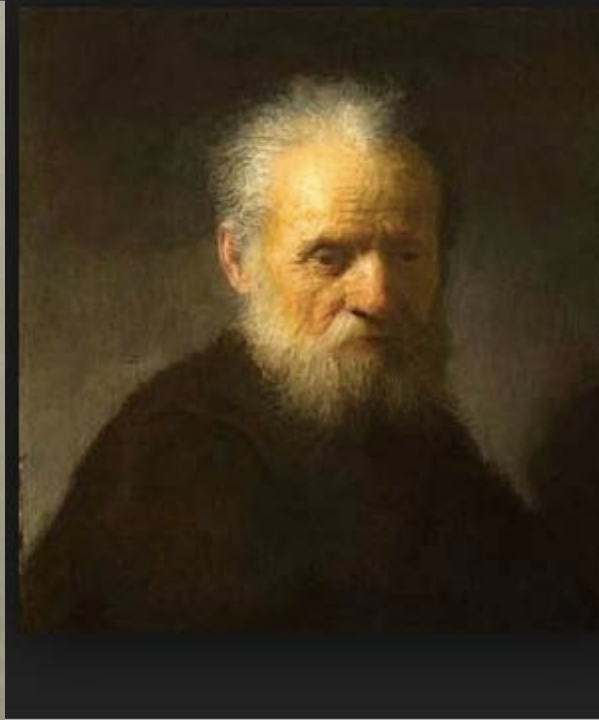


CONNECTION BETWEEN HEARING LOSS AND HEALTHY AGING

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

HEALTHY AGING

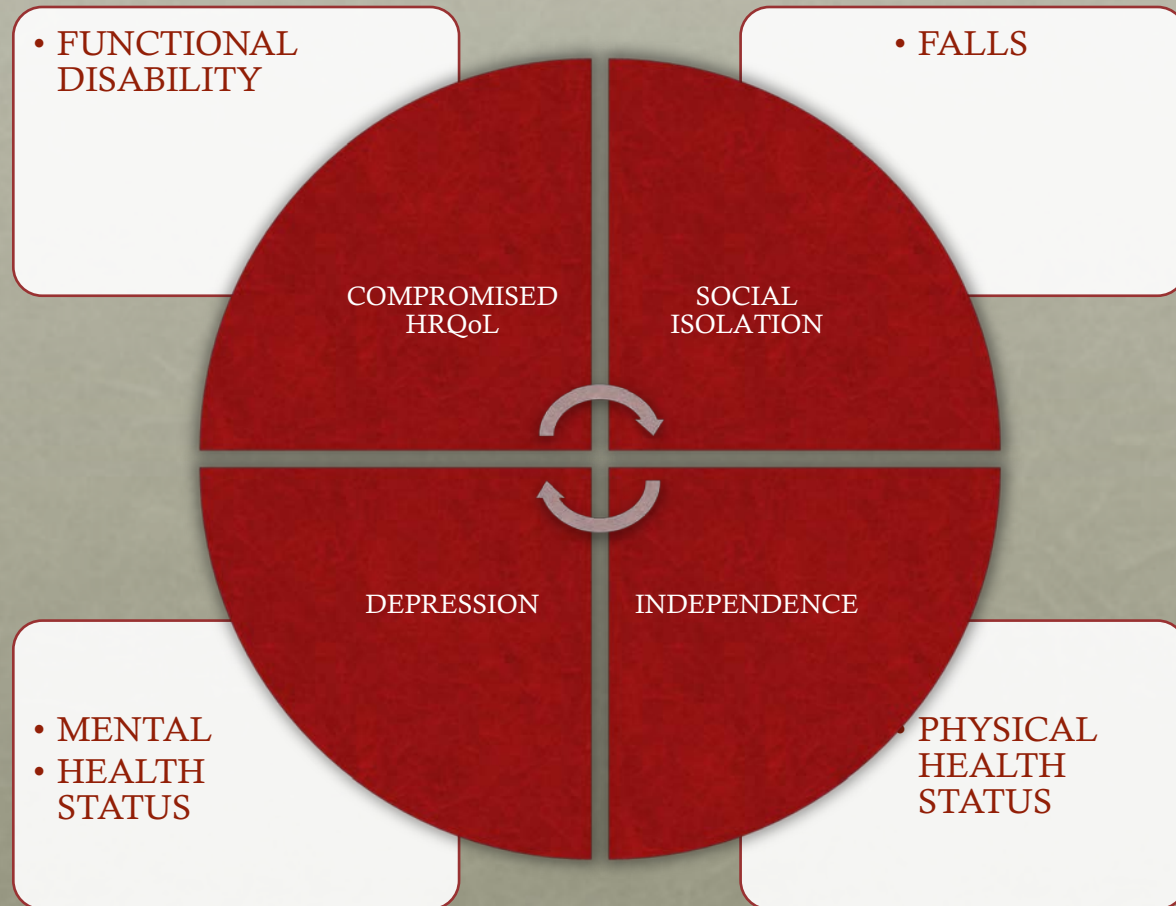




SAMPLES

- **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



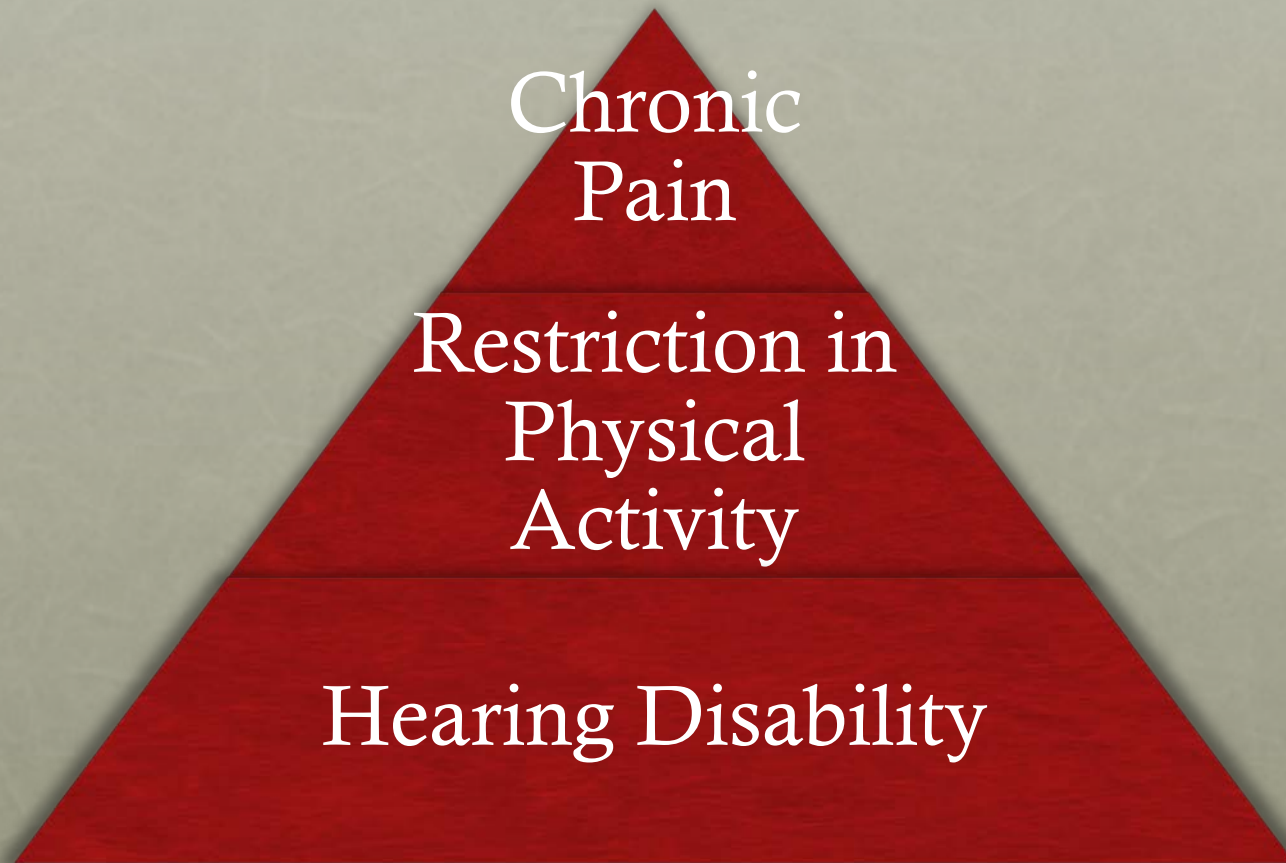
OUTCOME MEASURES

- Disease Specific Measure of Quality of Life
 - Hearing Handicap Inventory for the Elderly (HHIE, HHIE-S)
 - Ventry & Weinstein (1983) (1982)
 - 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?

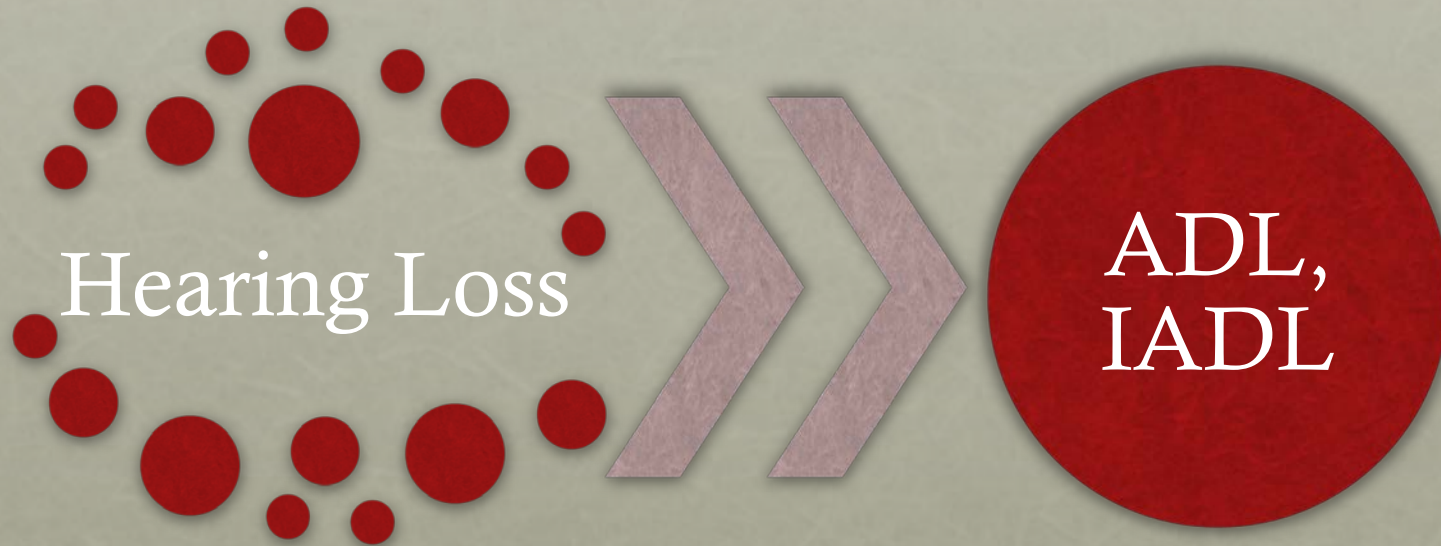


HEARING LOSS AND FUNCTIONAL DISABILITY

(GOPINATH, SCHNEIDER, MCMAHON, TEEBER, LEEDER, & MITCHELL (2012))

- 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



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,



N= 812



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

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

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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, Mizutani, et al., (2010); (N=548) (Long)

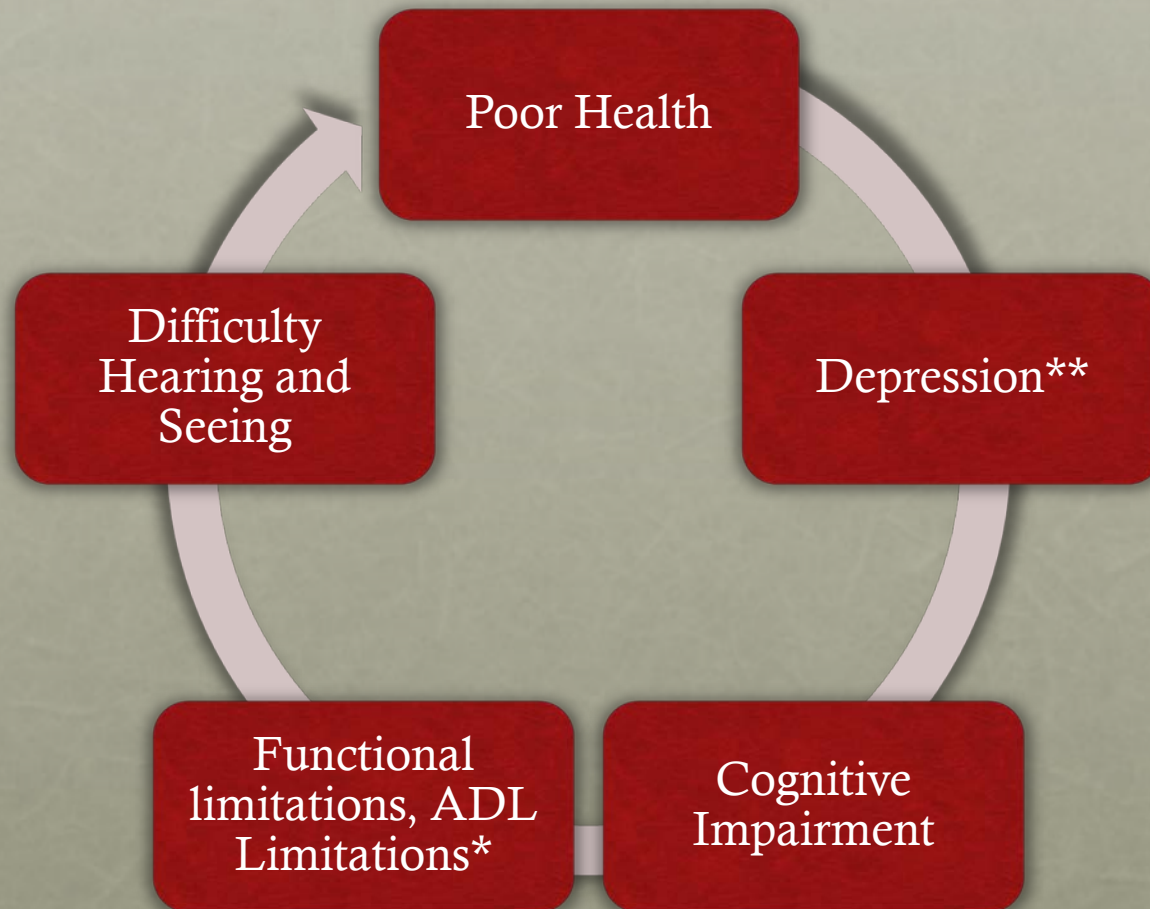
DEPRESSION

- 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



Stevens, Ballesteros, Mack, et al., 2012) N= 12,013, MCBS respondents

*strongest risk factors for falling

STEVENS, ET AL., (2012)

CONDITION	PROPORTION REPORTING FALLS
Poor Self Rated Health	45%
*Limitations in 2+ ADLS	43%
Depressed	38%
Difficulty Hearing	32%

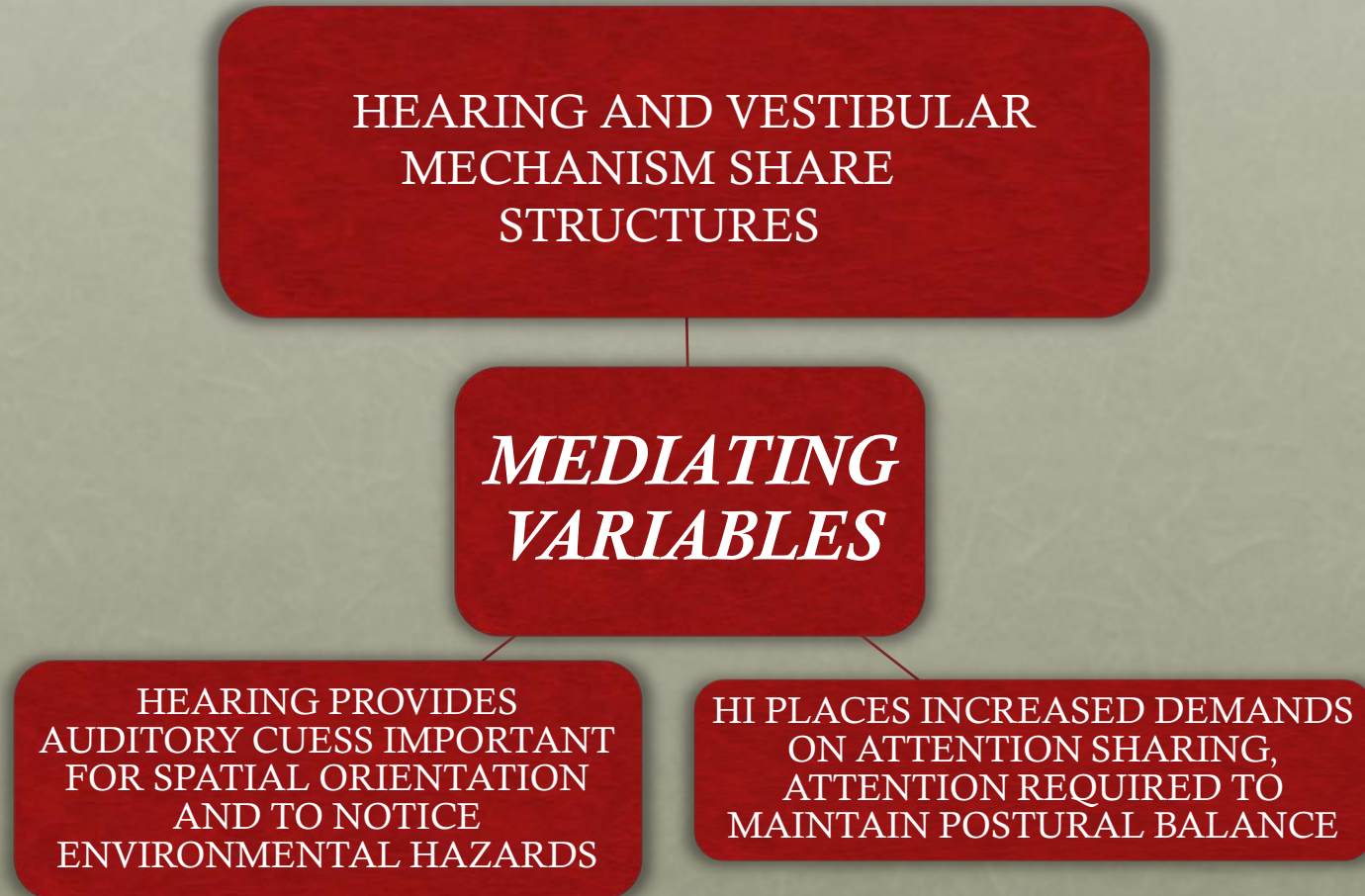
*Limited in two or more ADLS, and having two or more functional limitations – Strongest risk factors falls,**next strongest

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) (Viljanen, Kaprio, Pyykko, 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

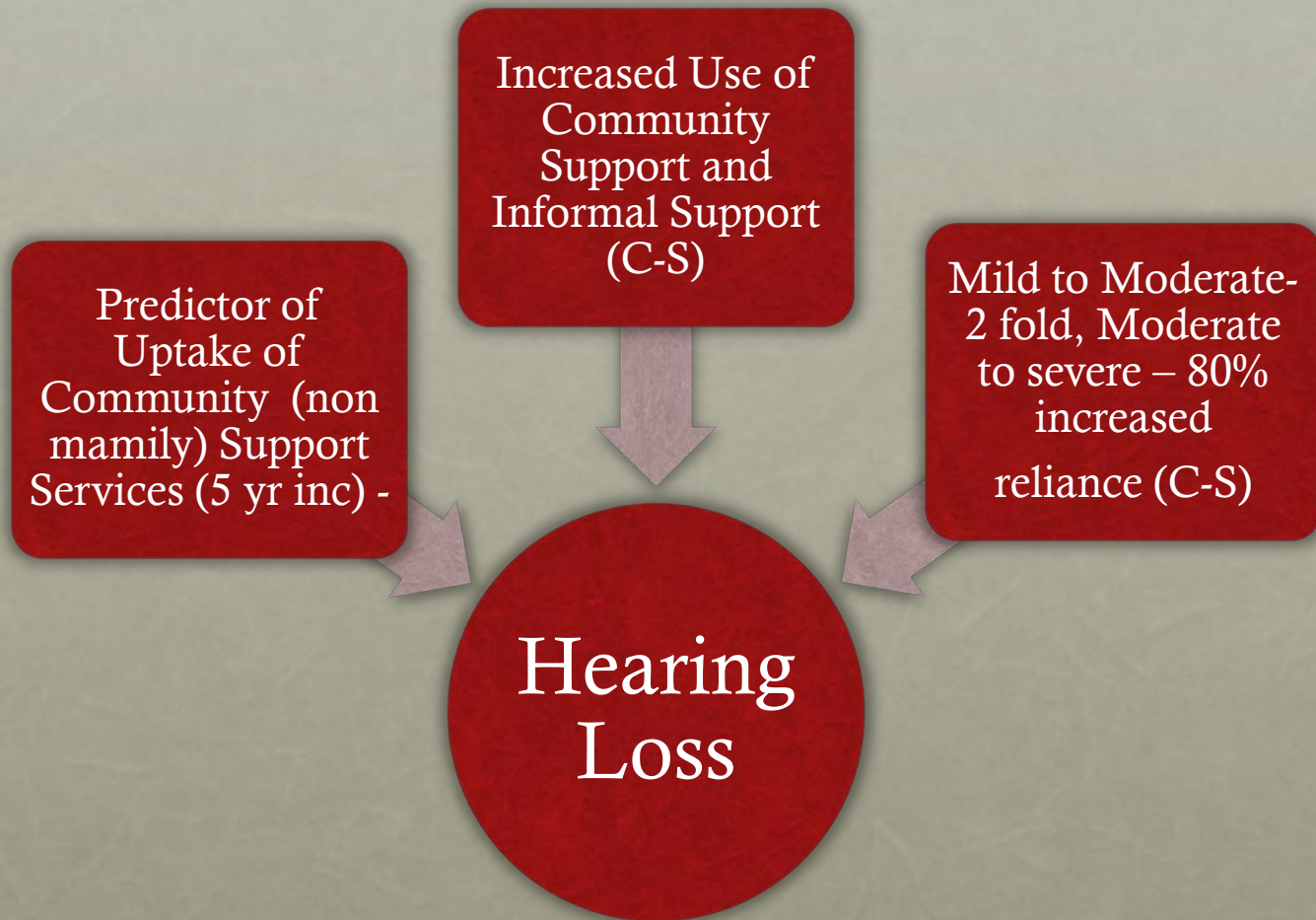
HEARING LOSS AND MOBILITY DECLINE



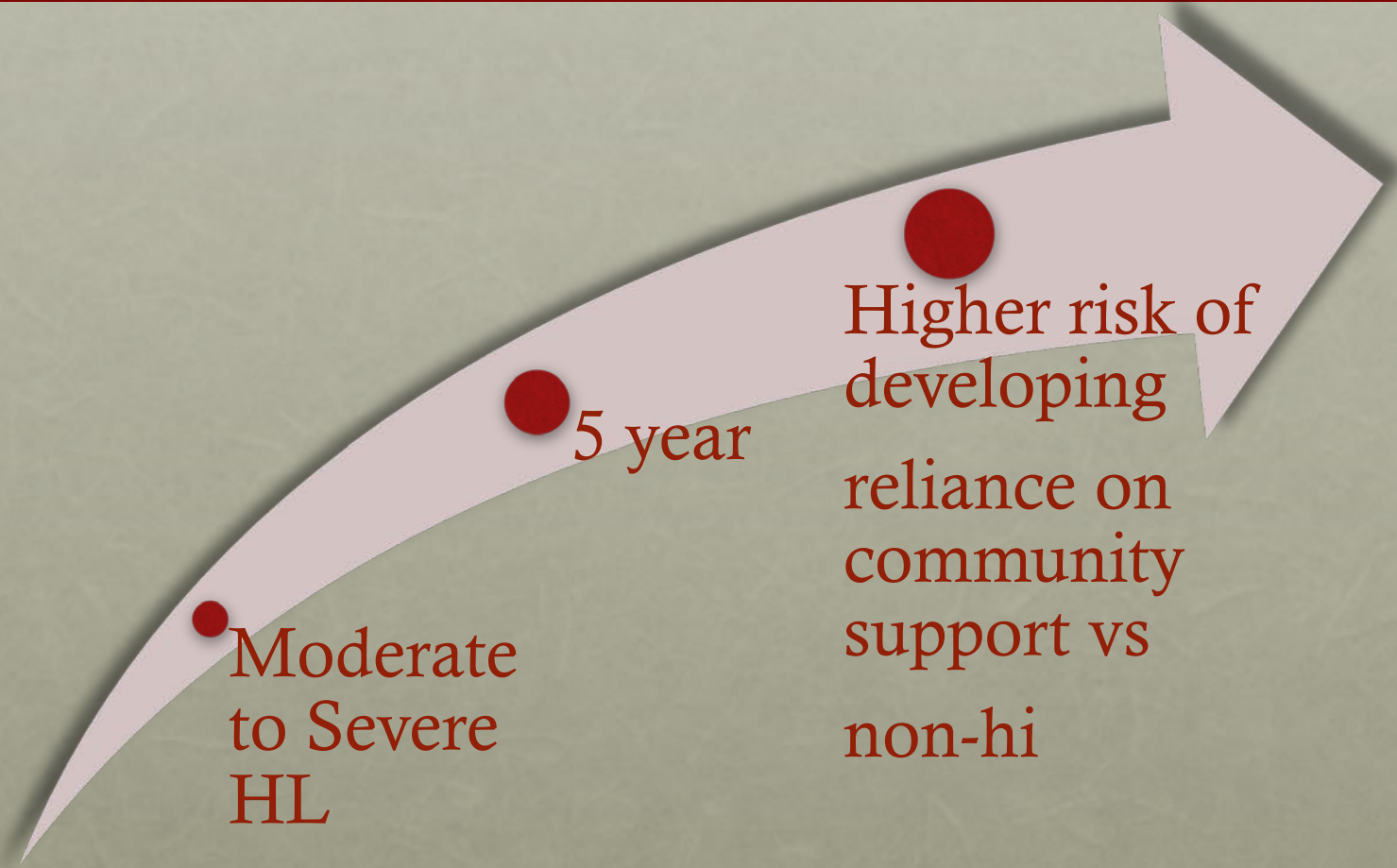
DOES HEARING LOSS IMPACT INDEPENDENCE BY INCREASING RELIANCE ON SUPPORT SYSTEMS?



HEARING LOSS AND INDEPENDENCE*



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



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

```
graph LR; A[HEARING LOSS OF ANY SEVERITY] --> B[MEDIATING VARIABLES  
WALKING DIFFICULTY,  
COGNITIVE IMPAIRMENT  
SELF RATED HEALTH]; B --> C[MORTALITY];
```

HEARING
LOSS OF ANY
SEVERITY

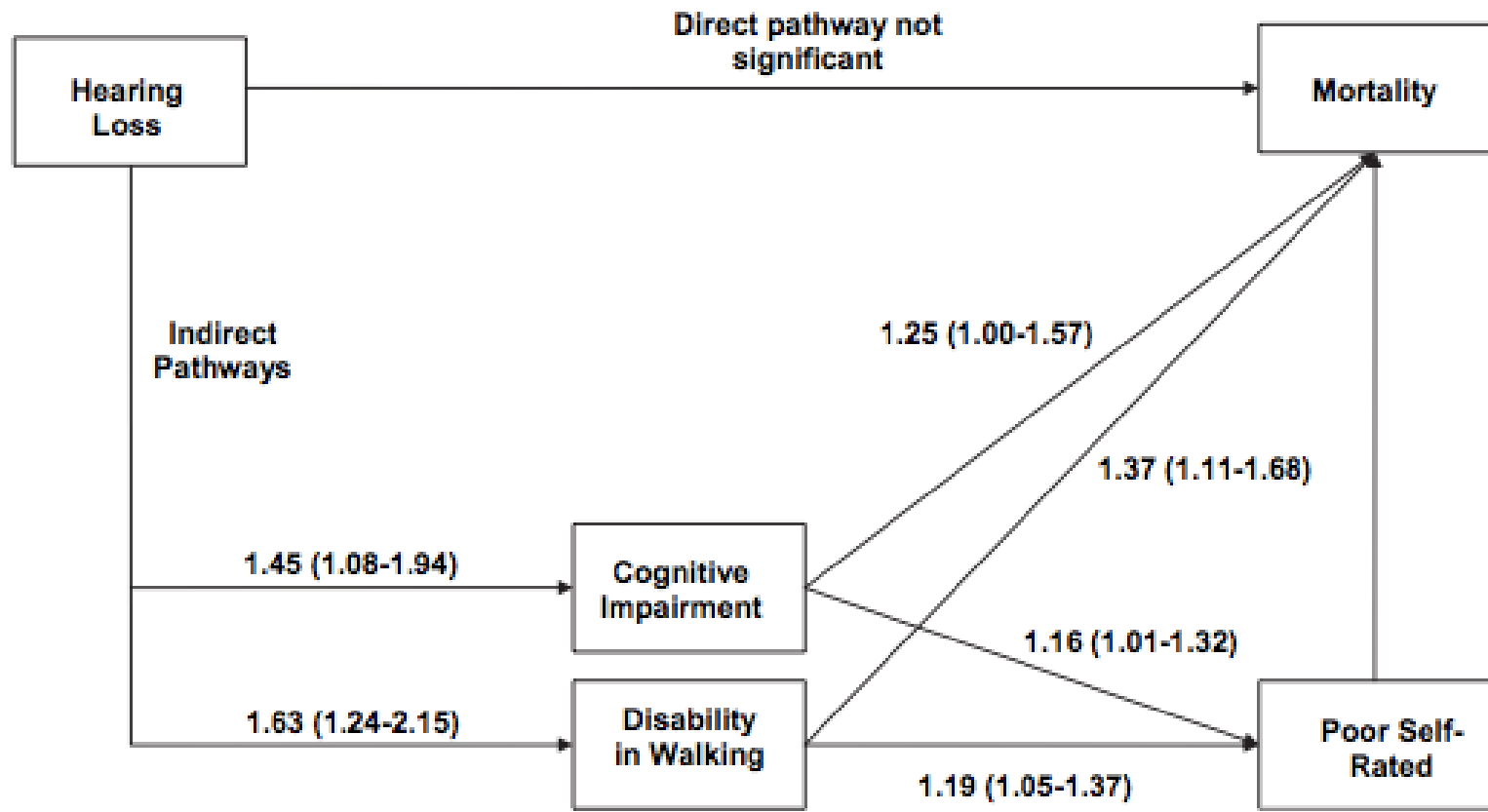
MEDIATING
VARIABLES
WALKING DIFFICULTY,
COGNITIVE
IMPAIRMENT
SELF RATED HEALTH

MORTALITY

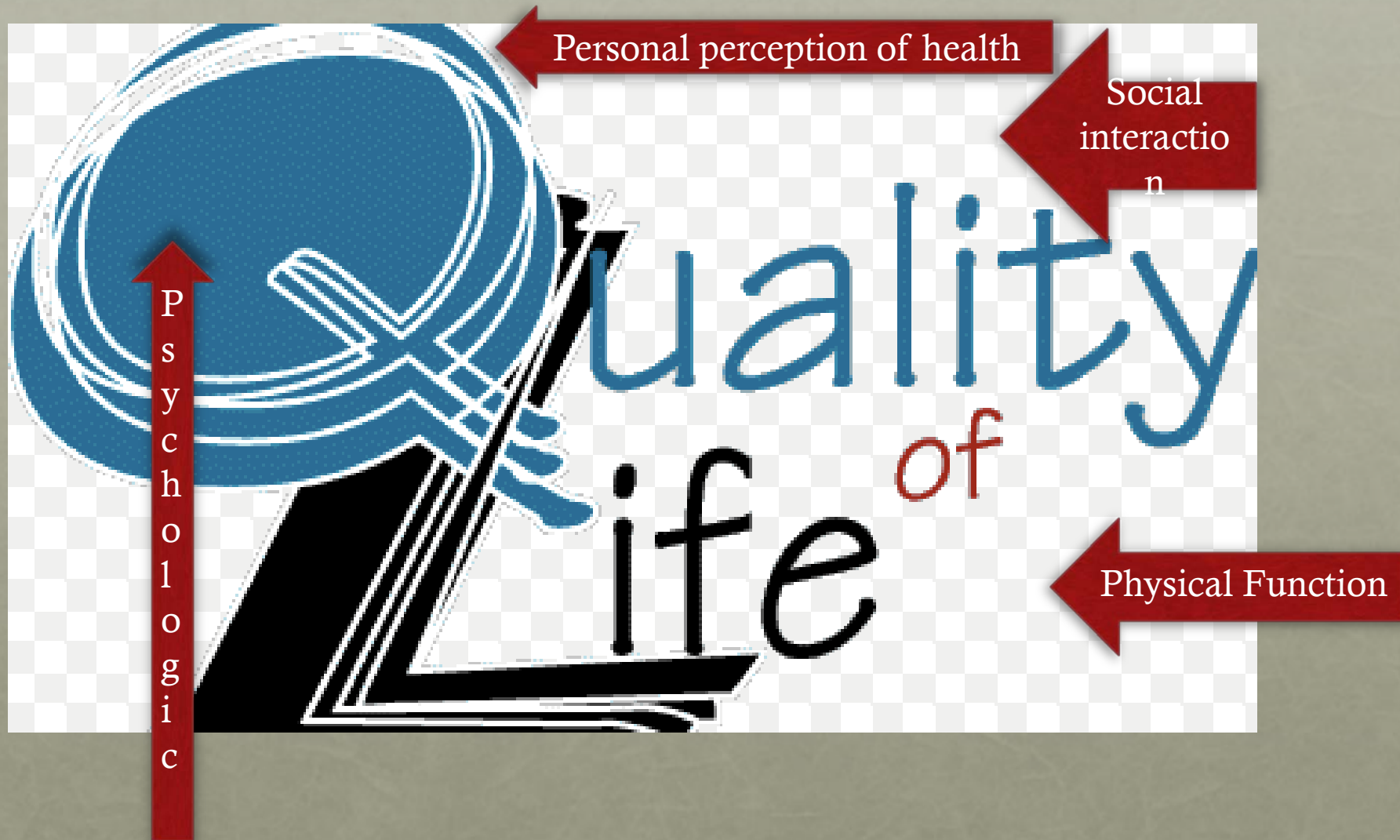
MORTALITY

(KARPA, ET AL., 2010)

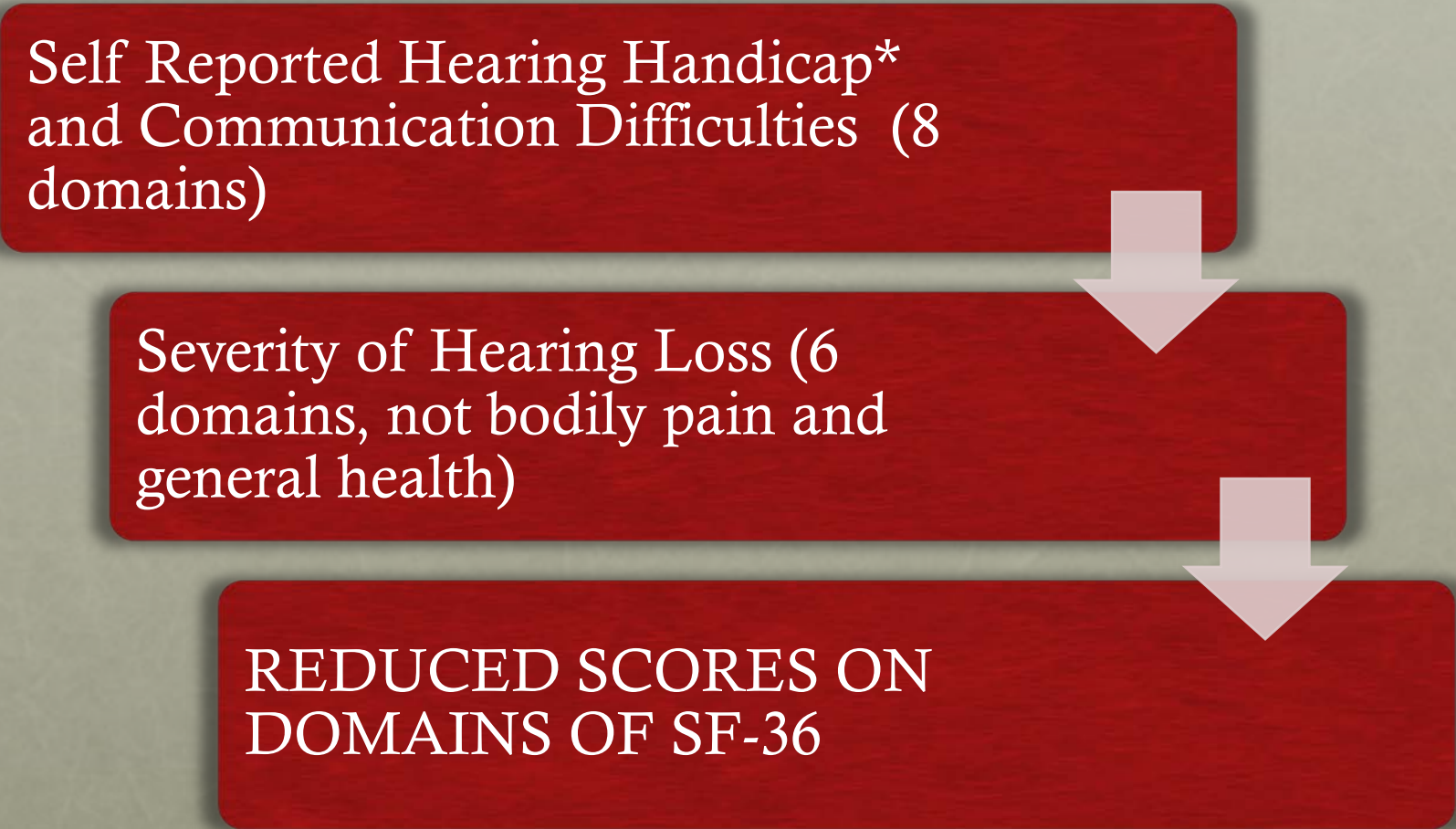
- HEARING LOSS - INDIRECT LINKS TO MORTALITY THROUGH MEDIATING VARIABLES (COGNITIVE IMPAIRMENT, DISABILITY IN WALKING)
- PATHWAY FROM DISABILITY IN WALKING AND CI TO MORTALITY OCCURRED DIRECTLY AND INDIRECTLY THROUGH ASSOCIATION WITH SELF RATED HEALTH
- SEVERITY OF HEARING LOSS DID NOT INFLUENCE EXTENT OF RELATIONSHIPS



NO ASSOCIATION DIRECTION, NO CAUSALITY



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



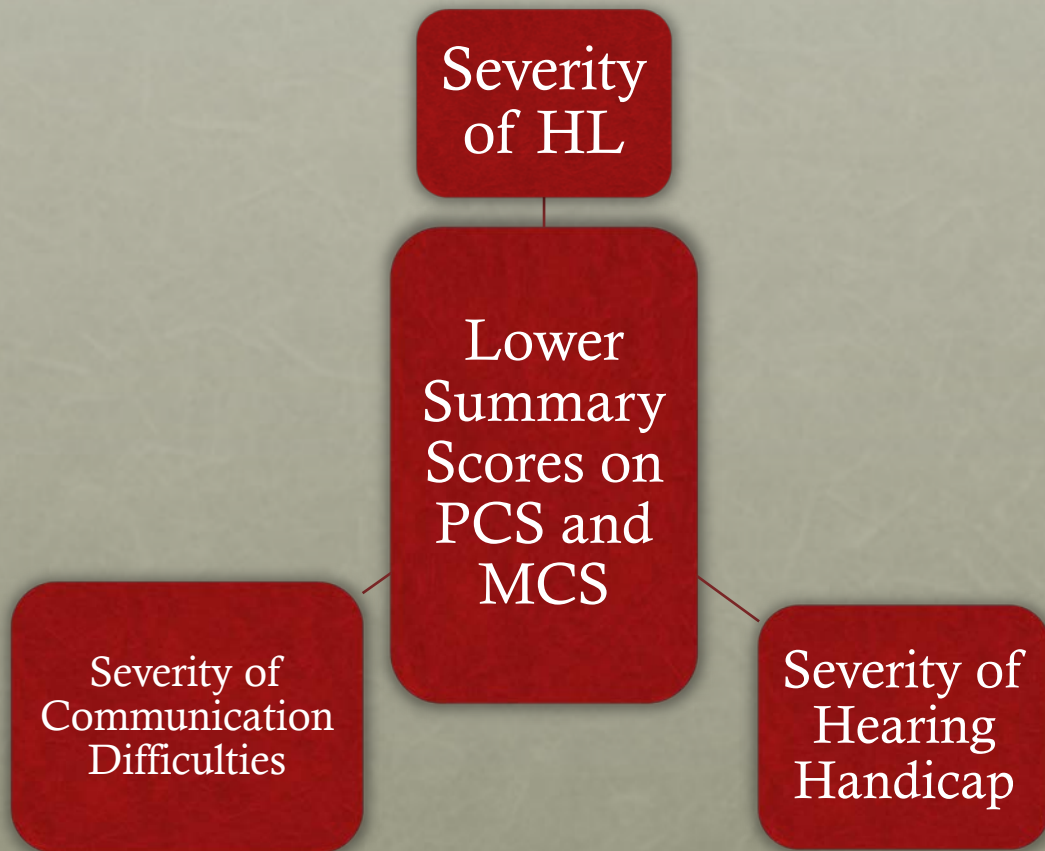
```
graph TD; A[Self Reported Hearing Handicap* and Communication Difficulties (8 domains)] --> B[Severity of Hearing Loss (6 domains, not bodily pain and general health)]; B --> C[REDUCED SCORES ON DOMAINS OF SF-36];
```

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

REDUCED SCORES ON
DOMAINS OF SF-36

Dalton, Cruickshanks, Klein, Klein, et al., (2003) N=2608, EHLS, HL-51%, HH-16%, 15% HA users (* greatest difference in SF-36 scores on HHIE-S)

DALTON, ET AL., (2003)



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

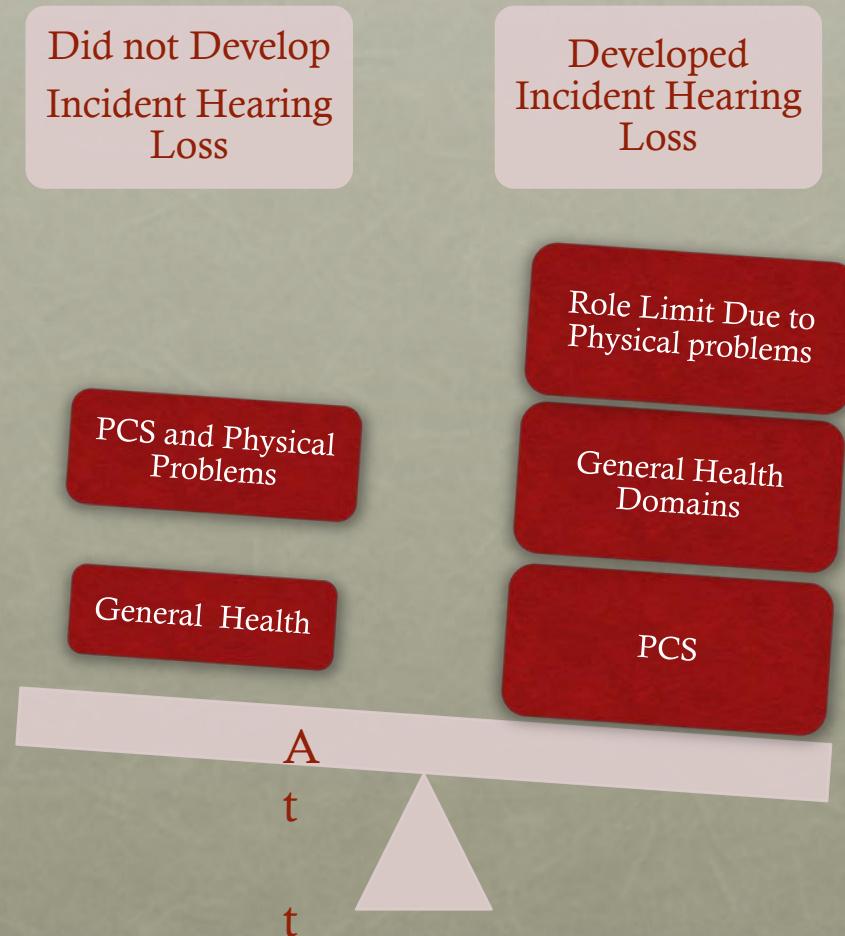
*(Chia, et al., 2007), 54% normal hearing, 32% bilat, 13% - majority mild to moderate, 33% had hearing aids – 26% used them

FIVE YEAR LONGITUDINAL STUDY – HL AND WELL-BEING BMHS (N=811)

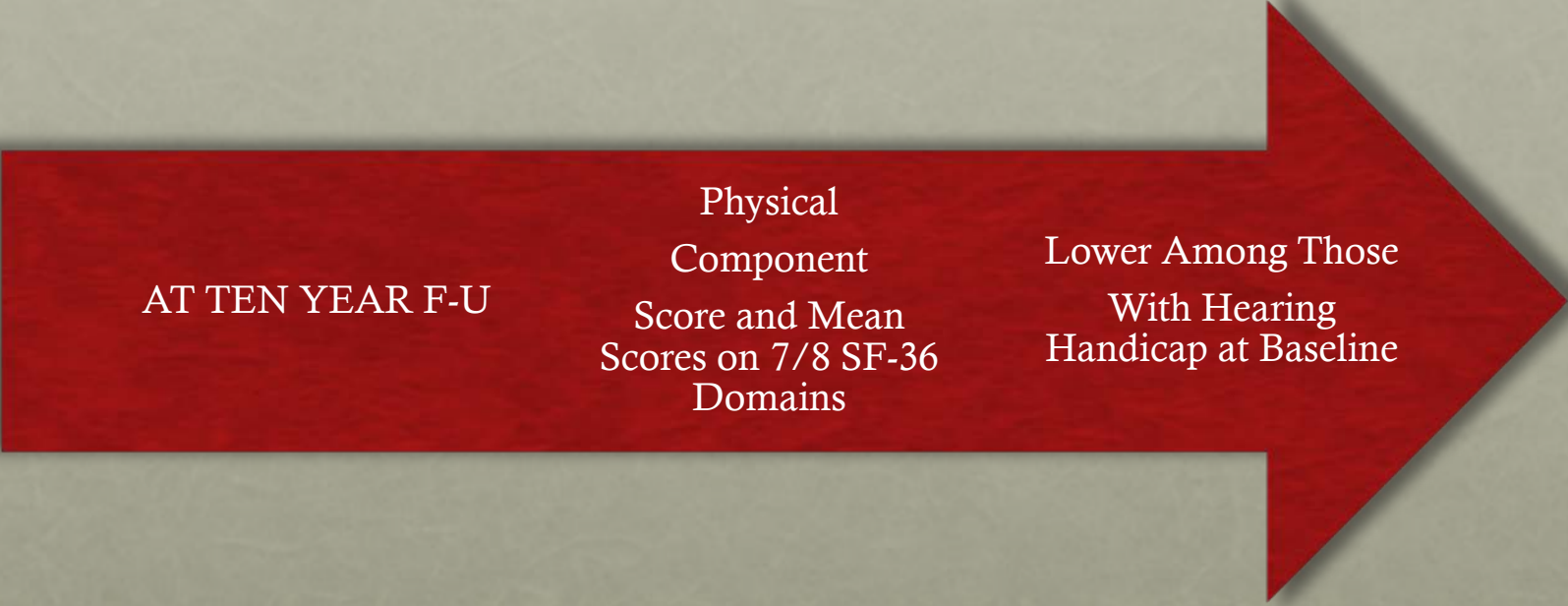


66% WITH HI AT BASELINE WERE HANDICAPPED AFTER FIVE YEARS
Gopinath, Hickson, Schneider, et al., (2012) (SF-36, HHIE)

TEN YEAR TRAJECTORY



Gopinath, Schneider, Hickson, et al., (2012) N=829, mean age= 64, 28% HI, HI- walking dis

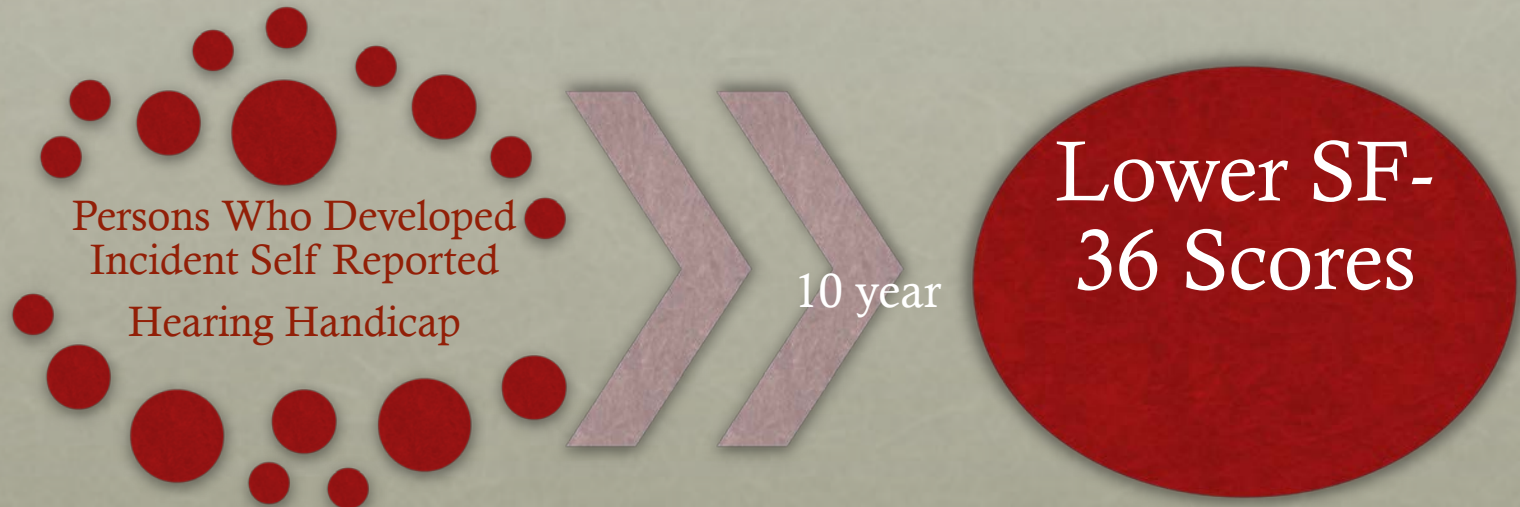


AT TEN YEAR F-U

Physical
Component
Score and Mean
Scores on 7/8 SF-36
Domains

Lower Among Those
With Hearing
Handicap at Baseline

Developed Incident Handicap Versus Those Who Did Not



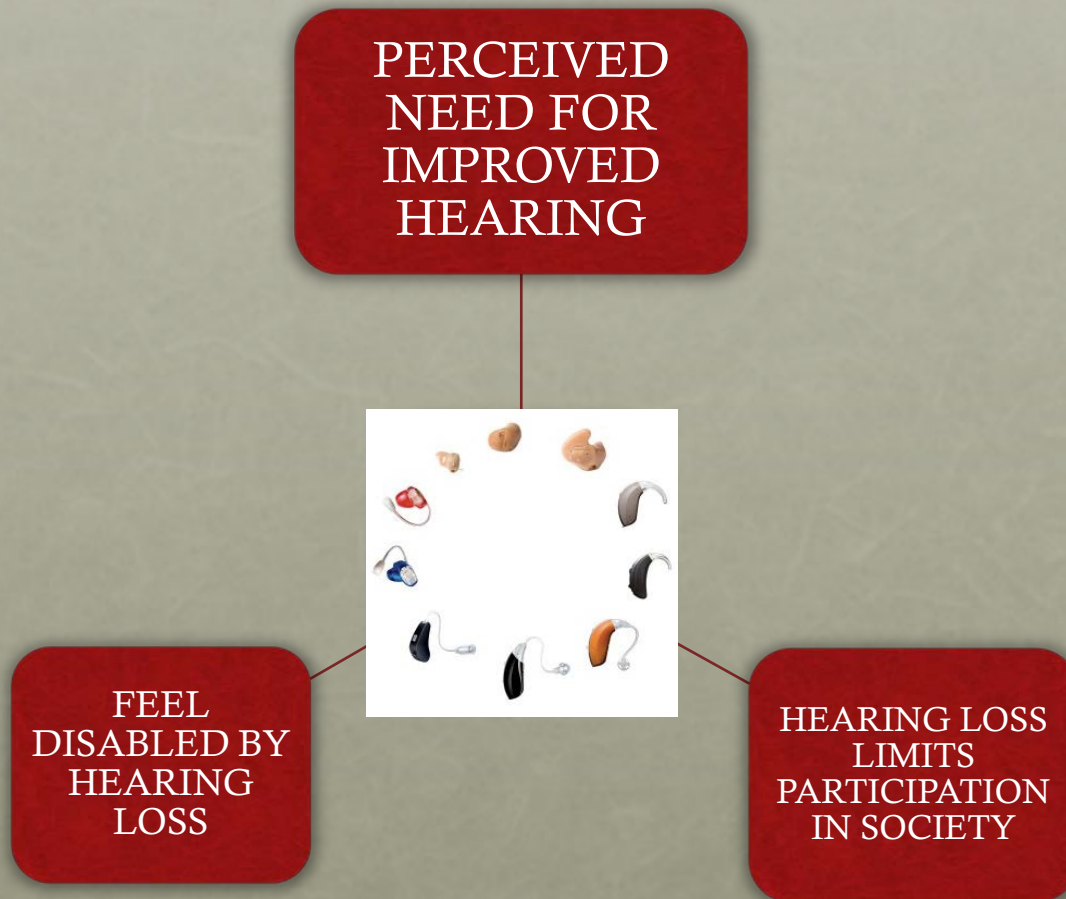
Role limit due to phys
probs, soc func, role
emot probb

Gopinath, et al., (2012)(n=829) *role limit due to phys probs, social function, role
Limit due to emotional probs

THE VALUE OF HEARING AIDS



CORRELATES OF HEARING AID USE

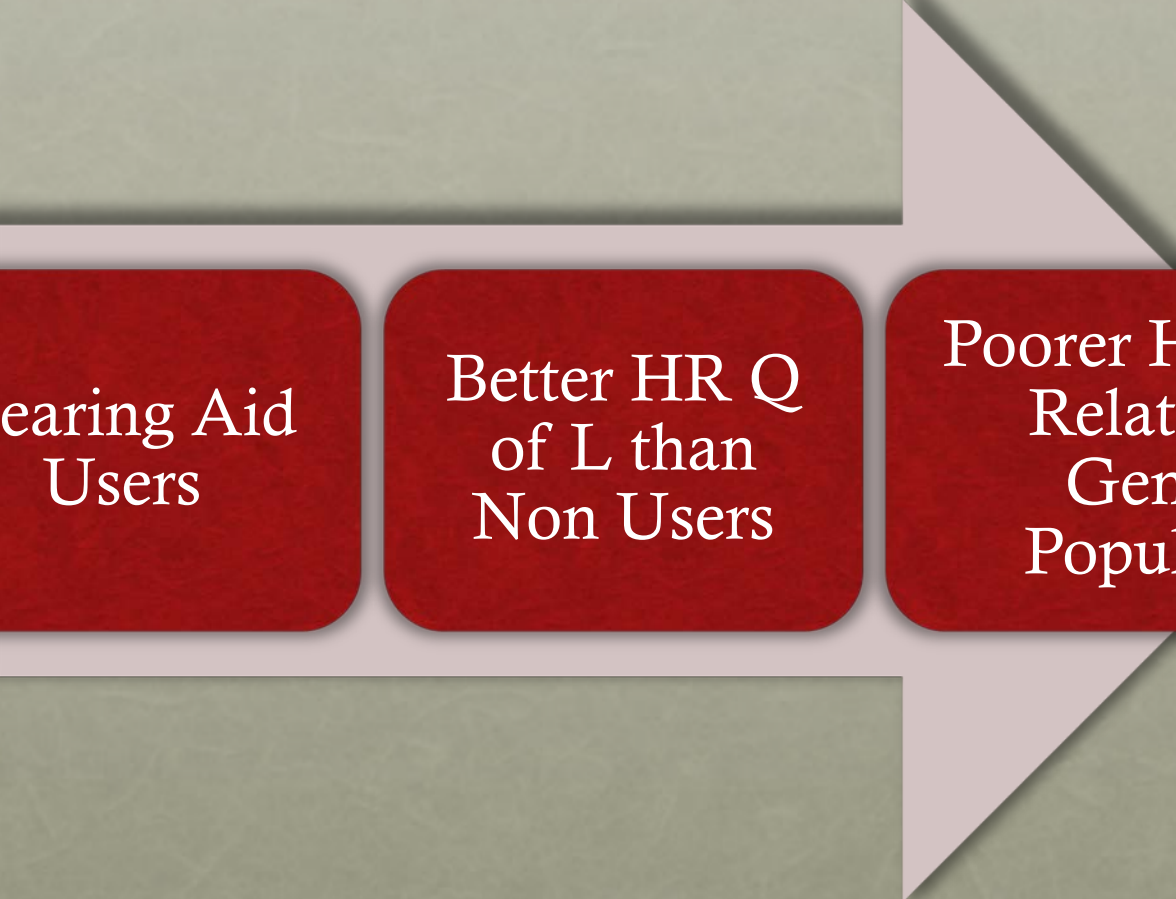


VALUE OF HEARING AIDS



*Chia, et al., (2007), **Schneider, et al., (2010), ***Gopinath, Schneider, et al. (2012)

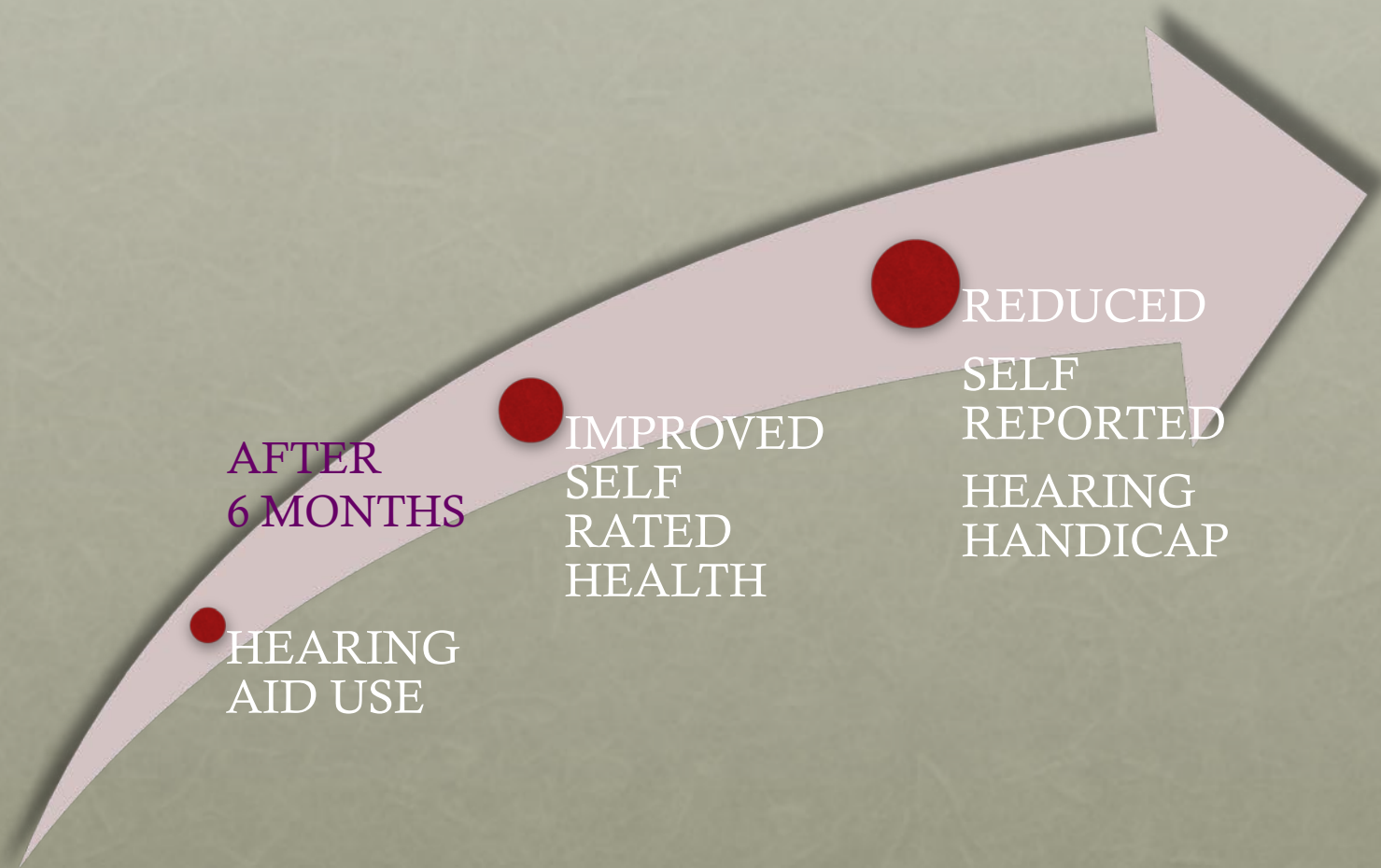
HOGAN, ET AL., (2009)



Hearing Aid
Users

Better HR Q
of L than
Non Users

Poorer HRQ o L
Relative to
General
Population



N=98, FINLAND

EFFECTS OF DIGITAL HEARING AID USE

(BOI, RACCA, CAVALLERO, ET AL., 2012)

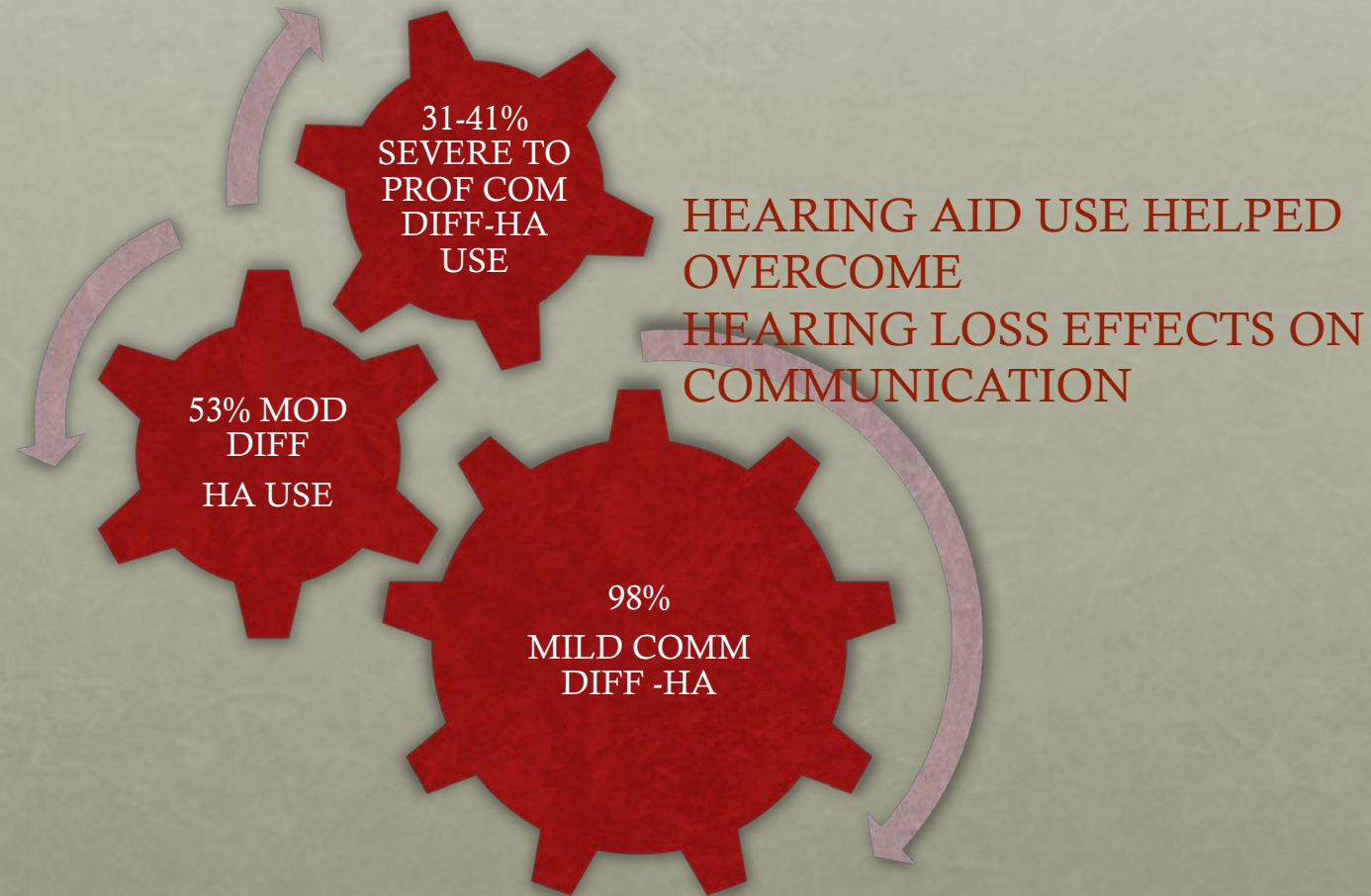


	Baseline	1 month	3 months	6 months
CES-D*	23.27	13.27	14.2	11.33
Caregiver Burden Inventory (CBI)*	10	7	7	3.8
SF-36**	387			523
*p<.01				
MMSE	26.9			28

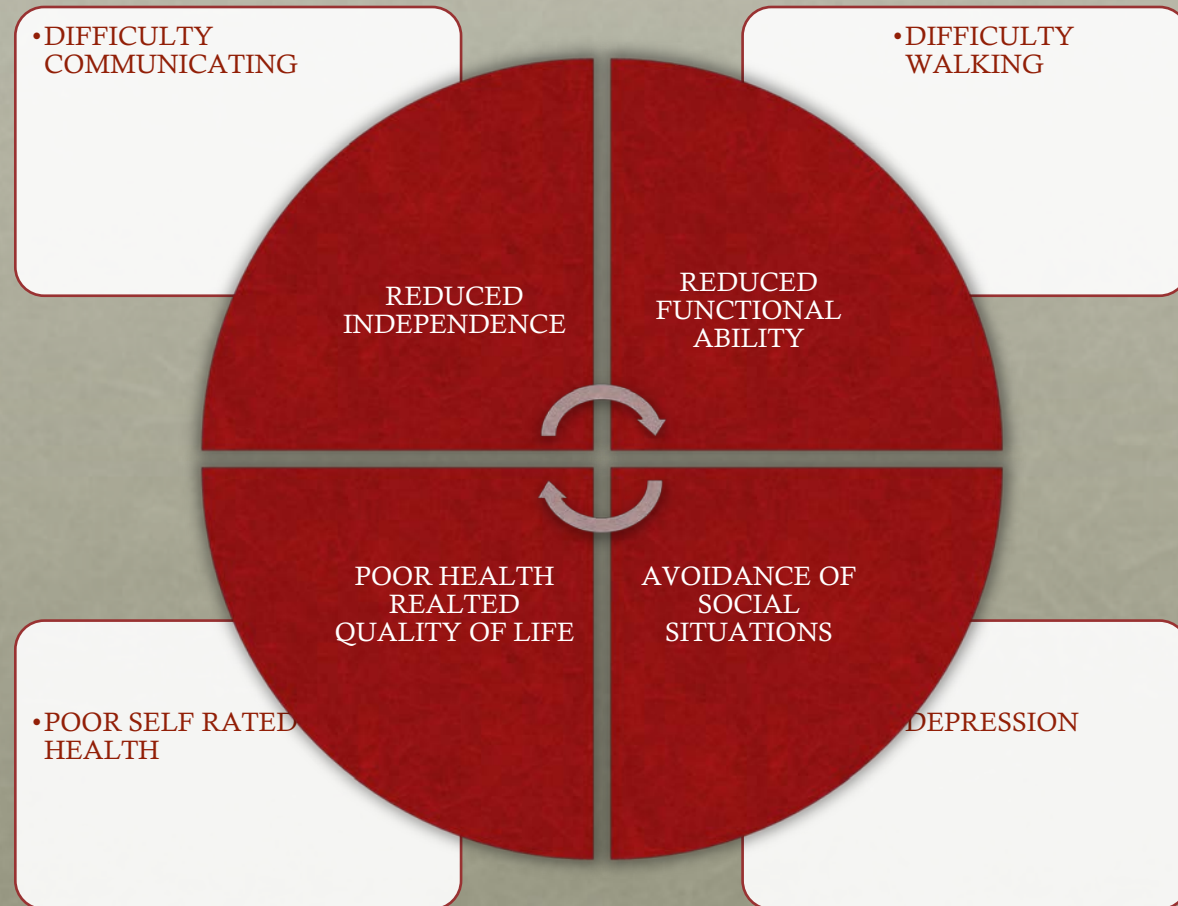
**general health, social function, role-emotional, mental health, vitality
(Significant changes)

Mean – 78 years, N=15, 93% Moder to Severe, 6-12 hrs per day

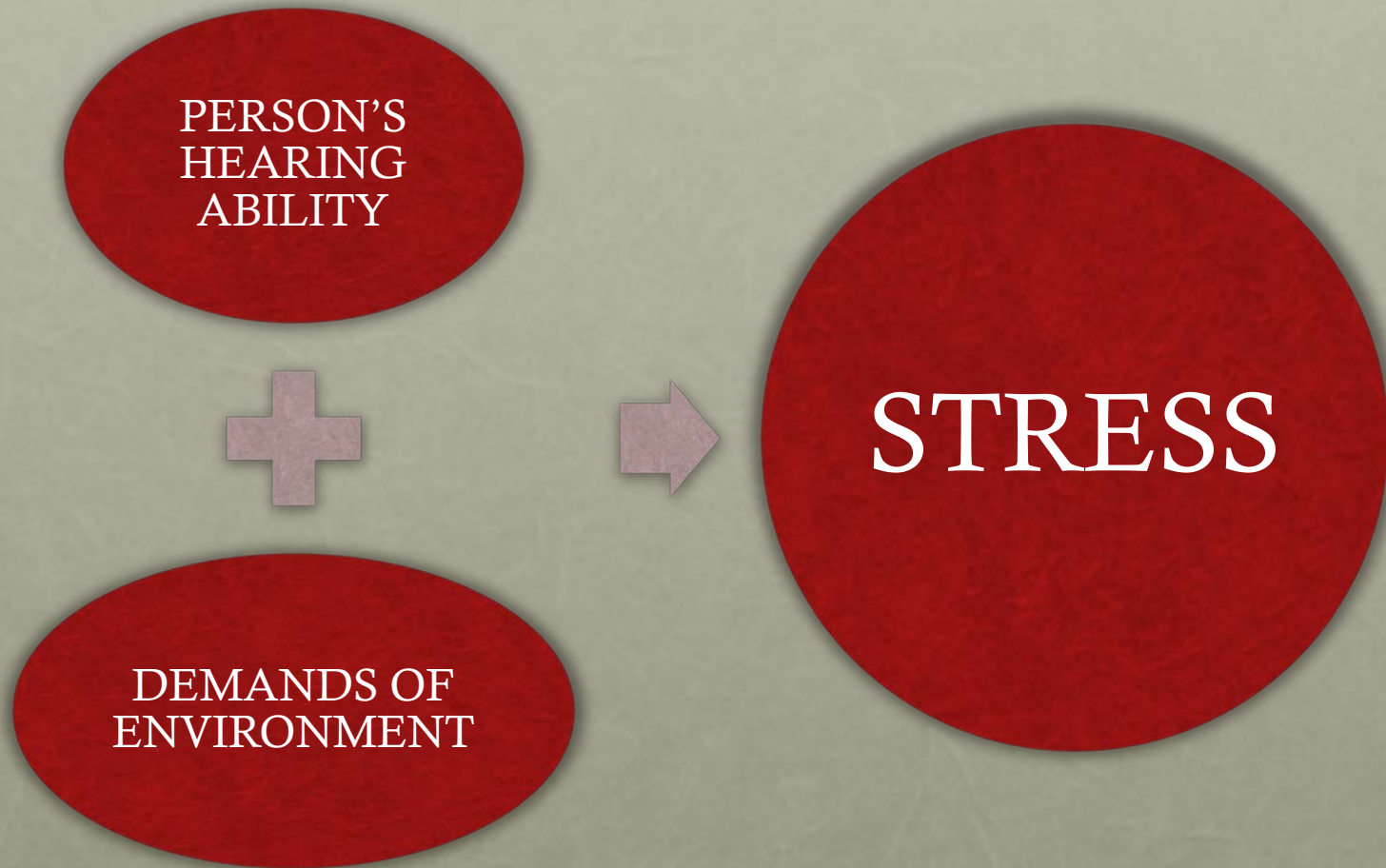
LEVEL OF REPORTED COMMUNICATION DIFFICULTY AND HEARING AID USE (HOGAN, ET AL., 2009)



CONSEQUENCES OF HEARING LOSS (VINAYA, ET AL., 2013)



PERSON-ENVIRONMENT FIT MODEL*



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**

THANK YOU