

Dual sensory impairment: Update 2025

Abstract

Dual sensory impairment (DSI) is the concurrent impairment of hearing and vision. DSI is linked to an increased risk of depression, loneliness, anxiety, social isolation, accelerated cognitive impairment, cognitive decline and dementia.

The fear of dementia is huge. However, fear of a particular disease may actually prevent people from seeking a diagnosis.¹ In general cancer (34%) and dementia (29%) are the two most feared diseases but for people 65+ years, dementia is the most feared. Therefore, preventing or delaying dementia is extremely important and is highly correlated with early and effective treatment of vision and hearing problems. Unfortunately, these correlations are not well-known or recognized by professionals or the public.²

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Background

Livingston et al³ reported approximately half of our individual risk of cognitive decline is attributed to the combined effects of DNA and age. The other half is attributable to 14 *potentially modifiable* risk factors including education level, social isolation, air pollution, traumatic brain injury, hearing loss, depression, high blood pressure, diabetes, obesity, physical inactivity, smoking, excessive alcohol consumption, untreated vision loss and high LDL cholesterol. Although assigning a specific percentage of risk to each potentially modifiable risk factor is tempting, the specific percentage of risk for any individual is unknown as their genome, personal history and many other factors need to be considered.

Mikos, Fartdinova, Seifert et al⁴ reported 132,000 nursing home residents. Sensory impairment was present in 57% of residents which included 19% with hearing impairment (HI), 15% with vision impairment (VI) and 23% with dual sensory impairment (DSI), and cognitive impairment in 57%. The likelihood of cognitive impairment was greatest for DSI, followed by HI, then VI. The authors note the average marginal effect for DSI on cognitive impairment exceeded the sum of effects for HI and VI. They report younger males and higher medical comorbidities were associated with increased likelihood of cognitive impairment in DSI. They concluded that sensory impairments are common in newly admitted nursing home residents and although hearing impairment and visual impairment are each independently associated with cognitive impairment, an interactive burden emerges given dual sensory impairment.

Untreated hearing and visual impairment

Untreated hearing loss by itself, in at-risk people, has been shown to represent some 7-8% of an individual's risk of cognitive decline making hearing loss the largest potentially modifiable risk factor. Untreated vision loss may represent approximately 2% of an individual's risk of cognitive decline. Fuller-Thomson, Nowaczynski & MacNeil (2022)⁵ investigated the relationship between hearing impairment, vision impairment, and dual sensory impairment regarding cognitive impairment inclusive of 5.4 million people age 65+ years.

The authors report that for people with hearing impairment only, their risk of cognitive impairment doubled, for people with vision impairment only, their risk of cognitive impairment tripled. For those with dual sensory impairment, the odds of cognitive impairment may increase eight-fold.

Introduction

DSI impairment can range from mild to profound in either or both senses. The key aspect is that combined sensory losses significantly limit an individual's ability to access information, communicate, and navigate the environment, compared to having only one sensory loss. This combined sensory loss has a negative synergistic effect, creating a more significant impact than the sum of its parts.

Yang, Macken, Huang-Lung, et al⁶ concluded that sensory impairment is associated with cognitive function and that earlier access to cataract surgery and hearing aid amplification may reduce cognitive decline.

There are multiple hypotheses regarding the potential link between sensory deficits and cognitive decline. Some, all or none may eventually be proven correct. Below is a summary of common hypotheses which contend that sensory deficits may negatively impact cognitive decline.⁷

- 1- The Harbinger Hypothesis proposes untreated sensory impairments may lower performance on cognitive assessments due to an impoverished (attenuated, faint, incomplete, etc.) perception of spoken or visual instructions rather than reflecting frank cognitive dysfunction.
- 2- The Cognitive Load Hypothesis posits that untreated sensory (i.e., hearing and vision) impairments place a greater burden on working memory, attention, executive functioning, and other cognitive resources to interpret impoverished sensory information.
- 3- The Cascade Hypothesis suggests untreated sensory impairments lead to decreased social engagement, reduced participation in cognitively stimulating activities, and diminished awareness of the external environment.
- 4- The Common Cause Hypothesis suggests sensory and cognitive decline may share one or more common underlying neurobiological mechanisms such as shared vascular, metabolic, inflammatory, or structural changes, impacting both arenas.
- 5- Glick, Beck, Darrow & Trinh's recent⁷ Cognitive Maladaptation hypothesis suggests prolonged sensory impairment, especially during the early stages of degradation, may trigger maladaptive neuroplastic changes in the brain. Although neuroplasticity is generally considered beneficial, the brain may recalibrate to non-ideal, distorted or degraded sensory input. Resultantly, erroneous sensory input may eventually reinforce cognitive distortions, confusion and may contribute to cognitive decline.

Hearing & listening

Hearing is defined as perceiving or detecting sound. Hearing is the foundation upon which listening occurs. Listening is a more complex process involving the ability to comprehend the meaning of sound, most notably spoken language. Listening involves decoding sound based on several factors including hearing thresholds, vocabulary, intention, attention, psychological well-being, cognitive well-being, knowledge of the speaker and the topic, the acoustic characteristics of the attended signal, the location from which sound occurs and more. Hearing therefore remains straightforward and passive, whereas listening is an active and comprehensive synergistic protocol, which might be considered a “whole brain event”.⁸

Hearing loss demographics

In the USA there are approximately 73 million people with hearing loss⁹ and another 26+ million people with no audiometrically detectable hearing loss, yet they have hearing difficulty and speech-in-noise (SIN) problems which might be referred to as “sub-clinical,” “auditory processing” or “central” problems.¹⁰ Combining these two populations reveals approximately 100 million people with hearing and/or listening problems in the USA.

Hearing loss and cognitive decline

Although mild-to-moderate hearing loss (by itself) does not appear to cause cognitive decline, for people at risk (older people, people with greater hearing loss, people in lower socioeconomic groups, people with less education, people with co-morbidities such as cardiovascular disease, diabetes...) of cognitive decline, hearing loss may exacerbate social disengagement,¹¹ cognitive decline² and other social, personal, psychological, medical and other problems.

Hearing loss and cognition

Amieva et al¹² reported 3,670 people assessed over 25 years and concluded “Self-reported hearing loss is associated with accelerated cognitive decline in older adults; hearing aid use attenuates such decline.” Stevenson et al¹³ reported 82,000 people 60+ years of age who were followed for approximately 11 years. The authors reported that people with poor SIN ability had a 61% Hazard Ratio of developing dementia. Huang et al¹⁴ reported 2000+ people and stated those with moderate to severe hearing loss had a greater prevalence of dementia than people with normal hearing. The ACHIEVE study¹⁵ reported hearing aids slowed the loss of thinking and memory abilities in at-risk people by 48% over 3 years. Yeo et al¹⁶ reported 137,484 people and noted hearing aids and cochlear implant use was associated with a decreased risk of cognitive decline, and the authors urged physicians to strongly encourage use of these such devices. Cantauria et al¹⁷ reported 573,088 people and stated hearing loss was associated with an increased risk of dementia, with more severe hearing loss being associated with a higher risk. Yu, Proctor, et al¹⁸ identified 50 studies of 1.5 million people and concluded that adult-onset hearing loss increases the risk of incident cognitive decline, dementia, mild cognitive impairment and more.

Wei et al¹⁹ reported hearing aid use is associated with a significant reduction in incident dementia. Sarant et. al.²⁰ reported 160 people with mild-to-severe hearing loss who were fitted with hearing aids and 102 controls. Hearing aid users demonstrated significantly better cognitive performance as assessed for three years duration suggesting hearing intervention may delay cognitive decline/dementia onset in older adults. Myrstad et. al²¹ reported 6879 people 70+ years and

reported an association between hearing impairment and reduced cognitive performance. Jang, Lee, et al²² reported 511,953 subjects and concluded hearing loss consistently increased the risk of all-cause dementia and Alzheimer’s disease.

The studies reported above are based on prescription hearing aids. Although Over the Counter (OTC) hearing aids were approved by the Food and Drug Administration (FDA) in 2022, as of this publication there is no data to support or address whether OTC hearing aids would have the same or similar impact as prescription products regarding cognitive decline and related matters. However, if people seek and use OTC earlier than prescription hearing aids, and if the sound quality and improvement in signal-to-noise ratio (SNR) makes it easier to communicate in challenging listening situations (i.e., restaurants, cocktail parties, family gatherings...) as well as less listening effort and a more complete understanding of the communicative event, perhaps high quality OTC products may provide the same/similar benefit as prescription hearing aids, and may serve to inspire people to seek prescription hearing aids as their hearing loss progresses.

Vision loss and cognition

The Centers of Disease Control²³ estimates 38 million people in the United States have diabetes and another 98 million have pre-diabetes. The CDC estimated 9.6 million people in the United States have diabetic retinopathy (DR) of which 20% were considered vision-threatening. Among people with diabetes, the prevalence rate of DR doubled from ages 25 years to 65-79 years. Ding, Strachan, Reynolds et al²⁴ concluded that diabetic retinopathy (DR) was independently associated with cognitive decline in older men with type 2 diabetes, and cerebral microvascular disease may contribute to observed and accelerated age-related cognitive decline.

The presence of cataracts, an often-treatable cause of vision impairment, has also been found to increase the risk of developing cognitive decline. Tandon²⁵ reports after age 40 years, the risk of cataracts grows from 2.5% for adults ages 40-49 years to 25% for adults ages 65-69 years, with women developing cataracts at a higher rate. In their systematic review and meta-analysis of the association between cataract development and incidence of cognitive impairment, Xiong, Li, Yang et al (2023) reviewed 13 studies (798,694 participants) and concluded the presence of cataracts may be associated with the development of cognitive impairment in older adults.

Cao, Chen, Yao et al²⁶ report 16 studies including 76,373 participants. They report a significantly increased risk of negative cognitive outcomes with visual impairment (VI) and VI was associated with increased risks of cognitive impairment and dementia across cross-sectional and longitudinal studies.

Yeo, Ong, Ganasekar et al²⁷ evaluated the association of cataract surgery with cognitive impairment and dementia. Their meta-analysis included multiple articles and some 558,000 participants. The authors reported cataract surgery was associated with a 25% reduced risk of long-term cognitive decline, compared to those with uncorrected cataracts.

Uncorrected refractive error is the leading cause of vision impairment around the world. Estimates from 2020 indicated 3.7 million individuals were deemed blind, yet 157 million more were diagnosed with moderate to severe vision impairment because of uncorrected refractive error. This data suggests the prevalence of blindness increased by 21.8% and of visual impairment by 72% since 2000.

Zhou, Chen, Huang¹⁴ report uncorrected refractive error (URE) is among the leading causes of visual impairments. URE may attenuate social and educational interaction, may negatively impact classroom learning and may lead to social isolation, irreversible amblyopia, lack of external knowledge, and may restrict education and employment opportunities. The authors report 2,910 adolescents with a mean age of 15 years with roughly half male and half female participants. The overall prevalence of URE was 23.7%. Of the 689 adolescents with URE, 362 (52.5%) did not receive any refractive correction, and 327 (47.5%) used corrected glasses.

Clinical implications of DSI

Although it appears intuitive to many healthcare professionals, it is certainly less clear to the public-at-large that diagnosing and treating hearing and vision loss as quickly as possible is of paramount importance to maintain a healthy brain and to maximize perception and comprehension of the world around us.

Hwang, Longstreth, Brenowitz et al²⁸ report on 2051 participants and report DSI was significantly associated with higher risk of all-cause dementia (hazard ratio [HR] = 1.86 and Alzheimer's disease (HR = 2.) They report older adults with DSI have a significantly increased risk for dementia.

Shakarchi, Assi, Gami, et al²⁹ note that by 2030 twenty percent of the USA population will be 65+ years of age, and of note, eighty percent of people 80+ years of age have hearing and/or vision loss. The authors report DSI impacts one in 9 adults (11%) over age 80+ years.

Yeo, Gao, Tan et al³⁰ report the global prevalence of DSI is 5.50% based on some 43 studies of 5.2 million people. By 2050, DSI will likely increase by 27%. Of note, 60% of people with DSI may have measurable cognitive impairment. DSI was associated with a 72% greater risk of incident cognitive decline (CD). Further, 3.8% of CD may be attributable to DSI.

Li, Ghosal, Zhang, et al³¹ report older adults in the U.S. with visual and hearing impairments simultaneously have a greater risk of dementia and Alzheimer's disease. Of 20,000 individuals studied over ten years, 14.6% had visual impairment only, 11.2% had hearing impairment only, and 9.1% had DSI at baseline. After adjusting for all covariates, DSI was associated with higher risk of dementia (HR = 1.46).

The Lancet Commission indicates hearing loss and vision loss are modifiable risk factors for dementia, and their correction slows CD in at-risk people. The authors conclude there is an urgent need to address sensory impairment and the resultant impact on cognition as the population is aging rapidly, and to better guide resource allocation.

Discussion

DSI has been linked to communication problems with family, friends, colleagues and significant others, a reduced quality of life, cognitive decline, depression, anxiety, increased mortality, depression, less overall life satisfaction, loneliness, social isolation, increased falls, and many other significant deficits.

Although vision loss (presbyopia) and hearing loss (presbycusis) are associated with aging, and both are common, importantly, they are not normal. Likewise, we would not say lower back pain, migraines, arthritis, floaters, or other maladies associated with aging are normal, although they too, are common.

When a professional attributes these problems to aging or says "that's a normal part of aging" or "get used to it..." that minimizes the pain of the patient and may make the patient feel childish or like a hypochondriac, because the professional implied their pain is not worthy of professional attention. However, we believe that when a patient presents with, or complains of, sensory impairment, these observations are worthy of professional attention, investigation, diagnosis and treatment. Untreated visual and hearing deficits may act synergistically to facilitate overall degradation of cognitive function.

Therefore, we urge that untreated visual and hearing problems should be managed professionally and as quickly as possible to minimize negative functional and maladaptive consequences.

Acknowledgments

None

Conflicts of interest

The authors declare that there are no conflicts of interest.

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