TV and speech levels as objective real-world hearing aid outcome measures

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INTRODUCTION

- Information about hearing aid outcomes can be gathered in many different ways, including clinical tests of speech perception and self-reported measures of satisfaction, benefit, etc.
- These traditional methods have been challenged as either 1) not representing real-world performance, or 2) relying too heavily on memory recall of success in various communication situations.
- The **L**anguage **En**vironment **A**nalysis (LENA) system holds the potential of combining the real-world relevance of survey data with the objectivity of clinical measures.
- In this study, the LENA system was used as a novel approach to better understand the effect of hearing aids on the real-world auditory environments of older adults.
- Study questions:
  1) How does the use of hearing aids affect TV and speech levels measured by LENA?
  2) What is the relationship between objective LENA measures and self-report real-world outcome measures?

METHODS

- Participants: 22 new and experienced hearing aid users aged 64 to 82 (*M* = 72.4), nine females and 13 males, with bilateral sensorineural hearing loss
- LENA digital language processor (DLP) worn 6-8 days while not wearing hearing aids (unaided condition) and 6-8 days while wearing hearing aids (aided condition)
- LENA variables examined in unaided and aided conditions:
  - Median sound level of "TV/electronic" audio segments
  - Median sound level of "meaningful speech" audio segments
    - Speech of speakers of opposite sex of DLP wearer used as measure of the speech of other adult speakers in environment
- Questionnaires completed for both unaided and aided conditions:
  - Hearing Handicap Inventory for the Elderly (HHIE)
  - Speech, Spatial, and Qualities of Hearing Scale (SSQ)
  - Abbreviated Profile of Hearing Aid Benefit (APHAB)
- Pearson correlation coefficients were calculated between change in TV/speech levels from unaided to aided condition and benefit from hearing aids on selected questionnaire subscale scores

RESULTS

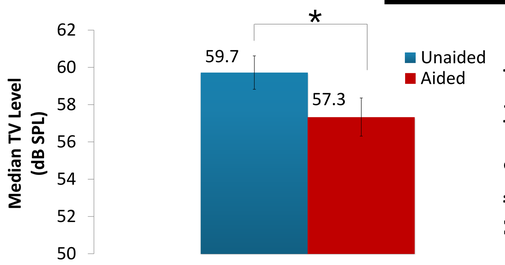


Figure 1. Means of TV levels measured in the unaided and aided conditions. * = p < .05

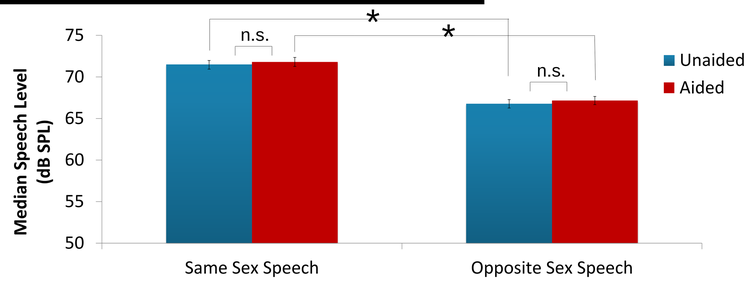


Figure 2. Means of speech levels measured in the unaided and aided conditions for speech of the same and opposite sex of the subject. * = p < .05, n.s. = not significant

Figure 3 (right). Scatterplot showing relationship between the LENA variable and questionnaire subscale pair with highest correlation. None of the LENA/questionnaire correlations, including the one shown here, was significant (p > .05). Change in level measured as aided median level – unaided median level.

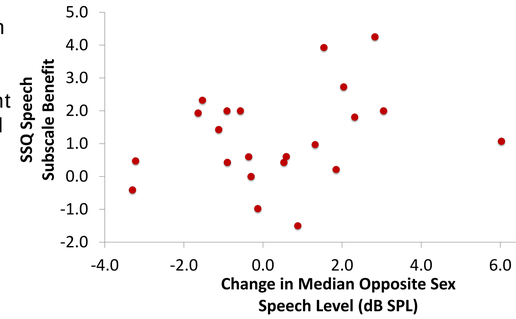
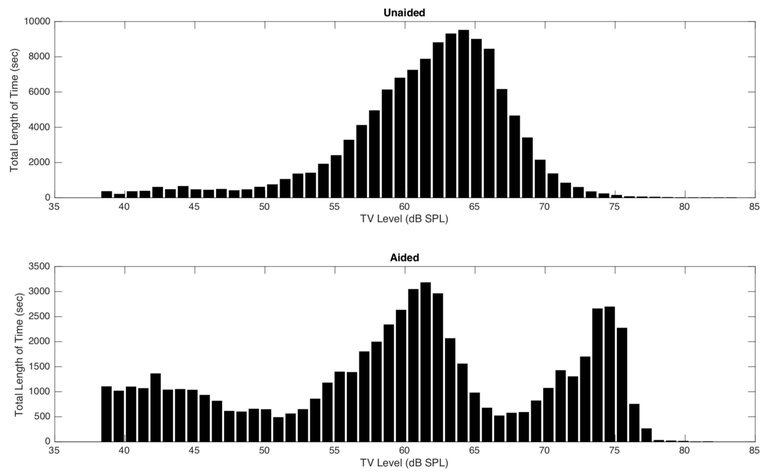


Figure 4 (below). Histograms showing amount of time spent in different TV levels in unaided and aided conditions for one subject.



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DISCUSSION

- TV levels were lower in the aided condition than the unaided condition
  - Consistent with idea that subjects set TV to lower volume due to improved audibility provided by hearing aids
  - Provides evidence for sensitivity of TV level as an outcome measure
- Same sex speech levels were higher than opposite sex speech levels
  - Speech of adult LENA DLP wearer is acoustically distinct from speech of other adults in environment
  - Altering LENA algorithms to distinguish between speech of adult DLP wearer and speech of other adults in environment may aid future analysis of LENA speech levels
- The lack of significant correlations between TV/speech levels and self-report measures suggests that either:
  - TV and speech levels measured by LENA are not valid as hearing aid outcome measures, or
  - LENA variables may measure fundamentally different aspect of the real-world outcomes of adult hearing aid users than what is captured by self-report measures
- A pattern-based approach to LENA data analysis may provide a more holistic understanding of the effects of hearing aid use on older adults' listening environments

CONCLUSIONS

- The usefulness of LENA TV and speech levels as an outcome measure for adults who receive hearing aids is unclear.
- TV levels measured by LENA may provide new information about the effect of hearing aids in adults' real-world listening environments.
- The application of LENA speech data as an outcome measure with adults may benefit from optimizing the LENA algorithms for use with an adult DLP wearer.
- Further research is needed in order to investigate the ways in which LENA data can potentially help to characterize the real world outcomes of adult hearing aid users.

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