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1. Disseminating professional perspectives on international advances in aging research
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4. Encouraging international research collaboration Aging Medicine and related topics

To pursue this mission, the AMH covers topics that include, but are not limited to: aging medicine, healthy aging, and health service research for older adults, with a strong focus on the biology, and pathophysiology of frailty, sarcopenia and other age-related conditions, and therapeutic interventions for people with these conditions.

The AMH welcomes Reviews and Original Research articles, Brief Communications, Case Reports, and Letters to the Editor.

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**KEYNOTE 1**

**Tuesday October 22**

**Hidden Faces of Sarcopenia on Skeletal Muscles**

Jean-Pierre Michel
University of Geneva, Geneva, Switzerland

Wasting is a serious complication that affects a large proportion of patients with malignant cancer, COPD, heart failure, and chronic kidney disease. Whilst muscle wasting, also known as sarcopenia, describes the loss of muscle mass and strength, the term cachexia describes loss of weight. Primary sarcopenia is aging associated (mediated) loss of muscle mass. Secondary sarcopenia (or disease-related sarcopenia) has predominantly focused on loss of muscle mass without the emphasis on muscle function. Management of primary as well as secondary sarcopenia should consist of resistance exercise in combination with a protein intake of 1 to 1.5 g/kg/day. There is insufficient evidence that vitamin D and anabolic steroids are beneficial. Secondary sarcopenia also needs appropriate treatment of the underlying disease. It is important that primary care health professionals become aware of and make the diagnosis of age-related and disease-related sarcopenia. Experimental approaches to treat sarcopenia include testosterone, estrogens, growth hormone, and angiotensin-converting enzyme inhibitors. Interesting nutritional interventions include high-caloric nutritional supplements and essential amino acids that support muscle fiber synthesis.


**KEYNOTE 2**

**Tuesday October 22**

**Sarcopenia in Arenas Other Than Aging**

Stephan von Haehling
Department of Cardiology and Pneumology, University of Goettingen Medical Center, Goettingen, Germany

Wasting is a serious complication that affects a large proportion of patients with malignant cancer, COPD, heart failure, and chronic kidney disease. Whilst muscle wasting, also known as sarcopenia, describes the loss of muscle mass and strength, the term cachexia describes loss of weight. Primary sarcopenia is aging associated (mediated) loss of muscle mass. Secondary sarcopenia (or disease-related sarcopenia) has predominantly focused on loss of muscle mass without the emphasis on muscle function. Management of primary as well as secondary sarcopenia should consist of resistance exercise in combination with a protein intake of 1 to 1.5 g/kg/day. There is insufficient evidence that vitamin D and anabolic steroids are beneficial. Secondary sarcopenia also needs appropriate treatment of the underlying disease. It is important that primary care health professionals become aware of and make the diagnosis of age-related and disease-related sarcopenia. Experimental approaches to treat sarcopenia include testosterone, estrogens, growth hormone, and angiotensin-converting enzyme inhibitors. Interesting nutritional interventions include high-caloric nutritional supplements and essential amino acids that support muscle fiber synthesis.


**KEYNOTE 3**

**Tuesday October 22**

**Physio-Cognitive Decline Syndrome: A New Proposal**

Liang-Kung Chen
Aging and Health Research Center, National Yang Ming University, Taipei, Taiwan

Concomitant functional declines in physical and cognitive domains had been reported to be associated with adverse outcomes of older people. Previously, “cognitive frailty” has been defined to describe this specific phenotype but the operational definition of cognitive frailty was inconclusive and epidemiological studies supporting the definition were inconsistent. Our previous study identified the subtypes of physical frailty that mobility type frailty featured by the mutual presentation of slowness and weakness was of greater risk for mortality, and the findings were supported by using a 10-year observational cohort study from Japan. Besides, neuroimaging studies in both Taiwan and Japan indicated gray matter deficits in cerebellum for older adults with physical frailty, especially mobility type. Based on these findings, we re-define “physio-cognitive decline syndrome” (PCDS) as the concomitant presentation of mobility component of physical frailty, i.e. slowness or weakness, and early declines in any cognitive domains (1.5 SD below the matched norm). Using longitudinal cohort data from Taiwan and Japan, we found that the prevalence of PCDS was around 10-15% in the communities with higher risk of all-cause mortality, cardiovascular mortality and incident dementia of all types. Besides, the recent neuroimaging findings linked gray matter deficits in cerebellum, hippocampus and amygdala for PCDS, and we also identified a potential track linking these deficits by using diffusion tensor imaging. In terms of reversibility, a sub-group analysis of a nationwide randomized controlled trial in Taiwan showed significant improvement in physical and cognitive function using a multi-modal intervention. Therefore, different from “cognitive frailty” or “motoric cognitive risk syndrome”, we propose a new definition of PCDS with supportive epidemiological evidences, structural deficits in neuroimaging together with the reversibility, and PCDS may be an appropriate candidate for geroprotective intervention in the communities to promote healthy aging.

**KEYNOTE 4**

**Tuesday October 22**

**Oral Frailty: Definition and Clinical Impacts**

Katsuya Iijima
Institute of Gerontology, The University of Tokyo, Japan

Oral health is important for maintaining general health among the elderly. However, a longitudinal association between poor oral health and general health, in particular sarcopenia-related frailty, has not been reported. Here, we think how we should reinforce “the eating ability” in the elderly and its strategic intervention. We investigated whether deterioration of oral multi-functions can predict physical weakening and identified the longitudinal impact of the accumulated poor oral health on adverse health outcomes, including mortality. Our Japanese large-scale longitudinal study, ‘KASHIWAYA study’, was based on data randomly selected community-dwelling older adults (initial Ave. age 73y) who participated in Kashiwa city, Japan. Poor oral status as determined by 6 measures, 1) number of natural teeth, 2) chewing ability, 3) articulatory motor skill (tongue and lip motion), 4) tongue pressure, and 5-6) subjective difficulties in eating and swallowing, significantly predicted future physical weakening (new-onsets of physical frailty, sarcopenia, disability and all mortality). Therefore, we created a new concept, so-called “ORAL FRAILITY”, which was defined as co-existing poor status in ≥3 of the 6 measures. 16% of participants had oral frailty at baseline, which was significantly associated with 2.4-, 2.2-, 2.3-, and 2.2-fold increased risk of physical frailty, sarcopenia, disability, and mortality, respectively. This concept means the important massage that slight decline and its overlay in multiple oral functions easily lead to sarcopenia-related frailty and further declines in oral functions (negative spiral flow) even at the earlier stage. To raise strategic intervention and
nation enlightenment against oral health, we developed the Oral Frailty diagram (OFD), which is a valid model to increase the development of a healthy life expectancy. The oral hypofunction (OHF) which is 3rd phase in the OFD is covered by the public insurance system from April 2018. Prevention of oral frailty at an earlier stage is essential for healthy aging.

**KEYNOTE 5**

**Wednesday October 23**

**1101 | 09:00-09:35**

**The Updated European Definition of Sarcopenia (EWGSOP2)**

**Alfonso J. Cruz-Jentoft**
Geriatric Department, Hospital Universitario Ramón y Cajal, IRYCIS, Madrid, Spain

In 2010, the European Working Group on Sarcopenia in Older People (EWGSOP) published a sarcopenia definition that aimed to foster advances in identifying and caring for people with sarcopenia. In early 2018, the Working Group met again (EWGSOP2) to update the original definition. Sarcopenia is defined as a muscle disease (muscle failure) rooted in adverse muscle changes that accrue across a lifetime; it is common among adults of older age but can also occur earlier in life. EWGSOP2 focuses on low muscle strength as a key characteristic of sarcopenia, uses detection of low muscle quantity and quality to confirm the sarcopenia diagnosis, and identifies poor physical performance as indicative of severe sarcopenia. The case finding algorithm is updated into a full sarcopenia case-finding, diagnosis and confirmation, and severity determination method. This new consensus also provides clear cut-off points for measurements of variables that identify and characterise sarcopenia.

In this conference, EWGSOP2’s will be presented, with a call to professionals to implement sarcopenia into mainstream clinical practice.

**KEYNOTE 6**

**Wednesday October 23**

**1101 | 09:35-10:10**

**Bone and Muscle as a Whole: Osteosarcopenia**

**Gustavo Duque**
Melbourne Medical School, The University of Melbourne, Australia

In older persons, the combination of osteopenia/osteoporosis and sarcopenia - known as osteosarcopenia - has been proposed as a subset of frailter individuals at higher risk of institutionalization, falls, and fractures. The pathophysiology of osteosarcopenia involves a complex set of interactions between bone, muscle and fat. Osteosarcopenic patients have very particular clinical, biochemical, diagnostic, and functional characteristics that could be identified in clinical practice. In addition, new therapies targeting both muscle and bone, are being developed. In this session, the pathophysiology of osteosarcopenia will be reviewed. In addition, a clinical definition of osteosarcopenia aiming to describe the clinical, functional, and biochemical features that are unique to these patients will be presented. The use of imaging combined with functional assessments for the diagnosis of osteosarcopenia will be discussed, including novel methods to quantify bone marrow and intra-muscular fat. In addition, we will analyze preventive measures and therapeutic interventions that can benefit both muscle and bone simultaneously. We intend to go over the translational aspects of sarcopenia and osteoporosis research, and highlight expected outcomes from different interventions for both conditions. In addition, evidence on the Falls and Fractures Clinic as the most cost-effective model of care for osteosarcopenia will be provided.

**KEYNOTE 8**

**Wednesday October 23**

**1101 | 11:10-11:45**

**Can We Increase the Accuracy, Predictability of FRAIL Questionnaire and SARC-F Questionnaire for Community Dwelling Elderly?**

**Chang Won Won**
Department of Family Medicine, Kyung Hee University, Korea

For clinical practice and epidemiologic survey, we find in need of accurate screening questionnaire for frailty and sarcopenia. Fortunately, we already have FRAIL and SARC-F questionnaire, but they have some limitations for a specific setting. Author’s group developed a 5-item questionnaire to screen Fried frailty phenotype exactly in community-dwelling older adults. The new Frailty Phenotype Questionnaire (FPQ) was well accurate (FFP sensitivity 81.7%, specificity 82.5%, PPV 30.1% NPV 98.0%) compared to FRAIL questionnaire (sensitivity 55.7%, specificity 92.0%).
exercise (EXER), diet plus exercise (COMBO) or control (CON). Primary outcome was modified Physical Performance Test (PPT). Secondary outcomes were skeletal muscle mass (SMM), bone mineral density (BMD), specific physical functions. Body weight decreased 10% DIET, 9% COMBO, no decrease EXER or CON. SMM and hip BMD decreased less COMBO than DIET. Strength, balance, and gait improved most COMBO (P<0.05 all comparisons).

Next trial randomized 160 obese, frail obese older adults to 6-months diet plus aerobic exercise (AET), diet plus resistance exercise (RET), diet plus combined aerobic and resistance training (COMBO) or control (CON). Similar primary and secondary outcomes. Body weight decreased 9% in all intervention groups and PPT increased more in COMBO than AET and RET. Skeletal muscle mass decreased similarly and less in COMBO and RET than AET, as did total hip BMD g/cm3. Findings were similar for femoral neck, trochanter, and intertrochanter BMD. No significant changes in one-third radius, lumbar spine or whole body BMD. Peak VO2 (ml/kg/min) increased similarly and more in COMBO and AET compared to RET (P <0.001). Strength increased similarly and more in COMBO and RET than AET (P <0.001).

In conclusion, for older adults with frailty and obesity, diet intervention should include resistance plus aerobic exercise, but avoid aerobic exercise alone to protect skeletal muscle and bone mass during weight-loss.

### KEYNOTE 11

#### Thursday October 24

**1101 | 10:35-11:15**

**Future Research of Frailty and Sarcopenia**

**John Morley**

Saint Louis University School of Medicine, USA

Both frailty and sarcopenia are now firmly established as geriatric giants. In the area of frailty there is a need to distinguish between frailty (physical and psychosocial) and comorbidity (Frailty Index). In addition, it is important to develop a logical approach to the management of frailty and to determine which components are effective at delaying disability and hospitalization. The utility of having GP’s do a rapid screening, e.g. FRAIL, for frailty also needed further study.

Similarly for sarcopenia the utility of a rapid screen, e.g. SARC-F, needs to be determined. Further studies are needed to see if the 3H-creatine dilution method should replace DEXA for measuring muscle mass. The role of ultrasound for measuring muscle mass and the angle of pannation needs to be determined. The potential role of hormones and other drugs as an additive to exercise needs to be determined. Studies to find biomarkers to separate sarcopenia from cachexia are needed.

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**Table 1. Frailty Phenotype Questionnaire (FPQ)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Name of Question</th>
<th>Questions</th>
<th>Answer Options</th>
<th>Score</th>
</tr>
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<tbody>
<tr>
<td>Fatigue</td>
<td>“During the past week, I felt that everything I did was an effort”</td>
<td>1) rare (less than 1 day per a week), 2) sometimes (1-2 days per a week), 3) often (3-4 days per a week), 4) most (over 5 days per a week).</td>
<td>1=3 or 4) or 2).</td>
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</tr>
<tr>
<td>Resistance</td>
<td>10 steps of stair climb</td>
<td>“By yourself and not using aids, do you have any difficulty walking up 10 stairs without resting?”</td>
<td>1) yes 2) no</td>
<td>1=1 or 2)</td>
</tr>
<tr>
<td>Ambulation</td>
<td>walking one lap of a playground track (400 m)</td>
<td>“Do you have any difficulty walking one lap of a playground track (400 m)?”</td>
<td>1) unable to do it at all, 2) very difficult, 3) a bit difficult, 4) not difficult at all.</td>
<td>1=1 or 2) or 3) or 4)</td>
</tr>
<tr>
<td>Inactivity</td>
<td>Moderate to vigorous physical activities of IPAQ</td>
<td>“During the past week, how often did you participate in any moderate physical activities that make you slightly more breathless than usual?”</td>
<td>1) never 2) more than once per week</td>
<td>1=1) on the both questions 0= others</td>
</tr>
<tr>
<td>Loss of weight</td>
<td>weight loss for one year</td>
<td>“Was there an unintended weight loss of 4.5 kg in the past year?”</td>
<td>1) yes 2) no</td>
<td>1=1) or 2)</td>
</tr>
</tbody>
</table>

Sum of the five items score: 0 = Robust, 1-2 = Prefrail, 3-5 = Frail
Symposium Abstracts
Symposium 1:  
**Muscle Quality in Aging**

**Tuesday October 22  1110A | 10:40-12:00**

**Muscle Quality in Aging and Sarcopenia**

Jae-Young Lim  
Department of Rehabilitation Medicine, Division of Musculoskeletal Rehabilitation, Seoul National University College of Medicine, Seoul National University Bundang Hospital, Korea

Sarcopenia is strongly related to poor muscle quality represented as force production per unit area. The mechanisms of muscle quality are divided into neurological factors and skeletal muscle properties. Neurological mechanisms are the excitatory drive to lower motor neurons and neuromuscular transmission. Muscle properties include cross-bridge functions, excitation-contraction coupling, fiber types, passive properties, and mitochondrial function. In laboratory settings, muscle power, maximal shortening velocity, stiffness, and calcium sensitivity have been investigated as muscle quality-related variables. Primary rationale for paying attention to muscle quality is its close relationship with functional variables and clinical outcomes such as disability and death.

Mechanical properties of muscle fibers are typical components of muscle quality index. The velocity, contractile force, and stiffness in the process of contracting and relaxing in the cellular level can be one of the indicators of muscle quality changes. Changes of fiber properties related to aging and diseases have contributed to understanding the pathophysiology and prognosis of sarcopenia. However, most studies have been conducted with cross-sectional design rather than longitudinal cohorts. Additionally, there is a critical limit to directly assessing muscle fiber functions in clinical practice because these data are obtained from the tissues taken by muscle biopsy.

Recently, myosteatosis, fat deposition in muscles, is highlighted as one of the muscle quality factors. Myosteatosis refers to intramuscular fat deposition or accumulation which is divided into intermuscular adipose tissue, intramuscular adipose tissue, and intramyocellular lipid droplets in muscle cells. Myosteatosis is a predictor of metabolic syndrome, functional decline and mortality. Therefore, it is necessary to understand myosteatosis as an indicator of muscle quality and a risk factor of sarcopenia.

In this review, the importance of muscle quality will be discussed with the basic and clinical research findings regarding the definition and classification of muscle fiber aging and myosteatosis.

**Keywords:** muscle quality, myosteatosis, sarcopenia, aging.

**Muscle Mass Measurement Using Ultrasonography: Development of a New Device that Assesses Wide Cross-Sectional Areas of the Thigh Muscle**

Yasumoto Matsui, Yasuo Suzuki, Tatsuo Arai, Hidenori Arai  
National Center for Geriatrics and Gerontology, Japan

Furuno Electrics Co, Ltd

In diagnosing sarcopenia, computed tomography (CT) can be used in addition to dual-energy X-ray absorptiometry (DXA) and bioelectrical impedance analysis (BIA) for muscle mass measurements according to the revised consensus of the European Working Group on Sarcopenia in Older People (EWGSOP2). However, there are some limitations in the clinical application of CT. In this presentation, along with a brief explanation about the traditional method of muscle mass evaluation using ultrasound, we will introduce a new device under development that portrays a wide cross-sectional area of a muscle.

We will also present recent findings on evaluating muscle mass and quality using mid-thigh CT imaging, together with a comparison between CT images and the new ultrasonographic images taken at the same site. Assessment in middle-aged (over 40 years old) and older community dwellers showed a decreasing trend by age in cross-sectional area (CSA) and CT attenuation value (CTAV) in both sexes. A study targeting patients who visited the Integrated Healthy Aging Clinic (Locomo-Frail Clinic in Japanese) at the National Center for Geriatrics and Gerontology (NCGC) demonstrated that muscle strength had the strongest correlation with CSA, and physical functions such as walking speed, had the strongest correlation with CTAV. Thus, in the diagnosis of sarcopenia, it is desirable to evaluate CSA (muscle mass) and muscle quality simultaneously. Although ultrasonography is very convenient, it can only describe a limited image by traditional devices. We, therefore, have been developing a new device similar to CT that allows the assessment of a wider cross-sectional area of a muscle.

Since our new device showed very good reproducibility and correlated well with CT in both CSA and attenuation value, it is expected to be very useful as the new diagnostic method for sarcopenia.

**Keywords:** muscle mass, measurement, ultrasonography, computed tomography (CT).

**Comparative Proteomic Profiling in Aging Muscle**

Yi-Long Huang  
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Skeletal muscle has emerged as one of the most important tissues involved in regulating systemic metabolism. The gastrocnemius is a powerful skeletal muscle composed of predominantly glycolytic fast-twitch fibers that are preferentially lost among old age. This decrease in gastrocnemius muscle mass is remarkable during aging; however, the underlying molecular mechanism is not fully understood. Strikingly, there is a ~70% decrease in Cisd2 protein, a key regulator of lifespan in mice and the disease gene for Wolfram syndrome 2 in humans, within the gastrocnemius after middle age among mice. A proteomics approach was used to investigate the gastrocnemius of naturally aged mice and this was compared to the autonomous effect of Cisd2 on gastrocnemius aging using muscle-specific Cisd2 knockout (mKO) mice as a premature aging model. Intriguingly, dysregulation of calcium signaling and activation of UPR/ER stress stand out as the top two pathways. Additionally, the activity of Serca1 was significantly impaired and this impairment is mainly attributable to irreversible oxidative modifications of Serca. Our results reveal that the overall characteristics of the gastrocnemius are very similar when naturally aged mice and the Cisd2 mKO mice are compared in terms of pathological alterations, ultrastructural abnormalities, and proteomics profiling. This suggests that Cisd2 mKO mouse is a unique model for understanding the aging mechanism of skeletal muscle. Furthermore, this work substantiates the hypothesis that Cisd2 is crucial to the gastrocnemius muscle and suggests that Cisd2 is a potential therapeutic target for muscle aging.

**Symposium 2:  
Social Dimensions of Frailty**

**Tuesday October 22  1110B | 10:40-12:00**

**Social Frailty and Its Impact on Disability**

Hyuma Makizako  
Kagoshima University, Japan

Frailty is a state commonly described as a condition of the poor restoration of homeostasis after a stressful event and increased risk of adverse health outcomes, such as falling, disability, and death. Although many studies focusing on frailty have examined physical functioning, the concept of frailty includes not only the physical domain, but also...
the psychological and social spheres. Social aspects of frailty include individual factors, physical and environmental factors, and economic conditions, whose quantitative evaluation is challenging. It has been suggested that various social factors may influence the physical and mental state of older adults, with social factors important in understanding the state of frailty. Several instruments have previously been used to assess social frailty among community-dwelling older adults. The National Center for Geriatrics and Gerontology-Study of Geriatric Syndrome (NCGG-SGS) aimed to gain a better understanding of social frailty by exploring the relationship between selected determinants of social frailty and functional decline. Five aspects of social frailty were found to be associated with new incidence of need for support and long-term care within 24 months. The five items were as follows: (1) being alone ("yes"), (2) going out less frequently than the last year ("yes"), (3) visiting the homes of friends ("no"), (4) feeling useful to your family and friends ("no"), and (5) conversing with someone every day ("no"). We defined social frailty using these five questions and found significant associations with incident disability in the NCGG-SGS. Further investigation is needed to define social frailty and identify effective interventions to promote active aging by focusing on the social aspects of older adults with social frailty. It would be reasonable to think that this approach will also improve physical and cognitive frailty.

**Air Pollution and Frailty**

Wei-Ju Lee
Department of Geriatric Medicine, Faculty of Medicine, National Yang-Ming University, Taipei, Taiwan
Division of Geriatric Medicine, Taipei Veterans General Hospital Yuanshan Branch, I-Lan, Taiwan

**Objective:** Frailty, featured as disrupt homeostasis of mutli-system and increasing vulnerability, is common among older adults and results in adverse health outcomes. The study aimed to investigate whether exposure to particulate matters2.5 μm in diameter (PM2.5) associated frailty in general population.

**Methods:** 20,606 participants aged ≥65 years in 2016 enrolled for this analysis. Demographic and functional data was collected. We used Fried’s phenotypic frailty to determine frailty, Charlson comorbidity index to assess disease severity and urbanization index for urban or rural residence. Exposure of PM2.5, obtained from Taiwan Air-Quality-Monitoring Database, less than first quartile of study population was defined as low. Multinomial logistic regression was used to explore the associations.

**Results:** Of all, 1,080 (5.2%) frail participants were older, female-dominant, higher burden of diseases, living in rural areas, and experiencing low level of PM2.5. Compared to robust, odds associated with PM2.5 were higher in prefrail (OR 1.4, 95% CI 1.3-1.5) and frail adults (OR 1.5, 95% CI 1.2-1.9). Associations were stronger in male (OR 2.1, 95% CI 1.5-3.1 for frail; OR 2.2, 95% CI 1.9-2.6 for prefrail), low household income (OR 4.0, 95%CI 2.8-5.8 for frail; OR 2.7, 95% CI 2.2-3.3 for prefrail), older aged ≥75 years (OR 1.8, 95%CI 1.3-2.4 for frail; OR 1.5, 95%CI 1.3-1.8 for prefrail), non-smoker (OR 1.6, 95% CI 1.3-2.0 for frail; OR 1.4, 95% CI 1.2-1.5 for prefrail); and higher disease severity (OR 5.1, 95%CI 2.1-12.6 for frail; OR 2.1, 95% CI 1.2-3.8 for prefrail).

**Conclusion:** The study detected a significant association between exposure of PM2.5 and frailty in general population and stronger impact of PM2.5 on frailty observed in more vulnerable group.

**Synergistic Effect of Weakness and Malnutrition of Older Adults**

Yu-Chun Wang
Center for Geriatrics and Gerontology, Kaohsiung Veterans General Hospital, Kaohsiung, Taiwan

**Background:** No studies have yet examined the interrelationship of malnutrition and low handgrip strength in terms of mortality. The aim of the present study was to evaluate the potential synergistic effects of malnutrition and low handgrip strength on mortality among older adults living in a retirement community.

**Methods:** This prospective longitudinal cohort study recruited subjects aged 65 years and over from a veterans care home in Taiwan in 2013. Nutritional status was assessed using the Mini-Nutritional Assessment-Short Form (MNA-SF, malnutrition was MNA-SF <12); muscle strength was measured by handgrip strength (low handgrip strength was handgrip strength <26 kg). The Kaplan-Meier method with the log-rank test was used to estimate survival differences between groups and Cox proportional regression model was used to estimate the adjusted difference in 4-year all-cause mortality between groups.

**Results:** Recruited for the present study were 333 male participants (mean age 85.4±5.7 years). Of these, 50.2% had malnutrition and 54.7% had low handgrip strength. Compared with subjects with no malnutrition and low handgrip strength, those with malnutrition had significantly greater risk of 4-year all-cause mortality (adjusted hazards ratio: 2.05, 95% CI 1.93-2.16; hazard ratio increased to 3.41 (95% CI 1.93-6.04) for those with both malnutrition and low handgrip strength.

**Conclusions:** Malnutrition was an independent risk factor for 4-year all-cause mortality and low handgrip strength with malnutrition synergistically increased the mortality risk. Further study is needed to confirm the effectiveness of integrated programs to assist those at risk.

**Symposium 3: Assessment for Frailty**

**Polypharmacy and Frailty**

Masahiro Akishita
Department of Geriatric Medicine, Graduate School of Medicine & Institute of Gerontology, University of Tokyo, Japan
The University of Tokyo Hospital, Japan

Polyparmacy is usually defined as taking 5 or more medications. Our studies have shown that older patients who were taking 6 or more drugs and those taking 5 or more drugs were likely to experience adverse drug events (ADE) and falls, respectively (Kojima T, et al. Geriatr Gerontol Int 2012), indicating the cut-off of 5 is also suitable for Asian patients. Recently, the concept of polypharmacy implies polypharmacy-related problems including adverse drug events (ADE), adverse drug withdrawal events, nonadherence and prescription/preparation errors, which are frequently seen in patients with frailty/disability. Importantly, ADE occur frequently as geriatric syndromes such as falls and dementia. Older people with frailty are likely to take many drugs because of multimorbidity, although some types of medications do more harm than good. Benzodiazepines and anticholinergics are representative and listed as potentially inappropriate medications (PIMs). These drugs may cause or accelerate frailty components such as anorexia, dysphagia, muscle weakness and cognitive impairment. Overtreatment should also be avoided. Hypoglycemia and hypotension are reported to cause falls and cognitive impairment. Thus, we should understand clearly that one of most important skills in geriatrics is to reduce medications appropriately, particularly in frail subjects.

In the symposium, I will overview the polypharmacy issue in elderly patients, focusing on the interaction of polypharmacy and frailty.
Using 3 mobile accelerometers to measure physical activity level and pattern to obtain feedback from subjects, in order to identify measures for frailty prevention in community-dwelling older Koreans. This combined intervention improved cognitive function and physical function in patients with pre-frail and/or MCI relative to controls. Data from this project indicate that in older adults many aspects of health (not only physical fitness and body composition, but also development of the osteoporosis, overall quality of life, depressive symptoms and cognitive impairment) are associated with both the quality of the habitual physical activity (the duration at a moderate to vigorous intensity, and interrupting prolonged periods of sedentary activity) and its quantity (the step count).

**Clinical Benefits of Integrated Intervention Program for Frailty**

Ming-Yueh Chou
Division of Geriatric Integrated Care, Kaohsiung Veterans General Hospital, Kaohsiung, Taiwan

Older people with frailty are at risk of adverse outcomes, such as falls, functional decline and mortality, and integrated intervention program may prevent those. The purpose of this study is to evaluate the effectiveness of integrated intervention program among those community-dwelling frail older people in southern Taiwan. During Jan 2018 and May 2019, frail older people were invited for study. A 12 week integrated intervention program were provided for all participants. They attended the 2 hour program once per week and physical activity, high protein diet education and cognitive simulation activity were included in the integrated intervention program. Comprehensive geriatric assessments were performed before and after the intervention program, including basic demographic data, risk for malnutrition (by MNA-SF), mood condition (by GDS-5), cognitive condition (by MMSE), weakness (by handgrip strength), slowness (by gait speed) and time-up-go test. Our results showed that through the integrated intervention programs, those frail older people could improve their mood condition, cognitive condition and usual gait speed. We concluded that through the 12 week integrated intervention program, those frail older people could improve their mood condition, cognitive condition and usual gait speed.

**Symposium 4: Intervention for Frailty and Sarcopenia**

**Tuesday October 22**

**1110A | 15:00-17:00**

**Adherence to Community-Based Group Exercise for Sarcopenia: The KAFCS Study**

Hyuntae Park
Department of Health Science and Care, College of Health Science, Dong-A University, Busan, Korea

Community dwelling older persons have an increasing number of complex health problems. Frail and demented older persons are at the risk of adverse health outcomes such as functional decline. The effectiveness of interventions on functional decline (pre-frailty and MCI) in community dwelling older persons are contradictory. Physical activity is considered an acceptable method for improving and maintaining physical and cognitive health. It provides an opportunity to develop physical skills and reflexes in relation to the brain. This presentation highlights the recent works evaluating the relationship between physical activity and both physical and cognitive health benefits. Furthermore, in this presentation, new knowledge based on state of the art research in a cohort studies in Korea will be addressed. Our study aimed to investigate the association between the ICT-based exercise intervention program and cognitive and physical functions. Our exercise intervention trial is designed to evaluate the feasibility and effectiveness of an easily administered information and communication technology (ICT)-based physical activity system, using 3 mobile accelerometers to measure physical activity level and pattern to obtain feedback from subjects, in order to identify measures for frailty prevention in community-dwelling older Koreans. This combined intervention improved cognitive function and physical function in patients with pre-frail and/or MCI relative to controls. Data from this project indicate that in older adults many aspects of health (not only physical fitness and body composition, but also development of the osteoporosis, overall quality of life, depressive symptoms and cognitive impairment) are associated with both the quality of the habitual physical activity (the duration at a moderate to vigorous intensity, and interrupting prolonged periods of sedentary activity) and its quantity (the step count).

**Clinical Impact and Underlying Mechanisms of Frailty & Sarcopenia among Memory Clinic Populations**

Taiki Sugimoto
Center for Comprehensive Care and Research on Memory Disorder, National Center for Geriatrics and Gerontology, Japan

The numerous evidence has shown a close association of frailty and sarcopenia with cognitive decline and dementia. The prevalence of frailty and sarcopenia is higher in older adults with cognitive impairment and increased with cognitive decline. Among memory clinic populations, frailty and sarcopenia have been reported to increase the risk of conversion to dementia and cognitive decline as well as disability, hospitalization, and death. In our Memory Clinic, frailty defined by accumulation deficit model was significantly associated with behavioral psychological symptoms of dementia (BPSD) and caregiver burden. The behind mechanisms of increase of frailty and sarcopenia are not still fully understood. Our study showed white matter hyperintensities as expressions of cerebral small vessel disease and total brain volume are associated with presence of frailty. Moreover, recent studies showed the significant association of frailty with Alzheimer’s disease pathologies. As for sarcopenia, besides older age, body mass index (BMI), and vitamin D, lower vitality and appetite, which are frequently seen as BPSD, are associated with sarcopenia among memory clinic populations. To clarify the association of nutritional status with dementia-related brain changes in this population, we investigated the association of BMI with Aβ deposition, gray matter volume,
and cerebral glucose metabolism. This study provided the results suggesting that hypometabolism in the medial prefrontal areas is specifically associated with lower BMI in memory clinic populations. These results may indicate that multiple factors including neurodegenerative and non-neurodegenerative pathologies increase frailty and sarcopenia. Further studies investigating underlying mechanisms comprehensively are still needed to implement appropriate interventions to mitigate the consequences of frailty and sarcopenia in memory clinic populations.

Symposium 5: Diagnosis and Intervention for Sarcopenia

Tuesday October 22 1110B | 13:00-14:40

Yubi-Waka (Finger-Ring) Test for Sarcopenia Diagnosis

Katsuya Iijima
Institute of Gerontology, The University of Tokyo, Japan

Sarcopenia is a condition characterized by loss of muscle mass and strength, and is largely overlapping geriatric conditions upstream of the disabling cascade. There are many multi-faced environmental and medical factors that contribute to the worsening of sarcopenia-based frailty. To raise nation enlightenment against sarcopenia and the subsequent physical weakness, we developed a simple self-screening method, “Yubi-Wakka (Finger-Ring) test”, to assess sarcopenia swiftly and simply. Our prospective cohort study aimed to examine the validity of this test as a practical method among community-dwelling elderly for identifying sarcopenia and for predicting disability and mortality. Of all subjects in our cohort study (initial Ave. age 73y), 14% were in smaller group (calf circumference <Yubi-Wakka finger ring size) in the “Yubi-Wakka” test. Relative to bigger group, the test results statistically associated with sarcopenia (just-fit group; OR 2.4, and smaller group; OR 6.6), by multivariate analyses. The test results also increased risk of new-onset sarcopenia (just-fit; HR 2.1, and smaller; HR 3.4). Moreover, the smaller group had 2.0-3.2-fold increased risks for needing long-term care insurance (LTC) services and mortality, respectively. The “Yubi-Wakka” test is an extremely practical method to identify the elderly at risks of sarcopenia, disability and mortality. This test might contribute to increased primary prevention for sarcopenia by serving as an early wake-up call for the elderly against becoming sarcopenic (nation enlightenment against sarcopenia).

Calf Circumference for the Sarcopenia Screening in Korean Older Adults

Miji Kim¹, Chang Won Won², Sunyoung Kim³

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² Department of Family Medicine, College of Medicine, Kyung Hee University, Seoul, Korea
³ Department of Family Medicine, Kyung Hee University Medical Center, Seoul, Korea

Background: Simple and easy-to-use screening tools for sarcopenia, such as the calf circumference, SARC-F questionnaire, and SARC-CalF combined with calf circumference (SARC-CalF) have been developed. Hence, this study aimed to compare the diagnostic value of calf circumference, SARC-F, and SARC-CalF for screening sarcopenia in a large group of community-dwelling older adults enrolled in the nationwide Korean Frailty and Aging Cohort Study (KFACTS). The study also aimed to evaluate the incidence of sarcopenia according to these screening tools over a 2-year follow-up.

Methods: We performed a cross-sectional analysis of 2,990 participants (mean age, 76.0±3.9 years; 47.4% women) who were subjected to the three screening tools and also analyzed baseline data from the 2016-2017 sarcopenia assessment of adults aged 70–84 years obtained from the KFACTS. Prospective analyses (n=1,138) included a subset of participants without baseline sarcopenia but with repeated sarcopenia assessment at 2 years of follow-up conducted during the 2016 baseline survey. Sarcopenia was defined according to the Asian Working Group for Sarcopenia (AWGS 2014) criteria as low muscle mass combined with low grip strength or low physical performance. The receiver operating characteristic (ROC) curve and area under the ROC curve (AUC) were performed to compare the overall accuracy of SARC-F and SARC-CalF. Sensitivity/specificity analyses were performed to better explore sarcopenia using the three screening tools. We used cut-off values for calf circumference (34 cm for men and 33 cm for women), SARC-F (≥4 points), and SARC-CalF (≥11 points). Logistic regressions were used to evaluate the effectiveness of the three screening tools in detecting the presence of sarcopenia.

Results: Overall, 315 (10.5%) participants were identified as having sarcopenia according to the AWGS criteria. The association between SARC and CalF significantly improved sarcopenia screening performance compared with SARC-F (AUC=0.740 [95% CI: 0.711, 0.768] vs. 0.672 [95% CI: 0.641, 0.703]; P <0.001). Using the AWGS criteria as the reference standard, the sensitivity/specificity analyses demonstrated the cut-off values of calf circumference (sensitivity 76.5%, specificity 57.6%; C-Statistic, 0.670), SARC-F (sensitivity 22.2%, specificity 92.0%; C-Statistic, 0.571), and SARC-CalF (sensitivity 61.9%, specificity 74.8%; C-Statistic, 0.684). The incidence of sarcopenia over the 2-year period was 95 (6.8%). In the longitudinal assessment, low calf circumference (OR: 3.07, 95% CI: 1.90–4.97) and SARC-CalF ≥11 points (OR: 3.76, 95% CI: 2.36–5.98) were associated with a greater risk of incident sarcopenia according to the AWGS criteria in the sex-age adjusted model; however, there was no significant association between SARC-F ≥4 points and the score of incident sarcopenia (OR: 1.14, 95% CI: 0.58–2.25).

Conclusions: Our results suggest that for screening sarcopenia, calf circumference and SARC-CalF were more effective than the SARC-F questionnaire alone in a study population of Korean community-dwelling older adults.

Keywords: sarcopenia, case-finding, calf circumference, screening tools, AWGS 2014.

Case-Finding for Sarcopenia in Asia: A Systematic Review

Li-Ming Peng
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National Yang Ming University Taipei, Taiwan

Sarcopenia is a condition characterized by loss of muscle mass and function. The status of sarcopenia could be reversed through adequate intervention, so early detection of people with the risk of sarcopenia is crucial. Calf circumference (CC), SARC-F and SARC-CalF were selected as the instruments for AWGS 2019 based on several sarcopenia researches in Asia. CC revealed a moderate-to-high sensitivity and specificity to predict sarcopenia or low skeletal muscle mass, and AWGS recommends using 34 cm for men and 33 cm for women as the cutoffs for screening or case-finding for sarcopenia. In addition, “Yubi-wakka” (finger-ring) test, using both index fingers and thumbs to circle the thickest part of the non-dominant calf of legs by the individual him/herself, showed at risk of sarcopenia if the finger-ring is just fit or small than the measured calf. In addition, SARC-F has been validated and associated with adverse outcomes. SARC-F comprises five questionnaires, such as strength, assistance in walking, rising from a chair, climb stairs and falls. The total score higher than three was defined as sarcopenia, but it revealed low sensitivity and high specificity. SARC-CalF, combined CC measurement to SARC-F, has been demonstrated the improved sensitivity of SARC-F in screening sarcopenia.
Symposium 6: Diagnosis and Intervention for Sarcopenia

Tuesday October 22

Role of Exercise on the Skeletal Muscle-Regenerative Actions in a Senescence-Accelerated Mouse Prone 10 (SAMP10)

Masatumi Kuzuya
Department of Community Healthcare & Geriatrics, Nagoya University Graduate School of Medicine, Japan
Institution of Innovation for Future Society, Nagoya University, Japan

Background: Exercise train (ET) stimulates muscle response in pathological conditions, including aging. The molecular mechanisms by which exercise improves decline of skeletal muscle mass and functional impairment associated with aging are poorly understood. Here we searched the molecules which are involved in the beneficial effect of ET on skeletal muscles using a senescence-accelerated mouse prone 10 (SAMP10).

Methods: 25-week-old male SAMP10 mice were randomly assigned to the control and the ET (45 min/time, 3/week) groups for 4 months. Mice that were maintained in a sedentary condition served controls.

Results: ET ameliorated aging-related muscle changes in microstructure, mitochondria, and performance. The amounts of proteins or mRNAs for p-AMPKα, p-Akt, p-ERK1/2, p-mTOR, Bcl-XL, p-FoxO3, peroxisome proliferators-activated receptor-γ coactivator, adiponectin receptor1 (AdipoR1), and cytochrome c oxidase-IV, and the numbers of CD34+/ integrin-α7+ muscle stem cells (MuSCs) and proliferating cells in the muscles and bone-marrow were enhanced by ET, whereas the levels of p-GSK-3α and gp130 proteins and apoptotic cells were reduced by ET. The ET also resulted in increased levels of plasma adiponectin and the numbers of bone-marrow (BM)-derived circulating CD34+/ integrin-α7+ MuSCs and their functions. Integrin-α7+ MuSCs of exercised mice had improved changes of those beneficial molecules. These ET-mediated aged muscle benefits were diminished by adiponectin and AdipoR1 blocking as well as AMPK inhibition. Finally, recombinant mouse adiponectin enhanced AMPK and mTOR phosphorylations in BM-derived integrin-α7+ cells.

Conclusions: These findings suggest that ET can improve aging-related impairments of BM-derived MuSC regenerative capacity and muscle metabolic alterations via an AMPK-dependent mechanism that is mediated by an adiponectin/AdipoR1 axis in SAMP10 mice.

Branched-Chain Amino Acids (BCAAs) for Sarcopenia

Chih-Hsing Wu
Department of Family Medicine, National Cheng Kung University Hospital, Tainan, Taiwan
Obesity, Osteoporosis and Body Composition Research Center, College of Medicine, National Cheng Kung University, Tainan, Taiwan

Background: We evaluated the short-term effects of enriched branched-chain amino acids (BCAAs) on subjects with pre-sarcopenia or sarcopenia.

Methods: Thirty-three community-dwelling subjects (6 men/27 women; mean age: 86.6±10.3 years old) were purposively sampled for intervention with 1 sachet (3.6 g) of enriched BCAA powder twice a day for 5 weeks and then to discontinue it for the following 12 weeks. Sarcopenia was defined as a low skeletal mass index (SMI) and either a low grip strength or a low walking speed by the modified 2014 consensus of the Asian Working Group on Sarcopenia. Body composition was measured using bioelectrical impedance analysis. Grip strength and 6-meter gait speed were evaluated at baseline, 5 weeks, and 17 weeks.

Results: After 5 weeks of BCAAs supplement, SMI (p <0.01), gait speed (p<0.001), and grip strength (p<0.001) were significantly improved in both pre-sarcopenic and sarcopenic subjects. Moreover, after 12 weeks without the BCAAs, all three parameters were lower progressively, especially SMI in subjects <65 years old and gait speed in subjects a65 years old.

Conclusions: Enriched BCAAs supplement for 5 weeks shows the short-term effects on the sarcopenic parameters and its discontinuation may diminish the effects in 12 weeks.

Keywords: BCAA, nutrition supplements, pre-sarcopenia, sarcopenia.

Symposium 7: Molecular Mechanisms of Sarcopenia

Wednesday October 23

Therapeutic Target for Sarcopenia: Mitochondrial Quality and Microenvironment

Sue-Joan Chang
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Sarcopenia, updated by EWGSOP2 (2018) as low muscle strength, low muscle quantity/quality and low physical performance, is associated with a risk of adverse outcomes. To intervene, delay, or even arrest sarcopenia, it is necessary to elucidate the molecular mechanisms involved in the progression of age-related sarcopenia. In our previous studies, the significant decrease in phosphorylated AKT, a key regulator of muscle protein synthesis and degradation, was observed in skeletal muscle of senescence-accelerated mouse (SAM) prone 8 (SAMP8) mice at week 40. We proceed to investigate molecular mechanisms for progression of sarcopenia in SAMP8 mice through a time course protocol, especially highlight the alteration before the onset of sarcopenia. We found that increase in FoxO3a-mediated transcription of Atrogin-1 and MuRF1 and decrease in phosphorylated mTOR/P70S6k were observed at week 40. High oxidative stress was observed from week 24 and persisted to week 40 evidenced by overexpression of protein carbonyl groups and reduced activities of CAT, SOD, and GPx. Downregulation of genes involved in mitochondrial biogenesis (PGC-1α, Nrf-1, Tfhm, Ndufs8, and Cox5b) and in mitochondrial fission (Mfn2 and Opa1) from week 24
indicated dysregulation of mitochondrial quality control in skeletal muscle. Impaired autophagic flux was observed evidenced by elevated Atg13 and LC3-II accompanied with the accumulation of P62 and lysosome-associated membrane protein 1 (LAMP1).

Increases in inflammatory factors (IL-6 and MCP-1), adipokines (leptin and resistin), and myostatin in serum at week 32 and decline in Pax7+ satellite cell resided next to muscle fibers at week 24 implied that muscle microenvironment contributed to the progression of sarcopenia in aging. Disturbances of mitochondrial quality control and muscle microenvironment were evident before muscle atrophy in aging, suggesting that mitochondrial quality control/muscle microenvironment is the promising therapeutic target to prevent muscle atrophy prior to the onset of sarcopenia.

**Keywords**: sarcopenia, senescence accelerated mouse prone 8, protein turnover, mitochondria quality/dynamics, autophagic flux.

### Role of Insulin Signaling on Sarcopenia

**Kojiro Ueki**  
Diabetes Research Center, Research Institute, National Center for Global Health and Medicine, Japan

Although age-dependent changes in insulin/IGF-1 signaling, mitochondrial functions and autophagy are thought to be involved in the development of sarcopenia, the precise mechanism still remains unclear. Since Akt is the key signaling mediator of insulin/IGF-1 signaling and appears to regulate mitochondrial function and autophagy, we have generated skeletal muscle specific Akt1 and Akt2, two major isomers of Akt, double knockout mice using MLC1f-Cre mice (MLC-DKO mice). MLC-DKO mice grow normally and show normal glucose tolerance until 8 weeks of age despite the almost complete shutdown of signaling downstream of Akt. However, MLC-DKO mice quite rapidly exhibit decreased muscle volume and functions, especially in fast twitch muscle, with systemic insulin resistance in an age-dependent fashion, compared to the control mice, indicating the development of premature sarcopenia in MLC-DKO mice.

In muscle of MLC-DKO mice, mitochondrial functions and biogenesis are impaired presumably due to a defect in the process of mitophagy, at least in part. Interestingly, MLC-DKO mice also show osteopenia even before they show decreased muscle volume. Finally, these mice significantly live shorter compared to the control mice on normal chow diet as well as high fat diet. Additional knockout of FoxO1 and FoxO4, the major isoforms of FoxO transcription factors in skeletal muscle, but not TSC2 knockout, almost completely rescues most of the phenotypes of MLC-DKO mice. These data demonstrate that loss of Akt signaling in muscle accelerates premature aging associated with sarcopenia, osteopenia, insulin resistance and shorter lifespan. Thus, maintaining Akt activity in muscle which can be achieved by increased insulin sensitivity is important to protect age-related diseases such as diabetes, metabolic syndrome and locomotive syndrome, and to prolong healthy lifespan.

### Molecular Regulation of Muscle Stem Cell Pool and Its Relationship with Sarcopenia

**Tohru Hosoyama**  
Department of Regenerative Medicine, National Center for Geriatrics and Gerontology (NCGG), Oita, Oita, Japan

It is thought that reduced number and also function of muscle stem cell (MuSC) cause age-related muscle atrophy, sarcopenia. However, it is still unclear how MuSC pool is maintained not only in elderly but also in younger people. We recently demonstrated using new in vitro model for MuSC maintenance, which has been established from iPSC cell technology and simulated microgravity culture technique, that ERK activity might be correlated with the size of MuSC pool (Hosoyama et al., 2017). So, we further investigated to clarify the role of ERK in MuSC pool maintenance using pharmacological and mouse genetic approaches. To inhibit ERK activity in MuSCs, human iPSC cell-derived muscle stem/progenitor cells were cultivated with MEK inhibitor, resulting in significant decrease of Pax7+ MuSCs in contrast to an increase of their progenies. In addition, conditional knockout of ERK specifically in MuSCs of genetically-engineered mice led to decrease of MuSC number with less proliferation capacity and severe defect in muscle regeneration after injury. We also found reduced ERK activity in MusCs from geriatric mice, indicating that ERK activity in MuSCs was attenuated with age. Taken together, our results suggest that ERK acts as critical regulator to maintain MuSC pool in postnatal muscle and age-related decline of ERK activity is associated with disease onset or increment of sarcopenia. We believe that ERK and its related-signaling pathway are potential preventive/therapeutic target for sarcopenia.

**Keywords**: sarcopenia, muscle stem cell, stem cell pool, ERK.

### Symposium 8: Sarcopenia and Rehabilitation

**Wednesday October 23 1110A | 10:35-12:00**

**Sarcopenic Dysphagia, Rehabilitation Nutrition and Rehabilitation Pharmacotherapy**

**Hidetaka Wakabayashi**  
Department of Rehabilitation Medicine, Yokohama City University Medical Center, Japan

Sarcopenic dysphagia is characterized by swallowing difficulty resulting from a loss of mass and function in whole-body skeletal and swallowing muscles. In 2019, the position paper of sarcopenia and dysphagia was published by the Japanese Society of Dysphagia Rehabilitation, the Japanese Association of Rehabilitation Nutrition, the Japanese Association on Sarcopenia and Frailty, and the Society of Swallowing and Dysphagia of Japan to consolidate the currently available evidence on the topics of sarcopenia and dysphagia. The prevalence of sarcopenic dysphagia in patients who require dysphagia rehabilitation in acute care hospital was 32%. In this study, sarcopenic dysphagia was independently associated with poor swallowing function at discharge.

For treatment of sarcopenic dysphagia, concept of rehabilitation nutrition is useful. Rehabilitation nutrition is defined as that 1) evaluates holistically by the International Classification of Functioning, Disability and Health (ICF), and the presence and causes of nutritional disorders, sarcopenia and excess or deficiency of nutrient intake, 2) conducts rehabilitation nutrition diagnosis and rehabilitation nutrition goal setting, and 3) elicits the highest body functions, activities, participations, and quality of life (QOL) by improving nutritional status, sarcopenia, and frailty using “nutrition care management in consideration of rehabilitation” and “rehabilitation in consideration of nutrition” in people with a disability and frail older people. Rehabilitation nutrition for sarcopenia and sarcopenic dysphagia differs depending on its etiology. Iatrogenic sarcopenia is defined as sarcopenia caused by the activities of medical staff including doctors, nurses, or other health care professionals in healthcare facilities.

Rehabilitation pharmacotherapy is defined as helping people with disabilities and frail older people to achieve the highest possible body functions, activities, participations, and QOL, using holistic evaluation by the ICF, “pharmacotherapy in consideration of rehabilitation”, and “rehabilitation in consideration of pharmacotherapy”. Polypharmacy may cause sarcopenia and dysphagia. Therefore, concept of rehabilitation pharmacotherapy is useful to avoid iatrogenic sarcopenia.

**Osteosarcopenic Obesity in Non-Frail Older Adults: Influence of Bone Mineral Density (BMD) Definition on Prevalence, Body Composition and Muscle Function**

**Wee-Shiong Lim**  
Department of Geriatric Medicine, Institute of Geriatrics and Active Aging, Tan Tock Seng Hospital, Singapore
Background: Osteosarcopenic obesity (OSO) is the triad of osteopenia/sarcopenia and increased adiposity. There is controversy whether OSO constitutes a unique entity or is part of frailty, with lack of consensus on how to grade its severity. Using a cohort of non-frail older adults, we compared the influence of BMD definitions (surrogate measure of severity) on OSO prevalence, body composition and muscle function.

Methods: We studied 191 community-dwelling older adults from the GERILABS-2 study who did not fulfill modified Fried criteria for frailty. We defined OSO using dual-energy X-ray absorptiometry: 1) Low BMD between -2.5 and 1.0 SD (osteopenia) or <-2.5 (osteoporosis); 2) Low appendicular lean mass (ALM/Height^2) using Asian Working Group cutoffs; and 3) High total-body fat percentage (FM%) using gender-specific cutoffs. Muscle function was assessed via handgrip strength, gait speed, and Short Physical Performance Battery (SPPB). Using osteopenia and osteoporosis definitions for low BMD, we analysed OSO prevalence, body composition and muscle function, and performed logistic regression of muscle function adjusted for confounders.

Results: The prevalence of OSO was 36.1% and 13.1% for osteopenia and osteoporosis definitions respectively. For body composition, OSO was associated with lower BMD, ALM, FM% and visceral adipose tissue using osteopenia and with lower BMD and ALM using osteoporosis. For muscle function, OSO defined using osteopenia was only associated with weak handgrip strength (adjusted OR: 2.40, 1.08–5.32), compared with weak handgrip strength (adjusted OR: 2.74, 1.02–7.39), slow gait speed (adjusted OR: 2741, 1.93–388.4), and low SPPB (adjusted OR: 3.10, 1.28–7.54) using osteoporosis.

Conclusion: OSO is prevalent in non-frail older adults and is associated with impaired muscle function, lending credence to viability of OSO beyond the frailty syndrome. BMD definitions selected OSO subjects with different body composition phenotype and degrees of physical performance impairment, supporting its role as a marker of severity in the non-frail population.

Cardiac Rehabilitation and Sarcopenia

Yoshiyuki Ikeda
Department of Cardiovascular Medicine and Hypertension, Graduate School of Medical and Dental Sciences, Kagoshima University, Japan

There are 17.7 million people deaths each year from cardiovascular diseases (CVD), which is estimated to be 31% of all deaths worldwide in 2015. In Japan, cases of CVD are recently increasing according to the aging of society and the diffusion of the western diet. CVD is the second highest cause of death. As for the elderly population over 75 years old, the death count of cerebral apoplexy and circulatory disease exceeds the one of cancer. Heart failure (HF) is the most advanced form of CVD, and HF patients have poor prognosis. Therefore, it is important to find the treatable factors in HF patients in order to alleviate their symptoms and prevention of major adverse cardiac events.

Cardiac rehabilitation (CR) based on aerobic and/or resistance exercise is widely adapted to the treatment for CVD, especially HF. CR has pleiotropic effects on increase of the number of mitochondria and its energy production in hearts and skeletal muscle, improving exercise tolerance, gain of skeletal muscle strength and mass, and so on. Recent evidences have been accumulated that frailty and sarcopenia are important factors to affect the prognosis of CVD, especially coronary artery disease and HF. It has also been revealed that CR is effective on the treatment of CVD with frailty and/or sarcopenia.

Here we review the association among CVD, CR and frailty/sarcopenia which may represent a potential therapeutic target for CVD.

Symposium 9: Sarcopenia and Cardiometabolic Health

Wednesday October 23
variables, including peak VO\textsubscript{2}, VE/VO\textsubscript{2} slope, and ΔVO\textsubscript{2}/ΔWR, were also associated with frailty status. These results indicate that CPX variables, especially peak WR and peak systolic BP, could be important for diagnosing frailty in elderly patients with HF.

**Symposium 10: Frailty, Sarcopenia with Associated Conditions**

**Wednesday October 23**

**1110B | 10:35-12:00**

**Concept of Spinal Sarcopenia and Clinical Interventions**

Sang Yoon Lee  
Department of Rehabilitation Medicine, Seoul National University College of Medicine, SMG-SNU Boramae Medical Center, Korea

Sarcopenia on lumbar paraspinal muscles is receiving renewed attention as a cause of spinal degeneration. Both the atrophy and fatty change of paraspinal muscles originated from spinal sarcopenia are also known to be associated with functional disorders and chronic back pain. However, there are few studies on the precise concept and diagnostic criteria for spinal sarcopenia and no clinical trials to determine whether it can be treated or prevented by strengthening exercise or nutritional support. Therefore, we aimed to review the updated relevant literatures to establish the concept of spinal sarcopenia and the clinical intervention that can treat and prevent it. While feasible, inexpensive, and less radiation-exposed tools such as dual energy X-ray absorptiometry have been used to measure appendicular skeletal muscle mass, paraspinal muscle assessment is still needed using spinal CT or MRI. In addition, spinal extensor strength measurement is necessary to confirm the function of lumbar paraspinal muscle, but isokinetic exercise equipment for accurate measurement is not as feasible as a dynamometer for hand grip strength to evaluate sarcopenia. Furthermore, many elderly people may experience pain during the measurement of spinal extension strength.

**Association between Anemia and Sarcopenia**

Sung-Hua Tseng\textsuperscript{1,3}, Wei-Ju Lee\textsuperscript{1,4}, Liang-Kung Chen\textsuperscript{1,2}

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\textsuperscript{4} Department of Family Medicine, Taipei Veterans General Hospital Yuanshan Branch, I-Lan, Taiwan  
\textsuperscript{5} Division of Geriatric Medicine, Department of Prevention and Community Medicine, Taipei Medical University Hospital, Taipei, Taiwan

**Background:** Hemoglobin was one of potential biomarkers of sarcopenia, but very few studies comprehensively analyzed the relationship between anemia and low muscle function or mass. Furthermore, there is no clear concept or treatment goal for anemia to prevent sarcopenia in the elderly.

**Methods:** Retrospective analyses of data retrieved from the I-Lan Longitudinal Aging Study (ILAS), 1,775 participants were included. Anemia was defined using the World Health Organization (WHO) criteria of a hemoglobin (Hb) <13 g/dL in men and <12 g/dL in women and divided into 5 groups (1 g/dL below anemia cutoff, 0–1 g/dL below anemia cutoff, 0–1 g/dL below anemia cutoff, 1–2 g/dL above anemia cutoff, and 2 g/dL above anemia cutoff) for trend analysis. Sarcopenia using the cutoff values of Asian Working Group for Sarcopenia (AWGS) criteria for (1) muscle mass measurements, relative appendicular skeletal muscle index (RASM) <7.0 kg/m\textsuperscript{2} for men and <5.4 kg/m\textsuperscript{2} for women by using DEXA, (2) handgrip strength <26 kg for men and <18 kg for women, (3) gait speed <0.8 m/s.

**Results:** A higher Hb level was significantly associated with higher appendicular skeletal mass, walking speed and handgrip strength. After adjusting for potential confounders, stronger correlation showed between anemia and muscle function (strength and performance) than muscle mass.

**Conclusions:** Hb level is independently associated with sarcopenia and had more influence on muscle function than mass and on men than women. In elderly, Anemia should be carefully evaluated and aggressively corrected, not only reached low normal range, “the higher may be the better”.

**Osteosarcopenia and Its Outcomes in Taiwan**

Li-Kuo Liu  
Center for Geriatrics and Gerontology, Taipei Veterans General Hospital, Taiwan

Osteoporosis and sarcopenia are well-recognized geriatric syndromes, which are associated with a variety of adverse outcomes. We evaluated the epidemiology of osteoporosis, sarcopenia and osteosarcopenia in Taiwan and its associative clinical characteristics by analyzing the data of the I-Lan Longitudinal Aging Study (ILAS), a community-dwelling middle-aged and elderly population-based cohort study.

**Symposium 11: Preventive Strategies in the Eating Ability of Older Adults**

**Wednesday October 23**

**1110A | 13:00-14:40**

**Oral Health Condition Affecting General Health Condition**

Seung-Yun Shin  
Department of Periodontology, Kyung Hee University School of Dentistry, Korea

Oral health is a determinant of quality of life and a part of whole-body health. As the age increases, the oral condition changes, resulting in reduced saliva flow rate, reduced number of muscle fiber and altered sense of taste. These changes could induce a variety of oral problems such as tooth loss, dental caries, and periodontal disease. Oral health is known to affect frailty states. Oral condition such as the number of teeth, use of dentures, xerostomia, and lesion of oral mucosa could affect frailty states. Also, frailty could affect oral health and oral health care. Decreased physical activity limits access to dental services and prevents adequate treatment. Poor endurance and low energy condition lead to neglect of oral hygiene.

In this presentation, I will show the recent result of the Korean Frailty and Aging Cohort Study (KFACS) about the oral condition. The aim of this study was to compare with oral health condition according to frailty stage in the elderly. The oral condition was different depending on the frailty status. Frailty group showed less healthy condition than pre-frail and non-frail group.

**Management of Oral Frailty-Sarcopenia during Dental Home Visit**

Chao-Yen Chen  
Department of Oral Diagnosis, School of Dentistry, Kaohsiung Medical University, Taiwan

Oral health is important in maintaining good general health for the elderly, whereas the oral hypo-function, potentially leading to presbyphagia is one of the urgent tasks to be addressed. If presbyphagia is managed or treated successfully, it may prevent frailty and sarcopenia that further
yield dysphagia and other oral functional disorders. It's evident that oral disorders, not managed or treated properly, could trigger the downfall of subject’s physical and mental stability, which commonly results in bedridden conditions in the long run.

The evidence on various oral functions and the accompanied environments vs. their impacts onto the oral hypofunction-sarcopenia (OHF-S) link has been reported, and recent studies have suggested a good correlation among the nutrition, oral functions and OHF-S. Early detection of oral frailty and sarcopenia is considered critical, since certain oral hypo-functions may be restored after proper dental management or treatments. Further to this, Minakuchi et al. have first reported in Gerontology 35 (4) entitled: "Oral hypofunction in the older population", a position paper of JSG, where the concept of OHF was introduced, from which it has been recommended that more evidence from clinical studies to clarify or/and verify the diagnostic criteria and management strategies is needed.

Lastly, in this presentation I will introduce the dental methods/protocols of prevention and management of OHF-S employed during the home visits for services. Also, I will provide information regarding how to provide educational and practical means to promote patient awareness in recognizing the importance of maintaining oral functions, which is critical for the interdisciplinary collaborations between the medical and dental professionals in the long-term care teamwork.

**Impact of Deterioration of Oral Health and Eating Function on the General Health and QOL**

Koichiro Matsuo
Dentistry and Oral-Maxillofacial Surgery, School of Medicine, Fujita Health University, Japan

Eating is one of essential human digestive function but also the joy of living left till the end of our life. Supporting proper oral feeding function would lead to maintain or improve patients’ quality of life in super aged society. Mastication has significant impact on swallowing and feeding, especially in frail older individuals. Poor masticatory performance increases the risk of malnutrition, choking or aspiration pneumonia in those patients, resulting in change the diet property to soft or liquid diet. Thus, supporting both mastication and swallowing for those patients would maintain or improve their QOL. Therefore, preventing deterioration of oral health and eating function is essential for older individuals to live longer healthy life. Japanese Society of Gerodontontology recently proposed "oral hypofunction" which is defined as several deteriorated oral symptoms and signs. Oral hypofunction consists of deteriorated seven oral functions that can be measured quantitatively with devices: poor oral hygiene, oral dryness, reduced occlusal force, decreased tongue-lip motor function, decreased tongue pressure, decreased masticatory function, and deterioration of swallowing function. Each condition has the cut-off value based on the data of previous studies, and oral hypofunction is defined when more than three of the seven oral function measures above meet the diagnostic criteria.

In this talk, first, I will introduce the oral hypofunction and some of the diagnostic measures. Then, I will explain the mechanism of eating dysfunction and its clinical applications as well.

**Symposium 12: Sarcopenic Dysphagia and Nutritional Intervention**

Wednesday October 23 1110A | 15:00-17:00

Nutritional Intervention for Sarcopenia in Post-Acute and Rehabilitation

Yoshihiro Yoshimura
Department of Rehabilitation Medicine, Kumamoto Rehabilitation Hospital, Kumamoto, Japan

Sarcopenia among older adults receiving in-hospital rehabilitation is an emerging concept. Compared to community or nursing home settings, the prevalence of sarcopenia in hospital-based rehabilitation settings is reported to be relatively higher, at approximately 50% (Yoshimura Y, Clin Nutr. 2018). Moreover, sarcopenia is associated with worse outcomes in hospital-based rehabilitation settings, including functional recovery, dysphagia recovery, and home discharge (Yoshimura Y, et al. Nutrition 2018). Therefore, there is an urgent need to identify sarcopenia at an early stage (i.e., at hospital admission) to initiate prevention and specific intervention to avoid worse functional outcomes among those population.

The main goals of sarcopenia treatment should include resistance training and sufficient protein intake, to maintain skeletal muscle mass and function, as well as to recover physical and swallowing function. A recent meta-analysis showed that low-intensity resistance training sufficiently enhances the synthesis of muscle proteins, and is therefore recommended for maintaining skeletal muscle mass in frail older people. Furthermore, early nutritional assessment and nutritional support on time is needed to make these exercises multimodal, especially in patients with sarcopenia. It is well accepted that individuals performing resistance training require adequate protein intake, and older adults may benefit from increasing their consumption of branched-amino acids, especially leucine. Rehabilitation nutrition, a concept combining both rehabilitation and nutrition care management can, therefore, further improve functional outcomes among hospitalized patients with sarcopenia undergoing rehabilitation. The concept of rehabilitation nutrition and the International Classification of Functioning, Disability and Health guidelines should be used to evaluate the nutritional status and to maximize functionality in frail older adults and other people with functional disability.

**Masseter Muscle Mass, Frailty and Sarcopenia**

Chia-Shu Lin
Department of Dentistry, and Institute of Brain Science, National Yang-Ming University, Taipei, Taiwan

Sarcopenia, defined as age-related diminution of muscle mass and strength, is a key determinant of frailty status and progression. Our recent study focused on the hypothesis that changing masseter muscle structure and function with advancing age may contribute to the development of frailty. We developed a novel voxel-based assessment of masseter muscle volume (MMV), using the T1-weighted MRI data. Our novel evidence revealed that the voxel-based approach based on the T1-weighted MRI data would be a reliable method for quantifying the MMV. The findings suggested that the variation in masseter muscle size may be a critical factor to the individual difference in oral functions. Furthermore, based on the sample from the I-Lan Longitudinal Aging Study, our preliminary findings suggested that MMV would be a valid clinical index for evaluating phenotypic frailty. Diminished MMV may predispose pre-frail/frail elders to depletion of physical reserves, consequent to its detrimental effect on oral functioning and nutrient intake.

**Diet and Frailty**

Rei Otsuka
Section of NILS-LSA (National Institute for Longevity Sciences, Longitudinal Study of Aging), National Center for Geriatrics and Gerontology, Aichi, Japan

The number of older people with physical frailty is increasing in aged societies. Nutrition is one of the key factors to prevent this age-related impairment. The National Institute for Longevity Sciences - Longitudinal Study of Aging (NILS-LSA), a comprehensive longitudinal epidemiological study of aging, started in 1997 at the National Center for Geriatrics and Gerontology (NCGG) in Aichi Prefecture, Japan.
Participants in this study were 2,300 residents aged 40-79 years who were age- and sex-stratified random samples selected from the area around the NCGG. Participants were examined at the NCGG examination center every 2 years from 1997 to 2012 and were followed-up from 2012 to 2017. Nutrition and food intake were calculated based on 3-day dietary records with photographs. Physical frailty was assessed using the modified criteria of the Cardiovascular Health Study, which included weight loss, weakness, exhaustion, slow walking speed, and low physical activity.

This presentation will show the recent nutritional findings from the NILS-LSA. Two-year prospective analyses of the NILS-LSA cohort showed that higher meat and dairy consumption to ensure sufficient protein and fat intake (achieve higher energy intake levels) may be an appropriate option to help prevent the development of physical frailty among older Japanese individuals.

**Symposium 13: Diet, Lifestyle and Sarcopenia**

**Taiwanese Eating Approach (TEA) to Manage Frailty and Sarcopenia**

**Wen-Harn Pan**
Institute of Biomedical Sciences, Academia Sinica, Taipei, Taiwan

It is part of a natural course to lose muscle mass and strength in older ages. Proper dietary content and composition along with adequate amount and types of physical activities may break the vicious cycle of sarcopenia and frailty in elders.

It is documented that frailty is associated with multiple nutrient inadequacies. The greater the number of nutrient inadequacies, the higher the risk of frailty. Among multiple nutrients implicated, the role of protein and the effect of protein supplementation have been well-documented. Nonetheless, dietary approach is favored more than the supplementation approach for long-term practice. Our intervention study indicates that dietary approach works better than supplementation either protein or multiple vitamins and minerals.

Analyzing data from Nutrition and Health Survey in Taiwan 2013-2016, we found that elderly with frailty tend to eat less calories and less dairies, protein-rich foods, fruits, vegetable (men only), and oils/nuts and seeds, but more rice. A protective dietary pattern has the characteristics of more plant-based whole foods such as vegetable, fruit, whole grains, and nuts and seeds as well as good quality protein foods including shell fish, fish, and milk. In addition, non-sweetened tea is also ranked high in the protective dietary pattern.

Therefore, we proposed a Taiwanese Eating approach (TEA) to combat frailty. That is (1) to eat proper level of calories to maintain healthy body weight and physical activity; (2) to include designated number of servings of 6 food groups recommended by Taiwanese Ministry of Health and Welfare; (3) to make sure to include fish and shell fish into the protein-rich food group in addition to soy, chicken, and red meat (pork); (4) to include tea drinking as an everyday life practice. However, for those with caloric intake level less than 1500 calories, adjustment should be made to ensure reaching protein intake over 1.2g per kg body weight. Taiwanese protein AI (adequate intake) is around 1.2 g/Kg body weight for those robust elders. We observed significant improvement in the mean Linda Fried frailty score in a 3-month trial for those adopting this TEA.

**Frailty Prevention for the Taiwan Elderly through Home-Based Exercise, Nutrition and Combination Interventions**

**Chih-Cheng Hsu**

**Institute of Population Health Sciences, National Health Research Institutes, Taiwan**

The proportion of the elderly population has increased rapidly worldwide. Frailty is a common geriatric syndrome. Exercise and comprehensive dietary management have been shown beneficial to frailty prevention and its reversal. However, center-based exercise and nutrition interventions may cause high attrition rate. We developed a home-based exercise and nutrition intervention protocol for frail and pre-frail elders. A total of 319 (pro)frail subjects were recruited and randomized into 4 groups: home-based exercise (n=79), nutrition (n=83), exercise and nutrition combination (n=77), and control groups (n=80). We provided intervention for 3 months and then followed up for another 3 months. The nutrition intervention included individualized nutrition education with designed dishware for balanced diet as well as food supplementations (mixed nuts and milk powder). In the end of the 6-month follow-up, our results show that home-based exercise and combination interventions are feasible for the elderly. Individualized home-based exercise interventions can help to improve physical performance and frailty status. Nutritional intervention may be helpful to improve nutrition status and mental health for the elderly. In addition, nutritional intervention can act as a supplemental remedy to the exercise program for frailty prevention.

**Tooth Loss, Protein Intake and Muscle Mass in Thai Elderly: The Possible Link**

**Dunyaporn Trachootham**
Institute of Nutrition, Mahidol University, Thailand

Adequate protein intake is essential for maintaining muscle mass. Protein is mainly found in food with hard texture such as meat and nuts. Thus, contact between upper and lower molar teeth (occlusion) may be crucial for chewing protein food. Tooth loss is a common health problem in Asian elderly. Loss of teeth affects food choice, dietary consumption and nutrient intake. However, the influence of occluding teeth loss on protein intake and muscle mass was unclear. Our recently published cross-sectional study compared consumption frequency of protein food, amount of protein and relevant micronutrient intakes and muscle mass indices among Thai older adults with different Eichner indices (EI) of occluding teeth loss. The EI is correlated with masticatory performance (the ability to chew food into small pieces ready to be swallowed). EI is composed of group A (having occluding molar teeth on both sides); group B (having occluding molar teeth only one side), and group C (having no occluding molar teeth). Ninety Thai healthy adults were divided into three groups (N=30 each) according EI with matched characters. Food frequency questionnaire (FFQ), 4-days diet record, and bioelectrical impedance analysis (BIA) were used for outcome measurement. Our findings suggested that loss of occluding teeth on both sides was associated with less frequent consumption of meat, nut, egg, fish and dairy products, inadequate intakes of protein (<0.8 g/kg body weight), iron and vitamin B12, and reduced muscle mass indices in older adults. Interestingly, even with higher percent use of removable denture the participants with bilateral occluding teeth loss still consumed less protein food. Further analysis revealed significant correlation between muscle mass and protein intake. Future large-scale cohort studies are warranted to confirm these findings. This study could be a reference for further exploring the association between bilateral occluding teeth loss and the risk of sarcopenia. Elderly people with loss of posterior teeth on both sides may be at risk of malnutrition and frailty, requiring special attention.


**Keywords:** older adults, tooth loss, protein intake, muscle mass, oral health, nutrition.
Aging Medicine and Healthcare

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Symposium 14: Improving Diagnosis of Frailty and Sarcopenia

Wednesday October 23

Automated Assessment of Physical Performance of Older Adults

Hee Won Jung
Seoul National University Hospital, Korea

With advances in understanding the varying clinical consequences of sarcopenia and frailty associated with aging, the roles of functional measures in clinical decision making is ever increasing. However, to date, most geriatric functional assessments are based on manual measurement by experienced investigators. However, training requirement for research personnel may preclude widespread adoption of physical performance measurements in researches and clinical practices. Also, inter-rater variability may affect measurements especially in multi-center based intervention studies.

In this talk, I will share our early experiences of using sensor based automated gait speed measurement technique using prototypes of Gaitspeedometers. We tentatively developed and validated 4 experimental devices. To assess compatibility between different versions of GSMs, we collected 426 data points from 4 young engineers walking at random speeds and with varying postures. In this study, we found that 4 methods of automatic gait speed measurement and the manually measured gait speed correlated well with each other. Also, we recently developed a multisensor based kiosk (eSPPB kiosk) which can perform automated measurement for of the short physical performance battery (SPPB). In a single center based prospective study (N=40), correlations between the total and component-specific scores of the the e-SPPB and the manually measured SPPB (mSPPB), assessed by a physical therapist, were assessed. In this study, the intraclass correlation coefficient between the eSPPB and mSPPB total score was 0.97 (P <0.001), and the kappa agreement was 0.79 (P <0.001). The intraclass coefficients between the components of eSPPB and mSPPB were 0.77 (P <0.001), 0.88 (P <0.001), and 0.99 (P <0.001) for standing balance, gait speed, and chair stand test, respectively.

In the future, we believe that bringing these novel sensor technologies into clinical assessments may facilitate wider adoption of functional evaluations in clinical care for older adults.

Rapid Geriatric Assessment iPad Application: A Practical Way of Identifying Older Adults at Risk in Primary Care

Reshma A Merchant1,2, Sing Cheer Kwek3, Meena Sundram1, Lim Jia Yi1, Jerome Jayasundram1, Matthew Chen1, Tan Li Feng4, Ng Shu Ee1, Richard Jor Yeong Hui1

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With rapid increase in ageing population, especially in Asian countries and limited number of geriatricians, there is an immediate need to enhance ability of primary care physicians, coordinators and nurses to screen and manage geriatric syndromes. Rapid Geriatric Assessment (RGA) developed by Saint Louis University measures frailty, sarcopenia, anorexia and cognition. In addition to screening, the RGA also includes additional questions should a person screen positive for fatigue, to exclude depression, sleep apnoea and additional investigations to exclude hypothyroidism, B12 deficiency and management plans eg recommendations on exercise and vitamin D.

We developed eRGA app (eRGA), and reviewed the feasibility and clinical utility of app use by coordinator and nurse in primary care. Frailty was measured using the FRAIL scale, sarcopenia using Sarc-F, nutrition using SNAQ (Simplified Nutritional Assessment Questionnaire) and for those with fatigue, depression was measured using PHQ-9. In the initial pilot phase, cognition was not measured as Rapid Cognitive Screen is undergoing local validation. Additional demographic information was obtained.

Over a duration of 3 weeks, 278 older adults (mean age 74 years) completed the eRGA administered by nurse and/or coordinator in 2 primary care centers. The average time to complete FRAIL, Sarc-F, SNAQ together with additional checklists and questions on basic demographics was 3 mins. Basic demographics of patients include 127 (45.7%) male, 211 (61.8%) were of Chinese ethnicity and one third lived with spouse with only 10% living alone. The prevalence of frailty was 7.6%, 82 (29.6%) were classified as prefrail and 174 (62.8%) robust. 1 in 5 patients responded yes to fatigue, and amongst them 76.9% were screened to be depressed using the PHQ-9. For the FRAIL resistance and aerobics component, 32 (11.5%) had difficulty climbing 1 flight of stairs and 37 (13.3%) had difficulties walking 1 bus stop. 1 in 10 patients had significant weight loss. Using Sarc-F, 57 (20.7%) were sarcopenic. 1 in 5 patients had difficulties walking across the room, with similar numbers reporting difficulties climbing a flight of ten stairs and transferring from chair to bed. 51 (18.3%) had fallen at least once during the previous year. Based on SNAQ, 75 (27.3%) are at significant risk of at least 5% weight loss within 6 months.

eRGA ipad app is a practical and feasible way to identify seniors at risk in primary care. The RGA app identified relevant geriatric syndromes and with appropriate implementation pathway could lead to improved outcomes.

Physical Frailty, Cognitive Function and Brain Structure

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Both physical frailty and cognitive dysfunction have a vulnerability to stress in older adults and cognitive frailty has been proposed as a concept of the simultaneous presence of physical frailty and cognitive impairment. To understand the progression of cognitive frailty, in addition, to consider the interventions of it, it is essential to accumulate the fundamental findings of the association of physical frailty with cognitive functions and brain structure. The purpose of this presentation was to clarify (1) which components of physical frailty were related with cognitive functions and (2) which components of physical frailty were related with atrophy of cerebral structures. The subjects were 900 community-dwelling Japanese aged over 65 who participated in the National Institute for Longevity Sciences – Longitudinal Study of Aging (NILS-LSA). Physical frailty was determined by the modified criteria of the Cardiovascular Health Study, which included weight loss, weakness, exhaustion, slowness, and low physical activity. Cognitive functions were assessed by Mini-mental state examination and Wechsler Adult intelligence scale- revised short form. The volume of cerebral structures was evaluated from 3D-T1 MR images by Statistical Parametric Mapping (SPM). In this session, we will show the results as follow: (1) general linear models showed that weakness and slowness were associated with MMSE and the score of Digit symbol substitution test and (2) voxel-based morphometry showed that weakness and slowness were associated with atrophy of the hippocampus, amygdala, and fusiform gyrus. Longitudinal studies are warranted to clarify the causal relationship among physical frailty (especially the components of mobility-type frailty), cognitive functions, and brain structures.
Poster Abstracts
**PO1 Correlation of Foot Lesions with Reduced Grip Strength and Other Diabetic Complications in Older Diabetic Patients**

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**Introduction:** Diabetic foot, characterized by foot lesions, is an important diabetic complication that affects life prognosis, leads to a decline in ADL and QOL, and nursing care. Advances in diabetes treatment using hypoglycemic agents and insulin tend to reduce angiopathies, but foot lesions, which do not improve with conventional diabetic medications, remain a clinically significant problem. In older adults, skeletal muscle mass, muscle strength, and walking speed decrease. Diabetic patients are particularly prone to muscle weakness, and a relationship between skeletal muscle function and neuropathy/foot lesions has been reported. Therefore, it is important to study foot lesions with an aging perspective in order to enable early detection of foot lesion risk, which leads to foot gangrene in older diabetic patients.

**Aim:** To examine the relationship of foot lesions with aging and diabetes-related complications in older diabetic patients.

**Methods:** The study examined 562 patients aged ≥65 years who visited the diabetes outpatient department. Foot lesions were characterized by ulceration, reddening, erosion, deformation, callus cuts, and other similar abnormalities in the feet. T-test and Mann-Whitney U test were used to compare the two study groups, i.e.; one with foot lesions and the other without, in terms of differences in clinical features. The correlation between the presence of foot lesions and blood sugar control status, diabetes, and aging-related issues were examined using logistic regression analysis.

**Results:** The study included 283 men and 279 women; the mean age of the patients was 74.4±5.6 years. The study group was divided into a group of 246 patients (43.8%) with foot lesions and a group of 316 patients (56.2%) without foot lesions. Neuropathy (OR: 1.76, 95% CI: 1.259–2.486), hypertension (OR: 1.821, 95% CI: 1.123–2.953), and reduced grip strength (OR: 2.021, 95% CI: 1.401–2.916) were statistically significant different between the two groups. Furthermore, based on the logistic regression analysis with the presence of foot lesions set as the outcome, age, gender, BMI, retinopathy, neuropathy, treatment methods, diabetic history, HbA1c, walking speed, sarcopenia, reduced cognitive function, adjustment with low nutrition, and forced entry were analyzed, and reduced grip strength (OR: 1.829, 95% CI: 1.211–2.762), hypertension (OR: 1.810, 95% CI: 1.094–2.997), and neuropathy (OR: 1.924, 95% CI: 1.243–2.978) were significantly correlated with foot lesions. Patients with neuropathy and hypertension were at higher risks of foot lesions than those with neuropathy or hypertension alone. Similarly, patients with neuropathy and reduced grip strength (OR: 1.747, 95% CI: 1.086–2.810) were at higher risks of foot lesions than those with neuropathy or reduced grip strength alone.

**Conclusion:** Hypertension, neuropathy, and reduced grip strength were significantly correlated with foot lesions in older diabetic patients. Having both neuropathy and hypertension increased the risk of developing foot lesions. Therefore, diabetic complications and muscle weakness should be closely monitored in older diabetic patients with foot lesions. This causal relationship needs to be clarified using longitudinal studies.

**PO2 Relationship between Diabetic Polyneuropathy and Sarcopenia in Elderly Patients with Type 2 Diabetes**

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**Purpose:** To clarify the influence of the presence or absence of diabetic polyneuropathy (DPN) in elderly patients with type 2 diabetes on sarcopenia prevalence.

**Subjects and Methods:** The subjects were 49 elderly patients with type 2 diabetes who participated in the hospital admission for diabetes education. We classified them into DPN group and non-DPN group, and compared sarcopenia prevalence among both groups. Sarcopenia was judged according to the Asian Working Group for Sarcopenia diagnostic criteria. For statistical analysis, Fisher’s exact test and unpaired t-test were used, and P values <0.05 were considered statistically significant.

**Results:** There were no significant differences between the two groups in patient characteristics (P>0.05). The overall prevalence of sarcopenia was 24.5%. The prevalence of sarcopenia in the DPN group and non-DPN group was 36.0% and 12.5%, respectively (P=0.09). In addition, skeletal muscle strength and gait speed were significantly reduced in the DPN group (P<0.05).

**Conclusion:** It was suggested that DPN may increase the risk of developing sarcopenia in elderly patients with type 2 diabetes.

**Keywords:** sarcopenia, type 2 diabetes, diabetic polyneuropathy.

**PO3 Frail Phenotype Versus eGFR in Predicting Longitudinal Outcomes for Elderly with Chronic Kidney Disease**

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**Background:** Geriatric population presents a unique set of challenge in geriatric nephrology. Frailty, function dependence, nutritional status and severity of comorbidities would alter treatment plan and compromised outcome in elder patients with advanced kidney disease. Continued refinement of medical advance offers a broader array of options for the gero-nephrologists and their patients than previously available. Assessment tool tailored elder patients with renal impairment rather than chronological age, is still lacking. This study aims to compare predictive accuracy for longitudinal outcomes using frail phenotype versus traditional renal parameter among elder patients with chronic kidney disease.

**Methods:** We conduct a prospective cohort study of elder patients with advanced chronic kidney disease (CKD; eGFR <60 ml/min/1.73m²) at a tertiary medical center in southern Taiwan. Comprehensive medical assessment, comprise demographic information, previous fall, nutrition status, depression, cognition, basic activity and physical performance. The primary endpoint was composite renal outcome, all-cause hospitalization and functional decline.

**Results:** During 2018.01.01 - 2018.12.31, a total of 215 patients were enrolled, with CKD stages distributed as 3a: 21.7%, 3b: 33%, stage 4: 25.6%, stage 5: 19.7%. The most common etiology for chronic kidney disease were DM (31.53%) and chronic glomerulitits (26.11%). They had several geriatric syndromes, including risk of cognition impairment (34%), depressive mood (27.1%), disability (30%), malnutrition (22.2%), multi-comorbidities (67%), polypharmacy (60%), and urinary incontinence (43%). On multiple logistic regression analysis, degree of frailty, assessed by Fried Phenotype, was associated with higher risk for renal progression and ESRD (OR: 1.47, 95% CI: 1.03-2.09), all-cause hospitalization (OR: 1.83, 95% CI: 1.2-2.79), cardiovascular event (OR: 2.62, 95% CI: 1.25-5.48) and 6-month function decline (OR: 2.00, 95% CI: 1.06-3.76). Frailty
improved predictive accuracy by logistic regression and area under curve of ROC analysis beyond traditional renal parameter.

Discussion: Geriatric syndrome were common among elderly patients with chronic kidney disease. Baseline frailty status assessed by Fried Phenotype was associated with higher risk of poor renal outcome, hospitalization and functional decline. Patients who scored above 3 may require further clinical trials to document efficacy for individualized geriatric intervention. Having a clear understanding of possible morbidities and functional trajectories is helpful for improving outcomes and appropriate discussions between physicians, patients, and their families.

Keywords: geriatric assessment, elderly, chronic kidney disease, hospitalization.

P04 Effects of Exercise Therapy on Preventing Sarcopenia in Elder Individuals with Knee Osteoarthritis: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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Objective: Knee osteoarthritis (KOA) and age are associated with high sarcopenia risk. This study aimed to investigate the effect of muscle strengthening exercise therapy (MSET) on muscle mass gain and muscle hypertrophy in older patients with knee osteoarthritis (KOA).

Methods: A comprehensive search of online databases, namely PubMed, EMBASE, CINAHL, The Cochrane Library, the Physiotherapy Evidence Database (PEDro), the China Knowledge Resource Integrated Database, and Google Scholar databases, until March 2019 was performed in accordance with PRISMA guidelines. Randomized controlled trials (RCT) which reported the efficacy of MSET on lean mass gains, muscular morphology changes including muscle thickness and cross-sectional area (CSA) in elder people with KOA were identified. The included RCTs were analyzed through meta-analysis and risk of bias assessment.

Results: We included 14 RCTs with a median PEDro score of 6/10 (range, 3/10 to 7/10). A total of 1,012 patients with a mean age of 61.6 years were analyzed. The MSET intervention resulted in a significantly higher gain in lean body mass with a standard mean difference (SMD) of 0.45 (95% confidence interval [CI]=0.24, 0.66; P < 0.0001). The results showed significant favorable effects of MSET on muscle thickness (SMD=0.64, 95% CI=0.03, 1.24; P=0.04) and muscle CSA (SMD=0.54, 95% CI=0.20, 0.87; P=0.002).

Conclusion: MSET is effective in increasing lean body mass and muscle size in older adults with KOA. Clinicians should incorporate strategies for improving muscle function into their management of patients who have a risk of low muscle mass to maximize health status, especially for older individuals with KOA.

Keywords: sarcopenia, osteoarthritis, arthroplasty, strength training, lean mass, muscular hypertrophy.

P05 SPPB Predicts In-Hospital Physical Activity of Heart Failure Patients

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Objective: In-hospital mobility levels are a central modifiable factor in preventing adverse outcomes after discharge in older adults, including heart failure. So it is important to quickly identify patients who are expected to have low physical activity (PA) in-hospital. Short physical performance battery (SPPB) is recommended as a measure of motor function in the elderly with frail. Frail patients have low PA, but it is unknown that SPPB predicts in-hospital PA. The aim of this study is to identify whether SPPB predicts in-hospital PA for heart failure patients.

Methods: Study participants were 59 patients older than 65 years who were admitted to Kainan Hospital for the exacerbation of heart failure. Patients who had severe dementia and were unable to walk on their own were excluded from this study. Patients were evaluated at the day allowed walking and wore an accelerometer up to their discharge day. SPPB score, cognitive function, depression, appetite, and self-efficacy for walking were also assessed as predictors of PA. A mean daily steps from the day after wearing the accelerometer was calculated as an index of PA.

Results: The mean age was 83.3±6.4 years, 38(64%) were men. The total score of SPPB was 7 (IQR: 5-10) in men, 5 (IQR: 3-7) in women. The mean steps were 1,668±1,964 in men and 879±1,181 in women. A multiple linear regression was calculated. A significant regression equation was found (F (8, 36)=2.95, p < 0.05), with an R2 of 0.261. The only total score of SPPB was significantly associated with steps in-hospital (p < 0.01).

Conclusion: The SPPB score was a strong indicator of steps in-hospital for elderly heart failure patients. Assessing SPPB and determining frail as soon as walking is permitted may help to identify patients who are at risk for low PA in-hospital.

Keywords: SPPB, physical activity, heart failure, frail.

P06 Prevalence of Sarcopenia in Japanese Community-Dwelling Older Adults: According to EWGSOP2

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Sarcopenia is a common problem among the elderly worldwide. Muscle mass can decrease with aging and decreased physical activity may occur. However, the sarcopenia prevalence among community dwelling older adults living in snow-covered cities remains largely unknown. Therefore, we evaluated the prevalence of and risk factors for sarcopenia in this population aged 65 years or older according to the definitions and diagnoses of the European Working Group on Sarcopenia in Older People-2 from two welfare centers in Sapporo, Hokkaido, Japan. The demographic characteristics, nutrition, and depression status of 310 participants were assessed using a standardized questionnaire. All participants were assessed for grip strength. Skeletal muscle index, body mass index (BMI), and total body water (TBW) were measured using bioelectrical impedance analysis. The overall sarcopenia prevalence in the study population was 7.4% according to EWGSOP2. Multivariate analysis revealed that taking more than four drugs per day were independently associated with sarcopenia (adjusted odds ratio (OR)=3.28, 95% confidence interval (CI)=1.31–8.21). BMI and TBW were negatively associated with sarcopenia. In this study, the lower sarcopenia prevalence is indicated that welfare center exercise may be a good intervention for the prevention of sarcopenia. Moreover, the management of medication, and nutrition is necessary for sarcopenia prevention in community dwelling older adults.

Keywords: sarcopenia, prevalence, community-dwelling, older adults, EWGSOP2.
Exogenous Delta-Like 1 Homolog (DLK1)-fc Treatment Protects Skeletal Muscle from Cardiotoxin-induced Degeneration

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Background and Aims: Diabetes decreases skeletal muscle contractility and thereby induced atrophy. Skeletal muscles have a tremendous capacity for repair and regeneration in response to injury. Skeletal muscle degeneration is accelerated in elderly patients with diabetes and the imbalance between muscle growth and wasting can lead to metabolic dysfunction. DLK1 is a member of the DGF-like family and is essential for skeletal muscle development and regeneration. This study was performed to identify whether exogenous DLK1 treatment can prevent muscle wasting. We assessed ultrastructural events of tibialis anterior (TA) muscle as well as muscle regeneration and atrophy markers in mice models: cardiotoxin (CTX)-induced atrophy mouse. The expressions of genes related to muscle regeneration and atrophy were determined using RT-PCR.

Materials and Methods: C57BL/6 mice (10 weeks old) were treated with an intraperitoneal injection of 0.8 mg/kg body weight of DLK1 in PBS or PBS alone (daily for 10 days). Normal, non-dystrophic, adult male mice were used in this study. For the CTX, muscle-crush injury mice were anesthetized and then 10 µM of CTX, isolated from Naja pallida (Latoxan L81-02), were intramuscularly administered into the TA muscle. PBS and DLK1 treated mice groups were sacrificed 5 days after CTX treatment. TA muscles were collected and snap frozen for RT-PCR. Injured muscles were subjected to both histological and ultrastructural analyses. In this study, mice were divided into (1) sham operation with PBS, (2) cardiotoxin injury to the TA muscle, and (3) cardiotoxin with DLK1 treatment (IP, 0.8 mg/kg, 2 wks) groups.

Results: We observed that ultrastructurally, myofibers in CTX-injured muscles were invaded by numerous macrophages. Compared with control group, there were significantly longer satellite cells in the CTX group at day 5 and also CTX injury caused mitochondrial accumulation and swelling followed by lysis. DLK1 treatment attenuated these degenerative changes. The level of myostatin, which inhibits muscle cell growth, was reduced in DLK1 treatment group compared to CTX group. Additionally, DLK1 group showed an increased expression of MyHCIIb than the CTX group. DLK1 inhibited muscle atrophy by decreasing the following atrophy markers: TNF-a and mrf1.

Conclusion: Taken together, these results indicate that DLK1 limits cardiotoxin damage by protecting myotubes from necrosis. Although the details of the molecular mechanisms underlying the protective effect remain to be elucidated, we report the ability of DLK1 to promote resistance to muscle damage. DLK1 attenuates CTX-induced muscle atrophy in mice by suppressing the downstream of myostatin/murf1 pathway. The increased expression of MyHCIIb indicates that DLK1 treatment can also improve the quality of muscle formation. Our study implies that DLK1 could be an attractive candidate in the treatment of aging or diabetes-related sarcopenia, characterized by muscle atrophy and dysfunction.

Sarcopenia in Community Dwelling Korean Older Adults with Diabetes: KFACS

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Objective: Diabetes is one of the major risk factors of physical disability in older adults. The objective of this study is to evaluate the prevalence of sarcopenia in Korean older adults with diabetes compared to those without diabetes.

Methods: We analyzed 2,403 older adults aged 70-84 years, who were enrolled in the Korean Frailty and Aging Cohort Study (KFACS). The skeletal muscle mass was assessed by DXA, and muscle strength was assessed by hand grip strength (HGS). Physical performance was assessed by the Short Physical Performance Battery (SPPB), and the Timed Up and Go (TUG) test. Sarcopenia was defined using the criteria of Asian Working Group for Sarcopenia (AWGS) and the Foundation for the National Institutes of Health (FNHI).

Results: The mean age of the subjects was 76.2±9.3 years, and 47% were men. Prevalence of diabetes was 30.2% in men and 25.7% in women. Subjects with diabetes had higher BMI and higher levels of fasting glucose, insulin, HbA1c, and HOMA-IR, compared to the non-diabetic group. The prevalence of sarcopenia and muscle mass index in men were not different between diabetic and non-diabetic groups, but the diabetic men had lower HGS and gait speed, and they took longer time on TUG test compared to the non-diabetic group. In women, the prevalence of sarcopenia defined by the FNHI was higher in the diabetic group compared to the non-diabetic group. Women with diabetes had lower HGS, gait speed and SPPB score, and took longer time on TUG test compared to the non-diabetic group, although muscle mass index were not different between the two groups.

Conclusion: Prevalence of sarcopenia was higher in older women with diabetes compared to non-diabetic group, but those are not different in men. In older adults with diabetes, physical performance and muscle strength were reduced, whereas muscle mass was not different compared to the non-diabetic group. Thus, in older adults, diabetes might be associated with developing sarcopenia, especially in a form of decreased muscle quality.

Keywords: sarcopenia, prevalence, muscle quality.

Are Subjective Masticatory Ability and Regular Dental Care to Mortality?

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Background: It is clear that the ability to eat firm foods using one’s own mouth has a strong influence on both physical and mental conditions of older people. Therefore, in order to preserve one’s own teeth as much as possible, and to maintain oral function using dentures after losing one’s own teeth, regular check-ups and controls while consulting at the dental clinic are very important. Thus, the present study examined whether the combination of self-reported masticatory ability and regular dental care was associated with mortality and new long-term care insurance (LTCI) service certifications.

Methods: Older residents in institutions or in need of LTCI services were excluded, and self-administered questionnaires were sent to 5,400 older adults in 2013; these participants were followed for 5 years. The total response rate was 94.3%. Our final sample comprised 4,968 older adults. Missing data were filled in using multiple imputation. We used 3 question-items to assess subjective masticatory ability: (1) decline in chewing abilities of the posterior teeth on either side, (2) no brushing one’s own teeth or dentures at least once a day, and (3) no visiting to the dentist at least once a year. And numbers of bad state of those 3 question-items were calculated as a score of self-reported masticatory ability and regular dental care.

Results: The mean age was 75.8 years and 58.4% of the participants were female, at baseline. Main outcomes included mortality (n=600) or new LTCI services (n=1,162) during the 5-year period. The prevalence of decline in chewing abilities of the posterior teeth on either side, non-regular dental self-care, and non-regular dental professional care was 6.3%, 8.4%, and 56.3%, respectively. The prevalence of occlusal force at score 0-point, 1-point, 2-point, and 3-point was 41.1%, 48.5%, 9.2%, and 1.2%, respectively. HR (95% CI) of mortality with 0-point reference to the
score of self-reported masticatory ability and regular dental care in order of 1, 2 and 3 points was 1.34 (1.10-2.02), 1.56 (1.19-2.04), and 2.59 (1.66-4.00), respectively. Similarly, HR (95% CI) of new LTCI services was 1.11 (0.97-1.27), 1.30 (1.06-1.60), and 1.63 (1.11-2.39), respectively. All HRs have been adjusted for age, sex, living alone, polypharmacy, comorbidity, frailty, dentures.

**Conclusion:** Presence of decline in chewing abilities of the posterior teeth, non-regular dental self-care, and non-regular dental professional care was related to mortality and new certifications for LTCI services.

**Keywords:** dental professional care, dental self-care, masticatory ability, mortality, oral frailty.

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### P10 Serum Free Thyroxine Levels and Frailty in the Elderly: Korean Frailty and Aging Cohort Study

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**Background:** Frailty is common in the elderly and associated with a functional decline of multiple physiological systems. Thyroid hormones play a crucial role in the metabolic activities of adults, and some symptoms of frailty overlap those of thyroid dysfunction. But there are few data evaluating the potential contribution of thyroid status to frailty. The objective of the study was to identify the association of thyroid status and frailty in community-dwelling Korean older adults.

**Methods:** This study based on the Korean Frailty and Aging Cohort Study represents a population of 2,860 people aged 70 years and older. Circulating thyrotropin (TSH) and free thyroxine (fT4) were assayed. Frailty was assessed as ≥3 of the Cardiovascular Health Study (CHS’s) 5 domains: unintentional weight loss, weakness, slow gait speed, low physical activity level, exhaustion. Multivariate logistic regression analysis was used to evaluate the association TSH and fT4 with frailty.

**Results:** There was no association of TSH, but fT4 was significantly correlated with CHS score. After adjusting for covariates, participants with fT4 in the highest quartile had increased odds of having frailty (odds ratio [OR]=1.69, 95% Confidence interval [CI]: 1.13-2.51). Female in highest quartile had significantly higher odds (OR=3.30, CI=1.11-9.77). Highest fT4 was associated with weight loss (OR=2.78, CI=1.28-5.99).

**Conclusion:** High-normal fT4 level is an independent predictor of frailty among community-dwelling older people.

**Keywords:** frailty, thyroid hormones, older, Korean Frailty and Aging Cohort Study.

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### P11 Leisure Activities and Resilience in Sarcopenia Geriatric Population with Heart Disease—A Trajectory Research

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**Background:** Sarcopenia is one of the most important factors influencing the physical ability of the geriatric population. The study of mental statuses and leisure activity of older patients with sarcopenia combined with heart disease is insufficient. Therefore, the relationship between resilience and leisure activity of this population and long-term trajectory are explored.

**Purpose:** To examine the relationship between resilience and leisure activity in geriatric population with sarcopenia combined with heart disease and the trend of long-term trajectory.

**Methods:** A long-term trajectory was studied at three time periods (baseline, three months and six months). A Group-Based trajectory analysis was applied.

**Results:** Ninety-six participants were recruited, 54 male and 42 female. The mean age of the participants was 83.3 years (SD=7.72). 45.8% of these subjects had the ability to read and write, 71.9% were low-income, 71.9% were married, 85.4% living with family, and 61.5% were cared by others. There were significant differences between leisure activities and age (p=0.01), education (p=0.02), family income (p=0.01) and exercise durations (p<0.01). Frequency of participating in leisure activities has improved gradually based on a long-term trajectory analysis (p-value=0.03). The state of resilience was significantly different from gender (p=0.02), age (p=0.03), and self-care (p<0.01). There were significant differences between leisure activity and age (p<0.01), significant differences with education (p=0.02), and family income and exercise time (p=0.01, p<0.01). There was a positive correlation between resilience and leisure activity (p=0.42, p<0.01). The resilience and leisure activity gradually increased at different time points (baseline, 3 months, and 6 months) across the long-term trajectory.

**Conclusion:** Leisure activities and resilience were important factors influencing in the geriatric population in maintaining physical ability. Health professionals should provide appropriate interventions and encourage older people to participate in leisure activities in order to promote physical functions, and also improve their mental health status.

**Keywords:** leisure time activity, resilience, sarcopenia, geriatric population, heart disease.

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### P12 Physical Performance Tests as a Diagnostic Tools for Sarcopenia

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**Background:** Physical performance measures have been used in a range of ways to detail an individual’s risk for adverse events including falls, fractures, morbidity and mortality. Sarcopenia, defined as the presence of low muscle mass, strength and function has been shown to increase an individual’s risk for falls by up to 3-fold. The aim of this study was to determine whether 2 measures of physical performance (timed up and go – TUG, and the Short Physical Performance Battery – SPPB) can be used to diagnose severe sarcopenia using the EWGSOP1 and EWGSOP2 criteria.

**Methods:** This was a cross-sectional study of 318 community-dwelling older adults from western Melbourne VIC, Australia. Participants were aged over 65 years old, could mobilise independently, were not cognitively impaired and reported a risk/history of falls and/or fractures. Appendicular lean mass corrected for height squared (ALM/h²), handgrip strength and gait speed were assessed for diagnosis of sarcopenia, in addition to TUG and SPPB. Diagnostic ability of the TUG and SPPB tests independently and combined with ALM/h² was determined using area under the ROC curve (AUC) and potential cut-points assessed.

**Results:** Prevalence of severe sarcopenia was 11.8% using EWGSOP1 and 7.3% using EWGSOP2. Participants presented with a median age of 78 years (IQR 73, 83) and 75% were female. AUC for TUG in diagnosing all sarcopenia definitions was poor, ranging between 0.666-0.672. Similar AUC was found for SPPB at 0.644-0.680. Highly sensitive and specific cut-points for each physical performance could not be found.

**Conclusions:** Physical performance measures alone cannot be used to accurately diagnose sarcopenia according to current EWGSOP definitions. This may be attributed to the currently recommended methods to assess ALM which have shown a disconnect between performance and muscle mass. Additionally, sensitive and specific cut-points could not be determined.
P13 Prevalence of Frailty and Its Associated Factors among Hemodialysis Patients

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Introduction: Frailty, a well-recognised geriatric syndrome among older person has attracted the interest of scientists lately in light of the increasing prevalence of frailty among hemodialysis patients. The etiology of frailty is multifactorial including sociodemographic, physical, biological, lifestyle, and psychological factors. Such information among the hemodialysis patients is scarce. The purpose of this study was therefore to identify the personal factors, anthropometry parameters, biochemical markers, nutritional status and sarcopenia among the hemodialysis patients and to determine how the above factors may associate with frailty.

Methods: A total of 68 eligible hemodialysis patients were recruited for this cross-sectional study. Anthropometry measurements were performed according to standard protocols while risk of malnutrition was ascertained using Dialysis Malnutrition Score (DMS). Biochemical parameters were retrieved from medical records as secondary data while dietary intakes were assessed for two days. The presence of sarcopenia was determined based on the assessment on muscle function (strength or gait speed) and muscle mass according to Asian Working Group for Sarcopenia (AWGS) criteria, while frailty status of patient was ascertained according to the universal Fried Phenotype. Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 24 with significance level set at p <0.05.

Results: The respondents comprise of 45.6% of male and 54.4% of female with a mean age of 52.35±13.76 years old. The prevalence of frailty and pre-frail was 44% and 50%, respectively. Approximately 9 in 10 of the patients had polypharmacy, 98.5% had malnutrition while only 1% of the respondents were sarcopenic. There were significant associations between age (p=0.43, p <0.001), number of medications (p=0.30, p=0.013), DMS (p=0.427, p <0.001) with frailty. Serum phosphate (p=0.305, p=0.011), dietary energy (p=0.348, p=0.004), dietary protein (p=0.255, p=0.036), dietary fat (p=0.413, p <0.001), dietary potassium (p=0.343, p=0.004) and dietary phosphate (p=0.278, p=0.022) were negatively associated with frailty. Conclusion: In conclusion, frail and pre-frail were prevalent among hemodialysis patients, which deserve attentions from the relevant authorities. The identification of some of the modifiable factors (eg number of medications used, malnutrition, dietary energy and protein intakes) should be considered in the formulation of appropriate intervention to reduce frailty among the hemodialysis population.

P14 Clinical Implications of Osteosarcopenia and Its Components in Community-Dwelling Older Adults

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Background: Osteosarcopenia is a musculoskeletal syndrome characterized by the concomitant loss of muscle (sarcopenia) and bone (osteopenia/osteoporosis) mass. As such, individuals with osteosarcopenia are more likely to have worse outcomes compared to those with either sarcopenia or osteoporosis alone. This study aimed to determine the associations of osteosarcopenia with physical performance, balance and falls and fractures in community-dwelling older adults. Additionally, we aimed to determine whether the impact on clinical outcomes is dependent on specific components of osteosarcopenia.

Methods: Cross-sectional data were extracted for 253 community-dwelling older adults (77% women) aged 77.9±0.42 years old who presented for a falls and fractures risk assessment in Melbourne, Australia. Participants were mobile, community-dwelling older adults aged 65 years or older without cognitive impairment. Participants underwent body composition analysis by dual energy X-ray absorptiometry, and assessments for physical performance including the Timed Up and Go (TUG) and Short Physical Performance Battery (SPPB). Static balance was assessed by posturography and dynamic balance by the four-square step test (FSS). Falls in the past year and fractures in the past 5 years were self-reported. Osteosarcopenia was defined as (i) low bone mineral density (BMD) (T-score <-1 SD) combined with sarcopenia, and (ii) osteoporosis (BMD T-score ≤-2.5 SD) combined with severe sarcopenia. To define sarcopenia, we employed the European Working Group on Sarcopenia in Older People (EWGSOP1), the revised criteria (EWGSOP2), and the Foundation for the National Institutes for Health (FNHI). Kruskal-Wallis and logistic regression were used for statistical analysis.

Results: Osteosarcopenia was associated with worse SPPB, TUG, FSS, limit of stability, falls and fractures history. Additionally, osteosarcopenia with severe sarcopenia component was related to an increased rate of falls (OR from 2.83 to 3.63; p <0.05 for all) when using the EWGSOP2 definition and fractures when using the FNHI definition (OR from 3.86 to 4.38; p <0.05 for all).

Conclusion: Osteosarcopenia was associated with overall worse physical performance and balance. Use of the EWGSOP2 and FNHI criteria resulted in the strongest associations with physical performance, falls and fracture rates.

P15 Prognostic Significance of Preoperative CT-Determined Sarcopenia in Patients with Gastric Cancer Received Curative Intent Surgery

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Background: Sarcopenia has been reported to be an important prognostic factor in the prediction of long-term outcomes of various cancers. The aim of this study was to investigate the impact of preoperative computed tomography (CT)-determined sarcopenia on the prognosis of patients with gastric cancer who underwent curative intent surgical resection.

Materials and Methods: A retrospective analysis of all patients treated with curative intent surgery for gastric adenocarcinoma in the E-Da Hospital and E-Da Cancer Hospital from January 2008 to December 2017 was performed. One hundred eighty-nine patients met the inclusion criteria. The skeletal muscle index and skeletal muscle density were analysed on the preoperative CT images. The sex-specific lowest quartile was defined as the cut-off point for sarcopenia.

Results: The skeletal muscle index (SMI) and skeletal muscle density (SMD) were evaluated as prognostic factors for these patients. In the
Kaplan-Meier curve analysis, the overall survival (log-rank test p=0.022 for SMI and p=0.028 for SMD) was significantly longer in nonsarcopenic patients than in sarcopenic patients. A multivariate analysis was done on two subgroups: one of patients older than 65 years, and another with disease stage II, III and IV. Both subgroups had identical independent negative prognostic factors for overall survival; SMD-sarcopenia, advanced disease stage (III, IV), hypoalbuminemia and a Charlson comorbidity index ≥3. Furthermore, in the multivariate analysis, SMI-sarcopenia, hypoalbuminemia, severe postoperative complications (Clavien-Dindo classification ≥3), and open total gastrectomy were independent prognostic factors for a length of hospital stay longer than 14 days in the all patients.

Conclusion: SMI-and SMD-sarcopenia were related to poor overall survival in patients with gastric cancer who underwent curative intent surgical treatment. SMD-sarcopenia was an independent prognostic factor in patients older than 65 years, and in patients with disease stage II, III, IV. Our study also demonstrated that SMI-sarcopenia was an independent risk factor resulting in a length of hospital stay longer than 14 days in the all patients. However, there was no association between sarcopenia and progression-free survival nor between sarcopenia and severe postoperative complications.

P16 Falls and Its Factors Association among the Hill Tribe Elderly Population

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Keywords: elderly, frailty, hand grip strength, gait speed, fall risk.

Methods: A cross-sectional study was conducted. Participants were recruited from 61 hill tribe villages in Chiang Rai province, Thailand who had been identified as one of six main hill tribe groups and age more than 60 years old. A validated questionnaire was developed and used for data collection. Timed up and go test (TUG) were used for assessing the dynamic balance for detected risk of falls in the elderly. A simple random method was used to select the participants. Logistic regression was used for evaluating the associations between variables at the significant level alpha=0.05.

Results: Totally, 351 participants were recruited into the study with mean age at 69.54 years (SD=7.02), 51.9% were women, regarding the fall history in the last 6 months, it was found that 9.7% and 38.2% were risk of falls measured by TUG. The multiple logistic regression model showed that two variables were associated with falls among the hill tribe elderly population; tribe and tooth diseases. Lahu tribe had a greater chance to risk of falls than Akha with OR=1.07 (95% CI=0.37-3.08), Lisu with OR=1.07 (95% CI=0.05-0.34) and Hmong with OR=0.17 (95% CI=0.07-0.46). The hill tribe elderly who had tooth disease had a greater chance to risk of falls than those who did not problem with OR=0.44 (95% CI=0.24-0.79).

Conclusion: It is important to determine the associated factors of falls so that appropriated falls prevention programs could be formulated and implemented to suit the hill tribe setting.

Keywords: fall, prevalence, factors, hill tribe elderly.

P17 Association between Hand Grip Strength, Gait Speed, Frailty Level and Fall Risk among the Community-Dwelling Older Adults in Northern Thailand

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Introduction: Frailty and sarcopenia change the physiological pathology in the elderly or it can the geriatric syndrome which affects the health outcomes including falls, disability and mortality.

Objective: To examine the association between hand grip strength, gait speed, frailty level and fall risk among community-dwelling older adults in Northern Thailand.

Study Design: A cross-sectional study was used in this study.

Methods: This study had a total of 333 elderly. Participants were more than equal sixty-five years old. The elderly who had immobility, were bedridden, had disability, severe audio and visual impairment, cancer and heart disease, cognitive impairment, severe depression, drug use, and alcoholism were exclusion criteria. The study tools were: 1) Fried’s frailty phenotype to assess frailty which had five criteria and can categorized as 0 score (non-frail), 1 to 2 score (pre-frail) and 3 to 5 (frail), 2) Time-up-and-go test (TUG) was to assess the fall risk. These steps were: from sitting in a chair, standing up, walking 3 meters, turning around, walking back, and sit down; the cutoff levels for TUG is ≥13.5 seconds. 3) Hand grip strength test was measured by handgrip dynamometer, which showed the maximum isometric strength. 4) Gait speed participants walked 4.5 meters. This was measured using a stopwatch, and the test started the time when the participant stepped over the starting line and stopped when at the end line. We used descriptive statistical and multiple linear regression to examine the association.

Results: The elderly were females (64.9%) and males (35.1%). The prevalence of frailty was 8.7%, pre-frailty was 78.4% and non-frailty was 12.9%. The total of history fall was 9.91%. In multiple linear regression analysis with adjusted by gender, age, co-mobility and polypharmacy, hand grip strength was negatively associated with frailty score (p<0.001, B=-0.057, SE=0.007). Gait speed was positively associated with frailty score (p<0.001, B=0.139, SE=0.015). In addition, we found the level of frailty was associated with fall risk in the elderly (p<0.001).

Conclusion: Weakness of hand grip strength and abnormal gait speed were associated with frailty in the elderly. Also, the elderly with frailty had high risk fall. Therefore, it is important to assess muscle strength and gait speed among the elderly as it can be a predictor to frailty and fall risk.

Keywords: elderly, frailty, hand grip strength, gait speed, fall risk.

P18 Frailty Defined by 19 Items as a Predictor of Short-Term Functional Recovery in Patients with Hip Fracture

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Introduction: Many hip fracture patients have decreased functional status inhibiting recovery to pre-fracture functional status. The prevalence of frailty in patients with hip fracture is high, but little is known how frailty is associated with functional recovery. The aim of this study was to determine whether frailty can predict functional recovery and clinical outcomes during the acute phase in hip fracture.

Methods: This study was retrospective observational study from two acute hospitals. Participants were recruited from hip fracture patients who underwent surgery. The main exposure was frailty defined using 19-item modified Frailty Index (mFI). The main outcome was functional
Prevalence of Sarcopenia Defined Using the Asia Working Group for Sarcopenia Criteria in Japanese Community-Dwelling Older Adults: A Systematic Review and Meta-Analysis

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Several different clinical diagnostic criteria for sarcopenia have been reported worldwide. The most utilized method for determining sarcopenia in Japan is the judgement criteria based on the Asian Working Group for Sarcopenia (AWGS) consensus published in 2014. AWGS consensus basically follows EWGSOP, but the cut-off values for the decrease in muscle strength (<26 kg for men and <18 kg for women), walking speed (<0.8 m/sec), and muscle mass (7.0 kg/m² for men and 5.4 kg/m² for women measured using dual X-ray absorptiometry, and 7.0 kg/m² for men and 5.7 kg/m² for women measured using bioimpedance analysis) have been revised according to the results from regional cohort studies for Asians. This systematic review and meta-analyses aimed to calculate the pooled prevalence of sarcopenia based on the AWGS criteria, among Japanese community-dwelling older adults. This study also performed meta-analyses stratified according to sex. We reviewed literature on sarcopenia published by researchers from Japan, including those represented on the AWGS, from February 2014 until October 2018. Studies using criteria other than AWGS for diagnosing sarcopenia and those including patients with diseases (e.g., Alzheimer’s disease and diabetes mellitus) were also excluded. This systematic review and meta-analysis encompassed 9 studies including 7,974 Japanese community-dwelling older adults for overall prevalence of sarcopenia. In the stratified analysis according to sex, 3,723 older men and 4,367 older women were included. The prevalence of sarcopenia in the overall, male, and female participants, as per individual studies, ranged from 4.7% to 25.7%, 4.9% to 25.0%, and 4.5% to 26.1%, respectively. Significant degrees of heterogeneity were found across studies for sarcopenia prevalence among the overall, male, and female participants (I²=92.6% to 97.0%, p <0.01). Therefore, random-effects models were used to estimate the pooled prevalence of sarcopenia. The pooled prevalence rates of sarcopenia based on AWGS in Japanese community-dwelling older adults, using random-effects models were as follows: overall, 9.9% (95% confidence interval, 6.2% to 15.4%); men, 9.8% (6.2% to 15.2%); women, 10.1% (6.4% to 15.5%). Similar prevalence rates in older men and women were found. The prevalence of sarcopenia using the European Working Group on Sarcopenia in Older People (EWGSOP) definition in a previous systematic review was 1-29% in community-dwelling populations, 14-33% in long-term care populations, and 10% in the only acute hospital-care population with regional and age-related variations. The findings of this study would be useful in framing community-based strategies and advanced studies for sarcopenia prevention.

Keywords: sarcopenia, prevalence, AWGS criteria, muscle mass.

P20 Prevalence of Sarcopenia in Community-Dwelling Older Adults Using the Definition of the European Working Group on Sarcopenia in Older People 2: Findings from the Korean Frailty and Aging Cohort Study

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Background: In October 2018, the European Working Group on Sarcopenia in Older People 2 (EWGSOP2) updated their original definition of sarcopenia to reflect the scientific and clinical evidence that has accumulated over the last decade.

Objective: To determine the prevalence of sarcopenia in a large group of community-dwelling older adults using the EWGSOP2 definition and algorithm. A second objective was to compare the prevalence of sarcopenia between the EWGSOP2 and different sarcopenia definitions (EWGSOP1, AWGS, IWGS, and FNIH Sarcopenia Project).

Design: A cross-sectional study.

Setting: The nationwide Korean Frailty and Aging Cohort Study (KFACS).

Subjects: A total of 2,099 ambulatory community-dwelling older adults, aged 70–84 years (mean age, 75.9±4.0 years; 49.8% women) who were enrolled in the KFACS.

Methods: Physical function was assessed by handgrip strength, usual gait speed, the five-times-sit-to-stand test, the timed up-and-go test, and the Short Physical Performance Battery. Appendicular skeletal muscle mass (ASM) was measured by dual-energy X-ray absorptiometry.

Results: According to the criteria of the EWGSOP2, the sarcopenia indicators of combined low muscle strength and low muscle quantity were present in 4.6–14.5% of men and 3.0–14.4% of women. The severe sarcopenia indicators of combined low muscle strength, low muscle quantity, and low physical performance were present in 0.3–2.2% of men and 0.0–6.2% of women. Compared with low muscle quantity calculated using the height-adjusted ASM (47.9% of men and 33.5% of women), the prevalence of sarcopenia was higher when the absolute ASM (63.2% of men and 80.1% of women) was applied. Using the clinical algorithm with SARC-F as a screening tool, the prevalence of probable sarcopenia (2.2%), confirmed sarcopenia (0.9%), and severe sarcopenia (0.4%) was low. Based on the EWGSOP1, EWGSOP2, IWGS, AWGS, and FNIH Sarcopenia Project, the prevalence of sarcopenia ranged from 8.4% to 25.5% in men and from 3.0% to 16.2% in women. The prevalence of severe sarcopenia defined by the EWGSOP1 (2.6%), EWGSOP2 (1.4%), and slow gait speed definition of the FNHI Sarcopenia Project (1.4%) showed no significant difference between the sexes.

Conclusion: The prevalence of sarcopenia among community-dwelling older individuals varied depending on which components of the revised EWGSOP2 definition were used; (e.g., the tools used to measure muscle strength and the ASM indicators for low muscle quantity. The prevalence of probable sarcopenia according to the results of grip strength and chair stand tests showed a significant difference between the sexes. Furthermore, the revised EWGSOP2 definition using the TUG to assess physical performance yielded the lowest prevalence of severe sarcopenia.
Keywords: sarcopenia, muscle strength, physical function, EWGSO2, community-dwelling older individuals.

P21 Cognitive Profile of Motoric Cognitive Risk Syndrome in Korean Older Adults: Results from Korean Frailty and Aging Cohort Study (KFACS)

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Aim: We investigated the prevalence of motoric cognitive risk (MCR) syndrome, and examined the association of MCR with cognitive function in community-dwelling older adults in the nationwide Korean Frailty and Aging Cohort Study.

Methods: We analyzed 2,881 individuals (52% women, mean age: 75.9 years) who were free of dementia and unrestricted in their activities of daily living. MCR syndrome was defined as the presence of subjective cognitive complaints and slow gait ≥1.0 standard deviations below age- and sex-specific means. Cognitive function was assessed using the Korean version of the Consortium to Establish a Registry for Alzheimer’s Disease Assessment Packet and the Frontal Assessment Battery.

Results: A total of 231 participants met MCR criteria (prevalence=8.02%; 95% confidence interval [CI]: 7.07–9.08%) for adults aged 70–84 years. The prevalence of MCR did not increase with advancing age: 70–74 years, 8.90%; 75–79 years, 7.06%; and 80–84 years, 8.04%. There were no sex-related differences in the prevalence of MCR. MCR syndrome was associated with global cognitive function, processing speed, attention, and executive function after adjusting for various confounders (all P <0.05). Participants with MCR were also at higher risk of global cognitive dysfunction (odds ratio [OR]: 1.85; 95% CI: 1.10–3.13) and cognitive impairment (OR: 1.62; 95% CI: 1.20–2.18) compared to those without MCR.

Conclusion: MCR syndrome is related to global cognition, processing speed, attention, and executive function, but not memory. Refinements of subjective cognitive complaints assessment tools are needed to establish a more accurate concept of MCR.

Keywords: cognitive function, gait speed, geriatrics, older adults, syndrome.

P22 Associations between Limits of Stability and Body Composition, Falls and Physical Performance with a Focus on Sarcopenia

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Background: Posturography provides accurate and specific data regarding static posture including limits of stability (LoS), centre of pressure and sway velocities. There is currently limited research investigating the links between LoS as a total area (cm²), falls, fractures, physical performance and body composition, all of which can be related to sarcopenia. This study aimed to determine whether individuals presenting with a LoS <170 cm² differ from others with respect to body composition, falls, efficacy and physical performance. We also aimed to determine whether those with LoS <170 cm² had increased likelihood of recurrent falls and components of sarcopenia.

Methods: This was a cross-sectional study of 357 community-dwelling older adults aged ≥65 years old from Western Melbourne, Australia. Analysed pooled data was collected from 2 studies. The first study included participants who were referred to an outpatients clinic for being at high risk of falls and/or fractures. Participants of the second study were assessed with an aim to determine environmental and biological risk factors for sarcopenia. The following measures were used for analysis: falls and fracture history, appendicular lean mass divided by height squared (ALM/h²), body fat %, gait speed, handgrip strength, Short Physical Performance Battery (SPPB), falls efficacy scale (FES-I), activities-specific balance confidence scale (ABC). Sarcopenia was diagnosed using EWGSO2 guidelines. Data were not normally distributed and are reported as median (IQR). Mann Whitney U test was performed to determine differences between participants with limits of stability ≥170 cm² or <170 cm², and logistic regression to determine odds ratios for poor performance with significance set at p<0.05.

Results: Median (IQR) age of participants was 77 years (71-82; 72.8% women). The majority of participants presented with limits of stability <170 cm² and a history of recurrent falls (70.8% and 46.8%, respectively). Median (IQR) measures for physical performance were: gait speed 0.745 m/s (0.548-1.013), handgrip strength 23 kg (18-30) and Short Physical Performance Battery of 6 (6-10). Median FES-I score indicated a moderate fear of falling at 34 (24-45) with ABC of 55% (36-74). Serum vitamin D was 69 nmol/L (54-84). Significant differences were evident between normal and reduced LoS for ALM/h² for those who were older, or had recurrent falls, fear of falling, poorer physical performance measures and less ability to stand with eyes closed on foam surface. Higher LoS was significantly associated with fewer multiple falls (OR 0.46, 95% CI 0.26-0.83), increased gait speed (OR 12.41, 95% CI 4.75-32.41) and increased handgrip strength (OR 1.09, 95% CI 1.05-1.15), but not ALM/h² or sarcopenia.

Conclusion: LoS presents an important measure of an individual’s overall balance. Although causation could not be determined, LoS was linked to muscle mass, strength, function and fear of falling, factors which may explain the increased likelihood of recurrent falls in sarcopenia.

P23 To Evaluate the Benefits of Nutritionally Balanced, “Ready-to-Eat” Texture-Modified Meals in Optimizing the Nutritional Intake of Older People with Risk of Sarcopenia

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Background: Sarcopenia is defined as the loss of muscle strength and function due to loss of muscle mass. Loss of muscle mass is related to insufficient intake of protein in the diet and lack of activity in the muscles in healthy people. Sarcopenia, frailty and dysphagia are also common with older adults. Nutrition-related sarcopenia often from inadequate dietary intake could be contributed by malabsorption, gastrointestinal disorders, or use of certain medications which cause anorexia/loss of appetite. Sarcopenia can cause varying physical function disorders, including dysphagia. Dysphagia is a significant risk factor for the development of aspiration pneumonia, which is a common reason for hospital admission in the frail older population. One of the treatments for dysphagia is through modification of food texture to reduce aspiration risk and increase dietary intake. Texture-modified diets facilitate eating and can help significantly by increasing energy and protein in the diet, which can help reduce the risk of malnutrition, loss of muscle mass and hence sarcopenia.

Objectives: The objectives of this study are to evaluate the benefits of nutritionally balanced, ‘ready-to-eat’ texture-modified meals on the dietary intake of older adults and also to investigate the impact of the meals on nutritional status to help reduce the risk of sarcopenia.

Methods: There were two phases to the study procedure.

Product development phase: Fourteen recipes in different texture
modified consistency were developed by the chef and dietician. The study meals were ‘ready-to-eat’ and each meal was designed to meet 25% of the Recommended Daily Allowance (RDA) for Singapore adults. Meals were evaluated by a panel of healthcare professionals and a focus group of patients.

Clinical intervention phase: Thirty-seven subjects recruited from two nursing homes were randomised into two groups. The control group was served routine nursing home diet while the intervention group was served study diet for three months. Anthropometric, biochemistry and nutritional status were analysed. Comparisons of data were made at baseline and at the third month and between the both groups.

Results: Improvements in weight, mid-upper arm circumference measurements and arm muscle area has been found in the intervention group after three months. Subjects in the intervention group have greater change in weight (3.57% vs 1.98%), mid-upper arm circumference measurements (1.20% vs 0.0%) and arm muscle area (242.72% vs 27.0%) as compared to the control group. Malnutrition risk scoring was also found to have improved in the intervention group. Greater change in albumin level has been observed in the intervention group (6.0% vs 3.13%).

Conclusion: Nutritionally balanced, culturally appropriate ‘ready-to-eat’ texture-modified meals can be beneficial and has positive impact on the nutritional status of the older people with dysphagia. This will help to reduce the risk of aspiration pneumonia, and associated hospitalization. Availability of these meals will also ensure optimal nutrient intake in the older persons, thus preventing or slowing the progression of sarcopenia. Maximizing muscle mass can improve function, strength, endurance, and general health.

Keywords: dysphagia, frailty, malnutrition, sarcopenia, texture-modified diet.

P24 Association between Red Cell Distribution Width and Frailty in Outpatients at a Frailty Clinic in Japan

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Aim: Adverse outcomes have been linked to elevated red cell distribution width (RDW) in some diseases such as heart failure, inflammatory disease, stroke and so on. Previous research had shown that anemia is related to frailty. We aimed to clarify the cross-sectional association between RDW and frailty in outpatients visiting a frailty clinic.

Methods: The subjects were 496 patients (156 men: the median age of 78 years, 340 women: the median age of 77 years). Frailty was evaluated using the Japanese version of the Cardiovascular Health Study (J-CHS) criteria. We classified subjects into the tertiles of RDW (%). The characteristics of subjects and the prevalence of frailty in each tertile group were compared using the Kruskal-Wallis test or the Chi-square test. The association between RDW and frailty was analyzed by the logistic regression model. The independent variable was RDW (%), as a continuous variable, the dependent variable was frailty, and the covariates were sex, age, BMI, and medications.

Results: One hundred fifty-two patients were frail. Range of RDW was the tertile 1: 11-13, the tertile 2: 14-14, and the tertile 3: 15-29. There were significant differences of age, usual walking speed, grip strength in men, and the prevalence of frailty among RDW tertile groups (p <0.05). We found a significant association between RDW (%) and frailty with an odds ratio (95% CI) of 1.124 (1.004-1.259), after multivariable adjustment.

Conclusion: An increase in RDW (i.e., higher variation in red blood cell size) was significantly associated with frailty. We need to verify whether RDW can be used as a biomarker of frailty in the future study.

Keywords: red cell distribution width, anemia, frailty, biomarker, outpatients.

Author Contributions: Conceptualization, Kaori Kinoshita; methodology, Kaori Kinoshita, Shosuke Satake, Yasumoto Matsu and Hidenori Arai; writing-original draft preparation, Kaori Kinoshita; writing-review and editing, Shosuke Satake, Yasumoto Matsu and Hidenori Arai; supervision, Hidenori Arai; project administration, Yasumoto Matsu.

P25 Preoperative Sarcopenia Screening for Gastric Cancer Patient

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Background: Japan is facing an unprecedented aging society. Along with that, surgery for elderly people is also increasing. However, surgery for the elderly has many difficulties and complications, and it is important to manage various comorbidities and complications. We evaluate sarcopenic state for preoperative patients by using a simple and easy method, measuring grip strength. The aim of this study is to examine the influence of sarcopenia for perioperative state in gastric cancer operation.

Methods: We analyzed 156 cases underwent gastric cancer operation for two years. We measured grip strength for these cases before surgery for screening sarcopenic state. Patients were assigned to 2 groups according to the presence of grip strength decline (Male <26 kg, female <18 kg). Then we examined the incidence of postoperative complications, and assessed the risk factor for postoperative complication.

Results: Grip strength decline (sarcopenic state) was present in 35 of 156 patients with gastric cancer. The incidence of postoperative complications was significantly higher in the sarcopenic group than normal group (43% vs. 17%, p=0.001). In particular infectious complications including respiratory complication (14% vs. 2%, p=0.002) and thrombotic complications (14% vs. 0.8%, p=0.0003) were higher in sarcopenic group although there was no difference in complication such as anastomotic leakage (2.9% vs. 2.5%, p=0.9) and pancreatic fistula (0% vs. 3.9%, p=0.3). Multi variate analysis revealed that only the grip strength decline was a risk factor for postoperative complications (OR: 3.35, 1.15-9.88; p=0.03).

Conclusion: Preoperative grip strength measurement is easy and useful tool for predicting postoperative complications. The sarcopenic state increased the risk of infectious complications including respiratory disease. In the future, it is suggested that interventions such as respiratory rehabilitation and nutritional guidance could reduce complications of sarcopenic patients.

Keywords: sarcopenia, gastric cancer surgery, preoperative screening, postoperative complication.

P26 Relationship between the Characteristics of Skeletal Muscle and Peak Cough Flow in Community-Dwelling Older Adults

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Background: Aspiration pneumonia is a serious problem in older adults. Research has shown that certain factors substantially contribute to the development of this illness, including oral function, swallowing function, and cough strength. Our previous study specifically showed poor oral function in both sarcopenic and dynapenic older adults when compared to normal or presarcopenic older adults. However, the relationship between...
cough strength and sarcopenia classification (i.e., normal, presarcopenia, dynapenia, and sarcopenia) remains unclear.

**Objective:** This study examined the relationship between cough strength and sarcopenia classification among community-dwelling older adults.

**Methods:** This cross-sectional observational study was conducted among community-dwelling older adults in Japan. All participants were recruited through public local advertisements. Qualified respondents were 65+ years of age and could walk independently. However, subjects were excluded from study if diagnosed with severe cardiac, pulmonary, or musculoskeletal disorders or had severe cognitive or psychiatric impairments. We measured cough strength using a peak cough flow meter (Mini-Wright Standard ATS scale; Clement Clarke International, England). Cough strength measurements were taken twice for each participant, but only the maximum values were used for analysis. Participants were then divided into four groups (i.e., normal, presarcopenia, dynapenia, and sarcopenia) according to an algorithm that operationally defined sarcopenia stages based on skeletal muscle mass and function. We then compared the characteristics of each sarcopenia stage using a general linear model, Kruskal-Wallis test, chi-square test, or Fisher's exact test. We also performed multivariate analyses for peak cough flow by adjusting for age. P-values less than 0.05 indicated significant differences for all analyses.

**Results:** This study analyzed a total of 1,148 participants. Here, median age (interquartile range) was 74.0 (69.0-79.0) for men and 73.0 (69.0-78.0) for women. For men, the proportions of normal, presarcopenia, dynapenia, and sarcopenia were 72.1% (n=361), 11.6% (n=58), 9.0% (n=45), and 7.4% (n=37), respectively; for women, the proportions of these same conditions were 68.2% (n=441), 11.9% (n=77), 15.0% (n=97), and 4.9% (n=32), respectively. For both sexes, the sarcopenia and dynapenia groups had significantly lower peak cough flow measurements than the normal group (P <0.001). Further, the multivariate analyses indicated that peak cough flow measurements were significantly lower in the sarcopenia and dynapenia groups than in the normal group (both sexes) (P <0.001).

**Conclusion:** This study revealed that participants with sarcopenia and dynapenia had weaker cough strength than normal or presarcopenic participants after adjusting for age. This finding indicates that both sarcopenic and dynapenic older adults may be more likely to develop aspiration pneumonia. Future research should attempt to clarify the effects of training programs designed to help prevent aspiration pneumonia in older adults.

**Keywords:** sarcopenia, dynapenia, peak cough flow, community-dwelling older adults.

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**P27** ERK Plays a Crucial Role in Maintenance of Stem/Progenitor Cell Pool in Postnatal Muscle

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It is thought that reduced number (and also function) of muscle stem cell (MuSC) might cause age-related muscle atrophy, sarcopenia. However, it is still unclear how MuSC pool is maintained not only in elderlies but also in younger people. We recently demonstrated using new in vitro model for MuSC maintenance, which has been established from iPS cell technology and simulated microgravity culture technique, that ERK activity might be correlated with the size of MuSC pool (Hosoyama et al., 2017). In this study, we further investigated to clarify the role of ERK in MuSC pool maintenance using pharmacological and mouse genetic approaches. To inhibit ERK activity in MuSCs, human iPS cell-derived muscle stem/ progenitor cells were cultivated with MEK inhibitor, resulting in significant decrease of Pax7+ MuSCs in contrast to an increase of their progenies. In addition, conditional knockout of ERK specifically in satellite cells of genetically-engineered mice (Pax7CreERT2", ERK1"; ERK2" flox/flox" led to decrease of MuSC number and severe defect in muscle regeneration after injury. We also found reduced ERK activity in satellite cells from geriatric mice, indicating that ERK activity in MuSCs was attenuated with age. Taken together, our results suggest that ERK acts as critical regulator for MuSC pool maintenance in postnatal muscle and is a potential therapeutic target for sarcopenia.

**Keywords:** sarcopenia, muscle stem cell, stem cell pool, ERK.
Conclusion: Our study indicates that the environmental characteristics of neighborhoods were associated with physical frailty. These findings suggest that policymakers and environmental designers involved in intervention should develop both common and individual environmental strategies to improve and increase awareness of the neighborhood environment, in order to promote the reduction of frailty status among older adults.

Keywords: environmental factors, physical frailty, cohort study, aging.

P29 Rehabilitation Nutrition Care Process for Hip Fracture Post Lung Cancer Surgery: A Case Report

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Introduction: The rehabilitation nutrition care process is a systematic problem-solving technique to address the nutritional state, sarcopenia, nutrient intake, and frailty of the older adults and people with disability. In this study, a rehabilitation nutritional care process was performed for a patient with hip fractures and a history of chronic obstructive pulmonary disease (COPD) and lung cancer surgery. The patient showed an improvement from their prevailing state of sarcopenia and physical function after the rehabilitation nutrition care process.

Case: A 71-year-old woman had a medical history of COPD (onset 5 years earlier) and left upper lobe lung cancer surgery. During home oxygen therapy, she fell and was hospitalized for a right hip fracture. A femoral head replacement was performed 4 days after the injury. The patient developed left lobe pneumonia during the postoperative course and was transferred to our hospital for rehabilitation on the 18th postoperative day.

Nutrition and Physical Assessment: The patient’s height, body weight, body mass index, mini nutritional assessment short-form (MNA-SF), and Functional Independence Measure (FIM) were 150 cm, 37.4 kg, 16.6 kg/m², 6 points, and 96 points (61 motor, 35 cognitive), respectively. Her body weight prior to the COPD was 60 kg, having lost 37.7% of body weight over 5 years. Oral energy intake was 1,170 kcal/day and protein intake was 43.2 g/day. Her hand grip strength (HG) was 14.3 kg (right) and her calf circumference (CC) was 27 cm, measured on the 23rd day of hospitalization.

Assessment: Based on the Asian Working Group for Sarcopenia diagnostic criteria, muscular weakness, muscle mass reduction, and physical function decline were confirmed. Assessment for muscle mass reduction was done using the cutoff value of CC as shown by Maeda et al., 2017.

Interventions: Rehabilitation and nutritional management were performed with the goals of independent walking on 2 months later, improvement of sarcopenia, and a weight gain of 3 kg. Oral nutritional supplements were used because the patient’s dietary intake was insufficient and she had dyspnea. The amount of energy consumed during rehabilitation procedures was balanced when her energy intake was reduced; therefore, energy balance were maintained sufficiently. In addition, after her nutritional status became satisfactory, rehabilitation interventions were performed while taking into account the amount of energy intake, so that the exercise intensity during rehabilitation could be increased. On day 37, her maximum energy intake was 2,000 kcal/day and protein intake was 76.6 g/day.

Outcome: The FIM score at discharge improved to 120 points (motor 85, cognitive 35). The patient’s CC increased to 29.0 cm, HG improved to 14.9 kg, and sarcopenia was not observed at the time of discharge. The patient gained 6.3 kg of body weight, and she was discharged to her home on the 76th day of hospitalization.

Conclusion: Rehabilitation nutritional care processes might improve sarcopenia and ADL more in hip fracture post lung cancer surgery.

Keywords: rehabilitation nutrition care process, hip fracture, post lung cancer surgery, sarcopenia, chronic obstructive pulmonary disease.

P30 The Effects of 12-Week Weight Bearing Exercise using Dumbbell on Elderly

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Aim: The purpose of this study was to investigate the effect of resistance training on physical fitness, mental fitness, blood parameters, and quality of life in elderly.

Methods: People over age 65 at the S and H elderly welfare center were recruited (n=13, w=25), and randomly divided into training group (n=19) and control group (n=19). Participants in the training group performed weight bearing exercise using dumbbell for 60 minutes, two times a week, for 12 weeks. Participants in the control group didn't participate in resistance exercise programs and maintained their regular lifestyle during the intervention period. Participants were assessed for 1) physical characteristics (blood pressure, body weight, body mass index (BMI), body fat percentage, calf circumference), 2) health fitness (upper and lower extremity muscle strength, flexibility, balance, cardiovascular endurance, coordination), 3) fasting blood glucose concentration and lipid profiles (total cholesterol, triglyceride, LDL, HDL) 4) health-related questionnaires (GDS-K, FES, Quality of Life), before and after the intervention.

Results: In the training group, 1) body weight, BMI, body fat percentage decreased and calf circumference increased. 2) Upper and lower extremity muscle strength, flexibility, balance, cardiovascular endurance, and coordination improved. 3) Fasting blood glucose concentration decreased but there was no difference in the lipid profiles. 4) Depression scale, fall efficacy and quality of life improved.

Conclusion: These finding are showing that 12-week weight bearing exercise using dumbbell would improve physical characteristic related to health, muscle strength, blood parameters, depression scale, fall efficacy and quality of life.

Keywords: intervention, resistance training, elderly, weight bearing exercise, dumbbell.

P31 Promoting the Concept of Sarcopenia in Hong Kong with the Hong Kong Sarcopenia Guideline

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Background: Sarcopenia is a medical disorder (ICD-10 code M62.84) defined by the loss of muscle mass plus quality and function with increased risk related to age. Starting at 40 years, healthy adults can lose up to 8% of their muscle mass per decade until 70 years of age, after which the loss increases to up to 15% per decade. Sarcopenia is associated with poor health outcomes, including osteoporosis, falls and fractures, impaired quality of life and increased mortality. With the aim to drive the awareness of sarcopenia in Hong Kong, an expert panel meeting was conducted in 2018 to discuss the local situation on sarcopenia. The panel members concluded that the awareness of sarcopenia was low among healthcare professionals, diagnosis was perceived as too time-consuming and complicated and intervention was lacking due to number of reasons including nutrition and lifestyle intervention were not part of
many physicians' remit.

**Objective:** Based on the 2018 Hong Kong expert meeting on sarcopenia, a local sarcopenia guideline for Hong Kong was developed and supported by The Hong Kong Geriatric Society; The Chinese University of Hong Kong Jockey Club Institute of Ageing and Centre for Osteoporosis Care and Control to drive the awareness of sarcopenia among health care professionals with suggested detection and management methods.

**Recommendation:** Among several tools for screening sarcopenia, SARC-F is deemed as an easy to use and effective tool for rapid assessment and has been validated in Hong Kong. Routine screening with SARC-F is recommended in all adults in the community aged 60+ years and 40+ when risk factors are detected. A sarcopenic adult can be recommended one, or a combination, of the following: (1) dietary modification with up to 1.5g/kg/d of protein or even higher in the severely ill or injury; (2) an exercise programme where patients should be encouraged to exercise to the maximum extent they are able to; and (3) oral nutritional supplementation (ONS) with a dose of 3.0 g calcium β-Hydroxy β-Methylbutyrate (CaHMB; 1.5g twice daily) for effective muscle protection. In all hospitalized patients aged 60+ years, initiation of HMB-containing ONS for muscle protection for the duration of the hospital stay is also recommended.

**Conclusion:** SARC-F is recommended for routine screening in the community. The optimal management of sarcopenia involves the increased intake of dietary protein by older adults (65+) compared with younger adults, continued participation in routine exercise or physical activities and, where appropriate, supplementation with HMB to sustain or improve muscle mass.

**Keywords:** sarcopenia, SARC-F, β-Hydroxy β-Methylbutyrate. HMB.

**P32 Prevalence and Characteristics of Physical Frailty among Community-Dwelling Korean Older Adults: Findings from the Korean Frailty and Aging Cohort Study**

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**Background:** Frailty is a state characterized by the progressive loss of reserve capacity and increased vulnerability to stressors and is associated with adverse health outcomes. Frailty is important from the social and public health perspective and it should be prevented through appropriate intervention. Hence, understanding the characteristics of frailty is important for determining the risk associated with frailty and methods of screening and early intervention. Today, both the national and international medical literature lack frailty data for large samples of the Korean older adult population. We aim to describe the prevalence and characteristics associated with physical frailty in a large group of community-dwelling older adults enrolled in the nationwide Korean Frailty and Aging Cohort Study (KFACS).

**Methods:** We analyzed 2,907 participants (mean age, 76.0±3.9 years; 52.4% women) who underwent frailty assessment from the baseline data of adults aged 70–84 years obtained from the KFACS. Physical frailty was operationalized using the modified Fried frailty criteria, which cover five components: weight loss, exhaustion, weakness, slowness, and low physical activity. The data that we analyzed included sociodemographic (8 items), physical (9 items), physical function-related (4 items), biological (17 items), lifestyle-related (8 items), health-related (8 items), medical condition-related (17 items), psychological (7 items), and social (7 items) factors. Multiple forward stepwise logistic regression analyses were carried out to identify the strongest correlation with frailty.

**Results:** In total, 47.0% (95% CI 45.2–48.8%) of the study population were pre-frail, and 7.8% (95% CI 6.9–8.9%) were frail. There were no differences in prevalence of frailty by sex (7.1% for men and 8.5% for women; P=0.084). Frailty was more common in older age groups, and its prevalence increased with advancing age: 70–74 years, 2.9%; 75–79 years, 8.2%; and 80–84 years, 15.8%. There was a significant difference in frailty status according to most factors, with the exception of some biomarkers, some diseases, current smoking status, and low interaction with neighbors (all P <0.05). In stepwise logistic regression analyses, the most influential factors for frailty were sarcopenia, current smoking status, risk of malnutrition, severe mobility limitation, depression symptoms, poor self-perceived health, low interaction with friends, high hemoglobin A1c, elevation of high sensitivity-CRP, low physical performance, old age, lack of 25-hydroxyvitamin D, and poor quality of life.

**Conclusion:** The prevalence of physical frailty in older Korean adults is similar to that reported in other populations. Frailty correlates with a broad range of sociodemographic, physical, physical function-related, biological, lifestyle-related, health-related, medical condition-related, psychological, social, individual, and population-level factors. These factors should be considered when developing interventions aimed at preventing frailty among community-dwelling Korean older adults.

**Keywords:** older adults, KFACS, frailty, prevalence, characteristics.

**P33 Difference in Frailty and Its Components among Rural, Suburban, and Urban Dwelling Older Adults: Korean Frailty and Aging Cohort Study (KFACS)**

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**Background:** Since frailty is closely related to the life expectancy level and the quality of life of older adults, it is significant to not only compare, but further analyze its health gap between urban and rural; it is necessary to outline the status quo by comparing and analyzing regional health inequalities in South Korea. The purpose of this study is to compare the prevalence of frailty and age-related health conditions of community dwelling older adults by residing area (rural, suburban, and urban) in South Korea.

**Methods:** This study analyzes the data of community dwelling older adults from age 70 to 84 (n=2,998, 52.5% women) by regional differences – urban (n=827), suburban (n=1,262), rural (n=909) – gathered by trained clinical research coordinators at 10 different centers from nation-wide cohort study, Korean Frailty and Aging Cohort Study (KFACS) throughout 2016 to 2017 (two years of baseline study).

**Results:** Frailty was more prevalent in rural women (p <0.01), while urban men were most healthy (p <0.01). The risk of frailty increased as they age in all three areas equally. In age between 80-84, the prevalence of frailty was 10.2% when living in urban area, 17.3% in suburban, and 19.1% in rural area (p <0.01). There were no statistical difference in risk of frailty between residing area. The risk of exhaustion among five clinical features of measuring frailty (unintentional 4.5 kg weight loss, low activity, exhaustion, weakness, and low walking speed) increased for both men (95% CI 0.422-0.673) and women (95% CI 1.434-2.099) in suburban area, and women (1.800-2.851) in rural area, while the risk of slow walking speed increased for only women in suburban (95% CI 0.490-0.835) and rural area (95% CI 1.032-1.830).

**Discussion:** This comparison provides useful data to inform government policies. The associated factors should be further considered for targeting particularly vulnerable individuals.

**Keywords:** frailty, incidence, elderly, risk factor, comparison.

**P34 How Much Dose Edema Increase Calf Circumference in Muscle Mass Measurement?**
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Aim: Edema of the lower limb certainly increases calf circumference, which is a useful and convenient index to assess the amount of skeletal muscle mass in clinical settings. However, little is known about how much the edema increases the circumference. The aim of this study was to clarify the mean increment of calf circumference in patients with edema.

Methods: The study included 2,101 hospitalized patients aged ≥65 years. The patients were divided by the presence of lower limb edema, and 1:1 matching was employed. This multi-factor exact matching uses as variables age (caliper 2 years), body height (caliper 5 cm), hand-grip strength (caliper 2 kg), and the Performance Status score. A matching model was made for each sex. Balances of the matched variables were examined. Other nutritional variables including the body weight were compared between the edema and non-edema groups. Differences of the mean calf circumference in each of the male and female models, and mean differences in the calf circumference between matched pairs were obtained in each model.

Results: The mean age of the patients was 79.7 years for female patients and 78.6 years for male patients. 602 patients (28.7%) had edema in the lower limb. The multi-factor exact matching models composed of 508 for female patients and 396 for male patients. The balance of matching variables seemed to be excellent in each model. Both models showed that the edema groups revealed a significantly greater body weight than the non-edema groups, suggesting edema increased the body weight. The mean calf circumferences of female patients in the edema and non-edema group were 30.3±3.5 and 28.7±3.0cm, respectively. Those of male patients in the edema and non-edema group were 32.2±3.7 and 30.1±3.0cm, respectively. Finally, the mean differences between matched pairs were 1.6 cm for female patients [95% CI 1.1-2.1], and 2.1 cm for male patients [95% CI 1.6-2.7].

Conclusion: The calf circumference in patients with edema of the lower limb increased approximately 1.6 cm for female patients and 2.0 cm for male patients. The increased length should be subtracted from the measured length in case of edema, so that overestimated skeletal muscle mass will be avoided in clinical practice.

Keywords: anthropometry, assessment, body composition, sarcopenia.

P36 Association between Spatial-Temporal Gait Parameter and Frailty in Community-Dwelling Older People

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Introduction: Frailty is a syndrome in older adults that carries an increased risk for poor health outcomes including falling, disease, hospitalization and mortality. Gait disorder which has various subtypes such as slowing down a gait speed, narrowing a stride length, decreasing a cadence and increasing wandering could coexist with frailty, however, these subtypes are payed less attention to other than a gait speed. The purpose of this study is to examine which gait characteristics are associated with frailty most closely.

Methods: Cross-sectional analysis of the baseline data of an interventional study for cognitive preservation with physical exercise (the TOyota Preventional Intervention for Cognitive decline and Sarcopenia (TOPICS trial)) was performed. In which community-dwelling older adults with self-reported cognitive decline were recruited.

Spatial-temporal gait parameter (mean of gait speed [cm/sec.], stride time [sec.], cadence [steps/min.], double support time [msec.], stride length [cm] and step width [cm]; coefficient of variation of stride time, double support time, stride length and step width) were assessed using electronic walkway. To account for acceleration and deceleration phase in gait, start and goal point was set 1.5 m prior to and beyond the end of sheet. After the familiarization trial, participants in walking shoes performed 5 trial of self-selected usual gait.

An 88-item frailty index (FI) consisting of five components (mood, physical, disease, cognition and quality of life; QOL) was created according to previous study. The total scores of FI were constructed by dividing total deficit values determined by the severity of deficit by the total number of included items. Mood component was documented by geriatric depression scale-15 and general anxiety disorder scale. Physical parameter was measured by fall efficacy scale, skeletal muscle mass index (appendicular skeletal muscle mass/height2 <7.0 kg/m2 in men or <5.7 kg/m2 in women), unintentional weight loss (2.0 kg in recent 6 months), weakness (grip strength <26.0 kg in men or <18.0 kg in women), slow walking speed (<1.0 m/sec.), and low physical activity (no engagement in moderate or low levels of physical exercise or sports aimed at health) according to the Japanese version of the cardiovascular health study criteria. Disease component included eleven age-related chronic diseases. Cognition component was documented by everyday memory questionnaire and mini-mental state examination. QOL component was presented by life satisfaction index.

Relationship with gait parameter and FI were investigated by multiple liner regression analysis with adjusted by age, gender, body mass index. Two-tailed P <0.05 was set as significant value.

Results: 416 participants (mean age, 72.32±4.60; male, n=220; FI, 0.32±0.12) was examined. According to the results of multiple liner regression analysis, higher stride length (β=−0.002, P <0.01) was shown to be only significant predictor of lower FI (R2=0.11).

Conclusion: Stride length was associated with older adult’s frailty

P35 Correlation of Lumbar Multifidus with Parameters of Sagittal Balance and Sarcopenia in Elderly Women

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Purpose: The purpose of this study was to investigate the correlation of lumbar multifidus muscle assessed by ultrasound with sagittal spinal alignment and sarcopenia related parameters in elderly women.

Participants and Methods: 23 community-dwelling elderly women were enrolled. Ultrasound images of the multifidus were obtained at L5 level to measure its muscle thickness (MT) and cross sectional area (CSA). The radiographic parameters of sagittal spinal alignment examined were lumbar lordosis, sagittal vertical axis (SVA), pelvic tilt, sacral slope, and pelvic incidence. Body composition was assessed by dual-energy X-ray absorptiometry (DXA) and bioelectrical impedance analysis (BIA). Muscle strength was measured by grip strength test and isometric knee extension strength test. Physical performance was measured by 10 meter walk test (10WT), Time up and go (TUG) test and Berg balance test (BBS). Spearman’s correlation coefficients were used in the statistical analysis.

Results: MT of multifidus had significant correlations with SVA (rs=0.568, P <0.01) and BBS (rs=0.511, P <0.05). CSA of multifidus had significant correlation with SVA (rs=0.586, P <0.01), 10WT (rs=-0.463, P <0.05), BBS (rs=0.441, P <0.05), TUG (rs=-0.457, P <0.05). Muscle strength and lean body mass had no significant correlations with the ultrasound findings of multifidus.

Conclusion: Our results suggest that the morphology of lumbar multifidus measured by ultrasound has close associations with sagittal vertical axis and physical performances in old women.

Keywords: sarcopenia, spinal alignment, paraspinal muscles.
examined with FL. Narrowing a stride length might be of more importance than slowing down a gait speed in clinical and community settings.

**Keywords:** frailty, gait characteristics, stride length, community-dwelling older adults.

### P37 Effects of the Health Extension Program Using Broadcast Media on Community-Dwelling Elderly and the Relationship with Health Literacy

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**Introduction:** Health literacy (HL) is a skill to obtain, understand, and use information necessary to promote and maintain health. Impaired HL in the elderly is associated with decline in physical function, physical activity, and cognitive function. However, the effects of HL on outcomes of health interventions were not investigated thoroughly. The interventional study called Nagoya-TENG Project (Nagoya university-Toyoyama town collaborative intervention project: strategies for promoting Exercise, Nutrition, and Going out) examined the effects of the health extension program using broadcasting media for the community-dwelling elderly. We explored the impact of HL on improvement of health outcomes including body composition, physical function, cognition, mental function, and socio-environmental interaction.

**Methods:** Nagoya-TENG project, which distributed a series of integrative health promotion programs lasting for 15 minutes every day on a cable TV channel for 3 months, was designed to prevent frailty and cognitive decline for the elderly living in Toyoyama town, nishikasugaigunn, Aichi prefecture where 3,452 elders reside. The Japanese version of the European Health Literacy Survey Questionnaire (J-HLS-EU-Q47) was used as a comprehensive health literacy assessment scale. Physical performance including grip strength, normal / maximum walking speed, and International Standardized Physical Activity Questionnaire (IPAQ), body composition including skeletal Muscle Index (SMI) were assessed. Mood status was evaluated using Geriatric Depression Scale-15 (GDS-15) and apathy scale. Cognitive function was assessed using MoCA-J. Social-environmental assessment included Lubben Social Network Scale (LSNS-6), Life Space Assessment (LSA), and social capital. All participants were categorized into two groups based on the cut-off value of 26 derived from J-HLS-EU-Q47. We used a two-way analysis of variance (ANOVA) to compare the effectiveness of intervention between low HL and high HL group.

**Results:** A total of 52 participants (17 men, 35 women) were recruited in the study. At baseline, mean age of low HL group (7 men, 14 women) and high HL group (10 men, 21 women) was 74.48±5.34, and 74.43±5.08 years, respectively. In longitudinal analysis, change of GDS-15 and SMI were significantly associated with HL. After intervention, GDS-15 scores decreased in low HL group compared to high HL group (F=5.856, p=0.02). On the other hand, SMI increased in high HL group compared to low HL group (F=7.456, p=0.009). However, there was no significant interaction between HL and grip strength, normal / maximum walking speed, apathy scale, social capital, LSNS-6, LSA, and IPAQ.

**Conclusion:** A health extension program utilizing broadcast media might prevent frailty in community-dwelling elderly. HL was associated with the effect of health intervention. In the future, a large-scale study with long-term follow-up is needed to confirm the effectiveness and practicability of media-based health extension program.

**Keywords:** health literacy, physical status, cognitive status, community-dwelling elderly, broadcast media.

### P38 Relationship between Protein Intake and Frailty in Community-Dwelling Older People: From the Nagoya Longitudinal Study for Healthy Elderly (NLS-HE)

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**Introduction:** Dietary Reference Intakes for Japanese (2015) suggest protein intake ≥1.0 g/kg body weight (BW) to preserve physical function in older adults. However, only a few published studies have used this cut-off to evaluate the association between protein intake and frailty. This study examined associations between protein intake and sources of protein intake with frailty status by the 3-year follow-up.

**Methods:** A prospective cohort study (Nagoya Longitudinal Study for Healthy Elderly; NLS-HE) was designed to recruit robust community-dwelling individuals aged 60 years and older, and implemented at a community college in Nagoya, Japan. The nutrition intake status was calculated using the food frequency questionnaire (FFQ) for daily nutrient intake and 18 food groups. Frailty phenotype was defined by the Japanese version of Cardiovascular Health Study (J-CHS) criteria based on weight loss, subjective fatigue, low daily activities, slow walking speed, and low grip strength. Three or more matches were determined as frailty, one or two matches were as prefrailty, and none was to be robust. The association of protein intake including animal protein and plant protein, with frailty status after 3-year follow-up was examined by multiple logistic regression analysis, adjusted for demographics, chronic conditions, total number of functional teeth, occlusal force and hospitalization history.

**Results:** After the 3-year follow-up, 32 people were frail and 132 people were prefrail. Higher protein intake ≥1.0 g/kg BW was associated with a lower likelihood of prefraility (OR 0.68 and 95% CI 0.23-0.80) and frailty (OR 0.25 and CI 0.10-0.68) compared to lower protein intake <1.0 g/kg BW. Older people in the higher tertile of animal protein intake, but not plant protein, had a lower prevalence of frailty (p for trend=0.032).

**Conclusions:** Protein intake ≥1.0 g/kg BW and higher intake of animal protein may be beneficial to prevent of frailty in older people.

**Keywords:** protein intake, frailty, prefrailty, animal protein, food history frequency questionnaire.

### P39 Effects of Exercise and Nutritional Intervention on Body Composition, Metabolic Health, and Physical Performance in Adults with Sarcopenic Obesity: A Meta-Analysis

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People with sarcopenic obesity (SO) are characterized by both low muscle mass (sarcopenia) and high body fat (obesity); they have greater risks of metabolic diseases and physical disability than people with sarcopenia or obesity alone. Exercise and nutrition have been reported to be effective for both obesity and sarcopenia
management. Thus, we aimed to investigate the effects of exercise and nutrition on body composition, metabolic health, and physical performance in individuals with SO. Studies investigating the effects of exercise and nutrition on body composition, metabolic health, and physical performance in SO individuals were searched from electronic databases up to April 2019. Fifteen studies were included in the meta-analysis. Aerobic exercise decreased body weight and fat mass (FM). Resistance exercise (RE) decreased FM and improved grip strength. The combination of aerobic exercise and RE decreased FM and improved walking speed. Nutritional intervention, especially low-calorie high-protein (LCHP) diet, decreased FM but did not affect muscle mass and grip strength. In addition to exercise training, nutrition did not provide extra benefits in outcome. Exercise, especially RE, is essential to improve body composition and physical performance in individuals with SO. Nutritional intervention with LCHP decreases FM but does not improve physical performance.

Keywords: resistance exercise, aerobic exercise, supplementation.

### P40 Effect of Long-Term Exercise in the Middle Age on Sarcopenia and Frailty: The Role of Ubiquitin-Proteasome Regulation in Mice Skeletal Muscles

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Sarcopenia and frailty are two common geriatric syndromes which cause muscle wasting and dysfunction responsible for disability and loss of independence in the elderly. The etiology of sarcopenia and frailty is still unknown; however, the impairment of ubiquitin-proteasome system has been suggested as a potential hallmark of aging process. Exercise is one of the most powerful interventions on reversing age-related negative impacts on skeletal muscle structure and function. The purpose of this study was to examine the role of ubiquitin-proteasome system on sarcopenia and frailty and determine the effect of long-term exercise in the middle age on mice skeletal muscles. Forty-five C57BL/6N old male mice (19 to 22-month-old) conducted physical phenotype tests (e.g., muscle mass index, inverted grid test, rotated test, treadmill running test, and voluntary wheel running test) and were assigned to one of three groups: old normal (ON), old sarcopenia (OS), and old frail (OF). The criterion cutoffs for sarcopenia and frailty were set to the 20th percentile and below -1.5 SD of the cohort mean, respectively. Ten adult mice (10 to 12-month-old) were used as adult control (AC) and eighteen middle-aged mice (15 to 18-month-old, EX) exercised on the treadmill for one hour, 5-16 m/min, and three times a week for 16 weeks. The morphological changes in skeletal muscles were measured by H&E staining and protein levels of ubiquitin and proteasome subunits (19S and 20S) were determined by the Western Immunoblot analysis. One-way ANOVA was used to determine the mean difference among groups followed by a Fisher’s LSD post-hoc test. The mean cross-sectional area of TA muscle fibers was significantly different among AC, ON, OS, and OF. The ubiquitin protein level in OF was significantly higher than in AC, ON, and OS. EX was significantly lower in the ubiquitin content by 43% than OF. The proteasome 19S protein level was not different among groups. The proteasome 20S α-7 subunit content was significantly higher in OF by 60% and 38% than in AC and ON, but the 20S β-1 and β-5 protein levels were not different. The 20S α-7 subunit protein levels were significantly reduced in EX by 33% compared to OF. Increased ubiquitin and proteasome 20S α-7 subunit content may be a potential biomarker of existing frailty and exercise can contribute to attenuate risk of frailty by modulating ubiquitin and proteasome subunit contents.

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Keywords: geriatric syndrome, physical exercise, skeletal muscle physiology, ubiquitin-proteasome.

### P41 The Pattern of Changes in Muscle Mass Using Ultrasound Before and After Allogeneic Hematopoietic Stem Cell Transplantation; the Reliability and Validity of the Modality

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Introduction: Allogeneic hematopoietic stem cell transplantation (allo-HSCT) patients often have physical dysfunction and loss of muscle mass due to isolation in a sterile room, malnutrition, dysgeusia, graft-versus-host disease and high-dose steroids. Maintaining physical function and muscle mass, such as through continuous rehabilitation, is important to prevent fatigue and complications and improve quality of life (QOL). However, constant assessment of physical function and muscle mass during the course of allo-HSCT is difficult due to medical dysfunction and isolation in a sterile room. There are several studies that use ultrasound to evaluate muscle mass, but the pattern of muscle mass change using ultrasound in allo-HSCT patients and the reliability and validity of this modality are still unclear. The aim of this study was to clarify the pattern of changes in muscle mass before and after allo-HSCT using ultrasound, and to evaluate the reliability and validity of ultrasound to assess muscle mass.

Methods: The prospective observational study included 104 consecutive patients who were treated with allo-HSCT from April 2017 to March 2019. Three professionals evaluated the thickness of the quadriceps and biceps and the cross-sectional area of the tongue muscle by ultrasound. The measurement points were 3 points before, 1 month and 3 months after allo-HSCT. The inter-rater reliability was calculated using inter-class correlation (ICC), and the efficacy was assessed by comparing the median values of ultrasound and lumbar muscle mass assessed by computed tomography (CT) before allo-HSCT.

Results: The follow-up rates at 1 and 3 months after allogeneic HSCT were 92.2% and 85.4%. The inter-rater reliability was 0.966, 0.977, 0.965 for biceps, 0.962, 0.968, 0.975 for quadriceps, 0.899, 0.912, 0.897 for supraphayoid muscles before and 1 month and 3 months after allo-HSCT, respectively. Correlation scores between biceps, quadriceps and supraphayoid muscles and the lumbar muscle as measured by CT were 0.714, 0.469, and 0.583, respectively. In 85 cases, all measurement points could be evaluated. In those patients, the median muscle thickness and cross-sectional area were 18.5 mm, 17.6 mm, 16.4 mm in biceps, 21.9 mm, 19.9 mm, 18.6 mm in quadriceps, 3.14 mm2, 2.01 mm2, 2.96 mm2 in supraphayoid muscles at each measurement points. In all evaluated muscles, the muscle mass assessed 3 months after allo-HSCT was significantly lower than that assessed before allo-HSCT. The change rates in the thickness of the biceps and quadriceps muscles and the cross-sectional area of the supraphayoid muscles between before and 3 months after allo-HSCT were 9.67, -13.43, and 7.45, respectively.

Conclusion: In allo-HSCT patients, it is suggested that ultrasound is a reliable and effective modality for muscle mass assessment and an accessible option that can be used even if the patient has a medical problem or stays in a sterile room.

Keywords: allogeneic hematopoietic stem cell transplantation, ultrasound, cancer sarcopenia.

### P42 Diabetes Mellitus in Community-Dwelling Older Adults Is Associated with Decreased Walking Speed and Higher Prevalence of Dynapenia

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Higher Prevalence of Dynapenia

Keywords: geriatric syndrome, physical exercise, skeletal muscle physiology, ubiquitin-proteasome.
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Abstract Book

P43 Effects of Comprehensive Geriatric Intervention on Oral Care and Dietary Habits among Community-Dwelling Older Adults

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Introduction: Sarcopenia is considered the primary or a major component of frailty, especially physical frailty. Therefore, preventing sarcopenia and/or frailty is important for maintaining independence and quality of life among older adults. Clinical guidelines supported by the Japanese Association on Sarcopenia and Frailty recommend proper nutritional intake and exercise for the prevention and/or improvement of sarcopenia. Furthermore, oral functions (e.g., feeding and swallowing) are important nutritional intake factors. Our research group designed a comprehensive geriatric intervention program (CGIP) consisting of resistance exercise, physical activity increments, oral functional care, and a nutritional guide; then, we conducted a 12-week intervention and investigated effects of the program on oral care and dietary habits among community-dwelling older adults.

Methods: Altogether, 526 older adults were willing to participate in the 12-week CGIP. In the first and second weeks, all participants were encouraged to attend two 90-minute lectures that included instructions on exercise and lectures by a professional dental hygienist and professional diettian. Eight resistance exercises (e.g., squats) were incorporated in multiple sets. During the lectures, the following exercise equipment was provided to all participants: a triaxial accelerometer, a single set of 500 g ankle weights, and an elastic band. Additionally, participants were given daily self-monitoring logs for recording their daily step counts, resistance and oral motor exercise status (did or did not perform), and nutritional status. Before and after the intervention, a survey questionnaire assessing oral care and dietary habits was administered to inquire about oral thirst, sputum when eating, brushing habits for the teeth and tongue, dental examinations, awareness of food combinations, and nutritional status. Responses were analyzed using McNemar’s test or Wilcoxon signed-rank test. We excluded participants with missing data on the survey before and/or after the intervention. For all statistical tests, p < 0.05 was considered significant.

Results: The percentages of those who brushed their teeth more than three times a day, brushed the tongue surface, and had regular dental checkups significantly increased after the intervention. Additionally, significant decreases were noted for those who experienced oral thirst and difficulty when eating hard food. However, the intervention did not change the percentage of those who had sputum or spilt food during or after a meal. Conversely, the percentages of those who considered a combination of foods and who ate fruit every day increased afterward.

Conclusion: Results of this study indicate that a CGIP could improve oral care and dietary habits among community-dwelling older adults. Such behavioral changes may enhance physical fitness induced by exercise intervention. Therefore, this type of intervention program contributes to the prevention of sarcopenia and/or frailty.

Keywords: self-monitoring intervention, behavioral change program, sarcopenia, frailty.

P44 Dietary Patterns and Sarcopenia Parameters in Community-Dwelling Japanese Elderly: A 3-Year Prospective Cohort Study

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Introduction: Nutritional support and physical exercise were reported to prevent and reduce sarcopenia. Although adherence to Mediterranean diet is associated with a lower risk of sarcopenia in the elderly, it remains controversial whether other dietary patterns could reverse sarcopenia. The aim of this study is to clarify the association between 4 validated dietary patterns and sarcopenia in community-dwelling Japanese elderly.

Methods: A prospective cohort study (Nagoya Longitudinal Study for...
Healthy Elderly; NLS-HE) recruited community-dwelling individuals older than 60 years old those attended a community college in Nagoya, Japan in 2014. A total of 666 participants were followed up yearly over the next 3 years, from 2014 to 2017. Demographic data, anthropometric measurements including body weight and height, and sarcopenia parameters including 5-m usual walking speed, handgrip strength, and skeletal muscle index (SMI) were recorded. Nutrition, depression, and physical activity habits were assessed by mini-nutritional assessment (MNA), geriatric depression scale (GDS), and Baecke physical activity questionnaire (BPAQ). Self-reported dietary intake was assessed by a one-week food frequency recall questionnaire (FFQ) consisting of 20 items of food ingredients. Mediterranean diet (MD) score, Dietary Approaches to Stop Hypertension (DASH) score, Japanese food guide (JFG) score, and diet quality index-international (DQI-I) score were created and assessed by tertiles where Q1 had the lowest adherence and Q3 had the highest adherence. We used a Generalized Estimating Equation (GEE) model to analyze the longitudinal association between dietary adherence scores and sarcopenia parameters.

**Result:** At baseline, mean age of all participants (56.5% women) was 69.4±4.4 years. WS, HS, SMI were 1.4±0.2 (m/s), 28.9±8.1 (kg), and 6.7±1.0 (kg/m²), respectively. In longitudinal analysis, participants with higher JFG adherence scores were more likely to have higher SMI (Q3 vs. Q1: B coefficient 0.048, 95% CI 0.002-0.094) after adjusting for age, sex, education, financial status, BMI, MNA score, GDS score, and BPAQ score. However, SMI was not associated with MD adherence score, DASH adherence score, and DQI-I adherence score. In addition, walking speed and handgrip strength were not associated to any type of dietary pattern.

**Conclusion:** JFG adherence scores were positively associated with SMI in Japanese community-dwelling people aged 60 years and older. Future studies are warranted to confirm the benefits of region-specific dietary patterns.

**Keywords:** sarcopenia, dietary pattern, Japanese food guide.

**P45 IL-15Ro Is Responsible for Translocation of IL-15, Anabolic Myokine, onto the Skeletal Muscle Cell Membrane Which Is Required for IL-15 Secretion**

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**Background:** Skeletal muscle is an organ responsible not only for motor function but also for 80% of glucose metabolism. Exercise increases glucose uptake in skeletal muscle and improves insulin resistance. On the other hand, myokine is a cytokine derived from skeletal muscle, and is considered as a carrier for skeletal muscle-organ linkage. We focused on Interleukin-15 (IL-15), an anabolic myokine, and reported that skeletal muscle-specific overexpression of IL-15 improves skeletal muscle glucose metabolism via the AMPK pathway. There is no report of IL-15 secretion from skeletal muscle cells. It is considered essential for IL-15 to bind to IL-15 receptor alpha (IL-15Ra) and move to the cell membrane in order for IL-15 to be secreted from leukocytes. Therefore, we investigated how intracellular localization of IL-15 moves by binding to receptors in skeletal muscle cells.

**Methods:** The vector of IL-15 tagged with GFP (IL-15GFP) and IL-15 receptor tagged with GFP (IL-15RoGFP) were transfected into C2C12 (mouse-derived skeletal muscle cells), and then C2C12 was induced to differentiate into myotube. Transfected myotube was observed with a confocal microscope.

**Results:** IL-15-GFP was mainly expressed in the cytoplasm, and IL-15Ro-GFP was expressed on the cell membrane. When IL-15GFP and IL-15RoGFP were co-transfected, IL-15-GFP expression was translocated onto the cell membrane. When the 46th amino acid of IL-15RaGFP was mutated from glutamic acid (E) to alanine (A), IL-15-GFP did not bind to IL-15RaGFP and did not move to the cytoplasm. In addition, IL-15RoGFP and IL-15RoGFP were expressed in the cytoplasm. When IL-15-GFP and IL-15RoGFP or IL-15Ro-RyGFP were co-expressed, IL-15-GFP was not merged with IL-15RoGFP or IL-15RoRyGFP. When IL-15GFP, IL-15Ro and IL-15Ro-GFP were co-expressed, IL-15GFP merged with IL-15Ro-GFP, and the same was true when IL-15RoGFP was replaced with IL-15Ro-RyGFP.

**Discussion:** IL-15 is shown to be transported to the cell membrane surface by binding to IL-15Ro. This translocation is considered to be the first step of IL-15 secretion in skeletal muscle as well as lymphocytes. In addition, in order for IL-15 to bind 15Ry, which are essential for signal transduction into cells, IL-15Ro was essential.

**Keywords:** interleukin-15, interleukin-15 receptor, skeletal muscle cell, translocation, secretion.

**P46 Association between Muscle Strength and Silent Lacunar Infarcts: The Bunkyo Health Study**

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**Introduction:** Silent lacunar infarcts by definition, lack clinically overt stroke-like symptom, are occasionally found by brain magnetic resonance imaging (MRI) scan in asymptomatic elderly individuals. A previous study revealed that more than 25% of elderly people have silent lacunar infarcts. The main risk factors for lacunar infarcts and stroke were reported as aging, hypertension, and smoking. While a recent study showed that low muscle strength is also a risk factor for cerebrovascular events, it remains unclear whether low muscle strength is a risk factor for silent lacunar infarcts. Therefore, this study investigated the association between muscle strength and silent lacunar infarcts in the elderly people living in urban community.

**Methods:** This study included 1,536 elderly people without past history of cerebral vascular events, aged 65–84 years living in an urban area of Tokyo, Japan (Bunkyo Health Study). All participants underwent brain MRI scan and silent lacunar infarcts were defined as the presence of 1 or more lacunar infarcts. Isokinetic muscle strength of knee extensors was evaluated at angular velocity of 60 degree per seconds using dynamometer. Subjects were categorized tertiles (high, medium, and low) by muscle strength, and compared the prevalence of silent lacunar infarcts.

**Results:** Mean age of subjects was 73.0±4.4 years old and 58.9% were female. Two hundred fifty-two (16.4%) subjects were diagnosed as silent lacunar infarcts, and the subjects categorized as lower muscle strength showed higher prevalence of silent lacunar infarcts (high: 12.3%, medium: 17.7%, and low: 19.3%, p for trend 0.003), while skeletal muscle indices among the groups were similar. After multivariate adjustment by age, sex, body mass index, smoking status, physical activity, hypertension, diabetes, and dyslipidemia, the trend was still significant and the odds ratio for having silent lacunar infarcts was significantly higher in the lowest muscle strength tertile compared to the highest tertile ([high]: 1.00 (reference), medium: 1.42 (95% CI: 0.98-2.04), low: 1.48 (1.02-2.14), p for
P47 Quality and Quantity of Muscle Based on Ultrasonography Images and Physical Performance in Community-Dwelling Older Adults: Involvement of Gender Differences

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**Aim:** This study aimed to investigate the relationships between muscle quality and quantity based on ultrasonography and physical function in community-dwelling older adults and examine whether the correlations between muscle quality and physical function by gender.

**Methods:** We performed a cross-sectional analysis of 112 ambulatory community-dwelling older adults (mean age, 77.6±3.8 years; 46.4% women) enrolled in the Korean Frailty and Aging Cohort Study (KFACS). The appendicular skeletal muscle mass (ASM) was measured by dual-energy X-ray absorptiometry. Ecogenicity and thickness of the rectus femoris (RF) and vastus lateralis (VL) in thigh, and tibialis anterior (TA) and medial gastrocnemius (GM), and pennation angle of the VL, TA, and GM in the lower leg were measured using the B-mode ultrasonography. Physical function was assessed by handgrip strength, usual gait speed, repeated 5-chair stand, the timed up-and-go test (TUG), and the Short Physical Performance Battery (SPPB). The relationship between physical performance, echo intensity and muscle thickness was analyzed using the spearman correlation coefficient. The receiver operating characteristic (ROC) curves and the area under the ROC curves (AUC) were applied to evaluate the low physical performance diagnostic accuracy.

**Results:** There were no differences between men and women with regard to age and body mass index. Muscle thickness and pennation angle of the thigh and lower leg muscles in women showed lower values than the men (all P<0.05), with the exception of longitudinal and cross-sectional GM thickness, and GM pennation angle. Of 4-muscle, GM muscle showed the markedly increased echogenicities in men (89.7±19.0) as well as women (99.9±20.3). In physical characteristics, cross-sectional RF thickness (r=0.582, P<0.001) in men, whereas longitudinal GM thickness (r=0.344, P<0.05) in women was moderately association with ASM index (kg/m²). In men, cross-sectional RF thickness was statistically significant association with usual gait speed (r=0.340, P<0.01), repeated 5-chair stand (r=0.370, TUG (r=0.338), and SPPB (r=0.394). In contrast, cross-sectional GM echogenicity in women was statistically significant association with usual gait speed (r=0.283), repeated 5-chair stand (r=0.409), and SPPB (r=0.302). In the ROC analysis, cross-sectional RF thickness in men was the most appropriate factor for predicting slowness (AUC=0.720, 95% CI=0.545–0.889), TUG ≥12s (AUC=0.702, 95% CI=0.523–0.881), and SPPB ≥9 scores (AUC=0.724, 95% CI=0.724–0.880). In women, cross-sectional GM echogenicity was suitable parameter for predicting slowness (AUC=0.741, 95% CI=0.581–0.900), repeated 5-chair stand ≥12s (AUC=0.746, 95% CI=0.601–0.891), and SPPB ≥9 scores (AUC=0.765, 95% CI=0.626–0.889).

**Conclusion:** Our study might be the first report to reveal the relationships between muscle quality and quantity obtained from ultrasonography and physical function with gender differences. Especially the RF, which mainly consists of more fast-twitch fibers in men; on the other hand GM, which mainly have much muscle volume of lower limb muscles in women might be a usefulness muscle for predicting the physical function in community-dwelling older adults.

**Keywords:** physical function, ultrasonography, thickness, echogenicity, lower-limb muscle, geriatrics.
reproducibility of continuous measurements and the test-retest reliability, and the correlation analysis was performed between body composition by BIA and by DOS.

**Results:** Body composition variables (muscle mass: FDS, ICC=0.997, 95% CI 0.994-0.999, p <0.001; VM, ICC=0.997, 95% CI 0.994-0.999, p <0.001 and fat mass: FDS, ICC=0.995, 95% CI 0.992-0.997, p <0.001; VM, ICC=0.990, 95% CI 0.978-0.995, p <0.001) using DOS showed a high reproducibility for continuous measurements at local measurement sites. Also, muscle mass (FDS, ICC=0.917, 95% CI 0.853-0.953, p <0.001; VM, ICC=0.963, 95% CI 0.934-0.979, p <0.001) and fat mass (FDS, ICC=0.884, 95% CI 0.796-0.934, p <0.001; VM, ICC=0.871, 95% CI 0.771-0.927, p <0.001) measured with DOS showed a high test-retest reliability at local sites. The Non-OB group was found to have more muscle mass (FSD, +44.2%, p <0.001 in men, +49.9%, p <0.001 in women; VM, +37.7%, p <0.001 in men, +14.2%, p <0.01 in women) and lower fat mass (FSD, -54.4%, p <0.01 in men, -19.4%, p <0.001 in women; VM, -22.2%, p <0.001 in men, -4.3%, p <0.05 in women) in the local area than the OB group. In addition, the muscle mass (VM, L=0.560, p <0.001) and fat mass (FDS, r=0.409, p <0.001; VM, r=0.203, p <0.05) measured by DOS were significantly positive correlated with body composition by BIA.

**Conclusion:** The local muscle and fat mass measured by DOS may be used as a tool to assess body composition of the local area in normal weight and obese individuals. Furthermore, the application of DOS imaging system may be considered as a simple method for assessing local muscle mass for the diagnosis of sarcopenia.

**Keywords:** diffuse optical spectroscopy imaging, body composition, skeletal muscle mass, fat mass, obesity.

### P50 Effects of Whole Body Vibration Training Using Side-Alternating Vibration Platform with Tilt Table in Hospitalized Older Adults with Sarcopenia: A Randomized Controlled Pilot Study

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**Background and Aims:** Sarcopenia is defined as the loss of skeletal muscle mass and strength with increased age. Increased activity following whole body vibration (WBV) has been reported in patients with chronic illness, but few studies reported the effect of WBV on the physical function of patients with acute illness. This study aimed to investigate the effects of WBV training using vibration platform with tilt table on muscle mass and physical performance in hospitalized older adults with sarcopenia.

**Methods:** Inclusion criteria were as follow: 1) age more than 70 years old 2) unable to independently ambulate due to long term hospitalized care 3) patient who was diagnosed as sarcopenia. Patient who underwent surgical implantation because of trauma during recent 2 months, or patient who had medically unstable course was excluded. Participants were randomly allocated into WBV group using side-alternating vibration platform with tilt table vs. conventional physical therapy composed of passive range of motion exercise, balance and ambulation training. It took 40 minutes a day, 5 sessions per week for both groups to receive the intervention. In WBV group, subjects lied down on tilt table at 60 degree with bare foot. Then, subjects stood on the platform board which could vibrate. All subjects were in a squat position, with flexed knee at 30 degree. During whole body vibration, frequency was 12 Hz and amplitude was 4 mm. Initial evaluation included muscle mass by imbody, hand grip force, balance by Berg balance scale (BBS), gait function by gait timed get up and go (TUG) test and gait speed, activities of daily living (ADL) by Modified Barthel index (MBI), cognitive function by Mini-Mental State Examination (MMSE) and mood by short form of Geriatric Depression Scale (SGDS-K). Muscle strength of lower limbs was evaluated using manual muscle test (MMT) and isometric test. After 2 weeks, when both groups finished 10 sessions, 2nd evaluation was conducted.

**Results:** Among 23 patients, 11 participants were WBV group and 12 participants were control group. There were no significant differences between two groups in demographic characteristics (sex, age, weight and height). After intervention, both groups showed improvements in BBS (WBV group: p=0.003; control group: p=0.005), MBI (WBV group: p=0.003; control group: p=0.003) and SGDS (WBV group: p=0.02; control group: p=0.012). The effect of WBV intervention resulted in significant differences only in isometric knee extension strength (p=0.033) after 2 weeks of intervention and in isokinetic knee extension strength after a 2-week follow-up period (p=0.033), for the left leg. And TUG improved after 2 weeks of vibration in the WBV group (p=0.046).

**Conclusion:** We have demonstrated that conventional physical therapy improves balance, ADL and depression in hospitalized older adults with sarcopenia. Furthermore, additional whole-body vibration intervention for 2weeks may also improve knee muscle strength and ability of ambulation in elderly patients. A sufficiently large sample size will be necessary to produce results of future studies.

**Keywords:** whole body vibration, sarcopenia, gait.

### P51 Relationship between Muscular Force Response and Frailty Using a Newly Developed Grip Strength Measuring Device

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**Background:** We have developed a new type of strength measurement that addresses the time axis to measure physical functions and have shown the relationship of the muscular force response with basic and instrumental activities of daily living. This method allows us to measure the dynamic aspect of force, such as reaction time and the change in grip strength response over time as well as maximum grip strength.

**Objective:** The purpose of this study was to introduce a novel automatic reading method for these indicators and to evaluate their relationship with the frailty phenotype.

**Methods:** The subjects were 248 patients (94 men, 154 women, average age 78.2±6.0) visiting our Integrated Healthy Aging Clinic (Locomotor-Frail outpatient clinic in Japan). The four indices of muscular force response measured were: reaction start time (RST), maximum value (MV), time constant (TC), and force rising slope (FRS). We examined the relationship between these four indices and the total number of items of the frailty phenotype, as well as each item (weight loss, exhaustion, low physical activity, low walking speed, and low grip strength) adjusting for sex and hand using Spearman's correlation coefficient.

**Results:** In women, walking speed was significantly correlated with all four indices for the left hand, and MV and RST alone for the right hand. Grip strength showed significant correlation with MV and RST for both hands. Exhaustion or low physical activity showed no significant correlation with any of the items, including MV for both hands. Weight loss was significantly correlated only with MV for the left hand. Overall, the left and right hands showed similar trends.

In contrast, in men, walking speed showed significant correlation only with MV and RST for both hands. Regarding grip strength, the right hand showed significant correlation with MV and RST (as in women), while the left hand showed a significant correlation only with MV. Exhaustion was correlated with MV for the left hand. Although low physical activity was not associated with any of the items for the right hand, significant correlations were noted among MV, TC, and FRS for the left hand; this indicated the apparent differences between the left and right hands. Weight loss was significantly correlated with the RST for the right hand and with TC for the left hand. Overall, men showed different tendencies in the right and left hands, in contrast with women.

**Conclusion:** The relationship between the studied indices of muscular...
force response and the items of the frailty phenotype differed between men and women and between the left and right hands. Weight loss was not related to maximum grip strength in men but was only significantly correlated to time-related items, such as reaction start time and time constant.

Keywords: grip strength, muscular force response, frailty phenotype.

P52 Assessment of Muscle Quality and Quantity for Diagnosis of Sarcopenia Using Mid-Thigh CT Scan

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Background: Sarcopenia had been diagnosed based on walking speed, grip strength, and muscle mass (skeletal muscle index (SMI)); however, in the revised guidelines of the European Working Group on Sarcopenia in older people (EWGSOP), an importance is placed on muscle quantity and quality. Yet, the assessment of muscle quality in the clinical practice remains controversial. In the present study, we evaluated the relationship between computed tomography (CT) of the mid-thigh region and skeletal muscle mass/physical performances to clarify that CT can assess muscle quantity and quality.

Methods: The subject sample included 214 patients who were examined at our center in the period of 2016-17. A single-slice CT scan was performed at the mid-thigh region, from which the cross-sectional area (CSA) of the quadriceps femoris muscle, and CT value (CTV), which is an attenuation coefficient of the muscle were measured using analysis software. Furthermore, SMI was measured by bioelectrical impedance analysis (BIA) and dual X-ray absorbimetry (DXA). To evaluate the motor function, walking speed, grip strength, knee extension strength, single leg standing, timed up and go (TUG), standing up test, short physical performance battery (SPPB), and 2 step test were measured. The subjects were classified into four groups, i.e. normal, dynapenia, pre-sarcopenia, and sarcopenia based on reduced walking speed, poor grip strength, and reduced muscle mass as measured by DXA or BIA.

Results: With regards to the relationship of motor functions evaluation with CSA, CTV, BIA, and DXA, the strongest correlation was observed between CSA and muscle strength i.e. knee extension strength (r=0.717) with grip strength (r=0.657), and the weakest correlation was observed with CTV. On the other hand, physical performance, i.e. walking speed (r=0.427), single leg standing (r=0.247), TUG (r=0.304), standing up test (r=0.411), SPPB (r=0.329), and the 2 step test (r=0.384) showed a significant correlation with CTV. Upon comparing each group, CSA was significantly reduced both in men and women with pre-sarcopenia (p <0.01) and sarcopenia (P <0.01). CTV was significantly lower in men with sarcopenia (p <0.01), and in women with dynapenia (p <0.01), and sarcopenia (p <0.01).

Conclusion: CSA showed the highest correlation with muscle strength whereas CTV had the strongest association with physical performances. CT can allow us to assess muscle mass and quality simultaneously. Thus, CT is useful for the diagnosis of sarcopenia, and in determining the degree of severity.

Keywords: sarcopenia, muscle quality, muscle quantity, CT scan, physical performance.

P53 Assessment of Muscle Quality by Cross-Sectional Computed Tomography Scan of Quadriceps

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Background: The European Working Group on Sarcopenia in Older People recently indicated the importance of muscle quality. Qualitative changes in skeletal muscles can be caused by age-related alterations, such as increase in fat infiltration within the skeletal muscle. Computed tomography (CT) has been considered an effective method to evaluate muscle mass. It is also possible to assess fat infiltration using CT value (CTV). Quadriceps (Qc cross-sectional area (CSA)) decreased with age mainly in the mid-thigh CSA, especially in women. The aim of this study was to clarify sex and age differences in muscle mass and quality of Qc by mid-thigh CT.

Methods: Using the cohort of National Institute for Longevity Sciences-Longitudinal Study of Aging, 520 participants (272 men and 248 women, age 40–91 years), who were randomly selected from the local residents in Japan, underwent CT examination of the right mid-thigh. Qc CSA and Qc CTV were measured. The participants were divided into 10 groups based on their sex and age (ages 40, 50, 60, 70, and >80 years for each sex).

Results: In men, the average Qc CSA was 63.6, 62.1, 58.2, 50.6, and 45.4 cm2 in those in their 40s, 50s, 60s, 70s, and 80s, respectively, and the average Qc CTV was 57.0, 55.1, 54.9, 51.7, and 49.0 HU in those in their 40s, 50s, 60s, 70s, and 80s, respectively. In women, the average Qc CSA was 48.3, 45.1, 40.3, 38.0, and 33.6 cm2 in those in their 40s, 50s, 60s, 70s, and 80s, respectively, and the average Qc CTV was 53.4, 52.2, 50.2, 48.1, and 47.9 HU in those in their 40s, 50s, 60s, 70s, and 80s, respectively. Qc CSA decreased with age at a rate of 0.7% per year in men and 0.8% per year in women from the 40s to 80s. Qc CTV decreased with age at a rate of 0.2 HU per year in men and 0.1 HU per year in women from the 40s to 80s. Tukey–Kramer test results showed that Qc CSA was significantly different in men between the 50s and 60s, and Qc CTV was significantly different between the 60s and 70s. In women, Qc CSA was significantly different between the 50s and 60s and Qc CTV was also significantly different between the 50s and 60s.

Discussion and Conclusion: Qc CSA and Qc CTV decreased with age in both men and women. In men, the decrease in muscle mass precedes the decrease in muscle quality. In women, the decrease in muscle mass and muscle quality may occur simultaneously. Meanwhile, in the long term, men may be more likely to suffer deterioration in muscle quality compared to that in muscle loss than women.

Keywords: computed tomography, muscle mass, muscle quality, aging, mid-thigh composition.

P54 Patient-Centered Quality of Transitional Care for Hospitalized Patients and Its Influencing Factors

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Background: Care transition has become an integral part of care continuum. The quality of care transition is highly related to the patient’s function and prognosis. Care transition refers to “patient transfer between different locations or different levels of care within the same location.” In today’s health care environment, patients discharged from acute hospitals may undergo multiple transfers. A study of hospitalized elderly in the United States showed that more than 65% of inpatients experienced 2-3 transfers and additional 13-14% of patients involved 4-6 transfers following their acute hospitalization. Hence, better quality of transitional care may not only improve patient experience, but also reduce potential avoidable readmissions, institutionalization and worsening prognosis.

Objective: To assess quality of care transitions and its influencing factors among stroke, fractures, and frail patients under the National Health Insurance program in Taiwan in 2018-2019.

Methods: This was a single-center prospective cohort study. Primary data...
were collected in one medical center in Taiwan from December 2018-May 2019 using self-developed structured questionnaire and face-to-face interviews. Patients were recruited and interviewed before discharge and follow-up telephone interviews were conducted 1 week after discharge. We recruited 210 patients and 200 patients were successfully followed for the telephone interview. Socio-demographic, decision-making preference, health status, function status, and cognition status were collected in the initial recruitment interview. In the follow-up interview, we collected patient’s self-reported quality of care transition. Care Transitions Measure (CTM-15) was used for assess quality of care transition.

Results: The overall CTM-15 score of our sample was 72.2 and was relatively high compared to the observations in other countries. Receipt of an understood written plan, consensus on patient’s health goals and how these goals would be reached, and understanding of the possible side effects of medications were three items had the lowest scores. In general, patients who were retired or with poor functioning had a lower CTM-15 score. Fracture and stroke patients, who were younger, higher educated, with poor cognitive function, and having high health tended to have a lower score. Fracture patients with poor access to health care, and stroke patients who preferred to make medical decisions themselves and did not participate in PAC programs also had a lower score. In contrast, frail patients who were younger, had a lower education, had normal cognitive function, and participate in PAC had a lower CTM-15 score.

Conclusion: This study was the first study to apply a widely used care assessment tool, CTM-15, to assess quality of care transition in hospital patients in Taiwan, and compare quality of care transition among different types of inpatients (medical vs. surgical patients). Emphasizing receipt of an understood written plan; consensus on patient’s health goals and how these goals would be reached, and understanding of the possible side effects of medication are three main areas need further improvement. The findings on different domains of CTM-15 and on different types of patients can provide clinicians and hospital teams more detailed references in designing patient-centered discharge preparation contents.

Keywords: care transition, quality of care, post-discharge.

P55 The Correlation and Influence Factors of Physical Fitness and Nutritional Status in Home-Dwelling Seniors

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Purpose: To investigate the correlation and influence factors of physical fitness and nutritional status among community-based seniors in Tainan City.

Methods: The project used the opportunity of the neighborhood community visits to invite senior citizens to participate in this fitness and nutrition assessment. Measures included 30 seconds sit-to-stand, 8 feet up-and-go, single-foot standing, 2-minutes step test, hand grip strength, height and weight, triceps skinfold thickness (TSF), mid-upper arm circumference (MAC), waist (WC), hip (HC) and calf (CC) circumferences, calculated BMI, calculated mid-upper arm muscle circumference (MAMC), and six food-groups frequency questions.

Results: There were 615 (71% females and 29% males) home dwelling and ambulatory citizens older than 55 years-old participated. Mean age was 74.8 for males and 71.3 for females. Data between males and females differed only for 8 feet up-and-go and grip strength. Age, on the other hand, showed negatively associated to nuts & oil, dairy, vegetable, cereal and water intake, MAC, TSF, MAMC, CC, HC. 30 seconds sit-to-stand, grip strength and positively associated with WC. All the physical fitness parameters were significantly associated with each other. BMI was positively associated with all the anthropometric parameters, and negatively associated with single foot standing and sit-to-stand. Waist circumference predicted physical fitness parameters better except grip strength, while calf circumference predicted grip strength better than other anthropometric parameters. Number of non-infectious chronic illnesses was not associated with age, but significantly and negatively associated with nuts and oil, fruit, protein food intakes, and degree of dietary balance, positively associated with BMI, waist circumference, 30 seconds sit-to-stand and 8 feet up-and-go.

Conclusion: Physical fitness, anthropometric parameters, dietary balance and chronic illness were highly correlated in home-dwelling seniors.

Keywords: home dwelling senior, physical fitness, nutritional status.

P56 Development of a Frailty Phenotype Questionnaire for Use in Screening Community-Dwelling Older Adults

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Objective: The purpose of this study was to develop a screening questionnaire for frailty based on the Fried's frailty phenotype (FPP) in community-dwelling older adults.

Design: Cross-sectional data analysis of a cohort study.

Setting and Participants: The study used baseline data from the Korean Frailty and Aging Cohort Survey, a multi-center longitudinal study undertaken in 10 urban, rural, or suburban communities in Korea, between 2016 and 2017. A total of 2,917 older adults aged 70 to 84 who underwent questionnaires and physical function tests were included in the analysis.

Methods: Gait speed and grip strength were measured, and all participants completed an international physical activity questionnaire and answered questions about weight loss and exhaustion based on FFP.

Results: Five questions were chosen to screen for FFP: fatigue (exhaustion), resistance (weakness), ambulation (slowness), inactivity, and loss of weight. The frailty phenotype Questionnaire (FPQ) scale (range of 0 to 5) was well correlated with Fried's frailty scale (range of 0 to 5) (r=0.643; P <0.001). Frailty based on FPQ (3 or more of 5) showed satisfactory diagnostic accuracy for FFP (area under the curve=0.89) with high sensitivity (81.7%) and specificity (82.5%).

Conclusion/Implications: The FPQ is a highly accurate screening tool for FFP in community-dwelling older adults.

P57 The Prevalence and Outcome of Frailty and/or Sarcopenia in a Community Hospital Ward

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Background: Frailty and sarcopenia outcomes have been studied in the acute hospitals and in the community. Working in a community hospital, we wanted to review the prevalence and the effect of premorbid frailty and sarcopenia on a patient’s outcome.

Methods: Over a period of 3 months, patients admitted to a ward in our CH were recruited and consented to participate in the study. Their premorbid FRAIL score and SARCF score were assessed. Other information like charlson comorbidity score, modified bathel index, premorbid and post discharge destination and the ability to self-care, and the percentage turning “subacute” during the stay were analysed.

Results: 54 patients were recruited, with an average length of stay of 26.4 days. The average FRAIL score was 1.09, SARCF score was 2.63, and charlson comorbidity score was 2.52. 100% of patients came from home, and only 12.96% required a dedicated caregiver prior to admission. Average MBI efficiency was 1.45.

25 patients were robust, 22 prefrail, and 7 patients were frail. The average
charlon comorbidity score was 1.96, 2.95, and 3.14. The average MBI efficiency declined from 1.56 to 1.44 to 1.05. The percentage needing a caregiver post discharge rose from 52% to 59.09% to 100%. The percentage discharged to a nursing home rose from 4% to 4.55% to 28.57%. The percentage turning “subacute/runwell during the stay rose from 65% to 40.91% to 71.4%. The 30 day readmission was 8% for the robust vs 14.29% for the frail group.

37 were SARCF <4, and 17 SARCF >4. The average charlon comorbidity score was 2.46 and 2.65. The average MBI efficiency declined from 1.50 to 1.33. The percentage needing a caregiver post discharge rose from 51.3% to 82.4%. The percentage discharged to a nursing home rose from 2.7% to 17.65%. The 30 day readmission was 5.4% for SARCF <4 vs 11.8% for SARCF >4.

Conclusion: Our pilot study reveals the prevalence and impact of premorbid frailty or sarcopenia on rehabilitating patients, in a community hospital. Frailty or sarcopenia not just affected a patient’s length of stay and rehabilitation efficiency, it also increased the risk of turning “subacute”, with higher care needs, during their rehabilitative stay in the community hospital. The presence of premorbid frailty or sarcopenia also had post discharge and societal implications, with a higher chance of readmissions within 30 days, or requiring a dedicated caregiver, or going to a nursing home.

All of these findings in turn have significant implications in this day and age of value driven outcomes, rising healthcare costs, and bundled care across a care continuum. Further studies need to be performed on the prevalence and impact of premorbid frailty and sarcopenia on patients, in a community hospital and across a care continuum. Since our study had looked at premorbid frailty and sarcopenia, and had predicted poorer outcomes, work to prevent and reverse the conditions need to continue for the population.

Keywords: FRAIL, SARCF; community hospital, prevalence, outcomes.

Frailty of COPD Patients at the Pulmonary Rehabilitation Clinic: An Exploratory Research in Validity of the Kihon Checklist (KCL) in Patients with Chronic Comorbidities for the Registry study at the Frailty Prevention Clinic in National Center for Geriatrics and Gerontology, Japan

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Background: We studied frailty of older COPD patients at the pulmonary rehabilitation clinic as an exploratory research in validity of the Kihon Checklist (KCL) in patients with chronic comorbidities for the registry study at the Frailty Prevention Clinic (FPC): the Locomo-frail Clinic in National Center for Geriatrics and Gerontology (NCGG), Japan. COPD is a prevalent chronic systemic inflammatory disease with multi-comorbidities and one of geriatric syndromes associated with sarcopenia leading to frailty. Older COPD patients carry the constellation of frailty, disabilities, and co-morbidities. KCL is a self-administered, comprehensive 25 items questionnaire for screening tool for the Preventive Care Service in Japan.

Methods: Stable outpatients with COPD at the Pulmonary Rehabilitation Clinic, NCGG, underwent a comprehensive geriatric assessment (CGA) and followed from October 2010 to March 2019 by a registered nurse. The cohort consisted of 40 males and 3 females; age: 74±9.5 years (65-87) years, BMI: 21.7±3.2 kg/m², appendicular skeletal muscle index (ASMl): 6.61±0.64 kg/m², Charson Comorbidity Index (CCI): 1.7±1.2. Control group was age- and gender-matched outpatients with geriatric syndromes (including sleep apnea syndrome, DM, dementia, etc.) at NCGG; age: 75±1.8 (66- 87) years, BMI: 22.8±3.3 kg/m², ASMl: 6.5±2.00 kg/m², CCI: 1.7±1.4.

Results: Initial KCL of COPD group was 5.2±25.4±4.0 (18). With frailty evaulation by KCL, 9 were classified as frail (K, F CL ≥8), 17 as pre-frail (7 ≥P >4), and 17 as robust (3 ≥R). As J-CHS criteria, F/R in COPD group were 5/27/11. In control group, KCL was 6.1±5.4 (5-18), and F/P/R were 16/10/17 with KCL, and 10/19/14 with J-CHS. KCL was concordant with number of J-CHS frailty criteria and parameters of CGA in patients with COPD and geriatric syndromes. Twelve of fatal 16 COPD cases were P (KCL ≥4) and 4 of 5 fatal cases in control were F. Nine cases in control group were lost the continuity of care at transitions of care settings.

Conclusion: The classification of frailty status by KCL score could be a significant tool to predict the mortality in older outpatients with COPD and geriatric syndromes. KCL might be a useful tool for frailty screening in patients with chronic comorbidities. COPD patients showed same level of frailty as geriatric syndrome outpatients at FPC, NCGG. Fatal case in this study showed higher KCL, which indicated possibility of KCL to evaluate not only physical function but prognosis for COPD and geriatric syndrome patients in integrated care settings by interdisciplinary team. We conduct the registry study with KCL among the older people at the FPC in NCGG.

Keywords: frailty, Kihon Checklist (KCL), COPD (chronic obstructive pulmonary disease), geriatric syndrome, comorbidity.

Sedentary Bouts Are Associated with Grip Strength in Type 2 Diabetes: A Cross-Sectional Study

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Background and Aims: Low grip strength is a high risk factor of mortality and cardiovascular disease for patients with type 2 diabetes. Improvement of sedentary behavior is important for prevent reducing grip strength. Many diabetes guidelines recommend sedentary time must be broken. However, it is unclear which total sedentary bouts or sedentary time influence grip strength. We aimed to assess the association between sedentary bouts or time and grip strength in patients with type 2 diabetes.

Materials and Methods: We performed a cross-sectional study to investigate the relationship between sedentary behavior and grip strength in patients with type 2 diabetes. Sedentary time was measured by a tri-axial accelerometer ActiGraph GT3X-BT (ActiGraph Corp., Pensacola, Florida) worn during seven days. A sedentary time was defined as under 99 counts per minute. A sedentary bout was defined as a period of time in continuous sedentary time where the activity intensity fell into the sedentary range with no interruption in more than 10 minutes. We assessed daily average of total sedentary time (minute) and average length of sedentary bouts (minute) as sedentary behavior. JMP version 12 was used for this statistical analysis.

Results: Among 104 patients (88 men (65.4%), mean age, body mass index, hemoglobin A1c, average of total sedentary time and average length of sedentary bouts were 64.1±9.3 years, 23.2±3.3 km², 7.2±0.8%, 546.1±101.6 minutes and 20.9±2.8 minutes, respectively. And mean grip strength was 39.0±6.6 kg in men and 23.4±3.7 kg in women.

Grip strength was associated with average length of sedentary bouts (r=-0.38, P=0.002 in men, r=-0.38, P=0.030 in women) and was not associated with sedentary time (r=0.08, P=0.527 in men, r=0.21, P=0.239 in women). After adjusting for age, body mass index, hemoglobin A1c, C reactive protein, urine albumin excretion, smoking states, alcohol consumptions and use of sodium-glucose cotransporter 2 inhibitors, grip strength was associated with average length of sedentary bouts (β=0.34, P=0.004 in men, β=0.45, P=0.025 in women), but was not associated with average of total sedentary time (β=0.05, P=0.686 in men, β=0.27, P=0.280 in women).

Conclusion: Reducing Grip strength was associated with sedentary bouts in patients with type2 diabetes. Reducing sedentary bouts rather than total sedentary time may be important to protect them from sarcopenia.

Keywords: sarcopenia, grip strength, sedentary, sedentary bout,
**P60 Relationships between Frailty and Disability in Community-Dwelling Older Adults: Korean Frailty and Aging Cohort Study**

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**Background:** The association frailty with disability and fall risk have been shown in the previous studies. However, less studies have examined associations between frailty and adverse health outcomes including disability and fall risk in Korea.

**Methods:** A population of 2,826 community dwelling older adults aged 70 years and older included in this cross-sectional study based on the Korean Frailty and Aging Cohort Study. Association frailty with activities of daily living (ADL) disability, instrumental activities of daily living (IADL) disability, and fall risk was evaluated among three validated frailty assessment tools using multivariate logistic regression analysis.

**Results:** The mean age of the participants was 76.0 (standard deviation, 3.9) years, and females comprised 51.8%. The risks of prefrail and frail older adults for ADL disability and IADL disability were increased using the Cardiovascular Health Study frailty scale (ADL disability-Prefrail, Odds Ratio 1.60, 95% Confidence Interval 1.17-2.20; ADL disability-frail, 2.78, 1.85-4.19; IADL disability-prefrail, 1.71, 1.31-2.24; IADL disability-frail, 2.53, 1.74-3.67) and the Korean version of the Fatigue, Resistance, Ambulation, Illnesses, and Loss of Weight scale (ADL disability-prefrail, 1.52, 1.12-2.08; ADL disability-frail, 3.14, 2.12-4.86; IADL disability-prefrail, 1.31, 1.01-1.70; IADL disability-frail, 1.80, 1.25-2.60), respectively. However, these association were disappeared in frail older adult assessed by the Study of Osteoporotic Fracture frailty index (ADL disability-frail, 1.53, 0.91-2.58; IADL disability-frail, 1.11, 0.83-1.94). The risks for fear and experience of fall increased with frailty on all scales after adjusting confounding variables.

**Conclusion:** The prefrail and frail older adults are at higher risks of disability and fall on different frailty scale in Korea.

**Keywords:** frailty, disability, fall, Korean Frailty and Aging Cohort Study.

**P61 Associations Reference of Malnutrition Prevalence Diagnosed According to Global Leadership Initiative on Malnutrition Criteria in the Elderly Requiring Care in Japan**

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**Background and Aims:** Most of elderly who requires nursing care has chronic disease, it diminished intake, there has been a great increase in the fall risk through decrease of skeletal muscle by less momentum, and increasing risk of malnutrition. And malnutrition known for adversely affecting elderly’s prognosis about infect by decreased immunity and delayed healing of disease. In 2016, the Global Leadership Initiative on Malnutrition (GLIM) released new criteria for diagnosing and grading malnutrition. However, there are few studies on the reliability and relevance of the GLIM standards in elderly people in Asia. Therefore, the present study aimed to investigate the prevalence of GLIM-defined malnutrition in elderly Japanese facilities to identify severe malnutrition according to GLIM criteria.

**Methods:** The subjects were 1,288 people aged 67-107 (average 88.3±5.9 years) who live in nursing homes, and screened under the GLIM criteria using the Malnutrition Universal Screening Tool (MUST) to identify undernutrition risk persons, and then Under-diagnostic assessment of those who are at risk of undernutrition should be judged whether they fall under the phenotype and etiology, and those who fall under either the phenotype or etiology may be those who are under the threat of malnutrition and who fall under both the phenotype and etiology I was diagnosed with malnutrition. Finally, the severity of those who were diagnosed with malnutrition was determined.

**Results:** 555 out of 1,288 people at risk for malnutrition (45.2%). There were 346 (62.3% for 555 people) undernourished elderly people extracted from Phenotypic and Etiologic. The severity of 346 patients was determined to be 138 moderate and 208 severe. The phenotype tended to have a low BMI ratio, and the disease with etiological inflammation had a high dementia ratio. In the severity diagnosis, muscle mass decline rate tended to be high in severe cases.

**Conclusion:** Based on the above results, as a result of conducting a nutritional diagnosis of the elderly in Japan using the GLIM criteria, the prevalence was 28.2% out of 1,228. The phenotype tended to have a low BMI ratio, and the disease with etiological inflammation had a high dementia ratio. In the severity diagnosis, muscle mass decline rate tended to be high in severe cases in the future, we will examine the relevance of malnutrition prevalence among elderly people in Asia while comparing other nutritional diagnostic criteria and GLIM criteria.

**Keywords:** Global Leadership Initiative on Malnutrition, elderly requiring care, diagnosing malnutrition, elderly Japanese facilities.

**P62 Cumulative and Incremental Value of Sarcopenia Components on Predicting Adverse Outcomes**

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**Background and Purpose:** People with sarcopenia were found to possess a higher risk of having adverse outcomes. However, it remains largely unclear whether the ability of sarcopenia to predict adverse outcomes are mediated by muscle strength, muscle function, muscle mass, or all of the factors included in the diagnosis. This study aims to use a stepwise model to examine the cumulative and incremental value of sarcopenia components in predicting adverse outcomes.

**Methods:** Four thousand older adults participated in the study (2,000 men, mean age=72.5±5.2). Age was used as the initial predictor with sarcopenia-related assessments added to the prediction model one-by-one according to the following sequence: 1) SARC-F questionnaire, 2) grip strength, 3) gait speed, 4) five-time chair-stand test, and 5) appendicular lean mass (ALM) measured by dual-energy X-ray absorptiometry. ALM adjusted by height, weight, and body mass index were computed and added to the prediction models separately. Adverse outcomes included for prediction were recurrent falls, physical limitation, nursing home placement, hospital stay >10 days, decline in mental (PCS) and physical (MCS) components of quality of life measured at the 4th year and 10-year hip fracture incidence, major osteoporosis fractures incidence and mortality.

The areas under the receiver operating characteristic curve (AUC) were calculated for the models formulated in each step. Each cumulative AUC would be compared to the age-adjusted model and the level above to check for the cumulative and incremental value of the sarcopenia components.

**Results:** Cumulatively, sarcopenia components could predict all adverse outcomes, except for MCS decline in men and fractures in women. The cumulative AUCs, ranging from 0.563 to 0.833, turned significant mostly at the level of SARC-F or grip strength. The prediction of hip fracture and major osteoporotic fractures turned significant at the level of gait speed and chair-stand test respectively for men. The prediction of PCS decline turned significant at the level of height-adjusted ALM for women.
For outcomes that could be predicted in the cumulative models, limited significant findings on incremental value were observed. Up till the level of chair-stand test, 17 out of 60 incremental value tests were shown to be significant, of which 8, 5, and 4 were noted at the level of SARC-F, grip strength, and gait speed respectively. For the three measures of ALM, adding height-adjusted ALM significantly increased the AUC of physical limitation and PCS decline in women. However, a higher height-adjusted ALM was associated with a higher risk of having the adverse outcomes (physical limitation: OR=1.27, 95%CI=1.15-1.41; PCS decline: OR=1.16, 95%CI=1.04-1.29). Adding weight-adjusted ALM increased the AUC of physical limitation in men and women with negative associations (men: AUC: from 0.709 to 0.717, OR=0.79, 95%CI=0.70-0.88; women: AUC: from 0.702 to 0.708, OR=0.81, 95%CI=0.73-0.90).

Conclusion: Cumulatively, sarcopenia components predict most adverse outcomes. The prediction power mostly comes from the assessment of SARC-F, grip strength and gait speed. Weight-adjusted ALM could improve the prediction of physical limitation. Increase in height-adjusted ALM was found to be a risk factor for physical limitation and PCS decline in women.

Keywords: sarcopenia, strength, function, adverse outcomes, prediction.

P63 Early Geriatric Evaluation and Management Services Reduced In-Hospital Mortality Risk among Frail Oldest-Old Patients

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Background: Geriatric Evaluation and Management (GEM)-based intervention has been a well-established approach for frail older patients with acute conditions, but whether delayed GEM introduction during the hospital course jeopardizes clinical outcomes remained unclear.

Aim: To compare the risk of mortality and functional declines among frail elderly patients receiving early GEM services or delayed GEM services at a tertiary medical center in Taiwan.

Methods: Data of all patients admitted to the GEM unit (GEMU) of Taipei Veterans General Hospital via the Emergency Department (ED) from January of 2015 to January of 2019 were obtained for study. Patients were further categorized into early GEM group (admitted to GEMU from ED directly) and delayed GEM group (admitted to GEMU from ED after a transitional stay at the hospitalist ward). Demographic characteristics and results of functional assessments were used for analysis, including Cumulative Illness Rating Scale for Geriatrics, Barthel Index, Instrumental Activities of Daily Living, Mini-Mental State Examination, Geriatric Depression Scale-5, Mini-Nutritional Assessment – Short Form, STRATIFY fall risk assessment tool, Braden Scale, and so on. All patients were followed by case managers by telephone at the first, third and sixth month after GEMU discharges. Mortality and declines in Barthel Index during the follow-up period were used as main outcome indicators for this study.

Results: The hospitalist ward provided transitional services for specialty units to reduce the ED congestion, therefore, all patients fulfilled the criteria for GEMU admission. Overall, data of 204 patients (mean age: 90.3±6.7 years, 73.5% males) were obtained for analysis and their baseline characteristics were similar between groups. Delayed GEM group (n=33, mean age: 90.2±7.1 years, 75.8% males) had significantly lower Barthel Index (18.33±29.33 vs. 33.54±32.55, P=0.01) than early GEM group (n=171, mean age: 90.3±6.7 years, 73.1% males), and higher risk for pressure sore. GEM services successfully secure patients in both groups from in-hospital functional declines. Besides, the delayed GEM group had a significantly higher in-hospital mortality rate than the early GEM group (15.2% vs 4.7%, P=0.024). However, no statistical significance was noted in in-hospital functional declines, post-discharge mortality or post-discharge functional declines between groups.

Conclusion: Frail elderly patients with acute conditions receiving early GEM services had significantly lower in-hospital mortality risk than those receiving delayed GEM services. Further intervention study is needed to establish the most optimal service model for frail oldest-old patients.

P64 Would the New EWGSOP2 Classification Share the Same Effectiveness in Differentiating Adverse Outcomes?

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Background and Objective: According to revised European consensus on definition and diagnosis on sarcopenia (EWGSOP2), low muscle strength has been served as the primary parameter of sarcopenia. ‘Sarcopenia is probable when low muscle strength is detected. A sarcopenia diagnosis is confirmed by the presence of low muscle quantity or quality. When low muscle strength, low muscle quantity/quality and low physical performance are all detected, sarcopenia is considered severe.’ Thus, we would like to identify the effectiveness of the revised European consensus compared to the old definition in predicting adverse outcomes using our Hong Kong MoRs and MsOs cohort study by different models.

Methods: Baseline and prospectively follow up data from Hong Kong Mr and Ms Os Cohort Study were analyzed. Cutoffs of Asia working group were used for sarcopenia was applied. Related adverse outcomes at follow ups included decline in muscle function (grip strength, gait speed, 5-chair stand), cognitive function (MMSE), PASE, IADL, SF-12, fall, frailty incident and mortality. Analysis was divided into two models: 1), EWGSOP 1, 2), EWGSOP2. Differences of parameters detected at baseline were used to determine. A logistic regression model was used to determine significance of affecting factors. Comparation was conducted between two models. Model 1 and Model 2 showed no difference in all the included adverse outcomes.

Results: In model 1, different stages of sarcopenia all showed association with mortality, low PASE and frailty incident. Confirmed and severe sarcopenia were also related to physical limitation, worse performance in repeated chair stand and physical component in SF-12 in male. Probable and severe sarcopenia found to be linked to decline in MMSE score and physical limitation in female. When compared to old model, EWGSOP2 showed similar power in predicting mortality. Severe sarcopenia is mainly associated with physical function decline and frailty incident in male. It was interesting to notice that probable sarcopenia was outstanding in predicting physical and cognitive function decline among female elderly.

Conclusion: EWGSOP2 model presented similar value in predicting physical function decline as previous one. Muscle strength is convenient and effective to apply in daily practice for probable sarcopenia detection and predicting function decline.

Keywords: sarcopenia, classification, adverse outcome.

P65 The Combined Effect of Physical Activity and Physical Function on Hospitalization in Older Adults

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Background and Purpose: Slowness and/or weakness have been
activity is a modifiable factor that could maintain quality of life and potentially prevent frailty and other adverse outcomes. However, how physical activity and physical function are jointly associated with adverse outcomes remains unclear. Elderly with poor physical function (e.g., slowness, weakness) may live healthier due to having adequate physical activity. This study aims to investigate the combined effect of physical activity and physical function on hospitalization in community-dwelling older adults.

Methods: Six hundred and seventy-one older men and women were recruited in this study. Gait speed was measured by the time to walk six meters at usual pace. Grip strength was measured using a dynamometer. According to the Asian Working Group on Sarcopenia (AWGS), slowness was defined as walking speed less than 0.8 m/s while weakness was defined as grip strength less than 26 kg for men or less than 18 kg for women. PA was measured by wearing Actigraph wGT3X on non-dominant wrist for seven consecutive days. Hospitalization in the following 12 months was recorded through tri-monthly telephone follow-up interviews. Participants were grouped into four categories based on activity and physical function levels.

Chi-square tests were used to test the differences of hospitalization between the four participant groups. Logistic regression was performed to evaluate the association between physical activity, physical function and hospitalization with adjustment of age, gender, body mass index and disease burden.

Results: 639 participants (359 men and 282 women) completed 7-day accelerometer monitoring and 12-month follow-up. During the 1-year follow-up period, the highest proportion of hospitalization (30.6%) occurred in older adults with low activity and slow gait speed. A somewhat higher proportion of hospitalization occurred in older adults with least active but rapid gait speed (24.8%). The hospitalization was relatively lower in those with high activity and slow gait speed (19.3%) and those with high activity and rapid gait speed (17.8%). A similar pattern was apparent in the analysis of grip strength.

As compared to older adults with high activity and rapid walking speed, those with least activity and slow gait speed presented higher risk of hospitalization (OR:1.799, 95% CI: 1.069-3.03). However, participants with high activity but slow gait speed did not have significant higher risk of hospitalization relative to the reference group (OR:1.075, 95% CI:0.563-2.053).

Conclusion: In community-dwelling older adults, most hospitalization occur in those with the lowest activity/worst physical performance, but hospitalization is also substantial with older adults with relatively low activity but reasonable performance. Maintaining high activity and reasonable physical performance are both important to reduce hospitalization. Activity and physical function assessments may improve identification of older adults at risk of hospitalization, and allow tailored interventions for prevention.

Keywords: physical activity, gait speed, strength, hospitalization, physical function.
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