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Tired from Listening? Exploring Associations Between Listening-Related Fatigue and Fatigability



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Introduction

- Mounting evidence strongly suggests that adults and children with hearing loss are at increased risk for greater listening effort and long-term, listening-related fatigue^{1,2,3,4}. Severe, long-term, fatigue can have significant negative effects on quality of life⁵.
- Long-term fatigue** refers to feelings of fatigue that recur frequently or are constant⁵.
- The Vanderbilt Fatigue Scale for Adults with Hearing Loss (VFS-AHL) has been developed to measure long-term listening-related fatigue⁶.
- Subjective reports of long-term fatigue are highly variable in people with hearing loss and our understanding of its underlying causes are limited^{2,3,4}. The construct of fatigability may explain some of the variability in long-term fatigue.
- Fatigability** describes the relationship between the level of perceived fatigue and the level of activity required to elicit the percept⁶.
 - Currently, a validated measure of listening-related fatigability does not exist.
- Long-term fatigue may reflect a high level of daily demands and activity. Alternatively, it could reflect a high level of fatigability⁷. Our hypothesis is that people with hearing loss experience increased fatigability in everyday listening situations, which increases their risk for long-term fatigue.
- Purpose:** This poster examines associations between short-term, listening-related, fatigability and long-term fatigue using subjective measures. A secondary purpose was to examine the effects of hearing loss and device type on long-term fatigue and fatigability.

Methods

- Long-term fatigue was measured using a 10-Item version of the Vanderbilt Fatigue Scale-Adults with Hearing Loss (VFS-AHL)⁸ while short-term fatigue was assessed using a newly developed 10-item Fatigability Scale for adults with hearing loss. (See Tables I & II)
- Data were collected from multiple sources using online and in person versions of the VFS-AHL⁸ and Fatigability Scale.
- Responses were obtained from 468 adults (5 no responses) with and without hearing loss (See Table III).
- Respondents self-reported their hearing loss as mild/ slight (n=56), moderate (n=102), severe (n=54), profound (n=44), or not reported (n=9) based on their perceived speech understanding difficulties.
- EFA model fit was evaluated using multiple indices (root-mean-square error of approximation index (RMSEA) <.06; root-mean-square residual (RMSR) <.08, comparative fit index (CFI) and Tucker-Lewis index (TTL) >.95)

Table III: Participant Characteristics	# Participants
Hearing Loss/No Hearing Loss	265/198
One Ear/ Both Ears	31/234
Male/Female/NR	130/331/2
Hearing Aid/CI/BAHA/Other/None/No Response	132/51/2/4/76
Total Number of Participants	463

Results

Exploratory Factor Analyses (EFA):

- EFA was used to assess similarity in the underlying constructs of fatigue and fatigability. Results on the combined scales revealed a good fit with all items loading on a single unidimensional factor.
- RSMEA=0.12; RMSR=0.05; CFI=0.98; TTL=0.97

Correlations between Fatigue and Fatigability:

- There were strong, significant (all p values <.05), positive correlations between fatigue and fatigability across all hearing groups, unilateral and bilateral losses, and gender (r² values ranged from .72-.92).
- See Figures I & II

Effect of self-reported hearing loss and device type on long-term fatigue and fatigability:

- A series of Mann-Whitney tests were used to examine differences in fatigue, and in fatigability, between respondents with varying degrees of hearing loss.
- Results revealed systematic increases in fatigue, and fatigability, as degree of loss increased up to the severe rating (significant p values ranged from .000-.018; See Figure III).
- However, as degree of loss increased from a severe to profound level, fatigue and fatigability decreased (p=.002 and .001, respectively).
- For respondents with severe-to-profound hearing loss, hearing aid users reported significantly more fatigue than CI users (See Figure IV).
- Although the reason for the difference is unclear

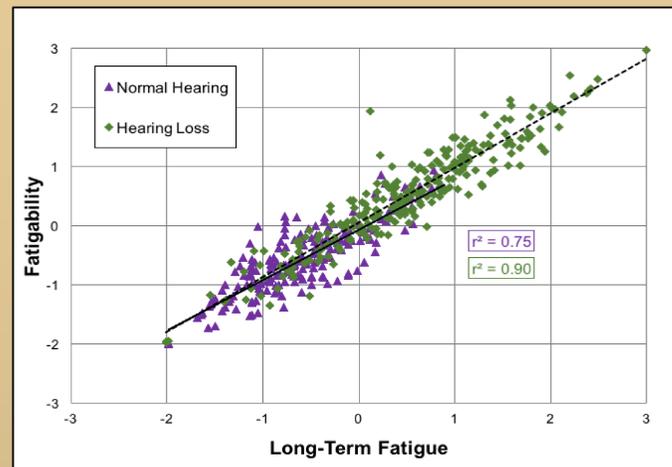


Figure I: Scatter plot showing associations between IRT scale scores for long-term fatigue versus fatigability. Solid and dashed lines show best fits to normal hearing and hearing loss data, respectively.

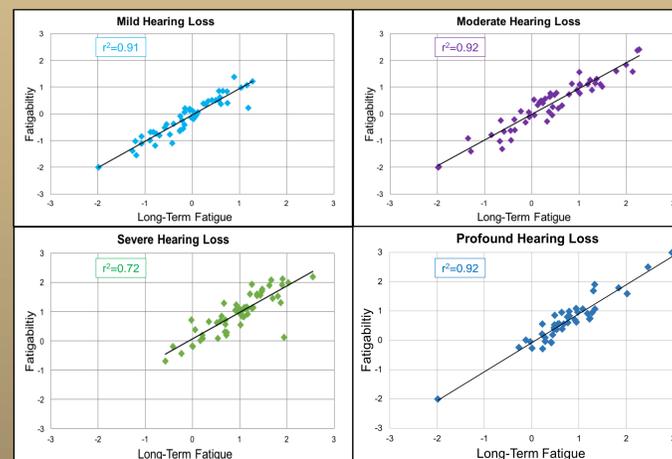


Figure II: Scatter plot showing associations between IRT scale scores for long-term fatigue versus fatigability for respondents with varying degrees of self-reported hearing loss. Solid lines show best fits to the data

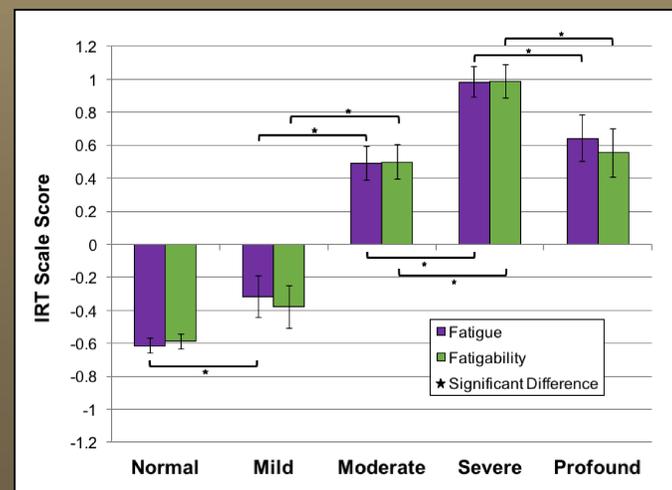


Figure III: Mean fatigue & fatigability IRT scale scores as a function of self-reported hearing loss level. Lower values indicate less fatigue/fatigability. Error bars = ± 1 standard error; stars = significant differences

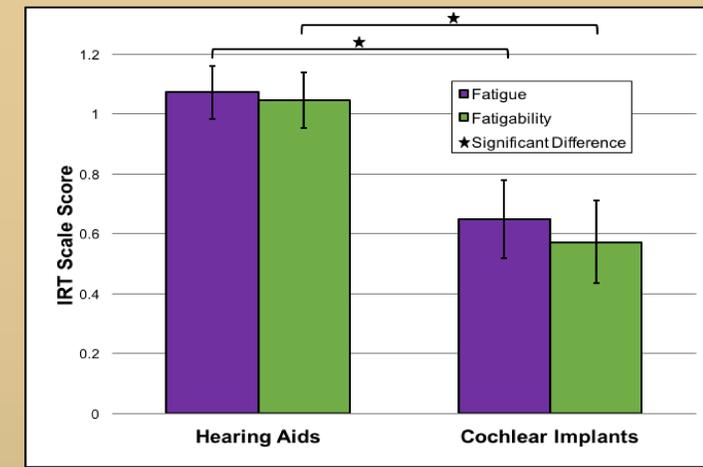


Figure IV: Mean IRT scale scores (long-term fatigue and fatigability) for respondents with self-reported severe and profound hearing loss who use hearing aids and CIs. Error bars = ± 1 standard error. Stars = significant differences.

Conclusion & Next Steps

- Exploratory factor, and correlation, analyses revealed a strong association between fatigability and long-term fatigue.
- This supports our hypothesis that long-term listening-related fatigue may be a consequence of high fatigability experienced in everyday listening situations.
- In contrast to prior work using generic fatigue scales², using a listening-related fatigue scale (the VFS-AHL), long-term fatigue, and fatigability, systematically increased with degree of self-reported HL up to the severe range (see Figure III).
- Interestingly, compared to those with only severe losses, listening-related fatigue and fatigability decreased significantly for respondents with profound hearing loss (see Figure III).
 - The reasons for this decrease are unclear but may reflect decreased engagement in listening-related tasks.
- Respondents with severe-profound self-reported hearing loss who use CIs reported less fatigue than hearing aid users.
 - The reasons for this difference are unknown but may reflect greater self-reported hearing loss and disengagement during listening-related tasks among CI users, or a benefit of CI use.
- Next steps include using the VFS-AHL to:
 - Identify the behavioral, psychological, and physiologic factors responsible for the increased fatigue and fatigability associated with self-reported hearing loss.
 - Explore benefits of interventions for reducing listening-related fatigue and fatigability.

Key References

- Hornsby, B. (2013). The Effects of Hearing Aid Use on Listening Effort and Mental Fatigue Associated With Sustained Speech Processing Demands. *Ear and Hearing*, 34(5), 523-534.
- Hornsby, B. & Kipp, A. (2016). Subjective ratings of fatigue and vigor in adults with hearing loss are driven by perceived hearing difficulties not degree of hearing loss. *Ear and Hearing* 37 (1), 1-10.
- Alhanbali, S., Daves, P., Lloyd, S., & Munro, K. J. (2017). Self-Reported Listening-Related Effort and Fatigue in Hearing-Impaired Adults. *Ear and Hearing*, 38(1), e39-e48.
- Hornsby, B., Gustafson, S., Lancaster, H., Cho, S.-J., Camarata, S., & Bess, F. (2017). Subjective Fatigue in Children With Hearing Loss Assessed Using Self- and Parent-Proxy Report. *American Journal of Audiology* 26(3S): 393-407.
- Hornsby, B. W., Naylor, G., & Bess, F. H. (2016). A taxonomy of fatigue concepts and their relation to hearing loss. *Ear and Hearing*, 37, 136S-144S.
- Eldadah B. (2010) Fatigue and Fatigability in Older Adults *PM R*, 2 (2010), pp. 406-413
- Hockey, Robert. (2013). *The Psychology of Fatigue: Work, Effort and Control*. Cambridge University Press.
- Dold, C., Bess, F., Camarata, S., McGarrigle, R., Davis, H., Cho, S.-J. & Hornsby, B. (2017, November). Initial Development of the Vanderbilt Fatigue Scale for Adults with Hearing Loss (VFS-AHL). Poster presented at the American Speech-Language-Hearing Association Convention, Los Angeles, CA.
- Hospers, J. M. B., Smits, N., Smits, C., Stam, M., Terwee, C. B., & Kramer, S. E. (2016). Reevaluation of the Amsterdam Inventory for Auditory Disability and Handicap Using Item Response Theory. *Journal of Speech, Language, and Hearing Research*, 59(2), 373-383.

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Table I: Sample VFS-AHL-10 (Long-Term Fatigue) Items

Select a single response that best describes how often you experience the following in a typical week.

Items	Response Options				
	Never/ Almost Never	Rarely	Sometimes	Often	Almost Always/ Always
I feel worn out from everyday listening.	0	1	2	3	4
It takes a lot of energy to listen and understand.	0	1	2	3	4

Table II: Sample Fatigability Items

For each item, please select ONE (1) rating which best describes how often you may feel fatigued or tired after completing the activities described below. Mark N/A if you have not experienced the situation often enough to make a reliable judgment.

Items	Response Options				
	Never/ Almost Never	Rarely	Sometimes	Often	Almost Always/ Always
Participating in an important group meeting at work or school for 1 hour	0	1	2	3	4
Talking on the phone with a friend or family member for 15 minutes	0	1	2	3	4

See our website for additional information on listening-related fatigue.
<https://my.vanderbilt.edu/hearingandcommunicationresearch/>