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Age-Related Disparities in the Treatment of Borderline/Mild Hearing Loss in the United States

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Abstract

To investigate disparities in hearing aid use across the life span for borderline/mild hearing loss, a cross-sectional epidemiologic study in the National Health and Nutrition Examination Survey was conducted. Multivariable logistic regressions controlling for hearing level analyzed the association between hearing aid use and age in borderline/mild hearing loss. Age was grouped into quartiles. Of 2470 subjects, 2.0% (n = 50) were <25 years old; 12.0% (n = 297), 25 to 49 years; 65.5% (n = 1618), 50 to 74 years; and 20.5% (n = 505), ≥75 years. When compared with the youngest quartile and while controlling for hearing level, those in the second quartile were 4.6 times less likely to use hearing aids ($P < .01$); those in the third were 4.2 times less likely ($P < .01$); and those in the fourth were 4.7 times less likely ($P < .001$). The dramatically lower hearing aid usage of all older age groups as compared with children/younger adults represents a large unaddressed age-related disparity in the treatment of borderline/mild hearing loss.

Keywords

hearing loss, hearing aids, mild hearing loss, ageism

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Children are routinely screened for hearing loss (HL) because of its effect on cognitive, language, and social development.[1-3] In contrast, adults are not screened, remaining undiagnosed until HL is more severe.[4] This age-related care gap may stem from the stigma of hearing aids (HAs) and ageism, misperceptions of hearing ability, and hesitancy to treat a "normal" consequence of aging.[5] However, HL in later life, even when minimal, is associated with deleterious conditions, such as cognitive impairment and depression.[6-8] Moreover, treatment of mild HL in adults with HAs is effective in decreasing negative psychosocial effects.[9,10] Thus, it would seem that minimal HL should be treated with equivalent urgency in older adults as in children.[11] Studies quantitatively investigating this are lacking. We present the most detailed analysis to date assessing HA usage across the life span for borderline/mild HL.

Methods

This was an epidemiologic study in the National Health and Nutrition Examination Survey (NHANES; 1999-2016). NHANES is a national recurrent cross-sectional survey conducted by the National Center for Health Statistics (NCHS) under the Centers for Disease Control and Prevention (CDC) that includes interviews and examinations to determine the prevalence and risks of diseases. It contains a complex survey design to be representative of the US population. It does not suffer from participation bias of convenience samples at medical clinics. Columbia University Institutional Review Board exemption was granted. Only subjects with audiograms and HA data were included.

Age was grouped into quartiles (<25, 25-49, 50-74, ≥75 years). Pediatric HL is relatively rare, making finer categorization impossible. Hearing was defined by 4-freqency pure tone average (PTA) in the better ear (500, 1000, 2000, 4000 Hz). Only subjects with borderline/mild HL (21-40 dB PTA)[12] were included. We included borderline HL (21-25 dB) because children are often identified and treated for HL at this level. When age-related treatment disparities are studied, it is critical to avoid double standards in defining the disorder.[13] In earlier cycles, HA use was assessed in those aged ≥12 years by the question "Ever worn a hearing aid?" and, in later cycles, by "Ever worn a hearing aid/cochlear implant?" with the follow-up "If yes, which one?" HA uptake was

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Table 1. Demographics of Subjects With Borderline/Mild Hearing Loss (21-40 dB) by Age Quartile.

	Age, No. (%) or mean ± SD				
	<25 y	25-49 y	50-74 y	≥75 y	Total
No.	50	297	1618	505	2470
Sex					
Female	18 (36.0)	99 (33.3)	622 (38.4)	255 (50.5)	994 (40.2)
Male	32 (64.0)	198 (66.7)	996 (61.6)	250 (49.5)	1476 (59.8)
Age, y	18.5 ± 3.71	41.5 ± 6.24	63.0 ± 6.48	79.4 ± 2.77	62.8 ± 13.6
PTA in better ear, dB	26.2 ± 5.40	26.1 ± 4.87	27.7 ± 5.10	30.2 ± 5.64	28.0 ± 5.34
Hearing aid use					
No	43 (86.0)	286 (96.3)	1536 (94.9)	471 (93.3)	2336 (94.6)
Yes	7 (14.0)	11 (3.7)	82 (5.1)	34 (6.7)	134 (5.4)

Abbreviation: PTA, pure tone average.

Table 2. Multivariable Logistic Regression: Hearing Aid Nonuse by Age Quartile, Controlling for Level of Hearing Loss.

	Age, odds ratio (95% CI)			
	<25 y	25-49 y	50-74 y	≥75 y
Hearing loss, dB				
Borderline/mild: 21-40	Reference	4.56 (1.57-13.16)[a]	4.15 (1.69-10.21)[a]	4.69 (1.82-12.19)[b]
Mild: 26-40	Reference	4.23 (1.13-15.38)[c]	4.18 (1.36-12.82)[c]	5.41 (1.69-17.24)[a]

[a]$P < .01$.
[b]$P < .001$.
[c]$P < .05$.

calculated as those who had borderline/mild HL and used HAs at a given age, divided by those at that age who had borderline/mild HL or used HAs.

Multivariable logistic regressions controlling for hearing were conducted to analyze the association between HA use and age quartile.

Results

An overall 2470 subjects had borderline/mild HL (21-40 dB PTA) and possessed HA usage data (**Table 1**): 2.0% (n = 50) were <25 years old; 12.0% (n = 297), 25 to 49 years; 65.5% (n = 1618), 50 to 74 years; and 20.5% (n = 505), ≥75 years. Average hearing was within 4 dB across all quartiles. HA usage plummeted after the first quartile (**Figure 1**), from 14.0% (n = 7) to 3.7% (n = 11), then slightly increased to 5.1% (n = 82) and 6.7% (n = 34). (The first 2 quartiles had several ages with no HA use due to the rarity of HL in these age groups.) When compared with subjects <25 years old and while controlling for hearing, those 25 to 49 years were 4.6 times less likely to use HAs (95% CI, 1.6-13.2; $P < .01$); those 50 to 74 years were 4.2 times less likely (95% CI, 1.67-10.2; $P < .01$); and those ≥75 years were 4.7 times less likely (95% CI, 1.8-12.2; $P < .001$). A similar drop-off in HA use over quartile is observed solely for mild HL (26-40 dB PTA; **Table 2**).

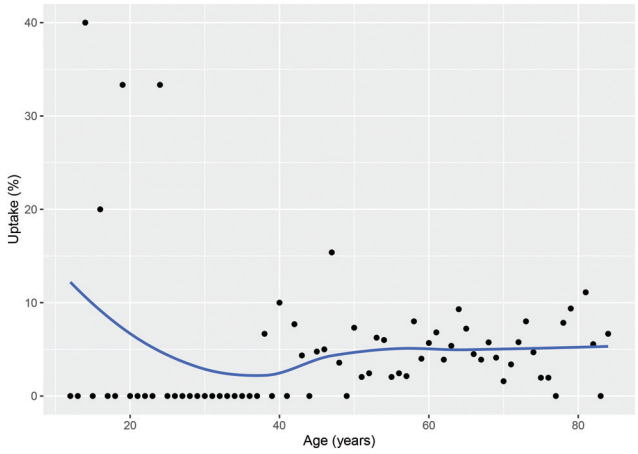

Figure 1. Hearing aid uptake for borderline/mild hearing loss (21-40 dB) declines after childhood/young adulthood. Each point represents summary of all participants for a particular age.

Discussion

HA use for borderline/mild HL dropped precipitously after the first quartile of life (<25 years) and remained low for the life span thereafter. Subjects in the upper 3 age quartiles (25-49, 50-74, ≥75 years) were 4 to 5 times less likely to wear

HAs than the youngest quartile, despite equivalent mean levels of hearing. This treatment disparity was nearly the same in mild HL.

Borderline/mild HL is important to study as it is likely the level with the greatest age-related treatment disparity. The disparity cause is likely multifactorial. Medicaid covers HAs for children in some states, whereas Medicare does not and few private insurances routinely cover HAs for adults. However, this difference in coverage is a manifestation of a disparity rather than the explanation of one. Health care disparities are defined as a difference in a health outcome closely linked with disadvantage, which includes age.[14] Disparities often result from societal discrimination against a disadvantaged group. The stigma of appearing old due to HAs is often cited as a reason for low usage.[15] Ageism, our inherent negative bias against older adults,[16,17] is likely a factor. To improve equity in HL treatment across the life span, a multifactorial approach is needed, including awareness of ageism and installing measures to combat it. This could include reducing stigmas of HAs through education and marketing, as well as improving access through upcoming over-the-counter HAs.

An argument against needing to treat mild HL in adults is that it is less impactful than HL in children. Children undergo a critical period of education and cognitive development when hearing is essential. However, adults undergo a period of cognitive decline in later life and are susceptible to dementia. Numerous studies have associated even minimal untreated HL with cognitive decline and dementia.[18-22] While randomized controlled trials are needed to prove causation, evidence no longer supports the assumption that mild HL is innocuous in adults. Increased awareness across medicine and the public may lead to higher adult HA uptake.

Although prior studies have observed differences in HA use in children vs adults,[23] this is the first to focus on borderline/mild HL and to do so in a national population. Age quartiles were chosen as opposed to a child/adult distinction in part due to low numbers of participants in NHANES aged <18 years with HL. Using the lower quartile (<25 years) allowed additional power. Quartiles also allow comparison across the life span, whereas age <18 vs ≥18 groups all adults as one. Under the Affordable Care Act, US health insurance companies cover dependents under their parents' plans until age 26 years[24]; thus, dependents would likely not stop using HAs through ages 18 to 25 due to insurance.

Study limitations include reporting bias, present in any survey-based study. Future studies should include granular usage information (eg, hours/day), although this would still include reporting bias, unless measured objectively.[25] NHANES queried usage frequency differently across cycles, prohibiting inclusion of these data in this analysis. Additionally, analyses with more pediatric participants would allow finer age categorization.

Conclusion

Treatment of borderline/mild HL with HAs is 4 to 5 times lower in all upper age quartiles vs <25 years. This glaring age-related treatment disparity warrants further investigation into possible causes and solutions.

Author Contributions

Maeher Grewal, project design, data analysis, and primary manuscript author; **Jacqueline Dragon**, data analysis and manuscript editing; **Justin S. Golub**, project design, data analysis, and manuscript editing.

Disclosures

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