**ARIC Manuscript Proposal #H4132**

**PC Reviewed: 10/11/22** **Status: _____** **Priority: 2**
**SC Reviewed: _____** **Status: _____** **Priority: ____**

**1.a. Full Title**: Depression, Loneliness, and Social Engagement in Older Adults with Hearing Impairment: Baseline Results from the ACHIEVE Trial

**b. Abbreviated Title (Length 26 characters)**: Hearing and mental health

**2. Writing Group**:
Writing group members:

Alison Huang, PhD, Jennifer Deal, PhD, Tara Thallmayer, MPH, Nick Reed, AuD, Josef Coresh, MD, PhD, Jim Pankow, PhD, Kathleen Hayden, PhD, Victoria Sanchez, AuD, PhD, Frank Lin, MD, PhD… others welcome

I, the first author, confirm that all the coauthors have given their approval for this manuscript proposal. __AH___ **[please confirm with your initials electronically or in writing]**

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**3. Timeline**:

| **Proposal timeline** | July 2022 | August 2022 | September 2022 |
|---|---|---|---|
| Proposal approval | x | | |
| Data Analysis | x | x | |
| Manuscript preparation and submission | | x | x |

**4. Rationale**:

The ability to hear is a critical component of communication and daily functioning. Loss of hearing and speech understanding as well as the perceived social and emotional impact of hearing impairment, especially in older age, can negatively impact the quantity and quality of social interactions and can limit one's ability to engage in day-to-day activities. These potential losses in daily and social functioning can have harmful implications for mental health and social isolation.

There is some prior evidence supporting associations between hearing impairment and poor mental health, particularly depression, loneliness, and social isolation[1–9]; however, gaps in the literature remain. Many studies use subjective measures of hearing[1,5,7–9]; thus, evidence regarding mental health and audiometrically measured hearing and severity of hearing impairment is lacking. Understanding of the association between speech-in-noise understanding and mental health is particularly limited; only one study, to our knowledge, has investigated the mental health implications associated with poor speech-in-noise understanding.[6] Further, the perceived social and emotional impact of hearing impairment (i.e., perceived disability) is an important construct in the context of mental health but evidence is also limited.

Many studies of hearing, mental health, and social engagement are also limited by availability of mental health measures and, thus, only focus on particular domains of mental health.[3,5,8] Few studies are able to compare the magnitude of association between hearing impairment and mental health across multiple domains of mental health and social engagement.

The ACHIEVE study is well-suited to contribute to the limited literature on hearing impairment and mental health. With measures of peripheral hearing, speech-in-noise understanding, and perceived hearing handicap, multiple measures of mental health (depression, mental health, loneliness, social engagement, social function), and large cohort of older adults, data from they ACHIEVE study can provide a significant contribution to the evidence on hearing impairment, mental health, and social isolation. A more comprehensive understanding of this association can inform efforts to improve mental health among older adults with hearing impairment.

**5. Main Hypothesis/Study Questions**:

*Study Question:*

To investigate the cross-sectional associations between hearing impairment (peripheral hearing, speech-in-noise performance) and perceived hearing handicap with depression, loneliness, and social engagement among older adults aged 70-84 years with mild to moderate hearing loss at ACHIEVE baseline (2018-2019).

*Main Hypotheses:*

Worse peripheral hearing measured by audiometry [higher pure tone average (PTA)], worse speech-in-noise performance measured by Quick Speech-in-noise (QuickSIN) test, and higher perceived hearing handicap measured by the Hearing Handicap Inventory for the Elderly Screening Version (HHIE-S) are independently associated with the following outcomes:

- Greater depressive symptoms measured by the 11 item CES-D
- Worse mental health measured by the SF-36 health survey
- Greater loneliness measured by the UCLA Loneliness Scale
- Worse social function measured by the SF-36 health survey
- Smaller social network size measured by the 12-item Cohen Social Network Index
- Lower social network diversity measured by the 12-item Cohen Social Network Index

**6. Design and analysis (study design, inclusion/exclusion, outcome and other variables of interest with specific reference to the time of their collection, summary of data analysis, and any anticipated methodologic limitations or challenges if present).**

**Study design**: Cross-sectional analysis of baseline ACHIEVE participants (2018-2019).

**Inclusion/exclusion criteria:** All eligible participants enrolled at baseline in the ACHIEVE study.

- Inclusion criteria: 1) age 70-84 years, 2) community-dwelling adults, 3) mild–to-moderate audiometric hearing impairment, defined as a better-hearing ear pure tone average (PTA) ≥30 and <70 dB hearing level (Deal et al., 2018), 4) MMSE ≥23 for those with high school degree or less, and ≥25 for those with some college education or more, 5) Word Recognition in Quiet score ≥60% correct in the better-hearing ear, 6) fluent English-speaker, 7) older adults who plan to remain in the area during the study period.
- Exclusion criteria: 1) self-reported difficulty in ≥2 activities of daily living, 2) prior dementia diagnosis, 3) vision impairment, 4) medical contraindication to hearing treatment, 5) untreatable conductive hearing impairment, 6) unwillingness to regularly wear hearing aids.

**Outcome Variables**

*Depressive Symptoms*

Depressive symptoms were measured using the 11-item Center for Epidemiologic Studies Depression Scale (CES-D-11). Depressive symptoms will be analyzed as a continuous score and as a dichotomous measure of clinically significant depressive symptoms based on a cutoff of >= 16 points.[10,11]

*Mental Health*

Mental health was measured by a series of questions from the SF-36 Health Survey. The SF-36 is an interviewer-administered scale measuring a person's perceptions of their health and health-related quality of life. The mental component score is a factor-analytically derived score with normative mean of 50 and SD of 10 (range 0 to 100); higher scores indicate better mental health. Mental health will be analyzed as a continuous score.[12(p36)]

*Loneliness*

Loneliness was measured using the 20-item UCLA Loneliness Scale. Loneliness will be analyzed as a continuous score and as a dichotomous measure of moderate/high loneliness (no/low loneliness [score <28] vs. moderate/high loneliness [total score >=28]).[13]

*Social Engagement*

Characteristics of participants' social network was measured using the Cohen's Social Network Index.[14,15]

*Social network size:* The total number of people with whom the participant has regular contact (at least once every 2 weeks) .

*Social network diversity:* The number of social roles (e.g. spouse, child, close friend, neighbor) in which the respondent has regular contact with at least one person.

*Social Function*

Social function was measured by two questions from the SF-36 Health Survey about disruptions to normal and social activities due to physical or emotional problems. Social function will be analyzed as a continuous score.[12]

**Exposure Variables**

*Peripheral hearing*

Peripheral hearing was measured as pure tone average (PTA) in the better-hearing ear. The PTA is the average of hearing thresholds at 0.5, 1, 2 and 4 kHz, with higher values indicating worse peripheral hearing. Right-ear and left-ear PTAs will both be investigated with better-ear PTA used in primary

analysis. PTAs will be analyzed as a continuous score as well as categorized according to clinical cut points: mild (26-40 dB HL) and moderate (41-60 dB HL) hearing loss.[16]

*Speech-in-noise performance*
Speech-in-noise performance was quantified by the QuickSIN test. Total scores range from 0 to 30 with higher scores indicating better speech-in-noise performance. Speech-in-noise performance will be analyzed as a continuous score.[17]

*Hearing handicap inventory for the elderly screening version (HHIE-S)*
The HHIE-S is a 10-item questionnaire that gathers data on the perception of the impact of hearing loss. This questionnaire assesses the social and emotional components of perceived hearing impairment such as embarrassment, and limits on personal and social life. HHIE will be analyzed as a continuous score and as a categorical measure of hearing handicap severity: no hearing handicap (0-8), mild to moderate hearing handicap (10-24), significant hearing handicap (26-40).

**Other Variables**
Demographic characteristics (age, sex, race-center, education), lifestyle characteristics (smoking), health variables (body mass index [BMI], chronic conditions, physical function)

**Analytic Plan**
*Analysis of Depression and Mental Function*
We will compare distributions of all outcome measures by peripheral hearing, speech-in-noise performance, and perceived hearing handicap. We will also compare distributions of outcome measures by participant demographic characteristics (age, sex, race/ethnicity) and study design characteristics (study site, ARIC vs. de novo sample).

Multivariable-adjusted linear and logistic regression will be used to assess the independent associations between each exposure (peripheral hearing, speech-in-noise understanding, perceived hearing handicap) and each outcome measure (depression, mental health, loneliness, social function, social network size and diversity). Linear regression will be used for continuous outcomes. Logistic regression will be used to assess prevalence odds of clinically significant depressive symptoms and loneliness.

Models will be adjusted for age, sex, race-center, education, BMI, chronic conditions, smoking, physical function.

**7.a. Will the data be used for non-ARIC analysis or by a for-profit organization in this manuscript? ____ Yes _X___ No**

**b. If Yes, is the author aware that the current derived consent file ICTDER05 must be used to exclude persons with a value RES_OTH and/or RES_DNA = "ARIC only" and/or "Not for Profit" ? ____ Yes ____ No**
(The file ICTDER has been distributed to ARIC PIs, and contains the responses to consent updates related to stored sample use for research.)

**8.a. Will the DNA data be used in this manuscript? ____ Yes _X___ No**

**8.b. If yes, is the author aware that either DNA data distributed by the Coordinating Center must be used, or the current derived consent file ICTDER05 must be used to exclude those with value RES_DNA = "No use/storage DNA"? ____ Yes ____ No**

9. **The lead author of this manuscript proposal has reviewed the list of existing ARIC Study manuscript proposals and has found no overlap between this proposal and previously approved manuscript proposals either published or still in active status.** ARIC Investigators have access to the publications lists under the Study Members Area of the web site at: http://www.cscc.unc.edu/aric/mantrack/maintain/search/dtSearch.html

___X___ Yes _____ No

**10. What are the most related manuscript proposals in ARIC (authors are encouraged to contact lead authors of these proposals for comments on the new proposal or collaboration)?**

**11.a. Is this manuscript proposal associated with any ARIC ancillary studies or use any ancillary study data? _X_ Yes ____ No**

**11.b. If yes, is the proposal**

**_X_ A. primarily the result of an ancillary study (list number* _2016.03_)**

**___ B. primarily based on ARIC data with ancillary data playing a minor role (usually control variables; list number(s)* _____ _____ _____)**

*ancillary studies are listed by number https://sites.cscc.unc.edu/aric/approved-ancillary-studies

**12a. Manuscript preparation is expected to be completed in one to three years. If a manuscript is not submitted for ARIC review at the end of the 3-years from the date of the approval, the manuscript proposal will expire.**

**12b. The NIH instituted a Public Access Policy in April, 2008** which ensures that the public has access to the published results of NIH funded research. It is **your responsibility to upload manuscripts to PubMed Central** whenever the journal does not and be in compliance with this policy. Four files about the public access policy from http://publicaccess.nih.gov/ are posted in http://www.cscc.unc.edu/aric/index.php, under Publications, Policies & Forms. http://publicaccess.nih.gov/submit_process_journals.htm shows you which journals automatically upload articles to PubMed central.


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