Factors Associated with Hearing Complaints
In Adults With Normal Audiograms
Sarah Levy, B.A. & Kelly Tremblay, Ph.D.
University of Washington Department of Speech & Hearing Sciences

BACKGROUND

Some individuals who appear in audiology clinics reporting hearing difficulty (HD) turn out to have normal audiometric thresholds. The needs of these patients are often unmet as it is unclear what to provide them. This phenomenon has been observed in children and adults and has been described under numerous names, including Central Auditory Processing Disorder (Moore, 2006), Hidden Hearing Loss (Schaeette & McAlpine, 2011), Auditory Neuropathy (Rhee, 2005), King-Kopetzky Syndrome (Hinchcliffe, 1992), and Observe Auditory Dysfunction (Sauders & Haggard, 1989).

It is especially common for older adults to report HD that is disproportionate to their audiometric thresholds. One potential source of difficulty is impaired temporal processing. Middle aged and older adults with normal audiometric thresholds are less able to process competing, rapidly changing signals, especially in background noise (e.g. Billings, Tremblay & Willott, 2012). They also frequently report HD in the presence of competing noise even when hearing thresholds (unaided or aided) are relatively good.

The prevalence of these types of HD is unknown and the sources of communication problems can be many, including but not limited to central dysfunctions, sub-cortical peripheral damage and non-auditory influences like personality, cognition and self-perception of personal wellbeing.

Therefore, the purpose of this study was:
1) To use epidemiological data from the Beaver Dam Offspring Study (BOSS) to examine the prevalence of individuals who express HD despite having normal audiometric thresholds.
2) To determine which factors, auditory and non-auditory, contribute to this phenomenon.

METHODS

PARTICIPANTS: Individuals (n=3753) from the Beaver Dam Offspring Study (BOSS). They are the adult children of those who participated in the Epidemiology of Hearing Loss Study in the 1980s and 1990s.

HEARING ASSESSMENT & OTHER MEASURES:
- Otoscopv, tympanometry, pure-tone air and bone conduction audiometry, distortion product otoacoustic emissions (DPOAEs) and word recognition in quiet and with a competing message (WRCM).
- Questionnaires about hearing health, noise exposure, hearing handicap, lifestyle factors, general health history, depression, cognition and self-perception of wellbeing.

OPERATIONAL DEFINITIONS: Normal Hearing was defined as those with audiometric pure-tone air conduction thresholds ≤20 dBHL bilaterally at 500, 1000, 2000, 3000, 4000, 6000 & 8000 Hz.

Hearing Difficulty was defined using 4 self-report questions:
1) Does a hearing problem cause you difficulty when in a restaurant with coworkers, clients, or customers?
2) Does a hearing problem cause you difficulty hearing/understanding coworkers, clients, or customers?
3) Do you have difficulty understanding conversations when several people are talking?
4) How much does your hearing difficulty limit you from hearing when someone talks to you in a noisy, large group of people?

RESULTS

STATISTICAL ANALYSES: Differences between groups were tested using the Chi-square or Independent Group T-test. Logistic regression was used to estimate odds ratios and examine risk factor associations.

PREVALENCE:
- The percentage of adults with reported HD and normal audiometric thresholds was 12% (82/682)
- The prevalence of self-reported communication problems and normal audiometric thresholds in the context of all individuals with complete hearing data was 3.0% (82/2772)

HEARING MEASURES:

Fig 1. Mean puretone threshold by group

Fig 2. Mean word recognition performance (% correct) by group and listening condition

Fig 3. Percent of individuals with absent DPOAE responses in one or both ears by group

Fig 4. Percentage of people reporting hearing difficulty (HD) by age

SELF-REPORT MEASURES:

Those in the “HD” group, on average:
- Reported more vision difficulty on the VFQ-25
- Reported engaging in a larger # of loud hobbies
- Scored lower on the SF-36 mental component
- Scored higher on the CES-D measure of depression

A higher percentage of the “HD” group:
- Reported experiencing numbness, tingling or loss of sensation
- Reported seeing a doctor for hearing loss
- Reported firing a gun outside of military use
- Had a CES-D total score greater than 16
- Had an income less than $50K

Factors found NOT to differ significantly between groups:
- Age (mean age = 42 years), gender, MMSE total score
- Trails B Trails A time in seconds (executive function task)
- Smoking, alcohol or use of sedative/antidepressant medication
- History of head injury or ear surgery
- Number of headaches in past 3 months

DISCUSSION

WHAT DO THE RESULTS REVEAL ABOUT POTENTIAL CONTRIBUTING FACTORS?
- The percentage of adults with reported HD and normal audiometric thresholds was 12% (82/682) and the prevalence was 3.0% (82/2772).
- Despite frequent reports of such phenomena from clinicians, the prevalence is small but significant.
- This problem does not appear to be specific to older adults because the mean age of people with and without HD did not differ (~42 years).
- Audiometric test results including DPOAEs and WRCM did not distinguish those with and without HD. However, those with reported difficulty were more likely to have a history of noise exposure and to report symptoms of neuropathy.

CONCLUSION

- A small but significant percentage of those with normal hearing reports report hearing difficulty, and this phenomenon is not limited to adults of advanced age.
- Audiometric tests, including DPOAEs, do not distinguish people experiencing HD from those who do not. Extended high frequency audiometry might prove to be more sensitive to group differences and ASR testing might reveal early signs of noise exposure and rule out auditory neuropathy (Kujawa & Liberman, 2009).
- Potential contributors to the experience of HD include noise exposure resulting in subclinical damage and/or central pathologies.

REFERENCES


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