

Hearing Aid Adoption among Old Adults Diagnosed with Presbycusis

Anna Pamela C. Dela Cruz, MD, Kimberly Mae C. Ong, MD, Cesar Vincent L. Villafuerte III, MD, Maria Luz M. San Agustin, RN, MCLinAud and Maria Rina T. Reyes-Quintos, MD, MCLinAud, PhD

*Philippine National Ear Institute, National Institutes of Health, University of the Philippines Manila
Department of Otolaryngology-Head and Neck Surgery, Philippine General Hospital, University of the Philippines Manila*

ABSTRACT

Objectives. Presbycusis or age-related hearing loss is one of the most common health conditions among old adults. This study aimed to investigate the hearing aid adoption and hearing handicap among old adults diagnosed with presbycusis.

Methods. A cross-sectional study on patients aged 60 years old and above diagnosed with presbycusis who were candidates for hearing aid fitting based on audiometry was done. Audiometry results were reviewed from the records of the PGH - Ear Unit and nearby hearing centers in Manila from January 2022 to June 2024. Those meeting the inclusion criteria were invited to answer a questionnaire through a telephone survey and a total of 51 participated in the study. Respondents were asked questions regarding hearing aid adoption and were requested to answer the screening version of the Hearing Handicap Inventory for the Elderly (HHIE-S) translated in Filipino to determine the degree of self-perceived hearing handicap.

Results. A total of 51 respondents participated in this study, with a mean (SD) age of 72.02 (8.3) years. For the pure tone audiometry results, the median (IQR) was 57 dB (51.7 to 68.3) on the right ear and 63.3 dB (49.2 to 68.3) on the left ear. The median (IQR) speech discrimination score was 80% (64 to 88) on the right ear and 76% (60 to 84) on the left ear. About 84.31% of respondents, both for those with and without hearing aids, reported mild to severe handicap based on the HHIE-S score. Only 37.25% of respondents were able to acquire hearing aids with a median (IQR) interval from disposition to acquisition and hearing aid use of six (2.5 to 13) months. Two-thirds of the participants (62.75%) who were advised hearing aid use were unable to acquire and use hearing aids. The majority of responses were that hearing aids were expensive followed by no funds or inadequate funds to buy one.

Conclusion. Hearing aid adoption remains to be low among old adults diagnosed with presbycusis and a major reason for non-adoption is due to socioeconomic costs. Majority of old adults in the study had hearing handicap based on the HHIE-S questionnaire. Further studies locally on hearing aid adoption in this population is recommended.

Keywords: age-related hearing loss, presbycusis, old adults, elderly, hearing aid

INTRODUCTION

According to the World Health Organization (WHO), about 430 million people worldwide have disabling hearing loss, with increasing prevalence with advancing age. Among those older than 60 years old, 25% were reported to have disabling hearing loss.¹ Over time, the number and proportion of people aged 60 years and older is increasing and is expected to rise to 1.4 billion in 2030 and to almost double to 2.1 billion by 2050.² In the Philippines, people aged 60 years and above made up 8.5% of the population or about 9.22 million individuals according to the Philippine Statistics Authority - 2020 Census of Population and Housing.³ It is important to recognize this shift in distribution in the population and

Corresponding author: Anna Pamela C. Dela Cruz, MD
Philippine National Ear Institute
National Institutes of Health
University of the Philippines Manila
623 Pedro Gil St., Ermita, Manila 1000, Philippines
Email: acdelacruz14@up.edu.ph
ORCID: <https://orcid.org/0000-0002-1858-4265>

address one of the common health conditions that occur in this age group, which is hearing loss. Presbycusis, also known as age-related hearing loss, is a gradual, progressive, irreversible, bilateral sensorineural hearing loss which occurs due to aging.⁴

Several studies have been published regarding the impact of hearing loss in old adults, with recognition of age-related hearing loss as a risk factor for cognitive decline, cognitive impairment, and dementia.^{5,6} It also affects the emotional and social aspect of the individual, resulting in loneliness, isolation, and depression.⁷

Primary management of presbycusis is through amplification of sound with assistive devices such as hearing aids. Hearing aid use has been shown to lower the hazards of cognitive decline and to be associated with lower dementia prevalence.^{6,8} These findings led to development of health policies towards improving hearing care access and making hearing aids more affordable.⁶ Despite its known benefits, hearing aid adoption has been a concern, with a worldwide hearing aid coverage of only 10% to 11%.⁹ This value is much lower in the Sub-Saharan Africa, South Asia, East Asia, and Southeast Asia regions with a coverage of only 1% and 5%.⁹

In countries such as the US, health policies such as the Over-the-Counter Hearing Aid Act of 2017 have been put forward to reduce the cost of hearing aids, thereby improving access for many patients with hearing loss.¹⁰ Locally, the Philippine Health Insurance Corporation (PhilHealth) has approved the “Z Benefits for Children with Hearing Impairment” since 2018, covering services from assessment, provision of appropriate devices such as hearing aids and rehabilitation.¹¹ However, this package is limited to patients less than 18 years of age. There is a lack of similar programs for old adults with hearing loss in the country. As stated on the National Unified Health Research Agenda (NUHRA) for 2023-2028, health of vulnerable populations including geriatric health is one of the priorities that need to be addressed.¹²

This study aimed to determine the prevalence and reasons for hearing aid adoption among old adult patients aged 60 years old and above diagnosed with presbycusis and describe the hearing handicap of these patients using the Hearing Handicap Inventory for the Elderly (HHIE-S).

Review of Related Literature

Presbycusis, also referred to as age-related hearing loss, is one of the most common conditions prevalent among the old adults. It is described as a gradual, progressive, irreversible, and bilateral sensorineural hearing loss resulting either from degeneration of the cochlea or loss of auditory nerve fibers during cochlear aging.^{4,13} It usually starts at the high-frequency region of the hearing spectrum and is initially evident at 60 years of age for most people.⁴ It may progress to involve midrange and lower frequencies over time.¹³ According to the WHO, about 430 million people worldwide have hearing loss, with increasing prevalence

with advancing age. Among those older than 60 years old, about 25% have disabling hearing loss. Most countries are experiencing an increase in the proportion of older persons, and it is estimated that between 2015 to 2050 the world's population with people over 60 years old will nearly double from 12% to 22%.² With this, a similar increase in prevalence of presbycusis will have to be addressed.

Studies on the impact of hearing loss among old adults have been widely published. Dementia has been reported to be higher among patients with moderate to severe hearing loss compared to those with normal hearing.⁶ Prevalence of dementia also increased with increasing severity of hearing loss.^{6,14} Aside from dementia and cognitive impairment, several studies have reported the effect of hearing loss on the mental health and quality of life among elderly patients. Elderly individuals with hearing loss have been found to have higher levels of depression based on the geriatric depression scale compared to those with normal hearing.¹³ A greater self-perceived hearing handicap based on the HHIE-S screening was also reported to be associated with depressive symptoms and poorer health-related quality of life.⁷ Hearing loss may also affect socialization thereby leading to feelings of loneliness and social isolation.¹³

Amplification with hearing aids has been the primary management for presbycusis. Studies show that among patients with moderate to severe hearing loss, hearing aid use was associated with lower dementia prevalence compared to those who do not use hearing aids.⁶ A meta-analysis of longitudinal association of hearing aid use also showed significantly lower hazards of cognitive decline among hearing aid users, with about 19% reduction compared to those with uncorrected hearing loss. Additionally, hearing aid use improved the cognitive test scores assessing general cognition of patients.⁸

Despite the known benefits of hearing aids for patients with hearing loss, hearing aid adoption has been low. In a longitudinal study by Simpson et al, the mean time from hearing aid candidacy to hearing aid adoption was 8.9 years.¹⁵ As low-frequency pure tone audiometry (PTA) (0.25, 0.5, 1.0 kHz) increased to more than 30 dB, hearing aid adoption shortens in time to 4.3 years. Also, as high-frequency PTA (2.0, 3.0, 4.0, 6.0, 8.0 kHz) increased, hearing aid adoption shortens in time to 6.8 years (high-frequency PTAs between 55 and 65 dB HL) and 5.9 years (high-frequency PTAs >65 dB HL).¹⁵ Also, as the self-reported HHIE score increased indicating more handicap, there was an observed decrease in time to hearing aid adoption.¹⁵ Accessibility has also been an issue and one of the cited reasons for non-adoption is that patients cannot afford the cost of hearing aids (27%)¹⁶, aside from self-perception that the patient can hear well enough. This study by Cho et al. in Korea also mentioned that those who received a 3rd party reimbursement were 19.44 times more likely to purchase hearing aids compared to those who received no reimbursement, showing an increase in hearing aid adoption if provided with insurance coverage.¹⁶

Similarly, in a systematic review done by Knoetze et al., four studies reported that people were more likely to adopt hearing aids if they applied for subsidized hearing services, received government assistance, had a senior mobility fund, or had health insurance.¹⁷

Bisgaard et al. computed the worldwide hearing aid coverage based on the global prevalence of hearing loss (moderate, moderately severe, severe) and data from worldwide hearing aid sales from 2009-2018. Coverage was computed as the ratio of hearing aid users to people with hearing loss. Results of their study showed that the worldwide hearing coverage is only 10-11%. There are noted major differences in coverage between the regions ranging from 1% in Sub-Saharan Africa to 57% in the high-income regions (North America and Western Europe). The regions of Central/Eastern Europe Central Asia, Middle East and North Africa, Latin America/Caribbean have coverage of 10%-12% while the Sub-Saharan Africa, South Asia, East Asia, and Southeast Asia regions have coverage between 1% and 5%.⁹

METHODS

Study Design

This was a cross-sectional study on patients aged 60 years old and above diagnosed with presbycusis who were candidates for hearing aid fitting based on audiometry done from January 2022 to June 2024. This was a multicenter study which included Philippine General Hospital - Ear Unit and nearby hearing centers in Manila. The sample size computed for this study was between 16 to 73, based on a hearing aid coverage prevalence of 1 to 5 %⁹ in Southeast Asia, with a 95% confidence interval and a 5% margin of error (OpenEpi, version 3).

Inclusion criteria were as follows: 1) patients aged 60 years old and above, 2) those with audiometry results showing bilateral sensorineural hearing loss, with at least one ear with a degree of hearing loss ranging from moderate to severe (moderate HL = 41-55 dB, moderate to severe HL = 56-70 dB, severe HL= 71-90 dB) based on pure tone averages at 0.5, 1.0, and 2.0 kHz and with at least one ear with a speech discrimination score of $\geq 50\%$, 3) those with disposition or recommendation to have hearing aid fitting following the audiometry test.

Patients excluded from the study were as follows: 1) patients less than 60 years of age, 2) those with audiometry results showing conductive hearing loss or mixed hearing loss, 3) those with unilateral sensorineural hearing loss, and 4) those with history of otologic disease such as chronic suppurative otitis media.

Study Procedure

Audiometry results were reviewed from the records of the PGH - Ear Unit and nearby hearing centers in Manila from January 2022 to June 2024. Those meeting the inclusion criteria were invited to answer a questionnaire through a

telephone survey. Demographic data such as age, sex, and highest educational attainment were obtained. Participants were then asked specific questions pertaining to hearing aids. They were inquired whether they were able to acquire and use hearing aid/s following the diagnosis of presbycusis. For those who were able to acquire hearing aid/s, the date of acquisition was asked. The source of funding in acquiring hearing aid/s, interval from hearing aid candidacy (based on disposition of hearing aid fitting) to hearing aid adoption (based on actual use of hearing aid/s) was also determined. If they were not able to acquire and use hearing aid/s, participants were instructed to enumerate the reasons.

Participants were also asked to answer the screening version of the HHIE-S translated in Filipino¹⁸, a 10-item questionnaire to assess the emotional and social effects of hearing impairment. Each item has three responses with a corresponding score (yes = 4, sometimes = 2, no = 0). The total score was used to determine the degree of self-perceived hearing handicap: Score of 0 to 8 indicated no self-perceived hearing handicap, 10 to 24 indicated mild to moderate handicap, and 26 to 40 meant severe handicap.

Data Collection and Data Analysis

Demographic data such as age, sex, and educational status were obtained. Clinical data on severity of hearing loss and hearing aid adoption were tabulated. The HHIE-S score for each subject was determined and tabulated based on the degree of self-perceived hearing handicap. Descriptive statistics were calculated using Microsoft Excel and presented as frequencies and percentages.

RESULTS

Out of the 270 subjects called to participate in the telephone survey, only 51 responded, with a mean (SD) age of 72.02 (8.3) years. Most participants were female, comprising about 56.86% of respondents compared to males comprising 43.14%. There were almost equal percentages of participants whose highest educational attainment were high school and college, with 35.30% and 37.25%, respectively. For the pure tone audiometry results, the median (IQR) was 57 dB (51.7 to 68.3) on the right ear and 63.3 dB (49.2 to 68.3) on the left ear. The median (IQR) speech discrimination score was 80% (64 to 88) on the right ear and 76% (60 to 84) on the left ear. For the HHIE-S questionnaire, scores showed that almost half of the respondents had mild to moderate handicap (47.06%), about one third had severe handicap (37.25%), and only 15.69% had no handicap. The mean HHIE-S score overall was 21.84 (Table 1).

Almost two-thirds of the participants (62.75%) who were advised hearing aid use were unable to acquire and use hearing aids. The most common reason for this was financial—hearing aids were found to be expensive and participants either had no funds or had inadequate funds to buy one. Only one answered the reason being able to still hear and understand

clearly (Table 2). Meanwhile, only 19 of the 51 respondents (37.25%) were able to avail and use hearing aids. The median (IQR) interval from disposition or advice of physician on hearing aid fitting to acquisition and hearing aid use was about six (2.5 to 13) months. Of those participants who had hearing aids, about 63.16% were able to acquire two hearing aids, while 36.84% were only able to acquire one hearing aid. The most common reason cited for acquiring just one hearing aid was funding issues. One respondent answered that the other ear can still hear well and another answered that sound becomes too loud with two hearing aids during fitting. When asked regarding the source of funding in acquiring hearing aids, 78.95% (15/19) answered out of pocket funding to pay for the hearing aids, either from personal funds or provided by their family members. Other respondents answered that it was subsidized by a government agency such as the Department of Social Welfare and Development (DSWD) (15.79%), and one participant answered that it was subsidized by the employer (5.26%).

Pure tone audiometry values only had slight differences between those with hearing aids and without hearing aids. For the speech discrimination scores, those who were unable to acquire hearing aids had higher percentages compared to those with hearing aids, but the difference was only within 5 to 10% (Table 3).

HHIE-S mean scores for those with hearing aids was only slightly higher at 22.21 compared to those without hearing aids at 21.63 or a difference of just 0.58. About more than 80% of respondents, both for those with and without hearing aids, reported mild to severe handicap based on the HHIE-S score. On further evaluation of the HHIE-S score and mean interval of hearing adoption, results showed the shortest mean interval for those with no handicap was 3.33 months and the longest mean interval for those with severe handicap was 33.25 months (Table 3).

DISCUSSION

Presbycusis is one of the common conditions affecting the health and overall quality of life of old adults. Studies have shown that addressing hearing loss with assistive devices such as hearing aids can lower the risk of cognitive impairment, dementia as well as depression.^{6,7,13,14} This study investigated the rate of hearing aid adoption among old adults diagnosed with presbycusis, and results showed a hearing aid adoption of about 36.54% among respondents, higher relative to the reported hearing aid coverage in Southeast Asia which was just between 1% to 5%.⁹ However, this rate is still lower compared to the high-income regions (North America and Western Europe) with a 57% hearing aid coverage.⁹

For those who acquired hearing aids, not everyone was fitted with two hearing aids, primarily because of insufficient funds. Evident also from the answers provided by the respondents who did not acquire hearing aids is the difficulty of procuring one, again due to funding issues. This

Table 1. Demographic and Clinical Data among Old Adults Aged 60 Years Old and above Diagnosed to have Presbycusis (N=51)

Variable	n (%)
Age [mean (SD) in years]	72.02 (8.3)
Sex	
Male	22 (43.14%)
Female	29 (56.86%)
Highest Educational Attainment	
Elementary undergraduate	2 (3.92%)
Elementary	9 (17.65%)
High School	18 (35.30%)
Vocational	2 (3.92%)
College	19 (37.25%)
Postgraduate	1 (1.96%)
Pure tone audiometry average [PTA, median (IQR) in dB]	
Right	57.0 (51.7 to 68.3)
Left	63.3 (49.2 to 68.3)
Speech discrimination score average [SDS, median (IQR) in %]	
Right	80 (64 to 88)
Left	76 (60 to 84)
Degree of self-perceived hearing handicap based on HHIE-S score	
No handicap	8 (15.69%)
Mild to moderate handicap	24 (47.06%)
Severe handicap	19 (37.25%)

Table 2. Hearing Aid Adoption among Patients Diagnosed with Presbycusis (N=51)

Hearing Aid Adoption	n (%)
Participants with Hearing Aid/s (n=19)	
Interval from disposition of hearing aid fitting to hearing aid acquisition and use [median (IQR) in months]	6 (2.5 to 13)
Number of hearing aids acquired	
Two	12 (63.16%)
One	7 (36.84%)
Reasons if with only one hearing aid:	
Funding issue	5 (71.44%)
Other ear is able to hear well	1 (14.28%)
Sound too loud with two hearing aids	1 (14.28%)
Source of funding for hearing aid/s (n=19)	
Self-funded	7 (36.84%)
Funds provided by family members	8 (42.11%)
Subsidized by a government agency (e.g., DSWD)	3 (15.79%)
Subsidized by employer	1 (5.26%)
Participants without Hearing Aid/s (n=32)	
Reasons for not acquiring hearing aid/s (cite as many reasons)	
Expensive	22 (66.67%)
No funds/inadequate funds to buy hearing aid	12 (36.36%)
Still able to hear and understand clearly	1 (3.03%)

Table 3. Comparison of Audiometric Findings and Self-perceived Hearing Handicap between those Able and Unable to Acquire Hearing Aids

	Able to Acquire Hearing Aids (N=19)	Unable to Acquire Hearing Aids (N=32)
PTA, in dB [median (IQR)]		
Right	60 (53.5 to 65.84)	56.84 (51.25 to 68.3)
Left	63.33 (58.33 to 67.67)	63.33 (44.58 to 68.33)
SDS, in % [median (IQR)]		
Right	76 (62 to 86)	82 (67 to 92)
Left	68 (52 to 76)	77 (62.25 to 88)
HHIE-S score, mean (SD)	22.21 (11.45)	21.63 (9.62)
Degree of self-perceived hearing handicap based on HHIE-S score		
No handicap	3 (15.8%)	5 (15.6%)
Mild to moderate handicap	8 (42.1%)	16 (50.0%)
Severe handicap	8 (42.1%)	11 (34.4%)
Mean (SD) interval of hearing aid adoption (in months) according to degree of self-perceived handicap		
No handicap	3.33 (4.16)	
Mild to moderate handicap	18.25 (3.61)	
Severe handicap	33.25 (3.01)	N/A

is consistent with other studies showing accessibility as an issue and one of the reasons mentioned for non-adoption is that patients cannot afford the cost of hearing aids.¹⁶ In this study, only three patients received a subsidy from the government (from DSWD) to fund acquisition of hearing aids. In other countries, certain programs and policies have been put forward to increase hearing aid coverage and access to hearing aids such as the Over-the-Counter Hearing Aid Act of 2017 in the US.¹⁰ There is an existing program in the country to address provision of appropriate devices such as hearing aids and rehabilitation for the hearing impaired approved by Philhealth. However, this benefit is limited to children less than 18 years of age.¹¹ This limitation in coverage further highlights the need for health programs to address problems such as hearing loss among old adults. In a systematic review by Knoetze et al., it was reported that people were more likely to adopt hearing aids if there are subsidized hearing services, government assistance, a senior mobility fund, or health insurance.¹⁷ This emphasizes the role that the government must play in supporting the health and well-being of all individuals and ensuring access to health services. Creating such programs for old adults or the elderly will reduce the financial burden to them, as well as their family. As shown in this study, most funding for hearing aids was provided by a family member.

In this study, 84.31% of the respondents have hearing handicap, ranging from mild to severe based on the 10-item HHIE-S translated in Filipino, a questionnaire used to assess the emotional and social effects of hearing impairment.¹⁸ There was only a very slight difference in HHIE-S scores between respondents who were able to acquire versus those who were unable to acquire hearing aids. However, of particular note in this study is that those who had more severe handicap had the longest average interval to hearing aid adoption compared to those who reported no handicap which

had the shortest interval from disposition to acquisition of hearing aids. This is in contrast to the study of Simpson et al. which showed that among those with self-reported HHIE scores indicating more handicap, there was an observed decrease in time to hearing aid adoption.¹⁵ This contrast might be driven by socioeconomic status. In this study, a good portion of those with severe handicap do not have educational attainment higher than high school, which can be reflective of lower income status, and therefore a decreased capacity to purchase hearing aids. This observation was also reported in the study of Weycker et al. in which higher education, a measure of socioeconomic status, was related to increased likelihood of hearing aid adoption.¹⁹

Though the study showed a higher hearing adoption rate among old adults compared to what is published for the Southeast Asian region (1-5%)⁹, the results cannot be generalized as the study site was limited only in Manila, an urban area in the country. In addition, due to the nature of the current Philippine healthcare system where audiologic testing is generally performed only on patients who seek medical consultation for hearing symptoms, recruitment of participants through hearing centers created a selection bias since these participants may be more motivated to address their hearing loss to begin with. Furthermore, less than 20% of the eligible patients responded to our calls, which could have further contributed to the bias. Thus, a higher sample size with recruitment at the community level would be recommended to be reflective of hearing aid adoption nationwide.

CONCLUSION

Hearing aid adoption remains to be low among old adults diagnosed with presbycusis and a major reason for non-adoption is due to socioeconomic costs. Majority of old adults in the study had hearing handicap based on the

HHIE-S questionnaire. Further studies locally on hearing aid adoption in this population is recommended.

Acknowledgments

The authors would like to acknowledge Ms. Angiela Marie G. Capispisan of PGH-Ear Unit, Ms. Abigail G. Juanga of Manila Hearing Aid, and Ms. Ruby M. Diosalan of Ear Diagnostics, for assisting the investigators during the conduct of the telephone survey.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

All authors declared no conflicts of interest.

Funding Source

None.

REFERENCES

- Deafness and Hearing Loss. [Internet]. 2025 [cited 2025 April]. Available from: <https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss>
- Ageing and Health. [Internet]. 2024 [cited 2025 April]. Available from: <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>
- Age and Sex Distribution in the Philippine Population (2020 Census of Population and Housing). [Internet]. 2022 [cited 2025 April]. Available from: <https://www.psa.gov.ph/content/age-and-sex-distribution-philippine-population-2020-census-population-and-housing>
- Wang J, Puel JL. Presbycusis: An Update on Cochlear Mechanisms and Therapies. *J Clin Med*. 2020 Jan 14;9(1):218. doi: 10.3390/jcm9010218. PMID: 31947524; PMCID: PMC7019248.
- Loughrey DG, Kelly ME, Kelley GA, Brennan S, Lawlor BA. Association of Age-Related Hearing Loss with Cognitive Function, Cognitive Impairment, and Dementia: A Systematic Review and Meta-analysis. *JAMA Otolaryngol Head Neck Surg*. 2018 Feb 1; 144(2):115-126. doi: 10.1001/jamaoto.2017.2513. Erratum in: *JAMA Otolaryngol Head Neck Surg*. 2018 Feb 1;144(2):176. doi: 10.1001/jamaoto.2017.3219. PMID: 29222544; PMCID: PMC5824986.
- Huang AR, Jiang K, Lin FR, Deal JA, Reed NS. Hearing Loss and Dementia Prevalence in Older Adults in the US. *JAMA*. 2023 Jan 10;329(2):171-173. doi: 10.1001/jama.2022.20954. PMID: 36625819. PMCID: PMC9856835.
- Huang AR, Reed NS, Deal JA, Arnold M, Burgard S, Chisolm T, et al. Depression and Health-Related Quality of Life Among Older Adults with Hearing Loss in the ACHIEVE Study. *J Appl Gerontol*. 2024 May;43(5):550-561. doi: 10.1177/07334648231212291
- Yeo BSY, Song HJJMD, Toh EMS, Ng LS, Ho CSH, Ho R, et al. Association of Hearing Aids and Cochlear Implants With Cognitive Decline and Dementia: A Systematic Review and Meta-analysis. *JAMA Neurol*. 2023 Feb 1;80(2):134-141. doi: 10.1001/jamaneurol.2022.4427. PMID: 36469314; PMCID: PMC9856596.
- Bisgaard N, Zimmer S, Laureyns M, Groth J. A model for estimating hearing aid coverage world-wide using historical data on hearing aid sales. *Int J Audiol*. 2022 Oct;61(10):841-849. doi: 10.1080/14992027.2021.1962551. PMID: 34428121.
- FDA Issues Landmark Proposal to Improve Access to Hearing Aid Technology for Millions of Americans. [Internet]. 2021 [cited 2025 April]. Available from: <https://www.fda.gov/news-events/press-announcements/fda-issues-landmark-proposal-improve-access-hearing-aid-technology-millions-americans>
- Z Benefits for Children with Hearing Impairment. [Internet]. 2018 [cited 2025 April]. Available from: <https://www.philhealth.gov.ph/circulars/2018/circ2018-0011.pdf>
- National Unified Health Research Agenda (NUHRA) 2023-2028. [Internet]. 2023 [cited 2025 April]. Available from: <https://www.healthresearch.ph/index.php/nuhra>
- Sharma RK, Chern A, Golub JS. Age-Related Hearing Loss and the Development of Cognitive Impairment and Late-Life Depression: A Scoping Overview. *Semin Hear*. 2021 Feb;42(1):10-25. doi: 10.1055/s-0041-1725997. PMID: 33883788. PMCID: PMC8050418.
- Smith JR, Huang AR, Lin FR, Reed NS, Deal JA. The Population Attributable Fraction of Dementia From Audiometric Hearing Loss Among a Nationally Representative Sample of Community-Dwelling Older Adults. *J Gerontol A Biol Sci Med Sci*. 2023 Jul 8; 78(7):1300-1306. doi: 10.1093/gerona/glad117. PMID: 37139951. PMCID: PMC10329222.
- Simpson AN, Matthews LJ, Cassarly C, Dubno JR. Time from Hearing Aid Candidacy to Hearing Aid Adoption: A Longitudinal Cohort Study. *Ear Hear*. 2019 May/June;40(3):468-476. doi: 10.1097/AUD.0000000000000641. PMID: 30085938. PMCID: PMC6363915.
- Cho YS, Kim GY, Choi JH, Baek SS, Seol HY, Lim J, et al. Factors Influencing Hearing Aid Adoption in Patients with Hearing Loss in Korea. *J Korean Med Sci*. 2022 Jan 10;37(2):e11. doi: 10.3346/jkms.2022.37.e11. PMID: 35014225; PMCID: PMC8748670.
- Knoetze M, Manchaiah V, Mothemela B, Swanepoel W. Factors Influencing Hearing Help-Seeking and Hearing Aid Uptake in Adults: A Systematic Review of the Past Decade. *Trends Hear*. 2023 Jan-Dec; 27:23312165231157255. doi: 10.1177/23312165231157255. PMID: 36798964; PMCID: PMC9940236.
- Sjahalam-King J, Newall J. Measuring hearing handicap for hearing impaired adults in the Philippines: A profound conundrum. *Speech, Language and Hearing* 2016; 19(4), 238-246. doi:10.1080/2050571X.2016.1213008
- Weycker JM, Dillard LK, Pinto A, Fischer ME, Cruickshanks KJ, Tweed TS. Factors Affecting Hearing Aid Adoption by Adults with High-Frequency Hearing Loss: The Beaver Dam Offspring Study. *Am J Audiol*. 2021 Dec 9;30(4):1067-1075. doi: 10.1044/2021_AJA-21-00050. PMID: 34731581. PMCID: PMC9126121.