PREVALENCE OF AGE RELATED SENSORINEURAL HEARING LOSS IN ELDERLY PATIENTS RECEIVING ENT SERVICES AT MUHIMBILI NATIONAL HOSPITAL

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A Dissertation Submitted in (Partial) Fulfillment of the Requirements for the Degree of Master of Medicine (Otorhinolaryngology) of Muhimbili University of Health and Allied Sciences

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CERTIFICATION

The undersigned certify that she has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled, **"*Prevalence of age related sensorineural hearing loss in elderly patients receiving ENT services at Muhimbili National Hospital*",** in partial fulfilment of the requirements for the degree of Master of Medicine (Otorhinolaryngology) of Muhimbili University of Health and Allied Sciences.

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Dr. Enica Richard

(Supervisor)

_____

Date

DECLARATION AND COPYRIGHT

I, **Jaria S. Rahib**, declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature……. Date…….……..

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Finally I would like to thank all, who, in one way or another, have contributed anything in making the production of this dissertation possible.

DEDICATION

To Almighty God

To my beloved, late parents

To all my family

This work is dedicated.

ABSTRACT

Background

Age related SNHL in elderly, is a progressive, usually bilateral hearing loss that occurs in older people as they age. It is eminently correctable using rehabilitative hearing devices, and its successful correction can vastly improve the older person's quality of life. There has been no study done to show the magnitude of age related SNHL in elderly in our country.

Objective;

To determine the prevalence of age related SNHL among elderly patients receiving ENT services at the MNH, Dar es salaam, Tanzania.

Study design

Hospital-based, descriptive cross sectional study

Methodology

This study included elderly with minimum age of 50 years and above. A total of 380 elderly patients who received ENT services at the ENT clinic at MNH from June 2016 to December 2016, through convenient sampling were enrolled to participate in this study. Participants were screened on hearing loss and interviewed by the structured questionnaire followed by otoscopic examination, and PTA. All information obtained was entered in computer and analyzed using SPSS version 20 software. A PTA with slopping pattern at higher frequencies was taken as age related SNHL. Chi-square test was used to determine the differences among different groups, and linear regression analysis done to determine the contribution of risk factors.

Results

This study included 380 elderly participants receiving ENT services at MNH, 182(47.9%) males, and 198 (52.1%) females. The prevalence of age related SNHL was 27.6%, males mostly affected 57(31.3%) p= 0.574. A statistically significant bilateral age related SNHL was found 90 (85.7%) p= 0.026, and the severity of age related SNHL was found to increase as age increase. No statistical significance in contribution of the risk factors was found, P>0.05

Conclusion and recommendations

Findings corresponded to several other literatures that prevalence of age related SNHL among elderly is high, mostly bilateral, and its severity increases with age, with the oldest age groups having the most severe hearing loss. Confounding factors such as duration of hypertension, DM and of cigarette smoking and the amount smoked, the dose of ototoxic medication used may have contributed to differences compared to other studies. Further studies that will address these factors at MNH are needed.

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LIST OF ABBREVIATIONS

AC- Air conduction

ARHI/L- Age related hearing Impairment/Loss

ATP- Adenosine Triphosphate

BC- Bone conduction

CT- Computed Tomographic scanning

ENT- Ear, nose, throat

FM- Frequency Modulation

HHIE-S- Hearing Handicap Inventory for the Elderly- Screening version

MDS- Minimum Data Set

MMED- Masters of Medicine

MNH- Muhimbili National Hospital

MRI- Magnetic Resonance Imaging

MUHAS- Muhimbili University of Health and Allied Sciences

NHANES- National Health And Nutrition Evaluation Survey

ORL-Otorhinolaryngology

PTA- Pure Tone Audiometry

SNHL- Sensorineural hearing loss

SPSS- Statistical Package for Social Sciences.

UK- United Kingdom

US- United States

WHO- World Health Organization

DEFINITION OF TERMS

Hearing loss; Also known as hearing impairment, is a reduction in the ability to perceive sound and may range from slight inability to complete deafness. (1)

Presbycusis; loss of ability to perceive or discriminate sound associated with aging. (1)

Sensorineural hearing loss; Hearing impairment resulting from the lesions of the cochlea, eighth nerve or central auditory pathways.

Auditory brainstem response (ABR); Also called brainstem auditory evoked response or potential, is a non invasive investigation to find the integrity of the central auditory pathways through the Eighth nerve to the brainstem.

Otoacoustic emission (OAE); These are low intensity sounds produced by outer hair cells of a normal cochlear and can be elicited by a very sensitive microphone placed in the external ear canal and an analysis by a computer.

ATPase- Adenosine Triphosphatase, enzyme catalysing the release of the terminal phosphate group of adenosine-5'-triphosphate in cell membranes, mitochondria and striated muscles.

Old age

Is that age at the latter part of life. The working definition for old age in Africa should be from 50 years and above.(2)

Thus for this reason, this study will take old persons from 50 years old and above.

CHAPTER ONE

1.0 BACKGROUND INFORMATION AND LITERATURE REVIEW

1.1 INTRODUCTION

Hearing loss refers to a reduction in the ability to perceive sound, with a hearing threshold of 25dB and beyond in both ears. It can be mild, moderate, moderately-severe, severe or profound and can affect one or both ears. It can lead to difficulty in hearing and understand conversational speech or loud sounds(2). WHO estimates that over 5% of the world's population -360 million people have disabling hearing loss.(3) Approximately one-third of people over 65 years of age are affected by disabling hearing loss and the prevalence in this age group is greatest in South Asia, Asia Pacific and Sub Saharan Africa.(3) Sensorineural hearing loss results from the diseases of the inner ear, with cochlear having the sensory type and the nerves having the neural type (vestibulochochlear nerve).(4)

Sensorineural hearing loss in the elderly also referred to as age related hearing loss or presbycusis, is a progressive, usually bilateral hearing loss that occurs in older people as they age. It is a multifactorial process determined by a combination of genetic and environmental factors. It can range from bothersome to severely disabling in its effects. And in its moderate to severe cases it can cause an older person to become isolated and depressed, and may significantly worsen age-related disabilities/cognitive impairment and dementia.(5)

It is eminently correctable using rehabilitative hearing devices, and its successful correction can vastly improve the older person's quality of life. Increasing awareness of the prevalence of hearing loss in the elderly population is of utmost importance, as those with hearing loss tend to be more socially withdrawn and isolated.(6)

The aim of this study is to find out the prevalence of age related Sensorineural hearing loss among elderly patients receiving ORL services at MNH as it is one of a silent morbid condition that causes several other health ailments to the elderly population. In Tanzania, general information regarding hearing loss among elderly population is lacking as no research has been done yet, just like majority of East Africa and most of Sub Saharan Countries. It is therefore important to explore its prevalence in order to better comprehend

the problem which should in turn inform strategies that will aim at better management and rehabilitation of the patients in the country. This will also pave way for further studies regarding SNHL in elderly as far as the contributing risk factors involved and its management is concerned.

Sensorineural hearing loss in elderly

The inner ear is getting its arterial blood supply from the labyrinthine artery which is an end artery, a branch of anterior inferior cerebellar artery. Vascular disorders like atherosclerosis, and hypercoagulable states which impairs tissue perfusion can easily impair inner ear perfusion and cause damage of the vital structures of the organ of Corti resulting into sensorineural hearing loss.

Lateralization

Unilateral hearing loss (UHL) occurs when the hearing in one ear is within normal limits and the other ear has a hearing loss ranging from mild to profound hearing loss. Individuals with unilateral hearing loss may have trouble localizing sounds. Localization is important when listening especially in groups of people and is helpful in identifying who is talking at any moment as well as for safety. Another effect is difficulty in understanding speech in noisy situations. Two normal hearing ears help to filter out noise to hear speech better. An individual presenting with a UHL can often hear speech from a distance, but may not always understand what is being said.(7)

Age related Sensorineural hearing loss in elderly people tends to occur bilaterally, affecting both ears symmetrically, however, some studies found a unilateral hearing loss, in old people which could possibly be attributed to other causes of SNHL other than aging per se.

Anatomy of inner ear

The organ of Corti is the main area for auditory transduction in the inner ear which rests on the basilar membrane and the osseous spiral lamina. Basilar membrane is about 0.12mm wide at the base and about 0.5mm wide at the apex. Components of the organ of Corti are Inner and Outer hair cells, supporting cells (Deiter, Hensen, Claudius), Tectorial

membrane and the Reticular lamina. Supporting cells provides structural and metabolic support for the organ of Corti. Deiters cells form tight cell junctions of the reticular lamina.(8)

There are about 15,500 hair cells in the organ of Corti, 3,500 being inner hair cells and 12,000 Outer hair cells. These hair cells are innervated by afferent and efferent neurons in a complex but orderly manner. The afferent neurons to the auditory sense organ are bipolar neurons referred to as spiral ganglion cells that are located in Rosenthal's canal of the bony modiolus.(9)

Of the 50,000 neurons that innervate the cochlea, 90% to 95% synapse directly on inner hair cells. These are called type I neurons. Each inner hair cell is innervated by approximately 15 to 20 type I neurons. In contrast, 5% to 10% of the 50,000 neurons innervate the outer hair cells (type II neurons). Each type II neuron branches to innervate approximately 10 outer hair cells.(8)

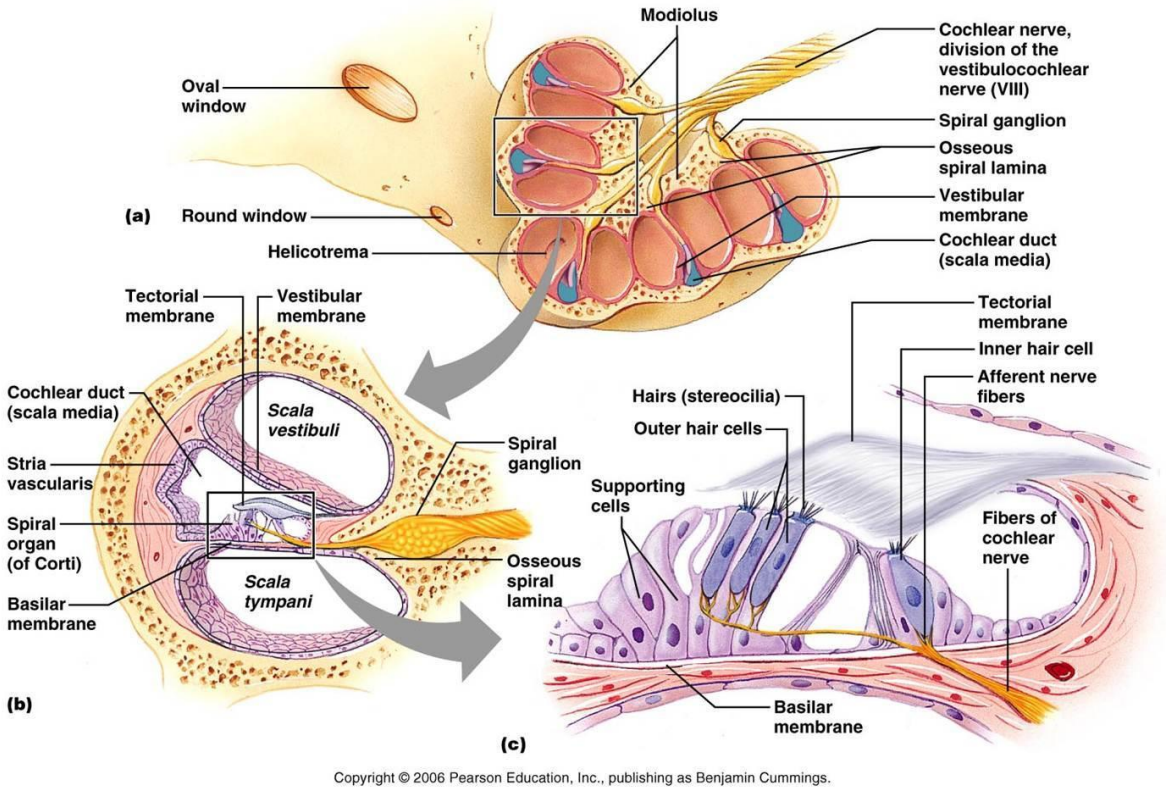
The apical portions of the hair cells are anchored in the cuticular plate, with the stereocilia (usually 100 to 150 per cell) protruding through the cuticular plate. The stereocilia of the outer hair cells make contact with the tectorial membrane, whereas the stereocilia of the inner hair cells lie free in the endolymphatic space inferior to the tectorial membrane.(9)

There are a single row of inner hair cells and three to five rows of outer hair cells. These cells differ morphologically in that the inner hair cells are more flask shaped and tightly surrounded by supporting cells and have stereocilia that are arranged in a linear fashion, whereas the outer hair cells are columnar and incompletely surrounded by phalangeal or supporting cells lying free in the perilymph of the organ of Corti. The stereocilia of the outer hair cells form an inverted "W", The inner hair cells are supported by interphalangeal cells, whereas the outer hair cells are supported by Deiters' cells inferiorly and laterally by Hensen's cells. The tectorial membrane is anchored medially at the limbus and attached to the Hensen's cells laterally by a fibrous net.(9)

The displacement of the basilar membrane in response to displacement of the stapes due to acoustic energy is a travelling wave through the cochlea fluids at a velocity of approximating 1.5 km/sec. The basilar membrane is stiffer at the base than in the apex. The stiffness component is distributed continuously. Therefore, the travelling wave always progresses from base to apex. The maximal amplitude of basilar membrane displacement varies as a function of stimulus frequency. Travelling waves produced by high-frequency sounds (10 kHz) have maximal displacement near the base of the cochlea, whereas the waves to low-frequency sounds (125 Hz) have the maximum toward the apical region. Travelling waves generated by high-frequency sounds do not reach the apical region of the cochlea, whereas waves to low-frequency sounds can travel the entire length of the basilar membrane.(8)

The basilar membrane and tectorial membrane are displaced vertically by the travelling wave created by sound energy delivered to the oval window. Since the fulcrum of these two structures is separate, they will slide horizontally when stimulated, resulting in a shearing action between the tectorial membrane and the cuticular plate. The resultant displacement of stereocilia initiates an electrical event in the hair cell which is carried through the nerves as auditory impulses to the brain.(9)

Diagram showing the inner ear organ of corti



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Pathophysiology of SNHL in elderly

Schuknecht identified four categories of SNHL in elderly based on clinical and histopathologic changes within the cochlea as a result of aging;

Sensory; have loss of sensory cell and supporting cells of the organ of Corti with epithelial atrophy

Neural; with reduction in the number of functioning cochlear neurons, it is estimated that with about 35,500 cochlear neurons at birth there is approximately loss of about 2100 neurons each decade and hearing loss occurs when neuronal population loss reach 50% or more.

Strial; there is atrophy of the strial vascularis with hearing loss resulting after atrophy of about 30% or more.

Cochlea conductive; an age related change in the stiffness of the basilar membrane that results in hearing loss.(8)

Genetic

Auditory durability is determined by genetic resistance and the physical stresses involved. The ability to differentiate different causes of hearing loss is increasing, though, it is very difficult to determine which component of hearing loss is due to genetic inheritance and which are due to physical stresses such as acoustic trauma (noise), otologic diseases, vascular diseases or ototoxic medications.(8)

In view of the genetic cause as a risk factor contributing to the development of SNHL in elderly, a cohort study comparing aggregation of hearing levels in genetically unrelated people (spouse pair) to genetically related people (sibling pairs, parent-child pairs). A clear familial aggregation was found in age related hearing levels which was much stronger in women than in men, that is, the mother-daughter, sister-sister aggregation was much stronger compared to father- son, brother-brother aggregation at high frequency thresholds, suggesting an extrinsic factor for hearing loss in elderly men.(10)

Sex

It is suggested that, through military, industrial, and recreational activities like hunting or target practice, men typically receive significantly greater noise exposure than women. Thus, the sensorineural hearing loss incidence trend being higher and of greater severity in men also argues in favour of the role of environmental causes as additional factors.(11)

The lower prevalence of SNHL in old women could be attributed to some of the hormonal mechanisms. According to a report on menopause, estrogen and hearing, there is some evidence of a relationship between gender, menopause, estrogens and hearing and that there is, however, sufficient evidence to begin to consider postmenopausal estrogen administration as being potentially beneficial for hearing.(12)

Noise

Due to the effect of noise, the stereocilia of the outer hair cells become less stiff and therefore respond poorly to stimulation. These floppy stereocilia may recover their normal mechanical properties and function normally again if exposure is discontinued. With

increasing intensity and duration of exposure sufficient to cause noise induced permanent threshold shift, more severe damage is seen with fusion of adjacent stereocilia and loss of stereocilia. The primary site of injury appears to be the rootlets that connect the stereocilia with the top of the hair cell. As stereocilia are lost, the hair cells themselves may die. As the severity of exposure increases, inner hair cells and supporting cells in the organ of corti may be damaged as well.(8)

First, in the predictable sequence of events, a small region of hair cell and nerve fiber degeneration appears bilaterally at a cochlear region corresponding to the 4-kHz notch. Typically, these discrete lesions gradually grow in the basal-ward direction (i.e., toward the high-frequency extent of the cochlea) to involve a greater portion of the organ of corti.(13)

The nature of interaction in noise induced hearing loss to age related hearing loss from epidemiologic studies, usually assume additivity; that is, the net hearing loss is the decibel sum of the threshold shifts from aging and from noise, thus increasing severity.(8)

Ototoxicity

Ototoxicity is defined as the ability of the drug or chemotherapeutic agent to cause damage to the inner ear. A number of drugs have been implicated towards this effect including aminoglycosides eg gentamycin, streptomycin which can damage cochlea and vestibular system through disruption of mitochondrial protein synthesis and production of oxygen free radicals which damage outer hair cells of the cochlea. Diuretics like furosemide and ethacrynic acid implicated to damage the cochlea through change in ionic gradients between perilymph and endolymph resulting into cystic changes and edema. Antimalarials like quinine and chloroquin cause vasoconstriction of small vessels within the cochlea and strial vascularis resulting into damaging effect. Analgesics like salicylates are thought to cause enzymatic damage to the cochlear hair cells, and cytotoxic drugs like some anticancer drugs especially the platinum based, cisplatin and carboplatin damage outer hair cell and strial vascularis by the release of oxygen free radicals.(4)

Hypertension and diabetes mellitus

Since inner ear receives arterial blood supply from labyrinthine artery, an end artery branch of anterior inferior cerebellar artery, thus cardiovascular diseases leading to occlusion of the artery from thrombosis or embolism could easily impair inner ear functioning secondary to ischemia and result into SNHL. Diabetes mellitus is also related to SNHL mainly due to its microangiopathic effect affecting labyrinthine blood supply. (13)

Cigarette smoking

Cigarette smoking effect and ototoxic effects of drugs has been implicated as a contributing factor to age related SNHL in the elderly with cigarette smoking having antioxidative mechanisms on the labyrinthine vasculature. (14)

Screening

The screening of the elderly patients with hearing loss is done using HHIE-S which is the best tool for assessing the hearing ability in this age group. (Screening tool- refer Appendix I). Is a ten item questionnaire developed to assess how an individual perceives the social and emotional effects of hearing loss. The higher the HHIE-S scores the greater the handicapping effect of hearing loss. Possible score range from 0 meaning there is no handicap, up to 40 which is the maximum handicap. Audiological assessment is recommended for individuals with HHIE-S scores of 10 and above.

It is usually administered in a face-to-face interview, but in cases of severe to profound hearing loss it is done in a paper-and-pencil self interview. It has been used for more than 30 years ago, with internal consistency reliability of 0.87 in a sample of 162 older adults, and a test re-test reliability reported at 0.84.(15)

In testing the diagnostic performance of the HHIE-S, used to screen a sample of 178 older adults, it was found, HHIE-S was having sensitivities ranging from 53% to 72% and specificities ranging from 70% to 84%, then he concluded that, HHIE-S is a valid and robust test for identifying hearing impaired elderly regardless the audiometric definition used to finally define hearing difficulties.(16)

Impact of age related SNHL in elderly

The major impact of hearing loss is on the individual's interpersonal communication with the others.(3). Through difficulty communication, two major effects can result;

Social and emotional impact; With an ongoing poor interpersonal communication, an elderly patient culminates into feelings of loneliness, isolation and frustration which might easily end up with depression and cognitive impairment.

Economic impact; unemployment rate is very high and among those who are employed, a higher percentage of people with hearing loss are in the lower grades of employment compared with the general workforce. (3), (17)

In a study on hearing loss and cognitive decline in older adults in America, it was concluded that hearing loss in older adults is independently associated with accelerated cognitive decline and incident cognitive impairment.(18)

Also a study on hearing impairment and mental state in elderly, done in London, revealed that, there is a significant association between deafness and depression among elderly people with hearing impairment, however no relation was observed between the severity of depression and the severity of deafness and thus concluding that deafness is a contributing factor but not a major cause of depression in old age. (19)

Moreover in another study done in America on the impact of hearing loss on quality of life of older adults, it revealed a significant impairment of function as measured by activities of daily living in older adults though it was not likely the direct cause of this reduction in physical functioning, however even after other factors are controlled for, it remained that people with hearing loss have more difficulty with these tasks.(17)

Management of age related SNHL in elderly

The management of age related SNHL is mainly with rehabilitative methods which, depending on the severity of loss, will range from reassurance with outpatient clinic follow

up visits evaluating progress, to amplification which depends on the severity of the hearing loss, hearing aids can be used.

But not all patients can afford hearing aids, thus, other modalities to help them includes the use of assisted listening devices for example speakers, FM systems (personal and group FM systems), infrared systems, induction loop systems and telephone amplifying devices. These can be used in theaters, places of worship, museums, public meeting places, corporate conference rooms, convention centers, and other large gathering areas, eventually can prevent the elderly patient from succumbing into complications that are a due result of being unable to hear. Patients should be taught to increase the signal to noise ratio of their surroundings, reduce the background noise, and have people facing directly at them.(Bailey, p 2258,2259). It is estimated that about less than 30% of people who can benefit from hearing aid use actually use them.(3)

In a study on presbycusis rehabilitation done in America, it was concluded that, comprehensive rehabilitation is widely available but is underused because, in part, of social attitudes that undervalue hearing, in addition to the cost and stigma of hearing aids, with cochlear implant used when hearing aids does not benefit.(20)

In another study on low prevalence of hearing aids use among older adults with hearing loss in America, few older adults were found to use hearing aids with a prevalence of 14.6% due to age, severity of loss, education and word recognition scores and suggested improved screening and intervention programs to identify older adults who would benefit from amplification and improve their quality of life.(21)

However, global production of hearing aids meets less than 10% of global need and less than 3% of developing country's needs.(3). Various reasons had been established explaining not using hearing aids among patients in need, some includes lack of availability of services for fitting and maintaining these devices, and the lack of batteries are also barriers in many low-income settings.

Therefore making properly-fitted, affordable hearing aids and cochlear implants and providing accessible follow-up services in all parts of the world will benefit many people

with hearing loss.(3) Also elderly patients with hearing loss should be taught to learn lip-reading skills and use of written or printed text.

LITERATURE REVIEW

Prevalence

In spite of the importance of hearing in everyday life, hearing loss remains an unrecognized and undertreated health disorder. Among people with hearing impairment there is a tendency to under report hearing-related difficulties. In the study of the impact of hearing loss on quality of life, it was found that among those with moderate to severe hearing loss as measured by PTA, many people did not report having any hearing handicap or any communication difficulties.(17)

In a population-based epidemiology of hearing loss study to measure the prevalence of hearing loss among older adults in Beaver Dam, Wisconsin it was found that the prevalence of hearing loss was 45.9% and was noted to be greater in men than women. The odds of hearing loss was identified to increase with age.(22)

Several other studies in America have a slight difference in prevalence but all report the effect to be increasing with increase in age and that men are more affected as compared to women of the same age. (18) (23) (24) (25)

Statistics from Europe shows more than 11 million people in UK with some form of hearing loss, or one in six of the population. It is estimated that by 2035 there will be 15.6 million people with hearing loss in the UK with elderly people more than 50 years having some form of hearing loss. (26) This indicates the rise in the burden of the disease which requires prompt action.

A systematic review of the prevalence of SNHL in elderly population across Europe revealed the prevalence of 30% in men and 20% in women with a loss of 30dB HL by the age 70 years, and prevalence of 55% in men and 45% in women by the age 80 years. Thus showing old men have higher prevalence of SNHL than women.(27) These findings

correlate with the studies done in America indicating a male preponderance and an increase in prevalence with age.

Several other studies on prevalence of age relatd SNHL in elderly were done in Italy, China, Taiwan and Saudi Arabia, which had a slight difference in their prevalence but revealing similarity in their effect to have male predominance and increasing with increase in age.(28) (29)(30) (31)

Africa is among areas with estimated greatest prevalence of SNHL in elderly population above 65 years of age.(3) There is limited number of studies done on SNHL in elderly, thus it is an area much consideration should be taken in conducting several researches to reveal the magnitude and the factors associated with it.

In a ten years retrospective study on pattern of ear diseases among older people at the University College Hospital of Ibadan, Nigeria, it was found that prevalence of SNHL in elderly was 18.2% of people aged 65 years and older and all were bilateral**.** (32)
Another study depicting the profile of ear diseases among elderly patients in Sagamu province, North Western Nigeria, revealed, among the three major clinical diagnoses, SNHL in elderly (presbycusis) was leading 38.2%, otitis 25.5%, and wax impaction 18.8%.(33)

Moreover, a different study conducted to determine the pattern of otorhinolaryngological diseases among the geriatric population of Benin City, Nigeria, it was found that, SNHL due to aging was the commonest 24.94% among all other ENT diseases. However, the study emphasized on awareness of the pattern of ORL diseases in general so as to plan for better management and outcome.(34)

In Limpopo province, South Africa, another similar study conducted to determine the prevalence of hearing impairment and auditory pathology, and found that the age group of 65 years and older presented with the highest prevalence of disabling hearing loss of about 74.65%. This shows that the prevalence of hearing loss in elderly people is significantly higher in African countries as well.(35)

Most, among the limited number of studies on age related SNHL in elderly done in Africa are hospital based studies, which does not give the actual prevalence in the population. That creates difficulties in making comparisons between different continents and formulating management strategies within the countries.

Gender

In America, a study conducted to determine how sex affects the degree of SNHL comprising a group of 687 elderly people with mean age at 68.9 years. It was revealed that, there was no systematic gender difference at 1 kHz and 2 kHz whereas the expected greater loss in males was at 3 and 4 kHz. The significant interaction between gender and degree of SNHL was noted at all three frequencies.(36)

Several other studies in America have been done to determine the prevalence of SNHL in elderly population whereby they further found a significant threshold increase in sensitivity of hearing loss in men than women of the same age groups. (18)
(22) (23) (24) (25)
This has also been revealed by studies done in Europe and Asia to determine the prevalence of SNHL in elderly population, which also delineated the increase in the threshold of sensitivity of hearing loss in men than the corresponding age in women.(27) (30) (37) (38)

In Africa, a similar study was conducted to determine the prevalence and correlates of self-reported hearing loss in Ibadan, Nigeria, found no significant gender difference in hearing loss. This differs to the findings in studies done in the other parts of the world like America and Europe which found elderly men as having significant SNHL as compared to women of the same age. (39)
Since some of the research found no gender difference where majority others revealing male preponderance, then larger population studies are needed to find the correlation in many different countries.

Degree of hearing loss

Literatures suggest a significant progression of hair cell loss in the organ of corti accompanied by neuronal loss from the age of 40 years. Patients younger than 55 years loose hearing at an average rate of 3dB per decade, and patients 55 years and older loose hearing at a rate of 9 dB per decade.(40) Thus, hearing declines gradually in the majority of the population, with clear observation of the rate of decline towards severity accelerating over time.

In the Beaver Dam study of hearing loss in elderly people, it was found that, for both men and women, hearing sensitivity declined with increasing frequency (high frequency loss) above 1000Hz which is typical for SNHL in elderly. It was further found that, the percentage of old people reporting a hearing handicap increased with severity of loss (5.5, 19.7, 47.5 and 71.4) percent for none, mild, moderate and severe losses respectively.(22)

Moreover, another different study conducted in Europe on epidemiology of age related hearing loss, it was found that, approximately 30% of males and 20% of females have a hearing loss of 30dB HL or more at age 70 years, and 55% of males and 45% of females at age 80 years.(41) This signifies an increase in prevalence of hearing loss with age.

Lateralization

A bilateral type of SNHL was found in The Blue Mountains Study done in America relating to several other studies done in Africa including the studies in Ibadan, Nigeria, Egypt and Korle Bu Teaching hospital in Ghana.(23) (32) (42) (43). It is still not known if the problem in Tanzania follows the same trend affecting both ears, thus prompting a research on it.

Factors contributing to age related SNHL in elderly

Genetic

In a study of ageing and hearing loss done in China, concluded that genetic factors determine the ageing process but are under the influence of intrinsic and environmental factors and it is difficult to distinguish changes of normal ageing from those of other contributing factors. (5) whereas a study of the complexity of age related hearing loss done

in Antwerp, Belgium concluded that little is known about the genetic factors contributing to the disease and the emphasis is placed much on the contribution of environmental factors which some still have some controversies, and their results will contribute much to the formulation of preventive strategies. (6)

Moreover, these findings related to findings of another study done in Sydney, Australia where it was found, a strong association between maternal family history of hearing loss and moderate to severe hearing loss in women. Paternal family history of hearing loss was also significant, though less strongly, associated with moderate-severe hearing loss in men.(44)

Cardiovascular diseases as among the contributing factors to SNHL in elderly has been evidenced by a study done to determine association between cardiovascular disease and cochlear function in older adults which found that women with a self-reported history of myocardial infarction were twice as likely to have cochlear impairment as women without a history of myocardial infarction which was not significant in men. (45). This correlates to findings of another study done in America to determine risk factors for presbycusis.

However a study done in Brazil found significant relationship between hypercholesterolemia with no significance to profession, hypertension, smoking cigarette and dyslipidemia. (46) (47)

The effect of diabetes mellitus on SNHL in elderly is evidenced by a study where it was concluded that SNHL was more common in patients with diabetes than in the control nondiabetic patients, and severity of hearing loss seemed to correlate with progression of disease. (48)
A study done at MNH diabetic clinic to determine the prevalence of hearing impairment and its characteristics found that a 20% prevalence of SNHL and a steady rise in SNHL with age was noted having high prevalence in elderly.(49)

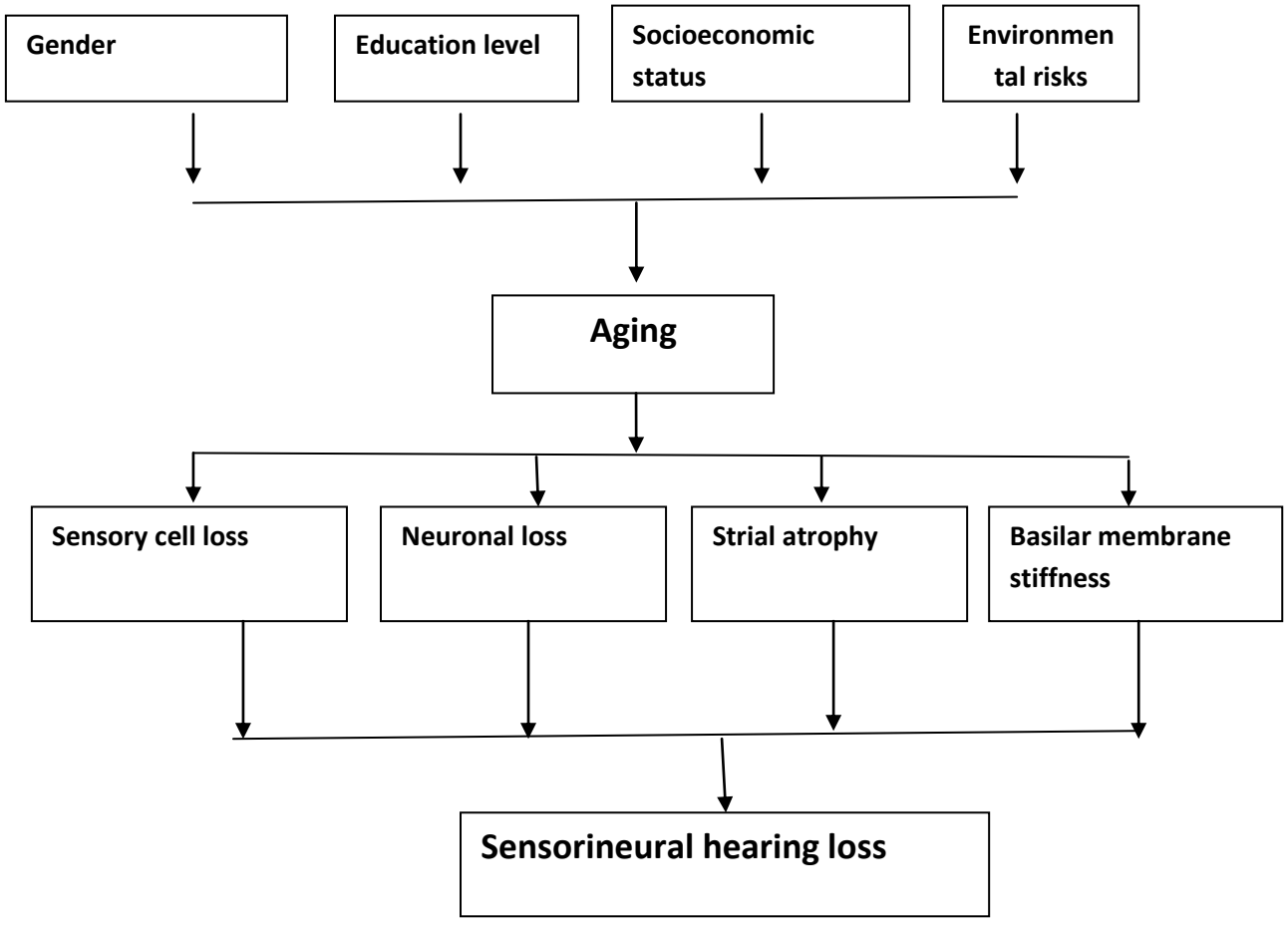
The effect of lifelong noise exposure to the SNHL in elderly was studied in an age cohort comparing study between those old men exposed to occupational noise against those who were not. Seventy year old men exposed to occupational noise had poorer hearing in the

high frequency range than non-exposed men whereas there were no differences in hearing sensitivity between those exposed to noise and those not exposed to noise in women, indicating little or no effect.(50)

The study on lifelong occupational exposure to loud noise and ototoxic medications demonstrated that the participants who reported occupational exposure to loud noise and/or ototoxic chemicals were, significantly, two times more likely to have hearing loss at high frequencies (4 to 8 kHz) compared to all others, P=0.016.(11)

On view of the effect of cigarette smoking to SNHL in elderly, a number of studies revealed the evidence of association on hearing deterioration between smokers as compared to non smokers especially in men as compared to women.(11) (14) (51)(52)(53) Since the same factors associated with the disease affect different populations globally, adding to lack of actual data regarding the problem in Tanzania, thus it is expected the burden to be the same or higher in Tanzania due to rise in population and that needs a research to reveal a picture of the magnitude of the problem**.**

CONCEPTUAL FRAMEWORK



PROBLEM STATEMENT

With about 5% of the world population, that is 360 million people having disabling hearing loss, that accounting to about 328 million adults and 32 million children, shows hearing impairment is a significant problem worldwide. Majority of those with disabling hearing loss live in low and middle income countries, Tanzania being one of them. About one third of these adults with disabling hearing loss are old people of age 65 years and above and their prevalence being higher in South Asia, Asia pacific and sub Saharan African countries. (3)

With current growth in population, the number of old people increases too, together with number of old people with age related SNHL. Tanzania has a very low median age with more than 44.8% of the population under 15, 52% between 15 and 64 and 3.1% over the age of 64. The last official census recording the population of Tanzania in 2012 showed there were 44,928,923 people living in the country, the population is now estimated at over 51 million with life expectancy of 60.85 years.(54). Globalization has an effect on increase in noise exposure, cigarette smoking, increase in infectious diseases which demands use of drugs including ototoxic ones and increase in diseases like hypertension and diabetes mellitus which all lead to a general rise in magnitude of age related SNHL in elderly.

In Tanzania, there is no study done yet concerning the prevalence of age related SNHL in elderly population. The extrapolations of number of people done based on US, UK,Canadian and Australian statistics shows the number of people with elderly SNHL is about 1406761 people, basing on population of 36,070,799 people. (55) indicating the approximate huge burden of the problem in this country.

STUDY RATIONALE

Aging affects every system and organ in the body without sparing the auditory system, where, among other effects, it causes sensorineural hearing loss. For this reason, it is important to conduct this study in this vulnerable population age group which has the highest risk.

As no research about age related SNHL in elderly has yet to be done in Tanzania, then knowing the magnitude of this problem in general is crucial for improving policy activities

as well as putting emphasis on planning management strategies which might be incorporated into other strategies aimed at combating noncommunicable diseases already in place within the Ministry of Health

As part of preventive strategy, findings of this study should make a significant contribution in educating and changing community perspective on how they perceive hearing impaired old people. This will also help the government through the Ministry of health to establish effective national strategies aiming at proper management and rehabilitation of the patients. This study will also pave way for further studies to delineate the contributing factors and management of age related SNHL in elderly.

This study is also a partial fulfilment of the requirements for the award of a Masters degree in Otorhinolaryngology at Muhimbili University of Health and Allied Sciences.

OBJECTIVES

Broad objective

To determine the prevalence of age related sensorineural hearing loss in elderly patients receiving ENT services at MNH by gender, characteristics and factors associated from April to October, 2016.

Specific objectives

i. To determine prevalence of age related SNHL in elderly patients by age and sex.
ii. To determine prevalence of age related SNHL in elderly patients by lateralization.
iii. To determine severity of age related SNHL in elderly patients.
iv. To determine risk factors associated with age related SNHL in elderly.

RESEARCH QUESTION

The primary research question of this research is; How big is the magnitude of age related sensorineural hearing loss among elderly patients at MNH?

The secondary research questions are;

a. Does gender have anything to contribute to the hearing loss attained at old age?
b. What is the severity pattern or the degree of sensorineural hearing loss acquired at old age?
c. Does the hearing loss attained at old age affect one or both ears?
d. How significant are the factors associated with hearing loss in elderly?

CHAPTER TWO

2.0 METHODOLOGY

Study area

This study was conducted at the ENT department of Muhimbili National hospital (MNH). This is a national referral hospital and a teaching hospital collaborating with Muhimbili University of Health and Allied Sciences (MUHAS). It has a bed capacity of 1500, whereas ORL wards male and female have bed capacity of 62.

Study design

This was a hospital based descriptive cross sectional analytical study aimed at determining prevalence of age related sensorineural hearing loss among elderly patients receiving ENT services at MNH.

Study duration

This study took about six months from April, 2016 to October, 2016

Study population

All patients receiving ENT services during the study period.

Target population

Patients from the age of 50 years and above

Inclusion criteria

1. All elderly patients with a HHIE-S score of more than 8 and consented for the study.

Exclusion criteria

1. All non elderly patients.

Sampling and sample size estimation

A convenient sampling was done whereby only available subjects at the ENT department were studied.

Sample size calculation

The sample size was calculated using Fischer's formula;

$$n = \frac{Z^2 p(1-p)}{d^2}$$

- n = Sample size
- Z= standard normal deviation (1.96) which correspond to 95% confidence interval
- P = Proportion of elderly patients with hearing loss, taken as 24.9% (from a study in Nigeria, Benin City Teaching Hospital, by Okhakhu et al 2013)
- d=margin of error (for this study I consider 4.5)

Therefore, from the above formula the required minimum sample size is **350.**

Thus, Adjusting for the non response rate, sample size included **380** patients.

Data collection

Data was collected by the principal investigator, residents and specialists in the ENT department and the Audiology section using a special designed questionnaire at the clinic and Audiology unit.

All the elderly patients were interviewed using a special designed questionnaire which consisted of three main parts;

Part 1; **Demographic profile**

This part of the questionnaire contained a serial number, socio-demographic data, and date of interview, hospital registration number and address of the patient.

Part 2; **Screening**

This included the screening score of the patient and associated risk factors.

Part 3; this part included otological examination as well as audiometric assessment for degree of hearing loss and laterality.

Instruments used included;

- Otoscope with various sizes of aural specula
- Cotton wool, spirit and boric acid ear drop
- Cerumen hook, hydrogen peroxide ear drop
- Pure tone audiometer
- Suction machine
- Glucometer and Blood Pressure machine.
- Cotton wool applicator
- Tunning fork

Screening

A screening tool was used to obtain the screening score and patients were asked about history of risk factors. All information was filled in the questionnaire.

Examination

All participants underwent otoscopic examination, which was done by the principal investigator. The external ear was carefully examined for any congenital or acquired malformation such as external meatal stenosis. Cerumen and foreign bodies encountered were removed by using suction and/or cerumen hook. Pus was removed by suctioning or ear moping and medications prescribed to all participants who presented with pus in the ear. Tuning fork tests conducted to diagnose hearing loss, and final hearing assessment was done on those with clean and dry ears. Those with ear infection had final hearing assessment after infection was cleared. Patient's history was relied in depicting Hypertensive and Diabetes mellitus, but Blood pressure and Random Blood Glucose was tested. Patient's phone numbers were recorded for any follow up if required.

Pure tone audiometry

This was done by trained audiologists in the audiology unit using Clinical Audiometer AC 40. The hearing threshold was 25dB. Those with a characteristic slopping graph at higher frequencies were considered as having presbycusis.

Data handling and analysis

All data were entered in a computer on the same day and soon after they were collected.

Quality check for inconsistency of the data was done on a daily basis to ensure that incomplete and missing data are identified and corrected immediately.

All information collected was kept confidential, stored in locked filing cabinets and computer data were stored in a secure, password-protected computer.

An SPSS program was used to analyze data collected with a consultation from biostatistician for analysis and interpretation.

A **Chi-square** test was used and p-value of less than 0.05 was considered as statistically significant for specific objectives (i) to (iii) and multiple logistic regression analysis was used to determine associated factors for specific objective (iv)

Degree of hearing loss

The degree or severity of a hearing loss depends on the amount of loss. A pure-tone audiometry/ average (PTA) is usually calculated for each ear (right and left). The PTA, which is simply the mean of the air-conduction thresholds at speech frequencies like 500, 1000 and 2000 Hz, is an attempt to summarize the degree of hearing loss.

Categories used to describe the degree of hearing loss at the ORL audiology unit of the Muhimbili National Hospital are as follows;

Degree of hearing loss at Muhimbili National Hospital Audiology Unit

Degree of hearing loss	**Pure tone average (dB HL)**
Normal hearing	-5 to 25
Mild hearing loss	26 to 40
Moderate hearing loss	41 to 55
Moderate severe hearing loss	56 to 70
Severe hearing loss	71 to 90
Profound hearing loss	>90

Data reproducibility

For the purpose of avoiding variations, all screening and clinical assessments of the patients was made by the researcher, residents and specialists in ENT department and as a principle investigator I ensured I am involved in all necessary steps of the patient evaluation and cross check all datas collected on the same day.

Ethical considerations

Proposal was submitted to Muhimbili University of Health and Allied Sciences (MUHAS) Directorate of Research and Publications for ethical review and clearance. No conflict of interest between the author and MUHAS. Possibility of research publication was revealed to participants for the benefit of the patients and medical fraternity. Candidates were ensured of confidentiality and allowed to make informed consent and no penalties for those rejecting participation.

Study limitations

- There were few studies done on this topic therefore it is difficult to make comparison of the findings from different countries with similar demography.
- The participants were only those receiving ENT services at MNH, therefore cannot be a representative of all elderly patients with age related SNHL in Tanzania.
- This study shows the magnitude of age related SNHL in elderly population, it will neither show causal relationship nor rule out other causes of hearing impairment which might affect old person.

CHAPTER THREE

3.0 RESULTS

The number of participants in this study was 380, in which 198 were females and 182were males. The mean of age was 66 years old with range of 50 – 96 years old and standard deviation (SD) was 10.33

TABLES OF RESULTS

Table 1; Demographic distribution of participants among elderly patients who received ENT services at the MNH. N= 380

		Gender		
		Male	**Female**	**Total**
Age groups	50-59	55 (14.5%)	62 (16.3%)	**117 (30.8%)**
	60-69	52 (13.7%)	84 (21.8%)	**136 (35.8%)**
	70-79	47 (12.4%)	39 (10.3%)	**86 (22.6%)**
	80+	28 (7.4%)	13 (3.5%)	**41 (10.8%)**
	Total	**182 (47.9%)**	**198 (51.8%)**	**380 (100.0%)**

Among 380 elderly patients who received ENT services at MNH, males were **182(47.9%)** and females were **198(51.8%)** and majority were along the age group **60-69**, **137(35.8%).**

Table 2; Prevalence of age related SNHL among elderly patients by age.

Age groups	**Age related SNHL**		
	Yes	**No**	**Total**
50-59	32 (27.4%)	85 (72.6%)	**117 (100.0%)**
60-69	33 (24.3%)	103 (75.7%)	**136 (100.0%)**
70-79	25 (29.1%)	61 (70.9%)	**86 (100.0%)**
80+	15 (36.6%)	26 (63.4%)	**41 (100.0%)**
Total	**105 (27.6%)**	**275 (72.4%)**	**380 (100.0%)**

Among 380 elderly patients, the prevalence of age related SNHL was found to be **27.6%** (**105** elderly patients) whereas age group 60-69 was mostly affected **33(8.7%) (P= 0.448)**

Table 3; Prevalence of age related SNHL in elderly by gender

		Age related SNHL		
	Age group	**Yes**	**No**	**Total**
Male	50-59	19 (34.5%)	36 (65.5%)	**55 (100.0%)**
	60-69	12 (23.1%)	40 (76.9%)	**52 (100.0%)**
	70-79	15 (31.9%)	32 (68.1%)	**47 (100.0%)**
	80+	11 (39.3%)	17 (60.7%)	**28 (100.0%)**
	Total	**57 (31.3%)**	**125 (68.7%)**	**182 (100.0%)**
Female	50-59	13 (21.0%)	49 (79.0%)	**62 (100.0%)**
	60-69	21 (25.3%)	62 (74.7%)	**83 (100.0%)**
	70-79	10 (25.6%)	29 (74.4%)	**39 (100.0%)**
	80+	4 (28.6%)	10 (71.4%)	**14 (100.0%)**
	Total	**48 (24.4%)**	**149 (75.6%)**	**198 (100.0%)**

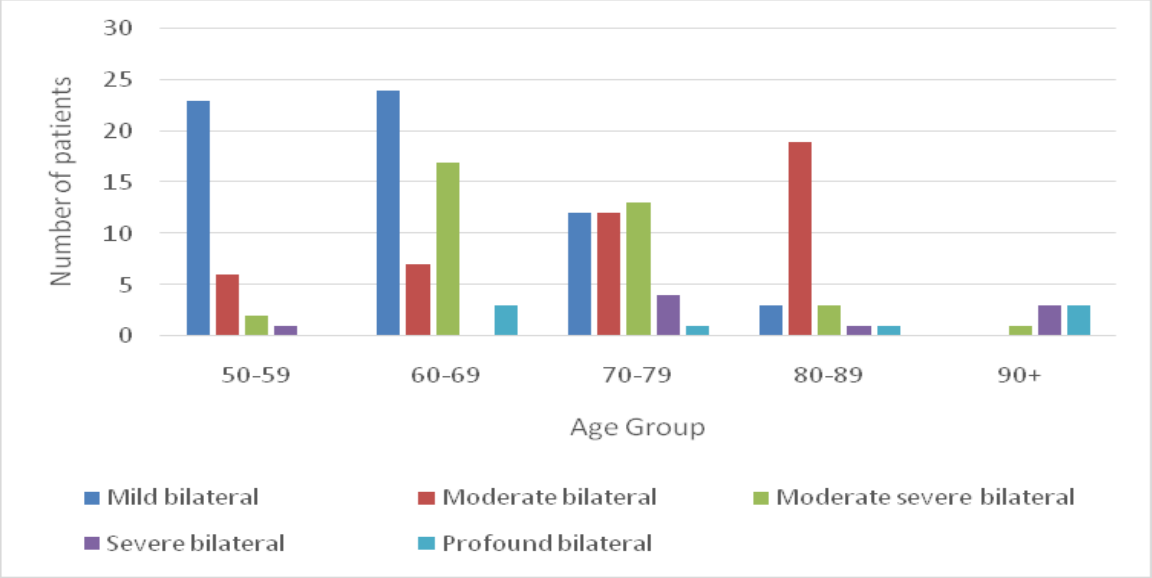
Among 380 participants, age related SNHL of elderly was found in **105 (27.6%),** where, males were mostly affected **57 (31.3%), P=0.574**, females were **48 (24.4%) P=0.467**

Table 4; Prevalence of age related SNHL in elderly by lateralization

		Age related SNHL in elderly			
		Right ear	**Left ear**	**Bilateral**	**Total**
Age groups	**50-59**	0 (0.0%)	5 (4.7%)	26 (24.7%)	**31 (29.5%)**
	60-69	4 (3.8%)	0 (0.0%)	27 (25.7%)	**31 (29.5%)**
	70-79	3 (2.8%)	0 (0.0%)	24 (22.8%)	**27 (25.7%)**
	80+	0 (0.0%)	3 (2.8%)	13 (12.3%)	**16 (15.2%)**
	Total	**7 (6.7%)**	**8 (7.6%)**	**90 (85.7%)**	**105 (100.0%)**

In 105 elderly patients with age related SNHL, majority were having **bilateral SNHL (90 (85.7%**), which is statisticaly significant (**p=0.026).** Left ear lateralization was 8(7.6%) and right ear lateralization 7(6.7%) with age group **50-59**, **60-69** being mostly affected **31 (29.5%)**

Figure 1; Severity of age related SNHL among elderly patients in different age groups



The less severe type of age related SNHL affected mainly the lower age groups, while the much severe type of age related SNHL affected most the higher age groups, with severity pattern increasing with age.

Table 5; Risk factors associated with age related SNHL in elderly patients who received ENT services at the MNH. N= 380.

Risk factors		Age related SNHL	No Age related SNHL	Total
Hearing loss in the first degree relative	Yes	50(13.2%)	150(39.5%)	200(52.6%)
	Total	105(27.6%)	275(72.4%)	380(100%)
History of noise exposure	Yes	26(6.8%)	82(21.6%)	108(28.4%)
	Total	105(27.6%)	275(72.4%)	380(100%)
Hypertensive disorder	Yes	29(7.6%)	80(21.1%)	109(28.7%)
	Total	105(27.6%)	275(72.4%)	380(100%)
Diabetes mellitus	Yes	11(2.9%)	21(5.5%)	32(8.4%)
	Total	105(27.6%)	275(72.4%)	380(100%)
History of ototoxic drug use	Yes	2(0.5%)	1(0.3%)	3(0.8%)
	Total	105(27.6%)	275(72.4%)	380(100%)
History of cigarette smoking	Yes	39(10.3%)	87(22.9%)	126(33.2%)
	Total	105(27.6%)	275(72.4%)	380(100%)

With multiple logistic regression analysis there were no statistical significant association between age related SNHL among elderly patients to all risk factors, **P >0.05**

CHAPTER FOUR

4.0 DISCUSSION

Scarcity of studies on age related SNHL in the elderly among the developing world and sub Saharan African countries is overwhelming. Most, among the few hearing loss studies done along the area target children and noise induced hearing losses, which, in most cases does not cover the elderly group.

In this study, 380 elderly participants were included. The age range was 50-96 years with mean age of 66 years. Males were 182(47.9%) and females were 198(51.8%).

Among 380 elderly participants in this study, 105(27.6%) had age related SNHL, whereas age group 60-69 was mostly affected, 33(8.7%) **(p=0.448).** In this study, males had higher prevalence of age related SNHL 57(31.3%) **p=0.574,** as compared to females 48(24.4%) p= 0.467. Concurrently, the age group 50-59 in males had higher prevalence 19(10.4%), while in females the age group 60-69 was mostly affected 21(10.7%).

The prevalence in this study is lower (27.6%)as compared to most of the studies done in America and Europe, like the study by Cruickshanks et al (45.9%), Moscicki et al (83%), and Lin et al (63.1%). The fact that these were mostly large population based cohort study with different methodologies could have contributed to the discrepancy on prevalence rate, for example, a study by Moscicki et al defined hearing loss as any dB >20.

This study is slightly corresponding to the prevalence obtained in the study done in Benin city which had prevalence of 24.94%, The approximately similarity in the prevalence between the two studies might be a result of both studies being hospital based and both being conducted within the ENT department with similar methodologies.

This study showed a statistically insignificant higher prevalence of age related SNHL in males as compared to females which corresponds to most of the studies done in Europe, America as well as sub Saharan African countries. Studies done by Cruickshanks et al in the Beaver Dam study of presbycusis found the odds of hearing loss increased with age and were more in males than females of corresponding age. Other authors like Lin et al,

Kim et al and Gopinath et al, have concluded that age related hearing loss is statistically significant higher in males than females ($p<0.005$)

Studies done in Europe and Asia to determine the prevalence of age related SNHL in elderly population, also delineated the statistically higher prevalence in men than the corresponding age in women.

A study on prevalence and correlates of self-reported hearing impairment among elderly population, the Ibadan study, there were no statistically difference in the prevalence among males and females. This might be justified by the fact that the study did analyze hearing impairment among elderly without lining out age related hearing loss, which might have resulted into males having higher prevalence than females like other age related hearing loss studies.

Reports of hearing loss prevalence across these studies vary because of different tonal frequencies utilized to obtain a pure tone average (PTA), monaural or binaural definition of hearing loss, and audiometric cut offs used to define hearing loss. Differences in cohort characteristics (volunteer cohort or recruitment of population sample) and the age of the cohort also limit comparisons across studies.

In this study, among the 105 elderly participants with age related SNHL, majority were having bilateral SNHL (90 (85.7%), which is statistically significant(**p=0.026**), left ear lateralization was 8(7.6%) and right ear lateralization 7(6.7%) with age groups 50-59, 60-69 being mostly affected 31 (29.5%)

As age related SNHL tends to affect both ears simultaneously, findings of this study corresponds to the findings in other similar studies done elsewhere. A bilateral type of SNHL was also found in The Blue Mountains Study done in America relating to several other studies done in Africa including the study in Ibadan, Nigeria, Egypt and Korle Bu Teaching hospital in Ghana. A finding of unilateral age related SNHL is mainly linked to other causes rather than age per se.

In the Beaver Dam, Wisconsin study of age related hearing loss, it was found that the hearing loss was usually symmetrical, 94.8% experienced bilateral hearing loss, which is almost similar to the findings of this study.

The similarity to the findings in these studies might be attributed to age as the primary factor to the causation of age related hearing loss, since all involved elderly population where age affects hearing symmetrically in both ears.

A bilateral type of hearing loss have higher social impact on an individual as unilateral hearing loss being frequently compasated by the normal hearing ear thus less felt in the affected person, thus bilateral SNHL was studied in different age groups and bilateral profound SNHL was statistically significant with **p=0.026**

Literatures suggest an increase in severity of hearing loss with age, which is quite similar to the findings in this study, where the less severe type of age related SNHL were mostly affecting lower age groups but decrease on going to higher age groups, whereas the severe type of age related SNHL mostly affected higher age groups and less affecting lower age groups. This indicates severity of age related SNHL in the elderly tend to increase with age.

In a study of presbycusis among older Chinese people in Taipei, the study cohort showed pure-tone thresholds worsening, especially at frequencies >2 kHz, with increasing age. (30)

In this study, all the factors studied, which literatures suggests have an additive effect on age related SNHL in elderly were analysed with multiple regression analysis and found to have a non statistical significance**. P > 0.05**

A study on family history on contribution to hearing loss in elderly done in Sydney, Australia, a strong association was found between maternal family history of hearing loss and moderate to severe hearing loss in women.(44)**.** In this study, 50(13.2%) of the participants with age related SNHL had history of hearing loss in the first degree relative which was statistically non significant**. (P=0.227)**

This study found no statistical significance on noise exposure to age related SNHL in elderly (**P=0.328**) which is contrary to the findings of some of the studies. History of noise exposure has been shown by the Beaver Dam, Wisconsin employment in noisy occupations and hearing loss are consistent with the damaging effects of exposure to loud noise, but they also may be markers of less healthy lifestyle factors. (22)

Findings of this study regarding noise exposure to age related SNHL in elderly, are consistent with another study on risk factors for presbycusis in Brazil where, there was, however, no positive association between engineering and presbycusis.

History of hypertensive disorders were found to have no statistical significance in this study (**P=0.777)**, which corresponds to many different studies on age related hearing loss. The similarity of the findings might be attributed to the effect of use of antihypertensive medications which might reduce its effect on blood vessels including labyrinthine artery, and duration of the illness in an individual.

In the study on prevalence of age related hearing loss (Blue mountains study), a non significant association between hypertension and any other hearing loss was observed but was marginal as increasing hearing loss severity.(23)

In another study on risk factors for presbycusis, it was found that there were non-significant associations with the variables: consumption of alcohol, smoking, a family history of dyslipidemia, systemic arterial hypertension, use of hormones, use of medication continuously, and other diseases.(47)

A non significant statistical association between diabetes mellitus to age related SNHL was found in this study, 11(2.9%) participants had diabetes mellitus among the 105 with age related SNHL, **(p=0.373**) which differs from the findings of other studies.

The effect of diabetes mellitus on SNHL in elderly is evidenced by a study where it was concluded that SNHL was more common in patients with diabetes than in the control nondiabetic patients, and severity of hearing loss seemed to correlate with progression of disease.(48)

Also another study done at MNH diabetic clinic to determine the prevalence of hearing impairment and its characteristics found a statistical significant association between prevalence of SNHL Diabetes mellitus and noted a steady rise in SNHL with age having high prevalence in elderly.(49)

The difference in the findings of this study to the others might be attributed to the details of use of antidiabetic medication to the vascular effect which was not established in the current study.

This study found 2(0.5%) among 105 participants with age related SNHL as having history of using ototoxic medication. This finding was statistically not significant, **P=0.129**, which differs from the findings of other studies on age related hearing loss in elderly.

The study on lifelong occupational exposure to loud noise and ototoxic medications demonstrated that the participants who reported occupational exposure to loud noise and/or ototoxic chemicals were, significantly, two times more likely to have hearing loss at high frequencies (4 to 8 kHz) compared to all others, **P=0.016**. (11)

This discrepancy on the findings may be explained by many factors that may work together to cause or protect certain group of patients from developing hearing impairment even on presence of ototoxic medication.

In this study, among 105 participants with age related SNHL, 39(10.3%) were found to have a history of cigarette smoking, and this finding was statistically not significant, **P=0.308**.

The effect of cigarette smoking to age related SNHL in elderly has been revealed by a number of studies evidencing a significant statistical association on hearing deterioration between smokers as compared to non smokers especially in men as compared to women.(14) (51) (52) (53) (11)

There is a similarity of the findings of this study to the study done on hearing loss prevalence and risk factors among older adults in United States which observed no

significant associations of hearing loss with other cardiovascular risk factors (hypertension, smoking, diabetes, stroke).(18)

One likely explanation for these inconsistent results is that cigarette smoking and other risk factors for age related SNHL are only weakly associated with hearing loss, and their effects may be masked by stronger risk factor which is age.

CHAPTER FIVE

5.0 CONCLUSION

Age related SNHL in elderly patients at MNH has an overall prevalence of 27.6%, and it is commonly bilateral, with male preponderance and tend to increase in severity as age increase. The similarity of the findings of this study to other studies gives a picture that age related SNHL has a considerable prevalence in elderly patients.

Despite the growing interest in age related SNHL in elderly as a complex disease, currently, little is known about the risk factors contributing to the disease. Up to now, the emphasis has been on the investigation of the contribution of environmental factors. Although there is still some controversy about some of these, the results obtained for environmental factors start to contribute to the formulation of prevention strategies for age related SNHL.

The discrepancy of the findings to certain literatures could be explained by different considerations and methodologies used in some of the studies, different definitions of hearing loss and the environment used to perform the tests to the participants. Confounding factors such as duration of hypertension, DM, duration of cigarette smoking and amount smoked, and the dose of ototoxic medication used may also contribute to differences compared to other studies. All these factors need to be addressed in future studies.

5.1 RECOMENDATIONS

This was a hospital based study, thus further community based studies should be done in order to obtain the magnitude of age related SNHL in elderly and compare the findings hence the ability to generalize the results.

Further studies should be carried out that will take consideration of all the mentioned confounding factors, so as to find the association between them and age related SNHL in elderly.

Health education should be given to the community concerning age related SNHL in elderly with measures on how to take care of the modifiable risk factors, to help reduce prevalence of age related SNHL in elderly

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APPENDIX I

Screening tool

The Hearing Handicap Inventory for the Elderly- Screening version

Instructions; please check 'yes', 'no' or 'sometimes' in response to each of the following items. Do not skip a question in trying to avoid a situation due to a hearing problem. If you use a hearing aid, you answer the way you hear without the aid.

	Item	Yes (4pts)	Sometimes (2pts)	No (0pts)
E	Does a hearing problem cause you to feel embarrassed when meeting new people?			
E	Does a hearing problem cause you to feel frustrated when talking to members of your family?			
S	Do you have difficulty hearing when someone speaks in a whisper?			
E	Do you feel handicapped by a hearing problem?			
S	Does a hearing problem cause you difficulty when visiting friends, relatives or neighbours?			
S	Does a hearing problem cause you to attend religious services less often than you would like?			
E	Does a hearing problem cause you to have arguments with family members?			
S	Does a hearing problem cause you difficulty when listening to TV or radio?			
E	Do you feel that any difficulty with your hearing limits or hampers your personal or social life?			
S	Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?			
	TOTAL SCORE= (sum of the points assigned to each of the items)			

(Reproduced with permission from The Hartford Institute for Geriatric Nursing, New York University, College of Nursing)

E= Emotional, S= Social

Score interpretation

0-8 suggests no hearing handicap

10-24 suggests mild to moderate hearing handicap

26- 40 suggests significant hearing handicap

APPENDIX II: Informed Consent Form

Consent to participate in the study titled"Prevalence of age related sensorineural hearing loss among elderly patients receiving ENT services at MNH''-2016

Greetings: I am Dr. Jaria Suleiman Rahib; a postgraduate student doing research on prevalence of sensorineural hearing loss among elderly patients receiving ENT services at MNH.

Purpose of the Study: To determine the prevalence of age related SNHL among elderly patients at MNH.

What participation involves: If you agree to participate in this study, you will be asked questions and examined.

Confidentiality: All information collected will be entered into computer with only an identification number; no names will be included.

Risk: We expect no harm to happen to you during the course of this study.

Rights to withdraw: Taking part in this study is completely voluntary and refusal to participate or withdrawal will not involve penalty or loss of any benefits to which you are entitled. You will be treated and as per the usual treatments provided.

Benefits: findings of this study will help to improve quality of care of the patients in general

Who to contact: If you have any other questions regarding this study, feel free to contact me, the investigator, Dr. Jaria S. Rahib, Muhimbili National Hospital, P.O. Box 65000, Dar es salaam, Mobile phone +255714083183 or my supervisor, Dr Enica Richard, +255715307717.

If you have any questions concerning your rights as a participant, you may contact **Prof. S Aboud,** Director of Research and Publication MUHAS, P.O. Box 65001, Dar es Salaam. Telephone: 2150302/6.

Signature

Do you agree to participate? .....

Participant does not agree……

I, ……..have read the consent form and my questions have been answered and I agree to participate in this study.

Signature of Participant……..

Signature of Investigator…….

Date of signed consent…….

Appendix II: Fomu ya Ridhaa ya Utafiti – Toleo la Kiswahili

Ruhusa ya Kushiriki Utafiti Kuhusu kuangalia ukubwa wa tatizo la ukiziwi wa sikio la ndani na mishipa ya fahamu kwa wazee wapatao huduma ya masikio, pua, na koo katika hospitali ya taifa Muhimbili -2016

Salaam!

Mimi naitwa Dr. Jaria Suleiman Rahib ni mwanafunzi wa uzamili chuo kikuu cha tiba Muhimbili. Nachunguza ukubwa wa tatizo la ukiziwi wa sikio la ndani na mishipa ya fahamu kwa wazee katika hospitali ya taifa Muhimbili -2016

Dhumuni la utafiti huu: Kupata ukubwa wa tatizo la ukiziwi wa sikio la ndani na mishipa ya fahamu kwa wazee katika hospitali ya taifa ya Muhimbili -2016.

Ushiriki: Kama unakubali kushiriki kwenye utafiti huu, utaulizwa maswali na utachunguzwa kwa kina katika kliniki yetu.

Usiri: Taarifa zote za uchunguzi zitashughulikiwa kwa namba, jina halitatambuliwa.

Madhara: Tunategemea kwamba hakuna madhara yoyote yatokanayo na utafiti huu

Haki ya kujitoa kwenye utafiti: Kushiriki katika utafiti huu ni hiari, na kutokubali kushiriki au kujitoa hautaadhibiwa au kupoteza haki yako ya matibabu. Utatibiwa na kuendelea kufuatiliwa kama taratibu za hospitali zinavyoelekeza kwa mtu mwenye ukiziwi.

Faida ya kushiriki kwenye utafiti: Matokeo ya utafiti huu yatasaidia kuboresha huduma kwa wazee wenye tatizo la usikivu kwa ujumla.

Kwa mawasiliano zaidi: Kama una maswali au maelezo kuhusu utafiti huu, uwe tayari kuwasiliana na mtafiti, Dr. Jaria S. Rahib, Hospitali ya Taifa Muhimbili, P.O. Box 65000, Dar es salaam,simu ya kiganjani +255714083183, au msimamizi wangu wa utafiti Dr Enica Richard, +255715307717

Kama una maswali kuhusu haki yako kama mshiriki wasiliana na **Prof. S Aboud**, Mkurugenzi wa Idara ya utafiti, P.O. Box 65001, DSM. Simu 2150302/6.

Saini:

Je, umekubali kushiriki? .....

Mshiriki hajakubali kushiriki……

Mimi……. nimesoma maelezo na kuyaelewa vizuri, na nimekubali kushiriki kwenye utafiti huu.

Sahihi ya Mshiriki……...

Sahihi ya Mtafiti…….

Tarehe …….

Appendix III: Research Questionnaire

TITLE: Prevalence of age related Sensorineural hearing loss among elderly patients receiving ENT services at MNH

A. Sociodemographic data

1. Serial No..... 2. Date...../...../..... 3. Hosp Reg. No.....

4. Adress ..... Phone number.....

5. Age (years).....

6. Gender i. Male ☐ ii. Female ☐

7. Education level;

i. No formal education

ii. Primary education

iii. Secondary education

iv. College education

v. University

8. Screening and risk factors assessment

i. Screening Score.....

ii. Risk factors	**Yes**	**No**
a. Hearing loss in first degree relative	☐	☐
b. History of noise exposure	☐	☐
c. Hypertensive disorder	☐	☐
d. Diabetes mellitus	☐	☐
e. History of ototoxic drug use (NSAIDS, Diuretics, antibiotics)	☐	☐
f. History of cigarette smoking	☐	☐

9. i. BP..... iii. RBG.....

B. PURE TONE AUDIOMETRY

10. Lateralization	**Right ear**	**Left ear**
SNHL	☐	☐

11. Degree of HL	**Right ear**	**Left ear**
i. Normal (less than 25)	☐	☐
ii. Mild (26-40)	☐	☐
iii. Moderate (41- 55)	☐	☐
iv. Moderately severe (56-70)	☐	☐
v. Severe (71-90)	☐	☐
vi. Profound (90 dB HL or greater)	☐	☐

12. Overall SNHL (Presbycusis) Yes ☐ No ☐

Appendix III; DODOSO LA KISWAHILI

Utafiti Kuhusu kuangalia ukubwa wa tatizo la ukiziwi wa sikio la ndani na mishipa ya fahamu kwa wazee wapatao huduma ya masikio, pua, na koo katika hospitali ya taifa Muhimbili -2016

A. Taarifa binafsi na kimakazi

1.Namba ya dodoso..... 2. Tarehe...../...../..... 3. Namba ya usajili ya hospitali.....

4. Anuani ..... Namba ya simu ya kiganjani.....

5. Umri (miaka).....

6. Jinsia i. Mume ☐ ii. Mke ☐

7**. Kiwango cha elimu**

i. Hajasoma

ii. Elimu ya msingi

iii. Elimu ya sekondari

iv. Elimu ya chuo

v. Chuo kikuu

8. Screening na tabia zinazochangia

i. Alama za screening.....

ii. Tabia zinazochangia	**Ndio**	**Hapana**
a. Kutosikia ndugu wa karibu	☐	☐
b. Kufanya kazi maeneo ya kelele nyingi	☐	☐
c. Shinikizo la damu	☐	☐
	☐	☐

d. Kisukari

e. Kutumia dawa zenye kudhuru sikio (maumivu, diuretics, antibiotic) ☐ ☐

f. Uvutaji wa sigara ☐ ☐

9. i.BP..... ii. RBG.....

B. PURE TONE AUDIOMETRY

10. Upande	**Sikio la kulia**	**Sikio la kushoto**
Kutosikia	☐	☐

11. Kiwango cha kutosikia	**Sikio la kulia**	**Sikio la kushoto**
i. Usikivu wa kawaida (chini ya 25dB HL)	☐	☐
ii. Kidogo (6-40)	☐	☐
iii. Cha kati (41- 55)	☐	☐
iv. Cha kati kwenda cha juu (56-70)	☐	☐
v. Cha juu (71-90)	☐	☐
vi. Kiziwi kabisa (90 dB HL na zaidi)	☐	☐

12. Jumla ya usikivu SNHL (Presbycusis) Ndio ☐ Hapana ☐