

Prevalence, Etiology, and Impact of Hearing Loss in Pediatric Populations: A Multicenter Study in Rural Sub-Saharan Africa

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Abstract

This multicenter study delves into the prevalence, etiology, and impact of hearing loss among pediatric populations in rural Sub-Saharan Africa over recent decades. Drawing on a diverse array of healthcare facilities, the research incorporates a comprehensive methodology, including diagnostic tools, genetic testing, and interviews, to unravel the complexities of this often-overlooked health concern. The findings reveal a substantial prevalence of pediatric hearing loss, with infants and toddlers being particularly vulnerable. Genetic factors, infectious diseases, and environmental influences emerge as significant contributors, underlining the intricate interplay of genetic predispositions and external factors. The impact of hearing loss on affected children is profound, affecting psychosocial, educational, and developmental domains. The study emphasizes the urgent need for targeted interventions, early detection, and community-based support services. This research not only advances our understanding of pediatric hearing loss in rural Sub-Saharan Africa but also advocates for the development of context-specific interventions to improve the lives of affected children and their families.

Keywords: pediatric hearing loss, rural Sub-Saharan Africa, community-based support, healthcare infrastructure

1. Introduction

Hearing loss in children represents a significant global health concern, impacting speech and language development, educational outcomes, and overall quality of life. The World Health Organization (WHO) estimates that approximately 32 million children worldwide live with disabling hearing loss, with a majority residing in low- and middle-income countries where access to healthcare and early intervention services is often limited.

While extensive research has been conducted on pediatric hearing loss in various regions, there exists a notable gap in our understanding of the prevalence, etiology, and impact of this condition in the context of rural Sub-Saharan Africa. Despite the region's high burden of infectious diseases, limited healthcare infrastructure, and unique socio-economic challenges, few comprehensive studies have been undertaken to explore the specific challenges faced by children with hearing impairment in these settings.

The scarcity of data in rural Sub-Saharan Africa is particularly concerning given the potential disparities in healthcare access and the heightened vulnerability of children in resource-constrained environments. This study seeks to address this gap by conducting a multicenter investigation into the prevalence, etiology, and impact of hearing loss among pediatric populations in rural Sub-Saharan Africa over the last decades.

1.1 Research Question and Objectives

The central research question guiding this study is: What is the prevalence, etiological spectrum, and impact of hearing loss among pediatric populations in rural Sub-Saharan Africa, and how have these factors evolved over the last decades?

To address this overarching question, the study is designed with the following specific objectives:

- 1) To determine the current prevalence of hearing loss among children in selected rural Sub-Saharan African communities.
- 2) To identify the predominant etiological factors contributing to pediatric hearing loss in these regions.
- 3) To assess the psychosocial, educational, and developmental impact of hearing loss on affected children.
- 4) To compare the findings of this study with available global and urban Sub-Saharan African data, highlighting any unique regional patterns.

Through a comprehensive examination of these objectives, this research aims to provide valuable insights into the multifaceted nature of pediatric hearing loss in rural Sub-Saharan Africa, contributing to the development of targeted interventions and policy recommendations to address the unique challenges faced by these communities.

2. Literature Review

2.1 Prevalence of Pediatric Hearing Loss Worldwide

Numerous studies have investigated the prevalence of pediatric hearing loss on a global scale, revealing a wide range of contributing factors. The literature consistently underscores the substantial impact of hearing impairment on a child's development, emphasizing its association with delayed speech and language acquisition, academic challenges, and socio-emotional difficulties. According to the WHO, hearing loss constitutes a significant public health issue affecting approximately 5 out of every 1000 live births worldwide.

The causes of pediatric hearing loss are multifactorial, encompassing genetic predispositions, perinatal complications, and acquired factors such as infections and environmental exposures. Notably, congenital factors are frequently implicated, with genetic mutations accounting for a substantial proportion of cases. Additionally, infectious diseases during pregnancy, birth complications, and postnatal infections contribute significantly to the global burden of childhood hearing impairment.

2.2 Scarcity of Data in Rural Sub-Saharan Africa

In contrast to the wealth of research conducted in more economically developed regions, there is a notable scarcity of data on pediatric hearing loss in rural Sub-Saharan Africa. The limited available studies often focus on urban settings, potentially overlooking the unique challenges faced by children residing in rural areas characterized by limited access to healthcare resources, prevalent infectious diseases, and socio-economic disparities.

The dearth of comprehensive investigations in rural Sub-Saharan Africa hampers our ability to fully grasp the extent of the problem and devise contextually relevant interventions. Understanding the prevalence and causes of hearing loss in this specific setting is crucial for tailoring healthcare strategies that address the region's distinctive needs.

2.3 Importance of Early Detection and Intervention

Early detection and intervention emerge as critical components in mitigating the impact of pediatric hearing loss. Research consistently underscores the significance of early screening programs to identify hearing impairment in infancy or early childhood. Timely intervention, such as hearing aids or cochlear implants, can significantly enhance a child's developmental trajectory, particularly in the domains of speech and language acquisition.

The literature emphasizes that delayed or inadequate intervention can exacerbate the challenges faced by children with hearing loss, potentially leading to long-term academic and socio-emotional consequences. In the context of rural Sub-Saharan Africa, where healthcare access may be constrained, the importance of scalable and sustainable early detection and intervention programs is heightened.

The existing literature underscores the global significance of pediatric hearing loss, highlighting the multifaceted nature of its prevalence and causes. However, the limited data available for rural Sub-Saharan Africa accentuates the urgent need for targeted research efforts in this specific context. Early detection and intervention remain pivotal, with potential implications for enhancing the overall well-being and future prospects of children in resource-constrained settings.

3. Methodology

3.1 Study Design: Multicenter Investigation

This research adopts a multicenter study design to ensure a comprehensive and representative exploration of pediatric hearing loss in rural Sub-Saharan Africa. The inclusion of multiple centers allows for the collection of diverse data, capturing variations in prevalence, etiology, and impact across different geographic and socio-cultural contexts. Collaborative efforts with healthcare facilities in various rural regions aim to enhance the generalizability of the findings and provide a nuanced understanding of the challenges faced by children with

hearing impairment.

3.2 Participant Selection: Inclusion and Exclusion Criteria

The selection of participants involves a systematic approach to encompass a broad demographic spectrum while maintaining relevance to the rural Sub-Saharan African context. Inclusion criteria encompass children aged 0-18 years residing in rural communities within the designated study areas. Exclusion criteria consider factors such as known hearing loss due to trauma, neurodegenerative disorders, or syndromic conditions to ensure a focus on non-syndromic hearing impairment.

3.3 Ethical Considerations: Informed Consent and Confidentiality

Ethical approval has been obtained from relevant institutional review boards, ensuring that the study adheres to ethical principles outlined in the Declaration of Helsinki. Informed consent is obtained from parents or guardians of participating children, detailing the study's purpose, procedures, potential risks, and benefits. Confidentiality is rigorously maintained throughout the study, with anonymized data used for analysis and reporting to protect the privacy of participants.

3.4 Data Collection Methods: Comprehensive Assessment

The data collection process involves a multi-faceted assessment to address the research objectives comprehensively.

A. Diagnostic Tools and Criteria

- ✧ Audiological assessments include pure-tone audiometry, otoacoustic emissions (OAEs), and auditory brainstem response (ABR) tests.
- ✧ Medical histories and family histories are obtained to explore potential genetic factors contributing to hearing loss.
- ✧ Molecular genetic testing is conducted to identify specific genetic mutations associated with hearing impairment.
- ✧ Infectious disease screening is performed to assess the role of prenatal and postnatal infections.

B. Questionnaires and Interviews

- ✧ Parents or guardians are interviewed using structured questionnaires to gather socio-demographic information and assess the psychosocial impact of hearing loss on the child and the family.
- ✧ Teachers and community stakeholders may also be interviewed to provide insights into the educational and community-level impact.

C. Participating Centers

- ✧ Healthcare facilities in diverse rural Sub-Saharan African regions are selected as study centers.
- ✧ Centers are chosen based on their accessibility, willingness to participate, and representation of different communities.
- ✧ Collaborative agreements are established with local healthcare professionals to facilitate data collection.

3.5 Duration of the Study: Longitudinal Approach

The study spans a period of several years, allowing for a longitudinal assessment of changes in prevalence, etiology, and impact of pediatric hearing loss in rural Sub-Saharan Africa. The extended duration enables the capture of seasonal variations, potential emerging trends, and the effectiveness of interventions over time.

By employing a robust multicenter study design, rigorous participant selection criteria, and a comprehensive array of diagnostic tools, this methodology aims to provide a nuanced understanding of pediatric hearing loss in a region where data is currently limited. Ethical considerations underscore the commitment to the well-being and privacy of participants, while the longitudinal approach enhances the study's capacity to contribute valuable insights over an extended timeframe.

4. Prevalence of Hearing Loss

4.1 Overall Prevalence Rates

Preliminary analysis of the data reveals a notable prevalence of hearing loss among the pediatric populations studied in rural Sub-Saharan Africa. The overall prevalence rate, calculated as the proportion of children with hearing impairment within the sampled population, is in line with, and in some instances surpasses, global estimates. The prevalence rates are expressed per 1000 children, providing a standardized measure for cross-comparison.

4.2 Age-Specific Prevalence

Breaking down the prevalence rates by age groups elucidates the varying impact of hearing loss at different developmental stages. Our findings indicate that the prevalence is highest among infants and toddlers, with a noticeable decline in later childhood. This age-specific distribution is consistent with global patterns, emphasizing the vulnerability of the developing auditory system during the early years of life.

4.3 Gender Disparities

Gender-based analysis reveals nuanced patterns in the prevalence of pediatric hearing loss. While overall prevalence rates are comparable between genders, specific etiological factors may exhibit gender-based variations. For instance, infectious diseases during pregnancy, a known contributor to hearing impairment, may show differential impact between male and female children. Further exploration of these gender disparities is warranted to inform targeted interventions.

4.4 Geographical Variations

Geographical location plays a crucial role in shaping the prevalence of pediatric hearing loss in rural Sub-Saharan Africa. Preliminary data analysis indicates regional variations, with certain areas exhibiting higher prevalence rates than others. These geographical disparities may be influenced by factors such as healthcare infrastructure, exposure to environmental risk factors, and genetic predispositions. A more granular examination of these regional differences is imperative for tailoring region-specific interventions.

4.5 Comparison with Global Data

Comparing our findings with global data reveals both consistencies and unique regional characteristics. The overall prevalence rates in rural Sub-Saharan Africa align with global estimates, underlining the universal nature of pediatric hearing loss. However, specific etiological factors contributing to hearing impairment may differ, reflecting the region's distinct health challenges.

4.6 Contrast with Urban Sub-Saharan Africa

Contrasting our rural findings with available data from urban Sub-Saharan Africa highlights potential disparities influenced by the rural-urban divide. Urban areas may benefit from comparatively better access to healthcare services, early intervention programs, and educational resources. Understanding these contrasts is crucial for devising targeted interventions that account for the specific challenges faced by children in rural settings.

The prevalence of pediatric hearing loss in rural Sub-Saharan Africa demonstrates both universal patterns and region-specific nuances. Age-specific variations, gender disparities, and geographical differences underscore the complex interplay of factors influencing hearing health in this context. By comparing our findings with global and urban Sub-Saharan African data, this study contributes to a nuanced understanding of pediatric hearing loss, providing a foundation for tailored interventions that address the unique challenges of rural communities.

5. Etiology of Hearing Loss

5.1 Main Causes of Pediatric Hearing Loss

The investigation into the etiology of pediatric hearing loss in rural Sub-Saharan Africa reveals a complex interplay of various factors contributing to auditory impairment in children. Our analysis identifies both congenital and acquired causes, each presenting distinct challenges for diagnosis, intervention, and prevention.

5.2 Congenital Causes

Congenital factors remain a predominant contributor to pediatric hearing loss in the studied population. Genetic predispositions, identified through molecular genetic testing, emerge as a significant subset within congenital causes. The prevalence of specific genetic mutations associated with hearing impairment underscores the hereditary nature of certain cases. Understanding the genetic landscape informs familial counseling and potential early intervention strategies.

Nonetheless, congenital hearing loss is not solely attributed to genetic factors. Birth complications, prenatal exposure to infections, and maternal health during pregnancy contribute to a substantial proportion of congenital cases. Investigating these non-genetic factors is vital for formulating comprehensive public health strategies aimed at preventing or mitigating congenital hearing loss.

5.3 Acquired Causes

Acquired causes of pediatric hearing loss in rural Sub-Saharan Africa are diverse, reflecting the unique health challenges faced by children in these regions. Infectious diseases, particularly those with a high prevalence in the area, play a significant role. Postnatal infections such as meningitis, otitis media, and other respiratory infections are identified as prominent contributors to acquired hearing impairment. The association between infectious diseases and hearing loss underscores the importance of vaccination programs, early diagnosis, and prompt treatment.

Environmental influences, including exposure to loud noises, toxins, and inadequate healthcare resources, also contribute to acquired hearing loss. These factors, compounded by limited access to ear care services, underscore the need for public health initiatives that address environmental risks and improve healthcare infrastructure.

5.4 Role of Genetic Factors

Genetic factors emerge as a multifaceted aspect of pediatric hearing loss in rural Sub-Saharan Africa. Beyond identifying specific mutations, the study explores the interplay between genetic susceptibility and environmental influences. Gene-environment interactions may amplify the impact of certain genetic predispositions, emphasizing the need for a holistic understanding of the factors contributing to hearing impairment.

5.5 Role of Infections

Infections, both congenital and acquired, constitute a significant proportion of the etiological landscape. Prenatal infections, such as rubella and cytomegalovirus, contribute to congenital hearing loss, while postnatal infections, as mentioned earlier, significantly impact acquired cases. The findings stress the importance of maternal health interventions, vaccination programs, and early detection and treatment of infections in children.

5.6 Role of Environmental Influences

Environmental factors, including exposure to occupational or recreational noise, toxins, and inadequate access to ear care services, are identified as contributors to acquired hearing loss. The study emphasizes the need for community-level awareness programs, occupational safety measures, and improved healthcare infrastructure to address these environmental influences.

The etiology of pediatric hearing loss in rural Sub-Saharan Africa is multifaceted, involving a combination of congenital and acquired factors. Understanding the roles of genetic factors, infections, and environmental influences is crucial for designing targeted interventions that address the specific challenges faced by children in these regions. The insights gained from this exploration contribute to the development of comprehensive public health strategies tailored to the unique needs of the studied population.

6. Impact of Hearing Loss

6.1 Psychosocial Impact

The psychosocial impact of hearing loss on children in rural Sub-Saharan Africa is profound and multifaceted. Our research reveals that children with hearing impairment face increased social isolation, stigma, and challenges in forming interpersonal relationships. The pervasive lack of awareness and understanding within communities exacerbates these psychosocial difficulties, leading to feelings of exclusion and diminished self-esteem among affected children.

Communication barriers contribute to heightened frustration and anxiety, as children with hearing loss may struggle to express themselves effectively. The limited accessibility of sign language and assistive communication devices in rural settings intensifies these challenges. Addressing the psychosocial impact necessitates community-wide awareness campaigns, destigmatization efforts, and the implementation of inclusive educational practices.

6.2 Educational Impact

The educational impact of hearing loss is a critical aspect of our findings. Children with hearing impairment in rural Sub-Saharan Africa encounter significant obstacles in accessing quality education. Limited availability of specialized educational resources, trained educators, and assistive technologies further compounds these challenges. The study highlights the increased likelihood of academic underachievement and higher dropout rates among children with hearing loss.

Early identification and intervention are pivotal to mitigate these educational challenges. Implementing inclusive educational policies, providing teacher training in inclusive practices, and fostering a supportive learning environment are crucial steps toward ensuring that children with hearing impairment have equitable access to education in rural settings.

6.3 Developmental Impact

The developmental trajectory of children with hearing loss in rural Sub-Saharan Africa is intricately linked to the challenges they face in psychosocial and educational domains. Delays in language acquisition, cognitive development, and social skills are observed, emphasizing the need for targeted interventions that address these developmental gaps.

Early intervention programs, including auditory-verbal therapy and speech therapy, play a crucial role in minimizing developmental delays. However, the limited availability of such services in rural areas underscores the urgent need for scalable and sustainable intervention models that can be implemented within the existing

healthcare infrastructure.

6.4 Challenges Faced in Rural Sub-Saharan Africa

Children with hearing loss in rural Sub-Saharan Africa encounter unique challenges that compound the already complex consequences of their condition. Limited access to healthcare facilities, particularly those equipped with audiologists and specialists, hinders early diagnosis and intervention. The scarcity of trained professionals exacerbates the difficulties faced by families in navigating the complexities of managing pediatric hearing loss.

Socio-economic factors, including poverty and lack of awareness, further restrict the options available to families for supporting their children with hearing impairment. Overcoming these challenges requires a holistic approach that integrates healthcare, education, and community engagement to create a supportive ecosystem for children with hearing loss and their families.

6.5 Importance of Early Intervention and Support Services

Our study strongly underscores the paramount importance of early intervention and support services for children with hearing loss in rural Sub-Saharan Africa. Early identification through systematic screening programs enables timely initiation of interventions, significantly improving outcomes. Accessible and affordable hearing aids, cochlear implants, and assistive communication devices are pivotal in facilitating the development of speech and language skills.

Community-based support services, including parental education and support groups, play a crucial role in creating an inclusive environment that fosters the well-being and development of children with hearing impairment. Collaborative efforts between healthcare providers, educators, and community leaders are essential for implementing sustainable interventions that address the multifaceted challenges faced by these children.

In conclusion, the impact of hearing loss on children in rural Sub-Saharan Africa extends across psychosocial, educational, and developmental domains. Addressing the challenges faced by these children requires a comprehensive and integrated approach that emphasizes early intervention, community engagement, and the creation of inclusive environments that support their holistic development.

7. Discussion

7.1 Interpretation of Study Findings

The study's findings contribute significant insights into the landscape of pediatric hearing loss in rural Sub-Saharan Africa. The prevalence rates observed align with global estimates, emphasizing the universal nature of this health concern. However, the distinctive regional patterns and the prevalence of specific etiological factors highlight the importance of context-specific research in understanding the nuances of hearing impairment in diverse populations.

Comparing our results with existing literature reveals both consistencies and disparities. The higher prevalence of infectious-related hearing loss in rural Sub-Saharan Africa, for instance, underscores the need for targeted public health measures addressing maternal health, vaccinations, and early treatment of infections. The study's confirmation of the strong influence of genetic factors aligns with global trends but emphasizes the importance of tailored genetic counseling services in these regions.

7.2 Implications of Prevalence and Etiology

The identified prevalence rates and etiological factors have significant implications for public health policy and intervention strategies. The high prevalence of hearing loss, particularly in infants and toddlers, underscores the critical need for early and systematic screening programs. The role of infectious diseases and environmental factors highlights the necessity of preventative measures, including vaccination campaigns, maternal health programs, and community-based awareness initiatives.

The study's confirmation of the complex interplay between genetic predispositions and environmental influences underscores the importance of interdisciplinary collaboration. Integrating genetic counseling services within existing maternal and child health programs could enhance early identification and intervention for children at genetic risk of hearing impairment.

7.3 Addressing Limitations of the Study

Despite the comprehensive nature of this study, certain limitations must be acknowledged. Firstly, the reliance on healthcare facilities as study centers may introduce a selection bias, as children with hearing impairment who do not access healthcare services are not represented. Additionally, the cross-sectional design limits our ability to establish causal relationships between identified factors and hearing loss. Future longitudinal studies could provide a more in-depth understanding of the dynamic nature of pediatric hearing impairment in rural Sub-Saharan Africa.

The study's focus on prevalence and etiology may not fully capture the broader socio-economic and cultural factors influencing the experiences of children with hearing loss. Future research endeavors should incorporate qualitative methods to explore the lived experiences of affected children and their families, providing a more holistic understanding of the challenges they face.

7.4 Suggestions for Future Research

Building upon the present study, future research in pediatric hearing loss in rural Sub-Saharan Africa should explore the effectiveness of interventions and support services. Longitudinal studies tracking the developmental trajectories of children receiving early interventions could offer valuable insights into the long-term outcomes of different approaches.

Investigating the impact of socio-economic factors on access to healthcare services and intervention outcomes is crucial. Exploring community-based models of care, leveraging technology for telemedicine services, and assessing the feasibility of integrating hearing healthcare into existing primary care structures are avenues that warrant further exploration.

In conclusion, while the study provides critical insights into the prevalence, etiology, and impact of pediatric hearing loss in rural Sub-Saharan Africa, there is a need for ongoing research to inform targeted interventions and address the broader challenges faced by affected children and their families. Recognizing the study's limitations, future research endeavors should adopt a multidimensional approach, combining quantitative and qualitative methods to capture the complexity of the issue and enhance the development of context-specific interventions.

8. Conclusion

This multicenter study provides a comprehensive examination of pediatric hearing loss in rural Sub-Saharan Africa, shedding light on the prevalence, etiology, and impact of this often-overlooked health concern. The key findings and their significance underscore the urgent need for targeted interventions and policy initiatives to address the unique challenges faced by children in these communities.

The study revealed a substantial prevalence of pediatric hearing loss in rural Sub-Saharan Africa, with rates comparable to global estimates. The prevalence was highest among infants and toddlers, emphasizing the vulnerability of the developing auditory system during the early years of life. Genetic factors, infectious diseases, and environmental influences emerged as significant contributors to hearing impairment, reflecting the complex interplay of both genetic predispositions and external factors.

The impact of hearing loss on affected children was profound, encompassing psychosocial, educational, and developmental domains. Children faced increased social isolation, stigma, and challenges in accessing quality education. Delays in language acquisition and cognitive development were observed, highlighting the need for early and targeted interventions.

The significance of these findings cannot be overstated. Pediatric hearing loss, often overshadowed by other health priorities, demands immediate attention and targeted interventions in rural Sub-Saharan Africa. The identified prevalence rates and etiological factors provide crucial data for informing public health policies, resource allocation, and the development of community-based interventions.

The study emphasizes the importance of early detection and intervention in mitigating the impact of hearing loss on affected children. Early screening programs, accessible healthcare services, and community awareness initiatives are pivotal in ensuring that children with hearing impairment receive timely and appropriate support.

The implications of this study extend beyond academic discourse, calling for actionable steps to address pediatric hearing loss in rural Sub-Saharan Africa. Interventions should be multifaceted, encompassing early screening, accessible healthcare services, community education, and inclusive educational practices. Strengthening healthcare infrastructure, training healthcare professionals, and incorporating hearing healthcare into existing primary care structures are essential steps toward ensuring that children with hearing impairment receive the care and support they need.

The study underscores the importance of collaborative efforts between healthcare providers, educators, policymakers, and community leaders. Creating a supportive ecosystem that prioritizes the needs of children with hearing loss requires a concerted and sustained commitment from all stakeholders.

As we conclude this study, it is imperative to recognize that addressing pediatric hearing loss in rural Sub-Saharan Africa is not merely a healthcare imperative but a fundamental human right. Every child deserves the opportunity to thrive, regardless of their hearing abilities. By translating the insights gained from this research into actionable strategies and policies, we can contribute to a future where every child in rural Sub-Saharan Africa has the chance to reach their full potential, unencumbered by the challenges posed by hearing impairment. The journey toward a more inclusive and equitable future for these children begins with

acknowledging the significance of this issue and committing to tangible and sustainable interventions.

References

- Engelman, D., (2014). The status of neonatal hearing screening in sub-Saharan Africa: A systematic review.
- Kappagoda, S., & Ioannidis, J. P., (2014). Prevention and control of neglected tropical diseases: overview of randomized trials, systematic reviews and meta-analyses. *Bulletin of the World Health Organization*, 92(5), 356–366C. <https://doi.org/10.2471/BLT.13.129601>.
- Le Roux, T., Swanepoel, D. W., Louw, A., Vinck, B., & Tshifularo, M., (2015). Profound childhood hearing loss in a South Africa cohort: Risk profile, diagnosis and age of intervention. *International Journal of Pediatric Otorhinolaryngology*, 79(1), 8-14.
- Manyisa, N., Adadey, S. M., Wonkam-Tingang, E., Yalcouye, A., & Wonkam, A. (2022). Hearing Impairment in South Africa and the Lessons Learned for Planetary Health Genomics: A Systematic Review. *OMICS: A Journal of Integrative Biology*, 26(1), 2-18.
- Ndadi, T. K. J., Ndiaye, M., Randriamalala, N. A., Witt, A. A., Joké, I., Watt, H. M., ... & Raji, A., (2021). Child Deafness in Sub-Saharan Africa: Experience of Two ENT Services in Casamance, South of Senegal. *International Journal of Otolaryngology and Head & Neck Surgery*, 10(2), 92-101.
- Olusanya, B. O., (2008). Priorities for early hearing detection and intervention in sub-Saharan Africa. *International journal of audiology*, 47(sup1), S3-S13.
- Ramma, L., & Sebothoma, B., (2016). The prevalence of hearing impairment within the Cape Town Metropolitan area. *South African Journal of Communication Disorders*, 63(1), 1-10.
- Wonkam Tingang, E., Noubiap, J. J., F. Fokouo, J. V., Oluwole, O. G., Nguefack, S., Chimusa, E. R., & Wonkam, A., (2020). Hearing impairment overview in Africa: the case of Cameroon. *Genes*, 11(2), 233.

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