

Post-intervention performance on a general cognitive assessment compared to pre-fit baseline in first time hearing aid users

Elizabeth Stewart^{1,2}, Raffael Schmitt¹, Sigrid Scherpiet^{1,3*}

¹Sonova AG, Stäfa, Schweiz; ²Sonova U.S. Corporate Services; ³Sonova Retail Germany (Geers)

Background

Assessment of hearing aid (HA) benefit in a clinical setting typically consists of administering various measures prior to fitting candidates with HAs and repeating these measures after a typical trial period with amplification (i.e., approximately four to six weeks). Traditionally, these measures have assessed hearing sensitivity, speech intelligibility in quiet and in noise, and patient-reported outcomes related primarily to communication and quality of life.

However, given the continuing and rapid advancement of hearing instrument technology, it is reasonable to look beyond these more traditional measures for further aided benefit. For example, given the evidence that untreated hearing loss impacts cognitive functioning¹, it may be appropriate to also monitor new HA users' performance on certain cognitive tasks.

Objective

In the present investigation, the commercially available, non-diagnostic Cognitive Assessment Battery (CAB) was administered before and after hearing intervention to identify specific tasks that are sensitive to short-term changes in cognitive performance.

Methods

Participants. Thirteen adults (5 male, 8 female) aged 43 to 76 years ($M_{Age} = 67 \pm 10.3$ years) took part in this study. Participants were first-time HA users (i.e., had never owned HAs) with bilateral sensorineural hearing loss of varying degrees (Fig. 1).

Hearing Aids. Participants were fit with Phonak Audéo™ L90-RT receiver-in-canal HAs. HAs were programmed to participants' most recent audiogram (completed no more than 6 months prior to study enrollment) according to first-time user gain settings prescribed by the manufacturer fitting software (Target). HAs were fit using non-custom acoustic coupling, with the exception of one participant who required custom earpieces for fit and retention. A feedback test was completed, and HA output was verified using Real Ear measures. Participants were instructed to wear the HAs at least 8 hours per day; fine tuning was completed as needed to facilitate compliance.

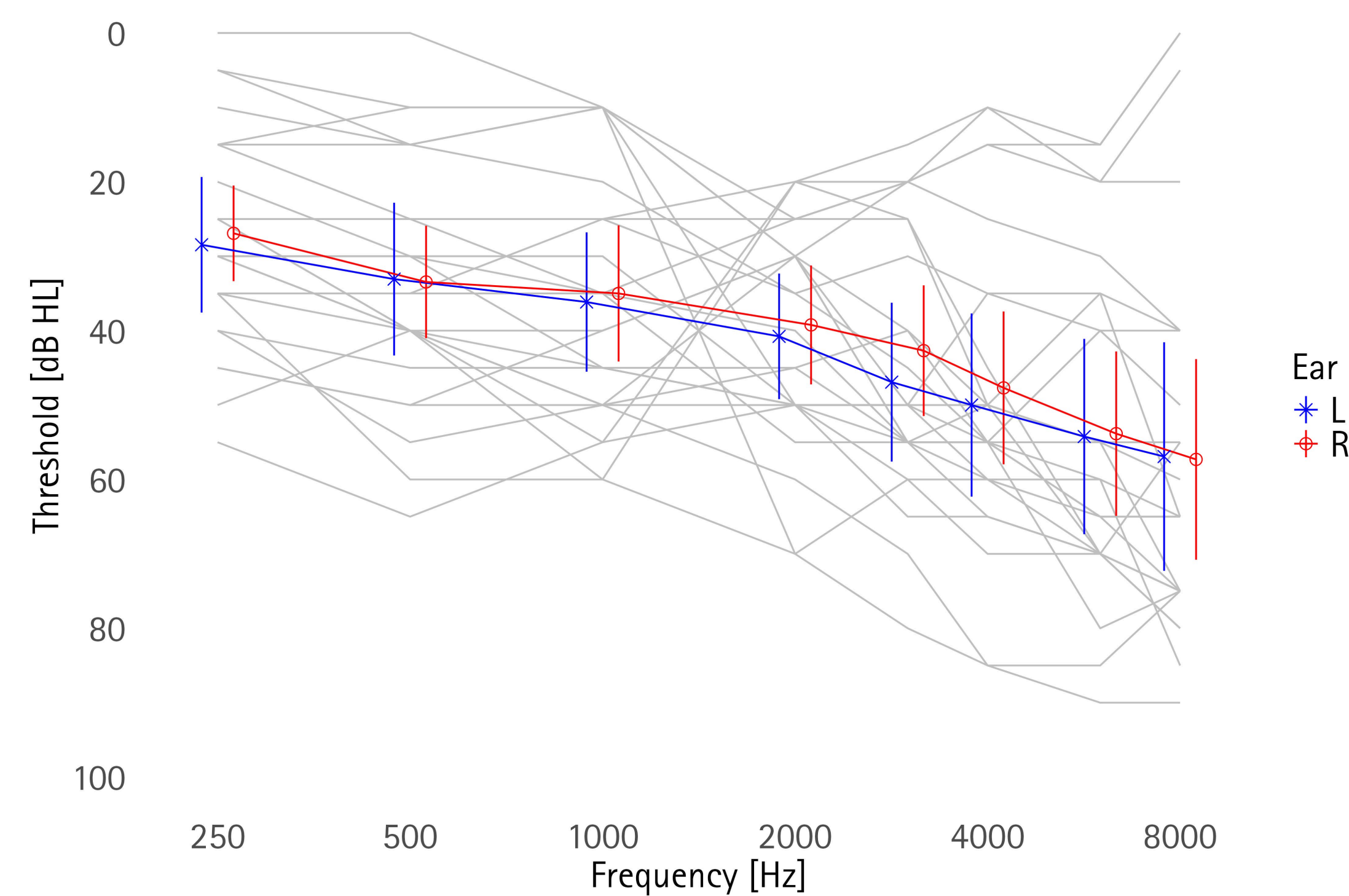


Fig. 1: Average (95% CI) pure tone thresholds for participants' left (x; blue) and right (o; red) ears. Individual audiograms are indicated by the gray lines.

Cognitive Assessment Battery (CAB). The CAB² is a general cognitive assessment created by CogniFit, a digital healthcare company focused on cognitive assessment and training. The battery consists of 17 tasks which assess 22 cognitive skills. In this study, the CAB was administered using a web browser on a PC laptop computer. Participants completed the tasks using a wireless mouse. Progress on the assessment was monitored by an experimenter seated in the testing room using a secondary display screen connected to the laptop.

Procedures. Participants completed the full CAB in a single study session prior to being fit with HAs. All participants were fit with HAs bilaterally between one and 28 days ($M_{HAfitting} = 13.5 \pm 7.8$ days) following baseline testing. Participants repeated the CAB after approximately six weeks of full-time (>8 hours per day) HA use.

Results

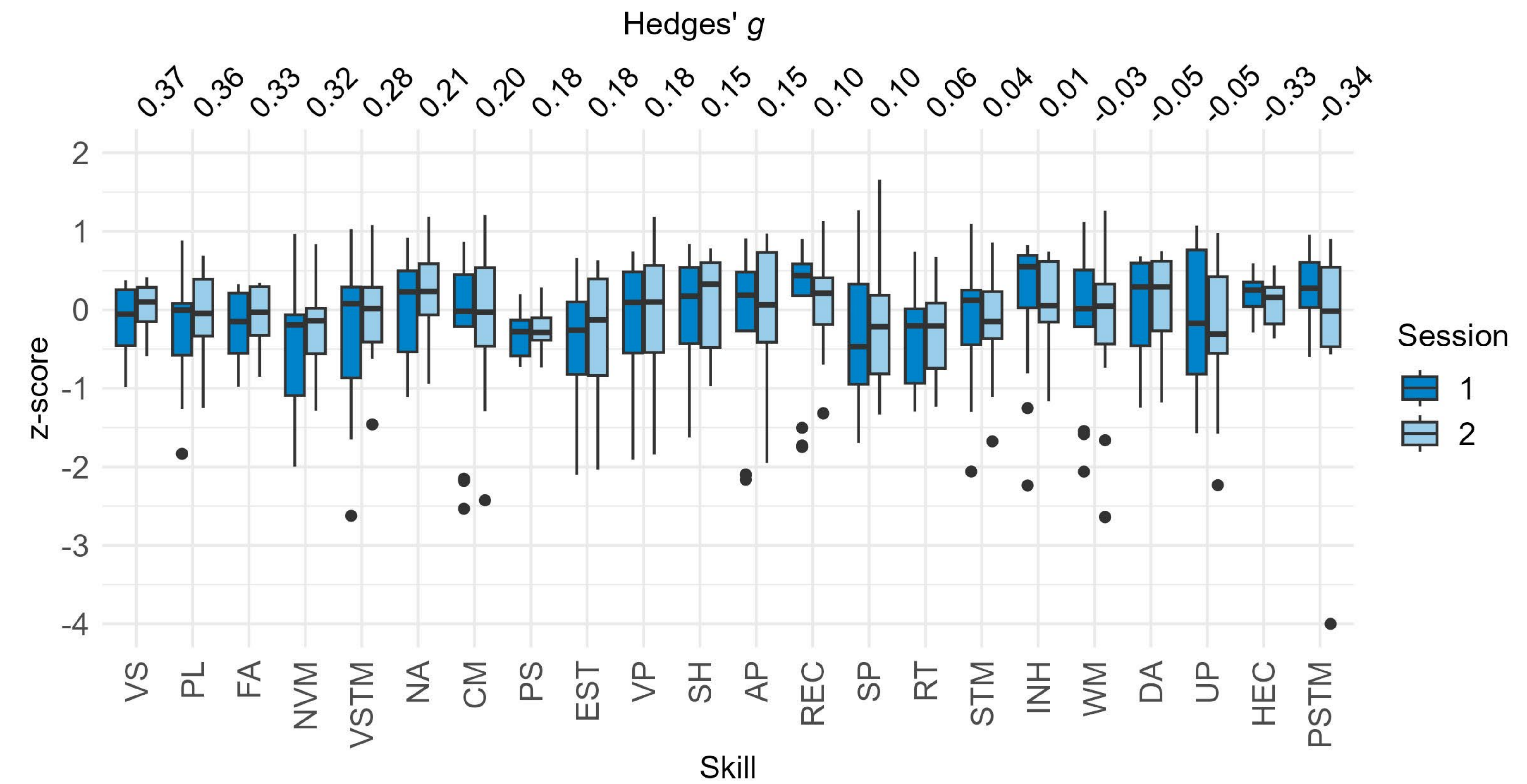
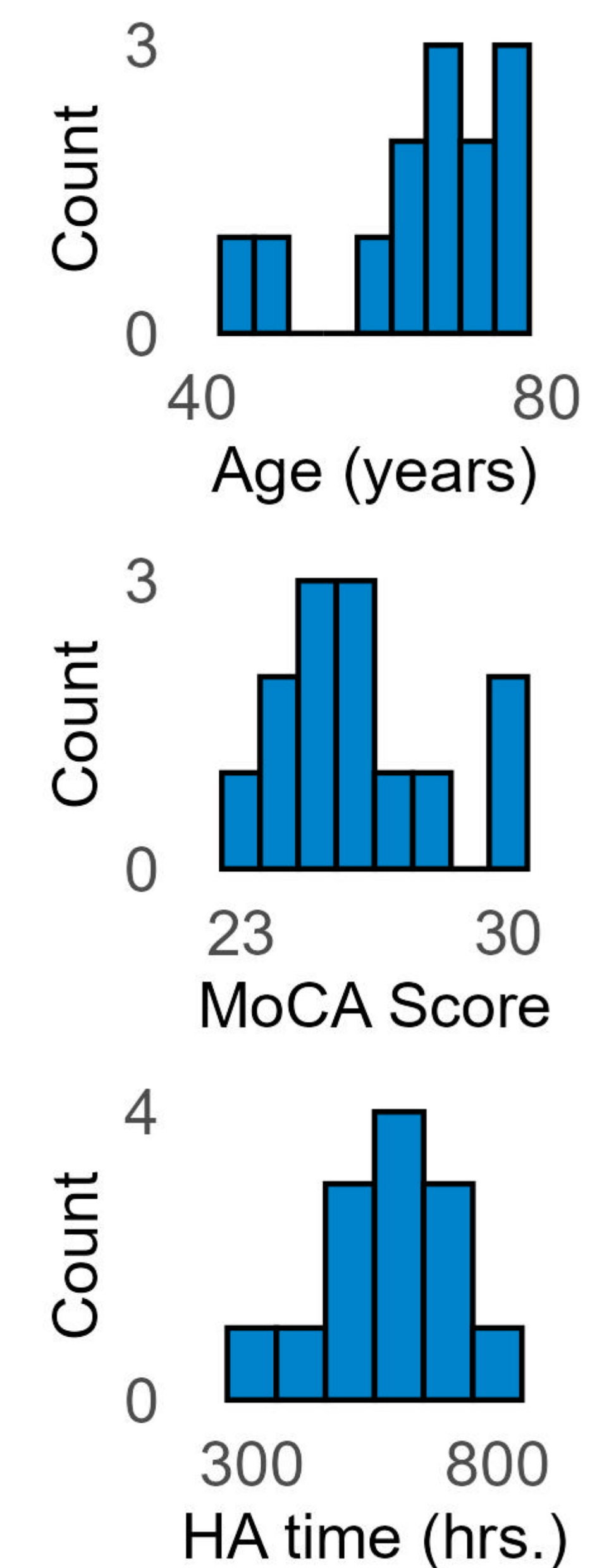


Fig. 2: On the left side, distribution of sample characteristics is shown, including age ($M_{Age} = 67 \pm 10.3$ years), MoCA scores ($M_{MoCA} = 26 \pm 2.2$ points), and the total hearing aid wearing time in hours ($M_{HAtime} = 583 \pm 130.9$ hours). On the right side, the effects of device uptake across different cognitive skills are illustrated. Higher z-scores indicate better performance. The skills are sorted by effect size, represented by Hedges' g , a measure of standardized mean difference, which is displayed at the top of the panel. Hedges' g was deemed the appropriate measure of effect size due to the small sample size ($N = 13$). Paired-samples t -tests or non-parametric alternatives where appropriate (i.e., Wilcoxon signed-rank test) were conducted to compare z-scores of pre- and post-fitting for each skill. None of the conducted comparisons reached statistical significance.

AP Auditory perception, **CM** Contextual memory, **DA** Divided attention, **EST** Estimation, **FA** Focus attention, **HEC** Hand-eye coordination, **INH** Inhibition, **NA** Naming, **NVM** Non-verbal memory, **PSTM** Phonological short-term memory, **PL** Planning, **PS** Processing speed, **REC** Recognition, **RT** Response time, **SH** Shifting, **STM** Short-term memory, **SP** Spatial perception, **UP** Updating, **VP** Visual perception, **VS** Visual scanning, **VSTM** Visual short-term memory, **WM** Working memory.

Conclusions

Results of the CAB showed no significant changes in performance for any of the cognitive skills assessed by this battery, suggesting that the tasks included in the CAB may not be sensitive to changes in cognition. However, it may be the case that improvements on any cognitive task are too small to be detected within such a short period of time following HA fitting. Future investigations involving larger samples and/or untreated control groups could clarify whether HA benefits for these cognitive skills can be observed during the HA trial period.

References

¹Loughrey, D.G., Kelly, M.E., Kelley, G.A., Brennan, S., & Lawlor, B. A. (2018). Association of Age-Related Hearing Loss With Cognitive Function, Cognitive Impairment, and Dementia. *JAMA Otolaryngology-Head & Neck Surgery*, 144(2), 115-126. <https://doi.org/10.1001/jamaoto.2017.2513>
²CogniFit. Cognitive assessments. (n.d.). <https://www.cognifit.com/cognitive-test>

* Email: sigrid.scherpiet02@sonova.com