SUPPLEMENTARY INFORMATION

Supplementary Analysis

Modelling relation between pure tone threshold and test scores

We modelled the effect of hearing level (HL) on the probability of low performance on AP and cognitive tests and caregiver questionnaires (Fig. 7). We first defined a binary outcome variable for each test indicating whether the score fell below the age-adjusted, bottom 5% threshold, determined by age-dependent quantile regression. We estimated the probability of a low score using a moving-window averaging approach applied to the binary variables (grey curves in Fig. 7). Window widths were chosen to contain 20% percent of the data except at the lower and upper ends of the HL range. The moving-window estimates were found to be in good agreement with the predictions of a cubic logistic regression in age (black curves). HLs were age-adjusted to the mean age of the sample.

Modelling compensation

<u>Background</u>: We operationalized the construct of compensation by testing the hypothesis that individuals with strong cognitive skills tend to be less impaired by their hearing loss than others. We have shown that AP measures have a pronounced association with cognitive skills. However, an association between AP and cognition among people with hearing loss should not be seen as evidence for compensation. To establish the presence of such an effect, it seems plausible to demand that the benefit of improved cognition should be larger in those with hearing loss than in NH subjects.

$$\mathrm{AP} \sim \mathrm{Age} + \mathrm{Age\hat{\ }2} + \mathrm{Gender} + \mathrm{PTA} + \mathrm{NVIQ} + \mathrm{Memory} + \mathrm{NVIQ{:}PTA} + \mathrm{Memory{:}PTA}$$

In the regression model above, the first three terms control for Age and Gender. The next three terms describe the overall dependence on pure tone average (PTA) threshold and Cognition, here represented by NVIQ and Memory (digits). We expect a deterioration of AP with increasing PTA (i.e. positive regression coefficient) but an improvement with NVIQ and Memory (i.e., negative coefficients). The two interaction terms describe a potential change in the relationship between AP and Cognition with varying PTA. If a compensation effect is present, the corresponding regression coefficients should be negative, thus reflecting a strengthening of the relationship between AP and cognition with increasing PTA.

Results: Detailed regression results for the AP measures, including VCV, were computed, together with R^2 values for the complete model, a model without any cognition effects and a model including age only. These R^2 values provided an impression of how much variance in the outcome is explained by the various types of predictors. Finally, the p-value for the likelihood ratio test of the combined interaction terms was checked to determine whether both interaction terms combined provided a significant improvement to a model without those terms (Suppl. Table 1).

SUPPL. TABLE 1 Variance explained by predictors in compensation model. 'hear loss.' shows data only for the Minimal/Mild groups. Significant combined interaction terms ($p < 0.05$) in bold.

R^2:	Uncorrected	Controlling for:		Interaction test
Test (full sample)	R^2	Cognition	Age	p
BM0	0.208	0.169	0.137	0.289
BM50	0.286	0.240	0.205	0.449
SM	0.121	0.091	0.086	0.950
SMN	0.164	0.109	0.102	0.083
TR	0.010	0.009	0.003	0.942
FR	0.034	0.023	0.021	0.821
FD	**0.238**	**0.136**	**0.129**	**0.016**
VCV	**0.145**	**0.115**	**0.069**	**< 0.001**
GCC	0.068	0.026	0.002	0.190
CHAPPS	0.058	0.033	0.003	0.078
Test (hear. loss)				
VCV	**0.356**	**0.198**	**0.020**	**< 0.001**
GCC	0.249	0.125	0.034	0.241
CHAPPS	0.180	0.109	0.011	0.519

Main conclusions:

1. There was no evidence of significant interactions of PTA with Cognition in the modelling, except for FD and VCV. For FD, only the PTA:NVIQ interaction was significant, but the sign was contrary to expectations. For VCV, both interactions were significant, but only the one for Memory had the expected sign. Altogether, the analyses do not provide evidence that a compensation effect in the sense explained above was at play for the children with hearing loss.

2. For the derived AP measures (TR and FR) that attempt to exclude the influence of cognition on hearing, the above model only explained a very small amount of variation (TR: $R^2 = 1.0\%$, FR: $R^2 = 3.4\%$). For the other measures, explained variance was 12.1% (SM) to 28.6% (BM50). In each case, Age alone accounted for 48% (VCV) or more of the explained variance. Cognition always contributed appreciably to the amount of explained variance on top of the other variables in the model, in particular for FD (42%).
3. For several measures, there was evidence of a nonlinear (quadratic) dependence on Cognition. Regression coefficients were positive; the benefit started to saturate for increasing cognitive scores (results not included).
4. The regression results seemed robust under variations of the model, for example omission of one of the cognition measures or including further interaction terms.