

What longitudinal studies tell us about

Inequalities in adult physical capability

Longitudinal evidence has helped track when in life gender differences and social inequalities in physical capability emerge, and how they grow as the population ages.

Introduction and key findings

Health is not just about disease and diagnoses – it's also about how we feel, how we function and how we adapt to changes in our lives, for example the changes we go through as we age¹. For most of us, our state of health is affected by our development and experience over the course of our entire lives.

Physical capability, or physical functioning as it is often called, refers to a person's capacity to undertake the physical tasks of everyday life, such as getting up from a chair, or walking². Looking at differences in people's physical capability over the course of their lives may be able to help us identify those people who are more likely to achieve a longer and healthier life and maintain their independence and quality of life as they get older.

It is important to remember that longitudinal studies use different types of complementary measures to assess important aspects of physical capability. These include self-reported information and objective assessments, such as grip strength, walking speed, ability to get up from a chair, and standing balance. These objective measures may be more accurate in assessing change over time. They also allow us to identify those both people performing well and those with limitations, and can make it easier to compare findings across studies and generations.

¹ Cooper, R., Strand, B. H., Hardy, R., Patel, K. V., & Kuh, D. (2014). [Physical capability in mid-life and survival over 13 years of follow-up: British birth cohort study](#). *BMJ: British Medical Journal*, 348.

² Cooper, R., Kuh, D., Cooper, C., Gale, C. R., Lawlor, D. A., Matthews, F., & Hardy, R. (2010a). [Objective measures of physical capability and subsequent health: a systematic review](#). *Age and ageing*, 40(1), 14-23.

Why is physical capability important?

Poor physical capability in early to mid adulthood may be an indicator of future health. A systematic review of research on this topic found that poorer performance on commonly used objective measures of physical capability (such as grip strength and walking speed) was associated with a higher risk of developing health problems later on in life, including fractures and cognitive decline³.

Other studies have found that lower physical capability is linked to higher rates of death^{4,5}. Recent findings from the [Medical Research Council National Survey of Health and Development](#) (1946 British birth cohort)⁶ looked at people's performance at age 53 on three measures of physical capability: grip strength, chair rise time and standing balance. They then compared this to death rates between ages 53 to 66.

When looking at overall performance across the three measures, the researchers found that the death rate among those who were unable to perform the tests and those who performed in the lowest fifth was much higher than those with the best overall performance.

These associations have a number of possible explanations. For instance, it is possible that poor physical capability is a sign of underlying disease or poor general health, or it could be that ageing processes cause both poor physical capability and poor health.

Key findings:

- In middle age, the gap between men and women's physical capability increases dramatically.
- Childhood socioeconomic circumstances are associated with physical capability in adulthood, even when controlling for other mediating factors.
- People enter later life with greater socioeconomic inequalities in physical functioning – studies have shown that the gap nearly doubles between midlife to early old age.

Gender differences in physical capability

Women are disproportionately more likely than men to develop disabilities in older age, with longitudinal evidence showing that these differences emerge earlier in life.

³ Cooper, R., Kuh, D., Cooper, C., Gale, C. R., Lawlor, D. A., Matthews, F., & Hardy, R. (2010a). [Objective measures of physical capability and subsequent health: a systematic review](#). *Age and ageing*, 40(1), 14-23.

⁴ Cooper, R., Kuh, D., Hardy, R. and the FALCon and HALCyon study teams. (2010b). [Objectively measured physical capability levels and mortality: Systematic review and meta-analysis](#). *British Medical Journal*, online first, 1-12.

⁵ Cooper, R., Strand, B. H., Hardy, R., Patel, K. V., & Kuh, D. (2014). [Physical capability in mid-life and survival over 13 years of follow-up: British birth cohort study](#). *BMJ: British Medical Journal*, 348.

⁶ Ibid.

A study⁷ including more than 3,000 members of the [Medical Research Council National Survey of Health and Development](#) (1946 British birth cohort) compared men and women's self-reported difficulty with day-to-day physical tasks, including walking and climbing stairs at ages 43 and 53.

At age 43, around 5 per cent of women reported that they had problems walking and using stairs due to a long-term health problem. A similar number reported having trouble gripping lids or reaching with their arms. Just over 3 per cent of men reported similar problems.

Ten years later, the gap between men and women had increased dramatically. Over 28 per cent of women reported difficulty performing simple tasks with their hands and arms, compared to just 12 per cent of men. Around one in five women reported difficulty with routine activities such as walking and stair climbing, compared to around one in ten men.

The cohort members' socioeconomic position was measured by their fathers' occupation at age four, and their head of household's occupation at age 43. Overall, people with lower socioeconomic position at either age deteriorated more quickly than their better-off peers, however the inequalities were greater among women than men. Education provided some protection, but far fewer women than men in this cohort achieved A levels or higher.

When combining findings from several UK cohort studies⁸, researchers found gender differences across a range of physical capability measures. Among adults over the age of 50, men tended to perform better on most measures, although differences in walking speed were reduced when controlling for body size. The review found that on most measures, the gender differences narrowed with age, with the exception of walking speed, which appeared to widen.

Childhood social background

The social inequalities we experience in early life matter to our physical capability in middle age, but the nature of this relationship can vary across measures.

Analyses of more than 2,900 members of the [Medical Research Council National Survey of Health and Development](#)^{9,10,11} (1946 British birth cohort) found that

⁷ Murray, E. T., Hardy, R., Strand, B. H., Cooper, R., Guralnik, J. M., & Kuh, D. (2011). [Gender and life course occupational social class differences in trajectories of functional limitations in midlife: findings from the 1946 British birth cohort](#). *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 66(12), 1350-1359.

⁸ Cooper, R., Hardy, R., Sayer, A. A., Ben-Shlomo, Y., Birnie, K., Cooper, C., ... & HALCyon Study Team. (2011). [Age and gender differences in physical capability levels from mid-life onwards: the harmonisation and meta-analysis of data from eight UK cohort studies](#). *PLoS One*, 6(11), e27899.

⁹ Strand, B. H., Cooper, R., Hardy, R., Kuh, D., & Guralnik, J. (2011). [Lifelong socioeconomic position and physical performance in midlife: results from the British 1946 birth cohort](#). *European journal of epidemiology*, 26(6), 475-483.

different measures of socioeconomic position were associated with different measures of physical capability . For example, cohort members whose mothers had little or no education had poorer standing balance at age 53 than those whose mothers were highly educated.

On the other hand, it was their fathers' occupations that were associated with their ability to get up and down from a chair – those whose fathers were in non-manual job were able to do this more easily than those whose fathers were manual workers.

The researchers found no association between childhood socioeconomic position and grip strength at this age.

In another set of analyses using the 1946 British birth cohort¹², researchers grouped the physical capability measures to create an overall score. They found that having a father in a manual job was associated with lower overall performance and having a well-educated mother was associated with better overall performance.

In both studies, the associations remained even after controlling for a range of factors in both childhood and adulthood, including the cohort members' own education, occupation and lifestyles.

Subsequent findings from the 1946 British birth cohort¹³ have shown that existing socioeconomic inequalities in physical capability persisted and further inequalities emerged by the time the cohort members had reached retirement age (60-64 years).

Researchers compared the cohort members' performance on a range of objective measures of their physical capability to the occupational class of their head of household at ages 4 and 53. They found that the cohort members' childhood circumstances were related to their physical capability in their 60s. These associations remained even when controlling for a wide range of other factors, including adult socioeconomic position, occupation and education.

A study¹⁴ which drew together data from different studies around the world found consistent evidence of an association between childhood socioeconomic position and physical capability even into people's late 60s and 70s. Researchers found that people who grew up in more disadvantaged circumstances performed less well in

¹⁰ Kuh, D., Bassey, J., Hardy, R., Sayer, A. A., Wadsworth, M., & Cooper, C. (2002). [Birth weight, childhood size, and muscle strength in adult life: Evidence from a birth cohort study](#). *American Journal of Epidemiology*, 156(7), 627-633.

¹¹ Kuh, D., Hardy, R., Butterworth, S., Okell, L., Richards, M., Wadsworth, M., Cooper, C. & Sayer, A. A. (2006). [Developmental origins of midlife physical performance: Evidence from a British birth cohort](#). *American Journal of Epidemiology*, 164(2), 110-121.

¹² Guralnik, J. M., Butterworth, S., Wadsworth, M. E., & Kuh, D. (2006). [Childhood socioeconomic status predicts physical functioning a half century later](#). *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 61(7), 694-701.

¹³ Hurst, L., Stafford, M., Cooper, R., Hardy, R., Richards, M., & Kuh, D. (2013). [Lifetime socioeconomic inequalities in physical and cognitive aging](#). *American Journal of Public Health*, 103(9), 1641-1648.

¹⁴ Birnie, K., Cooper, R., Martin, R. M., Kuh, D., et al. (2011). [Childhood socioeconomic position and objectively measured physical capability levels in adulthood: a systematic review and meta-analysis](#). *PLoS one*, 6(1), e15564.

some tests of physical capability, than their more affluent peers. The association for two measures – walking speed and ability to get up from a chair – remained even when adult socioeconomic position was taken into consideration.

Socioeconomic position and material deprivation

Findings from [Whitehall II](#)¹⁵, a longitudinal study of civil servants, show that self-reported physical functioning deteriorates more rapidly among those from lower employment grades.

Researchers analysed information on the general health and physical problems of more than 10,000 civil servants, which they compared to the individuals' employment grade.

People in low-grade posts aged more quickly than their peers in more senior positions. For example, the average physical health of a 45-year-old man in a high-grade post was equivalent to that of a man four and half years younger who had worked in a low-grade job.

By age 70, the average health of a man in a high-grade post was similar to that of a low grade man eight years younger. The differences were similar for women.

Material deprivation can also help identify those at greater risk of physical decline.

Researchers analysed information on more than 3,200 men and women aged 59 to 73 of the [Hertfordshire Cohort Study](#)¹⁶. They compared different measures of the cohort members' physical functioning to indicators of material deprivation, namely whether or not they owned their own home, and whether or not they had access to a car.

The average grip strength among men who did not own their home and had no cars was 40 kg, compared to 46 kg among those who owned their home and had three or more cars. Among women, those with fewer material assets had a grip strength of 23.8 kg, compared to 27.3 kg for women with more resources.

Over half of men who did not own their home and had no access to a car also had poor self-reported physical functioning, compared to just over a tenth of those who were home-owners and had three or more cars available.

These associations remained even after controlling for walking speed, medical history, and other current health conditions, such as heart disease and diabetes.

¹⁵ Chandola, T., Ferrie, J., Sacker, A., and Marmot, M. (2007). [Social inequalities in self reported health in early old age: follow-up of prospective cohort study](#). *BMJ. British medical journal*, 334(7601), 990-993.

¹⁶ Syddall, H., Evandrou, M., Cooper, C., & Sayer, A. A. (2009). [Social Inequalities in Grip Strength, Physical Function, and Falls Among Community Dwelling Older Men and Women Findings From the Hertfordshire Cohort Study](#). *Journal of aging and health*, 21(6), 913-939.