

Intelligence in early adulthood and midlife physical performance in men: The mediating roles of education and physical activity



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ABSTRACT

The objective of this study was to examine whether associations between intelligence in early adulthood and midlife physical performance in men were mediated by education and leisure-time physical activity. Intelligence correlated positively with later education ($r = 0.47$) and negatively with physical activity ($r = -0.04$). We found higher early adult intelligence to be associated with better midlife physical performance for five of the seven measures. Education mediated the association between intelligence and chair-rise and jump height with mediated proportions of 32.4% (95% confidence interval [CI]: 0.21%, 0.43%) and 28.4% (95% CI: 0.17%, 0.39%), respectively. No significant mediating effects of education were seen for sagittal flexibility, postural balance, handgrip strength, or muscle force in the abdomen or lower back. Physical activity was positively associated with physical performance, but because intelligence in early adulthood was inversely associated with physical activity, the indirect effects through physical activity were negative. Overall, education and leisure-time physical activity were not strong mediators of the association between early adult intelligence and midlife physical performance.

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1. Introduction

Preventing frailty and disability is important for maintaining independence and quality of life in old age. Measures of physical performance, e.g. handgrip strength and standing balance, have been associated with later disability risk (Onder et al., 2005). Insights into the mechanisms behind individual differences in physical performance are important for tailoring health promoting interventions. Physical performance in midlife has been associated with concurrent physical activity and occupational social class (Kuh, Bassey, Butterworth, Hardy, & Wadsworth, 2005), but early life factors such as childhood socioeconomic position (SEP) have also been associated with later physical performance (Birnie et al., 2011). Positive associations between early life intelligence and physical performance in midlife (Kuh et al., 2006; Kuh, Cooper, Hardy, Guralnik, & Richards, 2009; Meincke, Osler, Mortensen, & Hansen, 2015) or old age (Deary, Whalley, Batty, & Starr, 2006) have also been found, but the mechanisms behind these associations have still not been elucidated.

It has been hypothesized that childhood intelligence is related to midlife physical performance due to early individual differences in the central nervous system which affect the execution of physical tasks in midlife (Kuh et al., 2006). Kuh et al. (2009) found some support for this hypothesis by showing that balance was more strongly related to general intelligence than to more age-sensitive measures of intelligence such as verbal memory and search speed. In addition to the hypothesis of early individual differences in the central nervous system, it is likely that higher intelligence leads to a better understanding of health communication and a lifestyle in closer accordance with official health recommendations, for instance in relation to physical activity.

Previous research has found that people with higher intelligence test scores in childhood or young adulthood were more likely to engage in physical activity at the age of 30 (Batty, Deary, Schoon, & Gale, 2007) and less likely to engage in sedentary activities such as watching television at the age of 51 (Osler, Godtfredsen, & Prescott, 2008). Furthermore, intelligence has been shown to be predictive of later educational attainment (Deary, Strand, Smith, & Fernandes, 2007) while SEP, as indicated by occupational social class and physical activity, has been associated with physical performance in midlife (Kuh et al., 2005).

In order to provide insights into the mechanisms behind the association between early life intelligence and later physical performance we

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examined the hypothesis that higher intelligence test scores in early adulthood lead to higher educational attainment and higher levels of leisure-time physical activity resulting in better midlife physical performance. These potential mediating effects of education and physical activity were quantified using path analyses.

2. Methods

2.1. Study population

This study was carried out on a subpopulation of the Copenhagen Aging and Midlife Biobank (CAMB) established in 2009–2011 (Avlund et al., 2014). The subpopulation consisted of male participants from two cohorts with information from birth and onwards: The Copenhagen Perinatal Cohort (CPC) and the Metropolit Cohort (MP).

The CPC consists of 9125 individuals born at the Copenhagen University Hospital from October 1959 to December 1961; 4116 of these were males and living in Denmark in 1968 when the Danish Civil Registration System was established (Mortensen, Sørensen, Jensen, Reinisch, & Mednick, 2005). The MP consists of 11,532 men born in the Copenhagen metropolitan area in 1953 and living in Denmark in 1968 (Osler, Lund, Kriegbaum, & Christensen, 2006).

All individuals from the CPC and the MP living in the eastern part of Denmark were invited to participate in CAMB. The CAMB examination included a questionnaire and a visit to the study clinic where participants were subject to a health examination and assessment of physical performance (Avlund et al., 2014). Fig. 1 gives an overview of the selection of participants into the present study.

2.2. Exposure: intelligence in early adulthood

All Danish men have to attend military conscription when they turn 18 years-old. About 5–15% are exempted because of medical conditions like asthma (Teasdale, 2009). At the conscript board, the young men are subject to a medical examination and an intelligence test. The intelligence test was developed by the Danish psychologist Børge Prien and correlates substantially ($r = 0.82$) with the full-scale Wechsler Adult Intelligence Scale (Mortensen, Reinisch, & Teasdale, 1989). The psychometric properties of the test have been described elsewhere (Teasdale, 2009). The Børge Prien's test (BPP) consists of 78 items organized in four subtests: letter matrices (19 items), verbal analogies (24 items), number series (17 items), and geometric figures (18 items). One point was given for each correct answer resulting in a total score of 0–78. Information from military conscription had previously been collected manually from conscript boards for both cohorts.

2.3. Outcomes: measures of physical performance

We used seven different measures of physical performance included as continuous variables in order to preserve information.

Chair-rise was recorded as the number of times a participant was able to rise from a sitting position and sit down again during 30 s. The count was automatically recorded by a switch installed in the seat of the chair.

Sagittal flexibility was measured as the distance from fingertips to toes during maximal trunk flexion.

Muscle power in the legs was assessed by two-legged countermovement jumps. Using the impulse method described by Street, McMillan,

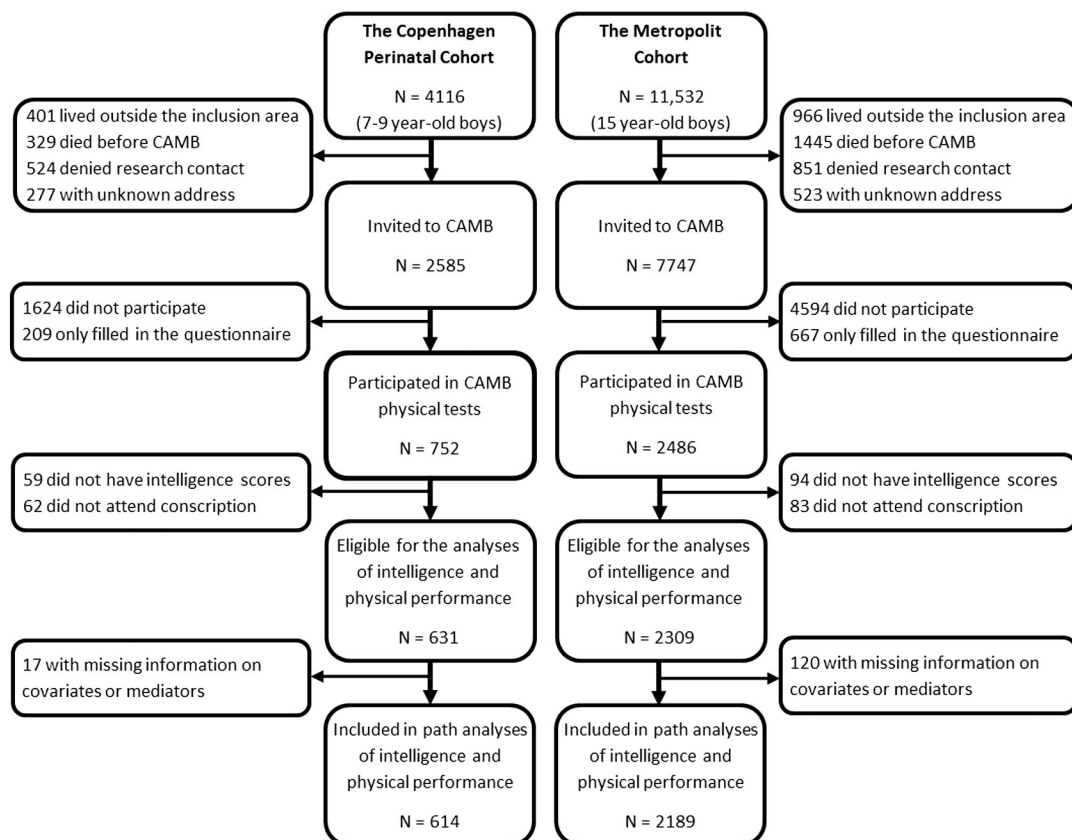


Fig. 1. Diagram showing selection of study participants from the Copenhagen Perinatal Cohort and the Metropolit Cohort. Number of participants (N) starts in 1968 when the Danish Civil Registration System was established.

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