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Mini Review Article

# Public Health issues in hospital management of Sarcopenic patients

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**Abstract**

Sarcopenia is a combination of a progressive and generalized loss of skeletal muscle mass and muscle strength or physical performance, with high risk of adverse outcomes such as physical disability, poor quality of life and death. It mainly affects older people, aged 60-70 years. The development of sarcopenia is multifactor. The first step towards the management of sarcopenia is the proper and professional diagnosis. According to EWGSOP the diagnosis of sarcopenia depends on the presence of low muscle mass (LMM) plus low muscle strength (LMS) or low physical performance (LPP). Although it is difficult to establish its prevalence, the higher prevalence is observed in hospitalized elderly patients. It has direct and indirect impact on public health, which are difficult to be measured due to numerous negative outcomes of sarcopenia.

**Keywords:** Sarcopenia, Public Health, Management, Public Health Expenditure, Quality of Life

## Introduction

The term *sarcopenia* is derived from the Greek word *Σάρξ* meaning "flesh" and *Πενία (penia)* meaning "poverty". It was described for the first time by Rosenberg in 1989[1,2], referring to age related loss of skeletal muscle mass[3]. However, over the last decades, there was no widely accepted definition of sarcopenia[4].

The European Working Group on Sarcopenia in Older People (EWGSOP) provided a definition of sarcopenia in 2010; *"A combination of a progressive and generalized loss of skeletal muscle mass and muscle strength or physical performance, with high risk of adverse outcomes such as physical disability, poor quality of life and death"* [5].

Sarcopenia is known to be a new geriatric syndrome[6], as it mainly affects older people, aged 60-70 years, on an average of 5-13%[7]. It is reported that 5-13% of people over 60 years of ages have low muscle mass, while the average rises to 50% in patients over 80 years[8]. The decrease of muscle mass is accompanied with loss in muscle strength, aerobic capacity and metabolic rate that lead to reduced muscle function[9]. The percentages are higher as far as the decline in muscle strength during the ages is concerned[7]. Although sarcopenia affects mostly older people, it can also be present in young adults, from the fourth decade of life, according to a recent study by Cherin et al. (2014)[10].

Sarcopenia can be divided into two main categories; primary and secondary. Primary sarcopenia includes cases where aging is the only apparent reason for its clinical manifestation, whereas secondary sarcopenia includes cases where further pathologies coexist[11]. Secondary sarcopenia includes activity-related, disease-related, and nutrition-related sarcopenia[12]. The EWGSOP suggested the separation of sarcopenia in three stages: a) Pre-sarcopenia, which includes only low muscle mass, without any muscle strength or performance dysfunctions, b) Sarcopenia, which is defined as the presence of low muscle mass and low muscle strength or physical performance and c) Severe sarcopenia, which includes all three criteria[11].

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## Etiology of Sarcopenia

The development of sarcopenia is considered to be the result of several factors including the genetic background[13], age related hormones[14], nutrition[14-16], neurodegeneration[5,17], chronic diseases[15,18] and disability, immobility and lack of physical activity[19].

## Diagnostic Criteria

The first step towards the management of sarcopenia is the proper and professional diagnosis. According to EWGSOP the diagnosis of sarcopenia depends on the presence of low muscle mass (LMM) plus low muscle strength (LMS) or low physical performance (LPP)[20].

### *Muscle mass*

There are three available imaging techniques to estimate muscle mass. Dual energy x-ray absorptiometry (DXA) measures precisely the body composition[21]. Although, DXA may overestimate skeletal muscle due to the difficulty in distinguishing muscle from water retention. It is a cheap method but there is lack of equipment[14].

The gold standard for measuring muscle mass is the Magnetic Resonance Imaging (MRI), without radiation exposure. Drawbacks of MRI are the high cost and the need of specialized staff and specific software, as well it is time consuming[22]. Computed Tomography (CT) is also very precise in measuring muscle mass, but not only it is an expensive method but also is associated with high radiation exposure[21].

Bioimpendance analysis estimates the volume of fat and lean body mass by dividing the skeletal muscle by the square of height[23]. Bioimpendance is easy to use, it can be used at the bedside without expose to radiation. But it is not very accurate, as it can be biased by the hydration status and the presence of edema[22]. Total body potassium (TBK) is another method for measuring skeletal muscle, as skeletal muscle contains approximately 50% of the total body potassium pool. Although, it is easy to use, it is not common[11].

### *Muscle strength*

Handgrip strength is a simple and very practical method of measuring muscle strength. The Jamar dynamometer is the most well-known device[24,25]. Knee flexion/extensionis another way of estimating muscle strength either isometrically or isokinetally. However, it requires special equipment and staff.

## Prevalence of Sarcopenia

Although, sarcopenia is mostly observed in older ages, it is still difficult to establish its prevalence[26]. This difficulty, as a consequence of the different diagnostic criteria, rises from the heterogeneity of the studied population[27]. Prevalence of sarcopenia in older people is estimated to range between 1 and 29%. This percentage increases for older people, aged over 80 years[26]. Higher prevalence of sarcopenia is observed in hospitalized elderly patients[27].

In general, prevalence of sarcopenia depends on various parameters, such as: a) Sex, where men have higher prevalence as compared to women, b) Age, where older individuals tend to be more prevalent for sarcopenia, while this tendency decreases with decreasing age. Yet, in a recent report by Cherin P et al. (2014) is has been found that one out of five patients aged under 65 years was sarcopenic[10], c) Life style, d) clinical status, in the sense if a patient lives in the community or is hospitalized, e) Body mass, where sarcopenia is more prevalent in patients with lower body mass, f) Education level, where patients with lower education levels tend to manifest clinical features of sarcopenia, g) Ethnic origin, where higher sarcopenia prevalence has been observed in Asians as compared to Caucasians and Black or Brown colored individuals are less susceptible to sarcopenia and h) Socioeconomic status, where low income, older individuals are more susceptible to developing sarcopenia as compared to middle or high income individuals[28]. Finally, sarcopenia has high prevalence in comorbidities. For instance, the presence of sarcopenia is raised to 58% in patients after a hip fracture surgery or for instance in patients after gastric cancer surgery[29,30].

## Impact on public health

### *Direct impact*

There is a lack of data concerning the impact of sarcopenia in the public health system. The only published study concerns the United States of America (USA), which may be representative for other developed countries. This research showed that in the USA the public health expenditure of sarcopenia is estimated to be 18.5$ billion, which is estimated to be divided to 8$ billion for males and 7.7$ billion for females in the year 2000.This expenditure corresponds to the 1.5% of total health care cost in the United States in 2000. It has been also reported that *"... reducing the prevalence of sarcopenia by 10% would result in savings of 1.1$ billion per year in USA healthcare cost"*. Comparatively, it is worth mentioning that in the same year the total healthcare expenditure for osteoporotic fractures in the USA was 16.3$ billion[31].

### *Indirect impact*

Sarcopenia has also numerous negative outcomes that have a major impact on public health including consequences in personal level, in the social and health care system. Sarcopenia is related to many comorbidities, such as physical disability, high risk of falls, depression, hospitalization[32] bad quality of life, loss of productivity[33] and mortality. In particular, sarcopenia is linked with physical disability[34] that is associated with increased health care cost, more as outpatient. It has been estimated that over 75% of those will use home health services[35]. Sarcopenia is also associated with loss of impendence and inability of doing

daily life activities[26,27]. Sarcopenia is related with great risk of falls with the subsequent outcomes of it, which increase the health care cost[36].

Another indirect impact of sarcopenia on public health is the comorbidities that are associated with it. Sarcopenia usually coexist with osteoporosis and high risk of hip fracture[26,27]. According to a recent study of Oliveira et al. (2015), there is a significant association between sarcopenia and hip fractures[37]. The higher risk of fracture has as a consequence the increased risk of hospitalization, leading to a rise of health care expenditure[26]. Sarcopenia is also associated with other diseases and predicts poor outcomes is some of them. Endocrine diseases, especially diabetes, kidney diseases[26,27], coronary heart diseases are linked with sarcopenia and affect negatively the outcomes[18]. Sarcopenia, also, may interactively correlate with the presence and severity of age-related osteoarthritis[38]. It is also associated with high risk of poor outcomes in severe liver disease[39]. Sarcopenia is strongly linked with frailty, an age related syndrome which is characterized by lack of adaptive capacity of the organism[40]. Frailty is also associated with high risk of hospitalization and increased health care costs[41].

In a recent study Sanchez-Rodríguez et al. using the ESPEN criteria for the definition of malnutrition and EWGSOP criteria for the definition of sarcopenia, drawn the conclusion that *"...sarcopenia and malnutrition are related conditions, as most patients with sarcopenia fulfilled the ESPEN criteria for a diagnosis of malnutrition"* [42]. Malnutrition is also one of the major factors of development age related diseases, such as sarcopenia. More specific, the cycle of frailty starts with chronic malnutrition, that in tern leads to sarcopenia. The health care cost of malnutrition must be taken into consideration in the cost and consequences of sarcopenia. Malnutrition affects every system of the human body, is both a cause and consequence of diseases and increases the risk of delaying recovery and poor outcomes, almost 70% are more likely for long-term stay in hospital, placing increased demans on hospital. All these lead to increased health care cost (Institute of Food and Health Policy 2009).

As it was mentioned before, frailty malnutrition and falls are associated with high risk of hospitalization. Moreover, sarcopenia its own presents also high risk of hospitalization. Poor physical condition leads to longer hospital stay for almost 20 days, that it means raise in health care cost[43].

Mortality is predicted to be higher in middle aged individuals and older adults suffering from sarcopenia[44]. A recent study confirmed that hospitalized patients with sarcopenia present a higher mortality rate as compared to hospitalized individuals without sarcopenia after one year postdischarge[14]. In addition, there is a strong association between the severity of sarcopenia and mortality[45].

As life expectancy increases, it is necessary for the public sector to invest to research for the prevention and treatment of sarcopenia. Public health expenditure and consequences of sarcopenia are considered to be direct and indirect. Up to date, expenditure estimation concerns the direct cost of sarcopenia, since the indirect cost is much complicated to be evaluated. Considering all these, is difficult to measure the real impact of sarcopenia on health care system.

*Authors' contributions: MV: collected literature, drafted the document, performed literature research, GIL: drafted the document, gave final permission for submission.*

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