SSQ Confirms Self-reported Hearing Difficulties for Listeners with Normal Audiograms

Brooke Dillard B.S.Ed.[1] Pavel Zahorik Ph.D.[1,2] James Shehorn Ph.D. Au.D.[2] Olaf Strelcyk Ph.D.[3]
[1]University of Louisville [2]Heuser Hearing Research Center [3]Sonova U.S. Corporate Services

Introduction

Audiologists often encounter patients who describe hearing difficulties but have normal audiometric thresholds. It is possible that these patients may have "hidden hearing loss," which is thought to result from degeneration of the synapses between inner hair cells and auditory nerve fibers (Kujawa & Liberman, 2009). Previous studies have suggested that hidden hearing loss might contribute to difficulties with understanding speech in complex listening environments. We therefore reasoned that subjective assessment of listening difficulty in complex listening situations, assessed using the SSQ (Speech and Spatial subscales), might also be indicative of hidden hearing loss. Additional subjective and objective measures reported in the literature as potential hidden hearing loss correlates were also collected.

Methods

Participants

- *n* = 26 adults with self-reported hearing difficulty
- Age range: 18-53 years, Mean age: 35 years
- Normal audiograms (≤20 dB HL from 250 to 8000 Hz, 1 subject ≤25 dB HL)

Tests

- The Speech, Spatial, and Qualities of Hearing Scale (Gatehouse & Noble, 2004)
  - Designed to measure hearing disabilities across three domains.
  - SSQ data were compared to normative data from a previous study with young normal-hearing listeners.
- The Noise Exposure Questionnaire (Johnson, Cooper, Stamper, & Chertoff, 2017)
  - Developed to quantify an individual's exposure to occupational and nonoccupational noise and estimate an individual's annual noise exposure.
  - High risk of noise induced hearing loss was determined using National Institute for Occupational Safety and Health and Environmental Protection Agency criterion.
- Tinnitus self-report
  - Participants were asked whether they experience any tinnitus in a sound booth prior to audiometric testing.
- Audiometric testing (125-16,000 Hz)
  - Air conduction thresholds were measured from 125-16000 Hz. Bone conduction thresholds were obtained from 500-4000 Hz.

Results

- SSQ scores were significantly worse than normative values for a young adult population (Figures 1 and 2).
- Noise exposure was elevated over the past year (18 of 26 had NEQ scores in the "high risk" or above category, Figure 3).
- SSQ scores did not significantly correlate with any of the other measures, including annual noise exposure (NEQ) and audiometric thresholds at frequencies up to 16 kHz while controlling for age (Table 1).

Results

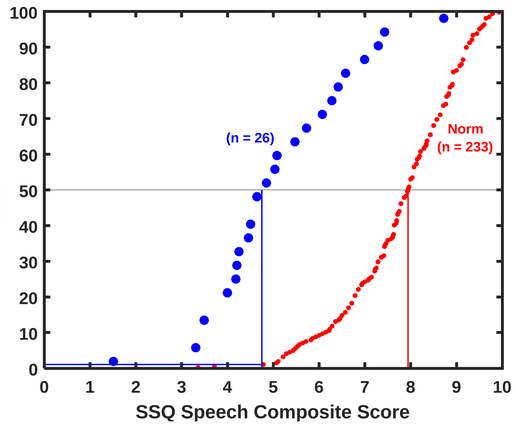

Fig. 1
Average scores of participants' self-rated speech listening abilities on the SSQ (blue symbols) compared to normative data (red symbols). Results of a Wilcoxon signed rank test confirmed a significant deficit in median (1st percentile re norm) score for the study sample, Z = 6.8488, p < .0001.

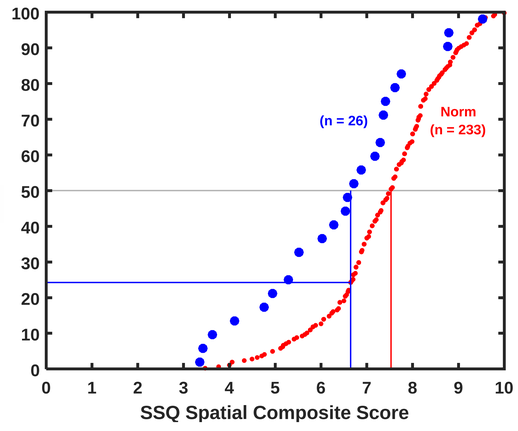

Fig. 2
Average scores of participants' self-rated spatial listening abilities on the SSQ (blue symbols) compared to normative data (red symbols). Results of a Wilcoxon signed rank test confirmed a significant deficit in median score (24th percentile re norm) for the study sample, Z = 2.8777, p = .0040.

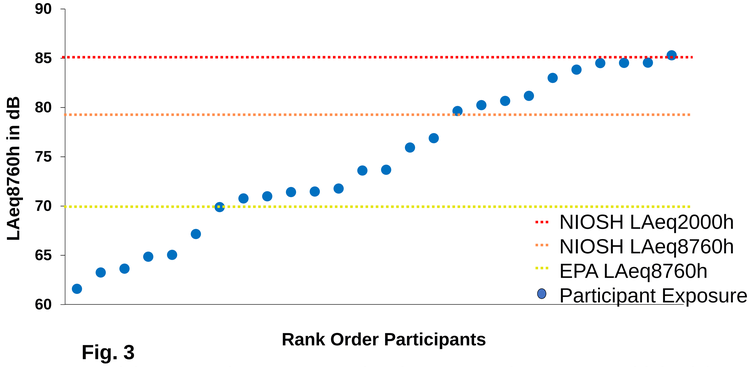

Fig. 3
Participant's noise exposure level comparted to NIOSH high risk values (average hours of work per year and total hours per year) and EPA high risk value (total hours per year).

Results

Table 1

Pearson correlations between measures

Measure	1	2	3	4
1. NEQ LAeq8760h	1.000	-0.235	-0.113	-0.122
2. SSQ Speech		1.000	***0.530****	-0.116
3. SSQ Spatial			1.000	0.203
4. Ultra High Avg				1.000

*p<.01

NEQ LAeq8760h = sound pressure level using an A-weighted frequency response with a 3-dB exchange rate to calculate the time/level relationship for the total during of noise exposure in a year

Correlations between SSQ Speech scores and SSQ Spatial scores were statistically significant when controlling for age.

Conclusions

Results from this study suggest that the SSQ can confirm self-reported hearing difficulty and may have future diagnostic potential for hidden hearing loss. The data presented here are part of a larger study with a population who has confirmed speech perception in competing speech difficulties (see poster PP1329) and normal processing speech, working memory, and executive functioning (see poster PP1302).

References

Gatehouse, S., & Noble, W. (2004). The Speech, Spatial and Qualities of Hearing Scale (SSQ). *Int J Audiol, 43*(2), 85-99.

Johnson, T. A., Cooper, S., Stamper, G. C., & Chertoff, M. (2017). Noise Exposure Questionnaire: A Tool for Quantifying Annual Noise Exposure. *J Am Acad Audiol, 28*(1), 14-35.

Kujawa, S. G., & Liberman, M. C. (2009). Adding insult to injury: cochlear nerve degeneration after "temporary" noise-induced hearing loss. *Journal of Neuroscience, 29*(45), 14077-14085.

Liberman, Epstein, Cleveland, Wang, & Maison, (2016) Toward a Differential Diagnosis of Hidden Hearing Loss in Humans. *PLoS One, 11*(9), e0162726.

Acknowledgements

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