

ARIC Manuscript Proposal #3511

PC Reviewed: 11/12/19
SC Reviewed: _____

Status: _____
Status: _____

Priority: 2
Priority: _____

1.a. Full Title: Prevalence of Multiple Sensory Deficits in Older Adults in the Atherosclerosis Risk in Communities Neurocognitive Study.

b. Abbreviated Title (Length 26 characters):
Multisensorial Deficits

2. Writing Group:

Writing group members: Nicole Armstrong (first author), Bonnie Swenor, Jennifer A. Deal, Hang Wang, Yuri Agrawal, Priya Palta, Alison Abraham, Pradeep Ramulu, Joe Coresh, Jennifer Schrack, Frank R. Lin, others welcome

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

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ARIC author to be contacted if there are questions about the manuscript and the first author does not respond or cannot be located (this must be an ARIC investigator).

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3. Timeline: Statistical Analysis: 1 month
Manuscript Preparation: 4 months

4. Rationale:

Sensorimotor deficits are prevalent in older adults (Agrawal, Platz, & Niparko, 2008; Goman & Lin, 2016; Swenor, Ramulu, Willis, Friedman, & Lin, 2013). Sensory

impairments, specifically hearing, vision, and olfactory impairments (HI, VI, and OI) have been linked to incident cognitive decline, MCI and ADRD. Most studies investigating the link between sensory and cognitive functioning have considered the independent effects of each type of sensory impairment (Deal et al., 2017; Lin et al., 2011; Palta et al., 2018; Zheng et al., 2018). These results suggest that impairment across multiple sensory systems may further augment the established associations between single sensory impairment and cognitive decline, given that there are individuals with dual hearing and visual impairments (Swenor et al., 2013).

As a first step in determining the association of multiple sensory impairments with change in cognitive function, as part of the aims of the R01-AG061786-01 grant on sensorimotor function to risk and pathogenic mechanisms of ADRD, we propose to evaluate the prevalence of multiple sensory impairments in older adults in the ARIC Study. The goal will be to understand how common multiple sensory impairments are in healthy older adults and to determine whether certain types of sensory impairments tend to cluster together.

Please note that this project is part of approved ancillary study proposal 2018-07 (PI: Jennifer Schrack, Yuri Agrawal, and Frank Lin). This differs from the manuscript proposal entitled *Associations between Visual and Hearing Function in an Older Adult Population* (first author: Simo Du), since we are integrating the olfaction data into this project.

5. Main Hypothesis/Study Questions:

Aim 1: To estimate the prevalence of individual and multiple sensory deficits among community-dwelling older adults and identify patterns of prevalence of multiple sensory deficits.

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 Population: Cross-sectional study of the most recent timepoint of all three measures of sensory deficits embedded within ARIC. This would be: hearing at visit 6 (2016-17), vision from the EyeDoc ancillary study at visits 6 & 7, and olfaction at visit 6 (2016-17). EyeDOC is an ancillary study of the Atherosclerosis Risk in Communities (ARIC) Study. The data update for this project was September 30, 2019.

EyeDOC study enrolled around 1000 participants from two sites including Jackson Field Center with 500 participants and Washington Co. Field Center with 500 participants.

Hearing and olfactory measures were collected at ARIC visit 6 at all four study sites.

ARIC participants recruited for the EyeDOC ancillary study with both hearing and function measured will be included in this analysis.

Sensory Measures

1. Measures of Visual Function
 - a. Visual Acuity, measured at distance by having participants read letters from a backlit early treatment of diabetic retinopathy study (ETDRS) chart using their normal refractive correction (if any). Eyes with a presenting visual acuity of 20/40 or worse will undergo subjective refraction with trial lenses to determine best-corrected visual acuity.
 - b. Contrast Sensitivity, evaluated using the MARS chart with participants wearing their presenting correction.
 - c. Near acuity/Reading speed, measured by the MNRead chart
2. Hearing function measurement
 - a. Peripheral hearing function: Pure Tone Audiometry (PTA) average in better ear. PTA conduction audiometry was conducted in a sound-treated booth at Visit 6 (2016-17). Air conduction thresholds in each ear were obtained at standard octaves from 0.5 kHz to 8 kHz by trained technicians using insert and an Interacoustics AD629 audiometer. All thresholds were measured in decibels of hearing level. PTA will be calculated using four frequency (0.5K Hz, 1 Hz, 2 Hz, 4 Hz) in the better hearing ear. Hearing impairment severity will be classified into three categories and defined as normal (≤ 25 decibel hearing level [dB HL]), mild hearing loss (26 dB HL – 40 dB HL) and moderate/severe hearing loss (> 40 dB HL).
3. Olfaction measure
 - a. Sniffin' Sticks test, categorized as olfactory impairment (OI) (score ≤ 6) or no OI (score > 6).

Covariates:

Demographic variables:

- a. Age
- b. Race-center (For vision, there are only two study sites. For the other sensory assessments, all sites were included.)
- c. Sex

Statistical Analysis:

Cross-sectional analysis of ARIC participants will be performed. We will evaluate the proportion of each type of sensory impairment and the proportion of individuals with multiple (2–4) concurrent sensory impairments across age categories in participants aged 60 or older (60-69, 70-79, 80+). We will compare the observed prevalence of multiple sensory impairment with the expected prevalence based on compounded probabilities of

multiple impairments under the assumption of independence. The expected percentages of sensory impairments for multiple systems was calculated by multiplying the corresponding observed ratios of individual sensory impairments for a particular age category together.

We will define each type of sensory impairment using clinical thresholds, as described in the funded R01 grant from NIA (R01-AG061786-01). Please note that this project is part of approved ancillary study proposal 2018-07 (PI: Jennifer Schrack, Yuri Agrawal, and Frank Lin).

7.a. Will the data be used for non-CVD analysis in this manuscript? Yes
 No

b. If Yes, is the author aware that the file ICTDER03 must be used to exclude persons with a value RES_OTH = "CVD Research" for non-DNA analysis, and for DNA analysis RES_DNA = "CVD Research" would be used? Yes
 No

(This 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 No

8.b. If yes, is the author aware that either DNA data distributed by the Coordinating Center must be used, or the file ICTDER03 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.csc.unc.edu/ARIC/search.php>

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)?

Please note that this project is part of approved ancillary study proposal 2018-07 (PI: Jennifer Schrack, Yuri Agrawal, and Frank Lin).

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

11.b. If yes, is the proposal

**A. primarily the result of an ancillary study (list number*
EyeDOC _____)**

**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 at <http://www.csc.unc.edu/aric/forms>

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.csc.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.

13. Per Data Use Agreement Addendum for the Use of Linked ARIC CMS Data, approved manuscripts using linked ARIC CMS data shall be submitted by the Coordinating Center to CMS for informational purposes prior to publication.

Approved manuscripts should be sent to Pingping Wu at CC, at pingping_wu@unc.edu. I will be using CMS data in my manuscript Yes No.

References:

- Agrawal, Y., Platz, E. A., & Niparko, J. K. (2008). Prevalence of hearing loss and differences by demographic characteristics among US adults: data from the National Health and Nutrition Examination Survey, 1999-2004. *Archives of Internal Medicine*, 168(14), 1522-1530.
- Deal, J. A., Betz, J., Yaffe, K., Harris, T., Purchase-Helzner, E., Satterfield, S., . . . Lin, F. R. (2017). Hearing impairment and incident dementia and cognitive decline in older adults: The Health ABC Study. *The Journals of Gerontology, Series A: Biological Sciences and Medical Sciences*, 72(5), 703-709. doi:10.1093/gerona/glw069
- Goman, A. M., & Lin, F. R. (2016). Prevalence of hearing loss by severity in the United States. *American Journal of Public Health*, 106(10), 1820-1822.
- Lin, F. R., Metter, E. J., O'Brien, R. J., Resnick, S. M., Zonderman, A. B., & Ferrucci, L. (2011). Hearing loss and incident dementia. *Archives of Neurology*, 68(2), 214-220. doi:10.1001/archneurol.2010.362

- Palta, P., Chen, H., Deal, J. A., Sharrett, A. R., Gross, A., Knopman, D., . . . Mosley, T. H. (2018). Olfactory function and neurocognitive outcomes in old age: The Atherosclerosis Risk in Communities Neurocognitive Study. *Alzheimer's & Dementia, 14*(8), 1015-1021. doi:10.1016/j.jalz.2018.02.019
- Swenor, B. K., Ramulu, P. Y., Willis, J. R., Friedman, D., & Lin, F. R. (2013). The prevalence of concurrent hearing and vision impairment in the United States. *JAMA Internal Medicine, 173*(4), 312-313.
- Zheng, D. D., Swenor, B. K., Christ, S. L., West, S. K., Lam, B. L., & Lee, D. J. (2018). Longitudinal associations between visual impairment and cognitive functioning: The Salisbury Eye Evaluation Study. *JAMA Ophthalmology, 136*(9), 989-995. doi:10.1001/jamaophthalmol.2018.2493