

Muscle strength and quality in old and oldest-old people

Citation for published version (APA):

Wearing, J. (2021). *Muscle strength and quality in old and oldest-old people*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20210119jw>

Document status and date:

Published: 01/01/2021

DOI:

[10.26481/dis.20210119jw](https://doi.org/10.26481/dis.20210119jw)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

Chapter 8

8. Valorisation

This chapter assesses the relevance and implication of the findings of the thesis for society, as outlined in Chapters 2-6. Potential implementation of the findings for different target groups are discussed in this Chapter, including boundaries that could prevent implementation. Finally, current and future dissemination of research findings are stated.

8.1 Relevance of the topic

Sarcopenia is a progressive, generalized muscle disorder characterized by excessive muscle wasting due to age, morbidity and inactivity [1] that can lead to immense health problems and increased health care costs when untreated [2-4], as outlined in Chapter 1. It has been recognized as an independent medical condition since 2016 [5], which highlights its emerging importance in adverse health-related outcomes. It has been estimated that the prevalence of sarcopenia, globally, will increase to 20% by 2045, as a consequence of the aging population [6]. However, to date, sarcopenia as a diagnosis has not been mentioned specifically in the Swiss health statistics or the Federal Office for Public Health as an independent medical condition [7, 8]. Understanding sarcopenia, its low muscle strength as a key characteristic and its relationship to health decline is, nonetheless, important for implementing prevention strategies. Furthermore, elderly but particularly adults > 75 years are at high risk of excessive strength decline. However, strength assessments for the early detection of people at risk of strength decline are rarely part of the routine assessment of community-living older people [9] or nursing-home residents [10]. Reference values for oldest-old age-groups are currently lacking. Moreover, strength assessments and interventions aiming to improve strength in older- old, comorbid people have not been researched extensively and hence recommendations regarding standardized testing tools to guide effective exercise programs have yet to be made [11]. There is a need for information about the overall muscle condition, specific risk of low muscle strength in older-old people (> 75 years) and neuromuscular changes in nursing-home residents (as outlined in Chapter 1) to specifically monitor and improve health in the older-old people. This thesis aims to directly address these challenges.

8.2 Main objectives and findings in brief

This research has established reference values for hand grip strength in oldest-old Swiss adults aged 85 years and over (Chapter 2). The data can be used by scientists and clinicians to monitor aspects of physical/muscular health in this population. It estimates the specific risk of sarcopenia in the community-living old Swiss population and shows that probable sarcopenia, an important preliminary stage of sarcopenia, was prevalent in about one third of those aged 75 years and over (Chapter 3). This research also evaluated the feasibility and relevance of the two recommended tests (handgrip strength and chair rise test) commonly used to detect probable sarcopenia

in community-living for the evaluation of institutionalized elderly, who are most at risk of sarcopenia (Chapter 4). The results have shown that handgrip strength is superior to the chair stand test in detecting probable sarcopenia in institutionalized elderly as the chair-stand test could only be completed by about 50% of the participants. The findings highlighted that low handgrip strength is an estimate of overall strength, meaningful indicating ADL dependence and frailty. Moreover, this research reveals, that quadriceps strength is an independent predictor of ADL performance in nursing-home residents (Chapter 5). Finally, this research gave the first insight into the relationship between muscle strength and sonographic measures of muscle quality (on ultrasound images) in nursing-home residents relevant for future evaluation and treatment of age-related muscle wasting in institutionalized elderly people (Chapter 6).

8.3 Implication, implementation and dissemination plans

Collectively, the findings of the research undertaken in this thesis would be of interest to clinicians, community service providers, nursing homes and health insurance companies. It is anticipated the research will increase awareness of the importance of strength testing and specific risk assessment of sarcopenia in the oldest age group; and with that, the awareness of individuals for the importance of muscle strength and weakness-related consequences. The implications of each specific project are outlined below.

Reference values for handgrip strength of old-old and oldest-old people were investigated in Chapter 2. These results build upon previously published reference values for young-old people (65-74 years) and for the first time provide data on the old-old (75-84 years) and oldest-old (85+ years) people in Switzerland ensuring a full range of handgrip strength values up to the age of 99 years. These values are of particular importance in light of the recommendations of the World Health Organization (WHO) that handgrip strength is frequently assessed in older people to screen for mobility loss [12]. Currently, handgrip strength is only measured infrequently in routine geriatric assessment [9], as outlined in Chapter 1. Hence, the present findings are of importance to general practitioners and can provide reference values for the evaluation of routine handgrip strength assessment in practices of geriatricians and physiotherapists. This would assist in the timely detection of strength decline and the initiation of specific interventions that counteract muscle wasting, which are critical for health improvement in an age-group most at risk for disability.

To facilitate accessibility of the reference values for those interested, apart from publication in this thesis and in *BMC geriatrics* 2018:8:266, research outcomes are also planned for more popularist dissemination via the journal "Swiss medical forum", a popular national journal commonly read by general practitioners. Participants of the study who expressed interest in seeing their results, received an overview of their individual handgrip strength values and the overall findings of the study. Reference values of this research were implemented for routine handgrip strength assessments at two sites (nursing-home Adullam Basel and Geriatric hospital St Gallen) to screen Swiss residents and patients for sarcopenia.

The prevalence of probable sarcopenia in older, community-living people (75+ years), based on low handgrip strength, was investigated in Chapter 3. The observation that 26% of women and 28% of men were affected by probable sarcopenia could inform the Swiss Federal Statistical Office and Swiss insurance companies to estimate the number of people at risk for developing sarcopenia and consequent health decline.

As the prevalence of sarcopenia is expected to rise up to 20% in the next 25 years [6], increasing the awareness for sarcopenia and reducing potential negative consequences is necessary. Therefore, a documentary called “Muscle loss in old age” was produced at our study site and broadcast by the local TV channel Tele Basel.

The findings of the study investigating probable sarcopenia in the older Swiss population, highlight the need for screening of handgrip strength in routine medical care of community living elderly people. Frequently performed strength assessments could further increase awareness of older people for the importance of overall strength for current and future health. The high prevalence of probable sarcopenia can inform the National health policy about the need for strategies to reduce disease burden and health care costs associated with sarcopenia.

A summary of the findings will be submitted to a local Swiss medical journal together with the reference values for handgrip strength to provide the findings in German language to the general practitioners. Presentation of the results is also planned at physiotherapy practices and in-house at both study sites to inform clinicians, allied health practitioners and the community about the need for frequent strength assessment and the importance of strength for physical health in every age group. The dates will be agreed once the Corona virus situation allows personal meetings of groups. Depending on how long the restrictions last, webinars will be planned and held if necessary.

Feasibility of handgrip strength test and chair stand test in nursing-home residents, and the relevance of detecting probable sarcopenia were investigated in Chapter 4. The handgrip strength test showed to be easy and feasible in nursing-home residents. Based on the findings of this research, it is recommended to be used in institutions and could be implemented in routine assessment of residents at admission and during frequent routine check-ups to inform the medical staff about the need for further evaluation of the person’s physical health. The findings show that probable sarcopenia detected by low handgrip strength was indicative of muscle function, ADL performance and frailty. Although these results need to be verified in reliability studies and larger cohort studies before they can be recommended for implementation, clinical examination to specifically address ADL performance and frailty is recommended by leading researchers and clinicians in the field of nursing-home practice [11, 13]. Handgrip strength is an easily applicable instrument to add to a test battery for screening nursing-home residents.

The relationship between quadriceps strength and independence in daily activities in nursing-home residents was investigated in Chapter 5. The results highlighted the predictive value of quadriceps strength cut-off values for the detection of independence in daily activities of nursing home residents. Based on the findings of this research, quadriceps strength testing should be used by nursing staff, medical doctors and therapists in nursing-homes to screen residents for ADL performance. Moreover, frequently performed strengthening exercises, targeting a strength of 11 kg (torque normalized to body mass of 0.52 Nm/kg), could potentially be used to help identify and monitor strategies to improve ADL performance and avoid further decline. This approach would be consistent with the recent report of a Task Force of experts in nursing-home care research, who discussed approaches to prevent or slow functional decline and disabilities for nursing-home residents [11, 13]. They strongly suggest to initiate timely assessments and interventions.

Apart from dissemination of the results in this thesis, in PLoS ONE 2019;14(9): e0223016, and presentation of the results at the 14th International Congress of the European Geriatric Medicine Society 2018 in Berlin (Germany), local nursing-homes will be informed about the importance of quadriceps strength for ADL independence. Additionally, they will be given recommendations for physical activity by an information letter.

Frequent quadriceps strength testing is planned to be implemented at Adullam (a Swiss nursing-home and geriatric hospital) in line with the objective of a project at the local nursing-home (promoting physical activity) at the end of 2020.

The observed relationship between muscle strength and a sonographic index of muscle quality in oldest-old nursing-home residents, investigated in Chapter 6, provided insight into neuromuscular changes of highly disordered muscles. The research builds upon a growing body of scientific literature that collectively indicates that ultrasound imaging may be useful for assessing age-related changes in muscle quality of community-dwelling elderly [14]. Chapter 6 showed that sonographically measured muscle quality was related to muscle strength and gait speed in nursing-home residents. As the results were presented at the 5th International Fascia Research Congress 2018 in Berlin, Germany, and submitted for publication, it is anticipated that these initial findings could stimulate researchers with a specific interest in nursing-home residents to conduct further research in this area. In the longer term, the results may inform ultrasound imaging for the detection of sarcopenia in the oldest-old population and be used to monitor advanced interventions for strength improvement in nursing-home residents.

8.4 Barriers for implementation of strength assessments and interventions in nursing-homes

There are likely several barriers to the implementation of strength assessments at the individual and institutional level. These are outlined below:

1. A lack of motivation of oldest-old people to start exercise programs. They often believe that exercising in old age is harmful and cannot be beneficial [15].
2. A lack of motivation to participate in activities aiming at improving health [15]. Those that are admitted to a nursing-home need to give up their accustomed environment, and therewith their own household and to a certain extent social connections. With that, the reason for staying healthy can easily become the reverse.
3. Institutional culture is often orientated towards basic care without additional promotion of an active lifestyle, particularly in the presence of understaffing or financial constraints. In addition, some nursing staff may not feel adequately trained in applying resource-orientated care (encouraging residents to stay as independent in ADL as possible, e.g. helping in household activities, promoting independence in basic ADL, going for a walk under supervision) [11]. Moreover, physical activity interventions are often both time and cost intensive. Although carers are encouraged to reduce the risk of functional decline, health insurance companies do not pay for additional time necessary to offer specific programs. The payment of the health insurance is dependent on the level of care required, with higher payments for higher care levels. People who could benefit the most from physical activity offerings with respect to disability prevention are the ones with minimal care needs [11]. Moreover, long-term physical therapy prescriptions necessary for people with disabilities to instruct and guide specific exercises are often limited by budgetary constraints in Switzerland.

However, the above barriers should not be viewed as an impediment to provide opportunities for an active lifestyle but rather a challenge to advance innovative solutions that evidently improve strength. Regular information sessions for staff and residents could provide knowledge about the benefit of exercise in old age and how to integrate strengthening exercises in daily activities. Activities likely to improve strength without the need of nursing staff could be organized as multi-generational projects e.g. excursions together with children or joint cooking events with the neighborhood of the institution. Moreover, the design of outdoor spaces and equipment for self-use and physical activity groups offered by volunteers could encourage older people to engage in life-long active exercise.

8.5 References

1. Clark BC, Manini TM. Functional consequences of sarcopenia and dynapenia in the elderly. *Curr Opin Clin Nutr Metab Care*. 2010;13(3):271-6.
2. da Silva Alexandre T, de Oliveira Duarte YA, Ferreira Santos JL, Wong R, Lebrão ML. Sarcopenia according to the european working group on sarcopenia in older people (EWGSOP) versus Dynapenia as a risk factor for disability in the elderly. *The journal of nutrition, health & aging*. 2014;18(5):547-53.
3. Rantanen T, Avlund K, Suominen H, Schroll M, Frandin K, Pertti E. Muscle strength as a predictor of onset of ADL dependence in people aged 75 years. *Aging Clin Exp Res*. 2002;14(3 Suppl):10-5.
4. Brown JC, Harhay MO, Harhay MN. Sarcopenia and mortality among a population-based sample of community-dwelling older adults. *J Cachexia Sarcopenia Muscle*. 2016;7(3):290-8.
5. Cao L, Morley JE. Sarcopenia Is Recognized as an Independent Condition by an International Classification of Disease, Tenth Revision, Clinical Modification (ICD-10-CM) Code. *J Am Med Dir Assoc*. 2016;17(8):675-7.
6. Ethgen O, Beaudart C, Buckinx F, Bruyere O, Reginster JY. The Future Prevalence of Sarcopenia in Europe: A Claim for Public Health Action. *Calcif Tissue Int*. 2017;100(3):229-34.
7. Gesundheitsstatistik [Internet]. Bundesamt für Statistik. 2019.
8. Erkrankungen des Bewegungsapparats [Internet]. Bundesamt für Gesundheit. 2018.
9. Keller K. Sarcopenia. *Wien Med Wochenschr*. 2019;169(7-8):157-72.
10. Onder G, Carpenter I, Finne-Soveri H, Gindin J, Frijters D, Henrard JC, et al. Assessment of nursing home residents in Europe: the Services and Health for Elderly in Long TERM care (SHELTER) study. *BMC Health Serv Res*. 2012; 12:5.
11. Laffon de Mazieres C, Morley JE, Levy C, Agenes F, Barbagallo M, Cesari M, et al. Prevention of Functional Decline by Reframing the Role of Nursing Homes? *J Am Med Dir Assoc*. 2017;18(2):105-10.
12. World Health Organisation. Guidelines on Integrated Care for Older People (ICOPE). <http://www.who.int/ageing/publications/guidelines-icope/en/>; 2017.
13. de Souto Barreto P, Morley JE, Chodzko-Zajko W, K HP, Weening-Dijksterhuis E, Rodriguez-Manas L, et al. Recommendations on Physical Activity and Exercise for Older Adults Living in Long-Term Care Facilities: A Taskforce Report. *J Am Med Dir Assoc*. 2016;17(5):381-92.
14. Correa-de-Araujo R, Harris-Love MO, Miljkovic I, Fragala MS, Anthony BW, Manini TM. The Need for Standardized Assessment of Muscle Quality in Skeletal Muscle Function Deficit and Other Aging-Related Muscle Dysfunctions: A Symposium Report. *Frontiers in physiology*. 2017; 8:87.
15. Lees FD, Clarkr PG, Nigg CR, Newman P. Barriers to exercise behavior among older adults: a focus-group study. *J Aging Phys Act*. 2005;13(1):23-33.