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Hearing the signs of age-related cognitive decline

A commentary on “Hearing Aid Use is Associated with Better Mini-Mental State Exam Performance”David R. Roalf Ph.D.¹ & Paul J. Moberg Ph.D.¹¹Brain Behavior Laboratory, Neuropsychiatry Section
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One of the biggest challenges in geriatric psychiatry today is the reliable identification of cognitive dysfunction of incipient dementia. While minor cognitive impairment is a common and potentially disabling feature of aging, significant change in cognitive ability can be catastrophic. In fact, nearly five million individuals in the United States have dementia, however many more suffer from milder cognitive deficits or subjective cognitive complaints(1). Recently, the diagnostic criteria of Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V) was updated to include neurocognitive disorders, effectively recognizing the continuum of cognitive impairment leading up to dementia. Thus, early recognition of cognitive impairment is in the best interest of clinical and public health and the potential benefits of early detection are likely immense. Cognitive screening is an initial step in a delicate process of assessing for cognitive impairment. While there is significant need for reliable, easy-to-administer screening tools, care must be taken to reduce false positives that may increase patient stress and potential stigma.

The intersection of cognition and sensory perception is one area that can increase false positive identification of cognitive impairment. For example, hearing loss is among the most common sensory problems that arise in older adults (2). Nearly one-third of adults over the age of 65 suffer from significant hearing loss. Presbycusis, or age-related changes of the inner ear that cause hearing loss, is a continual process, varies in severity, and is always permanent. Hearing loss is often considered an ‘invisible’ problem, as only the effects of the conditions are observed, and as such these effects may be attributed to aloofness, confusion, or even dementia. Empirical evidence indicates that age-related hearing loss is associated with communication difficulties, isolation, lower quality of life and depression (2). Unfortunately, the interaction between hearing loss and cognitive decline is not well understood. Hearing and cognition are likely interdependent as there is no sharp division between sensation, perception and cognition. It is challenging to measure all aspects of cognition without relying upon intact hearing, and vice versa. Hearing is often an effortful task and relies upon cognitive processes such as attention, executive function, and memory (3). Difficulty in hearing test items during administration may lead to poor performance and overestimation of the level of cognitive impairment. Alternatively, cognitive decline may reduce the cognitive resources that are available for auditory perception, thus manifesting as hearing loss. The influence of hearing on cognitive performance may be more apparent when the cognitive demands (‘listening effort’) are high due to the need for neural resource sharing.

In this issue Qian, Wattamwar and colleagues, contribute to this critical area of interest by measuring the relationship between hearing aid use and performance on standard cognitive screening measures in 100 healthy older adults. Individuals using hearing aids outperformed non-users on the Mini-Mental State Examination (MMSE) -- a general screen of cognition that is comprised of verbal commands—despite poorer overall uncorrected hearing ability. In non-users, MMSE performance was related to both low and high frequency pure tone detection. This relationship was stronger for the low frequency pure tones, which typically represent frequencies common in human speech. In comparison, hearing aid users and nonusers had equivalent performance on the Trail Making Test—a cognitive test of

executive function that has few auditory demands. The relationship between hearing loss and cognitive decline appears reliable, albeit small, particularly when hearing loss is measured using tests of pure tone. While the overall sample is small, this dissociation compliments previous studies indicating that declines in auditory function may mediate, to some extent, the relationship between increasing age and poorer cognitive function in some domains (4).

Qian, Wattamwar and colleagues also reiterate that hearing aid users feel more handicapped by their hearing loss. This self-assessment of hearing should not be overlooked as it provides a window into how hearing loss can affect quality of life in older adults, and subsequently their cognition. Older adults have spent their entire lives as hearing individuals and loss of this sense can be difficult to cope with and a challenge to manage. Hearing loss plays a role in how older adults experience and react to their environment and can lead to self-imposed solitary confinement. Many older adults with hearing loss do not acknowledge the disability or the impact it exerts on their quality of life. The inability to communicate effectively may result in physical symptoms such as stress and exhaustion. In fact, living with hearing loss can put individuals at risk for many psychological and psychosocial issues, including, depression, anger or irritability, nervousness, feelings of incompetence or distrust from colleagues, friends and family. Notably, many of the symptoms can lead to poor cognitive performance and potentially false positives on cognitive screening measures. In short, hearing loss can be physically and psychologically debilitating, however through targeted intervention and effective cognitive and mental health screening the root cause of the issue can be clarified and adequately managed.

Given the data presented by Qian, Wattamwar and colleagues the apparent solution is to provide hearing aids or other rehabilitation services much earlier in the course of hearing loss and to promote their use more aggressively. The implications for health care and public policy are clear; however better assessment does not always translate into better care. In fact, the use of hearing aids is known to be low in older adults—as an example in the current report only 34% of participants used hearing aids while 100% had significant hearing loss. Moreover, the average delay in seeking help following a hearing loss diagnosis is five to seven years. Poor fit, lack of comfort, psychosocial factors, and cost are several of the barriers to compliant use of hearing aids. Also, simple sound amplification does not resolve communication difficulties attributable to poor hearing acuity; unlike glasses hearing aids do not correct the problem. Thus, mechanisms must be in place to reduce barriers, monitor use, and improve compliance of hearing aids especially if the evidence continues to suggest mediating effects on cognition.

The use of cognitive screening measures is necessary and becoming routine in primary care settings (5). Such tests are easily administered, correlated with comprehensive neuropsychological performance(6), and demonstrate diagnostic utility(7). Yet, if performance on these valuable screening tools is related to sensory dysfunction, such as hearing loss, it is possible that mismanagement of underlying issues will interfere with diagnosis. Finally, we must recognize that reliance on simple cognitive screens may capture only limited variability, particularly in normal aging, and ceiling effects or overlearning of the measures may lead to underestimation of the true relationship between cognitive decline and other factors. Thus, additional protocols may need to be considered in order to reduce false positive classification of dementia since misclassification due to significant hearing loss potentially leads to undue burden for the patient and unnecessary waste of health care resources.

In sum, the study by Qian, Wattamwar and colleagues represents a thoughtful and productive step towards disentangling the relationship between cognition and hearing loss. Future work will likely require the identification of specific neuropsychological tests that target explicit aspects of hearing loss to improve our understanding and management of this complex relationship.

1. Hebert LE, Weuve J, Scherr PA, et al: Alzheimer disease in the United States (2010–2050) estimated using the 2010 census. *Neurology* 2013; 80:1778-1783
2. Wayne RV,Johnsrude IS: A review of causal mechanisms underlying the link between age-related hearing loss and cognitive decline. *Ageing Research Reviews* 2015; 23:154-166

3. Taljaard DS, Olaithe M, Brennan-Jones CG, et al: The relationship between hearing impairment and cognitive function: A meta-analysis in adults. *Clinical Otolaryngology* 2015;
4. Lin FR, Ferrucci L, Metter EJ, et al: Hearing loss and cognition in the Baltimore Longitudinal Study of Aging. *Neuropsychology* 2011; 25:763
5. Roalf DR, Moore TM, Wolk DA, et al: Defining and validating a short form Montreal Cognitive Assessment (s-MoCA) for use in neurodegenerative disease. *Journal of Neurology, Neurosurgery & Psychiatry* 2016; jnnp-2015-312723
6. Chandler MJ, Lacritz LH, Hynan LS, et al: A total score for the CERAD neuropsychological battery. *Neurology* 2005; 65:102-106
7. Damian AM, Jacobson SA, Hentz JG, et al: The Montreal Cognitive Assessment and the Mini-Mental State Examination as screening instruments for cognitive impairment: item analyses and threshold scores. *Dementia and geriatric cognitive disorders* 2011; 31:126-131

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