

**ANALYSIS OF CAUSES OF  
HEARING LOSS IN ADULTS- A REGISTER BASED STUDY**

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**This Dissertation Submitted as a Part Fulfilment for the  
Degree of Master of Science  
(Audiology)  
University of Mysore, Mysuru**



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**September, 2021**

## **CERTIFICATE**

This is to certify that this dissertation entitled '**Analysis of causes of hearing loss in adults- a register-based study**' is a bonafide work submitted in part fulfilment for degree of Master of Science (Audiology) of the student Registration Number: 19AUD032. This has been carried out under the guidance of faculty of the institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysuru

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## **DECLARATION**

This is to certify that this dissertation entitled '**Analysis of causes of hearing loss in adults- a register-based study**' is the result of my own study under the guidance of Dr. K Rajalakshmi, Professor in Audiology, Department of Audiology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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## **ABSTRACT**

A reduction in the ability to perceive sounds is referred to as hearing loss. It could be partial or complete, abrupt or slow, temporary or permanent. Hearing loss affects a large percentage of the population in one or both ears. It could be caused by diseases of the middle or inner ear, it could be congenital, age-related, or it could be caused by noise exposure or other aetiologies. Hearing loss can have a severe influence on a person's quality of life if it is left untreated.

Thus, a retrospective study was undertaken on the prevalence and possible causes of hearing loss in adults aged 18 to 45 years. Between January and December 2019, a total of 13780 cases were evaluated by an audiologist. 3086 individuals between the ages of 18 and 45 were reviewed, with 2386 of them being diagnosed with hearing loss. As a result, 29.93 % of adult cases with hearing loss were documented over this time period.

The results also found that males had a higher rate of hearing loss than females, and that more individuals had bilateral hearing loss. Sensorineural hearing loss, as well as profound and mild degrees of hearing loss, were more common in these individuals. The audiological test findings and detailed case history were used to identify possible causes for hearing loss, with Chronic Suppurative Otitis Media (CSOM), Tinnitus, and Hypertension being the most common aetiologies discovered in this study. Hearing aid trial (HAT) was suggested for the majority of the population when compared to other management options.

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## CHAPTER 1

### INTRODUCTION

Hearing is a vital sensation for human beings. It facilitates to apprehend of the encircling surroundings and might alert us of any imminent risk around us. Hearing is a crucial way of communication. Hearing loss is the impairment of the ability to pay attention to sound. The quietest sounds that humans can pay attention to are among 25 and 40 decibels (dB). Anybody who has mild hearing loss has trouble preserving up with normal conversations. People who have profound hearing loss are deaf and cannot hear anything at all. Hearing loss can affect gaining knowledge and improvement in children, along with speech and language. In adults, hearing loss can significantly affect the quality of life because it influences social interplay and general well-being. Consequently, hearing loss can cause many problems in numerous elements of life.

Hearing loss can arise in different types and degrees of severity. Sound vibrations pass from the outer ear via the middle ear to the inner ear in normal hearing. In conductive hearing loss (CHL), vibrations can't pass from the outer ear to the inner ear. In sensorineural hearing loss (SNHL), there may be a disorder in the inner ear. In mixed hearing loss, there may be a combination of conductive and sensorineural components. (Alshuaib et al., 2015)

In children, hearing loss can be congenital, which is inherited, or acquired as sequelae of viral or bacterial infections during pregnancy, childhood, or complications during birth, also due to ototoxic drugs, excessive noise, and specific nutritional deficiencies. Hearing loss in adults mainly can be caused by different factors, including genetic, age, exposure to noise, illness, chemicals, physical trauma, exposure to therapeutic drugs that have ototoxic side effects, etc. (Cunningham & Tucci, 2017)

A community-based study by Guleria et al.,(2017) carried out among 306 individuals in an urban area of Shimla, Himachal Pradesh, India, the Prevalence of hearing loss was found to be 13.1%, and mild sensorineural or conductive type of hearing loss was predominant. Presbycusis was the leading cause of hearing loss which followed by infectious middle ear diseases.

A cross-sectional survey of ear disease and hearing impairment by Westerberg et al. (2008) found that the prevalence of disabling hearing impairment was 11.7% in adults. Correctable causes such as dry perforations, cerumen impaction, and chronic suppurative otitis media resulted in 17% of adult subjects' preventable hearing impairment, such as meningitis and noise-induced hearing loss, present in a further significant percentage of subjects.

A cross-sectional survey in Uganda among adults by Hannula et al.,(2012) revealed that Chronic middle ear disease (both active and inactive) was the most common ear disease with a prevalence of 5.3%, while the Prevalence of otosclerosis was 1.3%, and that of Meniere's disease, 0.7%., noise exposure was reported to be 46% of the subjects. It did not affect hearing among those with no ear disease or other ontological risk factors for hearing impairment. Agrawal et al., (2008) survey showed an increase in the Prevalence of hearing loss that occurred earlier among participants with smoking, noise exposure, and systemic diseases.

A community-based study by Garg et al., (2018) was conducted in selected rural and urban areas of Delhi with a total sample size of 664,85 subjects. The overall percentage of hearing loss was 25.1%. Among which conductive hearing loss was present among 61 (10.3%) subjects, mixed hearing loss was found among 5 (0.8%) subjects, and sensorineural hearing loss among 94 (15.8%) subjects. Increasing age, female gender, and low education were significantly associated with hearing loss.

South Africa has one of the highest diabetes prevalence numbers in sub-Saharan Africa, with more than 2 million diagnosed. There is an increase in evidence linking diabetes with hearing loss. A study was done by Hlayisi et al.,(2019) revealed a significantly higher prevalence of hearing loss in those with diabetes (55%) when compared to those non-diabetic patients (20%). Hearing loss individuals with diabetes showed that sensorineural hearing loss was in the majority (74%) of the patients. This study showed that participants diagnosed with diabetes have a higher proportion of disabling hearing loss when compared to those without diabetes and further strengthen the suggestion that hearing loss should be considered comorbidity associated with diabetes.

Disabling hearing loss has unequally distributed across the world. Population-based studies are rare, particularly in developing countries where new-borns and children are not screened for hearing impairment. Prevalence of child and adult hearing impairment appears to be substantially higher in middle- and low-income countries than in high-income countries, demonstrating the global need for attention to hearing impairment. Approximately 15% of the world's adult population has some degree of hearing loss. 50% of those who are affected have disabling hearing loss. (Duthey, 2013)

Milder degrees of hearing loss and unilateral hearing loss would have a more significant magnitude than these estimations for bilateral hearing loss. A WHO survey (World Health Organization (WHO), 2012) has compiled the most common causes of hearing loss and ear infections in India. The most common cause of reversible hearing loss was ear wax (which accounted for 15.9% of cases). The second most prevalent cause of hearing impairment in India is non-infectious causes such as aging and presbycusis (10.3%). Other common causes of hearing loss include middle ear infections such as Chronic Suppurative Otitis Media (CSOM), which is 5.2%, and

serous otitis media (SOM) (3%). Dry tympanic membrane perforation (0.5%) and bilateral genetic and congenital deafness are the other causes (0.2%). Environmental factors such as prenatal hyperbilirubinemia, ototoxic drug exposure, neonatal hypoxia, viral infections, and meningitis account for around half of all occurrences of congenital hearing loss. The remaining 50% of instances are assumed to be inherited or caused by genetic factors. Approximately 30% of these hereditary instances are classified as syndromic. Hearing loss is linked to about 400 different syndromes, each with its own set of auditory characteristics - sensorineural or conductive, unilateral or bilateral, progressive or stable. Due to recognized traits other than hearing loss, this tiny subset of hearing loss patients (15% of all hearing loss patients) is the group most easily diagnosed by physicians. The remaining 70% of hereditary cases are categorized as non-syndromic.

Over the decades, researchers across the world have studied the incidence and prevalence of hearing impairment. In 2018, the (World Health Organization, 2018) estimated that 466 million people had hearing loss globally. According to the census of India 2011(Chandramouli et al., 2011), the proportion of hearing disability as reported to be 18.9%. The Prevalence studies conducted in India are either institution-based or survey-based. An institution-based study by Ravi et al., (2013) estimated the prevalence of hearing impairment to be 62% (among communication disorders) in Manipal, Karnataka. A hospital-based Study by Kanjekar et al.,(2015) in Bidar, Karnataka, revealed a high prevalence of hearing loss in males compared to females. A study by Jijo et al.,(2020) estimated that among 2110 clients, maximum clients had hearing impairment (1129) 62.9% (among communication disorders) in Northern Karnataka. Sinha et al., (2017) conducted a camp in Sinor taluq, Gujarat state, India, to estimate the prevalence of communication disorders, among which ear-related disorder

prevalence was more than speech and language disorders. According to the National Sample Survey Organization (NSSO) in Bengaluru (2017), 5.3%, about 33 lakhs of the state's population, suffer from Hearing impairment.

All India Institute of Speech and Hearing (AIISH), Mysuru, provides quality education, research, clinical services, and public awareness in communication disorders. Every year more than 20000 new cases related to speech and hearing difficulties have been reporting to AIISH. Over the past five years, the number of cases reported for hearing evaluation to the Department of Audiology is 14762, 13808, 1455,13003,13525 (AIISH annual report, 2018-2019), a total of 56553 cases, which indicates there is a consistently higher number of cases reported every year, seeking help.

From the above literature, it is evident that only a few studies of the Prevalence of hearing impairment were done in the state of Karnataka. It is also observed that the Prevalence of hearing impairment is high among communication disorders. If the hearing loss is left untreated, the impact of hearing impairment on the individual, their families, and society is substantial. As it is being noted that there is an increase in the number of cases in All India Institute of Speech and Hearing (AIISH), estimating the prevalence rate and analysing the cause of hearing loss in adults can assist in the prevention, early identification, intervention, rehabilitation, and counselling.

### **1.1Need for the study:**

The prevalence varies within and across countries which may differ because of the different populations and regions. The purpose of this investigation is to provide information on the Prevalence of hearing impairment in cases seen at the All India Institute of Speech and Hearing (AIISH) and to determine the risk factors and probably

associated variables so that prevention programs may be implemented effectively and efficiently. In addition, AIISH is an institute specialized in offering services for communication disorders. Wide Spectrum and unique cases of the hearing impairment register at AIISH. In the previous reporting year (2019-20), approximately 56553 cases of hearing-impaired patients were reported at AIISH, Mysuru. Thus, the Prevalence of hearing loss and analysing the cause of hearing loss will be studying in considering a wide spectrum of variables that have been reported to AIISH between January 2019 and December 2019.

### **1.2. Aim of the study:**

To estimate the prevalence of hearing loss in adults aged 18 to 45 years and analyse the cause of hearing loss among the cases reported to AIISH between January 2019 to December 2019.

### **1.3. Objectives of the study:**

1. To determine the prevalence of hearing impairment in adults who reported at AIISH between January 2019 to December 2019.
2. To identify and list various Possible aetiologies of hearing loss in adults who reported at AIISH between January 2019 to December 2019
3. To determine the Prevalence of hearing loss between adult males and females who reported at AIISH between January 2019 to December 2019
4. To estimate the Prevalence of unilateral or bilateral hearing loss
5. To analyse the type of hearing loss, degree of hearing loss and management options recommended in adults who reported at AIISH between January 2019 to December 2019.



## CHAPTER 2

### REVIEW OF LITERATURE

#### 2.1 Hearing loss and common Aetiologies

The most frequent form of human sensory impairment is hearing loss, defined as a partial or complete inability to pay attention to sound in one or both ears. It can be a one-time occurrence or a long-term impairment that worsens with time. It might be moderate or severe, transient or permanent, depending on the cause. Hearing loss can be bilateral (affecting both ears) or unilateral (affecting only one ear). Hearing loss can fluctuate over time, improving at times and deteriorating at other times. Hearing loss can be permanent in some cases, meaning it does not change over time. Hearing loss is caused by a variety of reasons, including heredity, age, noise exposure, disease, chemicals, and physical trauma. Hearing loss can affect people of all ages, affecting speech and language development in children and causing social and vocational issues in adults.

A normal sense of hearing is essential in the social, emotional, psychological, and communicative domains. It is required for both safety and more prosperous life. Adult hearing loss can be caused by various factors, including genetics, immune diseases, infections such as meningitis, mumps, scarlet fever, Meniere's disease, loud noise exposure, tumours, head injuries, and aging (presbycusis). Jha, (2021) studied to assess the impact of hearing loss on adult QOL (Quality of Life). For this study, a total of 100 people were recruited. Of 100 patients, 50 were assigned to the control group and 50 to the experimental group, both of whom were diagnosed with hearing loss (Severe sensorineural hearing loss). Weinstein et al. (1986) produced a 25-point sample developed from the initial Hearing Loss Inventory for the Elderly (HHIE). A 13-point

emotional and 12-point social-situational subscale are commonly used in the Hearing Handicap Inventory (HHIA).

Furthermore, the study determined that we must improve our understanding of the disease's physiopathology to combat its spread. Furthermore, developing methods for recognizing and deteriorating Hearing loss patients would be beneficial, allowing for more resources to be allocated to hearing aids, assistive communication systems, and auditory therapy. Individuals with hearing loss, the use of appropriate hearing aids or other hearing aids, and educational programs may all positively impact the quality of life of adults.

Bansal & Raj, (1998) conducted a study in a remote area of Western U.P. to determine the various aetiological reasons for hearing loss. A total of 758 instances were investigated, with the only complaint being a loss of hearing. The most common cause of hearing loss was Chronic suppurative otitis media (CSOM) which is 54.61%, followed by presbycusis (8.97%). Except for Acute suppurative Otitis Media (ASOM), every aetiological component was linked to sensorineural hearing loss. In these instances, the most common form of hearing loss was "Mild," while the severe hearing loss was only observed in cases of meningitis. 414 of the 434 cases fell into the Chronic suppurative otitis media (CSOM) category. In ASOM instances, only conductive hearing loss was found, which was the most common kind of hearing loss in CSOM cases. Both safe CSOM and unsafe CSOM involved the most significant number of instances (35.74%). ASOM (80 percent) and CSOM (65.70%) subjects had a mild degree of hearing loss. The instance of ASOM revealed a severe degree of severity due to a hearing loss.

König et al., (2006) studied the functional relationship between the pitch of the tinnitus sensation and the audiogram edge in patients with high-frequency hearing loss.

As a result, they looked into how the shape of the audiogram affects the occurrence of Tinnitus. Researchers looked at a group of 30 patients without Tinnitus, 24 patients with tone-like Tinnitus, and 17 patients with noise-like Tinnitus who all experienced noise-induced hearing loss. All of the patients exhibited moderate to severe high-frequency hearing loss, but only mild to moderate low-frequency hearing loss. Tinnitus patients experienced less overall hearing loss than non-tinnitus patients, according to findings from this study. Furthermore, the audiogram's maximum steepness was higher in tinnitus patients ( $-52.9 \pm 1.9$  dB/octave) than in non-tinnitus patients ( $-43.1 \pm 2.4$  dB/octave). There was a definite link between tinnitus pitch and the audiogram's edge, with tinnitus pitch averaging  $1.48 \pm 0.12$  octaves.  $0.81 \pm 0.1$  octaves above the audiogram edge frequency and  $0.81 \pm 0.1$  octaves above the steepest slope frequency. This study showed a steep audiogram slope promotes the incidence of Tinnitus. A steep slope causes abrupt discontinuities in auditory system activity along the tonotopic axis, which might be perceived as sound.

Diabetes (type 2) and sensorineural hearing loss are two frequent age-related health issues. While type 1 and type 2 diabetes have been linked to hearing loss, establishing a causative link has proven difficult. Samocha-bonet et al., (2021) showed that hearing loss is twice as common in people with diabetes as it is in people without diabetes, and people with prediabetes have a 30% greater chance of hearing loss. It's still unclear whether hearing loss is linked to diabetes regardless of glycemic management. Hearing loss has its own set of risk factors, as well as some that diabetes shares. The intricate association between diabetes and sensorineural hearing loss will be summarised in this review.

Rajakumar, Rohitkumar, (2020) conducted a cross-sectional study to determine the prevalence of Hearing loss, Tinnitus, and vertigo among diabetes patients at a

typical Indian tertiary care hospital. Patients were divided into groups based on their age (60 years and > 60 years), gender, diabetes mellitus chronicity (10 years and > 10 years), related comorbidities (hypertension, nephropathy, and retinopathy), and diabetic treatment modalities. The results showed that Hearing loss was identified in 148 cases (61.67%), Tinnitus in 70 instances (29.17%), and vertigo in 17 patients among 240 diabetic individuals (7.08%). The relationship between hearing loss, tinnitus, vertigo, age ( $p=0.21$ ), and sex ( $p=0.58$ ) were not statistically significant. Nonetheless, the length of diabetes and the treatment options for it were statistically significant ( $p=0.07$ ) and ( $p=0.05$ ), respectively, in relation to these disorders.

Al-rubeaan et al., (2021) conducted a cross-sectional study including patients with type 2 diabetes, aged 30 to 60 years, who were randomly chosen to take part in the survey. All of the patients had clinical ear examinations and were referred to an audiologist for a complete audiological evaluation. They found that of the 157 patients, 77 had hearing loss in both ears (49.0%), 13 had hearing loss in the right ear only (8.3%), 14 had hearing loss in the left ear only (8.9%), and 53 had normal hearing (33.8%). The 181 ears with sensorineural hearing loss were divided into 90 with mild loss (49.7%), 69 with moderate loss (38.2%), 16 with severe loss (8.8%), and 6 with profound loss (3.3 percent). In 46 (29%) of the patient's, hearing loss was found to be debilitating. Hearing loss was more common in people with glycated hemoglobin levels of less than 8%. Longer diabetes duration, poor glycemic management, and hypertension were the most critical factors associated with hearing loss in the multivariate logistic regression analysis. Hearing loss was underappreciated comorbidity of type 2 diabetes that necessitates regular hearing evaluations and care. For the effects of diabetes on hearing sensitivity to be minimized, strict glycemic and hypertension control is required.

A review done by Umashankar & Prabhu, (2021) highlighted a possible link between hypertension and hearing loss by stating that a change in cochlear microcirculation induced tissue hypoxia, which led to hearing loss.

Otitis media (O.M.) is a common inflammatory illness that causes hearing loss in people of all ages due to fluid effusion or pathological alterations in the tympanic membrane of the middle ear. Hearing loss can be transient or permanent. The goal of Manche et al., (2016) study was to determine the risk factors for the start and progression of otitis media, its subtypes, and related comorbidities in the South Indian population. The study included 2602 participants, including children and adults with Otitis media (O.M.), diagnosed by Ear, Nose, and Throat specialists using all necessary otorhinolaryngological testing. Results revealed that Squamous-chronic suppurative otitis media (47.3%), mucosal-chronic suppurative otitis media (18.5%), acute suppurative otitis media (17.6%), and otitis media with effusion (17.6%) were the most common (16.6 percent). Tinnitus was found to be associated with squamous-chronic suppurative otitis media, bilaterality, Tinnitus, and vertigo with mucosal-chronic suppurative otitis media, and bilaterality, adenoids, Tinnitus, and snoring with otitis media with effusion in a multinomial logistic regression study. Within the subtypes of otitis media, significant differences in different forms of hearing loss were seen at a greater frequency. According to the findings, otitis media affects people of all ages and is a severe health problem among hearing loss individuals and other comorbidities.

It's critical to recognize and diagnose unilateral sensorineural hearing loss (USNHL) as soon as possible. It is prevalent and can be a sign of a variety of illnesses. The USNHL has never been researched in our region, south India. In a study, Hm & Vu,(2021) discussed the various causes of this condition. This is a prospective observational hospital-based study that looked at 50 patients with USNHL who were

over 18 years old. The goal of this study was to identify risk factors, causes, and typical presentations of USNHL in south India and compare the findings to a literature review. During the research period, 50 cases of unilateral SNHL were discovered. It accounts for 15% of all cases screened. Hearing loss occurred gradually in the majority of the instances. Tinnitus, vertigo, and ear drainage are the most prevalent related symptoms respectively. On audiological evaluation, Pure Tone audiometry at the time of the study, significant hearing loss (46%). Aetiologies of unilateral sensorineural hearing loss, Meniere's disease (28%), Metabolic (24%), Sudden Sensorineural hearing loss (22%), idiopathic (20%), Acoustic neuroma (4%) and Left Chronic Otitis Media, squamosal disease (2%). The MRI was performed in 4 of the 50 individuals with unilateral SNHL, it was discovered to be abnormal. In 35 of the cases, an Electronystagmography (ENG) was performed, and in 30 of them, the left hypoactive labyrinth was shown to be abnormal (48.6 percent). In light of their findings, experts urge that patients get an MRI scan as part of their diagnostic process. Patient risk factors and exposures should guide the selection of diagnostic laboratory testing.

A prospective study was conducted by Sethukumar et al., (2018), which took place in a tertiary referral hospital from June 2016 to June 2017. This study comprised 200 participants with unilateral mucosal type CSOM and a normal contralateral ear. All frequencies above 25 dB had an average bone conduction threshold of 20 patients, indicating Sensorineural hearing loss (SNHL), which is 10 percent. At higher speech frequencies, the occurrence of SNHL became statistically significant. Diabetes Mellitus, smoking, the duration of the disease, the presence of active discharge, and the size of the perforation all contributed to an increase in the occurrence.

A review study by Taneja, (2017) presented the literature on the link between Tinnitus, hearing loss, and diabetes. According to existing research, Tinnitus is a

symptom associated with a number of auditory diseases for which the processes are not well understood. Tinnitus has been linked to metabolic problems, medicines, and excessive insulin levels. In animal studies, diabetes-induced microvascular alterations have been found to occur in the inner ear, disrupting circulation and causing capillary constriction. According to existing literature, the majority of people with diabetes suffer from cochlear, retrocochlear, or mixed cochlear-retrocochlear hearing abnormalities.

For a retrospective case analysis, Sao et al., (2018) reviewed 1189 registered cases who obtained services from the ENT department at Netaji Subhash Chandra Bose Medical College. According to the findings, 30 percent of the patients with hearing issues were between 18 and 29, while just 7% were under the age of 14. Males made up 60.8 percent of the group, while females made up 39.1 percent. Most patients had moderate hearing loss (21%), followed by mild hearing loss (12%). A considerable percentage of patients (18.4%) had normal results. Most of these patients had conductive hearing loss (48.3%), characterized by flat hearing loss. In the audiogram, there is a 64.2% configuration. As a result, most of these individuals (73.8 percent) received medical or surgical therapy to prevent the infection or disease from spreading further. Some patients with irreversible hearing loss indicated hearing aids (20.9) and cochlear implantation (5%).

Noise is the most pervasive of all industrial pollutants, affecting every industry and resulting in serious hearing loss in every country. Occupational noise is responsible for 16 percent of debilitating hearing loss in people worldwide, ranging from 7 to 21 percent in different subregions (Deborah et.al., 2005). Noise is estimated to cost developed countries between 0.2 and 2% of GDP, and it is responsible for more than one-third of hearing impairments. The consequences of workplace noise exposure are more severe in underdeveloped countries (World Health Organization (WHO), 1997).

In India, epidemiological statistics on the prevalence, risk factors, and costs of NIHL are lacking. To determine the exact prevalence of NIHL among various industries in India, more research is needed.

Agarwal et al., (2013) conducted a study to find out if there is a link between hypertension and hearing loss. After sample estimate, 150 cases and 124 controls, both genders, aged 45–64, were included in the study. Based on the results, blood pressure readings were used to confirm hypertension, which was then categorized as grade 1, grade 2, or grade 3 hypertension, or no hypertension. Pure tone threshold was measured at several frequencies ranging from 250 to 8,000 Hz to assess hearing. There is a link between high blood pressure and a rise in the hearing threshold. Hearing loss in the study group implies that hypertension is a factor that speeds up the aging of the auditory system.



## **CHAPTER 3**

### **METHOD**

A retrospective research design carried out to find out the prevalence of hearing loss and analyze the cause for hearing loss in adult cases (age range of 18 to 45 years), reported at All India Institute of Speech and Hearing, Mysuru, between January 2019 and December 2019. A complete audiological finding of the cases diagnosed with mild to profound hearing loss with any type of hearing loss and configuration was considered for profiling. The OPD register was reviewed for a total number of cases reported during the period of 12 months. The total number of adult hearing-impaired cases reported was noted from Out Patient Department (OPD) register in the Department of Audiology and Department of Ear, Nose, and Throat (ENT).

In case history, demographic details such as age, gender, duration of occurrence of the problem, ear specific complaints, possible cause for Hearing loss, associated problems were considered. Audiological evaluation- A calibrated diagnostic audiometry used to track the threshold. The modified Hughson and Westlake approach was used to obtain air conduction thresholds at octave frequencies from 250 Hz to 8000 kHz and bone conduction thresholds at octave frequencies from 250 Hz to 4 kHz. A tympanogram was used to establish the middle ear status, as well as reflexometry in each ear. The auditory neuronal integrity and cochlear state were examined using otoacoustic emission (OAE) and auditory brainstem response (ABR), respectively. The results of the above tests were interpreted, and a provisional diagnosis was made based on the findings of qualified audiologists. For data analysis, Otolaryngologist (medical line of treatment) or Audiologist's (audiological management) recommendations on

rehabilitative device or management advice/recommendation were recorded.

Based on the data collected, such as the details of the clients and the interpretation of the audiological tests' results, and the provisional diagnosis based on results made by qualified audiologists, which has been mentioned above. These data of adult cases with hearing impairment were categorized and analyzed in terms of the total number of individuals in the period. The prevalence of hearing loss between genders and the cause for hearing loss was analyzed. The percentage of the particular cause of hearing loss was done using Statistical Package for Social Sciences (SPSS, version 20.0) software.

## CHAPTER 4

### RESULTS

The study was conducted with the goal of assessing the prevalence of hearing loss and investigating the cause of hearing loss in individuals (18-45 years) who reported at the All India Institute of Speech and Hearing (AIISH), Mysore between January and December 2019. Data was collected and tabulated, and statistical analysis was performed using the Statistical Package for Social Sciences (SPSS, version 20.0) software. The study's findings are detailed below.

#### 4.1 Prevalence of Hearing loss

A total number of 23383 individuals reported to AIISH between January 2019 to December 2019 out of these cases 7970 individuals fall in the age range between 18 to 45 years. 13780 individuals underwent audiological evaluation at AIISH between January 2019 to December 2019 among which 3061 cases fall between the age 18 to 45 years. A total of 3061 case files were reviewed, out of which 2386 cases were diagnosed as having hearing loss. Hence, the prevalence of hearing loss (which is 2386 individuals with hearing loss out of 7970 individuals who reported to AIISH and fall into the age range 18 to 45 years) in the present study is 29.93% as shown in the Table 4.1 and Figure 4.1

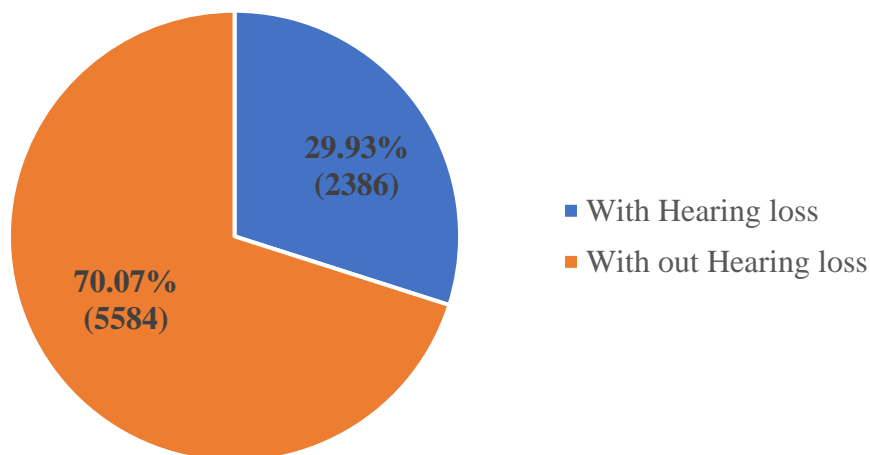
**Table 4.1**

*Number of individuals with and without Hearing loss*

Number of Individuals Reported to AIISH	Number Individuals with Hearing loss
7970	2386

**Figure 4.1**

*Percentage of individuals with Hearing loss and Without Hearing loss*



#### **4.2 Gender wise analysis of hearing loss cases**

Between January 2019 and December 2019, a total of 4639 males and 3331 females between the ages of 18 and 45 years old reported to AIISH, with 1440 males and 946 females reported hearing loss. In this study, the prevalence of hearing loss was reported to be 31.04 % of males and 28.39 % in females in the age range of 18 to 45 years who reported to AIISH had hearing loss. According to the data, males have a higher prevalence than females, as shown in Table 4.2 and Figure 4.2.

**Table 4.2**

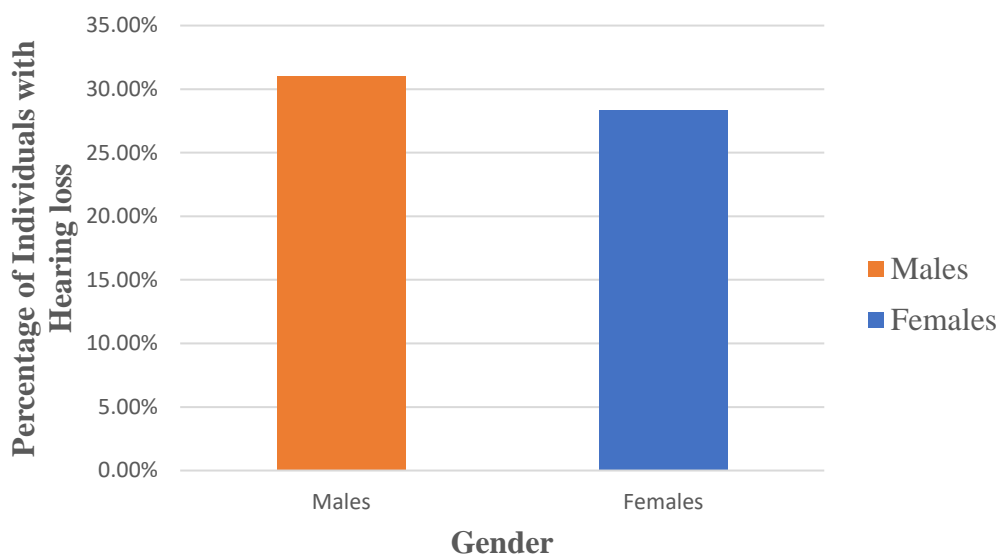
*Number of males and females with Hearing loss*

Gender	Number Of individuals with hearing loss
Males	1440

Females	946
Total	2386

**Figure 4.2**

*Percentage of Hearing loss across males and females*

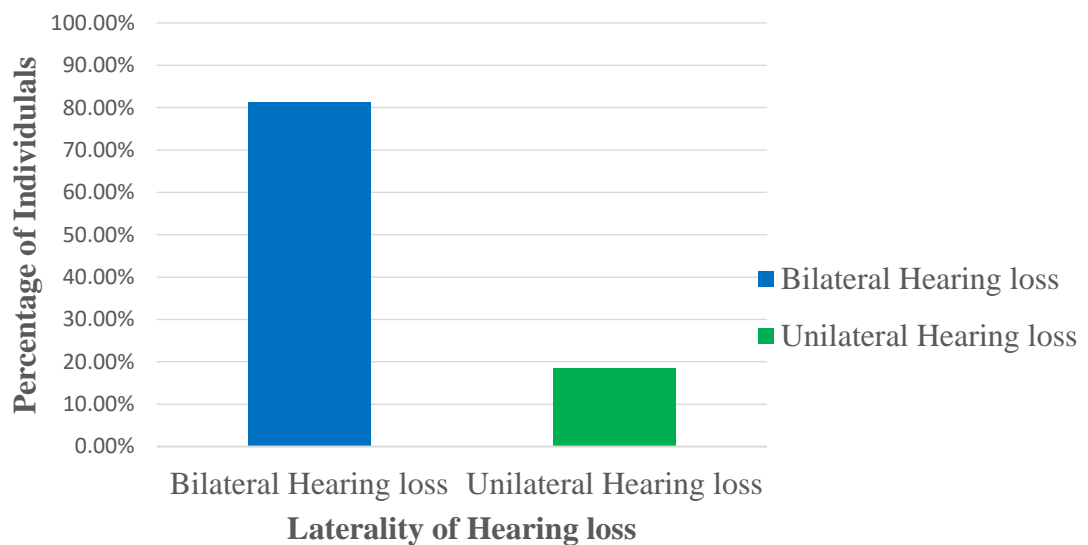


### **4.3 Analysis based on Unilateral vs bilateral hearing loss**

Hearing loss was documented in 2386 cases between the ages of 18 and 45, as previously reported. An ear wise analysis was made on these 2386 individuals. Clients with average audiometric thresholds greater than 26 dBHL are considered to have hearing loss, according to WHO (2008). According to the findings, 1942 individuals had bilateral hearing loss, accounting for 81.39 %, while 444 individuals had unilateral hearing loss, accounting for 18.6%. As shown in Table 4.3 and Figure 4.3, bilateral hearing loss was found to be most significant when compared to unilateral hearing loss.

**Table 4.3***Number of Individuals with unilateral and Bilateral Hearing loss*

Laterality of Hearing loss	Number of Individuals
Unilateral Hearing loss	444
Bilateral Hearing loss	1942
Total	2386

**Figure 4.3***Percentage of Individuals with Unilateral and bilateral Hearing loss*

#### 4.4 Analysis based on degree of hearing loss

The degree of hearing loss was also investigated. 444 of the 2386 participants experienced hearing loss in only one ear (unilateral), while 1942 had hearing loss in both ears (Bilateral). As a result, hearing loss was more prevalent in the bilateral condition. According to Goodman's categorization (1965) as updated by

Clarke (1981), hearing loss was classified as normal, slight/minimal, mild, moderate, moderately severe, and profound. The study found that in the right ear, profound hearing loss was the most common, accounting for 31.1 %, followed by mild hearing loss, which accounted for 16.9 %, severe hearing loss, which accounted for 15.3 %, moderate hearing loss, which accounted for 13.3 %, and moderately severe hearing loss, which accounted for 13.3 %. In the left ear, profound hearing loss was found in 801 individuals, accounting for 33.6 %, followed by mild hearing loss in 472 individuals, 19.8 %, severe hearing loss in 345 individuals, 14.5 %, moderately severe hearing loss in 335 individuals, 14.0 %, and moderate hearing loss in 246 individuals, accounting for 19.8%. As demonstrated in Table 4.4 and Figure 4.4, more individuals experienced profound hearing loss, followed by Mild hearing loss and Severe hearing loss in both ears.

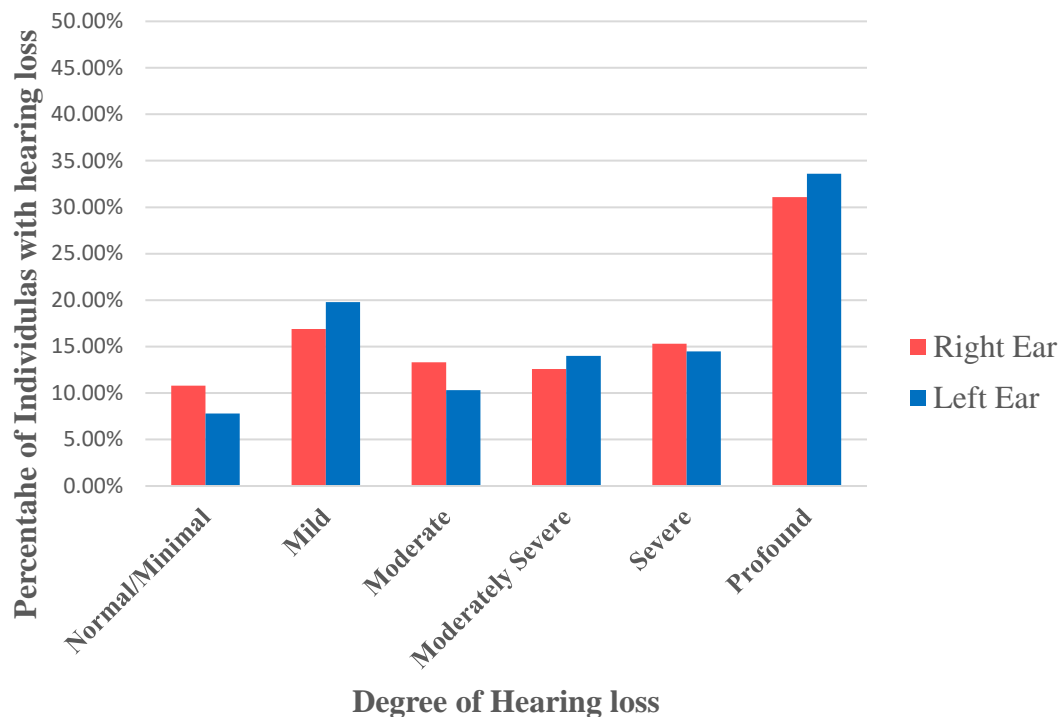
**Table 4.4**

*Number of Right and Left ears with different degree of hearing loss in Individuals with hearing loss*

Degree Of Hearing loss	Right ear	Left ear
Normal/Minimal	257	187
Mild	404	472
Moderate	317	246
Moderately Severe	300	335
Severe	365	345
Profound	743	801
Total	2386	2386

**Figure 4.4**

*Percentage of different degrees of hearing loss in right and left ear*



#### **4.5 Analysis based on type of hearing loss**

The data was analysed ear wise based on types of hearing loss identified in individuals with hearing loss as conductive, sensorineural and mixed hearing loss. Results showed that in Right ear a greater number of individuals that is 884 individuals had Sensorineural Hearing loss which accounted for 37.04% followed by Conductive Hearing loss in 545 individuals which is 22.84% and then Mixed hearing loss in 381 individuals which is 15.96%. Whereas, in Left ear a greater number of Individuals that is 839 individuals which accounted for 35.16% had sensorineural hearing loss which was followed by Mixed Hearing loss in 553 Individuals which is 23.17% and Conductive hearing loss in 552 individuals which accounted for 23.13%. In both the ears the type of hearing loss was Not applicable for 576 (24.14%) and 442 (18.52%)



Individuals in Right and Left ear respectively. In this study the results revealed that More number individuals had Sensorineural hearing loss in both the ears. The results are depicted in the Table 4.5 and Figure 4.5.

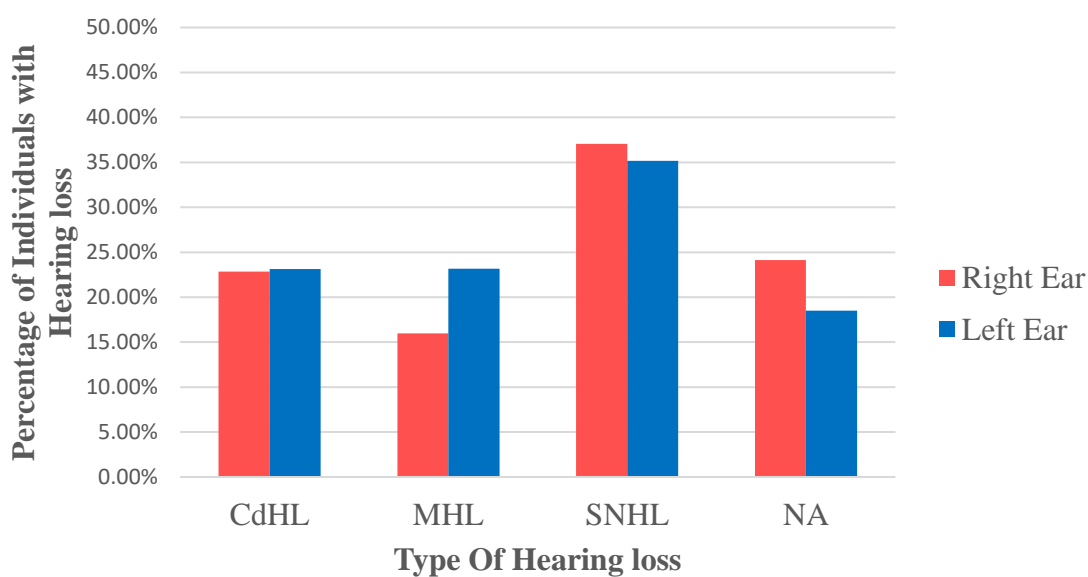
**Table 4.5**

*Type of hearing loss in individuals for right and left ear*

Type of Hearing loss	Right ear	Left ear
Conductive Hearing loss	545	552
Mixed Hearing loss	381	553
Sensorineural Hearing loss	884	839
Not Applicable	576	442
Total	2386	2386

**Figure 4.5**

*Percentage of different types of hearing loss in individuals for right and left ear*



## 4.6 Analysis of aetiology of hearing loss

The data was categorized according to the possible aetiology which was analysed by looking into the audiological factors like details from the case history (complaint, associated problems, medical history) and audiological test findings. The possible aetiologies are listed under different subgroups.

### 4.6.1 Infectious ear disease

Hearing loss in people can be caused by infectious ear diseases such CSOM, AOM, SOM, cholesteatoma, and otosclerosis, which are investigated. Out of 2385 individuals, 404 had CSOM, accounting for 16.93 %, followed by SOM, which was present in 62 individuals and accounted for 2.5 %, AOM, which was present in 30 individuals and accounted for 1.2%, Otosclerosis, which was present in 42 individuals and accounted for 1.80%, and cholesteatoma, which was present in 17 individuals and accounted for 0.71 %. The findings show that CSOM was found in a greater number of people. Table 4.6 and Figure 4.6 illustrate the results.

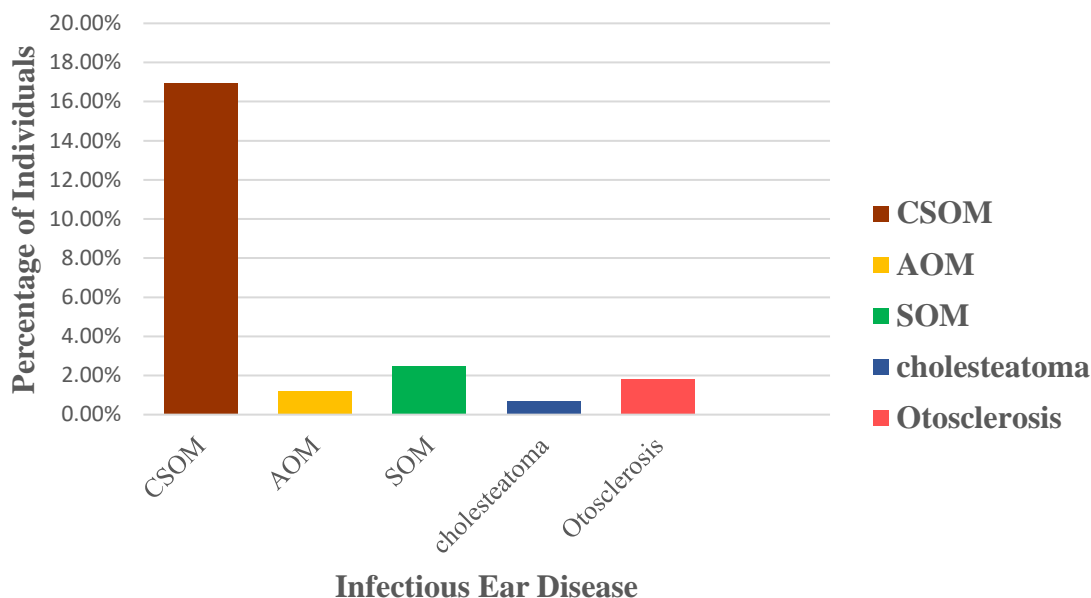
**Table 4.6**

*Number of individuals with possible infectious ear disease*

Infectious Ear disease	Number of Individuals
Chronic Suppurative Otitis Media (CSOM)	404
Acute Otitis media (AOM)	30
Secretory Otitis media (SOM)	62
Cholesteatoma	17
Otosclerosis	42
Total	555

**Figure 4.6**

*Percentage of possible infectious ear disease in individuals with hearing loss*

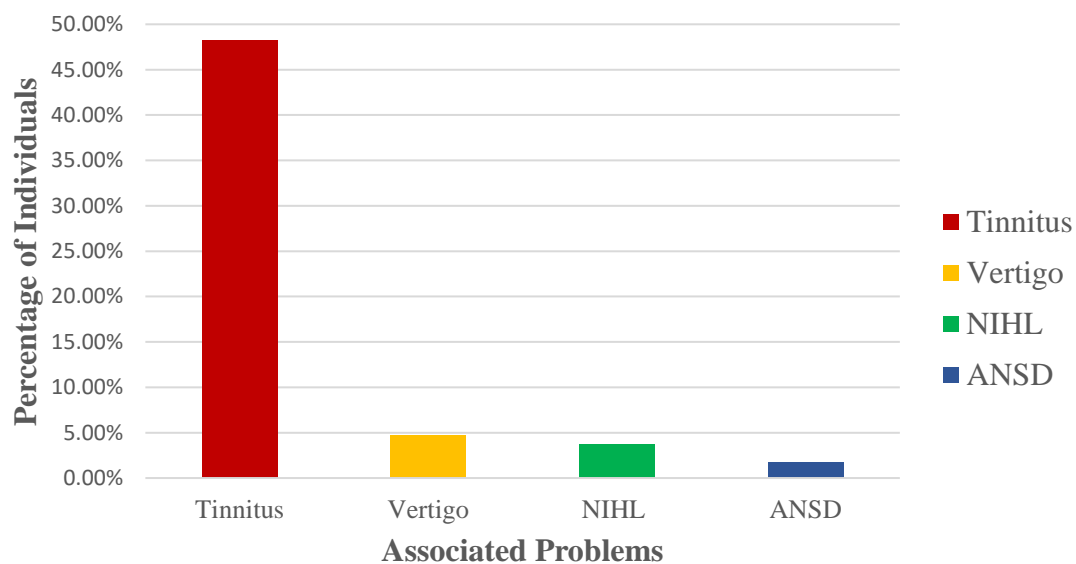


#### **4.6.2 Associated Problems**

Individuals' hearing loss can be caused by a variety of problems such as tinnitus, vertigo, noise-induced hearing loss (NIHL), or Auditory Neural Spectrum Disorder (ANSD). Tinnitus was the most common symptom, occurring in 1151 individuals with hearing loss (48.23%), followed by vertigo in 113 individuals with hearing loss (4.73%), Noise Induced Hearing Loss (NIHL) in 88 individuals (3.68%), and Auditory neuropathy spectrum disorder in 88 individuals (3.68%). These disorders could play a role in the development of hearing loss in these individuals. The results are depicted in Table 4.7 and Figure 4.7

**Table 4.7***Number of individuals with different associated problems*

Associated Problems	Number of Individuals
Tinnitus	1151
Vertigo	113
Noise Induced hearing loss (NIHL)	88
Auditory Neural spectrum disorder (ANSD)	40
Total	1392

**Figure 4.7***Percentage of Associated problems in Individuals with hearing loss*

### 4.6.3 Systemic Diseases

Hearing loss can be caused by a variety of factors, including systemic disease.

180 individuals out of 2386 had hypertension, accounting for 7.54 %. The second

most common systemic condition was diabetes, which was present in 155 individuals, accounting for 4.81 %. Other systemic illnesses such as Hypothyroidism, Renal Problems, and Cardiac Problems were found in 68 individuals, accounting for 2.84 %.

Table 4.8 and Figure 4.8 show the results.

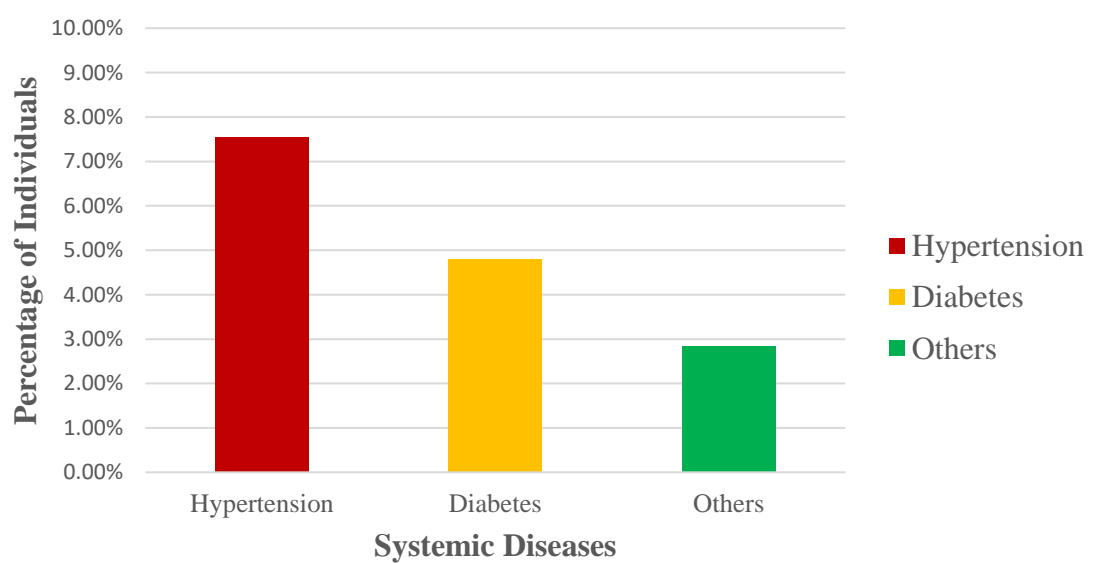
**Table 4.8**

*Number of individuals with systemic diseases*

Systemic Diseases	Number of Individuals
Hypertension	180
Diabetes	155
Other Systemic Diseases	68
Total	403

**Figure 4.8**

*Percentage of Individuals with different Systemic diseases*



#### 4.6.4 Other Possible aetiologies

Other probable causes of hearing loss discovered in this study were congenital hearing loss, which was found in 971 individuals, accounting for 40.69 %. And in 528 individuals, accounting for 22.12% of the total the cause was Idiopathic. Table 4.9 and Figure 4.9 show the results.

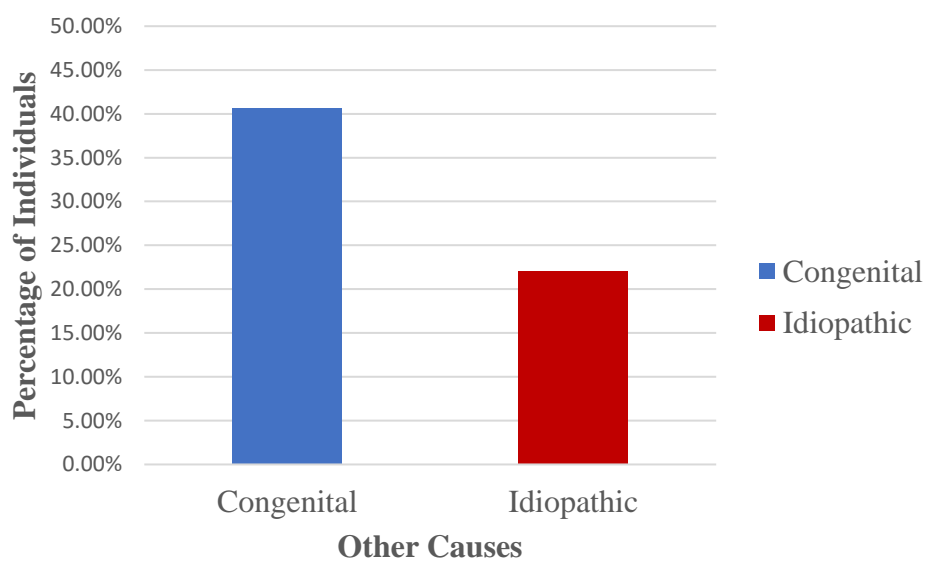
**Table 4.9**

*Number of individuals with other causes*

Other Causes	Number of Individuals
Congenital	971
Idiopathic	528
Total	1499

**Figure 4.9**

*Percentage of individuals with other Causes*



#### 4.7 Analysis based on management recommended for hearing loss

In this study the data was classified according to the management suggested to Individuals with hearing loss, such as medicine, surgery, or a hearing aid trial (HAT). As shown in Table 4.10 and Figure 4.10, 319 individuals (or 13.36 %) were suggested for medications, 142 individuals (or 5.95 %) for surgery, and 1925 individuals (or 80.67 %) for hearing aid trials.

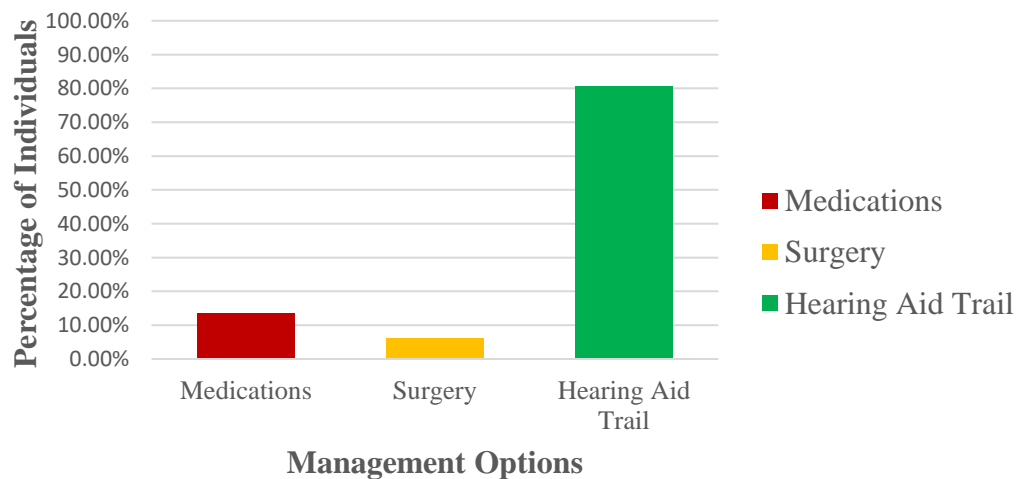
**Table 4.10**

*Number of individuals recommended with different management options*

Management Recommended	Number of Individuals
Medications	319
Surgery	142
Hearing Aid Trail	1925
Total	2386

**Figure 4.10**

*Percentage of individuals recommended with different management options*



To summarise, males were shown to have a higher prevalence of hearing loss in the age range 18 to 45 years. Furthermore, bilateral hearing loss was more common. When compared to other aetiologies, CSOM, Tinnitus, Hypertension, and Congenital possible aetiologies were more prevalent. A significant number of cases with profound degree of hearing loss and sensorineural type of hearing loss were discovered among the 2386 cases. And for more individuals HAT was suggested for further action.



## CHAPTER 5

### DISCUSSION

The present study was conducted to determine the prevalence and aetiology of hearing loss in adult hearing loss cases reported at All India Institute of Speech and Hearing (AIISH), Mysore, from January 2019 to December 2019. The data of 2386 was analysed based on gender, laterality of hearing loss, type of hearing loss, degree of hearing loss, possible aetiology of hearing loss, and management options recommended. The data was analysed to determine the number of individuals and percentage of individuals with hearing loss in each domain. Discussion of obtained results is discussed below:

#### 5.1 Prevalence of hearing loss

According to the World Health Organization, 360 million people worldwide with disabling hearing loss (5.3 %), with 328 million (91%) of these being adults. According to *National Programme for The Prevention & Control of Deafness (NPPCD)* - National Health Mission, 13213 people in Karnataka between 15 and 60 suffer hearing loss. The prevalence of hearing loss in adults (18 to 45 years) reported to AIISH from January to December 2019 is 29.93 %. As previously stated, this is consistent with other prevalence studies conducted across India (Duthey, 2013, Westerberg et al., 2008, Trilok C. Guleria<sup>1</sup> et al. 2017). The high prevalence of hearing loss in the current study could be attributed to a number of variables, including a lack of awareness of hearing loss and its consequences, as well as of the numerous aetiologies that could cause hearing loss and lack of awareness about early intervention and management by professionals.

## **5.2 Hearing loss across gender**

The prevalence of hearing loss was found to be higher in males than females in the current study. This finding is in line with a study conducted by Kanjekar et al. (2015) in Bidar, Karnataka, which found that males have a higher prevalence of hearing loss than females. According to the findings from the current study, CSOM was one of the most common causes of hearing loss. The larger pneumatization area of the mastoid among girls (Tos & Stangerup, 1985) and differences in endocrine-immune interactions (i.e., males are more sensitive to infections) could be the reason (Klein, 2000).

## **5.4 Audiological findings in hearing loss**

### **5.4.1 Unilateral vs. bilateral hearing loss**

In the current investigation, hearing loss was mainly bilateral. According to Kanjekar et al. (2015), bilateral hearing loss was more common, accounting for 89.8% of patients, whereas unilateral hearing loss accounted for 10.2% of cases. However, one probable explanation is that bilateral involvement was detected more frequently than unilateral involvement in all types of hearing loss.

### **5.4.2 Degree of hearing loss**

Hearing loss, both profound and mild, was shown to be more common in the current investigation. The findings are in line with Goel et al., (2016), who found that mild degrees of hearing loss is more common in CSOM cases. In the current study, mild hearing loss and CSOM are the second most common degree of hearing loss and likely aetiology of hearing loss. This could be explained by the fact that CSOM

obstructs sound conduction, resulting in a loss of less than 55 dBHL. If CSOM affects the inner ear, it is possible to lose more than 55 dBHL of hearing.

#### **5.4.3 Type of hearing loss**

In this investigation, sensorineural hearing loss was more common than other types of hearing loss. Similar findings were observed by Kanjekar et al. (2015) in their study, which revealed that SNHL was seen in 66.5 %, followed by mixed-type hearing impairment (15.9%). Hearing loss of the conductive type was found in 13.5 %. An aging population, increased occupational and recreational noise exposure (TC, 2007), increased hypertension (Gates et al., 1993), and diabetes incidence may contribute to a large number of sensorineural hearing loss cases. (DS et al., 1998) (H et al., 2006).

#### **5.5 Aetiology of hearing loss**

According to Santoshi et al., (2016), hearing loss and tinnitus are linked since tinnitus cases have a higher prevalence of hearing loss. According to Nondahl et al., (2010), 96.9% of tinnitus cases have a significant association with hearing loss, showing that tinnitus is one of the most critical risk factors. Furthermore, in tinnitus patients, hearing loss at higher frequencies shows the severity of the suffering caused by ontological diseases. (Baskill et al., (1999) (Weisz et al., 2004).

According to Carrasco et al., (1990) and Gates et al., (1993) sensorineural hearing loss is related to microcirculatory insufficiency caused by vascular occlusion caused by emboli, haemorrhage, or vasospasm. These occur as a result of a syndrome of hyper viscosity or microangiopathy caused by diabetes or hypertension. The latter could cause sensorineural hearing loss through histopathological mechanisms.)

Chronic suppurative otitis media is a persistent inflammation of the middle ear or mastoid cavity, is an important cause of hearing loss in low- and middle-income countries. Hearing loss in CSOM can result from perforations of the tympanic membrane, disruption of the ossicular chain (Conductive hearing loss), Outer hair cell damage caused by the diffusion of bacterial toxins into the inner ear (Sensorineural hearing loss), or both (mixed hearing loss).

### **5.6 Management of hearing loss**

Mishra et al., (2011) found that 27.5 % of individuals have sensorineural hearing loss and need hearing aids, supporting the current study. In the present study, 80.67 % of individuals were recommended for a hearing aid trial, 13.36 % were prescribed medications, and 5.95 % were referred for surgery. This could be because the hearing loss of the sensorineural type and hearing loss of a profound degree were more common among individuals aged 18 to 45 who were treated with hearing aids. Because hearing aids can assist people with sensorineural hearing loss (hearing loss in the inner ear due to damaged hearing nerve) improve their hearing and communication.

## CHAPTER 6

### SUMMARY AND CONCLUSION

Hearing loss is an "invisible" condition with visible and devastating impacts on an individual's ability to function upon quality of life. Hearing loss reduces communication efficiency and hinders interpersonal communication, which is the most important of all human characteristics. Conversational difficulty has an impact on work performance, familial relationships, leisure and recreational activities, and encounters with health care specialists. The inability to hear environmental sounds like car horns or smoke alarms can put one's safety at risk. According to the World Health Organization, there were 360 million people worldwide with disabling hearing loss (5.3%), with 328 million (91%) of these being adults. As a result, a register-based study on the prevalence and causes of hearing loss in adults aged 18 to 45 years was done. Between January and December 2019, a total of 3086 cases were evaluated by the Audiology department at AIISH. 2386 of the 3086 cases who underwent audiological evaluation were between the ages of 18 and 45, with 2386 of them being diagnosed with hearing loss. Thus, the prevalence of adults with hearing loss reported in this duration is 29.93%.

The salient features of the present study were

- Males had a higher prevalence of hearing loss than females.
- Bilateral hearing loss was more common than unilateral hearing loss.
- In adult hearing loss cases, sensorineural hearing loss predominated.
- In adult hearing loss cases, the degree of profound hearing loss and the degree of mild hearing loss were both significant.

- In adult cases, CSOM, Tinnitus, and Hypertension were the most common possible etiologies.
- For a greater number of adult cases, a hearing aid trial were recommended.

### **6.1 Clinical Implications**

- The study provides information on several audiological results seen in people who have hearing loss.
- The research sheds light on the vulnerable group that may be affected by hearing loss.
- It sheds light on the various causes of hearing loss. Which aids in obtaining a care plan for patients with hearing loss.
- As a result, the study emphasizes the importance of raising public awareness of hearing loss in order to lower the prevalence of hearing loss, which is the second most common disability.

### **6.3 Future implications**

- The same kind of study may be taken up for the understanding of prevalence in children and older adults.
- The same kind of study may be taken up for the understanding of prevalence in the district of Mysore and different districts of Karnataka.

## CHAPTER 7

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