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34 Grip strength across Europe –North/ South and East/West divides

- The north/south divide in handgrip strength found in previous SHARE waves, still persists in the 7th wave
- The enlargement of the set of countries participating in SHARE reveals an east/west divide in handgrip strength as well
- Country differences in handgrip strength are stable over age groups
- Country differences in handgrip strength are not concentrated at the bottom or at the top levels of handgrip strength

34.1 Introduction

One syndrome associated with the ageing process is sarcopenia. This syndrome can be defined as loss of muscle mass, muscle strength, and muscle function. Sarcopenia leads to several health and disability outcomes, including functional limitations, lower quality of life and premature death. We use grip strength as a proxy for the probable presence of sarcopenia in the European population according to the most recent definition of sarcopenia (Cruz-Jentoft et al., 2018). The measurement of low muscle strength by grip strength provides an indication of probable sarcopenia, while confirmation of sarcopenia requires additionally low muscle quantity and muscle strength or function.

Ageing populations increase the relevance of identifying the variables associated with sarcopenia. We use the Survey on Health, Ageing and Retirement in Europe (SHARE) database, to assess the existence and prevalence of probable sarcopenia by using grip strength as a proxy. Our analyses use SHARE Wave 7 data and thereby extends the number of countries covered by previous waves of SHARE (Andersen-Ranberg et al, 2009; Franzese, 2015). These previous analyses of earlier waves of SHARE established relevant differences across European countries, with an emphasis on the north–south divide, with higher grip strength in the north than in the south. Other regularities found in these previous studies were that grip strength declines with advancing age in all countries, and in both genders.

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The more recent inclusion of new SHARE countries mainly from the eastern European region allows us to look at grip strength from a broader perspective. Using SHARE Wave 7 data we are able to compare grip strength not from the north to the south of Europe and also from east to west. The 11 countries included in the analysis by Andersen-Ranberg et al. (2009), using data collected in the first wave of SHARE in 2004, were Austria, Belgium, Denmark, France, Germany, Greece, Italy, Netherlands, Spain, Sweden, and Switzerland. The 7th SHARE wave, with data from 2017, covers in addition 17 more countries: Israel, Czech Republic, Poland, Luxembourg, Hungary, Portugal, Slovenia, Estonia, Croatia, Lithuania, Bulgaria, Cyprus, Finland, Latvia, Malta, Romania and Slovakia. One country, the Netherlands, is not part of the 7th wave of SHARE. The expanded set of countries allows SHARE to now include eastern Europe, have an expanded southern European set of countries, and have Finland added to the north Europe group. We consider four groups of countries: northern Europe (Denmark, Finland, Sweden, Estonia, Latvia and Lithuania), southern Europe (Cyprus, Greece, Israel, Italy, Malta, Portugal and Spain), eastern Europe (Bulgaria, Hungary, Poland and Romania) and western and central Europe (Austria, Belgium, Croatia, Czech Republic, France, Germany, Luxembourg, Slovakia, Slovenia and Switzerland). We will concentrate our discussion below on northern, eastern and southern Europe.

34.2 Data and computations

The main variable from SHARE that allows addressing the presence of probable sarcopenia is handgrip strength. A proxy for the onset of sarcopenia is defined using criteria based on thresholds for grip strength (different for men and women), already available in the literature (Cruz-Jentoft et al., 2018). Handgrip strength is one of the criteria pointed out and the other is muscle mass or muscle function (for which no measurements exist in recent SHARE waves). Therefore, we concentrate on the first part of the algorithm set in Cruz-Jentoft et al. (2018), with an assessment of grip strength, to help identifying probable sarcopenia.

Our main variable of interest is handgrip strength, which is measured in the SHARE survey. Our measure of handgrip strength is the maximum value over two measurements in each hand. The indicator of probable sarcopenia is defined as 1 if handgrip strength, as previously defined, is less than 27 kg for men and 16kg for women (Cruz-Jentoft et al., 2018).

Simple probit models that regress our proxy for probable sarcopenia on individual characteristics (age and gender) and country fixed effects provide the main source of data analysis. A complementary analysis based on a linear

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regression that directly uses handgrip strength directly is also performed. The two approaches represent different ways of treating the information on grip strength. The indicator of probable sarcopenia, which transforms the measurement of grip strength into a simple indication of probable sarcopenia (indicator value of 1) or no probably sarcopenia (value of 0) according to cut-off values proposed in Cruz-Jentoft et al. (2018) has the advantage of a simplifying the data – a male respondent with a measurement of 26 kg in handgrip strength is treated equally relative to another male respondent with 24 kg and differently from another male respondent with 32 kg of handgrip strength (the cut-off used is 27 kg). Thus, small variations in measurement are, to some extent, neutralized and the results can be expressed in terms of the probability of a positive indicator for probable sarcopenia. The disadvantage is that the indicator variable has less information than the underlying measurement. Both approaches are subsequently reported, allowing for a cross-check of whether, or not, the option of using one or the other changes the comparison across countries.

34.3 Handgrip strength across Europe in Wave 7

Figures 34.1a and 34.1b present the estimated probability of probable sarcopenia for men and women, respectively, organized by quartiles, after controlling for age effects. Table 34.1 reports the underlying values. Figures 34.1a and 34.1b show that both men and women in eastern Europe and men in Spain have the highest probability of low handgrip strength. The northern countries have the lowest probability of poor handgrip strength, with the southern countries

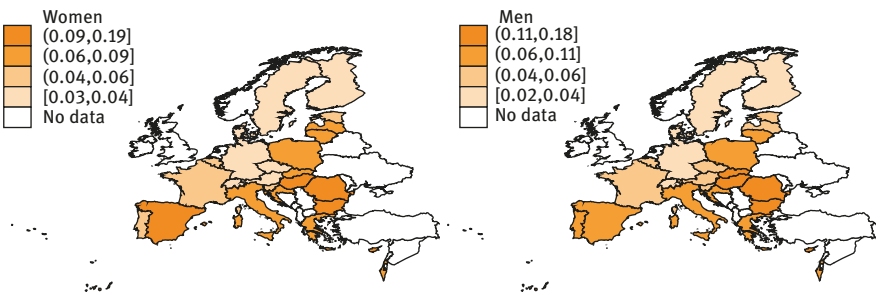

Figure 34.1: Probable sarcopenia.
Note: Numbers report the estimated probability of handgrip strength lower than the threshold for probable sarcopenia (Cruz-Jentoft, 2018).
Source: SHARE Wave 7 release.

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Table 34.1: Differences by Age Group (country fixed effects).

	Men (50–59)	**Men (60–69)**	**Men (70–79)**	**Men (80+)**
Average absolute deviation	2.818	2.394	2.559	2.518
Standard deviation	3.408	2.856	2.962	2.954
	Women (50–59)	**Women (60–69)**	**Women (70–79)**	**Women (80+)**
Average absolute deviation	1.529	1.487	1.744	1.686
Standard deviation	1.939	1.791	1.978	1.930

Source: SHARE Wave 7 release 0.

having a higher probability of probable sarcopenia, confirming the previous finding of a north versus south divide. The broad features do hold for men and women, which are estimated separately.

The measure of probable sarcopenia is based on the measurement of handgrip strength, as previously defined. This approach treats all values lower (or higher) than the cut-off as being equal and, naturally, has less information than the actual measurement value of handgrip strength. Thus, checking that our main insight – the existence of an east/west divide – holds is also important if handgrip strength in kg is used as the relevant continuous variable. The linear regression model allows computation of average values across countries, after accounting for age and gender differences between countries. These values are then used to build the quartiles over average handgrip strength, leading to Figure 34.2, in which a

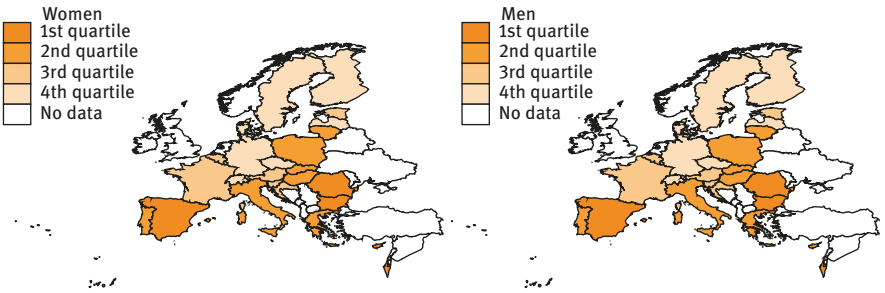

Figure 34.2: Handgrip strength.
Note: Darker colours indicate weaker grip strength.
Source: SHARE Wave 7 release 0.

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darker colour refers to higher likelihood of probable sarcopenia (weaker grip strength).

Overall, the countries added to SHARE since Wave 1 confirm the north-south distinction found in previous waves and studies (Andersen-Ranberg et al., 2009). The new countries in the south and north Europe (Finland) groups fit into the previous pattern found more than a decade ago. Additionally, the SHARE Wave 7 data shows that an east-west split exists as well, with most eastern European countries (Bulgaria, Hungary, Romania) plus Slovakia showing weaker grip strength and higher probabilities of sarcopenia than their more western and northern peers, and southern Europe, apart from Spain. In contrast, central European countries on are closer to the north Europe group (and western and central European countries).

The cut-off values for handgrip strength have changed recently. To confirm that the broad divides identified are not the result of the particular cut-off points for handgrip strength, the analysis was replicated using the old cut-off values, as defined in the initial proposal of Cruz-Jentoft et al. (2010). The new cut-off values, as indicated in Cruz-Jentoft et al. (2018), have lower values, meaning that some cases of hand grip strength that would be classified as probable sarcopenia under the 2010 criterion are not classified as such under the new 2018 criterion. Nevertheless, the same divides emerge (full results available from the authors upon request).

34.4 Country differences across groups

The north/south and the east/west divides in hand grip strength were assessed to this point on average values, even if these values were adjusted for elements such as age and gender.

An interesting aspect is whether these differences across countries are stable over the entire age range (as previously found in Andersen-Ranberg et al. (2009) in the comparison of north to south countries) or are driven by a particular age group. Differences between countries may widen at older ages. If that is the case, then attention should be paid to what motivates such a divergence. However, differences may also remain stable among age groups, or may even decline at older ages (through a convergence effect). The implications for international comparisons and learning from health policies related to frailty and sarcopenia detection and associated interventions are distinct.

To assess this (potential) effect, we split the sample according to age groups, along decades: 50–59 years of age, 60–69 years, 70–79 years of age

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and 80 years or older. Then, we proceed to re-estimate the relationship between the handgrip measurement and age and country fixed effects, with separate samples for men and women. We now have to set a criterion to assess whether differences across countries are increasing or decreasing over age groups. We use two different ways to measure these changes. The first one is to consider the sum of the absolute deviations to the mean (of the country fixed effects). The closer the value is to zero, the more similar are the countries. Thus, if this indicator has a smaller value for older age groups countries' populations have more similar handgrip strength at these older ages.

A second indicator is the standard deviation of the country fixed effects. This indicator has a similar interpretation, and the difference from the previous indicator is of significant importance to extreme differences.

As a brief technical note, in all regressions performed as the first step to compute the two indicators, we take Austria's country fixed effect to be normalized to zero (without loss of generality).

The results for the two indicators and the four age groups are reported in Table 34.1.

The differences across age groups do not seem to have any particular pattern for either men or women. For men, the dispersion of country fixed effects seems larger for the younger age group (50–59 years old). For the other groups, no systematic difference seems to exist. Thus, handgrip strength differences are present for all age groups in, essentially, a similar manner. Country differences are stable over age groups. This in line with the previous findings of Andersen-Ranberg et al. (2009) for the differences between north and south populations across the age range. We interpret this as reflecting permanent features of the population and of health systems.

Figures 34.3 and 34.4 present the quartiles of handgrip strength per age group (decade). Despite some changes from age group to age group, the broad divide of north, south and eastern Europe clusters is apparent. The values in Table 34.1 reveal that underlying variations among countries do not change significantly across age groups.

34.5 Final remarks

The main implication from the analysis performed is the existence of persistent differences in handgrip strength across several dimensions. North Europe countries have populations with a lower risk of probable sarcopenia, when measured by handgrip strength. The analysis by age groups reveals that these

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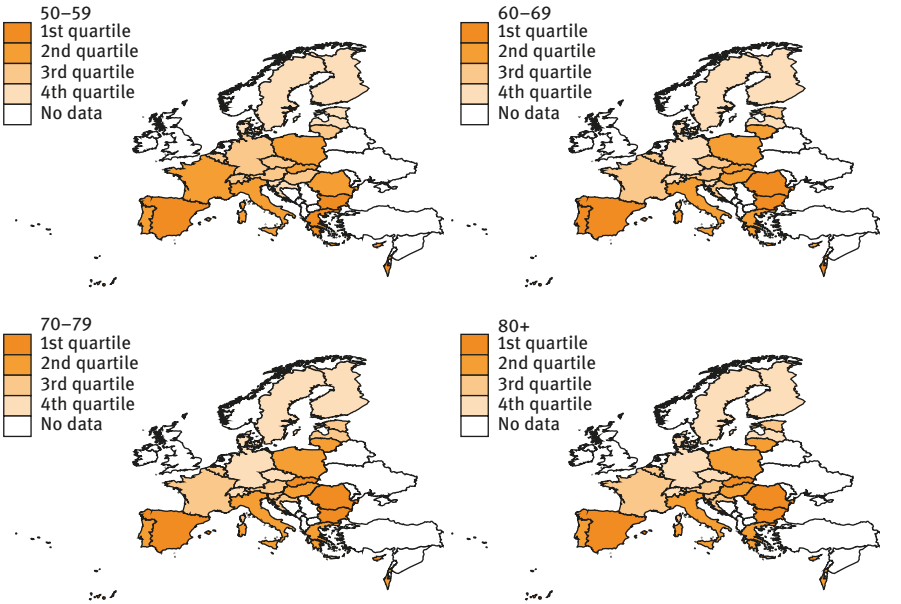

Figure 34.3: Handgrip strength, men by age group.
Note: Darker colours indicate weaker handgrip strength.
Source: SHARE Wave 7 release 0.

differences are stable across age groups and across handgrip strength (country-level) quartiles in the population (taking the lowest/highest 25 per cent of the population ordered by handgrip measurement in each country). Differences are not driven by age or by the weakest or strongest members of the population in terms of handgrip strength.

The three groups of European countries we focus on (eastern, northern and southern Europe) are different environmentally, socio-culturally, and institutionally. Eastern European countries tend to be, on average, less economically developed than northern and southern Europe countries, which can be associated with differences in access to healthcare and in healthy lifestyles by the population.

Southern European countries are more mixed in this respect, with important differences within this group with regard to income (GDP per capita) and in the design of the healthcare systems. However, southern Europe has several countries with higher life expectancy, even at older ages, than northern Europe countries. Higher handgrip strength is generally associated with less disability, lower morbidity and higher survival, which suggests that factors other than age must be present and relevant to explain cross-country differences in handgrip strength.

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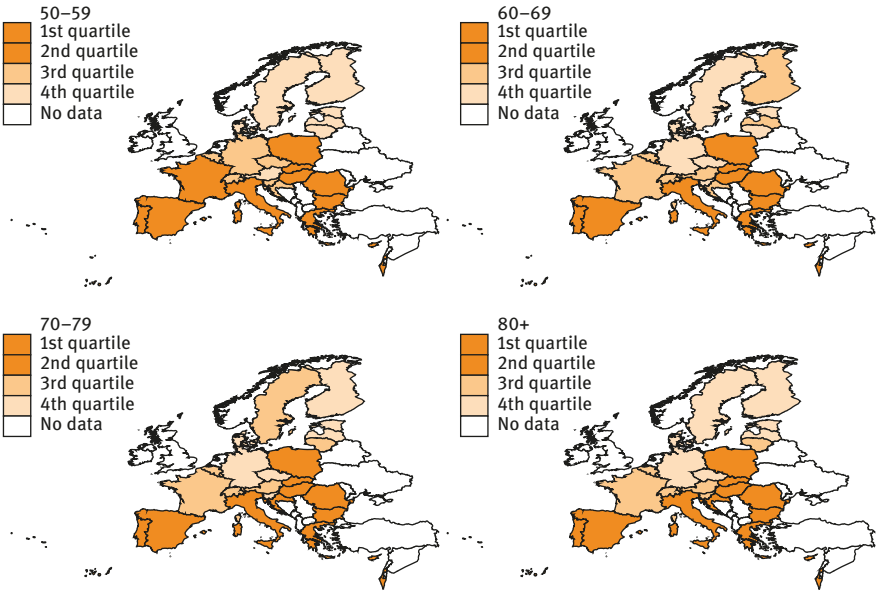

Figure 34.4: Handgrip strength, women by age group.
Note: Darker colours indicate weaker handgrip strength.
Source: SHARE Wave 7 release 0.

More important to our discussion is the possibility of different mechanisms behind the lower grip strength in eastern Europe and southern Europe. Unveiling the contribution of these and other characteristics will help to address concerns about the best approach to reduce the onset of sarcopenia, as well as improving and substantiating novel health policy recommendations that can positively affect the health and function of millions of Europeans. We leave for future exploration the role that exercise and physical activity as well as nutrition and the complex interplay between these factors, play with respect to sarcopenia. To understand the impact of physical activity it will be important to characterize type of exercise (aerobic vs resistance), frequency and intensity in different countries. Nutrition and typical diet of each country can also play a role, although full discussion requires information on eating habits of the population in each country. It will be of interest to evaluate levels of energy intake and contents of different nutrients in particular proteins, vitamin D and polyunsaturated fatty acids to speculate about the impact of nutrition in muscle strength and sarcopenia. The establishment of patterns of physical activity and nutritional habits will allow the identification of specific targets with respect to the relevant variables to prevent or delay sarcopenia. An early intervention will

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have an enormous social impact contributing for frailty prevention and their associated risks including falls and fractures (major determinant of reduced quality of life and life survival). Other variables should be evoked to complement these complex interplays. Cultural factors and architectural design of public spaces and cities favouring more physical exercise in some countries than in others may contribute to such differences. The role of other conditions, such as depression and diabetes for example, in fostering differences in grip strength across countries should be explored as well. These insights will inform health policies to tailor health promotion strategies, which may include changes in life styles related to exercise and nutrition. Our first results from SHARE wave 7 provide an initial step in better understanding sarcopenia distribution and its drivers across Europe.

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