

Normative values of hand grip strength for elderly Singaporeans elderly

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- **Definition / Diagnosis / Assessment**
- Normative values of hand grip strength

Definition / Diagnosis / Assessment...(1)

• Definition of Frailty

- "A state in which there is an increase in an individual's risk for developing increased dependency and/or mortality when exposed to a stressor"¹

• Assessment of Frailty

- Physical Frailty: Phenotypic approach² or Accumulation of deficits approach³
- Physical Frailty *plus* Psychological / Social Frailty⁴

¹Morley JE, Vellas B, van Kan GA, et al. Frailty consensus: a call to action. *Journal of the American Medical Directors Association* 2013;14:392-7.
²Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. *The journals of gerontology Series A, Biological sciences and medical sciences* 2001;56:M146-56.
³Searle SD, Mittelsch A, Gill TM, Rockwood K. A standard procedure for creating a frailty index. *BMC Geriatrics*. 2008;8:24. doi:10.1186/1471-2318-8-24.
⁴Rolfson DB, Majumdar SR, Tsuyuki RT, Tahir A, Rockwood K. Validity and reliability of the Edmonton Frail Scale. *Age and ageing* 2006;35:526-9.

Definition / Diagnosis / Assessment...(2)



• Definition of Sarcopenia

- A syndrome characterized by progressive and generalized loss of skeletal muscle mass and strength with a risk of adverse outcomes such as physical disability, poor quality of life and death ^{1,2}

• Diagnosis of Sarcopenia (European Working Group on Sarcopenia in Older People) ³

- Presence of BOTH low muscle mass *and* low muscle function (strength *or* performance)

¹Delmonico MJ, Harris TB, Lee JS, et al. Alternative definitions of sarcopenia, lower extremity performance, and functional impairment with aging in older men and women. *J Am Geriatr Soc.* 2007;55:769-74;Bohannon RW. Hand-Grip Dynamometry Predicts Future Outcomes in Aging Adults. *J Geriatr Phys Ther.* 2008;31(1):3-10.

²Goodpaster BH, Park SW, Harris TB, et al. The loss of skeletal muscle strength, mass, and quality in older adults: The health, aging and body composition study. *J Gerontol A Biol Sci Med Sci.* 2006;61:1059-64.

³Cruz-Jentoft AJ, Baeyens JP, Bauer JM, et al. Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. *Age and Ageing.* 2010;39(4):412-423. doi:10.1093/ageing/afq034.

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- Definition / Diagnosis / Assessment
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Normative HGS values: Background...(1)



• Hand grip strength (HGS)

- Diagnosis of sarcopenia ¹
- Single indicator of frailty ² as well as Component of frailty indices ^{3,4}

• Low HGS predicts adverse health events (e.g. mortality, disability), especially among the elderly ^{5,6}

• Measurement of HGS: Time-efficient, Non-invasive, Simple

¹Cruz-Jentoft AJ, Baeyens JP, Bauer JM, et al. Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. *Age and Ageing.* 2010;39(4):412-423. doi:10.1093/ageing/afq034.

²Syddall H, Cooper C, Martin F, et al. Is grip strength a useful single marker of frailty? *Age Ageing.* 2003;32(6):650-656. doi:10.1093/ageing/afq034.

³Bohannon RW. Hand-Grip Dynamometry Predicts Future Outcomes in Aging Adults. *J Geriatr Phys Ther.* 2008;31(1):3-10.

⁴Bohannon RW, Peolsson A, Massey-Westropp N, et al. Reference values for adult grip strength measured with a Jamar dynamometer: a descriptive meta-analysis. *Physiotherapy.* 2006;92(1):11-15.

⁵Bohannon RW, Bear-Lehman J, Desrosiers J, et al. Average Grip Strength: A Meta-Analysis of Data Obtained with a Jamar Dynamometer from Individuals 75 Years or More of Age. *Journal of Geriatric Physical Therapy.* 2007;30(1):28-30.

⁶Werte S, Goldhahn J, Drenup S, et al. Age- and Gender-Specific Normative Data of Grip and Pinch Strength in a Healthy Adult Swiss Population. *Journal of Hand Surgery (European Volume).* 2009;34(1):76-84.

⁷Malhotra R, Huang JS, Allen JC, Chan A, Tan NC, Ostbye T, Saito Y. Association of hand grip strength and 4-year mortality among elderly Singaporeans. Poster presentation. Presented at the SingHealth Duke-NUS Symposium 2014, Singapore, 5th-6th September 2014.

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Normative HGS values: Background...(2)



- Normative or reference values are used by clinicians (and researchers) to compare measured values of their patients (and participants) ~ low HGS
- Normative HGS values from elsewhere are not appropriate for Singapore
- In addition, most studies presenting normative values:
 - Use a convenience sample ^{1,2}
 - Usually present the mean and variance in ten-year age groups ¹⁻⁵

¹Schlüssel MM, dos Anjos LA, de Vasconcelos MTL, et al. Reference values of handgrip dynamometry of healthy adults: A population-based study. *Clinical Nutrition.* 2008;27(4):601-607;Bohannon RW. Hand-Grip Dynamometry Predicts Future Outcomes in Aging Adults. *J Geriatr Phys Ther.* 2008;31(1):3-10.

²Bohannon RW, Peolsson A, Massey-Westropp N, et al. Reference values for adult grip strength measured with a Jamar dynamometer: a descriptive meta-analysis. *Physiotherapy.* 2006;92(1):11-15.

³Bohannon RW, Bear-Lehman J, Desrosiers J, et al. Average Grip Strength: A Meta-Analysis of Data Obtained with a Jamar Dynamometer from Individuals 75 Years or More of Age. *Journal of Geriatric Physical Therapy.* 2007;30(1):28-30.

⁴Werte S, Goldhahn J, Drenup S, et al. Age- and Gender-Specific Normative Data of Grip and Pinch Strength in a Healthy Adult Swiss Population. *Journal of Hand Surgery (European Volume).* 2009;34(1):76-84.

⁵Massey-Westropp NM, Gill TK, Taylor AW, et al. Hand Grip Strength: age and gender stratified normative data in a population-based study. *BMC Research Notes.* 2011;4(1):1-5.

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Normative HGS values: **Aim**

Develop age-specific normative values for HGS, utilizing data from a nationally representative sample of community-dwelling elderly Singaporeans



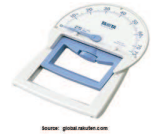
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Normative HGS values: **Data and methods...(1)**

- Social Isolation, Health and Lifestyles Survey 2009; N = 4990
- HGS: Smedley spring-type dynamometer (Hand Grip Meter, No. 6103, TANITA, Tokyo, 75 kg)
- After demonstrating its use, the interviewer would
 1. Request respondent to **stand**, with arms hanging freely by the side
 2. Adjusted the dynamometer to the respondent's hand size
 3. Ask the respondent to squeeze as hard as possible and then let go
 4. Record the measurement to nearest 0.5kg
 5. Repeat the process for a total of two times for each hand



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Normative HGS values: **Data and methods...(2)**

- Analytical sample: **N = 2664**, aged 60-89 years comprising -
 - Healthy (without cognitive impairment or memory problems or limitation in activities of daily living or underweight) elderly, *and*
 - with no surgery/swelling/severe pain/paralysis/inflammation/injury in the hand in past 6 months, *and*
 - did not rest their arm on a support, *and*
 - gave full effort while gripping the dynamometer, *and*
 - were measured in the standing position



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Normative HGS values: **Data and methods...(3)**

- All analyses were stratified by gender and hand dominance ("Which hand do you normally use?")
- Mean HGS was compared across age groups using ANOVA
- Quantile regression models were used to chart single year/ age/ hand specific **5th**, **20th** (for Fried's frailty index) and **50th percentile** curves



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Normative HGS values: Results...(1)

➤ HGS declines with age

➤ Within same age group and gender, HGS is significantly higher for dominant versus non-dominant hand

➤ Within same age group and hand-dominance, HGS is significantly higher for men versus women

➤ Lower than Western counterparts

Table 2
Descriptive statistics (mean, standard deviation, range) for hand grip strength in various gender/hand strata, by age group

Age group (years)	Men/Dominant Hand ^a Mean (SD); Range	Men/Non-dominant Hand ^a Mean (SD); Range	Women/Dominant Hand ^b Mean (SD); Range	Women/Non-dominant Hand ^b Mean (SD); Range
60-64	30.9 (8.0); 9.5 - 44.5	28.8 (7.8); 11.5 - 43.5	17.9 (5.3); 6.5 - 31.0	16.5 (5.1); 5.0 - 28.3
65-69	28.8 (6.8); 0.5 - 43.5	26.7 (6.5); 0.5 - 43.0	16.8 (4.3); 6.3 - 31.0	15.7 (4.1); 5.5 - 26.8
70-74	27.3 (5.4); 1.0 - 41.0	25.5 (5.2); 1.0 - 39.0	15.7 (4.0); 3.5 - 26.0	14.6 (4.0); 4.0 - 25.5
75-79	25.2 (4.2); 13.0 - 40.0	23.1 (4.1); 8.0 - 36.3	14.6 (3.3); 3.0 - 26.0	13.5 (3.2); 4.0 - 24.0
80-84	22.9 (3.9); 0.5 - 34.8	21.3 (3.9); 6.0 - 34.5	13.7 (3.0); 5.0 - 20.8	12.6 (2.8); 4.0 - 20.3
85-89	20.5 (3.7); 10.5 - 31.5	18.8 (3.3); 12.0 - 29.5	12.0 (3.4); 1.8 - 20.3	10.8 (3.1); 3.8 - 20.0

^aSD: Standard deviation

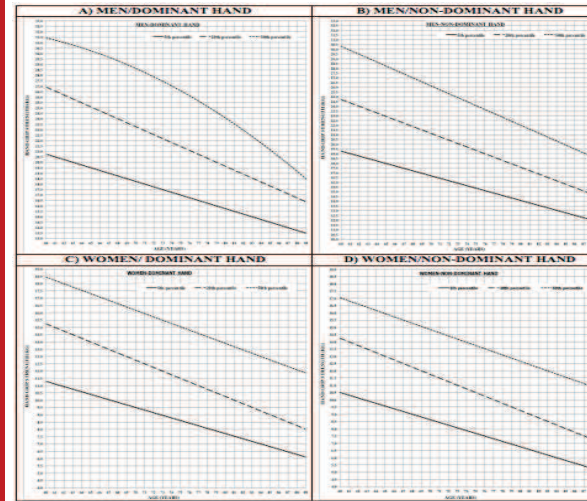
^bTukey-Kramer's post hoc test for analysis of variance revealed significant differences between all age groups, except between 80-84 and 85-89 years, as well as between 75-79 and 80-84 years.

^cTukey-Kramer's post hoc test for analysis of variance revealed significant differences between all age groups, except between 80-84 and 85-89 years; between 75-79 and 80-84 years, as well as between 65-69 and 70-74 years.

^dTukey-Kramer's post hoc test for analysis of variance revealed significant differences between all age groups, except between 75-79 and 80-84 years; between 75-79 and 80-84 years, as well as between 70-74 and 75-79 years.

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Normative HGS values: Results...(2)



➤ A downward, curvilinear pattern with age was observed only for the 50th percentile for the dominant hand for men

➤ Rest of the percentile curves showed a negative linear influence of age on HGS

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Normative HGS values: Conclusion

- Age, gender and hand-specific graphs for normative values of HGS are presented at the 5th, 20th and 50th percentiles.
- These will facilitate interpretation of HGS measurements among the elderly in clinical and research settings in Singapore.



Original Study

Normative Values of Hand Grip Strength for Elderly Singaporeans Aged 60 to 89 Years: A Cross-Sectional Study



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THANK YOU

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