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***PATTERNS AND CAUSES OF HEARING LOSS AMONG  
PATIENTS CONSULTING ENT/OPD AT CHUK***

A dissertation submitted in partial fulfillment of the requirements for the award of the Degree of Master of Medicine in ENT, Head and Neck Surgery of the University of Rwanda

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## **DEDICATION**

This dissertation is dedicated:

To the almighty God,

To my dear parents for their unconditional love, care, guidance, prayers, and sacrifices since my birth till this day

To my brothers and sisters for their love

To my friends and relatives

## **ACKNOWLEDGEMENTS**

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## **ABSTRACT**

**Introduction:** Hearing loss (HL) is complex and individual impact varies considerably. In addition, it has a significant impact on both the individual and society and can be found in all age groups throughout the lifespan. Hearing loss has many potential causes over one's lifetime unfortunately, little is known in the developing world about it. Furthermore, we do have limited data in Rwanda highlighting patterns and causes of hearing loss. The aim of this study was to determine the patterns and causes of hearing loss among patients consulting ENT/OPD at CHUK and will offer baseline epidemiological data for future researches.

**Methods:** This cross-sectional descriptive study was carried out in the department of otolaryngology-head & neck surgery at CHUK among patients from 5 years of age consulting ENT/OPD complaining of hearing loss. Using a questionnaire pre-designed for this study, data was collected from the history, carrying out ear examinations and referring to investigation reports.

**Results:** This study provided analysis regarding hearing impairment of 394 patients. The age ranged from 5 to 81 years (Mean 33.07, SD 18.42). Males constituted 50.8% (n=200) with a male to female ratio of 1.03:1. Students at 50.2% (n=198) was the commonest group of people. Mild hearing loss was the predominant degree of HL accounting for 57.8% (n=228) with the right ear involvement of 52.19% (n=119); left ear 47.80% (n=109). Regarding the type of hearing loss, the majority of patients, 62% (n=235) had CHL, 30.3% (n=115) had SNHL while mixed hearing loss accounted for 7.6% (n=29). Among known etiologies; CSOM was the most common cause accounting for 35% (n=138) followed by hearing loss due to head trauma 13.9% (n=55) then age related hearing loss 11.4% (n=45) and OME 7% (n=28). Furthermore, undefined causes accounted for 15.2% (n=60). 38% (n=151) of patients had no abnormality on examination. Otosopic findings were variable and TM perforation was the most common abnormality found in 32.2% (n=131) of all patients examined .

**Conclusion:** The most common cause of HL is chronic suppurative otitis media which is preventable or treatable and young adult is the most affected population. Prevention, early diagnosis followed by appropriate interventions can effectively reduce hearing loss or minimize its impact.

## **LIST OF ABBREVIATIONS**

USA: United States of America

ENT: Ear, Nose and Throat

OAE: Otoacoustic emission

CHUK: Centre Hospitalier Universitaire de Kigali

Db: decibel

OME: otitis media with effusion

CSOM: Chronic suppurative otitis media

CHL: conductive hearing loss

SNHL: Sensorineural hearing loss

PTA: Pure tone audiometry

CSF: Cerebrospinal fluid

VRA: Visual reinforcement audiometry

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## CHAPTER I. GENERAL CONSIDERATIONS

### 1.1. Introduction

Hearing loss has a significant impact on both the person and the society and is one of the most important causes that make a person different from others in a form of a handicap which detaches him or her from the society<sup>1,2</sup>. In addition, hearing loss is associated with numerous serious negative consequences such as speech, language and cognitive retardation, impairment difficulties in social adjustment and poor educational achievement. Consequently, the costs of increased needs and diminished autonomy associated with hearing loss are shared by the society<sup>1</sup>. Moreover, in children, the problem is compounded since normal hearing provides the primary source for acquisition of language, speech and cognitive skills<sup>2</sup>.

Although the socioeconomic cost of hearing loss is difficult to assess, it is associated with low employment rates, lost of productivity and high health care costs.

According to the World Health Organization (WHO) report released in 2017, the overall annual cost of unaddressed hearing loss is in the range of \$750-790 billion globally. A conservative estimate of the cost to the education sector of providing support to children (5–14 years) with unaddressed hearing loss is \$3.9 billion. In addition, loss of productivity due to unemployment and premature retirement among people with hearing loss is conservatively estimated to cost \$105 billion annually. Furthermore, the result of social isolation, communication difficulties and stigma add a further \$573 billion each year<sup>3</sup>.

According to the type of deafness, conductive hearing loss occurs when there is some interference of sound transmission or vibration due to pathology involving the external and/or middle ear, sensorineural hearing loss happens when there is injury to the cochlea or the cochlear nerve and mixed hearing loss when both sensorineural and conductive hearing loss are present at the same time<sup>1,2,4-6</sup>.

The degree of deafness ranges from mild impairment which is defined as an average threshold level between 26 and 40 dB, moderate impairment defined as an average threshold level between 41 and 60 dB, severe impairment defined as an average threshold level between 61 and 80 dB, and profound impairment as an average threshold level of 81db or greater<sup>1,4-6</sup>.



## 1.2. Causes of hearing loss

Hearing loss in any individual at any given time is either congenital (genetic or non genetic) or acquired<sup>5</sup>.

Congenital causes include hereditary hearing loss or hearing loss due to other factors present either in utero (prenatal) or at the time of birth. In addition, genetic factors are thought to cause more than 50% of all incidents of congenital hearing loss in children and may be autosomal dominant, autosomal recessive, or X-linked (related to the sex chromosome)<sup>5,7,8</sup>.

Other causes of congenital hearing loss that are not hereditary in nature include; prenatal infections, such as rubella (German measles), cytomegalovirus, and herpes simplex virus; toxins consumed by the mother during pregnancy or other conditions occurring at the time of birth or shortly thereafter, which are complications associated with the Rh factor in the blood, prematurity, maternal diabetes, toxemia during pregnancy and lack of oxygen (anoxia)<sup>5,7,8</sup>.

In acquired hearing loss, ear infection, precisely otitis media with effusion (OME) is the most common cause of CHL in children<sup>4</sup>. Furthermore, CSOM with a principal pathophysiologic mechanism of dysfunction of the Eustachian tube, long term negative middle ear pressure which may lead to TM retraction, resorption of ossicles, formation of cholesteatoma within the middle ear resulting in the disruption of the ossicles and fibrosis of the middle ear may result in conductive hearing loss<sup>4</sup>. In addition, complications of CSOM may lead to SNHL due to suppurative labyrinthitis, brain abscess and meningitis<sup>4</sup>. Furthermore, bacterial meningitis from any cause, both congenital or acquired (ex: from syphilis or tuberculosis) can cause SNHL<sup>4</sup>.

Although commonly used drugs such as aminoglycoside antibiotics (streptomycin, gentamycin, kanamycin and vancomycin); Loops diuretics (furosemide and bumax); Antineoplastic agent (cisplatin and carboplatin); Salicilates (aspirine) and quinine have ototoxic properties<sup>1,5,9</sup>.

In trauma, temporal bone fracture with otic capsule disruption will almost result in SNHL and is associated with a high incidence of facial nerve paralysis, CSF fistula and intracranial complications while otic capsule sparing fractures usually cause CHL or mixed HL<sup>10</sup>.

Barotrauma which usually occurs during descent from high altitude in which there is a rapid increase in aircraft pressure; the inability to equalize the air pressure on the external canal and middle ear side leads to substantial negative pressure within the middle ear, resulting in serous or bloody effusion and then pain and CHL<sup>4,11</sup>.

Head trauma, heavy lifting, straining and barotrauma may cause perilymphatic fistula which may cause progressive or fluctuating SNHL and vestibular symptoms<sup>4,5</sup>.

In addition, it has been found that some systemic immune mediated disorders such as relapsing polychondritis, polyarthritis nodosa, Wegner's granulomatosis, lupus erythematosus, giant cells arteritis are all associated with hearing loss and histopathological studies of the temporal bone in patients with these disorders supports the view that vasculitis and an inflammatory infiltrate are the cause of SNHL<sup>4</sup>.

Furthermore, a variety of tumors can cause conductive hearing loss by interfering with the motion mechanics of the middle ear and ossicles or SNHL by invading the inner ear or auditory nerve. The most common primary tumors arising within the temporal bone are acoustic neuroma, chemodectoma, squamous cell carcinoma, adenocarcinoma and basal-cell carcinoma.

The most common metastatic lesions to the temporal bone are adenocarcinoma of the breast in women and prostatic and renal cell carcinoma in men<sup>4,5</sup>.

Lastly there are a variety of degenerative disorders of the Ear. Meniere's syndrome is comprised of vertigo, aural fullness and fluctuating hearing loss. Presbycusis or age related hearing loss affects one third of the population over 75 years. This is a degenerative process involving hair cells, neurons and stria vascularis of the peripheral auditory system<sup>4,5,12</sup>.

### 1.3. Background

Throughout the world, there are limited data available on hearing loss.

According to the WHO, there are 466 million hearing loss people globally accounting for 6.1% of the world's population. 433 million (93%) of these are adults while 34 million (7%) are children<sup>13</sup>.

WHO defines disabling hearing loss as hearing worse than 40 dB in the better hearing ear in adults and a hearing loss greater than 30 dB in the better hearing ear in children<sup>6,13-15</sup>.

In 2014, approximately 40 million adults (15.8%) reported hearing troubles in USA which is the third most commonly reported condition compared with both diabetes (8.5%) and cancer (7.9%) combined<sup>16</sup>.

The prevalence of hearing loss in South-East Asia ranges from 4.6% to 8.8%. In India, 63 million people (6.3%) suffer from significant hearing loss<sup>15</sup>. In addition, 3.3% was the prevalence of disabling hearing loss in one study done in Nepal, 1.19% in the general population of one southwestern province of China and 10.6% in elder population of Seoul in Korea. Furthermore, prevalence of hearing loss in one community based study done in Oman was 2.07%, another done in pediatric rural Pakistan demonstrated a prevalence of 1.5%, while a study done in one province of Saudi Arabia showed the prevalence to be 0.9%<sup>6</sup>.

There are several studies on the prevalence of disabling hearing loss which have been conducted in Europe. A prevalence of 0.2% was reported in a rural Danish population aged 31-50 years survey, 3.2-4.9% in northern Finland, 4% among adults in Italy, 3.3% in one Swedish population, and 3.9% among adults in Great Britain<sup>6</sup>.

Some studies provided the statistics for hearing loss in Africa. It is estimated that there are more than 1.2 million children in sub-Saharan Africa aged 5 to 14 years old who have disabling hearing loss<sup>6</sup>. According to the International Centre for the Prevention of Deafness and Rehabilitation of Hearing impaired Persons (ICPDRHIP), about 6.7 % of Nigerians were suffering from hearing loss, meaning that of the country's 180 million, over 12 million of them were either deaf or going deaf in the country.

In addition, prevalence data for some countries in Africa including urban schoolchildren in Angola (2%), schoolchildren in one district in Kenya (2.2%), Sierra Leonean children (1.15%), western cape in South Africa (0.5%), northern districts of Tanzania (0.6-4.24%), primary school children in Zimbabwe (0.9%) were published<sup>6</sup>. Furthermore, In Uganda, the incidence of disabling hearing loss was 11.7% in adults and 10.2% in children<sup>6</sup>.

#### **1.4. Justification of the study**

Hearing loss has a significant impact on both the individual and society and can be found in all age groups throughout the lifespan. Affected individuals may not be able to appropriately interpret words, thus reducing their ability to communicate which will lead to a delay in language development. This in turn leads to difficulties in obtaining education or securing employment and leads to isolation and often stigmatization<sup>2,4,6</sup>.

In children the problem is compounded since normal hearing provides source of acquisition of language, speech and cognitive skills<sup>2,4,6</sup>. Moreover, most of the children with hearing impairment in developing countries do not complete primary education and never gain independence from their parents economically. Consequently, they become trapped in poverty and as a repercussion, hearing loss poses substantial costs to the health-care system and to the economy as a whole<sup>3,6</sup>.

Hearing loss may be due to variable causes and most of these causes are preventable or avoidable through simple and affordable interventions such as immunization against childhood diseases, diagnosis and early proper treatment.

In Rwanda, hearing difficulties are a common cause for consultation with an otolaryngologist. The prevalence of occupational related noisy induced HL in one of the first study done in Rwanda among wood and metal workers was 35.5%<sup>17</sup>. In addition, one study to investigate the prevalence and associated risk factors of middle ear infection in Rwanda, reported 5.8% of prevalence of middle ear infection known to be strongly associated with HL<sup>18</sup>. Further, in one of the first study done in Rwanda looking at perceived causes of hearing loss, found ear infections to be the most common cause of hearing loss<sup>19</sup>.

However, epidemiological data on hearing loss in relation to prevalence and incidence are limited. Besides the lack of data on prevalence of hearing impairment in Rwanda, little is known about causes required to inform which prevention and treatment services are needed.

The results of this study will offer baseline epidemiological data on patterns and causes of hearing loss among patients consulting ENT/OPD at CHUK and will establish reference for future researches.

## **1.5. Research questions**

What are the patterns and causes of hearing loss among patients consulting ENT/OPD at CHUK complaining of hearing impairment?

## **1.6. Study objectives**

### **1.6.1: General Objective of the Study**

-To determine the patterns and causes of hearing loss among patients consulting ENT/OPD at CHUK

### **1.6.2: Specific objectives**

-To determine the socio-demographic characteristics among patients consulting ENT/OPD at CHUK complaining of hearing loss

-To determine the type and degree of hearing loss among patients consulting ENT/OPD at CHUK

-To determine the causes of hearing loss among patients consulting ENT/OPD at CHUK

## CHAPTER II: METHODOLOGY

### 2.1. Study design

This was a cross-sectional descriptive study conducted at Kigali University Teaching Hospital.

Data was collected among patients from 5 years of age and above consulting ENT/OPD at CHUK for hearing impairment. After consenting and using a pre-designed questionnaire for this study, variables of interest including age of the patient, gender, profession, time of onset of hearing loss, ear discharge, family history of hearing loss, trauma before hearing loss, febrile disease before hearing loss, medication taken before hearing loss were documented. In addition, findings from ear examination performed in the ENT clinic by an ENT surgeon or Resident using a microscope or otoscope were recorded. Afterwards, they were referred to the audiology room for PTA and /or tympanometry.

### 2.2. Sample size calculation

The sample size was obtained using Fischer's formula

$$n = \frac{Z^2 \times pq \times D}{\alpha^2}$$

Where:

**n**= minimum sample size, **D**=design effect =1, **Z**= standard deviation at a confidence interval of 95%=1.96

**p**= current prevalence of the problem (No data is available that shows the number of patients from all age group suffering from hearing loss in Rwanda, therefore we will use 50%).

**q**= 1-p

**α**: precision=5%

$$n = \frac{1.96^2 \times 0.5(1-0.5)}{0.05^2} = 384 \text{ patients}$$

### **2.3. Inclusion criteria**

Patients from 5years of age and above consulting ENT/OPD at CHUK for hearing loss with or without other complaints.

### **2.4. Exclusion criteria**

Patients consulting ENT/OPD at CHUK for other complaint than hearing loss.

Patients below the age of 5years

Patients difficult for hearing test.

Patients who do not consent for participation in the study

### **2.5. Data collection process and tools**

Using a pre-established questionnaire, data was collected from the history, ear examination and investigation reports of the patients.

The questionnaire collected information about age, gender, occupation, hearing loss (right or left ear), time of onset of HL, any ear discharge, any history of trauma before hearing loss, history of febrile condition before hearing loss (meningitis, cerebral malaria), family history of hearing loss, any medication taken before HL such as gentamycin, cisplatin, lasix or quinine.

#### **Otoscopy:**

The first evaluation to be performed was otoscopy and was performed by an ENT surgeon or an ENT resident using a microscope or otoscope.

The exam was structured beginning with examination of the external ear for malformation. Next, the external ear canal was evaluated for inflammation, cerumen, presence of a foreign body, otorrhea, fungus, cholesteatoma, tumors of EAC (polyps, osteomas).The tympanic membrane was then evaluated for perforation, tympanosclerosis, dullness, retraction, hemotympanum, redness and bulging. Afterwards, patients were referred to the audiology room for hearing evaluation



## **Hearing Evaluation:**

**Tympanometry:** Results were plotted on a graph and were categorized as either type A, B, or C. Type A refers to eardrum movement within normal limits. Type B indicates little or no eardrum movement suggesting fluid in the middle ear space. A patient with this type of tympanogram needs medical attention. Type C refers to a middle ear with negative pressure, such tympanogram may be caused by retraction of the eardrum or blockage of the Eustachian tube. A patient with this type of tympanogram should be monitored and may need medical attention.

**Pure tone audiometry (PTA):** was performed in a very quiet room in ENT department at CHUK. Patients with impacted wax or debris had evacuation with Jobson Horner's probe where possible or syringing with warm water. Both ears were assessed, for air conduction and bone conduction, on different frequencies 500, 1000, 2000 and 4000 Hz generally assumed to be part of the speech frequency range.

Using the WHO hearing impairment grades, mild impairment was defined as an average threshold level between 26 and 40 dB, moderate impairment as an average threshold level between 41 and 60 dB, severe impairment as an average threshold level between 61 and 80 dB, and profound impairment as an average threshold level of 81dB or greater<sup>20</sup>. The average of the observed frequencies was recorded as the hearing level of the patient. See table 1 for more details.

**Table 1: WHO hearing impairment grades<sup>20</sup>.**

<b>Grade of impairment</b>	<b>Corresponding audiometric ISO value</b>	<b>Performance</b>	<b>Recommendations</b>
0 – no impairment	25 dB or better (better ear)	No or very slight hearing problems. Able to hear whispers	
1 – slight impairment	26 – 40 dB (better ear)	Able to hear and repeat words spoken in normal voice at 1 meter	Counseling. Hearing aids may be needed.
2 – moderate impairment	41 – 60 dB (better ear)	Able to hear and repeat words spoken in raised voice at 1 meter	Hearing aids usually recommended
3 –severe impairment	61 -80 dB (better ear)	Able to hear some words when shouted into better ear.	H.A needed. If no H.A available, lip-reading and signing should be taught.
4 –profound impairment including deafness	81dB or greater (better ear)	Unable to hear and understand even a shouted voice	H.A may help understanding words. Additional rehabilitation needed. Lip-reading and sometimes signing essential.

## **2.6. Data processing and analysis**

Data were recorded using Epidata 3.1 software. Data processing and statistical analyses were performed using SPSS 16.0. Comparison of categorical variables was performed using the chi-square test. The limit of significance was established at  $p = 0.05$ . Microsoft Word and Power Point were useful in draft, final writing and presentation of this study.

## **2.7. Ethical considerations**

This study was carried out after approval given respectively by the Department of ENT, Head and Neck Surgery and the Research and Ethics Committee of the College of Medicine and health sciences of University of Rwanda. Patients who were enrolled in the study were those having given their written informed consent. A parent or guardian was requested to consent for those patients who are <18 years of age. Confidentiality was assured for all data collected.

## CHAPTER III. RESULTS OF THE STUDY

### 3.1. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION

In this study, 394 participants were enrolled. The age of our population ranged from 5 to 81 years (Mean 33.07, SD 18.42). Majority of the enrolled patients were in the age range of 15-29 years (34%) followed by the age group of 30-44 years with 26.4% (n=104). Males constituted 50.8% (n=200) with a male to female ratio of 1.03:1. Our study population was predominantly students who accounted for 50.3% (n=198). Table 2 below gives more details.

**Table 2: Distribution of socio-demographic characteristics**

<b>Variables</b>	<b>N=394</b>	<b>%</b>
Mean age in years (M ± SD)	33.07 ± 18.42	
<b>Age range</b>		
5-14 years	61	15.5
15-29 years	134	34.0
30-44 years	104	26.4
45-59 years	50	12.7
≥60 years	45	11.4
<b>Gender</b>		
Female	194	49.2
Male	200	50.8
<b>Occupation</b>		
Farming	158	40.1
Student	198	50.3
Formal sector	19	4.8
Manual worker	8	2.0
Businessman	11	2.8

## 3.2: CLINICAL PRESENTATION OF THE STUDY

### 3.2.1: OTOSCOPIC FINDINGS

Ear examinations showed that, 151 patients (38.4%) had no abnormality. Otoscope findings were variable and TM perforation was the most common abnormality found in 32.2% (n=131) of all patients examined followed by dullness of the TM in 11.1% (n=44) then retracted TM in 6% (n=24) and ear wax in 3.8% (n=15). We also found EAC tumors in five patients (1%) and among them, three were EAC polyps and two were EAC osteomas. Other findings were healed TM 2% (n=9), otorrhea, red and bulging ear drum, hemotympanum and tympanosclerosis. See table 3 below

**TABLE 3: Distribution of otoscopic findings**

Otoscope findings	Affected side	N (%)	Overall %	Total N (%)
Normal EAC/Ear drum	Bilateral	151	38.40	151 (38.40%)
Atresia of EAC (N=2)	Right	1 (50.0)	0.50	2 (0.51%)
	Bilateral	1 (50.0)	0.25	
Ear wax (N=15)	Bilateral	15 (100.0)	3.81	15 (3.8%)
Healed TM (N=9)	Right	3 (33.3.)	0.76	9 (2.28%)
	Left	6 (66.6.)	1.52	
Otorrhea (N=7)	Right	1 (14.4)	0.25	7 (1.78%)
	Left	3 (42.8)	0.76	
	Bilateral	3 (42.8)	0.76	
EAC tumors (N=5)	Right	2 (40)	0.50	5 (1.26%)
	Left	3 (60)	0.76	
Dull tympanic membrane	Right	5 (11.4)	1.27	44 (11.17%)
	Left	2 (5.6%)	0.51	
	Bilateral	37 (83.0)	9.39	
Red and Bulging ear drum	Right	1 (33.3)	0.25	3 (0.76%)
	Left	1 (33.3)	0.25	
	Bilateral	1 (33.3)	0.25	
Perforated ear drum	Right	32 (24.4)	8.12	131 (32.25%)
	Left	38 (29.0)	9.64	
	Bilateral	61 (46.6)	15.48	
Retracted ear drum	Right	11 (45.88)	2.79	24 (6.09%)
	Left	9 (37.5)	2.28	
	Bilateral	4 (16.66)	1.01	
Hemotympanum	Right	2 (100.0)	0.51	2 (0.51%)
Tympanosclerosis	Bilateral	1 (100.0)	0.25	1 (0.25%)

### 3.2.2: DEGREE OF HEARING LOSS

**TABLE 4: Distribution of degree of hearing loss**

Degree of HL	Right	Left	Total N (%)
Mild	119 (52.19%)	109 (47.8%)	228 (57.86%)
Moderate	52 (43.3%)	68 (56.6%)	120 (30.45%)
Severe	13 (48.14%)	14 (51.85%)	27 (6.85%)
Profound	1 (25%)	3 (75%)	4 (1.01%)
normal			15(3.80%)

Mild hearing loss was predominant accounting for 57.86% (n=228) followed by moderate hearing loss 30.45% (n=120), then severe hearing loss in 6.85% (n=27). Furthermore, normal hearing were accounting for 3.80% (n=15). Table 4 gives more details.

### 3.2.3. TYPES OF HEARING LOSS

Regarding the type of hearing loss, the majority of patients 62% (n=235) had CHL, 30.3% (n=115) had SNHL while mixed hearing loss accounted for 7.6% (n=29). Table 5 gives more details

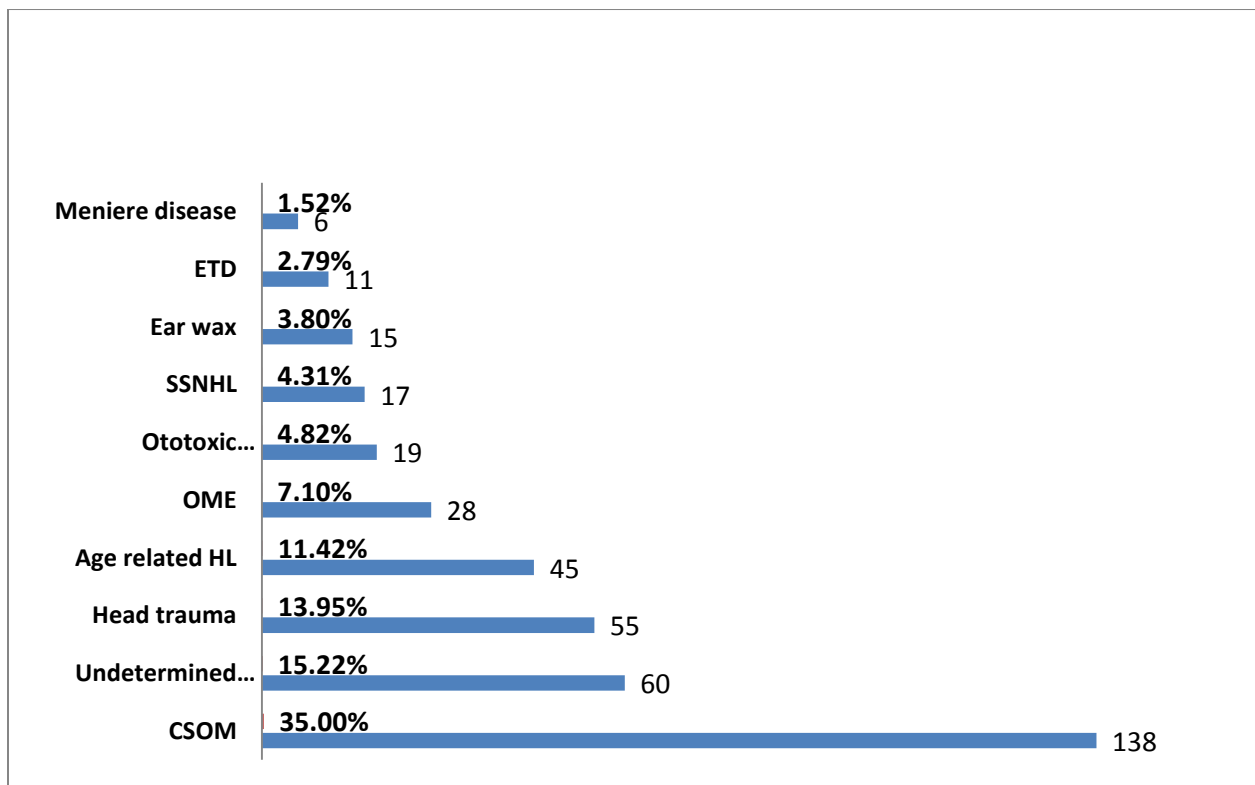
TABLE 5: Distribution of types of hearing loss

Type of HL	Right	Left	Total
CHL	126 (53.6%)	109 (46.3%)	235 (62%)
SNHL	58 (50.4%)	57 (49.5%)	115 (30.3%)
Mixed	14 (48.2%)	15 (51.7%)	29 (7.6%)

### 3.2.4: CAUSES OF HEARING LOSS

Among known etiologies; CSOM was the most common cause accounting for 35% followed by hearing loss due to head trauma 13.9% (n=55) then age related hearing loss 11.4% (n=45) and OME 7.1 % (n=28). Furthermore, undefined causes were accounting for 15.2% (n=60). Figure 1 gives more details.

Figure 1: Distribution of causes of hearing loss



## CHAPTER IV: DISCUSSION

In this Hospital based study looking at the patterns and causes of hearing loss, the age of our population ranged from 5 to 81 years (Mean 33.07, SD 18.42) with the majority 34% (n=134) being in the age group of 15-29 years followed by the age group of 30-44 years 26.4% (n=104) then 5-14 years age group with 15.5% (n=61). Different to our study, WHO report that the prevalence of disabling hearing loss increases with age. This difference could be due to the unawareness of our population about hearing loss. Moreover, most of age related hearing loss remains undiagnosed. Lastly, young adult population is more active hence more exposed.

It has been noted by the WHO that there is a male preponderance in prevalence of ear disease. Y.Agrawal et al. in USA (2008)<sup>21</sup>, S.Kellher et al. in Bolivia (2011)<sup>6</sup> in their respective studies found similar results. This is in accordance with our study where we found male predominance with 50.8% (n=200) and female with 49.2% (n=194).

Concerning the occupation, the majority were students 50.3% (n=198) followed by farmers 40.1% (n=158). K.Joubert et al. in South Africa (2017)<sup>22</sup> found unemployment being the majority in their study; S.Rabbani et al. in Bangladesh (2012)<sup>1</sup>, S.Kellher et Al. in Bolivia (2011)<sup>6</sup> found manual workers being the majority in their respective studies. This discrepancy could be explained by the fact that in Rwandan population behavior, they tend to consult too late or when the disease is harmful, while for students hearing is very paramount for the pursuit of their studies, they cannot ignore it without consulting.

In the present study, the majority of our study population was having mild hearing loss 57.8% (n=228) with predominance of CHL 62% (n=235) as type of hearing loss followed by moderate 30.4% (n=120) conductive hearing loss. This is similar to the results of studies done by S.Ferrite et al. in Cameroun (2017), A.Olusesi et al. in Nigeria (2008)<sup>23</sup>, W.Mulwafu et al. in many sub-Saharan countries (2016). Therefore, obtained results in their respective studies as well as ours revealed high prevalence of middle ear infection such as CSOM and OME known to be strongly associated with mild to moderate CHL<sup>23,24</sup>.

The predominant cause of hearing loss in our study was CSOM 35% (n= 139). Similar to our findings, studies conducted by A. Hamid et Al. in Egypt (2007)<sup>2</sup>; Westerberg et Al. in Uganda (2008), Zimbabwe (2004) and Olusanya et Al. in Nigeria (2000)<sup>25</sup> have shown that chronic ear infection account for the greatest proportion of causes of HL especially in developing countries.



Another important aspect of the etiology of HL to consider in our study is the undetermined cause of HL 15.2% (n=60). This could be explained by the fact that some diagnosis of hearing loss need information from a retrospective history which couldn't always be retrieved from the patient or next of kin. Consequently, an important number of cases were of unknown causes.

Age related hearing loss which is almost invariably inevitable accounted in our study for 11.4 % (n=45). S. Ferrite et Al. in Cameroun (2017)<sup>26</sup>; A. Lasisi et al in Nigeria (2018)<sup>27</sup> found 22% and 41% of age related hearing loss in their respective studies. This difference could be explained by the fact that in the perspective of Rwanda, most of the cases of hearing loss remain undiagnosed because of unawareness and/or unavailability of hearing assessment tools. In addition, the Rwandan population is very young with about 80% of the population below 65 years of age<sup>28, 29</sup>.

A variety of commonly used drugs have ototoxic properties as described in different literatures<sup>4,5,8,9</sup>. Our study found 4% (n=19) of ototoxicity as cause of HL while A. Dunmade et Al in Nigeria (2007)<sup>8</sup> found in their study 3.5% of ototoxicity. Many of patients in our study didn't remember exactly the drugs responsible for ototoxicity. However, most of them reported in the history being treated with either anti malarial or anti TB drugs and/ or unspecified traditional herbs known to be associated with ototoxicity.

SSNHL is not an uncommon cause of hearing loss, a number of authors have established the definition of SSNHL as at least 30 db of HL at three continuous frequencies in less than 3 days<sup>1,30,31</sup>. In our study, SSNHL accounted for 4% (n=17). S Rabbani et al. in Bangladesh (2012)<sup>1</sup> found 9% of SSNHL in their study, one retrospective cross-sectional study from Taiwan estimated the incidence at approximately 8 in 100,000 per year<sup>31</sup>. While another survey done in Japan regarding idiopathic sudden sensorineural hearing loss revealed that the incidence of SSNHL was 60.9 per 100.000 populations. These differences from our study could be explained by the fact that in our context the criteria for diagnosis of SSNHL is not almost always in accordance with the new one widely used in other parts of the world as described in the literature<sup>30,31</sup>. In addition, the above studies included all patients while ours included hearing impaired patients only.

## **LIMITATION OF THE STUDY**

Our study was a Hospital based study and may not reflect the reality which could be generalized at a national scale.

Some diagnosis of hearing loss need information from a retrospective history which couldn't always be retrieved from the patient or next of kin consequently an important number of cases were of unknown causes.

## **CHAPTER V: CONCLUSION AND RECOMMENDATION**

### **5.1: CONCLUSION**

Hearing impairment remains a major public health concern. Results of our study showed that young people who constitutes an important workforce in the society is the most affected. Further, among known causes such as ear infections, ototoxicity, age related hearing loss; head trauma among others could have been prevented or treated. In addition, the commonest type of HL in our study was conductive while mild HL was the commonest degree of HL.

Strengthening public health measures can effectively reduce hearing loss or minimizing its impact through prevention, treatment or early diagnosis followed by appropriate interventions.

### **5.2: RECOMMENDATION**

Hearing impairment is still a common problem among young people and usually begins in early childhood in developping countries like Rwanda. Furthermore, most of causes of hearing loss in our study are treatable or preventable. So far this could be used to direct the national management plan. Furthermore primary care providers, general practitionners and peditricians should play a very important role in the diagnosis and early proper treatment of middle ear infection consequently decreasing the incidence of hearing loss.

The following recommendations should be put into consideration:

To increase the investment allocated for training of ear care providers (ENT specialists, audiologists and speech therapists) for prevention, early detection and management of hearing impaired cases.

To develop institutionnal capacity by providing materials, adequate equipment for screening, management and rehabilitation of hearing impaired patients .

To increase population awareness of ear problems and their consequences by promoting outreach activities and strengthening service delivary.

A national survey on prevalence, causes and impact of hearing loss on the general population is needed.

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## VI. APPENDICES

### APPENDIX 1

#### 6.1. DATA COLLECTION FORM

<b>01.</b>	<b>PATIENT'S CODE</b>		
<b>02.</b>	<b>AGE</b>		
<b>03.</b>	<b>SEX</b>	<b>MALE</b> <input type="checkbox"/>	<b>FEMALE</b> <input type="checkbox"/>
<b>04.</b>	<b>PROFESSION</b> 1. CULTIVATORS 2. STUDENTS 3. OFFICE WORKERS 4. MANUAL WORKERS 5. BUSINESSMAN 6. OTHERS		
<b>05.</b>	<b>HISTORY OF EAR DISCHARGE</b>	<b>RIGHT</b>	<b>LEFT</b>
		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
<b>06.</b>	<b>DURATION OF EAR DISCHARGE</b> 1. ≤ 2WEEKS 2. ≥ 2WEEKS 3. UNCERTAIN	<b>RIGHT</b>	<b>LEFT</b>
		<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>



07.	<b>ONSET OF HEARING LOSS</b> 1.SUDDEN ONSET 2.PROGRESSIVE ONSET 3.RECURRENT 4.UNCERTAIN	<b>RIGHT</b> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	<b>LEFT</b> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>
08.	<b>HEAD TRAUMA BEFORE HL</b>	Yes <input type="checkbox"/>  No <input type="checkbox"/>	
09.	<b>HISTORY OF FEBRILE DISEASE</b>  <b>BEFORE HL</b> 1. BACTERIAL MENINGITIS 2. MEASLES 3. MUMPS 4. HEPES ZOSTER OTICUS 5. UNKOWN	Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	
10.	<b>MENIERE DISEASE</b>	Yes <input type="checkbox"/>  No <input type="checkbox"/>	
11.	<b>MEDICATION TAKEN BEFORE HL</b> 1. AMINOGLICOSIDE ATB 2. LOOPS DIURETICS 3. ANTINEOPLATSIC AGENT 4. SALICILATES 5. QUININE 6. OTHERS SPECIFY .....	Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	

12.	<b>FAMILY HISTORY OF H.L</b>	Yes <input type="checkbox"/>  No <input type="checkbox"/>	
13.	<b>OTOSCOPIC FINDING</b> 1. NORMAL EAC 2. ATRESIA OF EAC 3. EAR WAX 4. FOREIGN BODY 5. INFLAMMATION OF EAC 6. OTORRHEA 7. CHOLESTEATOMA 8. EAC TUMORS 9. NORMAL EAR DRUM 10. TYMPANOSCLEROSIS 11. RETRACTED EAR DRUM 12. DULL TM 13. RED AND BULGING EAR DRUM 14. PERFORATED EAR DRUM 15. OTHERS SPECIFY.....		
14.	<b>PTA FINDING</b>  <b>TYPE OF HL</b> A=CHL B=SNHL C=MIXTE	<b>RIGHT</b>  <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<b>LEFT</b>  <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

	<p><b>GRADE OF HL</b></p> <p>1. NORMAL</p> <p>2. MILD HEARING LOSS</p> <p>3. MODERATE HEARING LOSS</p> <p>4. SEVERE</p> <p>5. PROFOUND</p>	<p><b>RIGHT</b></p> <p><input type="text"/></p> <p><input type="text"/></p> <p><input type="text"/></p> <p><input type="text"/></p> <p><input type="text"/></p>	<p><b>LEFT</b></p> <p><input type="text"/></p> <p><input type="text"/></p> <p><input type="text"/></p> <p><input type="text"/></p> <p><input type="text"/></p>
<b>15.</b>	<p><b>TYMPANOMETRY</b></p> <p>1. TYPE A</p> <p>2. TYPE B</p> <p>3. TYPE C</p>	<p><b>RIGHT</b></p> <p><input type="text"/></p> <p><input type="text"/></p> <p><input type="text"/></p>	<p><b>LEFT</b></p> <p><input type="text"/></p> <p><input type="text"/></p> <p><input type="text"/></p>

## **6.2. Informed consent (English version)**

**Title of the study: “PATTERNS AND CAUSES OF HEARING LOSS AMONG PATIENTS CONSULTING OPD/ENT AT CHUK”.**

### **Explanation to the patient**

I am Dr GASANA Edgard, Registrant in ENT- Head and Neck Surgery at National University of Rwanda, Faculty of Medicine. I am conducting a study in Kigali University Teaching Hospital for the degree of Master of Medicine in ENT-Head and Neck Surgery. The aim of the study is to determine the patterns and causes of hearing loss among patients consulting OPD/ENT at CHUK. During the study, before enrollment, a consent form will be signed by the parent or guardian of the client. No direct benefit and no risks for the participant but the result of this study may be used to benefit of the patient or other patients in future.

All information obtained from this study will be handled in a confidential manner and be used for only research purposes.

If you have question about the study, please feel free to contact Edgard GASANA on:

\*Cell phone: 0788821357/0728821357

\*E-mail: [gedgaki2015@gmail.com](mailto:gedgaki2015@gmail.com)

**Consent form**

I,.....confirm that the purpose of this study and my role have been well explained to me by Dr.....

I agree to the conditions explained and give consent that Mr/Miss..... can be included in the study.

Signature..... Date...../...../.....

Relationship .....

Name of the Witness.....

Signature.....Date...../...../.....

Researcher's names.....

Researcher's signature..... Date...../...../.....

## **IBISOBANURO NO KWEMERA UBUSHAKASHATSI (Kinyarwanda version)**

### **Umutwe w’ubushakashatsi**

“Patterns and causes of hearing loss among patients consulting OPD/ENT at CHUK”.

### **Ibisobanuro**

Jyewe GASANA Edgard, ukora ubu bushakashatsi, ndi umuganga wiga muri

Kaminuza Nkuru y’u Rwanda ishami ry’Ubuwuzi, aho niga ibijyanye no kuvura indwara z’ Amatwi, Amazuru, Umuhogo, umutwe n’ijosi.

Muri ubu bushakashatsi tuzareba impanvu zaba ziteza uburwayi bwo kutunva ku barwayi baza kwisuzumisha bataha muri CHUK bafite ikibazo cyo kutunva .

Mbere ko umurwayi ashirwa muri ubu bushakashatsi, umurwayi we bwite cyangwa umubyeyi we cyangwa umurera asobanurirwa ibijyanye n’ubu bushakashatsi.hanyuma,agasinya ko yemeye ko akorerwaho ubushakashatsi.

Mu kujya muri ubu bushakashatsi ntakiguzi cyangwa inyungu yihariye umuntu ku giti cye akuramo; ariko ibizavamo bishobora kugirira akamaro uwabugiyemo ndetse bishobora kuzagirira akamaro abandi barwayi mu gihe kizaza.

Hakoreshwa inomeru mu mwanya w’amazina y’umurwayi; kandi amakuru yose avuye ku murwayi akabikanwa ibanga.

Ibizava muri ubu bushakashatsi ntibizakoreshwa kuzindi nyungu zitari iz’ubushakashatsi kandi mu kubitangaza nta na hamwe hazagaragazwa amazina y’ababukoreweho.

Inyigo y’ubu bushakashatsi yasuzumwe inemezwa na Komisiyo y’ubushakashatsi muri Kaminuza y’u Rwanda (Research commission).

Ku bibazo cyangwa ibindi bisobanuro, baza GASANA Edgard.

\*Telefoni igendanywa: 0788821357/0728821357

\* E-mail: [gedgaki2015@gmail.com](mailto:gedgaki2015@gmail.com)

**Kwemera kwinjira mu bushakashatsi ku bushake**

Njyewe ..... , (imyaka.....)  
nemeye ko nahawe ibisobanuro birambuye na Dr.....kuri  
ubu bushakashatsi mpabwa n’umwanya wo gusobanuzwa. Mu gusinye, nemeye kubushake  
bwanjye ntagahato ko ubu bushakashatsi bunkorerwaho/bukorerwa  
kuri..... (imyaka.....) mpagarariye.  
(Isano.....)

Umukono.....itariki...../...../.....

Isano.....

Umukono y’ukora ubushakashatsi/Umuhagarariye.....itariki...../...../.....

Amazina y’umutanga buhamya.....

Umukono.....itariki...../...../.....

Kigali, 3<sup>rd</sup> /04/2018

 Dr GASANA Edgard  
 School of Medicine and Pharmacy, CMHS, UR

**Approval Notice: No 076 /CMHS IRB/2018**

 Your Project Title *"Patterns And Causes Of Hearing Loss Among Patients Consulting OPD/ENT AT CHUK"* has been evaluated by CMHS Institutional Review Board.

Name of Members	Institute	Involved in the decision		
		Yes	No (Reason)	
			Absent	Withdrawn from the proceeding
Prof Karo J. Njanwa	UR-CMHS		X	
Prof Jean Bosco Garutu	UR-CMHS	X		
Dr Brenda Asimwe-Kateera	UR-CMHS	X		
Prof Ntaganira Joseph	UR-CMHS	X		
Dr Umusiime K. David	UR-CMHS	X		
Dr Kayunga N. Egide	UR-CMHS	X		
Mt Kanyari Maurice	UR-CMHS	X		
Prof Manyashongore Cyprien	UR-CMHS	X		
Mrs Ruzindana Lendrine	Kicukiro district		X	
Dr Gishoma Darius	UR-CMHS	X		
Dr Donatille Mukumana	UR-CMHS	X		
Prof Kyamanywa Patrick	UR-CMHS		X	
Prof Conde Umutesi Jeannine	UR-CMHS		X	
Dr Nyiranzoye Laetitia	UR-CMHS	X		
Dr Nke am'bigu Emmanuel	UR-CMHS	X		
Se Mallholi Marie Josce	CHUK	X		
Dr Mudenge Charles	Centre Psycho-Social	X		

 After reviewing your protocol during the IRB meeting of where quorum was met on 23<sup>rd</sup> March 2018, **Approval has been granted to your study.**



Please note that approval of the protocol and consent form is valid for **12 months**.


You are responsible for fulfilling the following requirements:

1. Changes, amendments, and addenda to the protocol or consent form must be submitted to the committee for review and approval, prior to activation of the changes.
2. Only approved consent forms are to be used in the enrolment of participants.
3. All consent forms signed by subjects should be retained on file. The IRB may conduct audits of all study records, and consent documentation may be part of such audits.
4. A continuing review application must be submitted to the IRB in a timely fashion and before expiry of this approval
5. Failure to submit a continuing review application will result in termination of the study
6. Notify the IRB committee once the study is finished

Sincerely,

Date of Approval: The 3<sup>rd</sup> April 2018

Expiration date: The 3<sup>rd</sup> April 2019

 Professor Kato J. NJUNWA  
Chairperson Institutional Review Board,  
College of Medicine and Health Sciences, UR



Cc:

- Principal College of Medicine and Health Sciences, UR
- University Director of Research and Postgraduate Studies, UR