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33 The association between self-reported physical activity and physical performance: Does advancing age matter?

- Older people who engage in moderate or vigorous physical activities have better muscle strength than their physically inactive peers
- The benefits of physical activity increase with advancing age

33.1 Physical activity and physical function at older ages

Ageing is associated with declines in physical functional performance, partly due to reductions in muscle mass and muscle fibres and a shift from faster (type 2) to slower muscle fibres (type 1). These changes are related to muscle weakness and lower speed of movement, thereby affecting muscle performance. However, intervention studies reveal that exercise training improves muscle strength and, consequently, physical performance. Moreover, more intense physical activity results in a better outcome (Paterson, Jones and Rice, 2007).

Physical performance is a prerequisite for physical independence. Such independence is the hallmark of satisfying healthy ageing. Physical activity also reduces the risk of age-related morbidities and mortality. However, although we know that physical activity is important for maintaining muscle performance and improving physical functioning, little is known about the magnitude at which physical activity affects muscle performance in advanced age.

Insofar as physical activity is important for healthy and disability-free living, the SHARE survey collects self-reported data on respondents' engagement in physical activity and the intensity of such activity. SHARE also collects an objective measure of hand grip strength. This particular measure is not only a good marker of physical performance – it is inversely correlated with all-cause

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mortality in middle and older adulthood and predicts disability among older adults (Andersen-Ranberg et al, 2009).

The relationship between the level of physical activity and hand grip strength in older adults has been studied in only two small studies and with partly contradicting results. A cross-sectional study showed that, although no association exists between grip strength and physical activity among 50–64-year-olds, a significant association was observed among those aged 65 and older (Hwang et al, 2016). Moreover, the association was strongest among the oldest participants, that is, those older than 75 years of age. A similar pattern was described in another study using the five sit-to-stand test (Landi et al., 2018). Gómez-Cabello et al. (2014) also showed that higher levels of physical activity were associated with greater grip strength among those aged 65+ and that the difference in grip strength was greatest in the youngest age group and became progressively lower with advancing age

Good health is important to individuals and society. Insofar as physical activity is associated with good health, it is essential to know more about the benefits of physical activity in the rapidly ageing European population. Therefore, the current chapter considers how different levels of self-reported physical activity are related to hand grip strength across older age groups in Europe.

33.2 The study

We used a *pooled* sample of data from SHARE Waves 1 to 6 (excluding Wave 3, which collected retrospective life histories). The first six waves of SHARE cover the time period from 2004 to 2015. The number of participants by wave and country is shown in Table 33.1. Physical activity levels were assessed by the following questions in the computer-assisted personal interview: 'How often do you engage in vigorous physical activity, such as sports, heavy housework or a job that involves physical labour?' and 'How often do you engage in activities that require a moderate level of energy, such as gardening, cleaning the car or doing a walk?'. In both questions, the answer categories were 'More than once a week', 'Once a week', 'One to three times a month', or 'Hardly ever or never'. For our analysis, we dichotomized the answer categories into 'active' and 'inactive', where 'active' reflected those who answered 'More than once a week' or 'Once a week' and 'inactive' represented those answering 'One to three times a month' or 'Hardly ever or never'.

Participants were divided into age groups (50–59, 60–69, 70–79 and 80+ years) and geographic regions because we have previously found a geographic

variation in grip strength in gender and height-adjusted peers (Andersen-Ranberg et al, 2009). The northern Europe category included respondents from Denmark and Sweden; western Europe reflected those from Austria, Germany, France, the Netherlands, Switzerland, Belgium, Ireland and Luxembourg; southern Europe grouped participants from Spain, Italy, Greece and Portugal; and Eastern Europe included those from the Czech Republic, Poland, Hungary, Slovenia, Estonia and Croatia.

Table 33.1: Overview of number of participants per country in each wave.

	Wave 1	Wave 2	Wave 4	Wave 5	Wave 6
Sweden	2,958	2,694	1,922	4,484	3,863
Denmark	1,583	2,463	2,172	4,016	3,640
Ireland	0	989	0	0	0
Germany	2,910	2,514	1,576	5,536	4,326
Luxembourg	0	0	0	1,580	1,539
Netherlands	2,810	2,564	2,683	4,092	0
Belgium	3,583	3,050	4,954	5,477	5,649
France	2,881	2,797	5,437	4,390	3,851
Switzerland	932	1,429	3,544	2,980	2,767
Austria	1,506	1,167	4,928	4,252	3,343
Portugal	0	0	1,659	0	1,644
Spain	2,175	2,272	3,262	6,457	5,521
Italy	2,480	2,895	3,489	4,635	5,177
Estonia	0	0	6,666	5,625	5,518
Poland	0	2,383	1,661	0	1,785
Czech Republic	0	2,609	5,258	5,486	4,778
Hungary	0	0	2,926	0	0
Slovenia	0	0	2,646	2,884	4,151
Croatia	0	0	0	0	2,376
Greece	2,633	3,179	0	0	4,759

Source: SHARE Wave 1–6.

Using linear regression analysis with robust standard errors, we compared grip strength between physically inactive and physically moderately or vigorously active participants for all countries combined, stratified by age groups and gender. The grip strength difference was measured in both absolute (kilograms) and relative (percentage) terms. The robust model employed clustering from repeated measurement of the participants over several different SHARE waves. All regression analyses included an interaction between age group and physical activity (moderate physical activity and vigorous physical activity) and were adjusted for SHARE wave, limitations in daily activities for the past 6 months due to a health problem, height and European region. A Holm-Bonferroni adjustment was carried out on each subdivision when evaluating the difference between physically active and inactive participants. Participants younger than 50 years were excluded from the analyses, as were those with missing information.

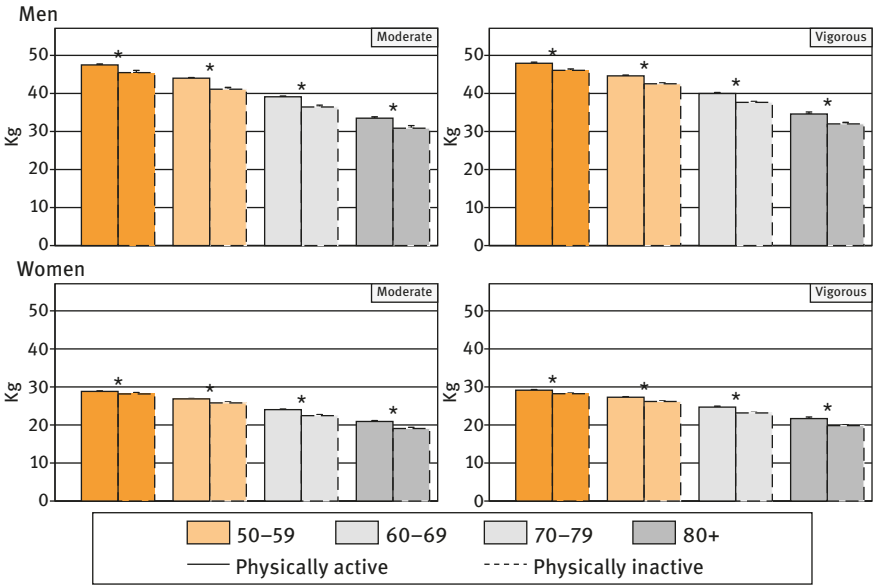
33.3 Key results

In this study, 50,690 (45%) men and 61,048 women (55%) were included, corresponding to 240,820 observations. Table 33.2 shows the distribution across age groups among participants and their mean grip strength. Both moderately and vigorously physically active participants had higher grip strength compared with the inactive participants, which was the case for both genders (Figure 33.1).

Table 33.2: Feasibility of grip strength (GS) test by age group and gender.

	Grip Strength							
Age group	**Men**				**Women**			
	Enrolled	**Completed**	**Missing GS**	**GS mean**	**Enrolled**	**Completed**	**Missing GS**	**GS mean**
years	**N**	**N**	**%**	**KG**	**N**	**N**	**%**	**KG**
50–59	31,254	29,475	6%	48.7	40,993	38,767	5%	29.7
60–69	38,355	36,136	6%	44.5	44,403	41,535	6%	27.3
70–79	26,594	24,455	8%	38.4	31,278	27,911	11%	23.6
80+	11,436	9,619	16%	31.5	16,507	12,652	23%	19.3

Note: Grip strength (GS), number of participants (N).
Source: SHARE Wave 1–6.



* significant difference between physically active and physically inactive

Figure 33.1: Grip strength for physically active and physically inactive (moderately or vigorously) participants by age groups and gender.
Note: Error bars are shown as confidence intervals.
Source: SHARE Wave 1–6.

For absolute grip strength (kg), we found an interaction for women between age and physical activity; that is, the difference in grip strength between physically inactive and physically active women differed by age (Figure 33.2). Thus, for the group of moderately physically active women aged 70–79 and 80+ and vigorously physically active women aged 80+, there was a larger difference in grip strength between the physically active and the physically inactive compared with the age groups 50–59 and 60–69. Likewise, for the group of vigorously physically active women aged 70–79, there was a larger difference in grip strength compared with the age group 50–59.

The relative changes were largest in the oldest age groups. Hence, moderately and vigorously physically active men and women aged 80+ showed significant differences in relative grip strength (%) compared with those aged 50–59 and 60–69 years. Moreover, both genders had significantly higher relative grip strength when comparing the 80+ year-old age group with the 70–79 years-old age group, and likewise when comparing the 70–79 years-old age group with the 50–59 and 60–69 years-old groups.

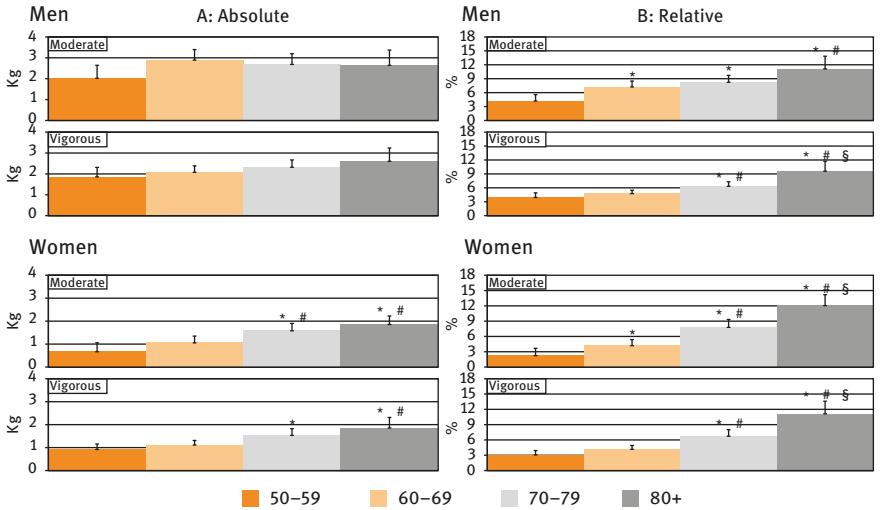


Figure 33.2: Grip strength differences between physically active and physically inactive (moderately or vigorously) participants by age group and gender.
Note: Grip strength difference is shown in absolute kilograms (A) and relative percentage change (B). Error bars are shown as confidence intervals.
Source: SHARE Wave 1–6.

33.4 What we learned

Using grip strength as a proxy indicator of good health, our analysis confirms that physical activity is associated with good health. Moreover, the findings underscore the increasing health benefit of physical activity with advancing age. Therefore, a physically active lifestyle is important even in very old age.

Our findings are in line with the works of Hwang et al. (2016), and Landi et al. (2018), both of whom showed that the health benefits from physical activity seem to increase with age. However, as recalled, Gómez-Cabello et al. (2014) found an increasingly smaller difference between the active and the inactive along with advancing age. This contradiction might be explained by differences in methodology in the respective studies, as Gómez-Cabello et al. (2014) used a different physical activity scale that includes both duration and intensity. The SHARE probe asks two basic questions on physical activity level. However,

despite the methodological differences, all studies showed that physical inactivity has a strong negative effect on health.

It is difficult to explain why the biggest difference in grip strength is seen in the oldest age group, but one explanation might be that higher relative workload leads to increased muscle strength. Given the general ageing-associated decline in muscle performance, a given physical exercise (for example, walking up a flight of stairs) yields a higher workload in the oldest age group relative to the youngest age group.

We should point out that, although SHARE collects data from a representative population sample, the possibility exists that survey participants in the oldest cohort are somewhat healthier than their non-participating counterparts. Nevertheless, the selection effect among those aged 80+ years notwithstanding, we still show that active participants have better grip strength than inactive ones. Thus, it is plausible that the difference in grip strength in the general population may be even larger.

We also note that the current inquiry employed a cross-sectional analysis because a sufficiently large number of survey participants with unknown vital status are lost to follow-up. This phenomenon occurs particularly among those in the oldest age groups because they suffer from the highest mortality risk and drop out more frequently due to morbidities. Thus, we cannot demonstrate a direct causal effect of the health benefits of vigorous and moderate physical activity with advancing age.

33.5 Conclusion

The results in this study show that, relative to physically inactive individuals, older people who engage in moderate or vigorous physical activity have better muscle strength. Moreover, the muscle strength difference between the active and the inactive is higher in the oldest age groups relative to the middle and younger ages. Because grip strength is highly correlated with mortality, morbidity and disability, the results of this study corroborate prior findings that physical activity has a positive health effect on older adults and that this effect may even be strongest in the oldest age groups. This knowledge should be used to set a policy agenda that focuses on discouraging a sedentary and inactive lifestyle and facilitates physical activity among all age groups, especially among older adults. Implementation of such initiatives may reduce the adverse outcomes of ageing-associated diseases and increase independent life expectancy and quality of life.

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