



SENSORY IMPAIRMENTS AND COGNITION

WHAT IS ALREADY KNOWN

Age-related dysfunctions in vision, hearing, and smell have each been linked separately to cognitive impairment and cognitive decline. 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. 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, or reduced function in one or more senses, is common with age. A recent study found that many older Americans experience deficits in multiple senses, suggesting a shared aging process across all five senses. Hearing loss often results from nerve degeneration in the inner ear, though other parts of the auditory system can also be affected. Vision impairment in older adults is typically caused by conditions such as macular degeneration, glaucoma, cataracts, diabetic retinopathy, and refractive errors. Loss of smell is also widespread, affecting up to half of older adults, with prevalence increasing with age.

The link between sensory impairment and cognitive decline is complex. Shared underlying conditions such as vascular disease may damage both the brain and sensory systems. Aging may also create a bi-directional relationship: declining sensory function can impair cognition, while brain changes can alter sensory processing. Additionally, sensory loss may increase cognitive load and contribute to social isolation, depression, and reduced activity, all of which are associated with 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.

Hearing: Hearing loss has been 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.

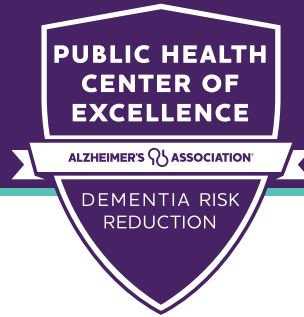
Vision: Two recent meta-analyses provide evidence of an association between vision impairment and dementia risk. Both analyses reported that the relative risk of dementia or cognitive impairment was greater among people with vision impairment than among those without vision impairment.

Smell: A 2016 longitudinal cohort study of more than 1,400 cognitively normal adults linked olfactory impairment to incident amnesic mild cognitive impairment and to 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.

One 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 after they began using hearing aids relative to their rate of memory decline before using hearing aids. The multi-center ACHIEVE trial randomized participants with untreated hearing loss but without significant cognitive impairment to a hearing aid intervention or an educational control. While the trial did not observe a significant treatment effect in the total population, the hearing aid intervention was more effective in participants who were older and had more risk factors for cognitive decline. 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

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 overall evidence is mixed, and more research is needed to determine whether these interventions can prevent or delay dementia. In people who already have dementia, sensory interventions are not expected to reverse or prevent the disease, but they may improve quality of life and functional outcomes. 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. However, the effects of these interventions on cognitive outcomes in people with dementia remain unclear. 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 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.

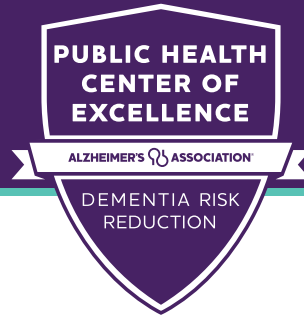
The role of social determinants of health

Many Americans do not receive appropriate sensory care. 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 groups.

DISCUSSION

There are many areas in which additional research is needed to understand 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. Additional randomized clinical trials are needed to determine whether specific interventions (such as hearing aids and cataract surgery) can improve cognitive outcomes in adults with high risk of 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 focused on populations at greatest risk of sensory and cognitive impairment.



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