



# THE AMERICAN OTOLOGICAL SOCIETY



## CLINICIAN SCIENTIST AWARD 2012-2014

“Influence of Vestibular Dysfunction on Fall Risk in Older Individuals”

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AMOUNT AWARDED BY AOS: \$174,726

ONGOING FUNDING: NIH/NIA R01 AG073115 \$2,046,875 9/15/21 – 9/14/26; NIH/NIA R01 AG065259 \$2,611,393 1/15/21 – 1/14/26; NIH/NIA R01 AG061786 \$3,894,134 1/15/19 – 1/14/24; NIH/NIA R01 AG057667 \$1,761,511 8/15/18 – 4/30/23

### PUBLICATIONS:

Agrawal Y, Davalos-Bichara M, Zuniga MG, Carey JP. [Head Impulse Test Abnormalities and Influence on Gait Speed and Falls in Older Individuals.](#) *Otol Neurotol.* 2013 Aug 6.

Mantokoudis G, Schubert MC, Saber Tehrani AS, Wong AL, Agrawal Y. [Early Adaptation and Compensation of Clinical Vestibular Responses After Unilateral Vestibular Deafferentation Surgery.](#) *Otol Neurotol.* 2013 Aug 20.

Agrawal Y, Schubert MC, Migliaccio AA, Zee DS, Schneider E, Lehnen N, Carey JP. [Evaluation of Quantitative Head Impulse Testing Using Search Coils vs. Video-oculography in Older Individuals.](#) *Otol Neurotol.* 2013 Sep 27.

Davalos-Bichara M, Agrawal Y. [Normative Results of Healthy Older Adults on Standard Clinical Vestibular Tests.](#) *Otol Neurotol.* 2013 Oct 16.

Sun D, Davalos-Bichara M, Zuniga MG, Carey JP, Agrawal Y. [Evaluation of a bedside test of utricular function – the bucket test – in older individuals.](#) *Acta Otolaryngol.* 2014 Apr;134(4):382-9.

Li C, Zuniga MG, Nguyen KD, Carey JP, Agrawal Y. [How to Interpret Latencies of Cervical and Ocular Vestibular-Evoked Myogenic Potentials: Our Experience in Fifty-Three Participants.](#) *Clinical Otolaryngology* 39, no. 5 (2014): 297-301.

Davalos-Bichara M, Zuniga MG, Agrawal Y, Carey JP, Schubert MC. [Forward and backward locomotion in individuals with dizziness.](#) *Gait Posture.* 2014 Sep;40(4):499-503.

Li C, Layman AJ, Geary R, Anson E, Carey JP, Ferrucci L, Agrawal Y. [Epidemiology of Vestibulo-Ocular Reflex Function: Data from the Baltimore Longitudinal Study of Aging.](#) *Otol Neurotol.* 2014 Oct 1.

Schubert MC, Mantokoudis G, Xie L, Agrawal Y. [Acute VOR gain differences for outward vs. inward head impulses.](#) *J Vestib Res.* 2014 Jan 1;24(5):397-402.

Layman AJ, Li C, Simonsick E, Ferrucci L, Carey JP, Agrawal Y. [Association Between Saccular Function and Gait Speed: Data From the Baltimore Longitudinal Study of Aging.](#) *Otol Neurotol.* 2015 Jan 7.

Li C, Layman AJ, Carey JP, Agrawal Y. [Epidemiology of vestibular evoked myogenic potentials: Data from the Baltimore Longitudinal Study of Aging.](#) *Clin Neurophysiol.* 2015 Jan 24.

**RESEARCH SUMMARY:** The research supported by the AOS CSA was aimed at understanding the changes in vestibular function that occur with aging and their impacts on physical function in older adults. Our group was the first to estimate the prevalence of vestibular impairment in the general US population. In a series of papers, our team also described the specific vestibular physiologic changes that occur with healthy aging (e.g. a preponderance of semicircular canal vs. otolith impairment), and to report that vestibular physiologic impairment contributes to the known decline in gait speed and increase in falls that occur with aging. Along the way, our group has published numerous highly-cited technical papers on vestibular physiologic testing in older adults, including establishing normative ranges for testing in this population and defining clinically significant thresholds.

**OUTCOMES:** Our report of a surprisingly high prevalence of 35% vestibular impairment among US adults has been cited >600 times and has motivated a number of investigators around the world to pursue vestibular research. Our research on vestibular function and aging helped establish the foundation for understanding and studying age-related vestibular loss as a common problem of broad significance to older individuals.

**FURTHER FUNDING HAS ENABLED US TO EXPAND OUR RESEARCH TO:** Work supported by the AOS CSA enabled our group to further investigate the relationship between vestibular function and cognition in older adults. Over the next 5 years, our group observed strong and consistent associations between vestibular dysfunction and cognitive impairment – specifically spatial cognitive impairment – in older adults. These results were published in several high-impact journals including the *Journal of the American Geriatrics Society*, the *Journal of Gerontology Medical Sciences*, and the *Journal of Neurology, Neurosurgery and Psychiatry*. These novel findings of the impact of vestibular impairment on cognitive function in older adults represent a paradigm shift in thinking about the impacts of vestibular impairment which extend beyond physical outcomes such as gait and balance dysfunction but also include cognitive outcomes. Moreover, these findings provide insight into the mechanisms by which the known decline in spatial cognitive skills (e.g. memory of places and routes) with aging occur. Our group further extended these analyses by evaluating vestibular function in patients with Alzheimer’s disease (AD) and dementia. In several landmark studies, our group reported a higher prevalence of vestibular impairment in AD patients relative to age-matched controls. We also observed that AD patients with vestibular impairment were more likely to have spatial deficits such as spatial disorientation and wandering behaviors. These are highly consequential symptoms in AD patients whose pathophysiology is poorly understood, and our work has laid the groundwork to understand the contribution of vestibular impairment to these adverse outcomes in AD and dementia.

**LAY SUMMARY OF FINDINGS AND IMPLICATIONS OF THIS RESEARCH:** My research program launched by the AOS CSA rigorously characterized the changes in inner ear balance (vestibular) function that occur with healthy aging. Our group also investigated the relationship between vestibular loss and changes in spatial cognitive function, for example spatial memory and navigation. We found that poorer vestibular function was related to poorer spatial memory and navigation abilities, in both healthy older adults, and in individuals with Alzheimer’s disease and dementia. We currently have an ongoing clinical trial in which we are studying whether vestibular treatment reduces spatial cognitive impairment and falls in individuals with Alzheimer’s disease.