

Prevalence of Hearing Loss in Primary School Children in Lusaka, Zambia

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ABSTRACT

Background: Disabling hearing loss has serious implications in a child's development as it reduces the intelligibility of speech thereby interfering with the learning process. This will negatively impact on their vocational choices.

Study objective: To determine the prevalence of hearing loss in primary school children in the central zone of Lusaka district, Zambia.

Methodology: 1277 children, aged 6 to 13 years, from public primary schools in the central zone of Lusaka district were randomly selected and examined. Clinical otologic assessment, tympanometry and audiometry screening were conducted on all participants. Children who failed the audiometry-screening test underwent a pure tone audiometry to determine the extent and nature of their hearing impairment.

Results: The prevalence of hearing impairment was 11.5% consisting of conductive hearing loss (87.8%), sensorineural hearing loss (6.8%) and mixed hearing loss (5.4%). Hearing impairment was more common in male children (13.8%) compared to female children (9.3%) (P value = < 0.05). Thirty six point eight percent children had ear disease. The commonest ear disease was wax impaction (66%) found in children followed by otitis media with

effusion (20%), foreign body ear (4%) and chronic suppurative otitis media (2%). The odds of developing hearing impairment in children with chronic suppurative otitis media was nine times greater than that of children without chronic suppurative otitis media OR = 9.9(95% CI, 2.33-47.43).

Conclusions: The prevalence of hearing impairment in school children in central zone of Lusaka district is high. This study shows that chronic suppurative otitis media has a statistical significant association with hearing loss and that the male children are at a higher risk of developing hearing impairment. There is urgent need for ear and hearing care awareness, and screening programs at the community level in the central zone of Lusaka district.

INTRODUCTION

Eighty percent (80%) of deaf people live in low and middle-income countries. The World Health Organization (WHO) estimates 5% of the world's population to have Disabling Hearing Loss (DHL) of which 32 (9%) million are children. DHL in children refers to hearing loss (HL) greater than 30dB in the better hearing ear. Sub-Saharan Africa records a 1.9% prevalence rate of DHL in children¹. Among congenital sensory birth defects, HL is the most common accounting for 4-6 per 1000 live births in the developing world². At some point in their first 10 years of life 95% of school children suffer from middle ear diseases, which will constitute a risk

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factor associated with hearing loss in the same age group^(3,4). Many types of Hearing impairment (HI) are preventable and/or reversible with appropriate intervention and treatment.

Hearing impairment if left undiagnosed can have devastating developmental results in children. Hearing is critical to speech development, communication, learning, school performance, social interaction, and vocational choices. The impacts of HL can be very costly on a country's economy. Income of individuals with HL in the low to middle income countries (LMICs) is estimated to be 40-45% less than the hearing population in developed countries⁶.

The negative impacts of HI in children can be mitigated through early diagnosis and proper management of HI through prevention and promotion, treatment and rehabilitation⁷. Public health interventions are an ideal and less costly approach of prevention of HI.

METHODOLOGY

This was a prospective, cross-sectional school based survey which was conducted on 1277 children aged 6 to 13 years from five primary schools in the central zone of Lusaka district between September and October 2015.

The study was conducted in five different primary schools namely Jacaranda, Mtendere, Kabulonga, Kalingalinga and Vera Chiluba primary schools. We recruited 344, 248, 78, 204 and 403 children respectively. Among the children screened for hearing impairment there was representation of pupils from grade 1 through to grade 7.

Sample size determination

The sample size was determined using Lwanga SK & Lameshow formula⁷ to estimate the proportion of population study size. Thus a sample size of 1277 pupils was taken to increase the representativeness of the sample, minimize sampling errors, increase generalizability of the results, and cater for attrition (10%).

Sampling method

Central zone has 10 co-education public basic schools. Five (50%) of these schools were randomly sampled using lottery method. Each school on an average has 7 classes per grade, and about 40-60 students per class. Seven classes in each school were purposively sampled and stratified according to gender. Proportionate samples of male and female students were systematically sampled from each level. Children between the ages 6 and 13 years old, with signed consent from parents/guardian and who were cooperative throughout the evaluation process were recruited.

Procedure

Once consent was obtained from parents of the pupils recruited the pupils were subjected to an otoscopic examination, tympanometry and audiometry tests after obtaining their biodata.

Data management

Data was analyzed using SPSS version 20.0. Descriptive analysis was done to determine means, frequencies and proportions of the various variables and findings were presented by means of graphs, tables and charts where appropriate. Chi-square test was used to assess any associations/relationships between outcomes and other variables. Confidence level was taken as 95% ($p < 0.05$) where applicable.

Ethical Consideration

Ethical approval from The University of Zambia Biomedical Research Ethics Committee in Lusaka, Zambia was obtained.

RESULTS

There were 640 (50.12%) male and 637 (49.9%) female pupils corresponding to a male to female ratio of approximately 1: 1.

The mean age of the children was 10.3 years ($SD \pm 1.97$) and ranged from 6 to 13 years. The age distribution of the participants is presented in Figure 1. The most frequent group was age 12-13 years, which accounted for 443 (34.7%) participants, whilst the least frequent group was ages 6-7 years recording a total of 126 (9.9%).

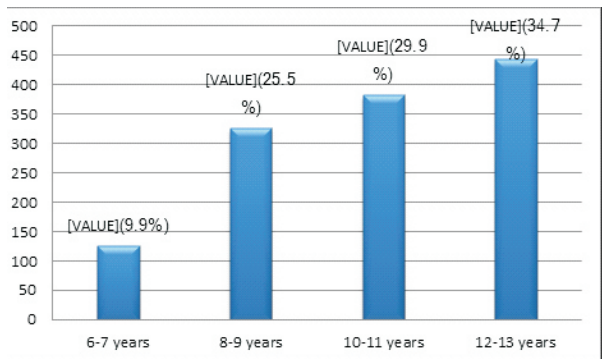


Figure 1: Age distribution of children (6-13 years) attending school in central zone, Lusaka district

The frequency distribution of ear diseases in the children is presented in Figure 2. There were 470(36.8%) children diagnosed with ear disorders , wax impaction being the most common. In this chart otitis externa represents both bacterial and fungal infections.

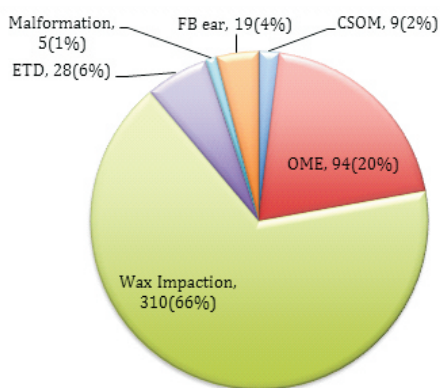


Figure 2: Distribution of ear diseases in primary school children in central zone, Lusaka district.

Hearing impairment (hearing of 30dB or more) occurred in 147 out of the 1277 school children corresponding to a prevalence of 11.5%. The proportion of children with unilateral hearing impairment was 77.6% (114/ 1277) whilst bilateral HI was present in 22.4% (33/1277).

Figure 3 presents severity of hearing impairment in school children. Most of the HI seen in the study was slight in severity. Out of all the 147 children with HI only 5 had severe HI and 1 had profound HI.

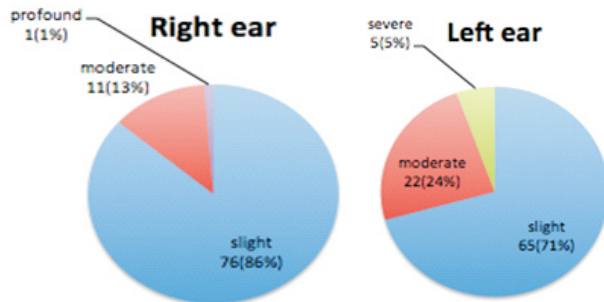


Figure 3: Severity of hearing impairment in school children in Lusaka

The most prevalent type of hearing impairment was CHL followed by SNHL and MHL respectively as shown in Table 1.

Type of HI	Frequency	Percentage
CHL	129	87.8
SNHL	10	6.8
MHL	8	5.4

Table 1: Shows the type of hearing impairment (n=147)

As shown in Table 2 hearing impairment was more common in the male children 13.8% compared to the female children 9.3%. The prevalence of hearing impairment showed a statistical significant association with the child's sex (p = 0.012).

Sex	Hearing Impairment		P
	Yes	No	
Male	88(13.8)	552(86.3)	0.012
Female	59(9.3)	578(90)	

Table 2: Hearing impairment and its association with child's sex

Tympanometric findings are summarized according to the classification recommended by Jerger⁹. Majority of children with impaired hearing had type A tympanograms. The most common tympanogram was type A seen in 2238 ears whilst the least common was type As seen in 10 ears. Types Ad, B and C graphs were recorded in 46 , 182 and 58 ears respectively.

Table 3 shows the associations between hearing impairment and ear diseases. Of all the ear diseases seen in the study only CSOM showed statistical significant association with hearing impairment. Children with CSOM were at higher risk of developing hearing impairment compared to those without CSOM (57.1 versus 11.3%), $P=0.002$. The odds of developing hearing impairment in children with CSOM was nine times greater than that of children without CSOM, $OR = 9.9(95\% CI, 2.33-47.43)$.

Ear disease	Hearing impairment		OR (95% CI)	P
	Yes	No		
Otitis externa				
	No	147(11.5)	1128(88.5)	NA
	Yes	0(0.0)	2(100.0)	NA
Wax impaction				
	No	109(11.3)	857(88.7)	1.00
	Yes	38(12.2)	273(87.8)	1.09(0.74-1.62)
Foreign body				
	No	145(11.5)	1114(88.5)	1.00
	Yes	2(11.1)	16(88.9)	0.96(0.22-4.22)
Fungi				
	No	147(11.5)	1127(88.5)	NA
	Yes	0(0.0)	3(100.0)	NA
ETD				
	No	145(11.6)	1103(88.4)	1.00
	Yes	2(6.9)	27(93.1)	0.56(0.13-2.39)
OME				
	No	133(11.2)	1050(88.8)	1.00
	Yes	14(14.9)	80(85.1)	1.38(0.76-2.51)
CSOM				
	No	142(11.8)	1126(88.2)	1.00
	Yes	5(55.6)	4(44.4)	9.9(2.63-37.34)

Table 3: Hearing impairment and its association with various ear diseases

DISCUSSION

Hearing in children is critical to speech development, communication and learning as it can have devastating developmental results in children. Amongst these consequences are poor vocational choices due to low academic achievements, challenges of social interaction with peers and the public at large. HI has been known to be a potential inhibitor of development. Screening of school children is a practical way of ensuring that children are evaluated for hearing capabilities and appropriate intervention instituted.

A total of 1277 children aged 6-13 years from 5 primary schools in the central zone of Lusaka district were recruited and examined in this study. The majority of the students examined (403) were from Vera Chiluba primary school reason being that the school had the highest number of children who had signed consent forms by their parents/guardians. The total number of boys examined was 640 (50.12%) whilst 637 (49.88%) girls were examined, bringing the gender ratio to almost 1:1. This is a true reflection of the gender ratio at the national level⁸ For our study we chose to include children from grade 1 to 7 from all the five schools. The most frequent age group was 12-13 years, which accounted for 443 (34.7%) participants. The least frequent age group was 6-7 years and this was because most children start attending school by age 8 years.

One hundred and forty seven children failed audiometry screening at 30dB giving a HI prevalence of 11.5%. This prevalence is lower than what was found in some sub-Saharan African countries such as Nigeria (13.9%)⁹ Rwanda (13.3%)¹⁰ but higher than Mozambique's prevalence rate (5%)¹¹. These varying prevalence rates could be as a consequence of different methodologies and definitions of HI used. High levels of background ambient noise (45-60 dB) in this study is the primary reason for using 30dB, rather than 25dB, as the lower threshold for defining hearing loss. According to the WHO's definition of DHL the prevalence rate of 11.5% found represents children with DHL. Prevalence rates of DHL in other countries were 5.6% and 7.3% in Kenya and Uganda respectively^(12,13). The high prevalence rate seen in this study could be as a result of poor availability of ear nose and throat (ENT) services to the public. There are currently 2 ENT surgeons to serve a population of 14 million people (i.e. 1 surgeon per 6 million people) in Zambia. This is unlike Kenya and Uganda which have an ENT surgeon per 1 million people^(13,14).

Out of the 147 pupils with hearing loss 78.5% had slight hearing loss, which was comparable to Rajab's study in Rwanda (72%) and Clark's study in Mozambique (79%)^(10,11). There was one case of

profound SNHL in a 7 year old who had a 4 years history of CSOM. It was not possible to confirm the cause of the profound hearing loss. Children with profound HL were few and this may be because they do not go to mainstream school but instead attend special schools.

There were 77.6% of unilateral hearing loss recorded and 22.4% of bilateral hearing loss. The commonest type of hearing loss was CHL (87.8%) whilst SNHL and mixed HL accounted for 10 (6.8%) and 8(5.4%) children respectively. The prevalence of CHL has been reported to be high in many studies, Rwanda and India reporting a prevalence of 65% and 96.2% respectively^(10,15). In this study the high prevalence of CHL was as a result of external and middle ear diseases such as cerumen impaction, OME and CSOM.

The prevalence of HL in male children was 13.8% whilst in females it was 9.3%. There was a statistical significant association between HL and the male sex ($p < 0.05$). Other studies have reported similar findings, Iran 8.9%: 7.7%, Egypt 12.2%: 7.4% in favour of the male sex^(16,17). Ogunleye in Nigeria and Ahmad in Iraq showed that there was a male predominance of otic foreign bodies in their studies^(18,19). Apart from traumatizing the tympanic membrane aural FB can interfere with sound transmission in the ear and this adventurous practice is also likely to disturb the normal self-cleaning process of the ear hence provoking occluding cerumen impaction, which could cause HL. CSOM, ETD, aural foreign body and OME were also more common in the male children.

In this study, ear disease was present in 36.8% children. This was comparable to Rajab's study in Rwanda (34%) but lower than Prakash et al study in Kathmandu (75.7%)^(10,20). The most common ear disease in this study was impacted wax 66%, which was mostly bilateral. This was followed by OME (20%), ETD (6%), foreign body in the ear (3.8%) and CSOM (2%). Wax impaction in this study was the most common ear disease because in the majority of cases it is asymptomatic and a coincidental finding. Wax impaction was noted to be

a common ear disease amongst school children in Nigeria (52.6%) Southeast India (53.8%), and Kathmandu valley (60.6%)^(21,22,23). In a Saudi Arabian study, Afaf²⁴ noted wax impaction in 12% of the total number of children aged 4-15 years. This low percentage could have been because the study included a higher age group unlike our study, which was restricted to children between 6-13 years old. Wax impaction is predominantly common in the younger age groups. Regional factors could also explain the wide variation in these findings.

CSOM was identified in 9 children (prevalence 2%), which is regarded as a high prevalence rate according to the WHO²⁵. This is comparable to findings from a study done in Mozambique (2%)²⁶. This prevalence rate is slightly higher than that reported in Angola, Tanzanian and Kenya, which reported prevalence rates of 1.6%, 1.6% and 1.1% respectively^(27,28,12). Lack of specialized ENT services to the public could be the explanation behind this high prevalence rate. Of all the ear diseases seen in the study only CSOM had a significant association with hearing impairment. Children with CSOM were at a higher risk of developing hearing impairment compared to those without CSOM. The odds of developing hearing impairment in children with CSOM was nine times greater than that of children without CSOM, OR = 9.9(95% CI, 2.33-47.43).

The prevalence rate of OME in this study was 7.3%, which is slightly lower than that of Saudi Arabia and Chile at 13.8% and 10% respectively^(29,30). The prevalence is not as high probably because the study was conducted in the months of September and October, which fall in the summer season of Zambia. Upper respiratory tract infections are less frequent during this season. The age group with the highest number of children in this study was 6-7 years (9.5%). Highest prevalence rates are seen at two peak ages, the first one at 2 years whilst the second is at 5 years⁽³¹⁾. In this study all the children were above the age of 5 years and this, perhaps would explain why group aged 6-7 years recorded the highest prevalent rate of OME as this age group falls immediately after the second peak.

CONCLUSION

The prevalence of disabling hearing loss in primary school children in the central zone of Lusaka district is high with the most common type being conductive hearing loss. Wax impaction is the most common ear disease in this population.

This study shows that CSOM has significant association with hearing loss and that the male children are at a higher risk of developing hearing impairment than the female children.

RECOMMENDATION

There is need for ear and hearing care awareness at the community level and screening programs in schools should be created. Health personnel training in the field of ENT in the country need to be supported in order to increase the number of ENT surgeons in Zambia.

Future studies to investigate the impact of hearing loss on academic performance in school children in order to support school screening programs are recommended.

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