

A Descriptive Analysis of Hearing Losses and its Prevalence in Andaman and Nicobar Islands

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ABSTRACT

Background: In Andaman and Nicobar Islands, there is very limited study that provides information on different aspects of hearing loss and even data that indicates the prevalence of hearing loss is limited. This study aims to descriptively analyses different aspects of hearing loss and also estimate the prevalence of hearing loss in Andaman and Nicobar Islands.

Material and Method: Andaman and Nicobar Islands have only one ENT and Audiology setup which is located in Port Blair, at G. B. Pant Hospital. Any disorders and diseases related to hearing loss were referred and or one has to attend the only hospital from every corner of the Islands. A retrospective and descriptive analysis was conducted for a total of 7021 cases who were referred for Audiological diagnosis during 2018 to 2019, before the Coronavirus pandemic. A descriptive analysis was done for different types and degree of hearing loss. The Prevalence of Hearing Loss for various types and degree of hearing loss, and their correlation with gender and age was estimated.

Results: Par degree of Hearing Impairment, of 7021 sample, the overall estimated prevalence of Hearing Impairment (HI) was 41.74%. Mild degree of HI (18.13%) was most prevalent and Profound HI (1.6%) was least prevalent. For type of Hearing loss, Bilateral SNHL (10.7%) was most prevalent and B/L Mixed HL (3.4%) was least prevalent. The prevalence of Unilateral CHL (10.06%) was surprisingly higher than other unilateral conditions. Par age, the prevalence of hearing loss was most significant among 14-50 age group. Par gender, results show more prevalence in males than females.

Conclusion: The estimated high prevalence of hearing loss will have negative impact in Andaman and Nicobar Islands. Health education, adequate manpower, systematic awareness plan in rural and among socio-economically deprived is an eminent requirement in order to reduce the burden of hearing loss.

Keywords: Prevalence, HI: Hearing Impairment, HL: Hearing Loss, SSD: Single Sided Deafness, Andaman and Nicobar Islands (A & N Islands), Port Blair. PTA: Puretone Audiometry

1. INTRODUCTION

Hearing loss is a burden and a disease which can manifest its effects at any time in life. The burden of HI (Hearing Impairment) in children and adults cannot be neglected as it affects a high percentage of society. The negative impact of hearing loss in children and adult is substantial. In children, if undetected and left untreated,

hearing loss can lead to delayed speech and language development, social and economic problems, and academic disadvantage [1]. Childhood hearing loss has more serious implications but it is far less common than adult-onset hearing loss [2]. In Adult, hearing loss is often associated with an increased risk of psychiatric, effective mood disorder, frustration, social isolation,

depression, poor self-esteem, and functional disability, particularly for those who have not been evaluated and treated. [3-6]

HI is one of the most prevalent sensory deficits in human population, affecting more than 250 million people worldwide. According to WHO, over 5% of the world population – 360 million people have disabling hearing loss (328 million adults and 32 million children), and it is unfortunate that most of these people live in developing or underdeveloped countries [7]. Also, as per WHO, about 1.1 billion young people worldwide may be at risk of hearing loss due to exposure to high intensity noise [8]. Further, WHO also estimates that the estimated high prevalence hearing loss of 466 million worldwide in 2018 would rise to 630 million by 2030, and 900 million by the year 2050.

Both developed and developing countries have embraced the high impact and burden of Hearing loss. In United States of America, there are more than 31 million that experience significant amount of hearing loss. Increased prevalence of HI was reported from 14.9% in 1994-1998 to 19.5% in 2005-2006. And in 1965 to 1994 prevalence increases by two times [9-10]. The incidence of congenital hearing loss based on universal neonatal screening programs is estimated to be 1.1 per 1000 [11]. In Australia, one in six persons was estimated to have HI. Prevalence rates for hearing loss increased from less than 1% for people below 15 years to 75% for people above 70 years. With an ageing population, hearing loss is projected to increase to 1 in every 4 Australian by 2050 [12]. In India, about 63 million people (6.3%) suffer from significant hearing loss. The National Sample Survey (NSS) 58th round (2002) survey reported hearing disability to be 2nd most common cause of disability and top most cause of sensory deficit. Hearing disability estimated was 291 per 100000, with higher in rural areas (310) compared to urban regions (236) [13]. Nepal, one of the least developed nations [14] reported hearing disability of 15.45% par 2011

census. And out of 1.94% total disability of Nepal population reported, 1.48% had a combined hearing loss and vision impairment [15].

The A & N islands are an archipelago of 572 islands (of which 38 are inhabited) in the Bay of Bengal stretching over 700 Kms from North to South. The Islands lie between 92° to 94° E longitude and 6° to 11°N latitude, 1200 kms. east of Chennai and 250 kms south of Kolkata, and in close proximity to Burma and other South East Asian countries Thailand, Malaysia and Indonesia. The islands are spread over a total area of 8249 sq. Kms (Andaman - 6408 sq. kms & Nicobar -1841 sq. kms). Today, the islands have grown rapidly populated over the past 10 years and have become a place of political interest due to its vast tourism activities, diverse culture and religion. As per 2011 census, the population reported was 380581(202871 males and 177710 females). About 238142 (62.57 %) of the total population resided in the district of South Andaman within the capital city of Port Blair [16].

The medical infrastructure in the Islands is still inadequate compare to medical facilities in mainland. There is only one Referral hospital, 2 District hospitals, 5 Urban Health Centres, 4 Community Health Centres, 22 Primary Health Centres and 122 Sub-Centre. The only available well-established ENT and Audiological facility is at GB Pant Hospital, which is the referral hospital situated in Port Blair. The NPPCD (National Programs for Prevention and Control of deafness) was approved and sanctioned in early 2011. However, there is still limited literature and no specific study or relevant data available on the prevalence of hearing loss in these Islands. The aim of this study is, therefore, to determine the prevalence of HI and deafness among the populations of A & N Islands. This will help the health organization to analyse the serious impact of HI.

2. MATERIAL AND METHOD

In the present study, we followed five essential steps to arrive at valid results and to gain the required knowledge of specific information on the prevalence of Hearing Loss. These are:

2.1. Selection of Study Site

After extensive evaluation, the site for the study selected was G. B. Pant Hospital, the only equipped ENT and Audiological setup state referral hospital located in Port Blair, Andaman and Nicobar Islands. The hospital serves the majority of population and including other patients referred from District

Hospitals and from all part of the Islands for treatment of hearing disorders. Unlike mainland, there is no private ENT setup and the entire people in the Islands depended on this state hospital for hearing treatments. This makes the hospital an excellent suitable site for retrospective study.

2.2. Selection Of Study Variables

The variables selected for the study are (a) age, (b) gender, (c) degree of HI, and (4) type of Hearing loss. These variables are indicated in Table 1. All variables included were managed to protect the personal identity.

Table 1: Study Variable

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Age	Prevalence of hearing loss among the designated ages of 0-5, 5-14, 14-50, 50 years and above
Gender	Prevalence of hearing loss among males and females
Degree of hearing loss	Prevalence of the various degrees of hearing loss- mild, moderate, moderately-severe, severe, profound, including SSD
Type of Hearing loss	Prevalence of the various type of hearing loss- conductive, sensorineural, mixed, Unilateral CHL, Unilateral SNHL/Mixed HL, etc.

2.3. Collection Of Data

An all-inclusive criterion was used for data collection procedure. An extensive review was made for all records of audiological evaluation from January 2018 to December 2019. This covers a total period of two years, just before Coronavirus pandemic. This data includes records of all patients who have had evaluation for hearing loss using one or combination of test procedure including Pure Tone Audiometry, OAE (optoacoustic emission), ABR (Auditory Brainstem Responses), Tympanometry or BOA (Behavioral Observation Audiometry). A table entry was made for each patient data. A total of 7021 patient's data, 4752 (67.68%) males and 2269 (32.32%) females irrespective of age and gender was identified and included in the study.

2.4. Classification of Data

All data variable collected are further classified into categories

based on gender, age, degree of HI and type of hearing loss. Male and females were categorized into age group as 0-5 yrs, 5-14yrs, 14-50yrs and > 50 yrs respectively. The distribution by age and gender of total data variable under study are indicated in Table 2.

Table 2: Age and Gender Distribution

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Age	M		F	
0 - 5	205	4.31 %	162	7.14 %
5 - 14	146	3.07 %	91	4.01 %
14-50	3558	74.87 %	1598	70.43 %
>50	843	17.75 %	418	18.42%
Total	4752	100 %	2269	100 %
Male + Female = 7021				

To ascertain Degree of HI, Pure tone Audiometry (PTA) was considered. The PTA was carried out using Clinical Audiometer ALPS AD 2000 (India) for frequencies 250Hz, 500Hz, 1kHz, 2kHz, 4kHz and 8kHz. A three frequency Pure tone average 500Hz, 1kHz and 2kHz (Katz et al, 2009) was adopted to determined degree of HL. The Category used to describe the degree of HL at GBPH were (a) Normal (0 – 25 dB), (b) mild HL (26 – 40

dB), (c) moderate HL (41 – 55 dB), (d) moderately severe HL (56 – 70 dB), severe HL (71 – 90 dB), (e) Profound HL (> 90 dB) according to the threshold levels, and (f) Unilateral HL (SSD/ Single Sided Deafness). A set criterion was followed for each classified category. When Audiogram presents minimal to moderate inter ear difference by degree of HL, the better ear was taken as variable data. In case, a patient presented normal or near normal hearing in one ear and severe or profound HL in another ear, the loss was categorized as Single sided deafness (SSD). Otoacoustic Emission (DPOAE) and Auditory Brainstem Response (ABR) was done using Interacoustic (OtoRead) and Interacoustic (Eclipse 21) respectively for difficult to test subjects to estimate degree of hearing loss as well as to correlate pure tone audiometry results. Behavioral observation (BOA) was also done as a part of Hearing Screening along with OAE test. All tests were done in a sound treated Audiology room by a qualified Audiologist.

To ascertain type of Hearing Loss, we compared the hearing thresholds of air conduction and bone conduction. A sensorineural HL has essentially equal amount of loss for AC and BC thresholds. A conductive HL has normal BC threshold levels with AC thresholds reduced beyond normal levels. A mixed HL has an air-bone gap and thresholds for BC that falls outside the range of normal hearing (Katz et al., 2009). All the confirmed type of HL was categorized into (a) B/L conductive HL, (b) B/L SNHL, (c) B/L Mixed HL, (d) Normal

with Conductive HL (unilateral conductive HL), (e) Normal with SNHL / Mixed HL (Unilateral SNHL or Mixed HL), and (f) Conductive HL with SNHL / mixed HL (CHL+SNHL / Mixed HL).

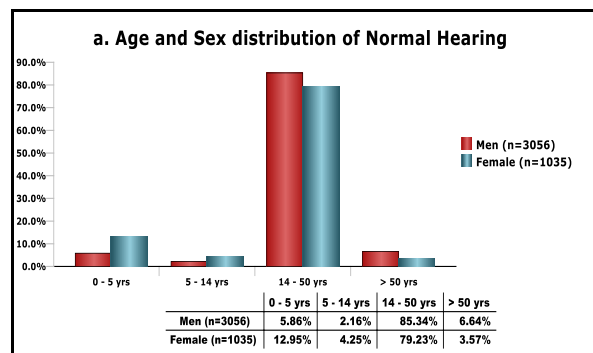
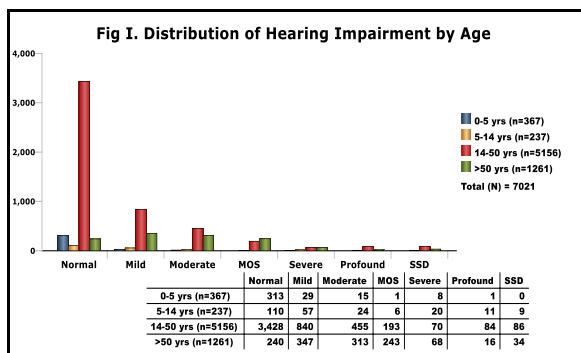
2.5. Analysis of Data: A simple descriptive statistical analysis for percentage and frequency using IBM SPSS version 26 was done to determine the prevalence of hearing loss based on the type and degree of HI.

3. RESULTS

Of 7021 samples, 67.68% (n=4752) were males and 32.32% (n=2269) were females. A simple descriptive statistical analysis for percentages and frequency was performed for key variable such as demographics (age and gender), degree of HI and type of HL.

3.1. Degree of Hearing Loss

Out of 7021 patients, 58.27% (n=4091) presented normal hearing sensitivity. As much as 41.74% (n=2930) were diagnosed to have mild degree to profound degree of HL and unilateral HL (SSD). The distribution of HI by age is presented in Fig 1, and distribution of degree of HL by age and sex is presented in as Figure I. a to g. The results show that 18.13% (n=1273) accounts for mild HL, 11.49% (n=807) have moderate HL, 6.31% (n=443) have moderately severe HL, 2.36% (n=166) have severe HL, 1.6% (n=112) have profound HL, and 1.84% (n=129) accounts for unilateral HL (SSD).



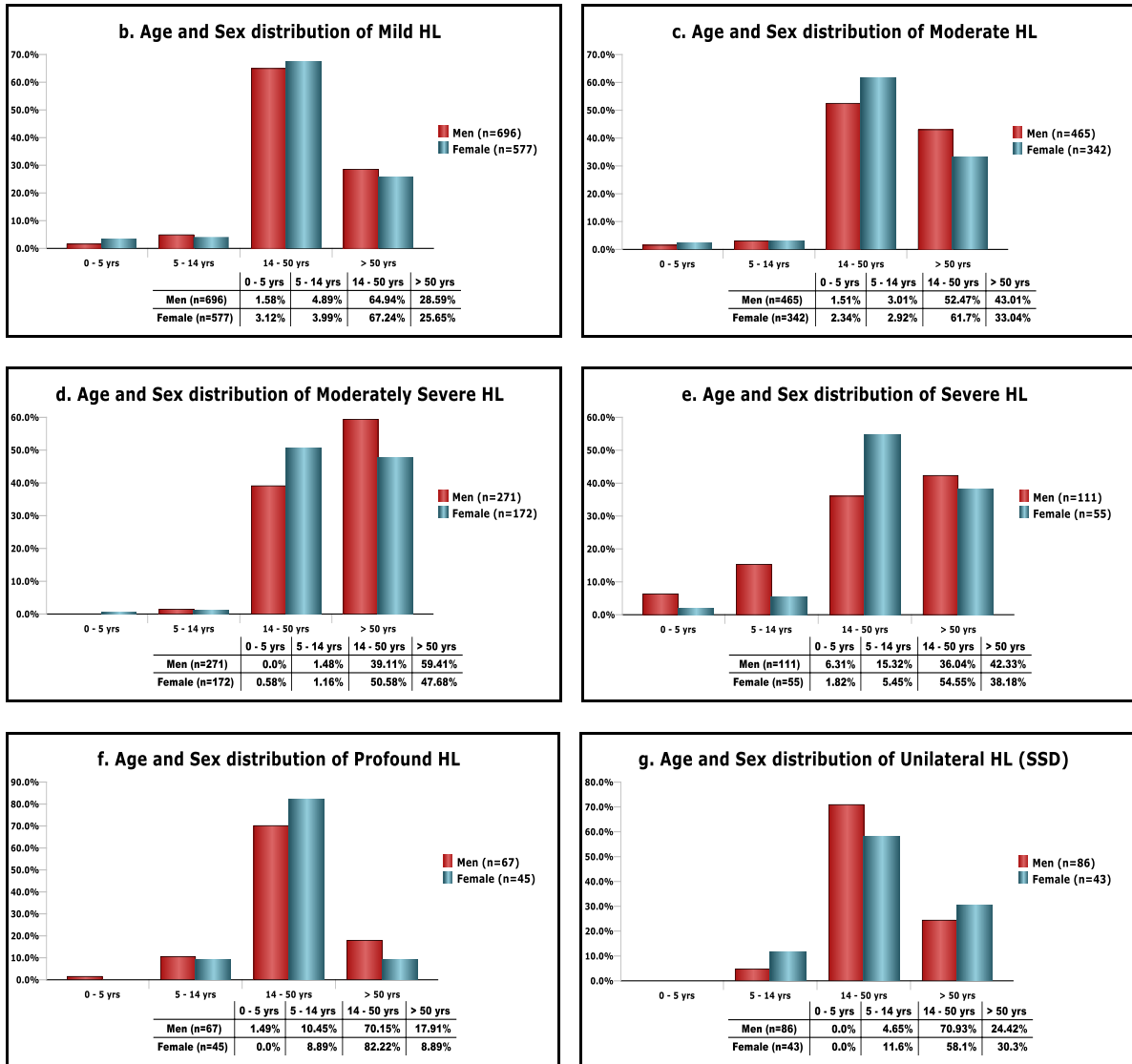
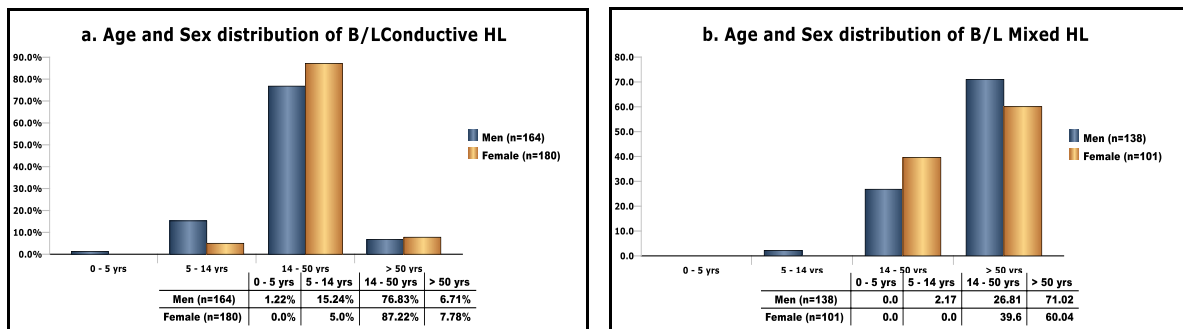


Figure 1: Distribution of Severity of HI by Age. Figure 1 (a to g): Age and Sex distribution of Normal, mild HL, moderate HL, moderately severe HL, severe HL, profound HL and Single Sided Deafness.

3.2. Type of Hearing Loss

Of 7021 patients, 4.9% (n = 344) had Bilateral conductive HL, 3.4% (n = 239) had Bilateral mixed HL, and 10.7% (n = 751) had Bilateral sensorineural HL. Separately, different effects of hearing loss were also analyzed and result shows that

10.06% (n = 706) had unilateral Conductive HL, 4.32% (n = 303) had unilateral SNHL or Unilateral Mixed HL, and 3.65% (256) had Conductive HL in one ear with SNHL or Mixed HL in another ear. However, in 0.66% (n = 46) cases, type of HL was not confirmed.



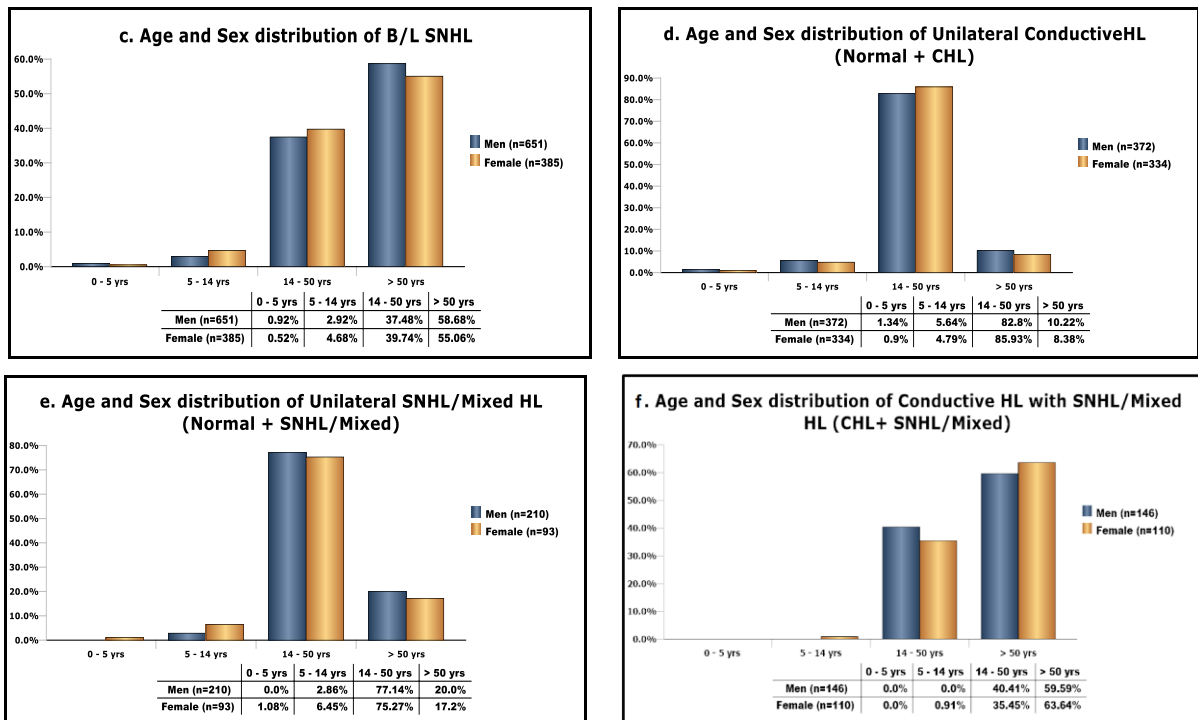


Figure 2 (a. to f.): Age and Sex Distribution of B/L Conductive HL, B/L SNHL, B/L Mixed HL, Unilateral CHL, Unilateral SN/Mixed HL and Conductive HL with SN/Mixed HL.

3.3. Age Demographic

Par age, the 14 – 50 age group (24.61%, n = 1728) shows highest prevalence of HL which was followed by age group > 50 accounting 14.54% (n = 1021) of HL. In age group 0 -5 and 5 – 14, the prevalence was 0.77% (n = 54) and 1.81% (n = 127) respectively.

3.4. Gender Demographic

Par gender, for HI > 25 dBHL, the prevalence of mild HI for male was 9.91% (n = 696) and female was 8.22% (n = 577), moderate HI in male was 6.62% (n = 465) and female was 4.87% (n = 342), moderately severe HI for male was 3.86% (n = 271) and female was 2.45% (n = 172), severe HI for male was 1.58% (n = 111) and female was 0.78% (n = 55), profound HI in male was 0.95% (n = 67) and female was 0.64% (n = 45) respectively. For unilateral HI, the prevalence in male was 1.22% (n = 86) and female was 0.61% (n = 43). When types of HL were considered, results show that in B/L Conductive HL in female (2.56%, n = 180) shows higher prevalence compare to males (2.34%, n = 164). In B/L SNHL,

B/L Mixed, unilateral conductive HL and unilateral SNHL/mixed HL, males show higher prevalence than females.

4. DISCUSSION

There are number of published studies about prevalence of hearing loss. This is one of the first studies to report Audiological data and variables used to estimate prevalence of hearing loss in Andaman and Nicobar Islands, India. The following data variables are taken for discussion.

4.1. Disabling Hearing Loss

According to our study, the prevalence of HI with inclusion of mild hearing loss was estimated to be 41.74% (n=2930). In the past, Konadath, S. et al. reported estimated prevalence of ear related problems to be 47.76% (n = 148), which was the only related study conducted in Port Blair till date [17]. From these two studies it appears that prevalence rates of hearing loss estimated based on Pure tone audiometry and the prevalence of ear related problems are very close and quite similar. It is highly

possible that this high prevalence of hearing loss and related ear problems is likely to cause high burden in health organization and create negative impact among the Islanders.

The WHO consider disabling HL as more than 40 dB in those aged 15 years or more but more than 30 dB in younger people. Applying the definition of disable hearing loss given by WHO in our studied sample, an overall 21.76% (n = 1528) of patients have presented disabling hearing loss. This result showing higher prevalence is alarming if we are to compare with other reported population based prevalent studies in mainland India (6%), or other developing countries Indonesian (4%), Nepal (16.6%), and Thailand (13.3%) [18]. These different outcomes and results in prevalent studies could be due to the different criteria, definitions and methods utilized during the studies and it should be interpreted with caution. However, comparatively in the mainland, Garg et al. reported similar overall prevalence of 25.1% hearing loss in Delhi [19]. The high prevalence rate of HI and Disabling Hearing loss may indicate requirement of better ear care services particularly among the most affected age group 14 – 50 yrs.

4.2. Gender Distribution

In our study, samples which consisted of male population 67.68% and female 32.32%, the result shows that prevalence of HI was slightly higher in males than in females across the degree of HI from mild to profound. This result is consistent and in agreement with the findings detailed by other studies [20-23]. The probable reason of higher hearing loss prevalence in men than women is not essentially biological but due to lifestyle factors. Men are typically more exposed to loud sounds, more likely to have bad habit like smoking, and loud hobbies which can intensifies natural degradation of hearing.

4.3. Age Distribution

According to our study, the age group 14 – 50 years which constitute majority of patients attending for hearing test also show highest prevalence (24.61%, n = 1728) of hearing loss. This suggest that adults of age around 14 – 50 years were more concern and aware of their health and wellbeing including ear and hearing care. The second highest prevalence is found in 50 year and above with 14.54% (n =1021). The Prevalence was smaller (1.81%, n = 127) in 5 – 15 age group and even smaller (0.77%, n = 54) among children and pediatric aged 0 – 5. Our findings were agreeable as par other literature that prevalence of hearing loss tends to increase with age [20, 22, 24-26].

4.4. Degree of Hearing Loss

According to our study, the data has shown that out of 7021, 41.74% (n=2930) were diagnosed as having at least mild degree of HI in one or both ears. Mild hearing loss (18.13%, n=1273) was the most common HI, while profound hearing loss (1.6%, n=112) was the least common. This finding agrees with Amedofu et al. which reported, of 142 respondents, 66.9% had mild hearing loss to 7.6% profound hearing loss, and Marfo, similarly recorded, of 135 respondents, majority (42%) had mild hearing loss, whereas minority (4%) had profound hearing loss [27, 22]. “Mild HL” has been the most common and under-diagnosed degree of hearing loss and it could have great impact, if left untreated.

Accordingly, our results were at par other literature showing the highest prevalence of HL by degree in Mild HL followed by moderate HL (11.49%, n=807), moderately severe HL (6.31%, n=443), severe HL (2.36%, n=166), profound HL (1.6%, n=112), and unilateral HL/SSD (1.84%, n=129) respectively [22, 27].

4.5. Types of Hearing Loss

Types of hearing loss evaluated shows variable degrees of prevalence. In the present study, Bilateral SNHL was the most common, with prevalence rate of 10.7% (n

= 751) which suggest that HL tends to be bilateral. In fact, hearing loss which tends to be a bilateral condition is supported in a study reported by Hamid et al. [28]. Amedofu et al. reported similar findings in their evaluated work on 6426 patients in Ghana [29]. Similar findings are also reported by Salvago et al. [30]. Surprisingly, in our study, Unilateral Conductive HL (10.06%, n = 706) was found to be more prevalent as compared to Bilateral CHL (4.03%, n = 283) among 14 – 50 age group. This may suggest that unlike SNHL, conductive HL is characteristically more varied and the effect, causes and course of hearing loss is also generally ear specific.

Our findings also indicated B/L Conductive HL (4.9%, n = 344) is slightly more prevalent than B/L Mixed HL (3.4%, n = 239). Among children and adolescent of 5 - 14 age groups, similar prevalence rates were seen in B/L SNHL (0.53%), B/L CHL (0.48%) and unilateral CHL (0.53%). Among, Pediatric (0-5 yrs.) there was similar prevalence of B/L SNHL (0.11%) and Unilateral CHL (0.11%). Our results show less variation of hearing loss among pediatrics which was probably due to the fact that lower age group were highly sensitive and difficult to test, and even the patterns of hearing loss that can be ascertained are limited to SNHL or Conductive HL.

4.6. Unilateral Hearing Loss (HL)

The prevalence of Unilateral HL is not uncommon among adults as well as children. In our study, separate information data and results were gathered for single sided deafness (SSD) / HI, unilateral conductive HL, unilateral SNHL or Mixed HL respectively. As many as 1.84% (n=129) had unilateral HL (single sided deafness) with severe to profound HL in one ear and normal or mild HL in another ear, 10.06% (n = 706) shows unilateral conductive HL and 4.32% (n = 303) had unilateral SNHL or Unilateral Mixed HL. Together they form an overall of 16.21% (n = 1138) prevalence of unilateral HL or asymmetrical

HL. In America, the overall prevalence of UHL in adult American was 7.2%, with 5.7% having mild and 1.5% with moderate-or-worse UHL [31]. And one in 1,000 newborns is identified with unilateral HL at birth. By the time they reach school age, 3 in 100 children may have developed unilateral HL [32]. The higher prevalence reported in our study for UHL was due to the fact that we have taken results of total samples population from paediatrics to geriatrics. Also, according to our study, the prevalence of unilateral conductive was significantly high. Many studies have indicated that there is the tendency that hearing loss usually affect both ears, but our results indicated that in case of CHL, Unilateral CHL is more common. Although deem necessary in UHL, Hearing aid usage is very low, even when there is perceived handicap. The benefits and satisfaction of HA users with unilateral auditory loss, regardless of the type, were previously reported. Public health education is needed to increase awareness of and auditory rehabilitation for UHL [31].

4.7. Hearing Loss in Children / Pediatric

According to our study, there was lower prevalence (0.77%, n = 54) among children / pediatrics in the age group of 0 -5 years, and 1.81% (n = 127) in children and adolescent of 5 -15 years age group which was, probably, due to small number of sample size. The small sample size could be due to lack of awareness or lack of referral for NBS. In our setup, universal newborn screening had not been started and only high-risk baby were referred for screening and hearing assessment. It is important for children and pediatrics to be screen and evaluated as early and as universal as possible, in all health setup and awareness of HI in every society is necessary. In reference to NBS and Pediatrics, Bess et.al estimated incidences in newborns for mild bilateral HL range from 0.36 to 1.30 (per 1,000) and from 0.8 to 2.7 (per 1,000) for unilateral HL [32]. White et.al estimated

prevalence in school-aged children, range from 10 to 15 (per 1,000) for mild bilateral HL and 30 to 56 (per 1,000) for unilateral HL [33]. It is advisable but estimation of incidence and prevalence of such alike study was not within the scope of our present study.

5. CONCLUSION AND RECOMMENDATION

In Andaman & Nicobar Islands, of 572 archipelagos, even the 38 inhabited Islands were scattered and accessibility is difficult especially for those that are not connected by roads. The present prevalent study was therefore carried out at the site of GB Pant Hospital, a place where majority and most people of the Andaman & Nicobar Islands attended or were referred to for hearing problems, and the results are direct indicative prevalence of hearing loss and reflects the burden of HI for the entire population. However, more and future population-based prevalent research study is suggested.

The estimated prevalence of HI (41.74%) and overall 21.76% of disabling hearing loss in our study is surprisingly high which will have significant impact in Andaman and Nicobar Islands. Early identification and treatment of hearing loss with improved health facilities is very crucial to reduce the prevalence of deafness. The NPPCD that was approved and implemented in A & N Islands during 2011 yielded remarkable efforts toward fulfilling certain goals in prevention and intervention but it is enough. Rehabilitation services through the distribution of Hearing aid, Auditory Training, and Speech Therapy was provided but there is a need for further improvement. In the current scenario, Cochlear Implantation is not available and patients that require CI were referred to mainland for surgery after ENT and Audiological assessment. Health education, adequate manpower, availability of modern health equipment, systematic awareness plan/program in rural and among socio – economically deprived could be the key in

reducing the burden and prevalence of deafness.

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Abbreviations

AC Air Conduction
BC Bone Conduction
CHL Conductive hearing loss
dBHL decibel hearing level
HI Hearing Impairment
HL Hearing Loss
NPPCD National Programme Prevention and Control of Deafness
PTA Pure tone Audiometry
SNHL Sensorineural hearing loss
SSD Single Sided Deafness

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