Prevalence of Hearing Impairment in children in Southern region of Malawi

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ABSTRACT

In 2000, the member states of the United Nations made a commitment to eliminate extreme poverty and improve the health and social welfare of the world's poorest people within 15 years. This commitment was known as the Millennium Declaration and from this declaration were developed eight time-linked goals (WHO, 2005). Achievement of many of these goals would directly or indirectly reduce the prevalence of hearing impairment. In fact, in Malawi, it is believed that the prevalence of hearing impairment is increasing as a result of many factors like severe malaria, chronic suppurative otitis media and cerebrospinal meningitis. Despite the scarcity of reliable and comprehensive statistics from the southern region, there is ample evidence that the risk for hearing impairment seem to have increased even more dramatically than expected.

This was a qualitative and quantitative study and the study design employed the use in-depth interviews and the sample size for the study was 256.

The data has shown that out of 64 file cases from Case files screened for hearing impairments, 39 (representing 60.9%) were diagnosed as having significant hearing impairment.

The results showed that the frequent causes of hearing impairment were as follows: CSOM, Meningitis and Malaria. It was moreover found out that drug like aminoglycoside caused hearing impairment when it was administered to certain number of people. Besides it was also revealed in the study that families with dominant genes for hearing impairment have the tendency of spreading the disease across generations.

Background: Hearing loss has been documented as a big problem in most parts of the world and Malawi has not been spared. The WHO (2018) defines hearing loss as not being able to hear sounds of 40dB or lower in the better hearing ear in Adults and 30 dB or lower in the better hearing ear in children). The WHO's report on hearing loss (2012) indicates that in adults above 15 years old is 15.0% in sub-Saharan Africa compared to 4.9% in developed countries while in children aged between 5 and 14, the prevalence is estimated at 1.9% in sub-Saharan Africa compared to 0.5% in developed countries.

Recently, there has been growing concern on hearing loss as reported by WHO (2018), it is estimated that 466 million people are living with hearing loss representing 6.1% of the total world population. Out of 466 million, 34 million are children representing (7%). The prevalence of hearing loss is high in different parts of the world like in South Asia (7.37%), Asia Pacific (6.90%) Sub-Saharan Africa (4.55%), Latin America and Caribbean (6.85%)

and Middle East and Central Asia (8.36%). Hearing loss in children looks to be more prevalent in Malawi with a prevalence of 11.5% (Mulwafu, 2019).

The study utilized case review of files of persons attending ENT outreach clinics in southern region of Malawi.

This study found that among participants reviewed in the outreach clinics in the Southern region of Malawi. There were 64 Case files of persons with hearing loss. Out of 64 Case files, 12 were from Blantyre representing (18.8 %), 12 from Zomba representing (18.8%) while Balaka, Chikwawa, Mwanza and Thyolo had 10 Case files respectively, representing (15.6%) of the total population.

It is important to pinpoint that the Africa estimates are based on very limited evidence, as the review included only 11 studies (8 published and 3 unpublished), all of which relied on school-based hearing screenings. The lack of data has arisen because many countries struggle to conduct relevant population based surveys using standardized protocols and classification methods.

Besides the lack of data on prevalence of hearing impairment in Africa, little is known about the causes required to inform which prevention and treatment services are needed. Hearing impairment is a silent or invisible disability. It may therefore not be apparent to advocates and health officials. Thus, 'hard data' are needed on prevalence, causes and impact of hearing impairment in the general population and on services available to people with hearing impairment. In conclusion, hearing loss is prevalent in Southern part of Malawi. Hence a need of necessary interventions and such data will help to implement appropriate planning of policies and services and evidence based advocacy for children with hearing impairment in Malawi.

Problem Statement: The prevalence of hearing impairment among primary school going children in the southern region of Malawi.

Objectives: The aim of this research is:

a) To determine the **prevalence** of hearing impairment in the Southern region of Malawi.

b) To determine the **demographic pattern** of hearing impairment.

c) To determine the **historical background** predisposing respondents to hearing impairment in children in primary schools (family history, past medical history and drug history).

d) To determine factor predisposing subjects to hearing impairment in children.

e) To assess the profile of hearing impairment in southern region of Malawi

In depth interviews

The collection of data that involves direct and one to one engagement with individual participants in order to create a friendly environment for people thus the results and feedback must be obtained more easily and accurately.

Findings and Dissemination:

In this research, the prevalence of hearing impairment was conducted in the Southern region of Malawi. A cross-sectional research study designed to recruit 64 respondents from the primary schools around the districts in the southern region was used in the data collection. The purpose of the study was to determine the occurrence of hearing impairment among the sample population at a given point in time, which will then be used to determine the prevalence of hearing impairment in the southern region. The procedure adopted included questionnaires, interviews and physical examination. The findings of the research show that the number of males with hearing impairment is greater than the number of females. The results show that the majority of the respondents had moderate conductive hearing loss and the occurrence of conductive hearing impairment was higher than other types of hearing impairment with severe malaria and meningitis as the major causes of sensorineural hearing impairment. The frequent causes of hearing impairment in children were: Chronic suppurative otitis media and infections e.g. Malaria and Meningitis. These findings have significant implications on the need of resource development for prevention and rehabilitation.

INTRODUCTION

BACKGROUND OF THE STUDY

The burden of hearing impairment is fast growing. It is a principal public health issue in the world. In fact, it is included among the diseases that burden the bulk of the world population. The World Health Organization (WHO) general assembly resolution of 15th of May 1985 pertaining to hearing problems, in which it was stated: *"…the attainment of health for all requires increased activity for the prevention of hearing impairment*" and further, *"…in developing countries most of the hearing impairment, which occurs in excessive prevalence in some communities, result from causes that can be prevented at the primary health level*" or is *"…reversible or remediable*". That was twenty-five years ago. Since then, worldwide statistics have demonstrated an increment in the prevalence of hearing impairment annually in developing countries, especially Ghana (Smith, 2008). In high-income countries, hearing impairment has been shown to have very large financial cost (Smith, 2008).

The WHO reports an increasing trend in the figures of global number of persons with disabling hearing impairment over the last 15 years. This number was originally estimated at 42 million in 1985 and then increased to 120 million in 1995 at the time of the last World Health Assembly Resolution on Prevention of Hearing impairment (WHO, 1995). The most recent figure is 278 million in the year 2005, which is approximately 4.2% of the world's population. The increase in the WHO estimates since 1985 is most likely due to a mixture of improved diagnosis, early detection, old age, ototoxic drugs and long-term exposure to environmental noise.

It is evident from the WHO figures that sensorineural hearing impairment is the most frequent neurological deficit, affecting the majority of the world human populations. Consequences of hearing impairment include inability to interpret speech sounds, often producing a reduced ability to communicate, delay in language acquisition, economic and educational disadvantage, social isolation and stigmatization. In Ghana, the common causes include cerebrospinal meningitis and severe malaria (World Health Report, 2003).

Approximately 466 million people live with disabling hearing loss globally, including 34 million children and most of these live in low and middle-income countries. Unaddressed hearing loss has a negative impact on language development, school performance, employment opportunities, psychosocial well being and aspects of family life, with an estimated annual global cost to society of 750 billion United States dollars. Hearing loss often goes unnoticed and unaddressed and its impact has not been explored adequately in low and middle-income countries.

Early detection, treatment and rehabilitation are important to mitigate some of the negative effects and maximize functioning for affected individuals. In 2017, the WHO adopted a resolution on ear and hearing care that urges member states to develop, implement and monitor screening programs for early identification of ear diseases and hearing loss in high-risk populations, including infants and young children. Ultimately, these initiatives contribute to the attainment of the sustainable development goals number 3 (to ensure healthy lives and

promote well-being for all at all ages) and number 4 (to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all). However, in many low and middle-income countries there is a shortage of good-quality ear and hearing services.

Data on the prevalence and causes of hearing loss in sub-Saharan Africa are sparse. In Malawi, a low-income country in southern Africa, there are two ear, nose and throat surgeons and three audiologists to serve a population of approximately 17.6 million people. A single community-based study has reported that the prevalence of childhood hearing impairment is high in Malawi. Timely and regular follow-up of children with hearing loss is important, but often difficult to achieve. To provide a more comprehensive assessment of the impact of ear and hearing disorders, treatment outcomes should focus not only on formal diagnostic assessments and treatment received, but also on holistic assessments of children, such as well-being and education inclusion (Gell & White, 1992).

Here we aimed to assess the outcome of children with ear and hearing disorders 3 years after initial diagnosis, in terms of referral uptake, treatment received and satisfaction with this treatment. We also aimed to assess the social participation of the affected children, specifically, their ability to make friends and communicate needs and their enrolment at school. Hearing is critical to speech and language development, communication and hearing. Some of the ways in which hearing loss affects children are as follows:

– It leads to delay in development of receptive expressive communication skills e.g. speech and language.

– It leads to social isolation and poor concept due to communication difficulties.

– There is poor academic achievement due to language deficit especially in reading and mathematical concept.

– It leads to loss off confidence in children with hearing impairment, which often have difficulties in understanding and writing complex sentences, such as those with relative clauses.

PROBLEM STATEMENT

In 2000, the member states of the United Nations made a commitment to eliminate extreme poverty and improve the health and social welfare of the world's poorest people within 15 years. This commitment was known as the Millennium Declaration and from this declaration were developed eight time-linked goals (WHO, 2005). Achievement of many of these goals would directly or indirectly reduce the prevalence of hearing impairment. In fact, in Malawi, it is believed that the prevalence of hearing impairment is increasing as a result of many factors like severe malaria, chronic suppurative otitis media and cerebrospinal meningitis. Despite the scarcity of reliable and comprehensive statistics from the southern region, there is ample evidence that the risk for hearing impairment seem to have increased even more dramatically than expected.

RATIONALE FOR THE STUDY

The current study can be justified on the following grounds:

First, the current research will help to deepen awareness of prevalence of hearing impairment in the southern region of Malawi. The research will highlight the gravity of the problem in the southern region

and its effect on children. It will qualify or quantify, assess the value cost to the society. The data will be used to design intervention strategies as well as policies directed towards prevention. The study will help to raise awareness amongst opinion leaders, health planners, decision makers and general public.

Secondly, the study will help develop a public health approach to hearing impairment problem in Malawi as a whole. This will motivate health planners and health professionals to reorient their thinking and activities along a public health path to address the situation of hearing impairment in the region. Unfortunately, there is shortage of appropriate and effective intervention in the field of hearing impairment in the district hospitals and Malawi as a whole not only at a research level, but also in terms of program effectiveness of new interventions.

In addition, the study will help in the establishment of an impact database required for future needs and developments. For instance, a large number of studies of the epidemiology of deafness and hearing impairment have been performed in many countries; however, many of these have deficiencies in their methodology, which makes the data unsuitable for its addition to databases. It is very important to improve data gathering methods because databases are essential for the assessment of the total burden of hearing impairment and its contribution to burden of disease estimates.

Finally, better and more comprehensive epidemiological data will be needed in order to carry out economic analysis studies in Malawi, especially of costs of the burden of hearing impairment and the cost-effectiveness of different interventions against it. The result of the current study will encourage, assist and justify the allocation of resources to develop the management of hearing impairment in Malawi with regards to prevention and treatment as well as rehabilitation of individuals with hearing impairment.

RESEARCH OBJECTIVES

Main Objective

The aim of this research is to determine the prevalence of hearing impairment in children in the southern region in Malawi.

Secondary objectives

The current study aims to achieve the following specific objectives.

– To determine the demographic pattern of hearing impairment in the southern region of Malawi.

– To determine the historical background predisposing respondents to hearing impairment in children (family history, past medical history and drug history).

– To determine factor predisposing subjects to hearing impairment in children.

– To assess the profile of hearing impairment in the southern region.

RESEARCH QUESTIONS

The secondary objectives are designed to answer the following questions:

– Are there any family histories of significant influencing respondent to hearing impairment in children?

– What are the predisposing factors subject to hearing impairment in children?

– What is the profile of hearing impairment of children in the southern region of Malawi?

– What are the demographic patterns of hearing impairment in children in the Southern region?

PROFILE OF THE STUDY AREA

The Southern region of Malawi is an area of Malawi. It covers an area of 31.753 square kilometres with a population of 7.750.629, its capital is Blantyre. Blantyre is a commercial city, is one of the 28 districts in Malawi, of these 28 districts in Malawi, 13 are located in the southern region. The Southern region is composed of the following districts: Balaka, Chiradzulo, Zomba, Nsanje, Chikwawa, Mangochi, Mwanza, Neno, Phalombe, Mulanje, Thyolo, Chikwawa and Machinga. In the Southern region we have one referral central hospital called Queen Elizabeth Central Hospital, which is found in Blantyre district. All patients with hearing impairments that need referral in the southern region of Malawi are referred to this hospital for treatment and rehabilitation.

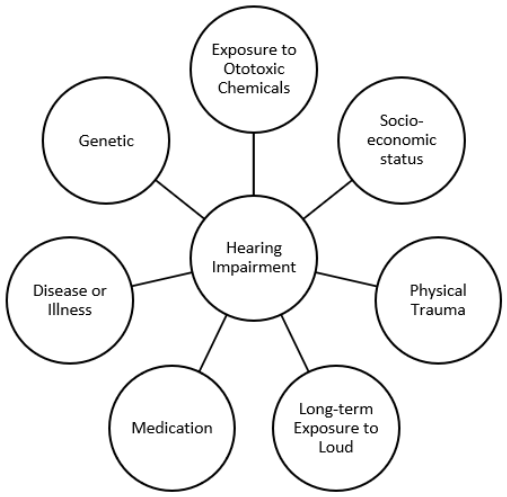
SCOPE OF THE STUDY

The study was limited to the prevalence of hearing impairment, to ascertain the demographic pattern of hearing impairment, predisposing factors and profile hearing impairment in children in the southern region of Malawi. The main study variables were derived from the objectives of the study, conceptual framework and literature review.

CONCEPTUAL FRAMEWORK

Fig. 1:

The conceptual framework for the causes of Hearing Impairment



Hearing impairment is a very serious health dilemma. Assessment of the prevalence of hearing impairment could be achieved by identifying the impact of factors like physical trauma, genetics, and exposure to ototoxic chemicals, diseases such as measles, severe malaria and mumps. Table 1 depicts the causes of the hearing loss and the how the data can be collected.

Table 1:

Study Variables

Variable	Operational Definition	Study indicator	Measurement scale	Data Type	Data Collection Technique/Source
Socio-economic Status	Access to good food, good housing condition, good medical care	No. of people with good socioeconomic condition	Discrete	Quantitative	Questionnaire, Interviews
Physical Trauma	damage to the ear itself or to the brain centers	No. of people with ear damage or brain centers	Discrete	Quantitative	Physical examination, screening, interviews and questionnaire
Genetic	Family history of hearing impairment	No. of people with family history of hearing impairment	Discrete	Quantitative	Patients medical History, Interviews
Disease or illness	Measles and Meningitis	No. of people with Measles, Meningitis, Mumps	Discrete	Quantitative	Physical examination, screening, interviews
Medications	Allergic/direct reactions to medications such antibiotics	No. of people allergic to medication such as diuretics, aspirin and macrolide	Discrete	Quantitative	Medical History and interviews, Physical examination,
Exposure to Ototoxic Chemicals	specific drugs or metals	No. of people exposed to ototoxic chemicals	Discrete	Quantitative	Interviews, screening, Physical examination, Patients history
Long-term exposure to environmental noise	Noise or Louder sound	No. of people exposed to environmental noise	Discrete	Quantitative	interviews, screening

Source: Author Marfoh, 2010.

LITERATURE REVIEW

INTRODUCTION

This chapter reviews relevant literature on the topic under study. For easy reference and better understanding, only the literature under the following headings has been reviewed Early detection and appropriate intervention for children with hearing loss is important for maximising function and quality of life. The lack of ear and hearing care services in low income countries is a significant challenge, however, evidence suggests that even where such services are available and hearing loss children are referred to them, uptake is low Early detection, treatment and rehabilitation are important to mitigate some of these negative effects and maximize functioning for affected individuals. In 2017, the World Health Organization (WHO) adopted a resolution on ear and hearing care that urges Member States to develop, implement and monitor screening programs for early identification of ear diseases and hearing loss in high-risk populations, including infants and young children. Ultimately, these initiatives contribute to the attainment of sustainable development goals 3 (that is, ensure healthy lives and promote well-being for all at all ages) and 4 (that is, ensure inclusive and equitable quality education and promote lifelong learning opportunities for all). However, in many low- and middle-income countries there is a shortage of good-quality ear and hearing services and even when services are available utilization remains low. At national and regional levels, data are currently lacking on the need for ear and hearing services that would help to advocate for, plan and implement these programs. (Mulwafu, 2017).

Prevalence studies

Prevalence studies are defined as the number of affected persons present in the population at a specific time divided by the number of persons in the population at that time (Gordis, 2000). For instance, if we are

interested in knowing the prevalence of hearing impairment in a certain community on a certain date, we might visit every household in that community and use structure questionnaire and physical examinations, to determine how many people have hearing impairments on that date. The number becomes the numerator for the prevalence rate. The denominator is the population in the community on that date.

Prevalence studies can be viewed as a slice through the population at a point in time at which it is determined who has the disease and who does not (Gordis, 2000). But in doing so, we are not determining when the disease developed. Prevalence studies do not take into account the duration of the disease (Gordis, 2000). Consequently, the numerator of prevalence includes a mix of people with different duration of disease and does not involve a measure of risk to measure risk. Incidence must be used, as this includes new cases or events.

In the medical and public health literature, the word prevalence is often used in two ways (Gordis, 2000). They are point prevalence and period prevalence. Point prevalence is the prevalence of the disease at a point in time. Period prevalence is how many people have had the disease at any time during a certain period, such as during a single calendar year. Some people may have developed the disease during that period and others may have had the disease before and died during that period. The important point is that every person represented by the numerator had the disease at some time during the period specified.

In the medical and public health, both point and period prevalence are an important and useful measure of the burden of disease in the community. They are, therefore, valuable for planning health services. Again, they are important for making future projections and estimate the changes that are likely to take place in the disease burden in coming years (Gordis, 2000). In the current study, point prevalence was used to measure the burden of hearing impairment in the southern region.

SCREENING FOR HEARING IMPAIRMENT IN MALAWI

Screening for the early detection of health problems is an integral part of the public healthcare system (Reynolds, 1982). Screening is defined as a "*medical investigation that does not arise from a patient's request for advice on specific complaints"* (WHO, 1971). The term covers all types of examinations and does not consider the speed or accuracy. This definition points to a public health management process in which an investigation is triggered by an administrative system and not a patient initiative. In this way "*screening is a process by which individuals who may have diseases or disorders that are otherwise undetected are identified*" (Harford & Bess, 1978) i.e., the "*finding of asymptomatic cases*" (Haggard & Hughes, 1991).

The basic purpose of screening for disease detection is to separate from a large number of people in apparent good condition those who have a high probability of having the disease under study, so that they may be given a diagnostic workup and, if diseased, brought to treatment (Thornier & Remein, 1982) within this statement is the implication that the main purpose of screening is to benefit the individuals being examined (Wald, 1994). (Wilson & Jungner, 1968) published ten basic principles that screening programs should adhere to. These were:

The condition to be screened for should be an important health problem.

There should be an accepted treatment for the identified cases.

Facilities for diagnosis and treatment should be available.

There should be a recognizable latent (early, asymptomatic) stage in the condition.

There should be a suitable test to employ in the screening.

The test should be acceptable to the population.

The natural history of the condition should be understood.

There should be an agreed policy on whom to treat as patients.

The cost of case finding (including diagnosis and treatment of those diagnosed) should be non-wastefully balanced in relation to expenditure on medical care as a whole.

Case- finding should be an on-going process and not a "*one-off*" project.

INFANT HEARING SCREENING

Significance of Prelingual Hearing Loss

Hearing loss before or during the development of speech and language is referred to as prelingual hearing loss. It includes permanent congenital and early-onset hearing loss. Congenital hearing disorder could manifest postnatally as late-onset, progressive or acquired hearing loss, with varying degrees of severity. Early-onset hearing loss refers to hearing loss that has occurred within the first twenty-eight days of life.

The period from birth to five years of age is considered as the critical or sensitive phase for the development of language, while normal hearing during the first year of life is crucial for normal acquisition of language (Carney and Moeller, 1997). A study from Kennedy *et al*. has demonstrated that the detection of prelingual hearing loss and the provision of amplification within a family oriented intervention program in the first year of life are associated with favourable outcomes in speech and language development (Kennedy *et al.,* 2006). In contrast, children not detected or detected late may never catch up with their normal hearing peers in their academic, social and emotional development even with the best of rehabilitation.

Hearing loss in infancy is considered as significant if the degree is such that it would interfere with normal speech and language development. Developmental delays in language therefore have adverse effects on social, emotional and academic development with a high cost to society (Schroeder *et al.,* 2006), however, moderate-to-profound bilateral permanent hearing loss (> 40

dBHL) in early childhood can impede speech, language and cognitive development (Robinshaw, 1996).

Prevalence of Hearing Loss in Early Childhood

Epidemiological data on early childhood (0-5 years) hearing impairment in developing countries is scarce or of limited value due to the lack of infant hearing screening programs (Bolajoko, 2008). Available studies are predominantly among school-aged children in mainstream schools. In developed countries, the incidence of congenital hearing loss is 2 to 4 per 1000 live births (White, 2004). Of the 133 million annual live births in developing countries, about 798,000 are likely to have permanent congenital and early-onset hearing loss, based on the latest estimates by the United Nations Children's Fund (UNICEF, 2005). These data suggest that prelingual hearing loss constitute a significant health problem in developing countries like Ghana compared to developed countries where new born hearing screening is an essential part of the neonatal care.

The Significance of Early Detection

Prior to the arrival of the objective hearing-screening test in developed countries, the median age of identification varied from 10.4 months to 43.2 months depending on the degree of hearing loss (Harrison *et al.*, 2003). Parents were usually the first to suspect hearing impairment but confirmation was always considerably delayed, sometimes by the physicians´ doubts about the possibility and efficacy of hearing screening in newborns and infants (Kittrel & Arjmand, 1997). In developing countries, parental suspicion prompted by a child´s inappropriate response, or lack of response, to sound is still the predominant mode of detection and occurs usually at a mean age of 22 months (Gopal *et al.*, 2001).

The use of consistent screening instruments with higher mainstreaming severe and improved amplification in the last decades has stimulated early detection of severe hearing loss in newborns or infants. Two objective screening tests currently available for detecting infants with hearing loss are otoacoustic emission (OAE) and auditory brainstem response (ABR).

Screening with OAE is an electro-physiological measure of the integrity of the outer hair cell in the cochlea. OAE, also known as cochlear echoes, are low intensity sounds originating from the outer hair cells and can be elicited in response to clicks presented to the ear through a light weight probe that houses both a transducer and microphone or receiver. The emissions are recorded and displayed in a waveform for interpretation in diagnostic instruments or simply produce a "pass" or "fail" result in OAE screeners. The test is relatively quick, non-invasive and can be done readily by babies and acceptable to parents. The recording often takes about one minute and can be administered without audiological expertise.

The ABR measures the electro-physiologic function of the eighth cranial nerve and its pathways in the brainstem. The electrical response of auditory stimuli is recorded with three surface scalp electrodes and it is not state-dependent, as recordings can be obtained when babies are sleeping. Also, the response is significantly correlated with the degree of hearing impairment. In general, the click-evoked threshold predicts behavioural audiometric threshold in the 1,000 to 4,000

Hz range within 10 to 15 dB HL. (Watkins, 2001).

Community-based Hearing Screening

In many developing countries such as Ghana and Nigeria, home birth and deliveries at private maternity homes run by traditional birth attendants account for majority of babies born outside hospitals (WHO, 2004). The rest are delivered in church premises or before arrival at the hospitals. Contemplating new born hearing screening programs at these various locations may be a logistical nightmare. However, the experiences in Ghana show that mothers from all birthing locations take their babies to immunization clinic at designated community health centres. Consequently, immunization clinics have been utilized as platforms for delivering new child health intervention packages, especially in the developing world (WHO, 2002). The community-based screening is not limited to immunization clinics and may be implemented during infant welfare clinics and other child health programs (Lin *et al.,* 2004).

Problems associated with management of hearing impairment in Malawi.

Management of hearing impairment is becoming difficult because of the different perception towards the ear and hearing conditions, financial concentrates among patients and lack of health awareness on ear and hearing care as elaborated below.

Many people regard ear conditions as not important rather than other health conditions, which makes people not to seek the services as fast as they can.

– Lack of money for transport when referred to a referral hospital. Many people live in faraway places where they require transport when they are referred so they tend to live with the condition rather than spend the money.

– Lack of awareness on the ear issues which make many people to be ignorant on the ear conditions. Although hearing loss is the most important cause of disability worldwide, there is a lack of awareness of the problem in all sectors of the population including health care professionals as well as a lack of health educational programs for prevention and detection (in addition to the lack of investment by most developing countries in programs, infrastructure and trained personnel). Because hearing loss is an invisible disability and most people and governments are not aware of the large size of the problem, children with hearing loss are not discovered and may be mistaken to have intellectual disabilities in school. In adults, hearing loss more often evokes irritation than sympathy. In health care, there is a lack of national programs to address hearing loss, especially in developing countries where the burden and need is greatest and a lack of investment in training and equipment.

– There is shortage of trained personnel in ear service delivery in Malawi; apparently, we have 1 audiologist, 1 ENT surgeon, 45 ENT clinical officers and 0 speech therapists for 17 million people in Malawi. This makes services to be unequally distributed in Malawi.

– The difficulty of access to health care facilities and other factors such as poor personal hygiene and overcrowding cause many children in low and middle-income countries to become deaf or hard of hearing following infections such as meningitis, measles, viral encephalitis, chicken pox, influenza, mumps or other viral infections. In the so-called “meningitis belt” in the sub-

Saharan Sahelian region of Africa, epidemics of meningococcal meningitis usually happen.

– In Malawi most people in the rural communities believe that when a child has hearing loss, it will one day be healed, the child will hear again without the hospital intervention.

– The referral system in Malawi has disappointed people in the villages because: for example a child who has been referred from rural health Centre has to pass via a district hospital before reaching the central Hospital, where the hearing services are found, so this has discouraged many people since they are not helped at the district but they spend some days waiting to be referred to Central Hospital and provide them with the transport like ambulance.

METHODOLOGY

INTRODUCTION

The rationale for this study is to examine the prevalence of hearing impairment in children of the southern region in Malawi. The chapter describes the approach employed in undertaking the research. It includes the study design, study area, study population, sampling design, data collection, research instruments and data analysis.

STUDY DESIGN

The research design used for the study was a cross-sectional research design. The term research design is used to describe a number of decisions, which need to be taken regarding the collection of data even before embarking upon the data collection process. The design intends at determining the prevalence of hearing impairment in children in the southern region of Malawi. This study assesses the occurrence of hearing impairment among primary school-going children, which were assessed during mobile outreaches, which will then be used to determine the prevalence of hearing impairment in the southern region of Malawi.

STUDY POPULATION

The target population in this study consists of all respondents with hearing impairment. Statistical software was used to compute a sample size of 64 having a confidence level value of 99%.

SAMPLING DESIGN

The sampling design employed for this study was cluster random sampling. Cluster sampling is a sampling technique in which the entire population of interest is divided into groups, or clusters, and a random sample of these clusters is selected. This was done by numbered all the schools in the district in each sub-cluster. Cards corresponding to the total number of schools in each sub-cluster was selected and numbered. The numbered cards were put in a box and shuffled thoroughly before picking the first sample unit. The researcher continued to reshuffle and pick the cards until the required number for the sample is obtained. This design was used because the population was unevenly distributed into 13 districts. One district represented a cluster, making 13 clusters in all. A ratio of the total sample was selected from each cluster by a random technique to obtain the required total sample. The ratio was based on the size of each cluster. The selected sample sub-sets was related to the size of the total cluster.

DATA COLLECTION TECHNIQUES

Upon assortment of the districts, we asked for approval from the District Health offices on the conduct of the study in their respective areas. Our team, was made up of Health surveillance assistants who stay with the children in their respective communities were responsible for the mobilisation of the patients to come to the outreach clinics, ENT staff made up of ENT nurses and clinical officers. The Health surveillance assistants were assigned to randomly selected primary schools of the various districts. My task of the research was to collect useful data on participants through appropriate data collection instruments such as interviews, questionnaires and physical examination. Before employing data collecting instruments, participants were given the consent form to read carefully and sign. All their questions and or concerns about the study were answered before data collection begins. After completion, they were thanked for their participation. Anonymity and confidentiality of the participants were ensured since there will be no inclusion of any identifiers and or any incriminating information on participants. Only individual information was reported, not group responses.

Questionnaire

A modified questionnaire was used to elicit respondents´ opinions. This questionnaire enabled the researcher to collect data from respondents with a view to describe the prevalence of hearing impairment in the municipality. The questionnaires were both open and closed ended questions. The questionnaire is attached in Appendix.

Physical Ear Examination

After the interview, the study participants were subjected to physical ear examination by otoscopy. An examination form was provided to determine the presence or absence of outer, middle and inner ear infections. All findings were recorded in the examination form provided. Participants with any form of ear infections were not allowed to carry the audiometric examination.

Audiometry

The audiometer used was Kamplex Screening Audiometer AS7 calibrated to the ANSI standard (ASHA 1975). The respondents were visited beforehand and the purpose of the screening was explained to them. The dates for the screening were arranged and the timetable given to the respondents in advance. A quiet room was then located for the test in each group. The average noise level (Quest Sound Level Meter Type) in the test room was 41dB SPL. On the day of screening, respondents were brought into the test rooms in groups of twenty and instructed regarding the procedure for the hearing test. Each respondent was presented questions on signs of possible hearing disorders. Each respondent was asked if he or she had an ear discharge or an earache. Audiometric screening was carried out at three frequencies 1000Hz, 2000Hz and 4000Hz. Ambient noise level in the test rooms limited testing to these mid – range and high frequencies. The degree of hearing impairment was based on the criteria developed by the world health organization. For each ear, “pass” was operationally defined as responding properly to stimuli at 30dB HTL and at all three frequencies. When a respondent failed to respond to any of these frequencies, the tone was re-presented at 35, 40 and at times 45 dB HTL and the response recorded.

RESEARCH INSTRUMENTS

For the credibility of the research, there were used three different tools for data collection. The research instruments employed were all regulated tools, which have been tested for validity and reliability. The research tools consist of the following:

– *Questionnaire.*

– *Audiometric Evaluation Form.* This form was used by the researchers and audiologists at different schools to assess the hearing threshold of the participants at 1000Hz, 2000Hz, 4000Hz, 8000Hz, 500Hz and 250Hz.

– *Physical Examination form.* To perform a physical examination, otoscopic examination was performed using a Welch Allyn Otoscope. Contents of the form incorporated examination of the outer, middle and inner ear for both ears. Presence and absence of ear infections were determined using the form. However, puretone audiometry, OAE and tympanometry were performed also.

SAMPLING SIZE DETERMINATION

The desired sample size was calculated as follows:

Z^2pq/e^2 *(Cochrane sample size formula)*

In this case as the prevalence rate is not known the assumption of p is 50%

Z=1.96 at 95% confidence interval

Q=1-p

E=margin of error (0.05)

Calculation

Sample size $=1.96^2x0.5\times0.5/0.05^2=0.9604/0.0025=384$

$Z^2pq\ n\ d2$

(Kirkwood and Sterne, 2003)

Where; n = the desired sample size z = the standard normal deviation 2.58 p = the proportion of event of interest be 72% q = 1 – P d = degree of accuracy desired at 0.05.

n = 64 but the feasible sample size is 256.

DATA QUALITY

Data quality was assured through:

– Careful design of questionnaire, interview guides and adherence to proper interviewing procedures

– Pre-testing of the questionnaires

– Proper training of the interviewers

– Closed supervision of the data collection by Principal Investigator

– Proper categorization and coding of the data

INCLUSION CRITERIA

– All the children with hearing impairment were engaged in the research. This included children respondents from the randomly chosen primary schools in the district.

– All primary school children up to 14 years with history or actively draining CSOM (using WHO CSOM definition)

– All primary school children attending the outreach clinics

– Hearing loss children who consented or for whom a legal guardian had consented to participate in the study.

EXCLUSION CRITERIA

1. Not all those who had any form of super active otitis media in the ears were allowed to proceed to the audiometric examination.

2. Patients not consenting to participate in the study.

ETHICAL CONSIDERATION

To fulfil ethical requirements, written permission was sought from the District Health Office in all the districts.

RECRUITMENT, CONSENTING AND DATA COLLECTION PROCEDURE

The study team comprised of:

– ENT clinical officers 2

– ENT Nurses 2

– Health surveillance assistant 1

– Audiology clinical officers 2

– Special needs teacher 1

STUDY LIMITATION

Prevalence studies have their strength in presenting a snapshot picture of the situation at hand. This could draw the attention of policy makers, advocates and interest groups to the situation at hand. The study shall not address aspects such as management and effects of hearing impairment and other related issues that may not necessarily fall within the concentration of the study.

ASSUMPTIONS

– Respondents will be honest and frank with their response.

– Data collection volunteers and other research assistants will follow all the laid down rules governing the study.

– The sample size will adequately represent the study population.

EXPECTED RESULTS AND DISSEMINATION

The findings from the study would be disseminated through:

– Peer review journals; a copy of which will be made available to the library in the community

– Community outreach programmes and district health offices

RESULTS

INTRODUCTION

This chapter deals with the presentation of the results of the data collected from ENT and Audiology outreach clinics in the Southern Region of Malawi by means of frequency tables, bar charts and appropriate inferential statistical techniques. The focus of the study was to determine the prevalence of hearing impairment in the Southern region of Malawi.

PERSONAL DATA OF CASE FILES

Demographic Characteristics of Study Population

Table 2 shows that among the 64 Case files selected from each district in the Southern region, 12 of the Case files (representing 18.8 %) came from Blantyre City during the ENT outreach, 12 of the Case files (representing 18.8%) came from Zomba district, while Balaka, Chikwawa, Mwanza and Thyolo all has 10 respondents (representing 15.6%) each.

Table 2:

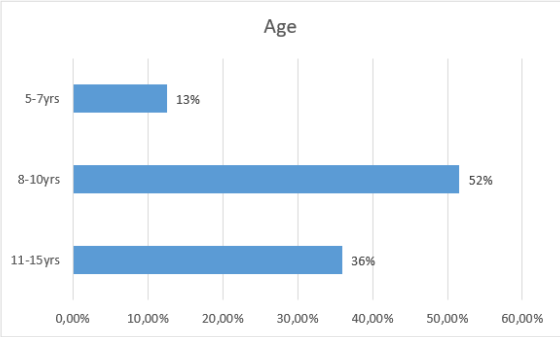
Geographical Area of Respondent within the Region

District	Frequency	Valid Percent
Balaka	10/64	15.6
Blantyre	12/64	18.8
Chikwawa	10/64	15.6
Mwanza	10/64	15.6
Thyolo	10/64	15.6
Zomba	12/64	18.8

The age distribution of the Case files in the present study are shown in Figure 2. Out of 64 respondents, 23 (representing 35.9%) belonged to the 11-15age group, 33 (representing 51.6%) were 8-10 years old and 8 (representing 12.5%) belonged to the 5-7 age group.

Fig.2.

A bar chart illustrating the age distribution of the Case files in the Southern region.



ASSESSMENT OF HEARING IMPAIRMENT

Field Audiometric Screening Test

Failing audiometric screening test means not able to respond correctly to stimuli at 30dB HTL for all frequencies and to pass audiometric screening test means to respond correctly to stimuli at 30dB HTL for all frequencies. As shown in the bellow table, of the 64 Case files selected from each district Southern Region of Malawi, majority of the Case files representing 60.9 % degree of hearing loss were moderate with 41 to 55 DB HTL. Meanwhile, representing 21.9% of the Case files were indicated severe degree of hearing loss.

Table 3.

Classification of degree of hearing loss.

Degree of hearing loss	Valid Percent	Hearing loss range (dB HL)
Mild	1.6	26 to 40
Moderate	60.9	41 to 55
Moderately severe	4.7	56 to 70
Severe	21.9	71 to 90
Profound	10.9	91+

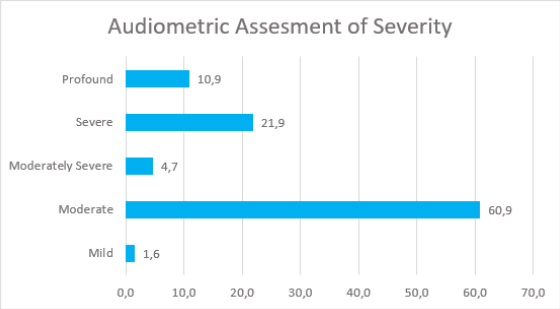
(Clark,1981).

Audiometric Assessment of Severity

The patterns of audiometric assessment of severity of hearing impairment in the present study are made known in Figure 3. Of 64 Case files from each district found with hearing impairments greater than 41dB HTL, the majority of the Case files (representing 60.9%) had moderate hearing impairment whereas minority of the Case files (representing 1.6%) had mild hearing impairment. Followed by 21.9% were found to have severe hearing impairment, with 10.9% had profound hearing impairment and 4.7% had moderate severe hearing impairment.

Fig.3.

A bar chart illustrating the audiometric assessment of those with hearing impairment in the Southern region.



Gender Distribution of Hearing Impairment

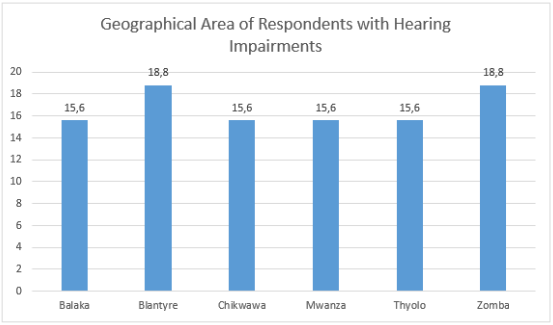
Regarding the gender distribution, 64 participants were interviewed in this study, 33 (representing 48.4%) were female while 31 (representing 51.6%) were male. Therefore, the distribution is almost equal between genders.

Geographical Area of Case files with Hearing Impairments

The geographical area of Case files with hearing impairment in the present study is made known in Figure 4. Of 64 Case files selected from the Southern region, 12 of the Case files (representing 18.8 %) came from Blantyre City during the ENT outreach, 12 of the Case files (representing 18.8%) came from Zomba Municipality, while Balaka, Chikwawa, Mwanza and Thyolo all has 10 respondent (representing 15.6%) each 135 Case files with hearing impairment.

Fig.4.

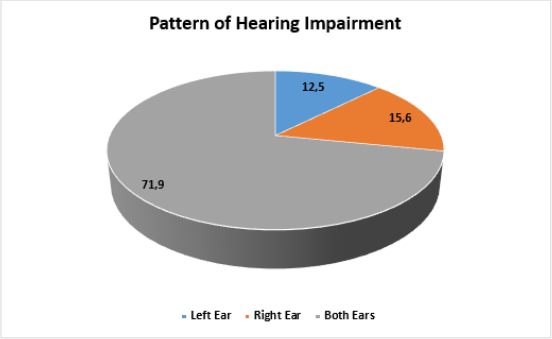
Geographical Area of Case files with Hearing Impairments



Pattern of Hearing Impairment

Fig. 5.

The Pattern of Hearing Impairments



Types of Hearing Impairment

The types of hearing loss of Case files using tuning fork in the recent study are shown in Table 4. Of 64 Case files with hearing loss, 28 (representing 43.8%) had conductive hearing loss, 23 (representing 35.9%) had sensorineural hearing loss and 13 (representing 20.3%) had mixed hearing loss.

Table 4.

Types of Hearing Impairment of Case files

Types of Hearing Loss	Frequency	%
Conductive Hearing Impairment	28	43.8
Sensorineural Hearing Impairment	23	35.9
Mixed Hearing Impairment	13	20.3
TOTAL	**64**	**100**

Medical Condition Attributable to Hearing Impairment

The medical conditions attributed to hearing impairment in Case file were shown in Table 5. Out of 64 Case files with medical conditions of hearing impairment, 6 (representing 9.5%) had otitis media, 9 (representing 14.3%) had infectious conditions, 32 (representing 50.8%) had CSOM and 6 (representing 9.5%) had severe malaria. While Meningitis had 13 (20.6% Heredity 3 (4.8%) and Other causes 4 representing (6.3%) respectively.

Table 5.

Medical Conditions Attributable to Hearing Impairment in Case files. Chronic suppurative Otitis media appears as a leading cause of hearing loss.

Otitis media	6	9.5
Infectious Conditions	9	14.3
CSOM	32	50.8
Severe Malaria	6	9.5
Meningitis	13	20.6
Heredity	3	4.8
Other	4	6.3

EVALUATION OF FAMILY HISTORY, PAST MEDICAL AND DRUGS HISTORY; RELATION TO HEARING IMPAIRMENT.

Family Histories

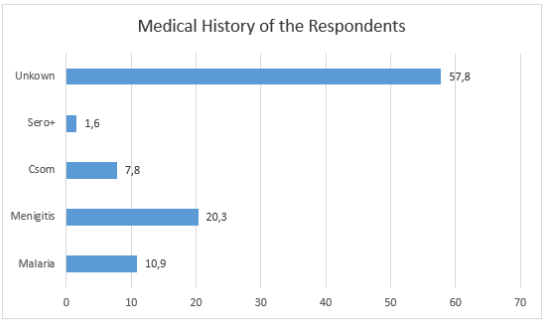
Family history was recorded from the 64 case files seen and (60%) had family history of hearing impairment, 20% had a family member with speech disorder while 20.0% had family history of heredity.

Medical Histories

Figure 6 below shows the profiles of medical histories of the Case files with hearing impairment in the present study. The profile shows that: 20.3% had medical history of meningitis, while 10% of the case files had medical history of malaria, 7.8% had medical history of CSOM, while Sero+ and Chronic Suppurate shares 1.6% each. The remaining 57.8% had no cause.

Fig.6.

Profile of Medical History of the Case files with Hearing Impairment



DISCUSSION

INTRODUCTION

This chapter presents a detailed discussion on the findings of the study conducted in the Southern region of Malawi. The purpose was to determine the true condition of hearing impairment in the Southern region. The discussions are done under the broad objectives of this study which include demographic pattern of hearing impairment in the Southern region, family history of the Case files that influence hearing impairment, causes of hearing impairment in the Southern region and profile of the severity of hearing impairment. The results indicate four main findings.

DEMOGRAPHIC PATTERN OF HEARING IMPAIRMENT

Geographical Area of Respondent with Hearing Impairment

The results showed that among the 64 Case files selected from the Southern region, 12 of the Case files (representing 18.8%) came from Blantyre City during the ENT outreach, 12 of the Case files (representing 18.8%) came from Zomba district, while Balaka, Chikwawa, Mwanza and Thyolo all has 10 respondents (representing 15.6%) each. It was however observed that the higher the population, the more likelihood of getting more hearing problems. Again, the higher percentage of hearing impairment recorded in the southern region could be due to diseases and heredity factors. This is in agreement with Bayazit & Yilmaz's report (2006), that the genetic basis of hearing loss is important because almost 50% of profound hearing loss are caused by genetic factors and more than 120 independent genes have been identified. In this review, after a brief explanation of some genetic terms (allele, heterozygosis, homozygosis, polymorphism, genotype and phenotype), classification of genetic hearing loss (syndromic versus non-syndromic, and recessive dominant, X-linked and mitochondrial) was performed. Some of the most common syndromes (Usher, Pendred, Jervell and Lange-Nielsen, Waardenburg, branchio-oto-renal, Stickler, Treacher-Collins and Alport syndromes, biotinidase deficiency and Norrie disease) were found to be the most common causes of hearing loss. However, people with dominant gene for deafness should be informed of their genetic inheritance for future generations.

Gender Distribution of Hearing Impairment

The results of the gender distribution of hearing impairment revealed among 64 Case files in the Southern region, 31 (representing 48.4 %) were male while 33 (representing 51.6%) were females.

Age Distribution of Hearing Impairment

The results of age distributions of the Case files show that out of 64 respondents, 23 (representing 35.9%) belonged to the 11- 15 age group, 33 (representing 51.6%) were 8-10 years old and 8 (representing 12.5%) belonged to the 5-7 age group. The results mean that age group of 8 to 10 years old have higher hearing impairment.

HISTORY OF CASE FILES THAT INFLUENCE THEM TO HEARING IMPAIRMENT.

Family History

The study revealed that out of the 64 Case files with hearing impairments, below are shown the profiles of family histories of the Case files with hearing impairment in the present study. From the 64 case files seen, 60.1% had family history of hearing impairment, 20% had a family member with speech disorder while 20.0% had family

history of heredity, that, if a family has a dominant gene for deafness it will persist across generations because it will manifest itself in the offspring even if it is inherited from only one parent. Schraders et al., (2010) is also of the view that if a family had genetic hearing impairment caused by a recessive gene it will not always be apparent as it will have to be passed onto offspring from both parents. This is in agreement with Sloan-Heggen et al.'s study (2016). Approximately 80% of prelingual deafness is genetic, most often autosomal recessive and non-syndromic. The most common cause of severe-to-profound autosomal recessive non-syndromic hearing loss in most populations is mutation of *GJB2*. The most common cause of mild-to-moderate autosomal recessive hearing loss is mutation of *STRC*; of note, there is ethnic-based variability. The inheritance pattern among the disorders with prelingual non-syndromic hearing loss is 80% autosomal recessive, 20% autosomal dominant, and 1%-1.5% X-linked, mitochondrial. Although similar data are not available for the disorders with postlingual non-syndromic hearing impairment, most reported families demonstrate autosomal dominant inheritance.

Medical History

The findings further showed 64 Case files with hearing impairment in the Southern region. Among 64 Case files with hearing impairment in the Southern region, 20.3% had medical history of Meningitis, while 10% of the Case files showed that they had medical history of Malaria, 7.8% had medical history of CSOM, while Sero+ and Chronic Suppurate shares 1.6 each respectively. Depending on the setting of the study and the feasibility, this study is contrary to what Mulwafu (2015) found that the most common cause of hearing loss was middle ear infection followed by undetermined causes then wax impaction.

CAUSES OF HEARING IMPAIRMENT IN THE SOUTHERN REGION

Conditions Associated with Hearing Impairments

This study reveals that out of 64 respondents with conditions associated with hearing impairment, the majority of respondents had Chronic suppurative Otitis Media, representing 50.8% Epidemiologically 50% and 85% of children experience one episode of AOM by 3 years of age with peak incidence being between 6 and 15. Otitis Media is the commonest cause of hearing impairment in children in the developed countries and can affect as many as 80% of children at some stage (Qureishi et al., 2014). School children screened with otoscope had unilateral or bilateral Chronic Suppurative Otitis Media with dry and wet perforations.

PROFILE OF THE SEVERITY OF HEARING IMPAIRMENT

The study revealed that out of 64 Case files found with hearing impairments greater than 41dB HTL, the majority of the Case files (60.9%) had moderate hearing impairment whereas the minority of the Case files (1.6%) had mild hearing impairment. Twenty-one point nine percent were found to have severe moderate hearing impairment, 10.9% had profound hearing impairment and 4.7% had moderate severe hearing impairment.

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CONCLUSION AND RECOMMENDATIONS

CONCLUSION

The purpose of this study was to survey the prevalence of hearing impairment in the Southern region. The prevalence rate of hearing impairment in Southern region was the number of affected people present at the

specific time of the study divided by the total number of the population. The data has shown that out of 64 Case files screened for hearing impairments, 39 (representing 60.9%) were diagnosed as having significant hearing impairment.

Again, the results showed that the frequent causes of hearing impairment were as follows: CSOM, Meningitis and Malaria. It was moreover found out that drug like aminoglycoside caused hearing impairment when it was administered to a certain number of people. Besides, it was also revealed in the study that families with dominant genes for hearing impairment have the tendency of spreading the disease across generations.

Hearing loss and its consequent difficulty in speech and language can be controlled and treated via appropriate different hearing screening protocols in every education setting. It is noteworthy that according to the obtained results, there should be an emphasis on annual hearing screening for school going children.

It can be concluded that most of these findings are preventable if appropriate measures are taken.

RECOMMENDATIONS

Based on the conclusion of this research I thus recommend that:

1. Drugs known to cause hearing impairment such as aminoglycoside should be prescribed with caution.

2. Health workers, such as nurses should be trained to join the hearing screening team to organize more frequent ear syringing of patients.

3. More attention should be paid to the identification of the hearing impaired so that appropriate interventions can be initiated.

4. Ear mold equipment need to be improved and be made more affordable to patients, more especially children.

5. Strengthening of public awareness programs regarding the need for hearing assessment.

6. It is necessary for governments, health planners and other decision makers to educate and protect the society by enacting laws aimed at safeguarding the life and protection of those who might be vulnerable to hearing impairment related problems.

7. There is a need for national survey to access the overall hearing impairment in the country.

8. To formulate guidelines for the appropriate treatment of CSOM based on the sensitivity patterns of microorganisms. since the guidelines offers specific treatment for the condition.

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