Hearing Loss and Comorbidities: 2022 Update

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Introduction

In 2018, the prevalence of multiple chronic conditions among those 65 years of age and older in the United States was as high as 76.9% in some population subgroups.[1] Given that approximately one third of those aged 64–75 and one half of those above the age of 75 are hearing impaired,[2] it's no surprise that hearing loss coexists with a number of age-related chronic conditions such as cardiovascular disease, diabetes, psychosocial disorders, and cognitive impairment to include dementia.

In 2017, Abrams[3] provided an overview of the literature that examined specific chronic conditions associated with hearing loss. This white paper expands on that 2017 paper in order to update our current knowledge concerning the associations between hearing loss and falls risk, psychosocial disorders (depression, loneliness and social isolation), cognitive impairment to include dementia, and cardiovascular disease. As the link between hearing loss and diabetes has been the subject of a recent white paper[4], that literature will not be reviewed here.

One important area of interest not addressed in the 2017 paper and added to this review is the literature associated with the combined consequences of hearing and visual impairment, or dual sensory impairment (DSI). This review will also provide an update of the literature associated with the potentially modifying effects of audiologic intervention – specifically hearing aids. While by no means an exhaustive review of the subject, this and the 2017 paper, taken together, provide an overview of the research spanning the last 10 years.

Falls Risk

There have been a number of investigations in recent years adding to the literature supporting the association between hearing loss and increased risk of falls. Criter and Gustavson[5] evaluated the relationship between the Hearing Handicap Inventory for the Elderly (HHIE)[6] and falls risk among 74 participants and found a positive correlation between the two so that as the HHIE score increased (indicating greater self-perceived hearing handicap) falls risk increased as well. Similarly, Riska and colleagues[7] found a 96% higher risk of falls among individuals who reported a little trouble hearing and an 81% higher risk of falls among individuals who reported a lot of trouble hearing among 8,091 individuals who participated in the National Health and Nutrition Examination Surveys (NHANES) between 1999 and 2004.

Bang and colleagues[8] investigated the relationship between postural instability and hearing loss among individuals participating in the Korean version of the NHANES from 2010 through 2012 to include over 3,800 individuals with self-reported hearing loss. Rather than rely on self-reports of a fall, the investigators conducted a direct measure of instability by determining if a participant could remain standing on a foam pad for 20 seconds with eyes closed and arms folded. The researchers found that the incidence of postural instability was associated with the degree of hearing loss. After adjusting for age and sex, it was found that females had a higher risk of postural instability than males and that for every year of increased age (over the age of 40) there was 13% higher odds of postural instability. The authors posit that, as suggested in previous studies, sound cues may play a role in maintaining balance control.

There have been several systematic reviews of the literature that examines the association between hearing loss and postural control in older adults. Of 211 articles screened, Agmon et al.[9] selected seven that met their criteria for review. The review concluded that there was sufficient evidence to support an independent association between hearing loss and postural control, to include falls risk, even after controlling for such covariates as obesity and physical activity. The underlying mechanisms for this association, however, were not fully understood. Jiam et al.[10] conducted a systematic review and meta-analysis of 12 articles (out of 2,404 initially identified) and also found a significant association between hearing loss and falls among older adults. The analysis revealed a pooled odds ratio (OR) of 1.69, 95% confidence interval (CI) = 1.18 - 2.19 (i.e., 69% higher odds) of falling among older individuals with measured hearing loss than those without. If self-reported hearing loss was included in the analysis, OR increased to 2.39, 95% CI = 2.11 - 2.68.

Riska et al.[7] proposed a model to describe the relationship between hearing loss and falls to include both direct and

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indirect pathways. The indirect pathway includes modifying factors such as auditory attention, spatial awareness, listening effort and psychosocial and cognitive factors; while direct pathway factors involve aging, inflammatory processes, and vascular disease. For a comprehensive review of the theorized mechanisms linking hearing loss and self-motion perception, the reader is encouraged to review the excellent tutorial by Campos and colleagues.[11] Another possible explanation for an association between hearing loss and falls was proposed by Gabriel and colleagues (2021)[12] who subjected 46 community-dwelling adults, half of whom had age-related hearing loss (ARHL), to a battery of vestibular tests. The results suggested that those with measured or self-reported AHRL exhibited poorer sensitivity to pitch movements compared to the normal hearing cohort. Low-frequency hearing loss, in particular, was associated with poorer pitch-detection thresholds. The authors posit that, as pitch perception is important for balance recovery, decreased sensitivity for this sensory input may lead to an increased risk of falls.

In an attempt to better identify the association of hearing loss with the risk of falls as a function of specific vestibular diagnoses, Huang et al.[13] retrospectively analyzed the records of 2,750 patients evaluated at a specialized vestibular clinic and classified them into the following diagnostic groups: benign paroxysmal positional vertigo; unilateral vestibular hypofunction; bilateral vestibular hypofunction; central vestibular hypofunction; multiple diagnoses; and a dizzy, non-vestibular group. Their analyses revealed that the highest rates of self-reported falls occurred among those diagnosed with bilateral vestibular hypofunction (23.6%) and central vestibular dysfunction (26.9%). When the data were adjusted for demographics, comorbidities, falls-associated medication, and vestibular diagnostic groups, there was no significant association between falls and any specific vestibular diagnosis, including non-vestibular dizziness, nor was there any relationship between hearing loss and falls (OR = 1.02, 95% CI = 0.93 - 1.11).

Psychosocial-Related Disorders

Depression

Recent investigations have supported an independent association between hearing loss and psychosocial disorders. Bigelow and colleagues[14] reviewed data from over 25,000 adults who participated in the 2017 National Health Interview Survey (NHIS) examining the relationship between self-reported hearing loss and psychological distress as measured by the Kessler 6 psychological distress scale (K6),[15] use of antidepressant and/or antianxiety medication, and utilization of mental health services. Analysis of the data revealed a positive association between self-reported hearing loss and each of the measures of psychological distress. Compared to those who did not report hearing loss, the odds of experiencing psychological distress (i.e., K6 score, use of antidepressant/antianxiety medication, and/or mental health service utilization), increased with the degree of self-reported hearing loss (categorized as mild or moderate or worse). For example, moderate or worse self-reported hearing loss was associated with a 53% higher odds (OR = 1.53, 95% CI = 1.30 - 1.79) of using mental health services. The authors posited that hearing loss has negative consequences for social engagement and loneliness as well as pathophysiologic effects on the brain leading to psychological distress.

Hispanic and Latino Community: The odds of having clinically significant depressive symptoms (as measured by the Center for Epidemiological Studies Depression Scale) increased 1.44 times for every 20 dB of hearing loss.

Tsimpida and colleagues[16] examined the complex interaction between hearing loss, quality of life, socioeconomic position and depression as part of the English Longitudinal Study of Aging (ELSA). Consistent with other studies, their analysis of the ELSA data indicated that hearing loss among older adults is associated with the development of significant depression, as measured by a shortened version of the Centre for Epidemiologic Studies Depression Scale (CES-D)[17], with up to a doubling of the relative risk for depression experienced by those in the lowest socioeconomic groups.

A systematic review and meta-analysis of the literature examining the hearing loss-depression link were conducted by Lawrence and colleagues.[18] Their meta-analysis of the 35 studies that met the inclusion criteria (involving a total of over 147,000 participants) revealed a higher risk associated with hearing loss (self-reported and measured) and depression. The pooled higher odds of experiencing depression among those with hearing loss compared to those with no reported or measured hearing loss was 47% (OR = 1.47, 95% CI = 1.31 - 1.65).

One of the limitations associated with most research examining the relationship between hearing loss and mental health is that the participants in these studies are overwhelmingly non-Hispanic/Latino White adults. Golub and colleagues[19] were interested in examining the association between hearing loss and psychosocial disorders among the Hispanic/Latino adult population of the U.S. They analyzed data from the 2008-2011 Hispanic Community Health Study/Study of Latinos (HCHS/SOL) which included 5,328 participants with hearing loss from field sites located in Miami, San Diego, Chicago, and the Bronx. Their analysis revealed that, after adjusting for demographic and health status covariates, the odds of having clinically significant depressive symptoms (as measured by the Center for Epidemiological Studies Depression Scale) increased 1.44 times for every 20 dB of hearing loss. Compared to individuals with normal hearing, the odds of experiencing clinically significant depression as a function of hearing loss in this subgroup of Hispanic/Latino adults ranged from 1.81 times for individuals with mild hearing loss to 4.30 times for individuals with severe hearing loss. For a comprehensive review of the hearing loss-depression link literature, the interested reader is encouraged to read Cosh et al.[20]

Loneliness and Social Isolation

Hearing loss has been associated with increased loneliness and social isolation which, some researchers have suggested, are contributing factors to cognitive decline in older individuals. A recent systematic review conducted by Shukla and colleagues[21] identified 2,495 relevantly titled articles through a search of electronic databases of which 14 met the review criteria. Eleven articles reported on the association between hearing loss and loneliness and five between hearing loss and social isolation. The researchers found consistent evidence for an association between hearing loss and both loneliness and social isolation. Of the two, social isolation exhibited the stronger association with hearing loss. The authors observed that, because of its consequent reduction in participation in activities, hearing loss can lead to social isolation but may not necessarily result in loneliness. One of the interesting findings of this systematic review was that older women tended to report greater social isolation than men.

Cognitive Impairment

The link between age-related hearing loss (ARHL) and cognitive decline has continued to receive a great deal of attention in the research community in recent years.[22-30-26] For example, Curhan and colleagues[22,23] published a pair of prospective, longitudinal studies reporting, separately, on the occurrence of self-reported hearing loss and subjective cognitive function among 20,193 women as part of the Nurse's Health Study, and 10,107 men as part of the Health Professionals Follow-up Study. In both studies, the participants reported no issues with cognitive function at baseline. The women were followed for two years (2012-2014) and the men for eight years (2008-2016). At the end of data collection, results for both men and women indicated an independent association between hearing loss and a higher risk of subjective cognitive impairment with an increasing risk as the severity of self-reported hearing loss increased.

One of the most consequential papers in recent years was published by Golub and associates[31] who examined the association between cognitive impairment and "normal" hearing loss (≤ 25 dB). The researchers analyzed neurocognitive performance among participants in two epidemiological studies (three cycles of the NHANES and the 2008-2011 HCHS/SOL) involving a total of 6,451 individuals. The results of the analyses revealed an independent association between decreased cognitive performance and decreased hearing even among those with clinically normal hearing. The implications of this study are two-fold: **1.** The relationship between cognition and hearing may occur at milder levels of impairment than currently assumed; and **2.** The definition of "normal" hearing may need to be reexamined.

Given the growing number of publications on this important topic involving different populations, study designs, sample sizes, etc., the systematic review conducted by Thomson et al.[32] and meta-analysis, conducted by Loughrey et al.,[33] are particularly informative. Thomson and colleagues analyzed the finding of 17 studies that met their inclusion criteria. The studies varied in how hearing loss was determined (audiometry or central auditory function tests). The studies also differed in how dementia was defined. The Mini-Mental State Exam (MMSE)[34] or variations of the MMSE were used in 11 of the 17 studies. Other studies employed a neurologic exam or battery of cognitive tests. Despite differences in study design, all 17 studies supported the finding that hearing loss was an independent risk factor for the development of dementia. Loughrey and colleagues analyzed the results of 40 research investigations involving a total of over 20,000 participants. The researchers analyzed cross-sectional and prospective cohort studies separately. The meta-analyses revealed small but significant associations between ARHL and several different domains of cognitive

Adjusted **Increase in the Incidence of Dementia**
with Self-Reported...

40%	9%	50%
...Vision Loss	...Hearing Loss	...Dual Sensory Impairment

impairment (e.g., processing speed, episodic memory, semantic memory) as well as dementia among both the cross-sectional and prospective cohort studies. The meta-analysis revealed a higher, but not statistically significant, risk of Alzheimer's Disease. The authors suggested that a common etiology to both hearing loss and cognitive decline, such as age-related decline in the vascular system, might explain the findings of their analyses. For a comprehensive review of the literature specifically related to hypothesized mechanisms explaining the hearing loss-cognition link, the interested reader is encouraged to read the excellent paper by Griffiths and colleagues[35] who describe four possible mechanisms: **1.** common pathology; **2.** impoverished environment causing decreased cognitive reserve; **3.** increased cognitive resources needed for listening; and **4.** interaction between brain activity related to auditory cognition and dementia pathology.

Dual Sensory Impairment

The audiology community is understandably interested in the consequences of hearing loss on other chronic conditions. But impaired hearing is not the only sensory modality impacted by aging. Vision impairment is also highly prevalent in the aging population. The prevalence of combined significant vision and hearing impairment, or dual sensory impairment (DSI), varies as a function of the criteria used to define vision or hearing impairment. Some studies use objective measures (e.g., audiometry, Snellen chart) while others depend upon a self-report of functional sensory impairment (e.g., scale or questionnaire). One study conducted in the U.S. using objective measures[36] estimated the prevalence of DSI in older adults at 3% increasing to 12% among those 85 years of age and older.

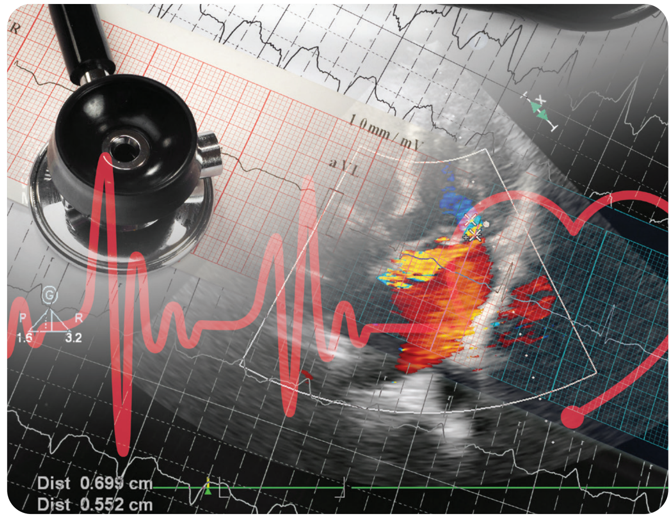
Byeon and colleagues[37] reported on an examination of the relationship between self-reported single (vision or hearing) or dual (vision and hearing) sensory impairment on dementia. They followed 6,520 individuals as part of the Longitudinal Study on Cognitive Aging and Dementia in South Korea. At baseline, DSI was positively associated with dementia prevalence compared to normal sensory function. Over the six-year follow-up period, DSI was associated with higher odds of dementia incidence. Interestingly, when the analysis was adjusted to include depression as a covariate, the association between dementia and single or dual sensory impairment was no longer statistically significant suggesting that depression, when it coexists with visual or hearing impairment (or both), is an independent risk factor associated with developing dementia in older adults.

In a similar cross-sectional and longitudinal study of older adults, Kuo and colleagues[38] examined the association between DSI and the risk of dementia. They collected baseline and follow-up self-reported sensory (vision and hearing) and cognitive function data from 7,562 Medicare beneficiaries from the U.S. National Health and Aging Trends Study from 2011 to 2020. The adjusted baseline data analysis suggested that, in contrast to Byeon et al., self-reported vision or hearing impairment, when compared to no impairment, was independently associated with a higher risk for dementia (89% and 14% respectively). It should be noted that depression was not included in the adjusted risk model. Self-reported DSI was associated with a two-fold higher risk of dementia. Over the seven years of follow-up, compared to no sensory impairment, self-reported vision, hearing and DSI were associated with an adjusted increase in the incidence of dementia of 40%, 9% and 50%, respectively. Other recent investigations supporting an association between vision, hearing or DSI and cognition include those of Rong et al.39 and Hwang et al.[40]

Investigations related to the health effects of DSI are not limited to cognition. Pardhan et al.[41] researched the impact of DSI on depression and chronic anxiety among 23,089 adults from the Spanish National Health Survey of 2017. The researchers analyzed self-reported vision, hearing, depression and chronic anxiety and found that vision or hearing impairment was significantly associated with higher odds for depression (OR = 2.37, 95% CI = 2.04–2.75 and 2.1, 95% CI = 1.67–2.64, respectively) and highest for DSI (OR = 3.86, 95% CI = 2.72–5.44). Visual or hearing impairment also increased the odds of chronic anxiety (OR = 1.98, 95% CI = 1.7–2.32 and 1.94, 95% CI = 1.54 – 2.46, respectively) and were highest for DSI (OR = 3.38, 95% CI = 2.38–4.82). Cosh et al.[42] also found a significant association between DSI and depression and anxiety as part of a longitudinal examination of a Norwegian population-based database. While hearing loss was initially significantly associated with depression and anxiety, only vision loss and DSI had persistent associations at the 6-year follow-up. Extending the question of the consequences of multi-sensory impairment to other modalities (smell and taste in addition to vision and hearing), Liljas and colleagues[43] found that quality of life decreased and depression increased as the number of impaired sensory modalities increased among a sample of 6,147 individuals in the English Longitudinal Study of Aging (May 2016–June 2017). Not surprisingly, those reporting three to four sensory impairments experienced the poorest quality of life.

Gopinath and colleagues[44] collected data from 1,478 participants in the Blue Mountains Eye Study to determine the association between DSI and incidence of falls. Individuals with best corrected visual impairment and mild hearing loss had a greater than two-fold risk of falls over the 5-year period of the study. However, when participants diagnosed with a cognitive impairment were excluded from the analysis, the statistically significant association between DSI and incident falls no longer persisted.

Tan et al.[45] conducted a systematic review of studies that examined the relationship between hearing loss and DSI with mortality. The investigators analyzed the results of 27 studies that met their inclusion criteria (14 retrospective and 13 prospective study designs representing a total of 1,213,756 participants). Their analysis revealed that, compared to those with normal hearing and vision, participants with DSI had a significantly higher risk (i.e., hazard ratio; HR) of all-cause mortality (HR = 1.40, 95% CI = 1.30 – 1.51) and cardiovascular mortality (HR = 1.86, 95% CI = 1.31 – 2.65).



Cardiovascular Disease

Unlike the chronic conditions described above, it is not likely that hearing loss has a direct effect on the incidence or severity of cardiovascular disease (CVD); rather, similar to the diabetes-hearing loss link, it's probable that a common pathophysiology negatively impacts both organ systems. Abe and colleagues[46] performed a retrospective analysis of the relationship between platelet levels and hearing impairment among 1,897 individuals participating in a population-based survey between 2014 and 2019. The participants were divided between those with high-normal platelet levels and those with low-normal platelet levels. The investigators discovered that those in the low-normal group (at baseline or at some later time during the five years of the study) exhibited a higher incidence of low-frequency hearing impairment (OR = 2.34, 95% CI = 1.15–4.76) as defined by pure tone thresholds > 25dBHL. These findings are consistent with those of Friedland et al.[47] (reviewed in the 2017 white paper)[3] who demonstrated a relationship between CVD and specific audiometric configurations. While the exact mechanism that might account for this association is not entirely known, there is some support to the idea that low platelets could result in degeneration of the stria vascularis in the cochlea leading to increased vascular permeability and consequent low frequency hearing loss. Previous animal research has shown such a relationship between damage to the stria vascularis and low frequency threshold changes.

High blood pressure as a possible contributor to hearing loss was recently studied by Baiduc et al.[48] The investigators tested the audiometric thresholds, DPOAEs and blood pressure (BP) of 55 participants. Participants were categorized as having either optimal BP (systolic/diastolic <120 and <80 mm Hg) or nonoptimal (not yet hypertensive) BP (systolic ≥120 or diastolic ≥80 mm Hg or use of antihypertensives). Unadjusted correlations indicated a significant correlation between elevated BP and low and high frequency audiometric thresholds. After adjusting for gender, age and frequency, these relationships were no longer statistically significant. However, there remained a significant correlation between BP and DPOAE levels that were approximately 1.5 dB poorer among the nonoptimal participants. Recall that "nonoptimal" was still within normal limits leading the investigators to posit that higher BP levels (i.e., true hypertension) might very well be associated with measurable changes in hearing. One possible explanation for this relationship is that hypertension results in reduced blood flow making structures such as the stria vascularis particularly vulnerable to the effects of high blood pressure.

The findings of these studies have significant clinical implications for audiologists as the data have uncovered an association between CVD and an audiometric configuration not usually seen in the older population, i.e., a relatively flat sensorineural hearing loss or decreasing low to mid frequency hearing acuity in a patient that has been followed over time. A history of CVD, if known to the audiologist, could explain these findings; if not known, the audiologist might consider referring the patient to their primary care provider to rule out CVD.

Other Risk Factors

In addition to the conditions described above, compared to normal hearing individuals, those with hearing loss are at higher risk for personal injury to include ER visits,[49] obesity in adolescents,[50] poorer physical performance and functioning,[51] lower physical activity,[52] lost productivity,[53] higher health care utilization[54-56] and lower life expectancy.[57,58,45]

The Hearing Aid Effect

Falls

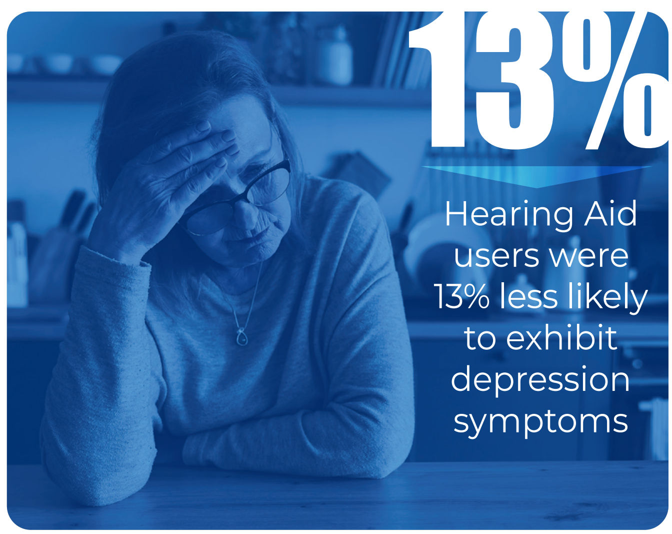
There has been considerable interest in examining the potential modifying effects of hearing aid use on falls risk, but the results of recent investigations have been equivocal. Criter and Gustavson,[5] as part of their cohort study involving 74 participants, found a significant association between self-perceived hearing difficulty, as measured by the HHIE, among participants with and without hearing aids and falls risk as measured by the Dizziness Handicap Inventory (DHI)[59] as well as reported falls in the previous 12 months. Those participants with hearing loss who wore hearing aids reported fewer falls than non-hearing aid users. Consistent with these findings, Mahmoudi and colleagues[60] compared the risk of injurious falls within three years of a diagnosis of hearing loss among 14,109 hearing aid users and 100,753 non-hearing aid users based on claims data from a large, national private insurance claims database. A review of those claims indicated that, compared to non-hearing aid users, hearing aid users experienced a 13% lower risk of injurious falls during that three-year period.

In contrast to studies supporting a lower risk of falls associated with hearing aid use, Riska et al.[7] reviewed the NHANES data from 1999-2004 to include over 8,000 individuals who reported a history of falls in the previous year. The individuals were categorized into those who self-reported hearing loss and wore hearing aids and those who self-reported hearing loss and did not wear hearing aids. When the analysis was adjusted for other confounding variables and comorbidities, hearing aid use was not determined to be a modifying factor associated with the relationship between self-perceived hearing loss and fall risk. The authors explain that this finding could be related to the self-report nature of hearing aid use (ranging from "at least once a day" to "always"), DSI in which compromised visual acuity posed a separate risk not mitigated by hearing aid use, and the possible presence of other contributing factors such as vestibular disorder and/or vascular disease.

Supporting the findings of Riska et al., McDaniel and colleagues[61] administered the Sensory Organization Test (SOT) to assess falls risk as a function of hearing aid use. The results of their experiment indicated no significant differences on SOT scores with bilateral hearing aid use. It should be noted that all of the participants were current hearing aid users, and each was assessed with and without their hearing aids; in addition, the scores on each of the SOT subtests were close to ceiling. It's possible that the positive effects of hearing aid use on postural stability are preserved when hearing aids are not in use among regular hearing aid users. The results of this study may have been different if non-hearing aid users were included as participants. In a surprising finding, Gopinath et al.[44] found that hearing aid users, when compared to non-hearing aid users, had a 75% higher risk of incidence falls over the 5-year course of their study. The authors posit that they do not believe the use of hearing aids, per se, increased the risk of falls but, rather, their use is a marker of other contributing falls risk factors such as fragility and aging.

Psychosocial-Related Disorders

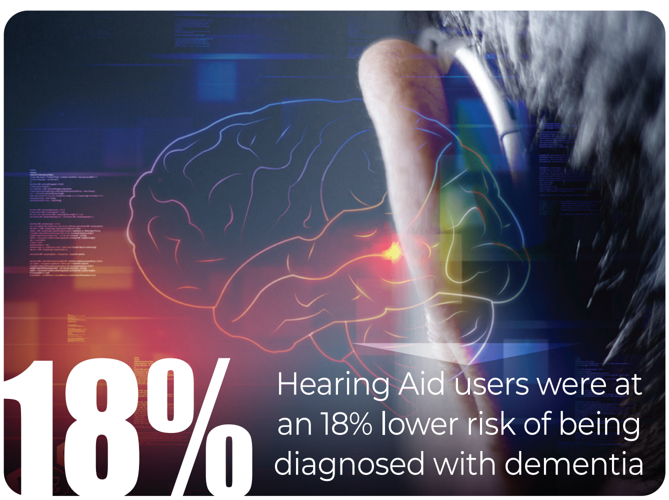
In a 25-year longitudinal study examining the association of hearing loss with death, depression, disability, and dementia, Amieva et al.[62] found that those who reported experiencing hearing difficulty and reported using hearing aids were 13% less likely to exhibit depression symptoms as measured by a clinical depression scale than those who did not wear hearing aids. Consistent with Amieva et al., Bigelow et al.[14] also found that those with moderate hearing loss were less likely to experience psychological distress if they were hearing aid users. The participants who wore hearing aids in the Mahmoudi et al. study[60] experienced an 11% lower risk of reporting anxiety and/or depression compared to non-hearing aid users over the three years following a diagnosis of hearing loss. In a study investigating the impact of audiologic intervention on loneliness, participants who received hearing aids or cochlear implants showed no increase in measures of loneliness at five years when compared to baseline measures[63].



The evidence is compelling enough at this time to recommend that clinicians conduct cognitive and depression screenings as part of a comprehensive audiologic evaluation, at least with their older patients.

In contrast to these studies, the systematic review and meta-analysis of 35 individual studies involving over 147,000 participants reported by Lawrence et al.[18] failed to show a significant modifying effect of hearing aid use on depression symptoms.

In the Tsimpida and colleagues[16] study on the interaction between hearing loss, quality of life, socioeconomic position and depression described earlier, the investigators found that hearing aid use tended to mitigate the depressive symptoms associated with hearing loss and that this effect was greater among hearing aid users in the lower versus higher socioeconomic groups.



Cognition

Several recent investigations have examined the potentially modifying impact of hearing aids on cognitive impairment to include dementia. Bucholc and colleagues[64] followed 2,114 hearing impaired participants from the National Alzheimer's Coordinating Center database between 2005 and 2018, some of whom were diagnosed with mild cognitive impairment or dementia at baseline. Results indicated that hearing aid use was associated with a lower risk of incident dementia over the course of the study (mean of four years before a diagnosis of dementia for hearing aid users vs. two years for non-users) as well as a slower decline in cognitive function among hearing aid users over the course of the study. Similarly, Mahmoudi et al.[60] found that, over the course of their study, participants who wore hearing aids experienced a mean 18% lower risk of being diagnosed with dementia compared to non-hearing aid users. In another longitudinal study, Curhan et al.[23] reported a 30%, 42% and 54% higher risk of cognitive decline among hearing impaired men with mild, moderate or severe hearing loss (respectively) who did not wear hearing aids compared to those who did. A meta-analysis performed by Taljaard et al.[65] on 33 individual studies that examined the link between hearing aid use and cognitive performance also found a significant positive effect of hearing aid use on cognition.

In a prospective study that evaluated the effect of hearing aid use on cognitive function, 99 adults with hearing loss and no diagnosed cognitive impairment were followed for 18 months. As reported by Sarant et al.,[66] compared to baseline measures, there was a statistically significant, gender-specific improvement on several cognitive measures to include executive function, working memory, visual attention and visual learning. However, in a cross-sectional review of survey data collected from 20,244 Medicare Supplemental plan beneficiaries, Wells and colleagues[67] found that, while hearing aid use was associated with lower risk for certain psychosocial impairments, their use did not have a significant effect on memory loss.

Conclusion

Research conducted in the last several years has provided growing and compelling evidence associating hearing loss with a number of psychosocial, cognitive and physiologic conditions. Some, like CVD, falls and diabetes, are likely the result of common pathophysiologic contributors such as a compromised vascular system that impacts different organ systems. Others, like depression and cognitive decline, while possibly sharing a common physiologic disorder, appear to be exacerbated by the presence and degree of hearing loss. Indeed, the evidence is compelling enough at this time to recommend that clinicians conduct cognitive and depression screenings as part of a comprehensive audiologic evaluation, at least with their older patients. What is still not clear from the current research is the modifying effect of intervention – specifically hearing aids. While perhaps disappointing, it should not be surprising that study results are equivocal as the current body of research is characterized by differences in study design (e.g., retrospective cross-sectional vs. prospective cohort), sample size (large existing databases vs. relatively small clinic-based convenience samples), independent variables (e.g., self-reported vs. measured hearing loss), dependent variables (e.g., self-reported vs. measured psychosocial and/or cognitive status) and statistical analyses, etc. That said, the influential Lancet Commission Report on dementia prevention, intervention and care[68] identified hearing loss as one of the 12 potentially modifiable risk factors for dementia. Importantly, the report concluded that of the 12 factors, hearing aid use was "the largest factor protecting from decline…for higher episodic memory..." [p.418]. What is clearly needed is a series of carefully designed and conducted randomized controlled trials (RCTs) that can accurately and definitively identify the modifying effects of intervention on a carefully selected and evaluated cohort of participants representing a wide range of age, gender, ethnic, racial, socioeconomic, geographic, and educational and health status diversity. Several RCTs are currently in progress, examining the impact of hearing aids and audiologic intervention on cognitive function.[69-71] We eagerly look forward to the results of those investigations.

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