

A systematic review on common causes of hearing loss and need for hearing aid Device intervention in Sub-saharan Africa

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ABSTRACT

Background: Hearing loss in children and adults is common and Countries in sub-Saharan Africa experience a myriad of challenges such as identifying causes of diseases, underusage of hearing aids and other enhanced hearing technologies. In Africa, lack of sufficient data can negatively impact on policies and practices of ear and hearing care, especially considering the dynamics in different countries, study findings obtained will be instrumental in addressing some of these gaps. This is a systemic review study aimed at reviewing published articles on common causes of hearing impairment from different countries and interventional measure on hearing aid usages in sub-Saharan Africa.

Design and method: Initially, 470 identified articles published between 2010 and 2023 were identified through electronic databases searches in PubMed. After the removal of duplicates, titles and abstracts, 144 studies were screened, of which 166 records were excluded. A total of 30 articles judged were eligible and included in the review. The articles that met the inclusion criteria were from the following sub-Saharan countries: South Africa, Nigeria, Uganda, Niger, Kenya, Malawi, Tanzania, Sierra Leone, Cameroon, Portugal and Zimbabwe. Review analysis major theme comprised causes of hearing impairment.

Findings: This study identified a widespread cause of hearing loss where age related hearing loss was leading at 75%. Ototoxicity induced hearing loss due to aminoglycosides and anti-tuberculosis comprised 63% and 60 % respectively. Noise induced hearing loss comprised 58.5%. Infections caused by various pathogens as reported in most of the journals where measles comprised 45.8%, bacterial meningitis at 44.4 %, diabetes mellitus 52%, otitis media 45.5%, HIV Infection 24%, Ebola 23% and Lassa fever 33.2%. Another important factor was wax impaction that contributed 45%. Hearing loss management with hearing device and its uptake was unsatisfactory.

Conclusion: The review provides evidence that indicate Infections are the leading causes of hearing loss in most sub-Saharan Africa countries, with medication, impacted wax and age-related disorder being other causes. Awareness of treatment strategies including hearings device options is lacking. This study will be instrumental in assist hearing care professionals on counseling of families and predicting prognosis of disease by early identification of hearing loss and understanding its etiology.

Keywords: *Audiology, hearing loss, hearing aid, Africa, ENT*

INTRODUCTION

Hearing impairment amongst subjects in sub-Saharan Africa is detrimental on quality of life and social economic concerns. It is a major public health concern worldwide due to its impact on communication and language development, especially if the onset is at an early age. Improving knowledge of causes of hearing impairments for the population that are at risk of developing hearing loss is an important step for hearing care providers and policy makers in designing targeted services and interventions, especially in sub-Saharan Africa. The main focus in most developed countries is preventing the major causes of hearing loss cases and reducing the burden associated with hearing loss. However, hearing loss that cannot be prevented can be managed satisfactorily with hearing aid amplification and aural rehabilitation. The majority of sensorineural hearing loss ranging from mild to severe impairments benefit with interventions such as hearing aids. Countries in sub-Saharan Africa, where Kenya falls experience a myriad of challenges from human resources, availability, access and, most importantly, cost implication associated with diagnosis, purchase and maintenance of hearing devices. According to the [World Health Organization](#) (WHO, 2023), 60% of all hearing loss in children in developing countries is due to lack of preventive measures. Globally, the WHO estimates above 430 million people with disabling hearing loss require rehabilitation, with nearly 80% living mostly in low- and middle-income countries (WHO, 2023). In Sub-Saharan areas, the prevalence of hearing impairments among children has been estimated to be around 8.6%.

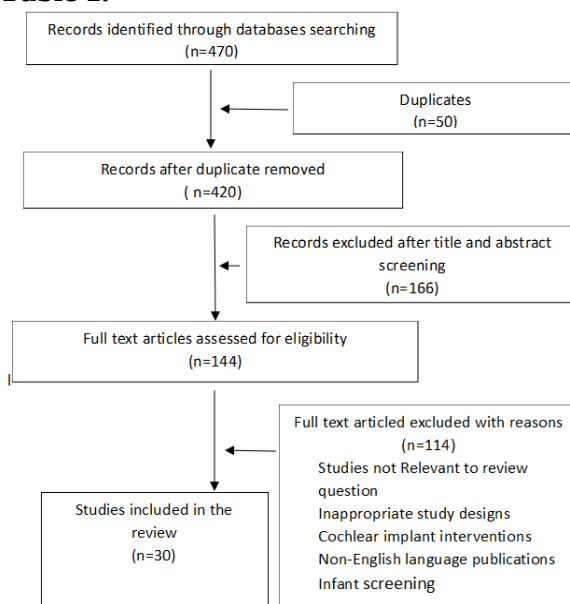
Hearing loss in children has a consequential impact on speech language, education, and interactive social functioning skills (Lieu et al., 2020). To attain universal ear and hearing care in low- and mid-income countries in sub-Saharan Africa where health financing, accessibility and availability of hearing services are key challenges. The objective of this study is to determine common causes of hearing loss in sub-Saharan Africa, establish treatment intervention of the hearing aid device usage in sub-Saharan Africa.

A systematic search of studies was performed about common causes of hearing loss, and hearing aid usage in sub-Saharan Africa. The search included literature until May 2023. The focus was centered on the questions stated in the objectives of this study. Source of the data was based on the search of relevant data in literature from April 2013 until May 2023, and the following databases were examined: [PubMed](#), [ResearchGate](#). Search of relevant literature was based on the following keywords: hearing impairment, hearing aids, Sub-Saharan Africa. Data extraction included systematic reviews, clinical based and school-based meta-analyses. Studies reviewed would examine relevant data from developing sub-Saharan countries addressing common causes of hearing loss and hearing aid usage. The study excluded inappropriate study designs, cochlear interventions, non-English language publications and non-relevant studies to review. Selection criteria included the date of literature published (2013 to May 2023) of all age groups and all gender with hearing loss and /or uses hearing aids.

RESULTS

A total number of 196 related articles were retrieved for adult hearing loss in Africa, 144 articles were obtained for causes of hearing loss in sub-Saharan Africa, after applying selection criteria for causes of hearing loss in sub-Saharan Africa a total of 24 articles were retrieved. A total of 17 were retrieved for hearing aid devices in sub-Saharan Africa, after applying selection criteria, 6 literature reviews were available for review.

Table 1.



Hearing device usage in sub-Saharan Africa

A total of 17 titles were retrieved with only 6 available for review. Sensorineural hearing loss contributed to the majority of indication for amplification with relatively satisfactory improved outcomes with usage.

Table 2. Summary of usage of hearing aids

Author	Country	Population age	Type of hearing loss	Number of cases	Outcome
Kuschke et al.(2022)	South Africa	0-13 years	SNHL	68	Improved daily outcome
Silva et al. (2023)	South Africa	All age group	Conductive hearing loss	133	Improved outcome
Moroe et al. (2019)	South Africa	71-84 years	SNHL		Multifactorial causes of disuse
Amina et al. (2021)	Uganda	Newborns	SNHL, CHL, Mixed	344	High susceptibility of hearing aid as an intervention
Vera et al. (2019)	South Africa	All age group	SNHL	584	Need for hearing aid far exceed supply
Taiwo et al. (2015)	Nigeria	1-15 years	SNHL	10	Unsatisfactory outcome with hearing aid management

CAUSES OF HEARING LOSS IN SUB-SAHARAN AFRICA

In establishing causes of hearing loss in sub-Saharan Africa Filters were applied in Abstract, Free full text and Full text where 24 Results of 144 were retrieved.

Table 3. Summary of causes of hearing loss

AUTHOR	COUNT RY OF ORIGIN	CAUSE	PREV ALEN CE
Wonkam et al. (2020)	Cameroon	ENVIRONMENTAL FACTORS MENINGITIS, IMPACTED WAX AGE-RELATED DISORDER HEREDITARY	Unkno wn
Pedersen et al.(2022)	Zimbabwe	OTITIS MEDIA	40%
Hong et al. (2020)	South Africa	DR TB	60%
Ude et al. (2022)	Niger	HIV	28.5%
Caroça et al. (2017)	Portugal	RUBELLA	64.1%
Olajuyin et al. (2021)	Nigeria	MEASLES	45.8%
		OTOTOXIC MEDICATION	32.2%
Ficenec et al. (2022)	Sierra Leone	EBOLA	23%
Chadambuka et al. (2013)	Zimbabwe	NOISE INDUCED	37%
Hong et al. (2020)	South Africa	AMINOGLYCOSIDE INDUCED	63%
Karanja et al. (2014)	Kenya	BACTERIAL MENINGITIS	44.4%
Abraham et al. (2019)	Tanzania	NOISE INDUCED HEARING LOSS	58.5%
Mateer et al. (2018)	West Africa	LASSA FEVER	33.2%
Pillay et al. (2021)	South Africa	DIABETIS MELLITUS	52%
Hrapcak et al. (2016)	Malawi	HIV INFECTION	24%
Folorunso et al. (2020)	Nigeria	AGE RELATED	75%
Musa et al. (2015)	Nigeria	OTITIS EXTERNA	1%
Iselin et al. (2019)	Tanzania	CERUMEN IMPACTION	45.5%
		OTITIS (ALL TYPES)	45.5%
		TYMPANIC PERFORATION	27.3%
		NO ABNORMALITIES	
Simões et al. (2016)	Kenya	OTITIS MEDIA	3.7%
Bamaraki et al. (2022)	Uganda	OME	11%
Jusot et al. (2013)	Niger	BACTERIAL MENINGITIS	30%
		N. meningitidis	87.3%
		S. pneumoniae.	11.5%
Appana et al. (2016)	Kwazulu Natal	ANTI TB DRUGS OTOTOXICITY	52%

Disease pattern

The study identified the following key areas of causes of hearing loss

Infections

Table 4. Pattern of disease-causing hearing loss

Infections	Rubella Drug resistance tuberculosis HIV Measles Otitis media Diabetes Ebola Meningitis Lassa fever
Medications	Ototoxic medications Anti tuberculosis
Others	Wax impaction Age related Idiopathic

DISCUSSION

The literature sets different criteria for what is considered “normal hearing”. The WHO defines normal hearing when the Pure-Tone-Average (PTA) is smaller than 25 dB HL (WHO, 2023). In Cape Town South Africa, the following factors were found to be associated with hearing impairment: male gender, age, hypertension, a history of head and neck trauma and a family history of hearing impairment (Ramma et al., 2016).

Permanent or irreversible sensorineural hearing loss associated with conditions such as Noise Induced Hearing Loss (NIHL) in a study by Kitcher et al. (2014) amongst market millers in the city of Accra, Ghana, there was significant sensorineural hearing loss and the presence of a 4 kHz audiometric notch among mill workers. The prevalence

of hearing loss, which may be characteristic of NIHL in the better hearing ears of the mill workers was 24.8%. In another comparative cross-sectional study in Ghana by Kitcher et al. (2012), where the prevalence rate of NIHL among stone crushing workers is about 19.3% for the left ear and 14.3% for the right ear. The noise level was much higher as reported in a study in Tanzania by Nyarubeli et al. (2019). On steel workers who were exposed to average noise level of up to 92 dB(A), Minja et al. (2003) found exposure to noise of above 85dB(A) that can cause hearing loss. Age and race were the most important influencing factors determining susceptibility to NIHL according to Strauss et al. (2014) comparatively the prevalence was higher in chili pepper grinders in Lagos, Southwest Nigeria, where 62.5% were confirmed with slight-to-moderate NIHL (Olusanya et al., 2012).

The prevalence of hearing loss at a rural province of Zimbabwe constituted conductive hearing loss at 95.1% and sensorineural hearing loss at 4.9%. Otitis media was the underlying cause in 40% of all cases of hearing loss (Pedersen et al., 2022). In Mozambique, which is a developing African country, Clark (2008) found that external auditory canal obstruction was the greatest otoscopic abnormality (regardless of age), followed by severely limited tympanic membrane mobility. The majority of cases in North-West Cameroon have well known causes that are treatable, with impacted wax playing a major role with 37% conductive causes, while sensorineural causes were less common at 26% (Ferrite et al., 2017). Determinants of hearing loss severity would enable better management especially if the cause is due to Tympanic membrane. The size of perforation was a predictor of hearing

loss severity as found in a study by Choffor-Nchinda et al. (2018). In a retrospective study by Kuschke (2020) in South African, Western Cape Province, the majority of participants presented with conductive hearing loss (64.6%), followed by sensorineural (28.7%) and mixed hearing loss (3.3%) or auditory neuropathy spectrum disorder (3.3%). The most prominent risk factor for conductive hearing loss was otitis media, for sensorineural hearing loss it was a family history of childhood hearing loss, and for auditory neuropathy spectrum disorder it was hyperbilirubinemia supporting other literature supporting causes of conductive hearing loss. In 2007, a study done by Abdel-Hamid et al. (2007) in Egypt showed that the commonest cause of hearing loss was Otitis media with effusion (30.8%), followed by presbycusis (22.7%). In a study done by Olusesi (2008) in Nigeria, 57.1% had OME, 33.8% had CSOM, and 9.1% had AOM Otitis media. This is an important cause of preventable hearing loss in developing countries and in most studies the findings are relatively similar.

In a study by Smith (2017) for HIV + children in Addis Ababa, Ethiopia. Hearing was significantly worse in HIV + children. Chronic OM, conductive and mixed hearing losses are significantly more common in HAART-treated HIV + children as well. In the HIV + cohort, 17.8% had evidence of TM perforations and 8.4% had otorrhea Olusanya et al. (2009) established a positive predictive value of 25.0% for identifying SNHL among infants with severe Neonatal jaundice in Lagos, Nigeria where 14 (6.0%) of the 234 infants with Neonatal jaundice (2.1%) were confirmed to have SNHL. To prevent or detect the onset of hearing loss amongst patients using Amikacin in the long-term MDR-TB treatment it was

established that it led to a higher risk of occurrence of severe forms of hearing loss compared to kanamycin use with a cumulative incidence of 58% with any form of hearing loss (Sagwa et al., 2015).

In Malawi, hearing aid coverage was <1% due to lack of perceived need (Bright et al., 2020). The need for hearing aids to provide hearing rehabilitation far exceeds the supply as established by Hlayisi et al. (2019) suggesting a multi-pronged approach that includes increased budget allocation and exploring low-cost interventions for developing countries to meet the demand for hearing aids.

In Africa, meningitis has been zoned in a region known as “meningitis belt”. The Belt countries affected by meningitis outbreaks includes countries such as Nigeria, Niger, Burkina Faso, and Chad. Meningitis is an inflammation of the meninges caused by bacterial, viral, or, less commonly, fungal infections. Meningitis is a significant cause of hearing loss in Africa. Bacterial meningitis, especially caused by *Neisseria meningitidis* and *Streptococcus pneumoniae*, is responsible for most cases of meningitis-related hearing loss. Bacterial meningitis outbreaks are often associated with the serogroup A strain of *Neisseria meningitidis*. The infection spreads through respiratory droplets, particularly in crowded settings like schools, dormitories, or refugee camps. In Niger, subjects exposed to acute bacterial meningitis were reported to have hearing loss that significantly disabled 31.3% of the exposed subjects and 10.4% exhibited a serious deafness (Jusot et al., 2013).

Hearing loss resulting from meningitis occurs via two main factors. Direct cochlear damage as a result of the infection can directly invade the cochlea part of one or

both sides resulting in inflammation and damage to this delicate structures. Secondly, ototoxicity from treatment of meningitis particularly certain antibiotics and antifungal agents, can have ototoxic effects especially if administered at high doses or for prolonged periods of time. Prevention and control measures are crucial in reducing the burden of meningitis-related hearing loss. Strategies such as routine vaccination campaigns with meningococcal vaccines and pneumococcal vaccines, early diagnosis, and appropriate treatment of meningitis cases are essential. Additionally, raising awareness about the signs and symptoms of meningitis, promoting good hygiene practices, and ensuring prompt medical care can contribute to better outcomes and minimize hearing loss associated with this devastating infection.

Prevention and control measures are crucial in reducing the burden of rubella. In Africa, only a few countries routinely immunize against rubella. Rubella, which is a viral infection caused by the rubella virus and which during pregnancy can result in congenital rubella syndrome in the developing fetus, leading to hearing loss that can range from mild to profound that can either be sensorineural, conductive, or mixed in nature. A study by Caroça et al. (2017) established 62.6% who had sensory neural hearing loss were positive for the rubella IgG although did not establish a cause-effect relationship between rubella infection and SNHL. Rubella infection has become relatively rare in many countries due to widespread vaccination programs.

Measles is a highly contagious viral infection that primarily affects the respiratory system, it can also have various complications, including hearing loss. The measles, mumps, and rubella (MMR) vaccine is routinely

administered to children and provides immunity against measles however some countries in Africa still exhibit outbreak of measles that leads to complications such as hearing loss for instance in Angola the commonest cause of hearing impairment was measles (63.3%) (Seguya et al., 2021).

Ototoxicity can occur anywhere in the world with specific prevalence and factors contributing to ototoxicity vary across different regions and populations. Ototoxicity remains prevalent in the developing countries of Africa. Numerous drugs are responsible for drug induced ototoxicity in the study by Kokong et al. (2014). The most common agents established were chloramphenicol at 16.0%, chloroquine 14.1%, and gentamicin 12.8%, where those affected with profound sensorineural hearing loss were 49.7%. Mixed hearing loss was seen in 28.8%. Although there no direct studies related to cisplatin induced hearing loss, the use of higher cumulative cisplatin dosages was associated with development of significant hearing loss (Whitehorn et al., 2014). As audiologist it will be prudent to create awareness and apply appropriate monitoring protocols among healthcare providers, patients, and the general population about the potential risks associated with ototoxic medications.

Africa carries a high burden of tuberculosis in general, including drug-susceptible TB. Treating MDR-TB is complex and requires the use of second-line drugs, which have more side effects including hearing loss. Patients with MDR-TB may already have compromised health due to the underlying TB infection. Preexisting factors, such as malnutrition, immune compromise, or coexisting conditions like HIV infection can

further increase the risk and severity of hearing loss. A meta-analysis of articles published in PubMed entailed eight studies of South Africa, Botswana and Namibia and published between 2012 and 2016 showed individuals with MDR-TB and HIV coinfection had a 22% higher risk of developing AG-induced hearing loss than non-HIV-infected individuals (Hong, 2018).

Sickle cell anemia has been associated with incidences of hearing loss mostly of the sensorineural type. Sensorineural hearing loss of 30 dB and above was demonstrated in 40% of sickle cell anemia patients in Kenya (Atsina et al., 1988). Comparatively to a lesser prevalence in Ghana, of about 29% of the Sickle cell patients studied showed hearing losses ranging from 30 to 60 dB in the high frequency range of 4 to 8 kHz (Tsibulevskaya et al., 1996).

The majority of elderly patients complaining of hearing impairment were patients aged 90 years and older. In Egypt, the prevalence was of 78.6% (El Kady, 2012), which is in concurrence with worldwide studies reporting that presbycusis is a common cause of hearing loss in adults. Age Related Hearing Loss from age 55 years and above at Gwagwalada Area Council, of FCT, Abuja was of 75.0% (Folorunso et al., 2020).

In summary, most causes of hearing loss in developing countries are preventable and the most common cause of conductive hearing loss recorded in this study was otitis followed by wax impaction. Other causes include ototoxic medication, age related hearing loss, noise induced hearing loss and infections with rubella, measles, bacterial meningitis.

CONCLUSION

There has been an increase in the usage of hearing devices as a result hearing loss in sub-Saharan Africa in the recent past. This review has summoned studies that indicate the main causes of hearing loss in sub-Saharan Africa and the need for hearing aids. Infections, and medications especially related to ototoxicity, age related and wax impactions have been cited in most literatures as causes of hearing loss. This calls for a common approach for African countries to synchronize available data on common causes of hearing loss from these countries so as to formulate policies and practices that could mitigate the impact. Hearing aid indications were commonly due to sensorineural hearing loss with varied outcomes and practices from country to country.

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