



The Effect of What Adults Know and Think About Hearing Loss and Cochlear Implantation on Utilization Rates Across the United States

Jean Bertrand Kalima¹ · John P. Marinelli^{1,2} · Matthew L. Carlson^{2,3}

Accepted: 2 September 2024

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2024

Abstract

Purpose of Review An aging demographic in the West is resulting in an increasing number of patients who qualify for cochlear implantation. Utilization of cochlear implants among qualifying adults in the United States is currently influenced by many factors. Among these, patient awareness and appreciation of adult-onset hearing loss and its health sequelae, along with perceptions regarding cochlear implantation as a treatment option, significantly impact patients' motivations to seek rehabilitation with cochlear implantation.

Recent Findings Cochlear implantation as a treatment option for adult hearing loss remains underutilized. Recent large surveys of adults within the United States identify limited awareness surrounding hearing loss as a chronic disease state and cochlear implants as a treatment option. Limited awareness extends beyond the general populace and includes healthcare professionals crucial to the detection and referral process. Despite overarching limited familiarity, patients' perceptions surrounding cochlear implants are slowly becoming favorable.

Summary Underutilization of cochlear implants among qualifying adults in the United States is compounded by limited awareness and appreciation of hearing loss as a chronic disease state with significant long-term health sequelae. Efforts to improve patients' and providers' understanding of the importance of hearing loss as a chronic disease state and the utility of cochlear implant rehabilitation are vital.

Keywords Hearing loss · Cochlear implant · Adults · Awareness · Utilization · Population · United States · Race · Gender · Age · Disparity · Healthcare

Introduction

Adult hearing loss constitutes one of the most prevalent contributors to years lived with disability globally. Despite its prevalence, many patients live untreated or inadequately treated from their hearing loss, with only 20% of adults with hearing loss in the United States using hearing aids. Among

those with more significant hearing loss, less than 10% of adults who qualify for cochlear implantation ultimately receive an implant [1]. Within the United States, approximately 1.2 million adults are estimated to qualify for cochlear implantation but have not received an implant [2].

Widespread underutilization of cochlear implants across the United States is multifactorial. Limited appreciation for the sequelae of untreated hearing loss among the general populace as well as frontline providers; absent national screening protocols for adults; misperceptions on the qualifications for device implantation and its attendant risks; and, limited access to specialist healthcare services among underserved communities in underserved regions all represents critical contributory factors that exist nationally and globally [1].

Nassiri et al. highlight significant obstacles faced by cochlear implant in the United States throughout the care delivery process [3]. A notable obstacle involves the discordance

✉ Matthew L. Carlson
carlson.matthew@mayo.edu

¹ Department of Otolaryngology-Head and Neck Surgery, San Antonio Military Medical Center, Joint Base Fort Sam Houston, Fort Sam Houston, TX, USA

² Department of Otolaryngology-Head and Neck Surgery, Mayo Clinic, 200 1st St SW, Rochester, MN 55905, USA

³ 3Department of Neurologic Surgery, Mayo Clinic, Rochester, MN, USA

between the criteria set forth by private insurers and excessively exclusive Medicare criteria – a barrier that uniquely disadvantages the subset of the population at highest risk for needing cochlear implantation (i.e., the older adult population). For instance, Medicare parameters require patients to harbor bilateral moderate-to-profound sensorineural hearing loss with sentence recognition scores no greater than 60% in the best-aided condition [4, 5]. Recognizing most adults achieve approximately 80% sentence recognition following cochlear implantation [5], these overly stringent healthcare requirements contribute to cochlear implant underutilization in the United States, as patients with significant hearing impairment are precluded from receiving the appropriate intervention by failing to meet the eligibility criteria despite having an established impairment with limited benefit from hearing aids [6].

Sorkin et al. note that despite numerous organizations serving different interest groups and working on raising awareness of cochlear implantation in the United States, there appears to be no concerted effort toward establishing a uniform public health policy initiative [7]. Moreover, national organizations have made limited efforts to promote cochlear implantation as a safe and effective health intervention to address hearing loss in adults [7].

Holder et al. note that despite expanded candidacy criteria, some patients still opt not to pursue cochlear implantation [2, 4]. Barnes et al. further observe that patients often experience years of qualifying deafness while waiting to meet the 60% binaural best-aided sentence criteria, allowing for extensive deterioration in their hearing [4]. During this waiting period, the affected ear likely experiences an extended duration of nonfunctional hearing. Hence, fewer

patients undergo preoperative cochlear implant evaluation, and those that do have an average preoperative CNC score of less than 10% [2, 4]. Suitable candidates are experiencing a delay in referral for cochlear implantation, leading to a decreased likelihood of undergoing implantation [4]. Therefore, appropriate education, outreach, and referral efforts by healthcare professionals following initial evaluation for cochlear implantation may help ensure early intervention [2].

Perceptions of Hearing Loss in the United States

Adult-onset hearing loss has been traditionally associated with natural consequences of aging. However, growing evidence is revealing that adult-onset hearing loss should be considered a chronic disease with critical health consequences. The link between auditory impairment and cognitive decline has received particular attention within the last decade, with the 2017 and 2020 Lancet Commission reports identifying adult-onset hearing disability as the most significant and potentially modifiable risk factor for the development of dementia [8, 9].

In a recent survey of 400 older United States adults, 26% of the participants with auditory impairment did not consider hearing loss a medical condition [10]. For this reason, United States adults expressed limited interest in having their hearing checked by an audiologist (Fig. 1A). Although adult hearing loss has been associated with depression, social isolation, loneliness, practical safety concerns, and dementia, the average adult in the United States considers hearing loss

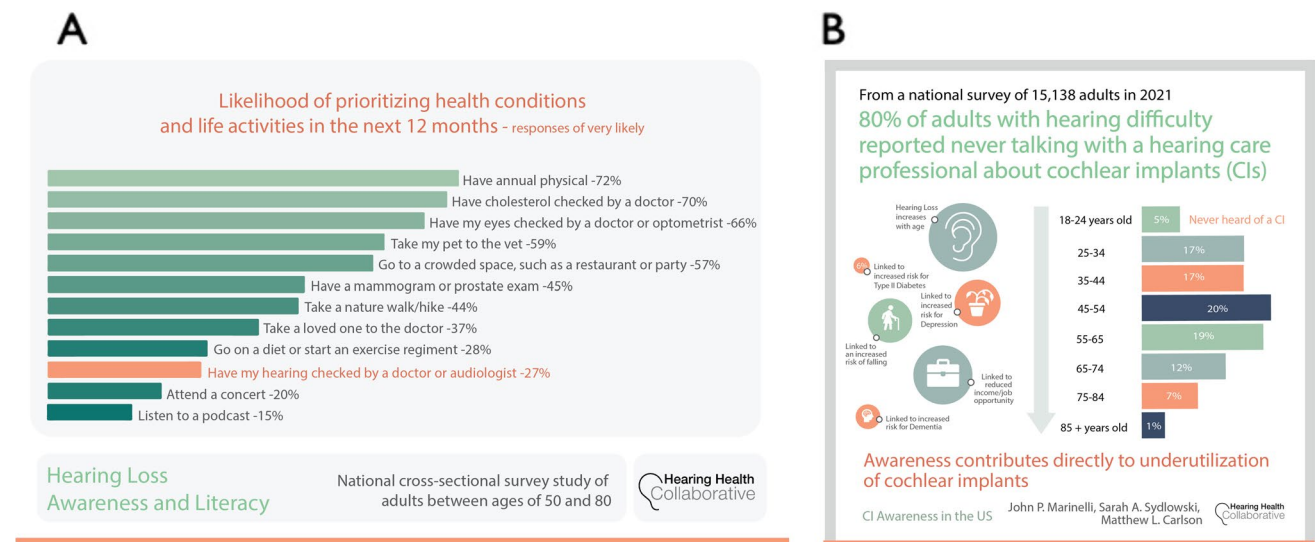


Fig. 1 Highlights from recent surveys of United States adults surrounding (A) perceptions of hearing loss and (B) specifically surrounding cochlear implant awareness [1, 11]. (Used with permission from the *Hearing Health Collaborative*)

to be more representative of a normal part of aging than a disease state that places them at risk for poorer long-term health outcomes [10, 12–15]. This claim was further substantiated by a recent survey by Carlson et al. in 2022 who found that less than a quarter of adults in the United States were aware of the association between hearing loss and its long-term sequelae if left untreated [1]. Compounding this limited appreciation for the long-term sequelae of untreated hearing loss surrounds the reality that no standardized national screening mechanism currently exists to identify at-risk or affected adults in the United States despite many other chronic diseases being annually screened by the primary care provider [1].

Cochlear Implantation Awareness Among Adults in the General Populace

As a natural extension of limited literacy surrounding hearing loss and its consequences, few United States adults harbor an understanding of interventions for hearing loss when compared to other common medical conditions such as breast cancer, diabetes, and obesity. For instance, a United States survey of 1,250 adults indicated that 93% of adults could correctly identify “normal” vision cutoffs, and 85% could identify normal blood pressure ranges. In contrast, less than 10% could identify normal ranges for hearing [1]. In this study, less than half of the respondents believed hearing loss could be treated and only 17% thought it could be prevented [1].

A subsequent survey of 406 healthcare professionals observed that primary care physicians possessed limited understanding of hearing loss as a disease state [16]. To this end, less than half of frontline providers believed hearing loss could be treated [16]. Thus, limited awareness of cochlear implantation as a therapeutic intervention among the general populace is compounded by the limited knowledge of preventing and treating adult-onset hearing loss among frontline providers [1].

Another recent survey of 15,638 United States adults indicated that most United States adults are largely unfamiliar with cochlear implants (Fig. 1B). Within the subset of participants who indicated hearing difficulty, more than 30% indicated they had “never heard” of cochlear implants, and this response was found to be significantly more common among minority racial groups. Moreover, nearly 80% of participants who indicated hearing difficulty reported never discussing cochlear implants with a healthcare professional. These findings further reinforce the limited awareness of hearing loss and cochlear implants as a potential intervention across the United States among the general population [11]. It is likely that this unfamiliarity influences the notable duration of years lived with qualifying degrees of hearing loss

prior to undergoing cochlear implantation, as demonstrated by several prior studies [2, 4].

In the same survey of nearly 16,000 United States adults, it was noted that gender, age, and racial disparities play an essential role in the awareness of cochlear implants among adults in the United States and have a significant impact on widespread underutilization [11]. Of those surveyed, less than one third of participants who indicated hearing difficulty reported familiarity with cochlear implants [11]. The survey also indicated that 9% of respondents between the ages 65 and 74, 10% of those between the ages 75 and 84, and 8% of those aged 85 and above manifested extensive familiarity with cochlear implants even though this subset of the survey populace represents the highest risk category for requiring cochlear implants to rehabilitate significant hearing loss [11]. Individuals who identified as members of racial minority groups reported low familiarity with cochlear implants compared to their counterparts who identified as White, a finding reinforcing overall healthcare disparities. In light of the aforementioned survey findings, existing evidence indicates the necessary familiarity with cochlear implants is lacking across most of the adult population within the United States.

Perceptions Surrounding Cochlear Implantation Among At-Risk Adults

Patient perceptions surrounding treatment dictate their interest in pursuing intervention. Recent work has begun to characterize perceptions surrounding cochlear implantation among adults who harbor at-risk or qualifying degrees of hearing loss [3]. In a 2023 survey of 400 older adults in the United States, there existed widespread lack of familiarity with cochlear implantation among individuals with suspected qualifying degrees of hearing impairment [10]. Furthermore, over 70% of these respondents reported that cochlear implants were only “somewhat relevant,” and 26% indicated cochlear implants were irrelevant to their condition. Overall, respondents expressed positive views on cochlear implants by associating positive verbiage such as hope, confidence, control, and optimism with cochlear implants. Fortunately, few respondents (< 10%) expressed a negative outlook regarding cochlear implants [10].

Although few participants harbored negative views of cochlear implants, only approximately 33% of those same participants felt that cochlear implants could be a part of their future with a notable quarter of participants reporting cochlear implants are not “for people like me.” Notwithstanding, a notable limitation of the survey surrounded the lack of objective audiometric data for the participants; therefore, it is possible that those individuals who felt cochlear implants were irrelevant to their care may indeed have

hearing loss that is better rehabilitated through other means, had medical comorbidities impeding cochlear implantation, or simply desired not to undergo cochlear implantation [10].

Nassiri et al. highlighted how inaccurate information surrounding medical insurance coverage and associated costs for the patient often poses a hindrance to patients seeking cochlear implantation. Ironically, cochlear implants are covered by insurance in most cases and patients typically incur less costs than they would when pursuing hearing aids, for example [17, 18].

Surgical intervention for hearing loss via cochlear implantation, as opposed to noninvasive hearing amplification via hearing aids, is cited as another barrier for many patients. Patients sometimes have perceived cochlear implantation as “brain surgery” with significant associated perioperative risk. Multiple studies have demonstrated very few patients experience major complications related to cochlear implantation, with most severe complications being estimated to occur in less than 1% of cases [5]. Patients also bear concerns regarding the speech quality of hearing through their cochlear implant. However, while sound quality may differ from the acoustic side, understanding speech and the resultant impact on quality of life are favorable for the vast majority of patients [3].

Potential Solutions

There is an increasing need for greater awareness and accessibility of cochlear implants. Some potential solutions include but are not limited to:

- Addressing misconceptions about cochlear implants by educating key healthcare stakeholders such as audiologists, otolaryngologists, and primary care physicians, among others, on the basics of qualification and expected outcomes [19];
- Performing routine hearing screening on adult patients at risk of hearing loss [3];
- Providing upfront, accurate information early in the hearing loss evaluation and treatment process to overcome informational barriers [3];
- Establishing a national organization (i.e., a partnership of public and private organizations) with the stated aim of preventing or delaying the early onset of hearing loss among at-risk populations utilizing evidence-based interventions such as cochlear implants, which was the primary motivation to create the Hearing Health Collaborative; and,
- Creating national awareness campaigns on hearing loss prevention and management and the sequela of hearing loss by engaging target audiences via their preferred

communication channels, including social media and other digital platforms, print, radio, and broadcast TV.

Conclusion

Despite cochlear implantation being widely regarded as the most successful neuroprosthesis to date, a minority of patients who would benefit from a cochlear implant have received one to date. Growing evidence characterizes one of the key explanatory etiologies behind this widespread utilization: the average adult in the United States possesses limited understanding that hearing loss is a chronic disease with important long-term health implications if left untreated; from this foundation, it is further evident that most adults in the United States have little familiarity with cochlear implants as a possible treatment option for hearing loss. These observations underscore ongoing national efforts to systematically increase frontline providers and patients understanding of hearing loss as a disease and treatment options such as cochlear implantation.

Acknowledgements The views expressed herein are those of the authors and do not necessarily reflect the official policy or position of the Defense Health Agency, Brooke Army Medical Center, the Department of Defense, or any agencies under the U.S. Government.

Author Contributions JBK is responsible for drafting the manuscript; all authors contributed to critical revision and approval of the final manuscript.

Data Availability No datasets were generated or analysed during the current study.

Declarations

Financial Material & Support None.

Conflict of Interest The authors declare no competing interests.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

1. Carlson ML, Nassiri AM, Marinelli JP, Lohse CM, Sydlowski SA. Hearing Health C. awareness, perceptions, and literacy surrounding hearing loss and hearing rehabilitation among the adult population in the United States. *Otol Neurotol.* 2022;43(3):e323-e30.
2. Holder JT, Reynolds SM, Sunderhaus LW, Gifford RH. Current profile of adults presenting for preoperative cochlear implant evaluation. *Trends Hear.* 2018;22:2331216518755288.
3. Nassiri AM, Marinelli JP, Sorkin DL, Carlson ML. Barriers to adult cochlear implant care in the United States: an analysis of health care delivery. *Semin Hear.* 2021;42(04):311–20.

4. Barnes JHYLXM, Carlson JP. Audiometric profile of cochlear implant recipients demonstrates need for revising insurance coverage. *Laryngoscope*. 2021;131(6):E2007-E.
5. Carlson ML. Cochlear implantation in adults. *N Engl J Med*. 2020;382(16):1531–42.
6. Zwolan TA, Kallogjeri D, Firszt JB, Buchman CA. Assessment of cochlear implants for adult medicare beneficiaries aged 65 years or older who meet expanded indications of open-set sentence recognition: a multicenter nonrandomized clinical trial. *JAMA Otolaryngol Head Neck Surg*. 2020;146(10):933–41.
7. Sorkin DL. Cochlear implantation in the world's largest medical device market: utilization and awareness of cochlear implants in the United States. *Cochlear Implants Int*. 2013;14(Suppl 1):S4–12.
8. Livingston G, Huntley J, Sommerlad A, Ames D, Ballard C, Banerjee S, et al. Dementia prevention, intervention, and care: 2020 report of the Lancet Commission. *Lancet*. 2020;396(10248):413–46.
9. Livingston G, Sommerlad A, Orgeta V, Costafreda SG, Huntley J, Ames D, et al. Dementia prevention, intervention, and care. *Lancet*. 2017;390(10113):2673–734.
10. Carlson ML, Lohse CM, Marinelli JP, Sydlowski SA, Collaborative HH. Perceptions surrounding cochlear implants among at-risk and qualifying older adults in the United States. *Otol Neurotol*. 2023;44(10):1021-6.
11. Marinelli JP, Sydlowski SA, Carlson ML. Cochlear implant awareness in the United States: a national survey of 15,138 Adults. *Semin Hear*. 2022;43(04):317–23.
12. Anstey KJ, Wood J, Lord S, Walker JG. Cognitive, sensory and physical factors enabling driving safety in older adults. *Clin Psychol Rev*. 2005;25(1):45–65.
13. Lawrence BJ, Jayakody DMP, Bennett RJ, Eikelboom RH, Gasson N, Friedland PL. Hearing loss and depression in older adults: a systematic review and Meta-analysis. *Gerontologist*. 2020;60(3):e137–54.
14. Marinelli JP, Lohse CM, Fussell WL, Petersen RC, Reed NS, Machulda MM, et al. Association between hearing loss and development of dementia using formal behavioural audiometric testing within the Mayo Clinic Study of Aging (MCSA): a prospective population-based study. *Lancet Healthy Longev*. 2022;3(12):e817–24.
15. Shukla A, Harper M, Pedersen E, Goman A, Suen JJ, Price C, et al. Hearing loss, loneliness, and social isolation: a systematic review. *Otolaryngol Head Neck Surg*. 2020;162(5):622–33.
16. Sydlowski SA, Marinelli JP, Lohse CM, Carlson ML, Hearing Health C. Hearing health perceptions and literacy among primary healthcare providers in the United States: a national cross-sectional survey. *Otol Neurotol*. 2022;43(8):894–9.
17. Barnett M, Hixon B, Okwiri N, Irungu C, Ayugi J, Thompson R, et al. Factors involved in access and utilization of adult hearing healthcare: a systematic review. *Laryngoscope*. 2017;127(5):1187–94.
18. Laplante-Levesque A, Hickson L, Worrall L. Factors influencing rehabilitation decisions of adults with acquired hearing impairment. *Int J Audiol*. 2010;49(7):497–507.
19. D'Haese SC, Van Rompaey P, De Bodt V, Van De Heyning M. P. The need to increase awareness and Access to Cochlear Implantation. *IntechOpen*; 2020.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.