JOURNAL OF CULTURAL ANALYSIS AND SOCIAL CHANGE

Journal of Cultural Analysis and Social Change,
2025, 10(3), 423-429
ISSN: 2589-1316

Handgrip Strength, Mental Health, and Quality of Life Among Older Women: Implications for AI and Big Data in Healthcare

Jae Woo Kim[1], Hyo Taek Lee[2*]

[1]*School of Liberal Arts, KOREATECH, Republic of Korea; Email: jaewoo666@koreateck.ac.kr*
[2]*Division of AI Convergence Engineering, Sehan University, South Korea*

*__Corresponding Author:__ take1682@sehan.ac.kr

Citation: Kim, J. W., & Lee, H. T. (2025). Handgrip Strength, Mental Health, and Quality of Life Among Older Women: Implications for AI and Big Data in Healthcare. *Journal of Cultural Analysis and Social Change*, *10*(3), 423–429. https://doi.org/10.64753/jcasc.v10i3.2427

Published: November 26, 2025

ABSTRACT

Handgrip strength (HGS) is increasingly recognized as a reliable marker of muscular fitness and overall health status in older adults. This study examined the associations between HGS, mental health, and quality of life (QoL) in women aged 65 years and older, using data from the 2023 Korea National Health and Nutrition Examination Survey (KNHANES). A total of 1,742 participants with complete data on HGS, mental health, and QoL indicators were included. Low HGS, defined as <18 kg according to the Asian Working Group for Sarcopenia criteria, was observed in 48.5% of participants, with prevalence rising sharply to 65.8% among women aged 75 years or older. Multivariate logistic regression demonstrated that low HGS was significantly associated with higher odds of perceived stress (OR = 1.54), depressive symptoms (OR = 1.71), and anxiety (OR = 1.68). Furthermore, low HGS was linked to reduced EQ-5D scores, elevated HINT-8 scores, and poorer self-rated health (OR = 2.24), underscoring its multidimensional impact. These findings highlight that HGS is not merely a measure of physical performance but also a comprehensive indicator reflecting psychological well-being and QoL. Routine monitoring of HGS, integrated with IoT, artificial intelligence, and big data technologies, could serve as a practical approach for early identification and intervention in super-aged societies.

Keywords: Handgrip Strength, Mental Health, Quality of Life, Older Women, AI, Big Data, IoT

INTRODUCTION

Globally, population aging is accelerating at an unprecedented pace, creating profound challenges for public health systems, social welfare, and economic sustainability. According to the United Nations [1], the proportion of individuals aged 65 years or older is projected to reach 16% of the global population by 2050. Among OECD countries, Korea represents one of the fastest-aging societies, with more than 20% of the total population expected to be aged 65 years or older by 2025 [2]. Older women constitute a greater proportion than men and, despite their longer life expectancy, tend to experience shorter healthy life expectancy [3]. This discrepancy makes them especially vulnerable, as they often face multiple health challenges simultaneously, including chronic diseases, musculoskeletal disorders, mental health concerns, and a decline in overall quality of life. Against this backdrop, evaluating the health of older women from a multidimensional perspective and establishing effective intervention strategies is a critical challenge not only for Korea but also for the global community entering the era of super-aged societies.

Among the various indicators used to assess physical health in older adults, handgrip strength (HGS) has emerged as one of the simplest yet most reliable measures of muscle function. Consensus statements such as the revised European Working Group on Sarcopenia in Older People (EWGSOP2) and the Asian Working Group for Sarcopenia (AWGS 2019) identify low HGS as a key component of sarcopenia assessment [5, 19]. Importantly,

HGS is not limited to reflecting hand muscle power but is strongly associated with overall muscle mass, physical performance, and functional independence in daily life [6]. Large-scale cohort studies and meta-analyses have further emphasized the prognostic significance of HGS. In the multinational PURE study with over 140,000 participants, lower HGS predicted higher all-cause mortality [7]. Similarly, a meta-analysis concluded that older adults with low HGS had more than twice the mortality risk compared to those with higher HGS [8]. Within Asian populations, low HGS has been linked not only to reduced survival but also to diminished mobility, functional decline, and frailty. In Korea, HGS was confirmed to be positively correlated with quality of life measured by EQ-5D [9], and lower HGS was significantly associated with depressive symptoms [10, 17]. Collectively, these findings suggest that HGS is more than a physical performance measure—it is a comprehensive marker that reflects multiple aspects of health and aging.

Mental health is another crucial determinant of health span and quality of life among older adults. Stress, depression, and anxiety are common in this population, often contributing to reduced physical activity, nutritional imbalance, and impaired sleep, thereby accelerating muscle decline and functional limitations [4]. Consistent with this, Korean cohort data indicate that lower HGS is associated with depressive symptoms [17]. These findings highlight the interdependence of physical and mental health and the need for integrated approaches to address both simultaneously.

Quality of life (QoL) in the elderly is typically evaluated through multidimensional tools such as EQ-5D and HINT-8, which assess mobility, self-care, pain/discomfort, anxiety/depression, and social participation; these instruments are used in national surveillance such as KNHANES [11]. National and international reports have shown that EQ-5D scores among older Koreans are often lower than OECD averages, and older women report especially high rates of poor self-rated health [11, 12]. Another Korean study further confirmed that lower HGS was significantly associated with reduced QoL in older women [10]. International guidance emphasizes the importance of maintaining muscle strength and physical activity to prolong independence and prevent disability [5, 13]. Thus, maintaining muscle strength is not only a matter of physical health but also central to preserving autonomy and social engagement in later life.

In recent years, the development of Internet of Things (IoT)-based healthcare devices and artificial intelligence (AI)-driven analytics has created new opportunities for monitoring and managing HGS. For example, smart IoT-based handgrip devices can measure grip strength continuously, transmit data to cloud-based servers, and support predictive modeling of health outcomes using big data [14]. Wearable devices have also been shown to accurately track physical activity and can be integrated with mental health assessments [15], while digital healthcare convergence is expected to become central to personalized medicine [16]. When combined with large-scale national surveys such as KNHANES, these technologies offer academic and practical value by enabling early identification of at-risk populations and the design of tailored interventions. Despite these advances, most existing studies have focused narrowly on the relationship between HGS and single outcomes such as mortality, falls, or depression. Few studies have comprehensively examined the integrated associations between HGS, mental health, and QoL in large population-based datasets. Therefore, the present study aims to address this gap by investigating the associations among HGS, mental health, and QoL in women aged 65 years and older, using the 2023 Korea National Health and Nutrition Examination Survey (KNHANES). Furthermore, this study discusses the potential applications of IoT, AI, and big data analytics in extending these findings into practical healthcare solutions for super-aged societies worldwide.

RESEARCH METHOD

Participants

This study was based on data from the Korea National Health and Nutrition Examination Survey (KNHANES) Phase VIII (2021–2023), conducted by the Korea Disease Control and Prevention Agency [11]. KNHANES is a nationally representative survey employing a stratified multistage clustered probability sampling design. The analysis was restricted to women aged 65 years and older. Among 1,950 women in this age group, 1,742 with complete data on handgrip strength (HGS), mental health indicators, and quality-of-life (QoL) measures were included in the final analysis. Participants were excluded if they were unable to measure HGS due to wrist or hand injury or neurological disorders; if they had missing responses to mental health questionnaires; if they did not complete the EQ-5D or HINT-8 surveys; or if key clinical covariates were missing (as per KNHANES documentation [11]). After applying these criteria, the final analytic sample consisted of 1,742 women, weighted to represent the Korean older female population.

Materials and Procedure

Handgrip Strength (HGS). Grip strength was measured using a digital dynamometer (T.K.K. 5401, Takei Scientific Instruments, Japan). Participants stood upright with arms relaxed at the sides. Each hand was measured twice, and the maximum values were averaged. Low grip strength was defined as <18.0 kg, consistent with the Asian Working Group for Sarcopenia (2019) cutoffs [19].

Mental health indicators included perceived stress, depressive symptoms, and anxiety. Perceived stress was assessed by the question, "How much stress do you usually feel in daily life?" with responses of "very much" or "much" classified as high risk. Depressive symptoms were defined as a depressive mood lasting at least two consecutive weeks in the past year. Anxiety was derived from selected items of the GAD-7 scale, with scores of ≥10 indicating high risk [18, 11].

Quality of life (QoL) was evaluated using EQ-5D and HINT-8 as implemented in KNHANES [11]. The EQ-5D covered five domains (mobility, self-care, usual activities, pain/discomfort, anxiety/depression), with scores ranging from 0 to 1 (1 = full health). The HINT-8 consisted of eight items, with higher scores reflecting poorer QoL. Self-rated health was assessed by asking participants to classify their health as good, average, or poor.

Covariates. To minimize confounding, the following covariates were included: sociodemographic factors (age group: 65–69, 70–74, ≥75; education level: none/elementary, middle school, ≥high school; household income quartiles), lifestyle factors (smoking status, alcohol consumption, and physical activity defined as ≥150 minutes/week vs. <150 minutes/week) [13], anthropometric measure (BMI categorized as <18.5, 18.5–24.9, and ≥25), and chronic conditions (hypertension, diabetes, arthritis, cardiovascular disease, and cancer).

Research Validation

Data Analysis

Descriptive statistics were presented as means ± standard deviations or frequencies (%). Differences between low and normal HGS groups were tested using chi-square (χ^2) tests and independent t-tests. Logistic regression analyses examined associations between low HGS and outcomes (stress, depression, anxiety, EQ-5D, HINT-8, self-rated health). Results were expressed as odds ratios (ORs) and 95% confidence intervals (CIs). Three models were fitted:

Model 1: unadjusted.

Model 2: adjusted for age, education, income.

Model 3: fully adjusted (BMI, chronic conditions, lifestyle).

All analyses incorporated KNHANES sampling weights, strata, and clusters. Statistical analyses were conducted using SPSS 26.0 (IBM Corp., Armonk, NY, USA) and R 4.2.1 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS AND DISCUSSION

General Characteristics of the Participants

The final analytic sample consisted of 1,742 women aged 65 years and older. The mean age was 73.8 ± 6.1 years, and the largest proportion belonged to the 70–74 age group (41.2%). More than half of the participants (54.6%) had an education level of elementary school or less, and 39.1% were in the lowest quartile of household income, indicating a high level of socioeconomic vulnerability. The mean body mass index (BMI) was 24.1 ± 3.8 kg/m², and 31.5% were categorized as overweight (BMI ≥25). The mean handgrip strength (HGS) was 18.2 ± 4.9 kg, and nearly half of the participants (48.5%) were classified as having low HGS (<18 kg). Age-specific analysis revealed that the prevalence of low HGS increased with age, from 29.7% among those aged 65–69 years to 65.8% among those aged 75 years or older.

Table 1. General characteristics of the study population (n = 1,742).

Characteristic	Value	Percentage (%)
Mean age (years)	73.8 ± 6.1	-
Age group 70–74	718	41.2
Education ≤ elementary school	951	54.6
Lowest income quartile	681	39.1
BMI (kg/m²)	24.1 ± 3.8	-
Overweight (BMI ≥25)	549	31.5
Low HGS (<18 kg)	845	48.5

Baseline characteristics of women aged 65 years and older, including age distribution, education, household

income, BMI, and prevalence of low handgrip strength.

Associations Between Handgrip Strength and Mental Health

Mental health indicators differed significantly between the low and normal HGS groups. The prevalence of high perceived stress was 39.8% in the low-HGS group compared with 26.1% in the normal-HGS group ($p < 0.01$). Depressive symptoms were reported by 25.6% of participants in the low-HGS group, nearly twice the prevalence in the normal-HGS group (13.7%, $p < 0.01$). Similarly, the prevalence of high anxiety was 19.8% among women with low HGS, compared with 10.6% among those with normal HGS ($p < 0.01$). Multivariate logistic regression analyses confirmed these findings. In the fully adjusted model, women with low HGS were more likely to be classified as high risk for stress (OR = 1.54, 95% CI = 1.22–1.92), depressive symptoms (OR = 1.71, 95% CI = 1.29–2.27), and anxiety (OR = 1.68, 95% CI = 1.23–2.31), compared with those with normal HGS.

Table 2. Mental health indicators by handgrip strength group.

Mental health indicator	Low HGS (<18 kg) %	Normal HGS (≥18 kg) %	p-value	Adjusted OR (95% CI)	Mental health indicator
High perceived stress	39.8	26.1	<0.01	1.54 (1.22–1.92)	High perceived stress
Depressive symptoms	25.6	13.7	<0.01	1.71 (1.29–2.27)	Depressive symptoms
High anxiety	19.8	10.6	<0.01	1.68 (1.23–2.31)	High anxiety

Comparison of high perceived stress, depressive symptoms, and high anxiety between low (<18 kg) and normal (≥18 kg) grip strength groups, with adjusted odds ratios (ORs) and 95% confidence intervals (CIs).

Associations Between Handgrip Strength and Quality of Life

Quality-of-life (QoL) outcomes also varied significantly by HGS level. The mean EQ-5D score was 0.77 ± 0.13 in the low-HGS group, significantly lower than the 0.87 ± 0.09 observed in the normal-HGS group ($p < 0.001$). The mean HINT-8 score was 22.8 ± 6.4 in the low-HGS group, compared to 18.1 ± 5.9 in the normal-HGS group, indicating poorer QoL among those with low HGS ($p < 0.001$). In terms of self-rated health, only 18.9% of the low-HGS group reported their health as "good," compared to 42.3% in the normal-HGS group ($p < 0.001$). Logistic regression analysis further indicated that participants with low HGS were more likely to belong to the lower EQ-5D group (OR = 2.12, 95% CI = 1.64–2.73), the higher HINT-8 group (OR = 1.87, 95% CI = 1.43–2.44), and to rate their health as "poor" (OR = 2.24, 95% CI = 1.69–2.96).

Table 3. Quality-of-life indicators by handgrip strength group.

Quality-of-life indicators	Low HGS (<18 kg)	Normal HGS (≥18 kg)	OR (95% CI)
EQ-5D (mean ± SD)	0.77 ± 0.13	0.87 ± 0.09	2.12 (1.64–2.73)
HINT-8 (mean ± SD)	22.8 ± 6.4	18.1 ± 5.9	1.87 (1.43–2.44)
Self-rated health (good, %)	18.9%		

Differences in EQ-5D scores, HINT-8 scores, and self-rated health between low and normal grip strength groups, with adjusted odds ratios (ORs) and 95% confidence intervals (CIs).

Subgroup Analyses

Subgroup analyses by age, BMI, and chronic disease status provided further insights. Among women aged 75 years and older, the association between low HGS and lower QoL was strongest. In the underweight subgroup (BMI <18.5), low HGS was particularly associated with higher risks of depression and anxiety. Additionally, women with chronic conditions such as hypertension, diabetes, or arthritis exhibited a stronger relationship between low HGS and poorer QoL outcomes compared to those without chronic disease.

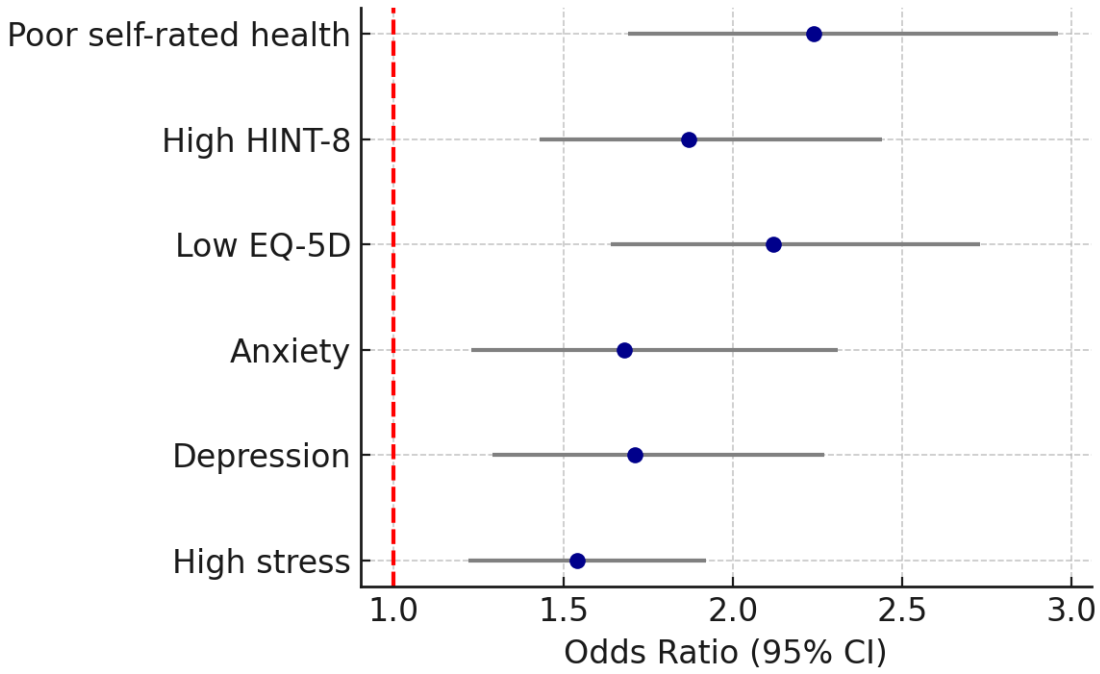

Figure 1. Associations between low handgrip strength and health outcomes.

Forest plot displaying odds ratios (ORs) with 95% confidence intervals for mental health outcomes (high stress, depressive symptoms, high anxiety) and quality-of-life outcomes (low EQ-5D, high HINT-8, poor self-rated health) among women with low HGS compared to those with normal HGS.

SUMMARY OF FINDINGS

In summary, the results demonstrate that low HGS among older women is significantly associated with poorer mental health (stress, depression, anxiety) and diminished QoL (EQ-5D, HINT-8, self-rated health). These findings reinforce the role of HGS as not only a measure of physical capability but also a comprehensive indicator of overall health and well-being in older adults.

DISCUSSION

This study investigated the associations among handgrip strength (HGS), mental health, and quality of life (QoL) in women aged 65 years and older using the 2023 KNHANES. The major findings were as follows: nearly half of older women were classified as having low HGS, with prevalence markedly increasing with age; low-HGS women were significantly more likely to report high stress, depressive symptoms, and anxiety; and low HGS was strongly associated with lower QoL, including lower EQ-5D and HINT-8 scores and poorer self-rated health. These findings provide meaningful academic and practical implications, especially in the context of Korea's transition into a super-aged society [2].

He relationship between HGS and adverse health outcomes has been well documented in international studies. Low HGS independently predicts mortality and cardiovascular events in the multinational PURE cohort [7], and a meta-analysis confirmed that older adults with reduced HGS face more than double the risk of mortality [8]. Domestic studies align with these findings, showing significant correlations between HGS and EQ-5D in Korean adults [9] and reporting that low HGS is associated with higher risk of depression and poorer well-being in Korean cohorts [10, 17]. Our results extend these findings by simultaneously addressing HGS, mental health, and QoL in one large-scale nationally representative dataset, highlighting HGS as a multidimensional health marker.

The associations identified in this study may be explained through both biological and psychosocial pathways. Physiologically, muscle weakness can lead to reduced physical activity, decreased social participation, and consequent increases in depressive symptoms and anxiety. Elevated stress is known to increase cortisol secretion and inflammatory responses, thereby accelerating muscle catabolism and further reducing HGS. Psychosocially, women with low HGS may experience lower self-esteem and increased social isolation—factors that negatively affect mental health and QoL [4]. These mechanisms suggest that HGS is not only a physical indicator but also

reflects broader biopsychosocial health domains. Consistent with international and national reports, older Koreans—especially women—show lower QoL and higher burden of poor self-rated health [11, 12].

Given Korea's demographic transition to a super-aged society by 2025 [2], our findings provide several implications for public health policy. Routine HGS measurement should be incorporated into health check-ups at community health centers and welfare facilities, enabling early detection of at-risk populations (consistent with consensus statements on sarcopenia assessment [5]). Screening for depression, anxiety, and stress alongside HGS can help identify vulnerable groups, using validated tools such as the GAD-7 [18]. Postmenopausal women should be targeted with resistance training and nutritional interventions consistent with global physical activity recommendations [13]. Moreover, IoT-enabled handgrip devices and AI-driven big data analytics could enable personalized interventions and predictive models, paving the way for innovative digital healthcare solutions [14–16].

CONCLUSION

This study examined the associations between handgrip strength (HGS), mental health, and quality of life (QoL) among women aged 65 years and older using nationally representative KNHANES 2023 data. Nearly half of the participants exhibited low HGS, which was associated with significantly higher risks of stress, depression, and anxiety, as well as poorer outcomes in EQ-5D, HINT-8, and self-rated health. These findings establish HGS as a multidimensional health indicator that reflects not only physical capacity but also psychological well-being and overall QoL in rapidly aging societies [7–10, 17, 18].

At the policy and practice level, routine HGS assessments could provide a simple yet effective screening component for early identification of vulnerable older adults [5]. Integrated interventions combining strength training tailored for postmenopausal women, mental health support, and community-based engagement are essential [13]. Moreover, the application of IoT-enabled smart grip devices, artificial intelligence, and big data analytics offers promising opportunities for personalized monitoring and preventive strategies [14–16], contributing valuable insights for both national health policies in Korea and global approaches to super-aged populations [2, 12].

Funding: This research was supported by the KOREATECH Research Fund of 2025.

REFERENCES

United Nations, Department of Economic and Social Affairs, Population Division. (2024). World population prospects 2024: Summary of results. United Nations. https://population.un.org/wpp/

Statistics Korea. (2023). Population projections for Korea, 2022–2072. Statistics Korea. https://kostat.go.kr

Sara Carmel. (2019). Health and Well-Being in Late Life: Gender Differences Worldwide. Front Med, 2019 Oct 10;6:218. doi: 10.3389/fmed.2019.00218

World Health Organization. (2015). World report on ageing and health. World Health Organization. World report on ageing and health

Cruz-Jentoft, A. J., & Sayer, A. A. (2019). Sarcopenia. The Lancet, 393(10191), 2636–2646. https://doi.org/10.1016/S0140-6736(19)31138-9

Roberts, H. C., Denison, H. J., Martin, H. J., Patel, H. P., Syddall, H., Cooper, C., & Sayer, A. A. (2011). A review of the measurement of grip strength in clinical and epidemiological studies: Towards a standardized approach. Age and Ageing, 40(4), 423–429. https://doi.org/10.1093/ageing/afr051

Leong, D. P., Teo, K. K., Rangarajan, S., Lopez-Jaramillo, P., Avezum, A., Orlandini, A.,Yusuf, S. (2015). Prognostic value of grip strength: Findings from the Prospective Urban Rural Epidemiology (PURE) study. The Lancet, 386(9990), 266–273. https://doi.org/10.1016/S0140-6736(14)62000-6

Rijk, J. M., Roos, P. R., Deckx, L., van den Akker, M., & Buntinx, F. (2016). Prognostic value of handgrip strength in people aged 60 years and older: A systematic review and meta-analysis. Geriatrics & Gerontology International, 16(1), 5–20. https://doi.org/10.1111/ggi.12508

[Oh, Y. H., Moon, J. H., Kong, M. H., Kim, H. J., & Kong, H. H. (2017). The association between handgrip strength and health-related quality of life in Korean adults. Korean Journal of Sports Medicine, 35(2), 103–111. https://doi.org/10.5763/kjsm.2017.35.2.103

Hong, Y. S., & Kim, H. (2021). Hand grip strength and health-related quality of life in postmenopausal women: A national population-based study. Menopause, 28(12), 1330-1339. https://doi.org/10.1097/GME.0000000000001863

Ministry of Health and Welfare. (2022). Korea National Health and Nutrition Examination Survey report 2022. Ministry of Health and Welfare. https://knhanes.kdca.go.kr

Organization for Economic Co-operation and Development. (2021). Health at a glance 2021: OECD indicators. OECD Publishing. https://doi.org/10.1787/4dd50c09-en

World Health Organization. (2010). Global recommendations on physical activity for health. World Health Organization. https://www.who.int/publications/i/item/9789241599979

Young Hee Lee., Jeong Eun Kim., Hyo Taek Lee. (2025). Evaluation of the grip strength of Korean female hair designers and the usability of a smart IoT grip strength measuring device. International Journal of Innovative Research in Social Science, 8(2), 491-498. https://doi.org/10.53894/ijirss.v8i2.5200

Lu, L., Zhang, J., Xie, Y., Gao, F., Xu, S., Wu, X., ... & Ye, Z. (2020). Wearable health devices in health care: Narrative systematic review. JMIR mHealth and uHealth, 8(11), e18907. https://doi.org/10.2196/18907

Topol, E. J. (2019). High-performance medicine: The convergence of human and artificial intelligence. Nature Medicine, 25(1), 44–56. https://doi.org/10.1038/s41591-018-0300-7

Kim H, Kim K, Kim M, Lee J, Kim H, Lee H, … Park J. (2022). Association between changes in handgrip strength and depression in Korean adults: a longitudinal panel study. Scientific Reports, 12:13768. https://doi.org/10.1038/s41598-022-18089-9

Spitzer RL, Kroenke K, Williams JBW, Löwe B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. Archives of Internal Medicine, 166(10), 1092–1097. https://doi.org/10.1001/archinte.166.10.1092

Chen LK, Woo J, Assantachai P, Auyeung T-W, Chou M-Y, Iijima K, … Akishita M. (2020). Asian Working Group for Sarcopenia: 2019 consensus update on sarcopenia diagnosis and treatment. Journal of the American Medical Directors Association, 21(3), 300–307.e2. https://doi.org/10.1016/j.jamda.2019.12.012

