

# PURE TONE AUDIOMETRIC EVALUATIONS OF ADULT PATIENTS WITH HEARING IMPAIRMENT IN A NIGERIAN UNIVERSITY TEACHING HOSPITAL

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## ABSTRACT

### BACKGROUND:

Hearing impairment irrespective of who is affected still remains a leading cause of disease burden in most developing countries. This study was conducted to establish the Pure Tone Audiometric (PTA) pattern of hearing impaired adult patients that presented to the Ear, Nose and Throat (ENT) clinics of the University of Port Harcourt Teaching Hospital (UPTH), Port Harcourt, Nigeria. It will also bring to limelight the burden of these patients.

**PATIENTS AND METHODS:** This was a retrospective study of adult patients who had PTA evaluations done on account of hearing impairment in the department of Ear Nose and Throat (ENT) surgery of the UPTH over a 7 year period from January 2006 to December 2012. The patient's data were retrieved from the Pure Tone Audiometry register, registers in the ENT clinics and patients case notes. Demographic data, clinical features, types and degree of hearing impairment, predisposing factors and management outcomes were recorded and analyzed.

**RESULTS:** Four hundred and seventy seven patients had PTA out of 5056 who attended the ENT clinics during the study period. There were 275 males and 202 females (male: female ratio of 1.4:1.0). Age range was 18 to 94 years, mean = 46.8 +/- 12.5 years. The age group that was commonly affected with hearing impairment was 51-61 years. Profound, severe, moderate, mild and normal hearing impairments were found in 50, 185, 110, 96 and 36 patients respectively. Sensorineural hearing loss was the commonest type of hearing impairment. Majority of the patients had severe hearing impairment and the commonest predisposing factor was exposure to loud noise. Majority (n=285) of the patients could not have further expert management because of poverty and lack of facilities/ manpower.

**CONCLUSION:** This study established the PTA pattern among adult patients with hearing impairment in UPTH. The middle aged group patients were mostly affected and most patients had severe hearing impairment of which sensorineural hearing loss ranked highest. Undue exposure to loud noise was implicated as the commonest factor responsible for hearing impairment.

**KEY WORDS:** Pure Tone Audiometry, Hearing impairment, Hearing screening, Noise-induced hearing loss, Wax impaction.

## INTRODUCTION

Hearing impairment is a reduction in the ability to perceive sound. The impairment may range from slight to complete deafness. It is the most frequent unseen sensory deficit in human populations, affecting more than 250 million people in the

world<sup>1</sup>. The consequences of hearing impairment include inability to interpret speech sounds, often producing a reduced ability to communicate, delay in language acquisition in children, economic and educational disadvantages, social isolation and stigmatisation<sup>2</sup>.

Furthermore, hearing impairment even though it affects people from all socioeconomic levels, the majority of people with hearing impairment lives in developing countries where services are scarce or non-existent. It is a unique problem that lies at the crossroads of health, education and economic development<sup>3</sup>.

Hearing impairment can be classified as conductive, sensorineural, or both (mixed loss) and majority of the factors implicated are preventable<sup>4, 5</sup>. Many models of classification of hearing impairment based on the audiogram have been devised to suit the needs of researchers and clinicians. However, the classification published by WHO is one of the most commonly employed models to date. Classification was according to the pure tone average in the better hearing ear. The categories of hearing impairment, ranges from “no impairment” to “profound impairment” according the threshold level. The hearing threshold level, using audiometry, is to be taken as the better ear average for four frequencies 0.5, 1, 2, and 4 kHz.<sup>6</sup>

Conductive hearing loss occurs due to lesions in the external auditory canal, tympanic membrane (TM), or middle ear. These lesions prevent sound from being effectively conducted to the inner ear. Sensorineural hearing loss is caused by lesions of either the inner ear (sensory) or the auditory (8th) nerve (neural) while mixed hearing loss has components of both conductive and sensorineural loss and may be caused by severe head injury with or without fracture of the skull or temporal bone, by chronic infection, or by one of many genetic disorders<sup>4,5,7,8</sup>.

To detect and quantify hearing loss it requires hearing assessment which usually includes the measurement of pure tone thresholds with air and bone conduction. Besides speech reception threshold, speech discrimination, tympanometry, acoustic reflex testing, oto-acoustic emissions and brain stem evoked response audiometry are necessary for completeness. Pure-tone audiometry

quantifies hearing loss by using an audiometer which delivers sounds of specific frequencies (pure tones) at different intensities to determine the patient's hearing threshold<sup>6</sup>.

We have observed that there is paucity of information on hearing impairment in our environment. Therefore, we decided to carry out this study to establish the PTA pattern of hearing impaired adult patients that presented to UPTH and to bring to limelight the burden of these patients.

## **PATIENTS AND METHODS**

This was a retrospective study of adult patients who had PTA evaluations done on account of hearing impairment in the department of Ear Nose and Throat (ENT) surgery of the UPTH over a 7 year period from January 2006 to December 2012. The patient's data were retrieved from the Pure Tone Audiometry register and patients case notes. Records from the registers in the ENT clinics were used to augment the data.

The degree of hearing loss had been determined by using a diagnostic audiometer (Itera Madsen EN 80645-1-2 type 2, A SN 211150 manufactured in December 2004 in Denmark) with well-fitting earphones. The PTA was performed in the standard manner in a sound proof audiology cabin<sup>3,5</sup>.

To define the various levels of hearing impairment, the WHO classification system that is based on the pure-tone average of four frequencies (500, 1,000, 2,000, and 4,000 Hz) in the better-hearing ear was used<sup>3, 6</sup>. However, measurements of pure-tone thresholds by air conduction were obtained at 125, 250, 500, 1,000, 2,000, 4,000, and 8,000 Hz in each ear. Bone-conduction measurements were performed with a vibrator placed on the mastoid bone at 250, 500, 1,000, 2,000, and 4,000 Hz on each side.

Based on pure-tone averages, the WHO places normal hearing in the range of -10 to 25 dB HL.

Hearing impairments are classified into one of five categories: mild (26 to 40 dB HL), moderate (41 to 55 dB), moderately severe (56 to 70dB), severe (71 to 90dB), and profound (greater than or equal to 91dB)<sup>3,6</sup>.

Demographic data, clinical features, types and degree of hearing impairment, predisposing factors and management outcomes were recorded and entered into the version 16 of the Statistical package for social sciences (SPSS16). Simple descriptive statistics in the form of mean, frequency distribution tables and percentages were used to illustrate the data.

## RESULTS

Pure Tone Audiometry was performed on 477 patients out of 5056 patients who attended the ENT clinics during the study period and this gave a prevalence of 9.43% of cases. There were 275 males and 202 females (male: female ratio of 1.4:1.0). Age range was 18 to 94 years, mean = 46.8 +/- 12.5 years. The age group that was commonly affected with hearing impairment was 51-61 years (Table 1). The commonest complaint was blocked ears (Table 2).

One hundred and forty three patients had conductive hearing loss, 204 had sensorineural hearing loss and 130 had mixed hearing impairment. Profound, severe, moderate, mild and normal hearing impairment were found in 50, 185, 110, 96 and 36 patients respectively (Table 3). Bilateral hearing impairment was found in 202 patients. The left ear alone was involved in 116 patients while the right alone was involved in 159 cases.

The commonest predisposing condition was exposure to loud noise followed by chronic suppurative otitis media (CSOM) (Table 4). The treatments given were mainly: gentle ear syringing with warm normal saline for those with wax in their external auditory canal, aural toileting, topical antibiotic ear drops, and nasal decongestants were used for those patients with CSOM, antifungal ear

drops and wick packing were used for those patients with otomycosis; heamatonics, stugerone and stemetil for patients with tinnitus and vertigo. One hundred and ninety two patients responded to treatment and these were mainly those with wax in the external auditory canal, patients with drug induced hearing impairment and CSOM. Majority (n=285) of the patients were referred to other centres for further audiological assessment and expert management.

**TABLE 1: Age distribution of Patients with hearing impairment n=477**

Age group (Years)	Number	Percentage (%)
18-28	60	12.58
29-39	90	18.87
40-50	98	20.55
51-61	128	26.83
62-72	60	12.58
73-83	35	7.33
84-94	6	1.26

**Table 2: Clinical features of patients with hearing impairment n=477**

Clinical features	Number	Percentage (%)
Fullness in the ears	45	9.43
Tinnitus	56	11.74
Otalgia	80	16.77
Otorrhoea	65	13.63
Vertigo	67	14.05
Blocked ears	102	21.38
Itching ears	62	13.00

**Table 2: Clinical features of patients with hearing impairment n=477**

Degree of hearing impairment	Number	Percentage (%)
Normal	36	7.55
Mild	96	20.13
Moderate	110	23.06
Severe	185	38.78
Profound	50	10.48

**TABLE 4: Aetiological factors of patients with hearing impairment n=477**

Aetiological factors	Number	Percentage (%)
Wax impaction	70	14.68
Trauma	66	13.84
Chronic Suppurative Otitis Media	73	15.30
Exposure to loud noise	95	19.92
Treatment of febrile conditions with drugs	45	9.43
Presbycusis	50	10.48
Menieres	25	5.24
Not documented	53	11.11

## DISCUSSION

The prevalence of hearing impairment in our study was found to be 9.43% which is high compared with figures obtainable in the United State of America and United Kingdom. Blanchfield et al in 2001 estimated that people with hearing impairment in the United States were approximately 3.4% of the total hearing-impaired population<sup>9</sup> while, Turton and Smith in 2013 designed a retrospective study of some 32,761 patient files, from which they too, estimated the prevalence of hearing impairment in the United Kingdom to be 6.7% of their local "clinical population," indicating 0.7 percent of the general population of the United Kingdom likely has hearing impairment<sup>10</sup>.

However, the prevalence of hearing loss in a study in Iran revealed 15.43% which was higher than what we found<sup>11</sup>. Although, their study population

included all age group including children and this may explain the reason they got a higher prevalence.

We found a slight male preponderance in our study which agrees with the findings of other researchers within and outside Nigeria<sup>3,4,11</sup>. However, we cannot infer from this study that the male gender affects hearing impairment. Further research is required to establish if gender actually contributes to hearing impairment.

The age distribution of our study population showed that the patients within the age group 51-61 years had the highest number of cases. This finding differs from the work done in Kaduna where the researchers found hearing impairment to be highest among patients between the ages of 11 and 20 years and 21 and 30 years. A high prevalence of impaired hearing among patients in their economically productive years can negatively affect both individual and community financial welfare and can lead to increased societal dependency<sup>2,3</sup>.

The majority of the patients in our study have sensorineural hearing loss which was due to noise pollution. Sensorineural hearing loss was also found to be the commonest type of hearing loss in Iran<sup>11</sup>. In highly industrialized countries noise induced hearing loss is an important cause of sensorineural hearing loss<sup>12,13</sup>. We were not surprised at the high number of patients with hearing impairment due to undue exposure to loud noise in our environment because most households within our environment use generator sets that are noisy to provide electricity to run their day to day activities<sup>3,11,14</sup>.

In several developing countries, preventable causes of sensorineural hearing loss such as infections and obstetric mishaps remain important<sup>15-17</sup>. The indiscriminate use of ototoxic ear drops and poorly treated /complicated ear disease like CSOM have also been implicated as predisposing factors of sensorineural hearing loss<sup>8</sup>. Besides, Okafor reported that most of the patients in his study with

severe to profound hearing impairment in eastern Nigeria were due to chronic suppurative otitis media<sup>18</sup>.

The majority of our patients had bilateral hearing impairment. This finding agrees with the finding of Davis in Great Britain who found 16% of their adult population (17–80 years) to have bilateral hearing impairment<sup>12</sup>. It is possible that these patients had initially experienced a unilateral loss that went unidentified and then progressed to a bilateral impairment as documented by some researchers in Kaduna<sup>3</sup>.

Furthermore, we found that most of our patients have bilateral severe hearing impairment. However, severe hearing impairment among patients within a given population has been documented by several researchers worldwide<sup>9-12</sup> and the disability associated with the condition is enormous especially when both ears are involved. It puts a strain on many aspects of personal, interpersonal, community, and economic well-being, and it can contribute to social isolation, poor communication, depression, and stigmatization<sup>2,4,5</sup>.

The burden of adults with impaired hearing in our society is further aggravated by poverty, ignorance and poor facilities<sup>19, 20</sup>. The prevailing level of poverty that follows unemployment and the non-availability of diagnostic facilities and hearing aids in most centres in the developing countries have made their management cumbersome<sup>4</sup>.

## CONCLUSION

This study established the PTA pattern among adult patients with hearing impairment in UPTH. The middle aged group patients were mostly affected and most patients had severe hearing impairment of which sensorineural hearing loss ranked highest. Undue exposure to loud noise was implicated as the commonest factor responsible for hearing impairment. Meanwhile, to reduce the prevalence and burden of hearing impairment in our society,

public health measures such as public enlightenment campaigns on the prevention of noise pollution and early detection of impaired hearing by carrying out universal hearing screening for the general population should be embarked upon as soon as possible.

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