

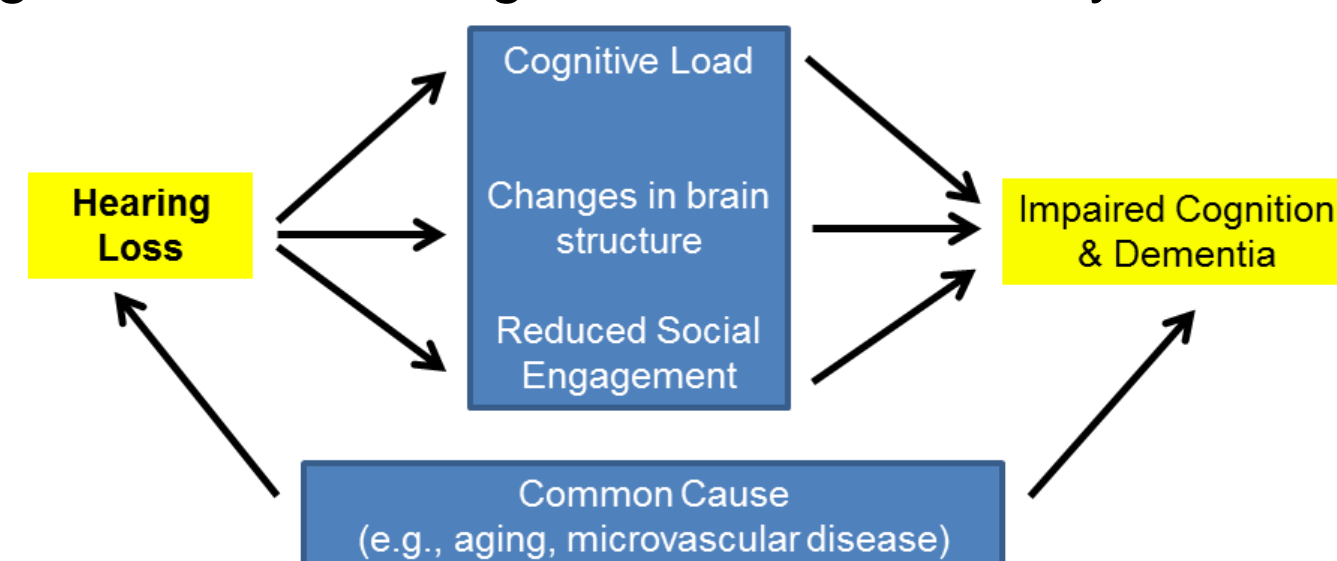
# Results from the ACHIEVE-P Study – A Pilot Study for an RCT to Determine if Hearing Loss Treatment Can Reduce the Risk of Cognitive Decline in Adults

Frank R. Lin MD PhD<sup>1</sup>, Marilyn Albert PhD.<sup>1</sup>, Shrikant Bangidwala, PhD<sup>2</sup>, Theresa Chisolm PhD<sup>3</sup>, Jennifer Deal PhD<sup>1</sup>, Sonia Davis, DrPH<sup>2</sup>, Nancy Glynn, PhD<sup>4</sup>, Melissa Minotti MPH<sup>1</sup>, Tom Mosley PhD<sup>5</sup>, George Rebok PhD<sup>1</sup>, Nicholas Reed, AuD<sup>1</sup>, Richey Sharrett MD<sup>1</sup>, Josef Coresh MD PhD<sup>1</sup>

(1) Johns Hopkins Univ.; (2) Univ. of North Carolina; (3) Univ. of S. Florida; (4) Univ. of Pittsburgh; (5) Univ. of Mississippi

## Introduction

- Hearing loss (HL) is independently associated with accelerated cognitive decline<sup>1</sup> and a 2-5-fold increased risk of incident all-cause dementia<sup>2,3</sup>.
- Hypothesized mechanistic pathways linking HL and impaired cognition & dementia (Figure) may be modifiable with HL treatment (e.g., hearing aids, counseling, etc.)
- No clinical trials have investigated whether HL treatment could reduce the risk of cognitive decline and dementia in older adults
- Development of the Aging, Cognition, and Hearing Evaluation in Elders (ACHIEVE) randomized trial to investigate this question is currently proceeding.
- The goal of the ACHIEVE-P pilot study was to determine feasibility of study recruitment/retention, assess compliance with study interventions, refine study protocols, and observe for an efficacy signal of the hearing intervention on early 6 month outcomes (e.g., communicative & social functioning) that may mediate downstream effects of hearing intervention on cognitive functioning.



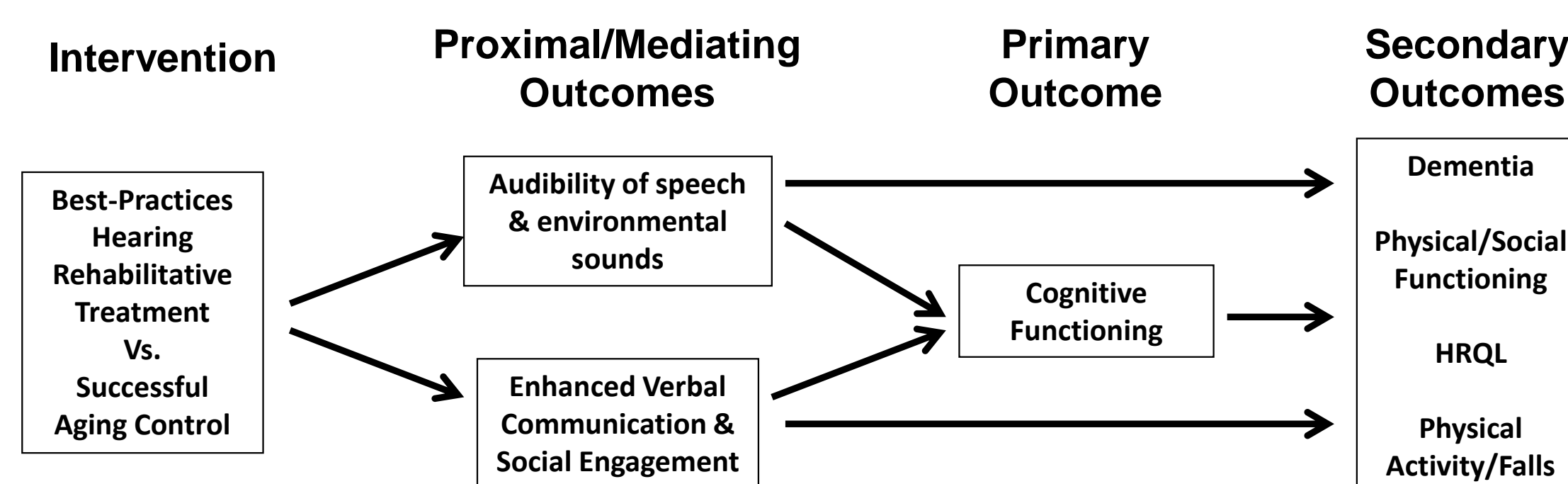
## ACHIEVE Trial Aims

**Aim #1** To determine the effect of hearing rehabilitative intervention versus a successful aging control intervention on rates of cognitive decline in 70-84 year-old well-functioning and cognitively-normal older adults with hearing loss.

→ Trial is powered to detect a 0.30 standard deviation difference in the annual rate of cognitive decline over 3 years between the two treatment groups

**Aim #2** To determine the effect of hearing rehabilitative intervention versus a successful aging control intervention on secondary outcome measures of adjudicated incident dementia, physical and social functioning, health-related quality of life (HRQL), and physical activity.

## ACHIEVE Trial Conceptual Model



## ACHIEVE-P Recruitment

- The ACHIEVE trial will be nested within the Atherosclerosis Risk in Communities Neurocognitive Study (ARIC-NCS), a prospective study of 15,792 adults recruited in 1987 from 4 sites. The ACHIEVE-P study took place at the Washington County, MD field site.
- To meet a recruitment goal of 40 participants, 81 individuals underwent in-person screening. 56 individuals (69%) were eligible. 40 individuals were randomized 1:1 to the study interventions (27 were from ARIC and 13 de novo from the community). Recruitment targets were reached in 12 weeks.
- Main inclusion criteria include: 70-84 years; Mild-moderate hearing loss; MMSE ≥ 23 for high school degree or less, ≥ 25 for some college or more

### Baseline Participant Characteristics, ACHIEVE-P Study, Washington County, MD

| Characteristic   | Total Pilot Cohort (N=40) | Hearing Intervention (N=20) | Successful Aging Intervention (N=20) |
|--|---------------------------|-----------------------------|--------------------------------------|
| Age (years), mean (SD); range  | 77.4 (4.1); 70-84         | 76.7 (4.1); 72-84           | 78.2 (4.0); 70-84                    |
| Female, N(%)   | 27 (68)                   | 15 (75)                     | 12 (60)                              |
| Education, N(%)  |                           |                             |                                      |
| < High school  | 14 (35)                   | 7 (35)                      | 7 (35)                               |
| High school  | 5 (13)                    | 1 (5)                       | 4 (20)                               |
| > High school  | 21 (53)                   | 12 (60)                     | 9 (45)                               |
| Hearing impairment level*, N(%)  |                           |                             |                                      |
| Mild (30 dB HL ≤ PTA < 40 dB HL)   | 22 (55)                   | 11 (55)                     | 11 (55)                              |
| Moderate (PTA ≥ 40 dB HL)  | 18 (45)                   | 9 (45)                      | 9 (45)                               |
| Pure tone average (dB HL), mean (SD); range                                  | 45 (8); 33-73             | 44 (6); 33-53               | 47 (10); 36-73                       |
| Smoking status, N(%)   |                           |                             |                                      |
| Never  | 23 (58)                   | 11 (55)                     | 12 (60)                              |
| Former   | 17 (43)                   | 9 (45)                      | 8 (40)                               |
| Hypertension, N(%)   | 28 (70)                   | 12 (60)                     | 16 (80)                              |
| Diabetes, N(%)   | 11 (28)                   | 3 (15)                      | 8 (40)                               |
| Mini-mental State Exam, median [25 <sup>th</sup> – 75 <sup>th</sup> ]; range | 29 [27, 29]; 23-30        | 28.5 [27, 29]; 23-30        | 29 [27, 29.5]; 23-30                 |

## ACHIEVE-P Interventions

### Hearing Rehabilitative Intervention

- 4 visits over ~3 months with a study audiologist for hearing aid fitting, hearing rehabilitative education, provision of other hearing technologies

### Successful Aging Intervention Control

- 4 visits over ~ 3 months with a health educator to review participant-selected topics on healthy aging (e.g., lowering cholesterol)
- Intervention adapted from the Univ. of Pittsburgh's "10 Keys to Successful Aging" program that was also utilized in the LIFE trial

## ACHIEVE-P Outcomes

- Proximal Outcomes:** Cohen Social Network Index; UCLA Loneliness Scale, CES-D Depression Scale, SF-12; Hearing Handicap Inventory
- Primary Outcomes:** Delayed Word Recall Test; Logical Memory A; Incidental Learning; Trail Making A & B; Digit Symbol Substitution; Word Fluency (F,A,S); Boston Naming Test
- Secondary Outcomes:** CHAMPS Activity Questionnaire; Accelerometry; Short Physical Performance Battery; Grip Strength; Hospitalizations; Falls

## ACHIEVE-P Results

- Average daily hearing aid use (from objective data logging) measured at each of the 3 post-hearing aid fitting intervention visits, respectively, was 9.8 hrs (SD: 6.1), 9.2 hrs (SD: 3.6), and 9.7 hrs (SD: 3.8)
- The hearing intervention demonstrated a clear efficacy signal on communication and social functioning. Estimated changes in standardized (z-score) outcomes were qualitatively different by intervention assignment for all measures.
- Differences in short-term cognitive change were not significantly different between the treatment groups consistent with the hypothesis that meaningful effects of hearing intervention on reducing cognitive decline will take >>1 year

### Standardized Differences in Proximal Outcome & Cognitive Domain Scores from Baseline to 6 months

|  | Hearing Intervention (N=20) | Successful Aging Intervention (N=19) |
|--|-----------------------------|--------------------------------------|
| <b>Proximal Outcomes</b>                             |                             |                                      |
| Hearing handicap inventory (lower scores are better) | -1.40 (0.96)                | 0.02 (0.68)                          |
| Loneliness (lower scores are better)                 | -0.19 (0.87)                | 0.22 (0.94)                          |
| Depression   | 0.05 (0.81)                 | 0.00 (0.58)                          |
| <b>Social Network</b>                                |                             |                                      |
| Number of people                                     | 0.15 (0.74)                 | -0.12 (0.70)                         |
| Diversity  | 0.18 (0.65)                 | -0.42 (0.66)                         |
| <b>Social Function</b>                               |                             |                                      |
| Mental Function                                      | 0.00 (0.65)                 | -0.26 (0.91)                         |
| Physical Function                                    | 0.26 (0.80)                 | -0.14 (0.60)                         |
| <b>Cognitive Domain Scores</b>                       |                             |                                      |
| Memory   | 0.11 (0.76)                 | -0.07 (0.40)                         |
| Language   | 0.48 (0.69)                 | 0.19 (0.66)                          |
| Executive Function                                   | 0.05 (0.38)                 | 0.00 (0.42)                          |
| Global Function                                      | 0.03 (0.42)                 | 0.17 (0.47)                          |
|  | 0.16 (0.42)                 | 0.14 (0.39)                          |

## Discussion

- ACHIEVE-P results demonstrate feasibility of study recruitment & retention and a clear efficacy signal of the hearing intervention on proximal outcomes of communication & social function
- The grant for the full-scale ACHIEVE trial (n = 750) is presently under review

### Acknowledgments

Development of the ACHIEVE trial has been supported by NIA R34AG0464548 and the Eleanor Schwartz Charitable Foundation

### References

- Lin FR, Yaffe K, Xia J, et al. Hearing loss and cognitive decline in older adults. *JAMA internal medicine*. Feb 25 2013;173(4):293-299.
- Lin FR, Metter EJ, O'Brien RJ, Resnick SM, Zonderman AB, Ferrucci L. Hearing loss and incident dementia. *Arch Neurol*. Feb 2011;68(2):214-220.
- Gallagher J, Ilubera V, Ben-Shlomo Y, et al. Auditory threshold, phonologic demand, and incident dementia. *Neurology*. Oct 9 2012;79(15):1583-1590.