CONNECTION BETWEEN
HEARING LOSS AND HEALTHY
AGING

PSYCHOSOCIAL IMPACT OF HEARING
LOSS
CHRONIC CONDITIONS
(NOLTE & MCKEE, 2008)

REQUIRE ONGOING MANAGEMENT OVER A PERIOD OF YEARS OR DECADES
REQUIRE COMPLEX RESPONSE OVER AN EXTENDED PERIOD OF TIME FROM A WIDE RANGE OF HEALTH PROFESSIONALS
FREQUENTLY GO UNTREATED UNTIL MORE ACCURATE COMPLICATIONS ARISE
LARGE GAP BETWEEN DEVELOPMENT OF EVIDENCE BASED TREATMENT GUIDELINES AND PRACTICE
PLACE SUBSTANTIAL ECONOMIC BURDEN ON SOCIETY ASSOCIATED WITH NEGATIVE CONSEQUENCES
SAMPLES

- Blue Mountains Hearing Study (BMHS) - a population based survey of age-related hearing loss in a representative older Australian community
- Blue Mountains Eye Study - population-based study of vision and eye diseases among a representative older Australian community sample
- Survey of Disability, Aging and Careers (SDAC) - a national household survey of 43,233 respondents with and without disability using the Australian Bureau of Statistics
- Program of Education and Aid for the Community-Dwelling Elderly (PEACE) - Kurabuchi, Town, Takasaki City, Gunma Prefecture, JAPAN - a field study of health parameters of community based elderly
- National Health and Nutrition Examination Study (NHANES) - a program of studies designed to assess health and nutritional status of adults and children in the US. Program is part of the NCHS.
- Epidemiology of Hearing Loss Study (EHLS) - population based longitudinal study of age-related hearing loss of people living in Beaver Dam, Wisconsin
- Medicare Current Beneficiary Statement (MCBS) - continuous multipurpose survey of a nationally representative sample of aged, disabled, and institutionalized beneficiaries
CORRELATES OF HEARING LOSS

- Physical Health Status
- Mental Health Status
- Falls
- Functional Disability
- Compromised HRQoL
- Social Isolation
- Depression
- Independence
- Physical Health Status
- Mental Health Status
OUTCOME MEASURES

• Disease Specific Measure of Quality of Life
  • Hearing Handicap Inventory for the Elderly (HHIE, HHIE-S)
  • Social and Emotional consequences of hearing loss

• Generic Measure of Health Related Quality of Life (HRQoL)
  • Medical Outcomes Study SF-36 - Encompasses physical, emotional and social dimensions of a condition, general health perceptions, role limitations due to emotional problems, mental health, bodily pain (Ware & Sherbourne, 1992)
  • Physical Component Score, Mental Component Score
  • The SF – 12 – shortened version providing summary measures of physical and mental health status

• Depression
  • Center for Epidemiological Studies-Depressions scale (CES-D) (Radloff, 1977)

• Functional Status
  • Older Americans Resources and Services (OARS) Multidimensional Functional Assessment Questionnaire
  • 14 items ADLS, IADLS
IS HEARING LOSS ASSOCIATED WITH FUNCTIONAL DISABILITY?
COMORBIDITIES?

Chronic Pain

Restriction in Physical Activity

Hearing Disability
Increasing severity of hearing loss associated with impaired ADL, those with moderate to severe HL greatest likelihood

A significantly higher proportion of hearing-impaired than non-impaired adults reported difficulty in performing three out of the seven basic ADL and six out of the seven instrumental ADL tasks (e.g. walking, shopping, telephone, dressing, housework)

Person <75 years of age with moderate to severe hearing loss had an 8-fold higher odds of having difficulty in ADL as compared with those without hearing loss

Hearing aid users more likely to have impaired ADL

BMHS-N=1,572 43% of sample HI, HI-77 years, 70-non HI, 10% participants 
Self reported ADL diff
Hearing Loss

Moderate to Severe

HEARING LOSS, BURDEN OF DISEASE AND HOSPITALIZATION RISK*

- Hearing impaired participants (mild to profound) were more likely to have a history of hospitalizations and hospitalization in the past year (similar to BMHS).

- Hearing loss was significantly and independently associated with increased health care use (e.g. any hospitalization and number of hospitalizations).

- Hearing loss was significantly associated with burden of disease (e.g. self-reported poor physical and mental health).

*Genther, Frick, Chen, Betz, & Lin (2013) N= 1669, 32% NH, HI – 77 yrs,
Self Reported Hearing Handicap

N = 812

Ind Assoc

Low Self Rated Health

BMHS
SOCIAL ISOLATION

HEALTH CONSEQUENCES OCCUR WHEN THERE IS AN INABILITY TO MAINTAIN MEANINGFUL CONTACTS
SOCIAL ISOLATION
(WEINSTEIN & VENTRY, 1982)

• Isolates versus Non Isolates
  • GREATER SELF PERCEIVED HEARING HANDICAP, AUDITORY PROCESSING DIFFICULTIES AND POORER HEARING

• Stronger Correlation with Subjective than Objective Social Isolation
  • SELF PERCEIVED HEARING HANDICAP, AUDITORY PROCESSING

N=80
SOCIAL ISOLATION

- LIKELIHOOD OF SELF PERCEIVED SOCIAL ISOLATION INCREASED WITH NUMBER OF CHRONIC CONDITIONS (HAWTHORNE, 2008)

- INDIVIDUALS WITH 5+ CHRONIC CONDITION WERE 19 TIMES MORE LIKELY TO FEEL SI THAN PERSONS WITH 0-1 CHRONIC HEALTH CONDITIONS

- DEPRESSION HAD THE STRONGEST ASSOCIATION WITH SI, FOLLOWED BY SELF REPORTED HEARING DIFFICULTIES

N=3015
SOCIAL ISOLATION

- LIKELIHOOD OF SELF PERCEIVED SOCIAL ISOLATION INCREASED WITH NUMBER OF CHRONIC CONDITIONS (HAWTHORNE, 2008)

- INDIVIDUALS WITH 5+ CHRONIC CONDITION WERE 19 TIMES MORE LIKELY TO FEEL SI THAN PERSONS WITH 0-1 CHRONIC HEALTH CONDITIONS

- DEPRESSION HAD THE STRONGEST ASSOCIATION WITH SI, FOLLOWED BY SELF REPORTED HEARING DIFFICULTIES

South Australian Health Omnibus Survey, N=3015
RISK FACTOR FOR DEVELOPMENT OF DEPRESSION

- *HHIE score accounted for 26% of variance in depression score (CES-D), accounted for more of the variance than did pure-tone hearing levels (10%)

- **Poor HHIE scores - incidence of depression higher among older adults with self reported hh (20% versus 8%) = Japan
  - Odds of developing depressive symptoms were high as compared to those without HH - after adjusting for age, co-existing medical conditions, vision impairment
  - HH independent predictor of depressive symptoms, HI was not
  - HH can predict depressive symptoms

-MacDonald (2011) (N=45)

**Saito, Nishiwaki, Michikawa, Kikuchi, Mizutari, et al., (2010); (N=548) (Long)
DEPRESSION

- Depressive symptoms significant association with bilateral hearing loss, common in those with hearing loss (Gopinath, et al., 2009) (N=1328) (13%-depressed) (Woman more likely than men to report depressive symptoms)

- Independent association between hearing handicap presence of depressive symptoms (Gopinath, Hickson, et al., 2012) (N= 811)
  - After adjusting for age, sex, walking disability, receipt of pension payment, use of community support services, living alone, cognitive impairment, and history of arthritis and/or stroke
A RISK FACTOR FOR FALLS
RISK FACTORS FOR FALLS

- Poor Health
- Depression**
- Difficulty Hearing and Seeing
- Functional limitations, ADL Limitations*
- Cognitive Impairment

*strongest risk factors for falling

Stevens, Ballesteros, Mack, et al., 2012) N= 12,013, MCBS respondents
**STEVENSON, ET AL., (2012)**

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>PROPORTION REPORTING FALLS</th>
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<tbody>
<tr>
<td>Poor Self Rated Health</td>
<td>45%</td>
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<tr>
<td>*Limitations in 2+ ADLS</td>
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<tr>
<td>Depressed</td>
<td>43%</td>
</tr>
<tr>
<td>Difficulty Hearing</td>
<td>38%</td>
</tr>
<tr>
<td></td>
<td>32%</td>
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</table>

*Limited in two or more ADLS, and having two or more functional limitatios – Strongest risk factors falls, **next strongest

MCBS,
N=12013
Hearing loss, walking difficulty and falls

- Impaired hearing correlated with greater risk of falls, poor mobility, lower walking endurance; HL preceded mobility decline in older woman (N=434, 419) (Vilianen, Kaprio, Prykko, et al., 2009)
  - Woman with hearing loss at baseline had twice the risk of developing new major difficulties in walking

- Robust, clinically and statistically relation between report of falls and severity of hearing loss (N=2017) (Lin & Ferrucci, 2012)
  - For every 10 dB increase in hearing level there was a 1.4 fold increased odds of an individual having reported a fall over the preceding 12 months
HEARING LOSS AND MOBILITY DECLINE

HEARING AND VESTIBULAR MECHANISM SHARE STRUCTURES

MEDIATING VARIABLES

HEARING PROVIDES AUDITORY CUES IMPORTANT FOR SPATIAL ORIENTATION AND TO NOTICE ENVIRONMENTAL HAZARDS

HI PLACES INCREASED DEMANDS ON ATTENTION SHARING, ATTENTION REQUIRED TO MAINTAIN POSTURAL BALANCE
DOES HEARING LOSS IMPACT INDEPENDENCE BY INCREASING RELIANCE ON SUPPORT SYSTEMS?
Hearing Loss and Independence*

Participants with hearing loss more likely to be older, have low self-rated health, experienced a fall in past year, CI, disab walking - 3% CS at baseline

*Schneider, Gopinath, Karpa, McMahon et al., (2010) (N=2803) (HI-33%).
Moderate to Severe HL

5 year

Higher risk of developing reliance on community support vs non-hi
MORTALITY
HEARING LOSS AND MORTALITY RISK (KARPA, GOPINATH, BEATH, ET AL., 2010)

Difficulty Walking
Cognitive Impairment
Poor Self Rated Health
Diabetes

N=2815, 33% HL

N=2815, 33% HI, HI older
HEARING LOSS OF ANY SEVERITY

MEDIATING VARIABLES
WALKING DIFFICULTY, COGNITIVE IMPAIRMENT
SELF RATED HEALTH

MORTALITY
MORTALITY
(KARPA, ET AL., 2010)

• HEARING LOSS - INDIRECT LINKS TO MORTALITY THROUGH MEDIATING VARIABLES (COGNITIVE IMPAIRMENT, DISABILITY IN WALKING)

• PATHWAY FROM DISABILITY IN WALKING AND CI TO MORTALITY OCCURRED DIRECTLY AND INDIRECTLY THROUGH ASSOCIATION WITH SELF RATED HEALTH

• SEVERITY OF HEARING LOSS DID NOT INFLUENCE EXTENT OF RELATIONSHIPS
NO ASSOCIATION DIRECTION, NO CAUSALITY
Personal perception of health

Social interaction

Physical Function

Psychological
Self Reported Hearing Handicap* and Communication Difficulties (8 domains)

Severity of Hearing Loss (6 domains, not bodily pain and general health)

REDUCED SCORES ON DOMAINS OF SF-36


Severity of HL

Lower Summary Scores on PCS and MCS

Severity of Communication Difficulties

Severity of Hearing Handicap
SEVERITY AND FREQUENCY MATTER (N=2662)*

- MODERATE TO SEVERE – ASSOCIATED WITH POOREST SCORES ON THE PCS, MCS AND ON FIVE OF EIGHT DIMENSIONS (E.G. ROLE LIMITATIONS DUE TO PHYSICAL PROBLEMS, ROLE LIMITATIONS DUE TO EMOTIONAL PROBLEMS)

- BOTH HIGH AND LOW FREQUENCY LOSS POORER SCORES ON SF-36 THAN PERSONS WITHOUT HEARING LOSS (FOUR DIMENSIONS) AND ON THE MCS

- BOTH HIGH AND LOW FREQUENCY LOSS POORER SCORES ON SF-36 THAN PERSONS WITH ONLY HIGH FREQUENCY LOSS ON FOUR DIMENSIONS AND PCS

- ONLY HIGH FREQUENCY LOSS HAD COMPARABLE SF-36 SCORES THAN THOSE WITHOUT HEARING LOSS

*(Chia, et al., 2007), 54% normal hearing, 32% bilat, 13% - majority mild to moderate, 33% had hearing aids – 26% used them
66% WITH HI AT BASELINE WERE HANDICAPPED AFTER FIVE YEARS
Lower Among Those With Hearing Handicap at Baseline

At ten year F-U

Physical Component Score and Mean Scores on 7/8 SF-36 Domains
Developed Incident Handicap Versus Those Who Did Not

Persons Who Developed Incident Self Reported Hearing Handicap

10 year

Lower SF-36 Scores

Role limit due to phys probs, soc func, role emot probb

Gopinath, et al., (2012)(n=829) *role limit due to phys probls, social function, role Limit due to emotional probs
THE VALUE OF HEARING AIDS
CORRELATES OF HEARING AID USE

PERCEIVED NEED FOR IMPROVED HEARING

FEEL DISABLED BY HEARING LOSS

HEARING LOSS LIMITS PARTICIPATION IN SOCIETY
VALUE OF HEARING AIDS

SLIGHTLY BETTER SCORES ON PCS SCALE*

UTILIZE AND NEED SUPPORT SERVICES**

SIGNIFICANT IMPROVEMENT ON MCS & MENTAL DOMAIN ITEMS – 10 YEARS***

LESS OF DECLINE ON VITALITY DOMAIN THAN NON USERS-10 YEARS***

HOGAN, ET AL., (2009)

- Hearing Aid Users
- Better HRQoL than Non Users
- Poorer HRQoL Relative to General Population
Hearing Aid Use Improved Self-Rated Health Reduced Self-Reported Hearing Handicap

AFTER 6 MONTHS

N=98, FINLAND
**EFFECTS OF DIGITAL HEARING AID USE**
*(BOI, RACCA, CAVALLO, ET AL., 2012)*

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<th>Baseline</th>
<th>1 month</th>
<th>3 months</th>
<th>6 months</th>
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<tbody>
<tr>
<td><strong>CES-D</strong>*</td>
<td>23.27</td>
<td>13.27</td>
<td>14.2</td>
<td>11.33</td>
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<tr>
<td>Caregiver Burden Inventory (CBI)*</td>
<td>10</td>
<td>7</td>
<td>7</td>
<td>3.8</td>
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<tr>
<td>SF-36**</td>
<td>387</td>
<td>26.9</td>
<td></td>
<td>523</td>
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<td>*p&lt;.01</td>
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</tr>
<tr>
<td><strong>MMSE</strong></td>
<td>23.27</td>
<td>13.27</td>
<td>14.2</td>
<td>11.33</td>
</tr>
<tr>
<td><strong>general health, social function, role-emotional, mental health, vitality</strong></td>
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<tr>
<td><em>(Significant changes)</em></td>
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Mean – 78 years, N=15, 93% Moder to Severe, 6-12 hrs per day
LEVEL OF REPORTED COMMUNICATION DIFFICULTY AND HEARING AID USE
(HOGAN, ET AL., 2009)

- 98% MILD COMM
- DIFF -HA USE
- 53% MOD
DIFF
HA USE
- 31-41%
SEVERE TO
PROF COM
DIFF-HA
USE

HEARING AID USE HELPED
OVERCOME
HEARING LOSS EFFECTS ON
COMMUNICATION

Australian Bureau of Statistics Survey of Disability, Aging, and Careers N= 654,113
CONSEQUENCES OF HEARING LOSS (VINAYA, ET AL., 2013)

- Depression
- Poor self-rated health
- Difficulty walking
- Difficulty communicating
- Reduced independence
- Reduced functional ability
- Avoidance of social situations
- Poor health related quality of life
- Depression
PERSON-ENVIRONMENT FIT MODEL*

PERSON’S HEARING ABILITY + DEMANDS OF ENVIRONMENT → STRESS

NEXT STEPS

• **ABSOLUTE and RELATIVE RISK REDUCTION** – How much is absolute risk of hearing related consequences reduced with HEARING INTERVENTIONS?

• **HORIZON TO BENEFIT** - What is the length of time needed to accrue a clinically meaningful risk reduction in health outcomes associated with hearing difficulties?
THE ABILITY TO HEAR AND UNDERSTAND REALLY MATTERS