



ST. PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE
DEPARTMENT OF OTORHINOLARYNGOLOGY-HEAD
AND NECK SURGERY

Gender Disparity in Hearing Loss in the Adult Population in
Ethiopia: Evidence from the National Hearing Survey

By: Hikma Amin Aliye (MD, ORL-HNS Resident)

March, 2026

Addis Ababa, Ethiopia

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Abbreviations and Acronyms

CSOM	Chronic Suppurative Otitis Media
dB	Decibel
HFHL	Higher High-frequency Hearing Loss
LMICs	Low- and Middle-Income Countries
NHANES	National Health and Nutrition Examination Survey
NHSE	National Hearing Survey of Ethiopia
PTA	Pure-Tone Average
SES	Socioeconomic Status
SNHL	Sensorineural Hearing Loss
SPHMMC	St. Paul's Hospital Millennium Medical College
SPSS	Statistical Package for Social Sciences
WHO	World Health Organization

Abstract

Background: Hearing loss is a major global public health challenge affecting over 1.5 billion people, with significant gender disparities in prevalence, severity, and risk factors influenced by occupational, behavioral, and sociocultural exposures. In Ethiopia, where hearing loss burdens aging populations and underserved communities, nationwide evidence on gender disparities remains limited, necessitating targeted evaluation for equitable policy.

Objective: To assess gender disparities in hearing loss among the adult population in Ethiopia using data from the National Hearing Survey, Ethiopia.

Methods: This retrospective secondary data analysis included all eligible adults from the National Hearing Survey of Ethiopia (NHSE) dataset (2023) who resided in Ethiopia and had complete objective audiometric data. Hearing loss was defined as pure-tone average (PTA) >20 dB in the better ear (0.5, 1, 2, 4 kHz), graded per WHO as mild (21–40 dB), moderate (41–60 dB), severe (61–80 dB), or profound (>80 dB). Data cleaning involved checks for completeness and outliers using IBM SPSS Statistics version 27. Descriptive statistics assessed disparities; bivariable/multivariable logistic regression were used to generate odds ratios (95% CI) to capture associated factors. A $p < 0.05$ was deemed statistically significant.

Results: A total of 4,876 adults were analyzed, of whom males constituted 36.2% ($n=1,765$). Participants' age ranged from 18 to >100 years with a median (interquartile range) of 34 (26–45) years. Hearing loss prevalence was significantly higher in males (27.5%, $n=485$) than females (21.9%, $n=682$; $p < 0.001$), with males showing greater severity across all grades and higher presbycusis rates (42.1% vs. 33.6%). Independent factors associated with hearing loss included age >60 years (AOR=4.67, 95% CI 2.50–8.70), lower education levels (no formal: AOR=2.58, 95% CI 1.20–5.51; primary: AOR=2.21, 95% CI 1.05–4.64; secondary: AOR=2.72, 95% CI 1.20–6.21), and chronic suppurative otitis media (AOR=4.67, 95% CI 2.30–9.47).

Conclusions: This first NHSE gender analysis reveals male predominance in hearing loss (27.5% vs. 21.9%). Age >60 years, lower educational attainment, and chronic suppurative otitis media independently drive hearing impairment, informing targeted screening and CSOM management to advance SDG 3 and 10. To our knowledge, this provides Ethiopia's first nationally representative evidence of gender disparities from population-based audiometric data.

Keywords: Gender disparity, Hearing loss, NHSE, Ethiopia

1. Introduction

1.1 Background

The ear's primary function is hearing, enabling sound detection and processing. Impairment of this vital function is known as hearing loss. Technically, hearing loss is defined as pure-tone average (PTA) >25 dB in the better ear (0.5, 1, 2, 4 kHz). It arises from diverse etiologies, including noise exposure, infections, aging, ototoxic drugs, and genetic factors. It manifests as conductive, sensorineural, or mixed types (1,2). The World Health Organization (WHO) classifies it as mild (26–40 dB), moderate (41–60 dB), severe (61–80 dB), or profound (>80 dB) (3,4).

Affecting 1.5 billion people globally, hearing loss ranks among the most prevalent sensory impairments worldwide. It is a major global public health challenge, with 430 million experiencing disabling hearing loss. The WHO projects this burden to rise to 2.45 billion by 2050, driven by aging populations, ototoxic medications, noise exposure, and chronic diseases. In low- and middle-income countries (LMICs) such as those in sub-Saharan Africa, prevalence is exacerbated by limited access to screening, rehabilitation, and ear care services (5,6).

Generally, epidemiological data reveal gender disparities in hearing loss (7,8). Globally, age-standardized prevalence is significantly higher in males than females, primarily attributed to occupational noise exposure, smoking, and elevated cardiovascular comorbidity rates (9). On the other hand, in LMICs, where women face disproportionate household noise exposure, aural infections, and healthcare barriers, these patterns may reverse or become distorted (10,11). Parallel to the prevalence patterns, severity varies by gender; men often present with noise-induced thresholds shifts, while women show higher rates of presbycusis in later life (12).

In Ethiopia, hearing loss affects an estimated 18% of adults, with national surveys indicating urban-rural disparities alongside associations with clinical factors such as diabetes, hypertension, and otitis media (13). Yet, gender-specific data remain scarce. Preliminary studies from Addis Ababa report higher moderate-to-severe hearing loss in elderly women. The absence of nationwide, representative evidence hinders targeted interventions, especially amid Ethiopia's demographic transition toward an aging population (14).

Population-based surveys are essential for accurate assessment and targeted management. The National Hearing Survey of Ethiopia (NHSE) offers a standardized, representative dataset to address this gap.

1.2 Statement of the problem

Hearing loss represents a major global health concern due to its substantial impact on communication, quality of life, mental health, and economic productivity (15–17). Globally, it contributes significantly to the global burden of disease by ranking as the third leading cause of years lived with disability (YLDs) and the largest potentially modifiable risk factor for dementia in mid-to-late life (6,18,19). In sub-Saharan Africa, the burden is exacerbated by limited screening practices, rehabilitation services, higher prevalence of infectious diseases, and noise exposure, which collectively complicate early detection and intervention (20).

Ethiopia faces similar challenges, with hearing loss affecting an estimated nearly-one-fifth of adults amid aging demographics and high rates of otitis media, immunocompromising diseases, and occupational hazards (13). However, gender-specific prevalence, severity, and risk factors remain underreported due to inadequate national data and weak surveillance systems. Underappreciated gender disparities can perpetuate inequities in healthcare access, increase disability-adjusted life years (DALYs), and strain limited resources, particularly for women facing household exposures and men with occupational risks (21).

Although national surveys like the NHSE provide population-based audiometric data, gender-disaggregated analyses are scarce, limiting targeted interventions. Secondary analyses of such datasets, while cost-effective, require robust evidence on disparity patterns to guide policy, unlike smaller clinic-based studies that lack representativeness.

Despite WHO support to Ethiopia for improving hearing health, which is directly aligned with Sustainable Development Goal 3 (Good Health and Well-being) and Goal 10 (Reduced Inequalities), evidence on gender disparities from nationwide survey data remains limited. This gap hinders evidence-based public health strategies, equitable resource allocation, and development of targeted interventions within Ethiopia's resource-constrained healthcare infrastructure.

Therefore, this study aims to assess gender disparities in hearing loss prevalence, severity, and determinants using secondary data from the NHSE among adults in Ethiopia, thereby

helping to inform targeted screening, gender-specific interventions, and national policy to address this public health challenge.

1.3 Significance of the study

The findings obtained from this study are expected to provide evidence-based insights to strengthen targeted screening, equity-focused interventions, and public health policy in the Ethiopian healthcare setting. Moreover, this study aims to fill an important gap in the literature on gender disparities in hearing loss prevalence, severity, and determinants, particularly using nationwide survey data from the NHSE where such analyses are scarce. It will equip local clinicians, including primary care practitioners, public health specialists, and audiologists, with practical data on gender-specific patterns to guide risk stratification, early detection, and rehabilitation planning. Additionally, the findings will assist healthcare policymakers and institutional leaders in updating screening protocols, integrating gender considerations into national ear health programs, and prioritizing interventions aligned with Sustainable Development Goals 3 and 10. Finally, for future researchers, this study is hoped to lay a foundation for exploring interaction effects on hearing loss disparities in such low-resource settings.

2. Literature review

2.1 Prevalence of hearing loss in adult males and females

Global epidemiological studies consistently demonstrate higher age-standardized prevalence of hearing loss in adult males compared to females. The Global Burden of Disease Study (1990-2019) reported moderate-to-severe hearing loss prevalence of 18.0% in males versus 11.7% in females among adults aged ≥ 30 years, with male predominance most pronounced in high-income regions due to occupational noise exposure (22).

A multi-country longitudinal study estimated the prevalence and male-to-female ratio of self-reported hearing loss and hearing aid use across 28 countries for the period 2001–2021. The analysis included 664,580 observations from individuals aged ≥ 50 years. The four countries with the highest hearing loss prevalence (China: 65%, South Korea: 39%, Mexico: 33%, Brazil: 31%) exhibited the lowest hearing aid use (as low as 1% in China). Males were more likely to report hearing loss than females in nearly all countries, particularly in regions with higher hearing aid utilization (USA, Northern/Western Europe); however, no gender differences were observed in China, South Korea, and South Africa. Both hearing loss prevalence and hearing aid use increased with age, with gender differences generally attenuating (7).

Country-specific findings reinforce these trends. In the United States, National Health and Nutrition Examination Survey (NHANES) data show 20.2% moderate-severe hearing loss in males versus 14.8% in females aged 50-69 years (23). European studies report similar disparities (males 22.4% vs. females 16.7%), attributed to cumulative occupational exposures (9).

In China, a cross-sectional study of 2,280 shipyard workers exposed to industrial noise (1,140 males and 1,140 females, matched for age, job type, and employment duration) reported significantly higher high-frequency hearing loss (HFHL) prevalence in males (34.4%) than females (13.8%) (24).

Another Chinese study that analyzed data from the National Health and Nutrition Examination Survey (2010-2011) involving 655 participants aged 60-69 years demonstrated that moderate-to-severe hearing loss was significantly associated with lower composite z-scores in males but not in females, indicating gender-specific differences in this association (8).

However, LMICs reveal context-specific reversals. Nigeria clinic data (n=498) revealed female predominance (70.9% of cases; male:female 1:2.4) in hearing loss, especially disabling loss (20), potentially linked to untreated infections and household biomass exposure. South Africa primary care clinics showed 17.5% overall prevalence of hearing impairment, with limited gender stratification (25).

2.2 Factors associated with hearing loss among adults

Various factors spanning sociodemographic, occupational, comorbidity, and regional domains have demonstrated consistent associations with hearing loss prevalence and severity among adults globally and in LMICs.

2.2.1 Sociodemographic Factors

Age represents the strongest determinant of hearing loss, with prevalence rising exponentially from 10-15% in adults aged 40-49 years to 60-80% by age 80 (22). Gender modifies this trajectory: males exhibit earlier onset due to cumulative occupational exposures, while females show accelerated age-related decline post-menopause linked to estrogen loss (8).

Notably, socioeconomic status (SES) inversely correlates with hearing loss prevalence (low SES), mediated through noise exposure, limited healthcare access, and chronic comorbidities (8,17,23). Urban residence associates with higher noise-induced loss, while rural adults face elevated risks from agricultural exposures and untreated infections (26).

2.2.2 Occupational and Environmental Exposures

Occupational noise exposure remains the leading modifiable risk factor, with odds ratios of for high-frequency hearing loss among industrial workers (24). Heavy machinery, construction, and agriculture elevate risks of hearing loss, disproportionately affecting males (26).

Household biomass fuel exposure has been also incriminated as a risk factor for hearing loss, with women experiencing higher odds due to cooking duties (26,27). Ototoxic medications (aminoglycosides, platinum-based chemotherapy) contribute to significant cases in resource-limited settings (28).

2.2.3 Clinical and Lifestyle Factors

Cardiovascular disease strongly predicts hearing loss, through microvascular damage to cochlear hair cells (29). Diabetes mellitus also increases the risk, particularly sensorineural hearing loss (SNHL), via neuropathy and hyperglycemia (30,31). Smoking accelerates loss across frequencies, with dose-response relationships (1,2,21). Moreover, otitis media sequelae has been observed to account for a quarter of adult hearing impairment in Africa,

with chronic suppurative cases yielding 10-15 dB permanent thresholds (1,20,32,33). Nutritional deficiencies (vitamin A, D) exacerbate risks in iodine-deficient regions (34). These factors contextualize the need for NHSE multivariate analysis to identify Ethiopia-specific predictors.

2.3 Conceptual framework

This conceptual framework was developed specifically for this study by the principal investigator through a review of related literature (2,7,8,17,35) around which the analysis revolves.

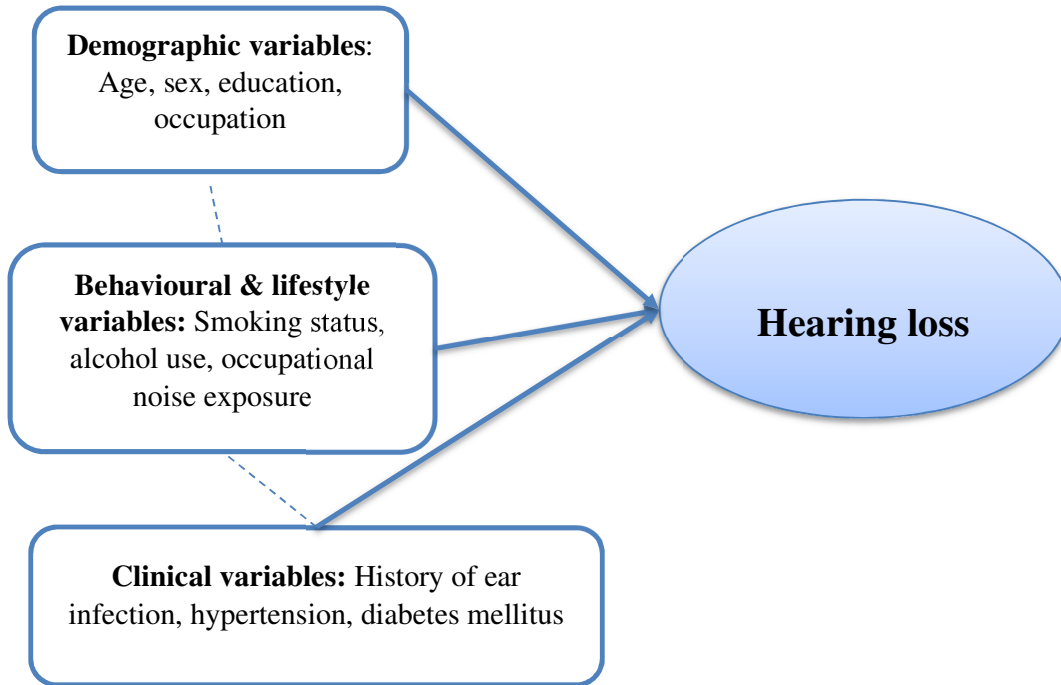


Figure 1. Conceptual framework for *factors associated with hearing loss* (Source: (2,7,8,17,35))

3. Objective of study

3.1 General objective

- To assess gender disparities in hearing loss among the adult population in Ethiopia using data from the National Hearing Survey, Ethiopia.

3.2 Specific objectives

- To determine the prevalence of hearing loss, to describe severity and type of hearing loss in adult males and females across Ethiopia
- To identify factors associated with hearing loss in Ethiopia

4. Methods and Materials

4.1 Study area

This study was conducted in Ethiopia using data extracted from the National Hearing Survey of Ethiopia (NHSE), a nationwide survey carried out in 2023 to assess the prevalence and determinants of hearing loss among adults. The NHSE provides a reliable dataset for secondary analysis.

4.2 Study period

The study period spans from September 1, 2025, through March 20, 2026.

4.3 Study design

A retrospective study design was employed, utilizing secondary data from the NHSE.

4.4 Population

4.4.1 Source population

The source population consisted of all adults (≥ 18 years) living in Ethiopia during the survey period.

4.4.1 Study population

All adults (men and women) included in the NHSE dataset who resided in Ethiopia and had complete hearing assessment data.

4.5 Eligibility criteria

4.5.1 Inclusion criteria

- Adults aged 18 years and older.
- Participants with complete demographic, clinical, and audiometric data.

4.5.2 Exclusion criteria

- Participants with incomplete or missing audiometric data.
- Individuals with congenital ear malformations or documented non-audiometric causes of hearing impairment.

4.6 Sample size determination

The sample size for this study was calculated using the single population proportion formula. Taking the prevalence of hearing loss among Ethiopian population from the WHO report (36)

and assuming 95% confidence level, 0.011% margin error and 10% nonresponse rate the sample size is estimated as follows:-

$$n = \frac{z^2 p(1 - p)}{e^2}$$

n = the required sample size

p = the expected prevalence of hearing loss (4.5%)

$Z_{\alpha/2}$ = the z-score for the desired confidence level at 95% confidence level = 1.96

e = the desired margin of error (precision) = 1.1% (0.011)

Accordingly,

$$n = \frac{(1.96)^2 * 0.045(1 - 0.045)}{0.011^2}$$

$$n = \frac{(1.96)^2 * 0.045(0.955)}{0.011^2}$$

$$n = 1364$$

Hence, adding 10% for nonresponse rate, the total sample size required for this study becomes 1500. Finally, by multiplying the sample size by 3 for design effect as multistage sampling technique was applied, the final sample size becomes 4500.

4.7 Sampling technique

The NHSE employed a multi-stage cluster sampling technique to ensure representativeness at national and regional levels. For this study, a subset of adults residing in Ethiopia was extracted from the survey dataset. As a secondary data analysis, no new sampling was conducted, and all eligible cases were included.

4.8 Data collection tools and procedures

The data used in this study were obtained from the 2025 NHSE. The NHSE employed standardized and validated data collection instruments adapted from the World Health Organization (WHO) Ear and Hearing Disorders Survey Protocol. The tools included structured questionnaires, clinical examination checklists, and audiometric assessment equipment. The tool used to collect the original dataset is described elsewhere (13).

4.9 Study variables

4.9.1 Dependent variable

- Hearing loss (presence vs. absence)

4.9.2 Independent variables

- Socio-demographic characteristics: Age, education, occupation
- Behavioral and lifestyle factors: Smoking status, alcohol consumption, occupational noise exposure
- Medical factors: History of ear infection, hypertension, diabetes mellitus

4.10 Operational definitions

- **Hearing Loss:** Defined as pure-tone average hearing threshold >20 dB in the better ear, consistent with WHO criteria (3).
 - Mild Hearing Loss: 21–40 dB.
 - Moderate Hearing Loss: 41–60 dB.
 - Severe Hearing Loss: 61–80 dB.
 - Profound Hearing Loss: >80 dB.
- **Gender Disparity:** A statistically significant difference in the prevalence, severity, or associated risk factors of hearing loss between males and females (4).

4.11 Data quality management

NHSE data collection followed standardized WHO guidelines for hearing assessment, including calibrated audiometers and trained audiologists. For this analysis, data were checked for completeness, consistency, and accuracy prior to analysis; outliers and implausible values were cross-checked against the raw dataset.

4.12 Methods of processing and data analysis

Statistical analysis was conducted using IBM SPSS Statistics version 27. Data sorting, frequencies, and cross-tabulations were used to identify missing values and describe variables. Normally distributed continuous data were presented as mean $\pm$ standard deviation; skewed data as median with interquartile range. Frequencies and percentages were computed for categorical variables. Bivariable and multivariable logistic regression analyses were used to identify factors associated with hearing loss. Variables demonstrating associations at $p < 0.25$ in bivariate analyses were advanced to a multivariable logistic regression model. Odds ratios with 95% confidence intervals were calculated to assess associations between hearing loss and explanatory variables.

Before conducting regression analysis, potential multicollinearity among predictor variables was assessed using the Variance Inflation Factor (VIF) and tolerance values. All variables demonstrated acceptable collinearity thresholds (VIF < 2.5; tolerance > 0.4), confirming the absence of significant multicollinearity. The Hosmer-Lemeshow test yielded a good fit for the model with a value of $p=0.293$, indicating its appropriateness. Statistical significance was set at $p<0.05$. Findings were presented using text, tables, and figures.

4.13 Ethical consideration

Ethical clearance was obtained from the Institutional Review Board (IRB) of St. Paul's Millennium Medical College. As a retrospective study using de-identified secondary data from the NHSE, the need for informed consent was waived. All data were fully anonymized prior to analysis, with personal identifiers such as names, medical record numbers and contact details were removed. The dataset was stored on password-protected computers; any physical records were kept in locked cabinets. Access was restricted to the principal investigator and authorized team members only. All information was used solely for academic and research purposes and securely destroyed upon study completion.

4.14 Dissemination of the study findings

The results obtained from this study will be submitted to the Department of Otorhinolaryngology-Head and Neck Surgery at SPHMMC as partial fulfillment of the requirements for the Specialty Degree in Otorhinolaryngology-Head and Neck Surgery. The findings will also be disseminated to clinical stakeholders to inform and enhance clinical practice. In addition, we plan to present the study outcomes at annual Ethiopian conferences that focus on related thematic areas. Following the thesis defense, the manuscript will be submitted to a peer-reviewed scientific journal for possible publication and dissemination to the scientific community.

5. Results

5.1 Socio-professional and behavioral profile of study participants

The study included 4,876 adults residing in Ethiopia. The median age was 34 years (IQR: 26–45), with most (72.9%) aged 18–44 years, 17.1% aged 45–60 years, and 10.0% >60 years. Females comprised nearly two-thirds (63.8%, n=3,111), yielding a male-to-female ratio of 1:1.76. Rural residents predominated (55.9%, n=2,725), 42.2% (n=2,056) had no formal education. Farmers (31.6%, n=1,542) were the most common occupation, and more than a quarter (27.0%, n=1,315) were unemployed (Table 1).

Moreover, exposure to loud noise was uncommon, with 99.1% reporting never being exposed, and nearly all participants reported never using headphones (95.3%). Only 28 (0.6%) has history of cigarette smoking (Table 1).

Table 1. Socio-professional and Behavioral Characteristics of Adults Included in the NHSE Dataset Residing in Ethiopia, 2023 (n=4,876)

Variable	Frequency	Percent (%)
Age category		
18–44 years	3555	72.9
45–60 years	834	17.1
>60 years	487	10.0
Median (interquartile range)	34(26–45)	
Sex		
Male	1765	36.2
Female	3111	63.8
Residence		
Rural	2725	55.9
Urban	2151	44.1
Educational status		
No formal education	2056	42.2
Primary	1447	29.7
Secondary	876	18.0
Tertiary	497	10.2
Occupation		
Farmer	1542	31.6
Unemployed	1315	27.0
Employed	795	16.3
Private	521	10.7
Student	419	8.6
Not applicable	180	3.7
Retired	67	1.4
Driver	25	0.5
Military	8	0.2
Not documented	4	0.1
Frequency of exposure to loud noise		
Never	4831	99.1
≤Once per month	12	0.2
2–3 times per month	6	0.1
Once a week	8	0.2
Almost everyday	19	0.4
Frequency of using headphones		
Never	4649	95.3
≤Once per week	122	2.5
2–3 per week	66	1.4
Everyday	39	0.8
Smoking history		
Yes	28	0.6
No	4848	99.4

5.2 Clinical characteristics of the study population

Among the studied participants, diabetes mellitus affected 1.1% (n=54), hypertension 3.1% (n=153), and cardiovascular disease 0.3% (n=14). Chronic suppurative otitis media (CSOM)

was documented in 4.6% (n=222), with 0.1% (n=4) uncertain and 95.3% (n=4,650) absent (Table 2).

Table 2. Clinical Characteristics of Adults Included in the NHSE Dataset Residing in Ethiopia, 2023 (n=4,876)

Variable	Frequency	Percent (%)
Presence of diabetes mellitus		
Yes	54	1.1
No	4822	98.9
Presence of hypertension		
Yes	153	3.1
No	4723	96.9
Presence of cardiovascular disease		
Yes	14	0.3
No	4862	99.7
Chronic Suppurative Otitis Media		
Yes	222	4.6
No	4650	95.3
Uncertain	4	0.1

5.3 Prevalence of hearing loss in adult males and females across Ethiopia

Among 4,876 the studied adults (1,765 males, 3,111 females), hearing loss prevalence was significantly higher in males (27.5%, n=485) than females (21.9%, n=682; $\chi^2=19.10$, $p<0.001$). Severity distribution followed similar patterns ($\chi^2=30.3$, $p<0.001$), with males exhibiting higher proportions of moderate (9.2% vs. 7.1%), moderate-to-severe (5.5% vs. 3.5%), severe (2.3% vs. 1.5%), profound (1.4% vs. 0.8%), and complete loss (1.0% vs. 0.8%). Moreover, age-related hearing loss (presbycusis) was more prevalent among affected males (42.1%) than females (33.6%) (Table 3).

Table 3. Prevalence of Hearing Loss in Adult Males and Females, NHSE Dataset, Ethiopia, 2023 (N=4,876)

Variable	Males	Females	χ^2	P value
Hearing loss				
No	1280 (72.5%)	2429 (78.1%)	19.10	<0.001
Yes	485 (27.5%)	682 (21.9%)		
Hearing loss severity				
Normal	1280 (72.5%)	2429 (78.1%)	30.3	<0.001
Mild	142 (8.0%)	256 (8.2%)		
Moderate	162 (9.2%)	220 (7.1%)		
Moderate-to-severe	97 (5.5%)	109 (3.5%)		
Severe	41 (2.3%)	48 (1.5%)		
Profound	25 (1.4%)	25 (0.8%)		
Complete	18 (1.0)	24 (0.8%)		
Presbycusis	212 (42.1)	233(33.6%)		

5.4 Factors associated with hearing loss among the studied adults

In this study, crude associations between independent variables and hearing loss were examined using bivariable logistic regression. Variables with $p < 0.25$ were entered into the multivariable model. Accordingly, age category, sex, residence, educational status, loud noise exposure, headphone use, smoking, diabetes, hypertension, and CSOM were candidates for multivariable analysis. After adjustment for confounders, only age, educational status, and CSOM remained independently associated with hearing loss (all $p < 0.05$) (Table 4).

More specifically, adults aged >60 years had 4.67 times higher odds of hearing loss compared to those aged 18–44 years ($p < 0.001$). Individuals with no formal education had 2.58 times higher odds ($p = 0.015$), those with primary education had 2.21 times higher odds ($p = 0.037$), and those with secondary education had 2.72 times higher odds ($p = 0.017$), all compared to tertiary-educated respondents. Finally, participants with CSOM had 4.67 times higher odds of hearing loss compared to those without ($p < 0.001$).

Table 4. Factors associated with hearing loss among adults, NHSE Dataset, Ethiopia, 2023 (N=4,876)

Variable	Hearing loss		COR (95%CI)	AOR (95%CI)	P value
	Present	Absent			
Age					
18–44 years	501(14.1)	3054(85.9)	1	1	-
45–60 years	307(36.8)	527(63.2)	3.55(3.00,4.21)	1.51(0.94,2.41)	0.087
>60 years	359(73.9)	128(26.3)	17.10(13.68,21.36)	4.67(2.50,8.70)	<0.001
Sex					
Male	485(27.5)	1280(72.5)	1.35(1.18,1.54)	1.03(0.69,1.54)	0.893
Female	682(21.9)	2429(78.1)	1	1	-
Residence					
Rural	677(24.8)	2048(75.2)	1.12(0.98,1.28)	0.70(0.46,1.08)	0.107
Urban	490(22.8)	1661(77.2)	1	1	-
Educational status					
No formal education	675(32.8)	1381(67.2)	3.77(2.82,5.05)	2.58(1.20,5.51)	0.015
Primary	298(20.6)	1149(79.4)	2.00(1.48,2.74)	2.21(1.05,4.64)	0.037
Secondary	137(15.7)	739(84.4)	1.43(1.03,1.99)	2.72(1.20,6.21)	0.017
Tertiary	57(11.5)	440(88.5)	1	1	-
Loud noise exposure					
Never	1144(23.7)	3687(76.3)	1	1	-
Any exposure	23(51.1)	22(48.9)	3.37(1.87,6.07)	1.22(0.32,4.62)	0.768
Headphone use					
Never	1144(24.6)	3505(75.4)	1	1	-
Any use	23(10.1)	204(89.9)	0.34(0.22,0.53)	0.43(0.18,1.05)	0.064
Smoking history					
Yes	12(42.9)	16(57.1)	2.40(1.13,5.08)	1.46(0.17,12.62)	0.729
No	1155(23.8)	3693(76.2)	1	1	-
Diabetes mellitus					
Yes	22(40.7)	32(59.3)	2.21(1.28,3.81)	1.08(0.22,5.34)	0.928
No	1144(23.7)	3675(76.3)	1	1	-
Hypertension					
Yes	78(51.0)	75(49.0)	3.48(2.52,4.81)	0.61(0.27,1.39)	0.241
No	1086(23.0)	3631(77.0)	1	1	-
CSOM					
Yes	213(95.9)	9(4.1)	3.29(1.65,6.59)	4.67(2.30,9.47)	<0.001
No/Uncertain	855(87.8)	119(12.2)	1	1	-

Only variables with p value <0.25 in the bivariable regression are depicted here;

CSOM: Chronic Suppurative Otitis Media

1: Reference category

6. Discussion

This study demonstrated significantly higher hearing loss prevalence among males (27.5%) than females (21.9%; $p < 0.001$), with males exhibiting greater severity across all WHO grades and higher presbycusis rates (42.1% vs. 33.6%). Independent risk factors included age >60 years (AOR=4.67, 95% CI 2.50–8.70), lower educational attainment (no formal education: AOR=2.58, 95% CI 1.20–5.51), and CSOM (AOR=4.67, 95% CI 2.30–9.47).

The results demonstrated significantly higher hearing loss prevalence in males (27.5%) than females (21.9%), with males also showing greater severity across all grades and higher presbycusis rates (42.1% vs. 33.6%). The male predominance observed in this study aligns with patterns in high-income and many middle-income settings. Global Burden of Disease data indicate higher age-standardized moderate-to-severe hearing impairment prevalence in males versus females (37). This is consistent with European and Japanese studies, where males exhibited greater hearing impairment (38,39). Similarly, NHANES (USA) reports 20.2% moderate-severe hearing loss in males versus 14.8% in females (40).

In contrast, the present findings diverge from LMIC patterns showing female predominance, such as Nigerian clinic data (20). They also deviate from reports of no gender differences in self-reported hearing loss from China, South Korea, South Africa, Iran, or Saudi Arabia (7,41,42).

The possible justification for such gender disparity discrepancies might be differences in study design (self-reported vs. audiometric), study population characteristics, hearing loss diagnostic criteria (PTA thresholds), clinical comorbidities, and predominant risk exposures. For example, while this NHSE study used objective audiometry across a nationally representative adult sample (median age 34 years, 55.9% rural), the Nigerian clinic study reporting female predominance (70.9% cases) focused on treatment-seeking patients with higher CSOM burdens (20). Also, unlike the multi-country self-report analysis showing no gender differences in China/South Korea/South Africa—where cultural reporting biases and lower occupational noise exposure prevailed (7)—this Ethiopian study captured higher male prevalence (36.2% sample) likely reflecting rural agricultural/occupational risks in a younger cohort (72.9% aged 18-44 years).

This study demonstrated that adults aged >60 years exhibited higher odds of hearing loss (AOR=4.67, 95% CI 2.50–8.70), precisely aligning with several international benchmarks (20,40). Age is universally recognized as the strongest risk factor for hearing loss

(presbycusis), with odds ratios escalating exponentially after age 60. This can be plausibly explained by the fact that progressive degeneration of cochlear hair cells, spiral ganglion neurons, and stria vascularis function accelerates after age 60, driven by cumulative oxidative stress, reduced estrogen protection (post-menopause in females), and microvascular ischemia (43).

Lower education levels were associated with higher odds of hearing loss, consistent with previous studies from Iran, the USA, and Nigeria (20,40,44). This apparent association is expected and likely mediated by occupational noise exposure, healthcare access barriers, and health literacy deficits.

Finally, CSOM was significantly associated with hearing loss (AOR=4.67, 95% CI 2.30–9.47). This finding is in agreement with previous reports (32,33). The possible pathophysiology behind this association can be that Tympanic perforation, ossicular erosion, and chronic inflammation cause conductive hearing loss, while bacterial toxins/endotoxins induce cochlear SNHL via hair cell apoptosis (45).

7. Strengths and Limitations

7.1 Strengths

- The study utilized the NHSE (2023), which employed multi-stage cluster sampling for robust generalizability across Ethiopia's diverse regions and demographics.
- The analysis based WHO-validated audiometric protocols with calibrated equipment ensure reliable hearing loss classification (PTA >20 dB) and severity grading.

7.2 Limitations

- The analysis relied on the NHSE dataset without primary data collection, limiting variables to those available. Consequently, detailed quantification of noise exposure, alcohol consumption, and ototoxic drug use were unavailable.
- The cross-sectional design precludes causal inference between factors like CSOM and hearing loss; temporality remains unclear.
- Although the dataset included self-reported noise exposure and headphone use, these retrospective measures may be subject to recall bias.
- Comorbidities such as diabetes and hypertension were self-reported and may underestimate true prevalence due to diagnostic access issues in rural Ethiopia.

8. Conclusion and Recommendations

8.1 Conclusion

The results of this study demonstrated significantly higher hearing loss prevalence among adult males than females in the NHSE dataset, with males exhibiting greater severity across all WHO grades and higher presbycusis rates. Age over 60 years, lower education levels, and CSOM were independently associated with hearing loss among the studied population.

8.2 Recommendations

Based on the findings of the study, the following recommendations are forwarded.

To clinicians,

Clinicians should prioritize routine audiometric screening for adults over 60 years, those with lower education levels, and patients with CSOM, given their elevated hearing loss risk. Prompt CSOM management is recommended to mitigate associated hearing impairment, particularly in rural settings.

To local health policy makers,

Policymakers should integrate gender-sensitive hearing screening into primary care, targeting males for noise exposure risks. They should develop national protocols for CSOM treatment and presbycusis rehabilitation, allocating resources to underserved regions per NHSE findings to advance SDG 3 (health) and SDG 10 (inequalities).

To researchers,

Future studies should adopt prospective cohort designs to establish causality between CSOM and hearing loss, incorporating detailed noise exposure, alcohol use, and ototoxic drug histories unavailable in the NHSE dataset.

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St. Paul's Hospital Millennium Medical College
Department of Otorhinolaryngology-Head and Neck Surgery

Annex

Annex I: Information sheet

This note will be presented to the medical director of the institution before accessing any data from the registries.

Greetings. My name is Dr. Hikma Amin Aliye (MD, ORL-HNS Resident), and I am a postgraduate researcher affiliated with St. Paul's Hospital Millennium Medical College (SPHMMC).

The Department of Otorhinolaryngology-Head and Neck Surgery at SPHMMC was selected to conduct the proposed study entitled "*Gender Disparity in Hearing Loss in the Adult Population in Ethiopia: Evidence from the National Hearing Survey, Ethiopia*" as it represents a key institution with access to relevant national survey data and diverse adult patient demographics from clinical epidemiology and public health research.

I humbly request your esteemed office grant permission to conduct this secondary data analysis study using the National Hearing Survey of Ethiopia (NHSE) dataset. Please review the following details:

Study procedure: To achieve the planned objectives, sociodemographic data, clinical characteristics, and audiometric results of adults will be extracted from the de-identified NHSE dataset using a structured checklist. If your institution approves, trained data extractors will access only the necessary secondary data. Your cooperation is greatly appreciated.

Risks and benefits: As a retrospective secondary analysis using fully anonymized public health data, this study poses no risks to participants. The results will inform gender-specific hearing health interventions, strengthen national screening programs, and guide equitable resource allocation to reduce hearing loss disparities in Ethiopia.

Confidentiality: All extracted data will remain strictly confidential and used solely for research purposes. Only research team members will have access. Patient names, identifiers, or personal information will not be collected or reported. Digital records will be password-protected and stored securely, with data destroyed upon study completion per ethical guidelines.

Contact Address of the Principal Investigator

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Annex II: Data collection format

Section 1: Demographic Information

1. **Age:**
2. **Gender:**
 - ☐ Male
 - ☐ Female
 - ☐
3. **Educational Level:**
 - ☐ No formal education
 - ☐ Primary education
 - ☐ Secondary education
 - ☐ Tertiary education
4. **Occupation:**
 - ☐ Employed
 - ☐ Unemployed
 - ☐ Student
 - ☐ Retired
 - ☐ Other (please specify): _____
5. **Residence:**
 - ☐ Urban
 - ☐ Rural

Section 2 Socio-Economic Factors

12. **What is your household income level?**
 - ☐ Low
 - ☐ Middle
 - ☐ High
13. **Do you have access to healthcare services?**
 - ☐ Yes
 - ☐ No
14. **If yes, how often do you visit healthcare services for hearing-related issues?**
 - ☐ Regularly
 - ☐ Occasionally
 - ☐ Rarely
 - ☐ Never
15. **Have you received any education or information about hearing health?**

- ☐ Yes
- ☐ No

16. If yes, where did you receive this information? (select all that apply)

- ☐ School
- ☐ Community programs
- ☐ Healthcare facilities
- ☐ Family/friends
- ☐ Other (please specify): _____

Section 3: Hearing Health

6. Do you experience any difficulty hearing?

- ☐ Yes
- ☐ No

7. If yes, please specify the type of difficulty (select all that apply):

- ☐ Difficulty hearing in noisy environments
- ☐ Difficulty understanding speech
- ☐ Difficulty hearing certain frequencies
- ☐ Other (please specify): _____

8. Have you ever been diagnosed with hearing loss by a healthcare professional?

- ☐ Yes
- ☐ No

9. If yes, what type of hearing loss was diagnosed?

- ☐ Conductive hearing loss
- ☐ Sensorineural hearing loss
- ☐ Mixed hearing loss
- ☐ Not specified

10. Have you ever used a hearing aid?

- ☐ Yes
- ☐ No

11. If no, what are the reasons for not using a hearing aid? (select all that apply)

- ☐ Cost
- ☐ Lack of awareness
- ☐ Social stigma
- ☐ No recommendation from a healthcare provider
- ☐ Other (please specify): _____

Assurance of Investigator

I, the undersigned student, agree to accept all responsibilities for the scientific, ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the Research and Publication Directorate and Department of Otorhinolaryngology-Head and Neck Surgery of St. Paul's Hospital Millennium Medical College.

Name of the Resident: _____

Signature: _____

Date: _____

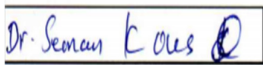
Approval of Advisors

Name of Chief Advisor: _____

Signature: _____

Date: _____

Name of Co-Advisor: Seman K Ousman (PhD)

Signature:  _____

Date: April 3 2026