Early life origins of hearing impairment in older people

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Conflict of interest: The authors declare no conflict of interest.

Acknowledgements: Funding was provided by the US National Institute on Aging, and a consortium of UK government departments coordinated by the Economic and Social Research Council.

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Manuscript statistics: 618 words main text; 1 table; 9 references

Keywords: Ageing; Anthropometry; Hearing; Height; Life course

Data sharing: Code for replication of the present analyses is available from the corresponding author upon request. Anonymised individual-level data for the English Longitudinal Study of Ageing are available to bonafide researchers (https://www.ukdataservice.ac.uk/)
To the Editor:

Hearing loss is a major cause of disability: in people over 70 years of age in the United States and United Kingdom, around two-thirds report some form of hearing loss. The social and health consequences of hearing impairment are as considerable as the economic implications for care. That the most prevalent presentation of hearing impairment, age-related hearing loss, is currently incurable brings into sharp focus the need to identify risk factors for its occurrence.

There is strong evidence that several age-related chronic conditions, particularly cardiovascular disease (CVD), have their origins in early life. A shared etiology between hearing impairment and CVD has been advanced in adults. Also, physical stature (height), which captures exposure to early life psychosocial stress, adversity, somatic illness, and nutrition, reveals an inverse relationship with CVD. That a correlate of height, insulin-like growth factor 1 (IGF-1), is central to the optimal development of several organs, including the cochlea, is further reason to anticipate a stature–hearing link. Studies examining this relationship are, however, scarce.

The English Longitudinal Study of Ageing is an on-going, population-representative, open, prospective cohort study of men and women living in England aged ≥50 years at recruitment in 2002 (wave 1). Ethical approval for the study was granted by the National Research and Ethics Committee; all participants provided written consent. To capture any loss of height over time (shrinkage), we used a mean value based on direct measurements at waves 4 (2008) and 6 (2012), and related these to performance on an objective hearing examination at wave 7 (2014). Hearing acuity was quantified with the HearCheck device, a simple, low-cost, handheld appliance which produces a fixed series of six pure tones. With any hearing aids removed, the device was held against the left ear of the participant and they were asked to indicate when a beep became audible for the mid-frequency sound (1 kHz) made at three decreasing intensities (55, 35 and 20 dB HL). The process was repeated for a high frequency (3 kHz) sound, again at three different intensities (75, 55, and 35 dB HL). The test was then re-administered for the right ear. Hearing impairment
was defined as hearing fewer than six tones in the best hearing ear. We assessed covariate data using standard protocols.⁷

In an analytical sample of 4,398 study members, there were 1,682 cases (38%) of hearing impairment. We found evidence of an inverse relationship between height and later hearing impairment, such that taller study members experienced a lower risk (Table). Thus, the age- and sex-adjusted (Model 0) odds ratio for the highest quintile of height relative to the lowest was 0.64 (95% confidence interval: 0.51, 0.79). There was also some evidence of a gradient across the height groups (Table, eFigure 1; http://links.lww.com/EDE/B204). Adjusting for all study covariates (Model 2), which included socioeconomic status, smoking, and IGF-1, had a partial attenuating effect (0.75; 0.59, 0.95).

This inverse height–hearing impairment association is comparable in direction and magnitude to that apparent when CVD is the outcome of interest⁴ and potentially offers some etiological insights into the burdensome disorder of hearing loss. We are aware of only two studies reporting on the relationship between height and hearing impairment or acuity.⁹¹⁰ One combined small samples of military conscripts and people occupationally subject to high levels of noise, so offering modest generalizability.⁹ In the only general population-based sample of which we are aware,¹⁰ a positive correlation between height and hearing acuity was reported in the UK Biobank study, so supporting our own result. While low height per se is of course not a risk factor for hearing impairment, it is more likely that one or more of the characteristics for which it is a proxy—early life diet, illness, social adversity, cognition—has a role. Future research should therefore attempt to relate these individual, prospectively gathered indicators in childhood populations to hearing impairment several decades later.
References


Table. Prospective association of height with hearing impairment: the English Longitudinal Study of Ageing (N=4,398)

<table>
<thead>
<tr>
<th>Height quintiles (number of participants)</th>
<th>1 (880)</th>
<th>2 (877)</th>
<th>3 (880)</th>
<th>4 (880)</th>
<th>5 (881)</th>
<th>OR per 5 cm height advantage</th>
<th>P-value for trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median height, cm (range) – men</td>
<td>164.5</td>
<td>169.7</td>
<td>173.4</td>
<td>177.0</td>
<td>182.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(147.8-167.3)</td>
<td>(167.4-171.6)</td>
<td>(171.7-175.1)</td>
<td>(175.2-179.3)</td>
<td>(179.4-201.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median height, cm (range) – women</td>
<td>151.7</td>
<td>156.8</td>
<td>160.2</td>
<td>163.6</td>
<td>168.2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(134-175.6)</td>
<td>(154.7-158.6)</td>
<td>(158.7-161.9)</td>
<td>(161.9-165.5)</td>
<td>(165.6-186.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hearing impaired, % (N)</td>
<td>51.1 (450)</td>
<td>42.9 (376)</td>
<td>35.9 (316)</td>
<td>32.9 (290)</td>
<td>28.4 (250)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Model 0: age (continuous) and sex; Model 1: Model 0 + IGF-1 (nmol/l, continuous), smoking status (never, ex-smoker, current), body mass index (BMI, continuous kg/m2), cognitive function (continuous score), educational level (low, medium, high), physical activity (categorical, 5 levels), self-rated poor health (binary); Model 2: Model 1 + self-rated hearing impairment at baseline.

CI indicates confidence interval, OR indicates odds ratio.