Dear Editor,

Sarcopenia is an aging-related disease characterized by progressive muscle mass loss, decreasing muscle strength, and physiological muscle function decline. It is associated with multiple adverse outcomes, including falls, fractures, physical disability, and death. The new code in ICD-10-CM (M62.84) in 2016 signifies its being recognized as a disease and drawing attention to the condition in this ever-aging society. The prevalence of sarcopenia in the elderly is ~6.8%–25.7% for Asia, and, in particular, 8.9%–38.8% for China. The mechanism of sarcopenia is complex and includes hormonal changes, nutritional deficiencies, chronic inflammation, neuromuscular function decline, and decreased physical activity. While no specific drugs have been approved to treat sarcopenia, ten pharmacological interventions have been identified to ameliorate the condition in the elderly, including growth hormone, growth hormone-releasing hormone, insulin-like growth factor-1 (IGF1), insulin-like growth factor binding protein 3 (IGFBP3), uncoupling protein-2/3 (UCP2/3), apolipoprotein E (APOE), and ciliary neurotrophic factor/R (CNTF/R) genes. Thus, determining the underpinning skeletal muscle genotype is important in precision treatment/intervention for sarcopenia.

Today’s new technologies, including smartphone software and wearable devices, neuromuscular electrical stimulation, smart house, 3D printed foods, and interactive and virtual reality (VR) games, help to make individualized sarcopenia management possible. These techniques can help older adults with sarcopenia remain independent and get adequate physical activity and nutrition depending on individualized requirement. For example, smartphone software and wearables can track activity metrics including steps, distance, and intensity of physical activity, helping clinicians to obtain activity data remotely and monitor patient compliance and exercise progress. Other technologies, such as whole-body vibration training (WBVT) and neuromuscular electrical stimulation (NMES), can help improve muscle strength. In addition, robotic devices also facilitate passive or active training for sarcopenia patients.

Furthermore, a smart home includes many connected devices that can help the elderly achieve independence. For example, smart refrigerators have the function to help older adults maintain adequate nutrition by monitoring daily dietary intake, providing older adults with personalized meal plans, and buying food through online systems. In addition, 3D food printers are emerging as a new way to provide personalized nutrition to older adults. Meals may be printed at home and customized to provide nutrient contents that can help older adults meet dietary prescriptions. Besides, VR and interactive video games can supply a new platform for exercise programs, providing more enjoyable experiences than a typical exercise regime in treating sarcopenia. Of course, further research is needed to determine the role of currently available technologies in managing sarcopenia.

Precision medicine is defined as a novel medical paradigm focusing on personalized, predictive, preventive, and participatory approaches, depicting a brand new way to treat sarcopenia. A person’s genotype and other characteristics will determine how to individualize the management of sarcopenia. Precision medicine

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Table 1. Current development of drugs for sarcopenia.4

| Drug name       | Target                        | Company name                      | Current status                                                                 |
|-----------------|-------------------------------|-----------------------------------|-------------------------------------------------------------------------------|
| Bimagrumab      | Activin receptor type 2B      | Novartis AG                       | Leads to significant reductions in fat mass, increases in lean body mass and metabolic improvements over 48 weeks in overweight or obese patients with type 2 diabetes. (February 2017 to May 2019, 48-week, phase 2 randomized clinical trial). |
| Trevogrumab     | Myostatin                     | Regeneron Pharmaceuticals Inc.    | Leads to significant change in total lean body mass (phase 2).                 |
| Sarconeos       | Proto-oncogene protein c-MAS-1, MAS receptor | Biophytis SAS                     | Leads to better muscle function in animal models of muscular dystrophies with good tolerability profile (phase 1). |
| ARM-210         | Ryanodine receptor            | ARMGO Pharma Inc.                 | Treats Becker and limb-girdle muscular dystrophies and cachexia.              |
| NA (cell therapy)| Enzyme/protein replacement therapy | Immusoft Corporation              | Immune system programming technology.                                         |
| NT-1654         | The agrin/Lrp4/MuSK system    | Neurotune AG                      | Leads to accelerating muscle re-innervation after nerve crush.                |
| AVGN7           | Activin receptors             | AAVogen Inc.                      | Contains SMAD7 gene that could stop gene expression for muscle wasting.       |
| ATA 842         | Myostatin, activin            | Amgen Inc.                        | Leads to increased muscle mass and muscle strength in mouse model after 4 weeks. |
| VB-102 (protein)| Furin, Janus kinase 3, myostatin | Vibe Pharmaceuticals LLC          | A myostatin inhibitor for the treatment of sarcopenia.                        |
| Peptide of follistatin | Growth factor-β family ligands, Myostatin | MYOS RENS Technology Inc. | Has the potential to regenerate muscle and bones.                             |
| Monovalent FSTL3-Fc fusion protein (monoclonal antibody) | Growth factor-β family ligands, Myostatin | NA                             | Leads to an increase of systemic muscle mass in mice using intraperitoneal administration. Has potential ability in the modulation of myostatin expression. |
| TEI-SARM2       | Androgen receptor             | Teijin Pharma Ltd.                | A selective androgen receptor modulator.                                      |

NA, not applicable.

will improve the life quality of a large population of sarcopenia patients.

Conflict of interest
None declared.

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