

Hearing Loss

The Silent Risk for Psychiatric Disorders in Late Life



Dan G. Blazer, MD, MPH, PhD

KEYWORDS

- Hearing loss • Schizophrenia • Depression • Hearing aids • Red flag conditions
- Ototoxicity • Neurocognitive disorders

KEY POINTS

- Hearing loss is a silent epidemic among older adults. Nearly 30 million Americans experience hearing loss, and the prevalence increases dramatically with age.
- Hearing loss is associated with many psychiatric disorders, including depression, anxiety, schizophrenia and other psychoses, and cognitive impairment.
- Psychiatrists are in an excellent position to identify hearing loss given that when they administer a mental status examination the older adult may expose the disorder through answers that suggest the question was misunderstood.
- Knowing the services available to those with hearing loss is key to a proper referral and follow-up of older adults identified as experiencing the problem.

INTRODUCTION

Hearing loss in later life is among the most common impairments experienced and among the most easily underdiagnosed and unappreciated in terms of the potential for significant risk of both physical and psychiatric problems.¹ The loss can be gradual or acute (usually gradual for older adults) and can lead to problems with communication, quality of life issues such as increased isolation, and significant financial challenges. Despite the problems associated with hearing loss, many older adults do not seek hearing health care, and when they do, they find the care to not be optimal. A pair of hearing aids (which are not covered by Medicare) cost on average around \$4700, including professional services.^{1(p207)} In addition, these devices are often not deemed useful to older adults once purchased, so they are relegated to a bureau drawer.

This article originally appeared in *Psychiatric Clinics*, Volume 41, Issue 1, March 2018.

Disclosures: The author chaired the National Academies Committee on Accessible and Affordable Hearing Health Care for Adults (2016). No other disclosures.

JP Gibbons Professor Emeritus of Psychiatry and Behavioral Sciences, Duke University Medical Center, Box 3003, 3521 Hosp South, Durham, NC 27710, USA

E-mail address: dan.g.blazer@dm.duke.edu

Clin Geriatr Med 36 (2020) 201–209

<https://doi.org/10.1016/j.cger.2019.11.002>

0749-0690/20/© 2019 Published by Elsevier Inc.

geriatric.theclinics.com

A most understudied area is the risk for psychiatric disorders and emotional stress related to hearing loss. This article provides some background into the world of hearing loss and hearing health care providers, the current literature on the association of hearing loss and psychiatric disorders, the expanded horizons of assistance provided for hearing health care, and the role of geriatric mental health care workers in assuring the best possible treatment for hearing problems in older adults (**Table 1**).

EPIDEMIOLOGY OF HEARING LOSS IN LATER LIFE

Determining the prevalence of hearing loss must not be based solely upon self-report. The Centers for Disease Control and Prevention (CDC) report that 1 in 4 US adults who report excellent-to-good hearing already experience hearing damage.³ Prevalence and incidence studies typically measure severity by the decibels (dB) that can be

Table 1	
Definitions	
Deaf	A community and culture of individuals with shared language (American Sign Language) and cultural values and priorities. The deaf are not discussed in this article.
Hearing Loss	Hearing function that is poorer than normal in the general population and applied to persons who were not born with hearing impairment. Loss usually begins in middle or late life and progresses over the years. It can range from difficulty in hearing quiet sounds such as a whisper to profound loss that totally eliminates effective communication except through adaptations such as lip reading. ¹
Hearing Health Care	All forms of care provided to persons with hearing loss ranging from devices for individuals such as hearing aids and training by audiologists in practices to improve comprehension to environmental provisions (such as loop technology, which connects hearing aids with microphones in an auditorium). ¹ When hearing loss is profound and cannot be corrected, cochlear implants are a last resort approach to care and can be remarkably effective.
Otolaryngologists	Physicians trained in ear, nose and throat conditions. They roughly can be divided into those who focus on hearing loss, including surgery, treatment of infections of the ear, removal of cerumen, as well as inserting cochlear implants, and those who engage in other disorders (such as tumors of the head and neck). About 10,000 practice in the United States. ¹
Audiologist	Nonphysician health care professionals trained in the assessment treatment and prevention of hearing, balance, and related disorders. They usually have attained a doctoral degree in audiology and are licensed by states. Around 12, 250 audiologists practice in the United States. ¹
Hearing Instrument Specialists	Individuals trained to identify individuals with hearing loss, fit individuals with hearing aids, and educate persons and their families who experience hearing loss. Relatively short training period followed by an internship. Licensed by states. About 5570 practice in the United States. ¹
Red Flag Conditions	Several conditions are signals of serious or readily treatable causes of hearing loss according to the FDA. These include: active drainage from the ear, sudden-onset or rapidly progressing hearing loss, acute or chronic dizziness, sudden or rapidly progressive hearing loss in 1 ear, visible evidence of significant cerumen within the ear canal, and pain or discomfort in the ear. ²

heard. For all ages, the normal person can hear sounds at less than 26 dB. Persons with mild hearing loss can hear sounds between 26 to 40 dB; those with moderate loss hear 41 to 70 dB, and those with severe loss hear 71 or more dB. The prevalence of hearing loss of mild-to-severe loss in the Framingham Heart Study was 29% for subjects 63 to 95 years.³ National Health and Nutrition Examination Survey (NHANES) investigators found the frequency in men 70 years of age and older to be 44.8%.^{1(p43)} In the Health ABC study (ages 73–84), 76.9% of subjects were found to have loss of hearing for high-frequency sounds (inability to hear higher frequency sounds is more prevalent than for low frequency sounds in older adults). Hearing loss is typically greater for men than for women over age 70.⁴ In the Framingham study the incidence of hearing loss was 8.4% in the right ear and 13.7% in the left ear over a 6-year follow-up of persons 58 to 86 years of age.^{1(p46)}

In the NHANES study, investigators found a lower prevalence of hearing loss among African Americans compared with non-Hispanic whites. Prevalence for Mexican Americans was approximately equal to that among whites.⁵ Hearing loss for all older adults appears to be declining as younger birth cohorts are experiencing a lower rate of loss than older cohorts, although as noted previously, it remains a major impairment.⁵ This trend is surprising given the exposure to loud sounds via smartphones and ear buds. As would be expected, with aging, the onset and progression of hearing loss increase, in 1 study by 0.7 to 1.2 dB per year. In summary, hearing loss progresses gradually over time, although it accelerates among the oldest old.

Risk factors for hearing loss in later life include lower socioeconomic status, a long history of smoking, higher systolic blood pressure, obesity, high waist circumference, highly elevated glycosylated hemoglobin, atherosclerosis, and many ototoxic medications such as nonsteroidal anti-inflammatory drugs (NSAIDs) and acetaminophen. One area that is receiving increased attention is noise-induced hearing loss. The CDC³ recently issued a report suggestion that 1 in 2 US adults with hearing damage from noise did not have noisy jobs, and the resulting problems with hearing derive from noise exposure such as using a leaf blower, attending a sporting event, or being close to a siren for an extended period of time. They determined that noises above 85 dB can cause hearing damage.

PSYCHIATRIC DISORDERS SECONDARY TO HEARING LOSS

To gain a perspective on psychiatric problems associated with hearing loss, the clinician must have an appreciation of the problems faced by those with the impairment. Persons with hearing loss have difficulty following a conversation if there is background noise, such as in a restaurant. They become frustrated when trying to communicate with their families. Although they can hear speech, that speech may be muffled, because they can understand only portions of the conversation. This problem can be partially corrected if they can see the person talking and learn to read lips. In addition, the standard treatment is hearing aids, yet these aids are expensive and often not as effective as desired, leading to more frustration. Clinicians should also recognize that hearing loss in older adults will be more likely hidden from clinicians and family. Elders may even become more adaptable to the impairment than young adults. For example, in 1 study, younger adults reported being lonely at a higher frequency than older adults with hearing loss.⁶

The association of hearing loss with paranoid disorders has long been investigated by psychiatrists, yet the empirical evidence is mixed. For example, Kay and Roth explored whether deafness, along with abnormalities of personality and loss of many relatives, contributed to more social isolation in a paraphrenic population of

older adults than in mood disorder patients. (Paraphrenia was a term used frequently by psychiatrists decades ago to describe older patients who developed delusions and occasionally hallucinations without the loss of intellect or personality.) They found some impairment in hearing in 40% of the British paraphrenic patients; in 15% of patients, it was of marked degree. In Sweden, only the most severe cases of hearing loss had been recorded, and the prevalence was 16% among paraphrenics. The frequency of hearing loss in patients with affective disorders was only 7%. Although associated with the prevalence of paraphrenia, visual or hearing loss did not seem to modify the symptomatology of paraphrenia greatly.⁷ Felix Post, in a report from 1966, found that among 72 patients with paranoid disorder, 25% experienced hearing loss compared with 11% of controls.⁸ Since these early publications, the belief has been prevalent among psychiatrists that hearing loss is associated with paranoid psychoses, although this has not much been explored during the past few years in the psychiatric literature.

In a more recent meta-analysis of epidemiologic studies, the investigators found an increased risk of hearing impairment for all psychosis outcomes, such as hallucinations, delusions, psychotic symptoms, and delirium, although the odds ratios were relatively small. Early exposure to hearing impairment led to elevated the risk of later development of schizophrenia. The investigators suggested that potential mechanisms underlying this association include loneliness and disturbances of source monitoring (locating the source of sounds and interpreting these sounds).⁹

In another study, self-reported hearing impairment was associated with increased frequency of psychotic symptoms among those using a hearing aid in younger persons but not older adults.¹⁰ Following up this study, the same team found that although social isolation and loneliness were both associated with psychosis, perhaps related to an inability to interpret the environment in which they lived, the level of complexity of the social world in urban settings compared with rural settings explained most of the individual's inability to correctly process this information and therefore increased the likelihood of psychosis.¹¹

Other psychiatric symptoms are also associated with hearing loss, especially depression and anxiety. Thomas and colleagues¹² found a fourfold increase in scores above a clinically significant cutoff for anxiety and depression symptoms among patients with a hearing impairment compared with the general population. In another study among community respondents in underserved areas and using self-rated scales, subjects who reported sensory loss had high rates of depression and a compromised quality of life compared with respondents without these impairments.¹³ In yet another study, investigators explored the associated relationship of hearing impairment with anxiety symptoms. They found that, compared with individuals with no hearing impairment, the odds of prevalent anxiety were significantly higher among individuals with mild hearing impairment, and for those with moderate or severe impairment the odds were even greater. Hearing aid use was not significantly associated with lower likelihood of anxiety.¹⁴ Not all studies, however, confirm the association of hearing loss with psychiatric disorders, especially for major depression.¹⁵

Recent attention has been directed toward the risk for cognitive decline secondary to hearing loss. Findings from a chart review of 133 patients 50 years of age and older suggest that hearing loss is highly prevalent among this sample of cognitively impaired older adults. Sixty percent of the sample had at least a mild hearing loss in the better hearing ear. Among variables examined, age and medical history of diabetes were also strongly associated with hearing impairment. Hearing aid utilization increased with the severity of hearing loss, from 9% to 54% of individuals with a mild or moderate/severe hearing loss, respectively. No evidence was available, however, as to

whether the use of hearing aids improved or slowed the decline in cognition.¹⁶ In a more refined study, consistent peripheral hearing was significantly related to 10 of 11 measures of cognition that assessed processing speed, executive function, or memory, as well as global cognitive status.¹⁷

The Treatment of Hearing Loss

The recognition and treatment of hearing loss should be the responsibility of all health care professionals working with older adults. From the perspective of the psychiatrist and other mental health care workers, referring their patients to the appropriate specialists along with a discussion as to the significant risks of leaving hearing loss unattended is the most important point. To engage older patients and their families about hearing loss and its treatment, the mental health care worker must have a working knowledge of the hearing health care workforce and the services that can be offered.

Four disciplines should be at the front line.^{1(pp76,77)} Audiologists are trained in assessment and treatment, including the dispensing of hearing aids as well as rehabilitation of hearing loss and related problems (such as problems with balance and tinnitus). Hearing instrument specialists are qualified to identify individuals with hearing loss (through basic audiologic testing), dispense and adjust hearing aids, and educate clients and family members about hearing loss. A small fraction of otolaryngologists dispense hearing aids yet are key in treating the red flag conditions noted previously as well as inserting cochlear implants. The practitioners from each of these 3 disciplines tend to cluster in large metropolitan areas.

As can be recognized from the small number of persons specializing in hearing health care, the burden of identifying and referring individuals for hearing health care among the professions usually falls to primary care physicians (including geriatricians) and other specialties, perhaps especially psychiatrists. Primary care physicians are in the best position to identify hearing loss among older adults, such as during the annual wellness visit under Medicare, yet many elders do not take advantage of this visit. Given the busy practices of primary care doctors, checking for hearing loss, even via a simple question such as “Are you having any trouble with your hearing?” is limited, especially since checking for hearing loss is not a required screen as set up by the US Preventive Services Task Force for adults 50 years of age and older.¹⁸ In addition, the quiet physician’s office where the older adult is usually face-to-face with the doctor is not ideal for determining the degree of impairment that is present.

Psychiatrists and other mental health workers, when they suspect hearing loss in their patients, are in an excellent position to determine if hearing loss is present. Responses to questions to test cognitive function may be inaccurate in part because the questions are misunderstood or not answered. Other queries frequently are misinterpreted. Patients may complain that they forgot their hearing aid or they place the aid in their ear during the session. In addition, the older adult is often accompanied by a family member who can inform the psychiatrist about hearing loss. Final determination of the extent of hearing loss should be delegated to an audiologist who can perform appropriate testing. Formal screening by the audiologist (including the audiogram) is covered by Medicare if referred by a physician, an option all too often a neglected. However, audiologists are not reimbursed for any treatment of the problem such as rehabilitation and fitting of hearing aids.

The physician should also determine if the older adult is taking a potentially ototoxic medication. The most common of these are: aspirin, NSAIDs, some antibiotics, diuretics such as furosemide and bumetanide, and some anticancer drugs. Hearing loss has been rarely reported for some psychotropic drugs such as olanzapine, carbamazepine, and valproic acid. Some selective serotonin reuptake inhibitors can cause

tinnitus.¹⁹ If tinnitus is a major concern, patients may be switched to mirtazapine, which has not been found to cause tinnitus. Almost all older persons have lost hearing in the higher frequencies and frequencies below 25 dB. Therefore, the speech frequency range that renders understanding of soft speech in a quiet room difficult is a frequent problem for older adults.²⁰ It usually occurs gradually and bilaterally, because of changes in the inner ear.

All clinicians should be aware of more serious and/or treatable causes of hearing loss among older adult, the most common being cerumen impaction (unilateral or bilateral), which can be treated by an audiologist, otolaryngologist, or even self-removal with ceruminolytics or irrigation. Other red flag conditions listed by the US Food and Drug Administration (FDA) and requiring referral to a physician with experience in treating hearing problems have already been noted.²¹ Unilateral hearing loss is a potentially serious condition that should lead to an immediate referral to an otolaryngologist, because it may be the primary symptom of an acoustic neuroma or a cholesteatoma.

Once referred to a hearing health care specialist for treatment, several options are available to persons with hearing loss. Hearing aids are the standard treatment and what most consumers consider initially as the first-line treatment. Yet hearing aids are expensive, costing around \$4700 for a pair of medium range aids in the United States in 2013, this cost including both the hearing aid itself and the services of the audiologist or hearing instrument specialist.²² Therefore cost is an initial barrier to hearing aid use. Yet for those who have purchased hearing aids, they frequently are not used following initial adjustments. Primary reasons for nonuse are perception that the hearing aids are not effective, difficulty fitting (adjustment of the hearing aid to the proper pitch and frequency), maintenance (such as changing batteries), stigma, and ongoing costs of batteries, maintenance, and repair. Frustration with hearing aids may lead individuals to decide that they can manage without the hearing aid.²³ In a sample of the patients aged 50 years and older from the NHANES, 3.8 million Americans wore hearing aids, but only 14.2% with hearing loss used hearing aids.²⁴

Yet for many, hearing aids significantly reduce the impairment that results from hearing loss. In 1 study, the use of hearing aids was associated with improved minimal state performance.^{25,26} This suggested to the authors that hearing loss was associated with sensory specific cognitive decline rather than global cognitive impairment.

Recently, bipartisan legislation was introduced by Senators Elizabeth Warren (D-Mass) and Chuck Grassley (R-Iowa) to permit the sale of over-the-counter hearing aids.²⁷ These devices will not replace clinician-prescribed hearing aids but are focused upon improving hearing for those with mild-to-moderate impairment. There would be some FDA regulation, but that regulation would be minimal yet protect against problems such as sound intensity being set dangerously high. Therefore, cost should significantly be reduced, and persons who believe they might benefit from such an instrument would be much more willing to expend a few hundred dollars rather than thousands. Personal sound amplification products (PSAPs) are already widely available, advertised frequently in the media, yet they cannot be recommended as a hearing aid at present. Many people, however, do purchase them, and some may even today meet the standards for an over-the-counter device.

Several other hearing assistive technologies are available. These include hearing induction loop and telecoil technologies that allow the sound system in a room to connect wirelessly with an individual's hearing via a telecoil in the hearing aid and the installation of hearing loop wiring around the perimeter of the room that connects to

the room's sound system (ideal for group gatherings where speakers use microphones such as worship services). This combination can reduce background noise and improve the clarity of sound.^{1(p162)} Another option, although less frequently used, is captioning of a talk or conversation using transcription (similar to that used by court reporting and projected onto a screen in the room). Yet another approach is the production of apps for smart phones, which in combination with Bluetooth technology, can permit, for example, placing a smart phone in the center of the table of a noisy restaurant and using an earpiece connected to the device to amplify the conversation at the table.

Treatment of hearing loss does not stop with technological assistance. Auditory rehabilitation is an evidenced-based intervention.²⁸ These programs are designed to help individuals learn to adapt to their hearing loss, become familiar with hearing-assistive technologies, learn strategies for better listening and communication, and provide psychosocial support.^{1(p86–88)} The programs can be group based or individualized. Audiologists and speech and language pathologists can administer these programs.

SUMMARY

In general, hearing health care technology is at a point where a combination of opening the market to new products coupled with new and disruptive technologies may significantly change the options persons with hearing loss have available as well as decrease the stigma of seeking and using hearing assistive technologies and approaches to rehabilitation. Psychiatrists and other mental health professionals should be aware of this changing landscape and take advantage of their unique opportunity to recognize hearing loss and refer their patients to professionals or even to the local drug store to seek products that can assist them to hear better. Data are not yet available that definitively demonstrate improved hearing can reduce the frequency of psychiatric disorders including cognitive impairment. Yet there is reason to believe that improved hearing will at least improve the quality of life of those experiencing such loss.

REFERENCES

1. National Academies of Science. *Engineering and medicine: hearing health care for adults: priorities for improving access and affordability*. Washington, DC: The National Academies Press; 2016.
2. Federal Drug Administration. Red Flag Conditions Available at: https://ihsinfo.org/IhsV2/hearing_professional/2003/010_January-February/030_FDA_Red_Flags.cfm. Accessed March 1, 2017.
3. Centers for Disease Control and Prevention. Vital signs: too loud! For too long! Loud noises damage hearing. 2017. Available at: www.cdc.gov/vitalsigns/HearingLoss. Accessed April 26, 2017.
4. Cruickshanks KJ, Wiley TL, Tweed TS, et al. The 5-year incidence and progression of hearing loss: the epidemiology of hearing loss study. *Arch Otolaryngol Head Neck Surg* 2003;129:1041–6.
5. Gates GA, Cooper JC Jr, Kannel WE, et al. Hearing in the elderly: the Framingham cohort, 1983-1985. Part I. Basic audiometric test results. *Ear Hear* 1990; 11:247–56.
6. Sung YK, Li L, Blake C, et al. Association of hearing loss and loneliness in older adults. *J Aging Health* 2016;28:979–94.

7. Kay DW, Roth R. Environmental and hereditary factors in the schizophrenias of old age ("late paraphrenia") and their bearing on the general problem of causation in schizophrenia. *J Ment Sci* 1961;107:649–86.
8. Post F. Persistent persecutory states of the elderly. Oxford (England): Pergamon Press; 1966.
9. Linszen MM, Brouwer RM, Heringa SM, et al. Increased risk of psychosis in patients with hearing impairment: review and meta-analyses. *Neurosci Biobehav Rev* 2016;62:1–20.
10. van der Werf M, van Boxtel M, Verhey F, et al. Mild hearing impairment and psychotic experiences in a normal aging population. *Schizophr Res* 2007;94:180–6.
11. van der Werf M, van Winkel R, van Boxtel M, et al. Evidence that the impact of hearing impairment on psychosis risk is moderated by the level of complexity of the social environment. *Schizophr Res* 2010;122:193–8.
12. Thomas A. Acquired hearing loss: psychological and social implications. Orlando (FL): Academic Press; 1984.
13. Armstrong TW, Surya S, Elliott TR, et al. Depression and health-related quality of life among persons with sensory disabilities in a health professional shortage area. *Rehabil Psychol* 2016;61:240–50.
14. Contrera KJ, Betz J, Deal J, et al. Health ABC Study. Association of hearing impairment and anxiety in older adults. *J Aging Health* 2016;29:172–84.
15. Mener DJ, Betz J, Genther DJ, et al. Hearing loss and depression in older adults. *J Am Geriatr Soc* 2013;61:1627–9.
16. Nirmalasari O, Mamo SK, Nieman CL, et al. Age-related hearing loss in older adults with cognitive impairment. *Int Psychogeriatr* 2017;29:115–21.
17. Harrison Bush AL, Lister JJ, Lin FR, et al. Peripheral hearing and cognition: evidence from the staying keen in later life (SKILL) study. *Ear Hear* 2015;36:395–407.
18. Available at: <https://www.uspreventiveservicestaskforce.org/Page/Document/UpdateSummaryFinal/hearing-loss-in-older-adults-screening>. Accessed March 22, 2017.
19. Cianfrone G, Pentangelo D, Cianfrone E, et al. Pharmacological drugs inducing ototoxicity, vestibular symptoms and tinnitus: a reasoned and updated guide. *Eur Rev Med Pharmacol Sci* 2011;15:601–36.
20. Available at: <https://www.nidcd.nih.gov/health/age-related-hearing-loss#1>. Accessed March 22, 2017.
21. Available at: <https://www.slideshare.net/HISDepartment/fda-regulations-for-hearing-instrument-specialists>. Accessed March 22, 2017.
22. Strom K. HR 2013 hearing aid dispenser survey. Available at: <http://www.hearingreview.com/2014/04/hr-2013-hearing-aid-dispenser-survey-dispensing-age-internet-big-box-retailers-comparison-present-past-key-business-indicators-dispensing-offices/>. Accessed March 22, 2017.
23. McCormack A, Fortnum H. Why do people fitted with hearing aids not wear them. *Int J Audiol* 2013;52:360–8.
24. Chien W, Lin FR. Presence of hearing aid use among older adults in the United States. *Arch Intern Med* 2012;172:292–3.
25. Qian ZJ, Wattamwar K, Caruana FF, et al. Hearing aid use is associated with better mini-mental state exam performance. *Am J Geriatr Psychiatry* 2016;24:694–702.
26. Folstein MF, Folstein SE, McHugh PR. "Mini-Mental State." A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975;12:189–98.

27. Warren E, Grassley C. Over-the-counter hearing aids: the path forward. *JAMA Intern Med* 2017;177(5):609–10.
28. Chisolm T, Arnold M. Evidence about the effectiveness of aural rehabilitation programs for adults. In: Wong L, Hickson L, editors. *Evidence-based practice in audiology: evaluating interventions for children and adults with hearing impairment*. San Diego (CA): Plural Publishing; 2012. p. 237–66.