University Hospital, Lund University, SE 205 20 Malmo, Sweden
*To whom correspondence should be addressed

References


Research letters

Socio-economic position predicts grip strength and its decline between 79 and 87 years: the Lothian Birth Cohort 1921

SIR—Grip strength is a useful measure of health in older adults, predicting both disability [1, 2] and mortality [1, 3]. In adulthood grip strength declines with age, though reaches a plateau in women in their tenth decade [4]. In a recent systematic review and meta-analysis, we reported that childhood socio-economic position (SEP) predicted physical capability in adulthood; comparing the lowest with the highest childhood SEP there was a reduction in grip strength of 0.13 standard deviations (95% CI: 0.06–0.21) [5]. Adjustment for the potential mediating factors, adult SEP and body size, attenuated this association so that it was no longer statistically significant. However, to facilitate the meta-analysis only paternal occupation was used as the index of childhood SEP for studies where more than one indicator was available. The Lothian Birth Cohort 1921 (LBC1921) was one study included in the meta-analysis, and there are several measures of childhood SEP available which were not used in the meta-analysis [5]. In addition, LBC1921 participants provided longitudinal data on grip strength measured on three occasions, at mean ages 79, 83 and 87 years. These assessments cover a period of life when the relationship of muscle strength to disability and mortality is particularly important. Drawing on these data, we sought to test whether paternal and maternal indices of childhood SEP improve the prediction grip strength and change in grip strength in old age beyond well-recognised adult predictors.
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Methods

Sample

The sample comprised LBC1921 participants who were seen at 79, 83 and 87 years of age [6]. Full details of recruitment to the LBC1921 cohort are available [7]. Briefly, potential participants were identified from the local Community Health Index and written to by the Director of Public Health. Consent, in accordance with permission from the Multicentre Research Ethics Committee for Scotland, was sought from those who responded positively. Some participants were recruited directly following local publicity for the study. Five-hundred and sixty-nine participants (238 men, 331 women) were seen at age 79, 549 having a physical assessment; 321 (145 men, 176 women) were seen again at age 83; 191 (87 male, 104 female) at age 87 years. Deaths of all participants were prospectively flagged by the General Register Office for Scotland with a census date of 28 May 2008 after the last participant had been seen at the third wave of follow-up.

Measures of childhood and adult SEP

Participants were asked about the main occupation of both parents up to when the participant was 11 years old and the number of years of full-time education each parent had received. Also recorded were the participant’s own years of full-time education and main occupation. Occupations were classified in five social classes as I (professional) to V (unskilled). Women were asked for their husband’s occupation as well as their own, and assigned a social class based on the highest occupation of their household.

Other measures

These were performed by trained nurses at a clinical research facility. Grip strength was measured with a Jamar hand-held dynamometer with the maximum of three trials with the dominant hand taken as the variable for use in analyses. Participants were weighed in normal indoor clothes and height was measured to the nearest millimetre with the participant standing by a SECA stadiometer. Some participants attended in the morning and others in the afternoon: there was no systematic selection of which participants attended when during the day.

Statistical analyses

All analyses were performed with the SPSS 16.0 statistical package. Mixed linear models were constructed to test effects of fixed factors and covariates on the overall trait of grip strength measured over three Waves and their effects on change in grip strength over the three Waves: this allowed all data to be included from each Wave, not just those from participants who completed all three Waves. Information criteria indicated that a first-order autoregressive within-subject covariance structure fitted the model best, so this was used in all analyses. Variables were entered into the model in the following sequence: (i) Wave, (ii) vital status, (iii) sex, (iv) height and weight, (v) participant’s adult SEP, (vi) participant’s childhood SEP. Terms were excluded at each step where $P > 0.05$.

Results

We were able to ascertain vital status at the censorship date for 559 of the original 569 Wave 1 participants, of whom 202 (99 men, 117 women, $\chi^2 = 1.48$, $P = 0.22$) had died. Forward conditional entry of participant’s childhood and SEP, gender and Wave 1 grip strength identified education (hazard ratio: 0.94, 95% CI 0.88–0.998 per year extra) as the only significant predictor of mortality: Wave 1 grip strength ($P = 0.22$) was not a significant predictor of death. Five hundred and forty-four (229 men, 315 women) had grip strength measured at Wave 1: Table 1 shows mean grip strength for those participants ($n = 203$) with data at all three Waves. Men’s grip strength declined by 22% between ages 79 and 87, and women’s by 26%. Table 2 shows adult and childhood SEP for participants who had grip strength measured at Wave 1.

Following the planned variable entry sequence, the final model comprised the following terms with significant effects: Wave ($P < 0.001$), vital status (remaining alive 1.9, 95% CI 0.8, 3.0 kg stronger, $P = 0.001$), sex (men 9.3, 95% CI 7.8, 10.9 kg stronger, $P < 0.001$), height (0.27, 95% CI 0.19, 0.36 kg stronger per cm taller, $P < 0.001$), education (0.38, 95% CI 0.14, 0.61 kg stronger per extra year, $P = 0.002$) and an interaction of father’s years of education by Wave ($0.29, 95\% \text{ CI: } 0.08, 0.49$ kg stronger at ages 83 and 87 compared with age 79 per extra year, $P = 0.014$).

Discussion

In this cohort grip strength was associated with sex, body size and adult SEP, consistent with previous studies [8]. Although baseline grip strength was not a significant predictor of mortality, participants who died did have lower grip strength over all three Waves, in practice mostly Waves 1 and 2, again consistent with earlier reports [1]. Even in those participants who remained alive and healthy enough to attend for Wave 3 at age 87, grip strength declined by about one quarter over 8 years. This rapid decline in grip strength was unrelated to sex, body size or adult SEP, but was associated with an index of childhood SEP, father’s education. This indicates that factors associated with SEP in childhood are influencing important aspects of ageing seven decades later. The size of this effect, about 1.5 kg stronger grip over 8 years standard deviation increase in the number of years of father’s full-time education approximates to an amelioration of approximately 25% of the rate of decline. The finding that father’s education but not social class predicted this decline could occur for two possible reasons. First, greater variance in education than social
although there is nothing to suggest that these are unusual, sectional studies, is highly speci c to effects of chronological age which often confounds cross-sectional studies, and Retirement Study which did not include this as a variable. In the current study, we found that paternal education and Retirement Study found paternal education rather than occupation predicted disability in later life and since grip strength relates strongly to disability, these data are consistent with our observations. However, paternal education is also associated with height which, since it influences grip strength, might mediate the effects seen in the Health and Retirement Study which did not include this as a variable: in the current study, we found that paternal education contributed to change in grip strength after adjusting for the effects of height.

There are several limitations to the study. First, the narrow-age cohort, despite being helpful in attenuating the effects of chronological age which often confounds cross-sectional studies, is highly specific in its characteristics and, although there is nothing to suggest that these are unusual, class (Table 2) may have provided greater statistical power. Alternatively, factors in the childhood environment associated with paternal education rather than occupation may be more important in predicting decline in strength in later life. Such factors might include income, with better educated fathers making available a greater proportion of income to children, and positive parenting behaviours associated with greater education. The Health and Retirement Study found paternal education rather than occupation predicted disability in later life and since grip strength relates strongly to disability, these data are consistent with our observations. However, paternal education is also associated with height which, since it influences grip strength, might mediate the effects seen in the Health and Retirement Study which did not include this as a variable: in the current study, we found that paternal education contributed to change in grip strength after adjusting for the effects of height.

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Table 2. Childhood socio-economic position variables for all LBC1921 participants who had grip strength measured at age 79 years (Wave 1)

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Mean (SD) or % frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant’s education (years)</td>
<td>542</td>
<td>10.9 (2.5)</td>
</tr>
<tr>
<td>Father’s education (years)</td>
<td>380</td>
<td>10.1 (3.0)</td>
</tr>
<tr>
<td>Mother’s education (years)</td>
<td>378</td>
<td>9.9 (2.40)</td>
</tr>
<tr>
<td>Participant’s social class</td>
<td>542</td>
<td>I—23.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II—33.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>III—39.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV—1.8</td>
</tr>
<tr>
<td>Father’s social class</td>
<td>465</td>
<td>I—10.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II—26.5</td>
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<tr>
<td></td>
<td></td>
<td>III—48.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV—10.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V—4.3</td>
</tr>
<tr>
<td>Mother’s social class</td>
<td>301</td>
<td>I—0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II—18.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>III—48.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV—23.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V—9.0</td>
</tr>
</tbody>
</table>

Table 1. Mean (SD) grip strength (kg) for 96 male and 107 female LBC1921 participants with data at all three study Waves

- **Means grip strength (SD)**
  - Age 79: 36.1 (6.7) for men, 21.0 (3.9) for women
  - Age 83: 33.2 (7.5) for men, 19.4 (4.1) for women
  - Age 87: 28.1 (7.3) for men, 15.6 (4.5) for women

Key points

- Grip strength declines by about one quarter over 8 years in both men and women in their ninth decade.
- Participants who survived had stronger grip than those who died during follow-up.
- Participants with lower childhood socio-economic position exhibited greater decline in grip strength.

Acknowledgements

We are indebted to Alison Pattie and Alan Gow who tested participants.

Conflicts of interest

None declared.

Funding

This study was supported by grants from the BBSRC, Research Into Ageing, British Academy and the Chief Scientist Office, Scotland. L.P. is funded by the UK Medical Research Council (Grant No. 82800), which is part of the Help The Aged-funded Disconnected Mind research programme. The work was undertaken by The University of Edinburgh Centre for Cognitive Ageing and Cognitive Epidemiology, part of the cross council Lifelong Health and Wellbeing Initiative. Funding from the BBSRC, EPSRC, ESRC and MRC is gratefully acknowledged. The sponsors had no role in the design and conduct of the replication in other cohorts is required. Second, we relied on participants’ report of childhood SEP; direct observation would be preferable, but data about individuals’ schooling is not available from over a century ago in Scotland. This limitation applies to other measures of childhood SEP of interest, such as income, which participants are unlikely to know with any accuracy. Although we adjusted for attrition due to mortality and used mixed models to provide better estimates of longitudinal effects, it is difficult to adjust for all sources of potential bias. Of importance is that of paternal education on mortality and disability. As noted, the Health and Retirement Study found that less paternal education was associated with increased disability, so we would expect the effects we observed on grip strength to have been attenuated by disability-associated attrition. In practice, the effect may well be larger than estimated here. Finally, the data do not provide any explanatory mechanisms for the association between childhood SEP and rate of grip strength decline in old age: this, too, is an area for future research, for example the effects of diet-related DNA methylation on oxidative stress genes which influence grip strength.

Research letters
study; in the collection, analysis and interpretation of data; or in the preparation, review or approval of the manuscript.

John M. Starr, Ian J. Deary

Geriatric Medicine, University of Edinburgh, Royal Victoria Hospital, Craigleith Road, Edinburgh EH4 2DN, UK
Tel: (+44) 131 537 5023; Fax: (+44) 537 5140.
Email: jstarr@staffmail.ed.ac.uk

Centre for Cognitive Ageing and Cognitive Epidemiology, Psychology, University of Edinburgh, Edinburgh, UK

*To whom correspondence should be addressed

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Prevalence of arthritis and joint pain in the oldest old: findings from the Newcastle 85+ Study

SIR—Arthritis is a condition strongly associated with age, yet surprisingly few comprehensive studies to date have examined how arthritis affects the oldest old—those aged 85 years and older, who will number 3.3 million in the UK by 2033 [1]. As the prevalence of musculoskeletal disease increases with age [2, 3], and musculoskeletal pain is one of the leading causes of age-related disability [4], increasing longevity is likely to have major consequences for older people’s quality of life and service provision in the UK. Estimates for arthritis in the 85+ group range from 24.2 to 57.1% [5, 6], with shoulder disorders being common [7]. Prevalence of joint pain in those over 85 years old is estimated between 12.9 and 57.0%, with painful joints more likely to be in the lower limb [3, 7–11]. However, only one of these studies is UK based. We present baseline findings on the prevalence of arthritis and of joint pain from the Newcastle 85+ study [12], an unselected cohort of 1,029 individuals born in 1921.

Methods

Study design and population

A prospective observational cohort study of 85 year olds (1921 birth cohort) from general practices in Newcastle upon Tyne and North Tyneside Primary Care Trusts. Full details of the study design, recruitment and data collected have been published previously [12]. Data were gathered by two methods — (i) general practice record review (GPRR) and (ii) a multidimensional health assessment (MDHA) conducted by trained research nurses in the participants’ own home or institution.

Full ethical approval was obtained for all parts of the study from Newcastle and North Tyneside Local Research and Ethics Committee. This work is supported by a joint grant from the Medical Research Council and the Biotechnology and Biological Sciences Research Council (G0500997). The funders had no role in the design and analysis of this study.

Data collection

Socioeconomic data and information regarding joint pain were obtained at the MDHA. The GPRR (paper and electronic records) provided lifetime prevalence of arthritis, as the reliability of self-report in a population with high levels of impaired cognition is questionable [13–16].

Full details of methods are provided in Supplementary data in Age and Ageing online, Appendix 1.

Statistical analysis

Lifetime prevalence of arthritis and the point prevalence of joint pain are presented using frequencies and percentages and the total number of painful joints as a median and