



Sensory Impairments and Cognition: *Does Intervening on One Improve the Other?*

What Is Already Known

Historically, it has been challenging to disentangle assessments of cognitive impairment from assessments of sensory impairment. However, more recent data from cognitive tests that did not rely on *both* unimpaired hearing and vision have established moderate evidence for a link between sensory impairment and cognitive decline/dementia. Age-related dysfunctions in vision, hearing, and smell have each been linked separately to cognitive impairment and cognitive decline. Recent meta-analyses support an association between cognitive decline and vision and hearing impairments in particular, which are the most easily modifiable sensory impairments. Multisensory decline is common as people age, but few large population-based studies collect the data needed to examine the relationship between multisensory loss and cognitive decline and dementia.

Background and Evidence Base

Evidence for a relationship between sensory impairment and aging

Sensory impairment — the reduction in function of one or more of your senses — is a highly prevalent age-related condition. A recent study showed that deficits in multiple senses are prevalent among older Americans, supporting the idea that a common process may underlie the aging process of all five senses. Age-related hearing impairment most commonly occurs through nerve degeneration or damage in the inner ear, but damage to other parts of the auditory system can lead to hearing impairment as well. Similarly, vision has multiple components, which are generally assessed separately when vision is tested. The five most common causes of vision impairment in older adults are age-related macular degeneration, glaucoma, cataract, diabetic retinopathy, and refractive error. Olfactory impairments are also common in older adults; as many as half of older adults have some loss of smell, and the prevalence increases with age.

The mechanisms that link sensory impairment to cognitive decline are likely complex. Some processes, such as vascular disease, may concurrently damage both the brain and sensory organs. Additionally, aging may contribute to a bidirectional relationship between peripheral

sensory function and central cognitive function: age-related changes in sensory function may worsen cognition, while age-related changes in brain function may alter how sensory input is perceived. Finally, sensory impairments may lead to cognitive and psychological outcomes, such as excess cognitive load (when your working memory receives more information than it can handle), impairments in brain structure and function, social isolation, depression, and reduced activity — all of which in turn can result in cognitive decline.

Evidence for a relationship between sensory impairment and cognitive decline

A 2017 study assessed participants with both the Global Sensory Impairment (GSI) score, an integrated measure of dysfunction in the five classical senses (vision, hearing, smell, taste, and touch), and a modified Montreal Cognitive Assessment. Worse GSI scores at baseline predicted worse cognitive function five years later.

Vision: Two recent meta-analyses provide strong evidence of an association between vision impairment and dementia risk. Both analyses reported that the relative risk of dementia or cognitive impairment was greater among people with vision impairment than among those without vision impairment.

Hearing: Hearing loss has also been strongly associated with increased rates of cognitive decline and dementia risk. Older adults with severe hearing impairment often have widespread cognitive impairments. A recent meta-analysis found that age-related hearing loss may be a modifiable risk factor for cognitive decline, cognitive impairment, and dementia.

Smell: A 2016 longitudinal cohort study of more than 1,400 cognitively normal adults linked olfactory impairment to incident amnesic mild cognitive impairment and with the progression from mild cognitive impairment to Alzheimer's dementia. Importantly, among people with normal olfaction, there were no dementia events over the study period. A 2014 review noted that many age-related dementias, such as Alzheimer's, vascular dementia, Parkinson's disease, and frontotemporal dementia, are associated with olfactory impairment. Loss of smell may lead to diminished quality of life, depression, and potential issues with food safety and hygiene.



Does intervening on hearing or vision improve outcomes for people with dementia?

Because of the interconnections between sensory and cognitive function, it is reasonable to wonder if interventions to address sensory impairment could also have an effect on cognitive function. Interventions could consist of preventing disease or injury as well as treating deficits.

There is currently insufficient evidence to determine whether preventing disease or injury to the sensory organs can improve cognitive trajectories or prevent/delay dementia. There is more information on whether treatment to improve or accommodate already-occurring impairments in vision or hearing has an effect on cognitive outcomes. A recent review examined the results of studies that evaluated the effect of vision and hearing interventions on outcomes in people with dementia. The authors reported that most published studies on this topic were small and of moderate quality, but many showed evidence of benefit. An analysis of data from the Health and Retirement Study reported that the use of hearing aids slowed the rate of memory decline in older adults in the years after they first began using hearing aids relative to their rate of memory decline in the years before they first used hearing aids. With respect to treatment of vision deficits, an analysis of participants in the English Longitudinal Study of Ageing showed cataract surgery was associated with a lower rate of memory decline compared with a control group of participants who did not have cataracts. Thus, there is some evidence to suggest treating sensory deficits positively affects cognitive decline, but further studies are needed.

Implications for Public Health

In recognition of the relationship between sensory and cognitive impairment and the overall benefit of addressing sensory health, the U.K.'s National Institute for Health and Care Excellence guidelines were recently updated to recommend sensory examinations for people with cognitive deficits, including hearing assessments for people with suspected or diagnosed dementia and eye tests every two years for those living with dementia.

Interventions for hearing and vision impairment have been shown to improve noncognitive outcomes in the general population. While some studies suggest that treating vision and hearing problems in older adults may reduce their risk of cognitive decline, the evidence overall is mixed, and stronger evidence is needed before concluding that sensory interventions improve cognitive

outcomes in people with dementia. The current evidence suggests that people with dementia may benefit from, and are unlikely to be harmed by, sensory interventions, especially those that are minimally invasive, such as glasses and hearing aids.

Many Americans do not receive appropriate sensory care, regardless of their dementia status. More than six million have chronic vision loss of some type, but fewer than half receive appropriate care for these conditions; only 1 in 6 people who could benefit from hearing aids use them. Furthermore, assessment and treatment of sensory impairments are unequal among populations, leading to significant inequities in sensory health outcomes by socioeconomic status and racial/ethnic group.

Discussion

There are many areas in which additional research is needed on understanding the connections between sensory impairment and cognitive function. Also, it is difficult to compare findings across studies to date because of inconsistencies in the cognitive assessments used in hearing and vision studies. Nonetheless, there is evidence of an association between sensory impairment (particularly in vision, hearing, and olfaction) and cognitive decline and dementia. The evidence is mixed as to whether addressing hearing or vision impairments can reduce the risk of cognitive decline, but people with dementia may benefit from, and are unlikely to be harmed by, sensory interventions, especially those that are minimally invasive. Current randomized clinical trials are seeking to determine whether specific interventions (such as hearing aids and cataract surgery) can improve cognitive outcomes in adults with possible or probable dementia.

Although screening programs for vision/hearing problems have been tested, they may not be cost-effective for the general population of middle-aged and older adults. Therefore, screening should be targeted at populations at greatest risk of sensory and cognitive impairment. Screening for loss of smell may help identify individuals at risk of cognitive impairment, but such screening is less common, and many older individuals are unaware of losses in this ability.

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