Contribution of Aided Audibility to Real-World Hearing Aid Outcomes

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INTRODUCTION

- Audibility can be quantified by the Speech Intelligibility Index (SII), ranging between 0.0 and 1.0, indicating how much of the given speech signal is audible for the listener (ANSI, S3.5-1997).
- The relationship between audibility and speech recognition performance has been well established (Dubno et al, 1989; Pavlovic et al, 1986).
- Evidence indicates that when hearing aids (HAs) provide better audibility (i.e., aided audibility), children with hearing impairment tend to have better speech/language outcomes (Stiles et al, 2012; Tomblin et al, 2014).
- However, the relationship between aided audibility and self-reported outcomes for adults remains unclear (Souza et al, 2000).
- Study question: **Does the change in audibility provided by HAs (unaided vs. aided) contribute to real-world benefits for adult listeners?**

METHODS

- Participants: Sixty-two adults, aged 32 to 79 (M = 69.4), 18 females and 44 males, who have worn hearing aids for at least six months were recruited at two sites (University of Iowa and University of Washington).
- Aided audibility was quantified using the Verifit system with a speech input of 65 dB SPL; unaided audibility was calculated based on audiometric thresholds (Bentler et al, 2011).

- For aided measures, subjects wore their own HAs at the typical volume and settings. The higher SII across the two ears was used in the analysis. The difference between unaided SII and aided SII was calculated.
- Two questionnaires were completed for aided/unaided conditions; global scores were calculated, and benefit was defined as unaided global score minus the aided global score:
  - ❑ Abbreviated Profile of Hearing Aid Benefit (**APHAB**) (Cox & Alexander, 1995)
  - ❑ Hearing Handicap Inventory for the Elderly/Adults (**HHIE/A**) (Ventry & Weinstein, 1982; Newman et al, 1990)
- One questionnaire was completed in the aided condition only:
  - ❑ Satisfaction with Amplification in Daily Life (**SADL**) (Cox & Alexander, 1999)
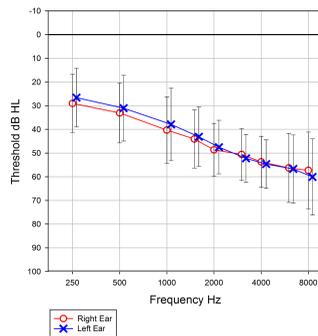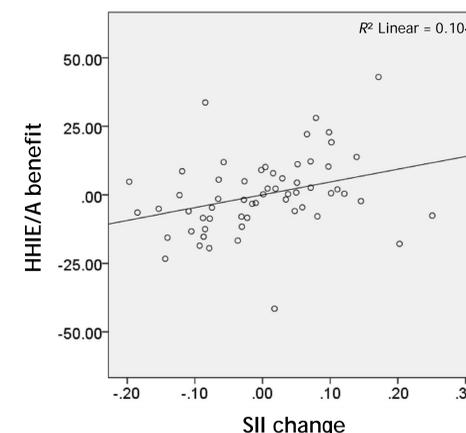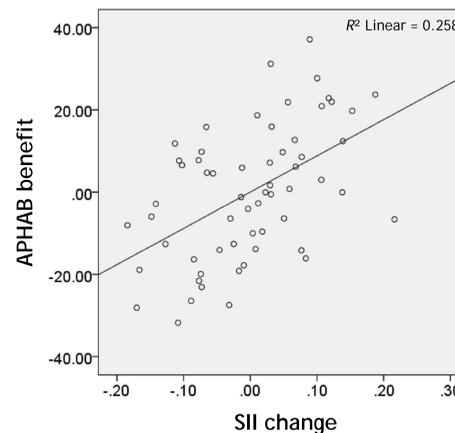
RESULTS

To determine the contribution of audibility provided by HAs to self-reported HA outcomes, the relationship between **SII change** (difference between aided and unaided SIIs) and **HA benefit** (difference between aided and unaided APHAB or HHIE/A scores) or **HA satisfaction** (SADL) was examined using regression analysis. Because subjects with more severe hearing loss tended to have more room for HAs to improve SII and provide benefit, the relationship between SII change and HA outcomes could be confounded by the degree of hearing loss (i.e., unaided SII). Therefore, unaided SII was entered to the regression model to control for its effect.

	B	R	R^2	F	p	partial cor.
APHAB benefit[a]		.57	.33	13.95	<.001	
SII change[b]	.67				<.001	.51
Unaided SII[b]	.15				.32	.13
HHIE/A benefit[a]		.47	.22	7.86	<.01	
SII change[b]	.42				<.05	.32
Unaided SII[b]	-.06				.72	-.05
SADL global[a]		.01	.00	.00	>.05	
SII change[b]	-.02				.99	.00
Unaided SII[b]	-.02				.97	.01

[a] dependent variable, [b] independent variable

Figure. Partial regression plots. Positive correlations between HA benefit (left: APHAB, right: HHIE/A) and SII change are shown, after controlling for the effect of unaided SII.

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DISCUSSION

- The results of the current study (improved audibility was associated with better self-reported outcomes) are not consistent with previous published research (Souza et al, 2000). In our study, subjects were recruited "off the street" with wider variance in fitting "goodness." Subsequent to this broader variance, we were able to see the statistical relationship.
- In this study, the outcomes chosen represented different domains of hearing aid success/effectiveness:
  - ❑ APHAB explores the difficulties encountered in communication situations;
  - ❑ HHIE/A relates to the impact of the communication difficulty on social and emotional wellbeing;
  - ❑ SADL is a satisfaction inventory.
- Consequently, the results seem logical in that improved audibility had the most impact on APHAB, and secondly on HHIE/A, both related to communication. Satisfaction may be more related to non-communication factors (such as cost, fit, inconvenience, etc).

CONCLUSIONS

- Improved audibility was significantly associated with better self-reported outcomes (APHAB, HHIE/A).
- For individuals with similar audiometric profiles, these data suggest that the more audibility the HA can provide, the more real-world benefit the user can obtain (given that the amplified sounds are not uncomfortably loud).
- These data further support the importance of quantifying/ensuring audibility is optimized in our hearing aid fittings.

CONTACT

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