Cross-national differences in grip strength among 50+ year-old Europeans.  
Results from the SHARE study

Andersen-Ranberg K1,2, Petersen I1, Frederiksen H1, Mackenbach JP3, and Christensen K1.

1 Institute of Public Health, University of Southern Denmark, Denmark
2 Department of Geriatrics, Odense University Hospital, Denmark
3 Department of Public Health, Erasmus Medical Center, Rotterdam, the Netherlands.

Background: Hand grip is a measure of physical functioning and a predictor of morbidity, disability and mortality.

Objective: To study hand grip strength in people aged 50 and older across 10 European countries.

Design: Cross-national, cross-sectional population-based study.

Setting: Sweden, Denmark, the Netherlands, Germany, France, Switzerland, Austria, Spain, Italy, and Greece.

Participants: The study population comprised 22,777 men and women aged 50 and older who participated in the SHARE (Survey on Health, Ageing and Retirement in Europe) study.

Measurements: Hand grip strength was measured twice on each hand using a dynamometer (Smedley, S Dynamometer, TTM, Tokyo, 100 kg). In the analyses, the maximum grip strength measurement was used (Maxgrip), along with self-reported body weight (Ph012) and height (Ph013).

Main results: Of the 21,972 50+y old participants in SHARE, grip strength measurements were obtained in 20,014 (91.0%). Additional information on height and weight was present in 19,688 (89.6%). The unadjusted maximum grip strength measurements show an age-dependent decline from age 50 and onwards in both genders, with men having higher grip strength scores than women. The gender differences and the pattern of decline are similar in all SHARE countries. However, northern (Sweden and Denmark) and continental (the Netherlands, Germany, Austria, Switzerland, and France) SHARE countries have higher grip strength scores compared to southern (Spain, Italy and Greece) SHARE countries, the difference being almost constant over the entire age range, on average 13.7% [CI: 13.4;14.0] higher for men, and 17.1% [CI: 16.8;17.4] higher for women. Adjusting for height and weight did not change the country and gender-specific pattern or the
North-South gradient over the entire age range (Men: 9.4% [CI: 9.1;9.7]; women: 14.1% [CI: 13.8;14.5]).

**Conclusion:** Grip strength is easily measured in a large cross-national survey. Gender-specific grip strength declines with age in all countries. The pattern of decline is similar in all countries, but people aged 50 and over in the southern European countries have lower grip strength than their northern and continental European peers. The North-South pattern is intriguing and might reflect both genetically and other biologically determined factors. However, the pattern is in conflict with the present knowledge that higher grip strength is a predictor of better survival and lower disability, as the Mediterranean countries are those countries in Europe with lowest old age mortality. If this survey is extended to a longitudinal one it may help us to understand more of the underlying mechanisms that are analogous to the gender difference in grip strength, which indicates that men have substantially better grip strength than women, but still higher mortality rate, even if grip strength predicts mortality within each gender.
Cross-national differences in grip strength among 50+ year old Europeans

Andersen-Ranberg K¹, Petersen I¹, Frederiksen H¹, Mackenbach J², and Christensen K¹

¹ Institute of Public Health, University of Southern Denmark, Denmark
² Department of Public Health, Erasmus Medical Center, the Netherlands
The natural history of grip strength decline - cross-sectional data

H. Frederiksen et al. Ph.D. thesis: Genes and Physical functioning in the Elderly, Epidemiology, Institute of Public Health, Faculty of Health Sciences, University of Southern Denmark 2002
Why use grip strength?

Grip strength is
- Correlated to other muscle groups, incl. lower extremities (Rantanen 1994)
- A good "overall measure" of muscle strength (Innes 1999, Rantanen 1994, Richards 1996)

Grip strength is a strong predictor of
- Morbidity (Rantanen 1998, Blake 1988)
Grip strength predicts disability


(Rantanen 1999)
Why use grip strength? - 2

Grip strength is
- Easy to use in surveys
- No ceiling effect
- Discriminates at all ages
- High participation rates
- Feasible even in the weakest subjects
Aim of using grip strength in SHARE

- Cross-national comparisons using the same instrument
  - Are mortality differences across countries reflected in grip strength?
  - Does grip strength predict differently across nationalities regarding disability, morbidity and mortality? (SHARE longitudinal)
Method

- Standing (sitting) position
- $90^\circ$ angle of the elbow
- Upper arm tight against the trunk
- Adjusted inner lever to fit hand size
- 2 measurements of each hand
- All interviewers got the same instruction
- Valid measurements defined
  - $< 20$ kg between 2 measurements in one hand
  - $0$ kg $< \text{valid} < 100$ kg
- Maximum grip strength used
# Results - feasibility

<table>
<thead>
<tr>
<th>Country</th>
<th>50+ y N</th>
<th>GS n</th>
<th>valid GS, n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT</td>
<td>1,938</td>
<td>1,650</td>
<td>1,627</td>
<td>84.0</td>
</tr>
<tr>
<td>GE</td>
<td>2,946</td>
<td>2,700</td>
<td>2,683</td>
<td>91.1</td>
</tr>
<tr>
<td>SE</td>
<td>3,010</td>
<td>2,816</td>
<td>2,779</td>
<td>92.3</td>
</tr>
<tr>
<td>NL</td>
<td>2,878</td>
<td>2,684</td>
<td>2,661</td>
<td>92.5</td>
</tr>
<tr>
<td>ES</td>
<td>2,373</td>
<td>2,177</td>
<td>2,041</td>
<td>86.0</td>
</tr>
<tr>
<td>IT</td>
<td>2,506</td>
<td>2,253</td>
<td>2,232</td>
<td>89.1</td>
</tr>
<tr>
<td>FR</td>
<td>1,748</td>
<td>1,528</td>
<td>1,508</td>
<td>86.3</td>
</tr>
<tr>
<td>DK</td>
<td>1,637</td>
<td>1,550</td>
<td>1,531</td>
<td>93.5</td>
</tr>
<tr>
<td>GR</td>
<td>1,980</td>
<td>1,752</td>
<td>1,736</td>
<td>87.7</td>
</tr>
<tr>
<td>CH</td>
<td>956</td>
<td>904</td>
<td>890</td>
<td>93.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>21,972</td>
<td><strong>20,014</strong></td>
<td><strong>19,688</strong></td>
<td><strong>89.6</strong></td>
</tr>
</tbody>
</table>
Females

Weight- and height-adjusted maxgrip vs. Age

-15 -10 -5 0 5

50 60 70 80 90 100

AU GE SE NL FR DK CH

IT ES GR
Why these north–south differences?

- Cannot be explained by lower stature in the southern countries
- Does not reflect the higher life expectancy at birth for Italians and Spaniards
Why these north–south differences?

- Genetics? Twin studies show a substantial genetic component in hand grip
- Environment? Warmer climate, sedentary lifestyle?
- Gene-environment interaction?
- Similar to gender - predicts within gender and country, not across gender or country