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Letter to the Editor

# Relationships between sarcopenia, depressive symptoms, and the risk of all-cause mortality in the Chinese population

## 1. Introduction

Sarcopenia is prevalent among older adults, with its incidence varying across different diseases in the elderly population. A recent study indicated that the global prevalence of sarcopenia among patients with chronic kidney disease (CKD) is 24.5% [1], while it ranged from 34% to 66% among those with heart failure [2]. Concurrently, depression, another common geriatric syndrome, has garnered significant attention. Previous research has established a correlation between sarcopenia and depression, with a high prevalence of depression observed among sarcopenic individual [3]. This suggests that sarcopenia and depression frequently co-exist. Both conditions have been independently associated with adverse clinical outcomes. However, the question remains whether sarcopenia and depression together exert an additive impact on adverse outcomes in older adults. Xue and colleagues' recent study, published in The Journal of nutrition, health and aging, highlighted a combined effect of sarcopenia and depression on the risk of cardiovascular diseases (CVDs), showing a gradual increase in CVD risk across different types of depressive sarcopenia [4]. The effect size was 1.41 for depressive sarcopenia, 1.31 for depression only, and 1.16 for sarcopenia only. Inspired by these intriguing findings, we sought to explore whether a similar combined effect of sarcopenia and depression exists on all-cause mortality among older adults using data from the China Health and Retirement Longitudinal Study (CHARLS).

## 2. Methods

### 2.1. Study population and variables

We utilized data from the four waves of CHARLS for follow-up. The primary outcome was all-cause mortality, extracted from waves 2, 3, 4, and 5. Depression scores were assessed using the CES-D scale at baseline, with depression defined as a score of 12 or higher. Sarcopenia was diagnosed following the Asian Working Group for Sarcopenia (AWGS) 2019 criteria. Handgrip strength was measured using a dynamometer, and appendicular skeletal muscle mass (ASM) was calculated using the formula: ASM = 0.193 × weight (kg) + 0.107 × height (cm) − 4.157 × gender - 0.037 × age (years) − 2.631. Low muscle mass was defined as $<4.89\,kg/m^2$ for females and $<6.79\,kg/m^2$ for males. Physical performance was assessed via gait speed, the five-time chair stand test, and the Short Physical Performance Battery (SPPB), as reported in previous studies [5]. Sarcopenia was confirmed if an individual had low muscle mass and either low handgrip strength or poor physical performance. Additional covariates included age, gender, education, marital status, hukou, smoking status, drinking status, BMI, sleep duration and the total number of chronic diseases.

### 2.2. Statistical analysis

Participants were categorized into four groups based on sarcopenia and depressive symptoms: robust (no sarcopenia or depression), sarcopenia only, depression only, and depressive sarcopenia. Baseline characteristics were presented as percentages for categorical variables, means and standard deviations (SD) for normally distributed variables, and medians with interquartile ranges for non-normally distributed variables. Differences in demographic and clinical characteristics among the four groups were analyzed using ANOVA or Kruskal-Wallis tests for continuous variables and $\chi^2$ tests for categorical variables. Multivariable logistic models were employed to explore the association between depressive sarcopenia and all-cause mortality, adjusting for potential covariates. Results were presented as odds ratios (OR) with 95% confidence intervals (CIs).

A total of 11367 individuals were included in the final analysis. After adjusting age, gender, education, marital status, hukou, smoking status, drinking status, BMI, sleep duration and total number of chronic diseases, the results of multivariable logistic models revealed that the OR for the association between depressive sarcopenia and all-cause mortality was 1.87 (95% CI: 1.47–2.39), 1.59 (95% CI: 1.30–1.95) for sarcopenia only, and 1.11 (95% CI: 0.96–1.30) for depression only, with the robust group as the reference, showed in Table1.

Our research demonstrated that sarcopenia, whether occurring alone or in conjunction with depressive symptoms, is linked to increased all-cause mortality. In contrast, depression by itself did not exhibit a similar influence on mortality within this cohort, as analyzed using CHARLS data. These results corroborate the findings of Xue's study, which highlighted the compounded effect of depressive sarcopenia on adverse outcomes. It is evident that individuals with cardiovascular diseases, stroke, or heart attacks face a greater mortality risk compared to their healthier counterparts. Our findings further affirm that the intersection of sarcopenia and depression exerts a synergistic impact on adverse health outcomes, thereby contributing valuable insights to this critical issue.

In conclusion, individuals experiencing both depression and sarcopenia are at heightened risk for adverse health outcomes, underscoring the imperative for healthcare professionals to promptly screen for these conditions and implement targeted interventions to ameliorate sarcopenia and depression, ultimately aiming to reduce mortality rates in this population.

## Data statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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**Table 1**
Logistic regression analysis for the association of sarcopenia and depression with all-cause mortality.

| Exposure | Crude | Model I | Model II |
|---|---|---|---|
| Normal participants | Ref | Ref | Ref |
| Depression only | 1.28 (1.13, 1.46) 0.0002 | 1.26 (1.09, 1.45) 0.0015 | 1.11 (0.96, 1.30) 0.1697 |
| Sarcopenia only | 5.01 (4.21, 5.95) <0.0001 | 1.44 (1.18, 1.76) 0.0003 | 1.59 (1.30, 1.95) <0.0001 |
| Depressive sarcopenia | 5.29 (4.30, 6.51) <0.0001 | 1.91 (1.51, 2.43) <0.0001 | 1.87 (1.47, 2.39) <0.0001 |

Crude, adjusted for none.
Model I, adjusted for age, gender, education, marital status, hukou.
Model II, adjusted for age, gender, education, marital status, hukou, smoking status, drinking status, BMI, sleep duration and total number of chornic diseases.

## Conflicts of interest

The authors declare that they have no conflicts of interest.

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