0.8 m/s or less) due to a lack of outcome-based evidence. However, if we use the lowest 20th percentile of gait speed in community settings, according to most Asian studies, the cut-off would be higher than 1 m/s. Meanwhile, we have more data on the cut-offs of grip strength and muscle mass in Asian populations. Based on several epidemiological studies in Asia, we define low grip strength as <26 kg for men and <18 kg for women. The AWGS recommends using height-adjusted skeletal muscle mass, with the suggested cut-off values of 7.0 kg/m^2 in men and 5.4 kg/m^2 in women using dual X-ray absorptiometry (DXA). The suggested cut-off values are 7.0 kg/m^2 in men and 5.7 kg/m^2 in women when bioelectrical impedance analysis (BIA) is used. However, we should keep in mind that DXA and BIA are not yet available in many Asian countries for the screening of muscle mass. Therefore, we must develop an inexpensive measurement for assessing muscle mass.

In this special issue, to maintain consistency, we referred to "sarcopenia" only if authors measured gait speed, grip strength (quadriceps strength was acceptable) and muscle mass. Therefore, "low muscle mass" was used when authors only measured muscle mass. Additionally, many articles used different cut-off values for the grip strength and muscle mass measurements. Table 1 summarizes these data and the prevalence of sarcopenia. We also compared the difference in the diagnostic flow of sarcopenia across the AWGS, EWGSOP and International Working Group on Sarcopenia (IWGS), as shown in Table 2.

As described in the articles of this special issue, sarcopenia has a substantial impact on the health care of older adults. Therefore, additional research is required to further develop the diagnosis and treatment of sarcopenia. We hope that this special issue will inspire more Asian researchers to carry out sarcopenia research.

doi: 10.1111/ggi.12236

Table 1 Surrogates comparison for Asian consensus

1st Author and nationality	Available measurements	Cut-off definition	Cut-off values	Prevalence of sarcopenia	Research population	Reference population	Ref. no.
Assantachai Thailand	• QS measured by a hand-held dynamometer: Lafayette Manual Muscle Test System (MMT)® model 01163 (Lafayette Instrument, Lafayette, IN, USA) • Total lean body mass, using BIA Model 450 (Biodynamics Corp. Seattle, WA, USA) • Timed 5-step test • Timed 5-chair stand test • 6-min walk test	–	**QS** 18 kg in men 16 kg in women	Low QS: 32.9%	n = 950, aged ≥60 years	–	4
Wu Taiwan	• Body composition by BIA (Tanita BC-418, Tanita Corp., Tokyo, Japan) • GS • Handgrip strength	**ASM/ht^2:** ① mean − 2SD of young adults ② 1st quintile of study population **GS:** Sex- and height- specific 1st quintile **Handgrip strength**: Sex- and BMI-specific 1st quintile	① 6.76 kg/m^2 for men; 5.28 kg/m^2 for women ② 7.09 kg/m^2 for men; 5.70 kg/m^2 for women **GS:** Men: height ≤163 cm, 0.67 m/s, height >163 cm, 0.71 m/s Women: height ≤152 cm, 0.57 m/s, height >152 cm, 0.67 m/s **Handgrip strength** Men: BMI <22.1 kg/m^2, 25.0 kg, BMI 22.1–24.3 kg/m^2, 26.5 kg, BMI 24.4–26.3 kg/m^2, 26.4 kg, BMI >26.3 kg/m^2, 27.2 kg Women: BMI <22.3 kg/m^2, 14.6 kg, BMI 22.3–24.2 kg/m^2, 16.1 kg, BMI 24.3–26.8 kg/m^2, 16.5 kg, BMI >26.8 kg/m^2, 16.4 kg	① Using young ref. 5.4% in men 2.5% in women ② Using study ref. 8.2% in men 6.5% in women	2867 community-dwelling older adults Mean age: 74 ± 6.0 years, 50% women	998 healthy adults aged 20–40 years	5
Hsu Taiwan	• Muscle mass by BIA (InBody 220, Seoul, South Korea) • GS: A 6-m walk • Handgrip strength by using a digital dynamometer (TTM-YD, Tokyo, Japan; 3 trials for each hand, using the best reading)	**FFM/m^2**: mean − 2SD of young adults[6] **GS**: EWGSOP cut-off **Handgrip strength:**[7]	**Muscle mass index:** 8.87 kg/m^2 in men 6.42 kg/m^2 in women **GS:** ≤0.8 m/s **Handgrip strength**: 22.5 kg	30.9% (109/353)	353 men living in facilities aged ≥65 years Mean age: 82.7 ± 5.3 years	–	8
Meng and Hu China	• Muscle mass by DXA (GE Lunar) RASM: ASM/ht^2 SMI%: ASM/weight × 100 • Handgrip strength by a dynamometer (Jamar Plus+ digital hand dynamometer, USA; 1 trial for each hand, using the best reading • GS: 6-m walk	**RASM:** mean − 2SD of young adults **Handgrip strength:**[7] **GS**: EWGSOP cut-off	6.85 kg/m^2 by RASM, 28.0% by SMI% **Handgrip strength**: 22.4 kg **GS**: ≤0.8 m/s	Sarcopenia, 45.7%, Sarcopenic obesity, 4.9% by RASM Sarcopenia, 53.2%, Sarcopenic obesity, 11.5% by SMI%	Community-dwelling men aged ≥80 years, n = 101, mean age 88.8 ± 3.7 years	75 healthy young volunteers (male) aged 20–40 years	9