Functional Consequences of Hearing Loss

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- Hearing Loss (HL) is seen by many to be a communication disorder but HL may have more wide ranging consequences
- It has been hypothesized that HL:
  - Increases risk of falls and injuries;
  - May lead to increased functional limitations and disability; and
  - Reduces activity and participation which can lead to decreased quality of life

Functional Consequences of Hearing Loss

- My goal is to highlight some of the most recent longitudinal research on the potential functional consequences of HL
- Draw some conclusions and make some recommendations for future research in this area.

IS HEARING LOSS RELATED TO FALLS?

Finnish Twin Study: Falls Risk
(Viljanen et al, 2009)

- Investigators hypothesized that HL increased risk of falls and that postural balance acts as a mediator between HL and falls.
- N=423 women, Mean age = 68.6 yrs
- HL assessed with a Madsen OB 822 clinical audiometer
- Postural balance measured on a force platform
- Falls tracked with 12 monthly calendars

Findings…

- Falls rates for the best to the poorest hearing quartiles were: 7.1, 6.7, 10.4, 11.3 falls per 100 person months.
- 2+ falls: 30% in poorest hearing group vs. 17% in best hearing group.
- Higher falls risk was partially explained by reduced postural control; however, after controlling for postural balance, those with poor hearing had a two fold risk for falls.

IS HEARING LOSS RELATED TO FUNCTIONAL LIMITATIONS?

Finnish Twin Study: Walking
(Viljanen et al, 2009)

- N=434 women aged 63-76
- Follow-up measures after 3 yrs.
- Madsen OB 822 clinical audiometer
- 10m maximal walking speed measured in the corridor using photocells for timing.
- 6-min. walk test for walking endurance.
- PRO of difficulty walking 2 kilometers without resting

Findings…

- 41.2% participants had impaired hearing HL correlated cross-sectionally with poor mobility.
- In age-adjusted logistic regression, the women with HL had twice the risk (odds ratio (OR) 2.04 for new major difficulties in walking 2km as those with- out HL.

Health ABC Cohort Study: Function & Disability (Chen et al, 2013)

- Prospective cohort study annual visits at yr 1,4,6,10,11
- N=2206 adults from two states aged 70-79
- Uncorrected hearing loss measured by Pure Tone Audiometry
- Lower extremity Function measured by the SPPB index (gait speed, standing balance, chair rises)
- Incident disability assessed using a unspecified PRO.

- Chen et al observed a small "dose-dependent" effect with greater levels of hearing loss associated with poorer function over time and, among women, greater risk for incident disability; results were robust to adjustment for multiple potential confounders.

SPPB	Visit 1	Visit 5	Visit 11
Normal	10.36	NS	7.71
Mild HL	10.14	NS	7.35
Moderate HL	10.04	NS	7.00

Women with moderate+ HL had a 31% increase risk of disability compared with those with normal hearing; not seen for men.

- Fully adjusted analyses restricted to individuals with mild or greater hearing loss found that individuals who used hearing aids had function scores at Visits 1, 5, and 11 that were **not significantly different than individuals not using hearing aids** and **no significant attenuation in the risk of incident disability associated with hearing aid use.**

- However, data on other key variables (e.g., hours hearing aid worn per day, number of years used, adequacy of rehabilitation, etc.) that may affect the success of hearing rehabilitation and affect any observed association were not available in Health ABC.

Alameda County Study: Function & Disability (Wallhagen et al, 2001)

- 1 Yr prospective cohort study (N=2504)
- PRO of hearing loss even with a hearing aid.
  - 48.5% with some hearing loss
  - 17.1% with moderate to severe hearing loss
- Association with ADL, IADL, Physical performance, depression, and social participation.

- No consistent association with ADLs, IADLs, or physical performance
- Was associated with social functioning
- Social functioning results:

	OR Mild	OR Moderate+
Feel left out:	1.52 (1.1–2.0)	1.66 (1.1–2.3)
Feel lonely or remote:	1.25 (1.0–1.5)	1.27 (0.9–1.6)
Hard to feel close:	1.16 (0.8–1.5)	1.55 (1.1–2.1)
Can't pay attention:	1.46 (1.1–1.7)	1.73 (1.3-2.2)

IS HEARING LOSS RELATED TO DRIVING BEHAVIORS?

Hearing Impairment and Driving

- Past research has shown that people with hearing impairments are more likely to have ceased driving. (Gilhotra et al, 2001)

- In a Quebec study (Picard et al, 2008), daily noise exposure and measured hearing loss were associated with greater risk of traffic accidents recorded in a database of driving records in Quebec.

Queensland Univ. of Technology
(Hickson et al, 2010)

- 107 men and women mean age 73.5 (62-88)
- Hearing measured with Pure Tone Audiometry, and Hearing Handicap Inventory for the Elderly
- 26% with mild HL and 19% with mod/sev HL
- Drove a 5-km closed course wearing glasses and/or hearing aids if usually worn
- Drove with and without auditory and visual distractors (verbal or visual requests to report sums of numbers presented while driving)

Findings…

- No individual hearing measure was associated with overall driving performance after controlling for age

- A significant interaction between hearing impairment and distracters, such that people with moderate to severe hearing impairment had significantly poorer driving performance in the presence of distracters than those with normal or mild hearing impairment.

STATE OF THE SCIENCE ON THE FUNCTIONAL CONSEQUENCES OF HEARING LOSS

Conclusions:

- Existing studies on the association of HL with incident functional decline have had inconsistent results, with some studies demonstrating a positive association and others finding weak or no significant association.
- Although findings are mixed, HL appears to have some real but modest functional and disability consequences that could affect quality of life.

- Heterogeneity in study results is likely explained by many differences across studies:
  - How hearing was measured (e.g. subjective self-report vs. objective clinical audiometry)
  - Whether hearing aid use was taken into consideration
  - What disablement dimensions were assessed

    (e.g. falls, walking difficulty, ADLs, social function, driving).

In Future Research

Need to clarify the **exposure variable** of greatest interest.

- Uncorrected HL most commonly assessed. Seems appropriate when the focus is on the impact of HL on outcomes such as falls and functional limitations. However…
- When the focus is on disability behaviors such as driving and social participation, hearing loss with correction may be the more meaningful exposure variable.

Functional **outcomes** are complex and work is needed to clarify those most importantly related to HL.

- One's capacity to perform key functional tasks (eg., walking), and prevent events such as falls are critical to explore further, and
- Further exploration of disability behaviors (eg., driving, social function, ADLs) and quality of life outcomes in later life.