

A Survey of Hearing Impairment in Inclusion Schools in Kenya

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Abstract: In Kenya, screening for hearing is not routinely done. As such, hearing impairment goes widely unchecked. The objective of the study was to determine the level of hearing loss among children with and without hearing disability (HD) in Nairobi, Kenya. The study was conducted in inclusive primary schools which had both deaf and non-deaf children. This was a descriptive cross-sectional study. Eighty-one children who met the inclusion criteria and were attending deaf units in city primary schools were recruited. Matching was done for age and gender with eighty-one non-deaf children. The children's ages ranged from 5 to 15 years, with a mean age of 10.3 years. Out of the 81 children with disability, 36(44.4%) were males and 45(55.6%) were females. Fifty-eight (71.61%) had profound hearing impairment, 21(25.93%) had severe hearing impairment, and 2(2.46%) had moderate hearing impairment. Of those without disability, 7(8.64%) had slight hearing impairment while 74(91.36%) had no hearing impairment. In age-groups 5-7 years and 14-15 years, majority of children with HD were males; 8(53.33%) and 7(58.33%) respectively. However in age groups 8-10 years and 11-13 years, majority of children with HD were females; 17(65.38%) and 16(57.14%) respectively. These results were identical among the comparison group, due to matching. The study concluded that though profound hearing disability is the most prevalent, seven children attending the mainstream school who were believed to have no disorder were found to have slight hearing impairment. This is of concern and may call for introduction of a screening program for all children at various levels while in school.

Keywords: deaf, hearing, disability children

1. Introduction

Hearing Disability (HD), is described by WHO as where an individual has moderate hearing impairment or worse, measured as an inability to hear sounds of 31decibels or greater in the better ear in children up to age 15 years, and an inability to hear sounds of 41decibels or greater in the better ear of those over 15 years [1]. The WHO has divided the severity of hearing disability in four categories on a scale of 0-4 as shown in table 1[1].

Of all the congenital diseases that occur worldwide, hearing disability remains the most disabling condition with the highest rate for age-standardized disability [2]. HD is of 3 main types: sensorineural, conductive, or mixed. Any of these types of HD can exhibit unilaterally or bilaterally; can be symmetric or asymmetric; can be syndromic (associated with other genetic, medical, or anatomic problems) or nonsyndromic (lacking such associations); can be congenital (exhibited at birth) or postnatal (exhibited after birth); and can be prelingual, perilingual or postlingual (i.e. onset before, during, or after speech/ language was acquired)[3]. Though hearing aids may improve hearing by amplifying sounds, they do not improve sound clarity. In addition, in many developing countries where hearing aids are introduced late, the hearing disabled children still have poor understanding of sounds heard, and in such cases, the child is still considered as a special child despite having a hearing aid[1].

The consequences of HD in children may include lifelong impairment in the language skills and possible delays in social development and academic achievement [4]. The severity of the disability that is experienced by the child is influenced by the degree and duration of hearing loss, the age at which the hearing loss first appears, and the hearing

frequencies affected [5]. The severity of the disability is also influenced by other coexisting disabilities that the child has, such as visual impairment, learning disabilities, and cerebral palsy [5].

According to the report from Stevens et al., the global prevalence of HD in 2013 was 1.4% in children aged 5–14 years, 9.8% in females, and 12.2% in males [6]. A recent estimate published in 2012 by the WHO revealed a prevalence of disabling hearing loss in children in sub-Saharan Africa to be 1.9%, versus 0.4% in high-income countries [6], [7]. Early diagnosis and intervention for children with hearing impairment are recommended to maximize their cognitive, social-emotional, speech, and language development [8]. However, in the absence of widely used new-born screening, the age at diagnosis is usually quite late in Africa, for example, 3.3 years in Cameroon [9]. Annually, up to 6 per 1000 live-born infants, or 798,000 babies worldwide, suffer permanent hearing loss at birth or within the neonatal period. At least 90% of them are in developing countries [10].

In the U.S.A, several studies indicate the overall estimated prevalence of new-borns with congenital hearing loss as 1 to 6 per 1000 new-borns [11], [12]. According to Blanchfield et al., as many as 738,000 individuals in U.S.A in 2001 have severe to profound hearing loss. Of these almost 8% were children under 18 years of age [13]. A Kenyan survey revealed that 14 out of 1,000 children in Kenya aged 6 to 9 years had HD. [14]

Table 1: WHO Grades of Hearing impairment

Grade/ Hearing Impairment	Hearing Loss in decibels (dB)	Manifestation	Hearing Disability
Grade 0/ None	25dB or less	Hears whispers.	HD None

Grade 1/ Slight	26-30 dB (15yrs or less)	Hears or repeats words in normal voice at 1metre.	HD None
	26-40 dB (over 15 years)		
Grade 2/ Moderate	31-60 dB (15 yrs or less)	Hears or repeats words in raised voice at 1metre.	HD
	41-60 dB (over 15 years)		
Grade 3/ Severe	61 – 80 dB	Hears words shouted into better ear.	HD
Grade 4/ Profound	81 dB or more	Cannot hear or understand shouted voice.	HD

2. Materials and methods

2.1 Study design and area

This was a Cross-sectional study. The study was carried out in Nairobi county primary schools which have special units for children with disability. A total of 162 children were recruited in the study. Of these, 81 included all the children with Hearing Disability (HD) as an isolated handicapping condition attending these schools in Nairobi, Kenya.

2.2 Sampling Procedure

A total of 162 children aged 5-15 years were recruited in the study of which, 81 who met the criteria for children with HD were selected. Using stratified random sampling, the children were then matched for age and gender with 81 children from the same schools who met the inclusion criteria and who were measured to have no HD. Therefore, the study comprised of two groups: one group of children with HD; moderate, severe and profound, and a comparison group of children without HD attending the same schools.

2.3 Hearing Assessment

A licensed audiometrist measured the hearing of each child according to the WHO criteria 2009 [1]. Each child was required to sit in a quiet room with a sound ambience of 40 decibels or less, measured using a sound level meter. Hearing loss was then measured for all children using a Portable digital EMiD screening audiometer AS208 at four different frequencies; 500Hz, 1000Hz, 2000Hz and 4000Hz. An average hearing loss for each ear was then calculated. The value of hearing loss for the ear with better hearing was recorded as the individual's value. It was noted that all types of hearing disability (conductive, sensory neural and mixed) were included in this study.

2.4 Data Validation

The EMiD screening audiometer machine, the sound level meter machine, the Salter weighing scale and standard height board were calibrated. Calibration of both the principal investigator (Cohen's Kappa score of 0.82) and the audiometrist (Cohen's Kappa score of 0.96) was also carried out.

3. Results

A total of one hundred and sixty two children were included in the study. The children were matched for site (school), age and gender. Therefore both the HD and non HD groups each had 36 (44.4%) males and 45 (55.6%) females, and a mean age of 10.30 ± 2.89 years. In both groups, the mean age for the males was 10.22 ± 3.20 years and for the females was 10.36 ± 2.62 years. There was no statistical difference between the mean ages of males and females ($U = 3182$; $p = 0.84$); and also between the number of males and females (χ^2 Fisher's Exact Test = 0; $df = 1$, $p = 0.56$).

Of the 81 children with HD, 58 (71.61%) had profound hearing impairment (hearing loss of 81 dB or greater), 21 (25.93%) had severe hearing impairment (hearing loss of 61-80 dB), and only 2 (2.46%) had moderate hearing impairment (hearing loss of 31-60 dB). Of the males with HD, 28 (77.78%) had profound hearing impairment, 7 (19.44%) had severe hearing impairment, and 1 (2.78%) had moderate hearing impairment. Of the females with HD, 30 (66.67%) had profound hearing impairment, 14 (31.11%) had severe hearing impairment, and 1 (2.22%) had moderate hearing impairment. There was no statistically significant difference in the gender distribution of children with HD ($\chi^2 = 1.42$, $DF = 2$; $p = 0.49$). (Table 2)

Among the 81 children without HD, 7 (8.64%) had slight hearing impairment (hearing loss of 26-30 dB) while 74 (91.36%) had no hearing impairment (hearing loss of 25dB or less). Of these, 4 males (11.11%) had slight hearing impairment and 32 males (88.89%) had no hearing impairment; while 3 females (6.67%) had slight hearing impairment, and 42 females (93.33%) had no hearing impairment. There was no statistically significant difference in their gender distribution (Fisher exact test = 0.50, $DF = 1$, $p = 0.38$). (Table 2)

Table 2: Gender distribution of children by level of hearing

	Number of children (%)			χ^2 $p \leq 0.05$
	Male No (%)	Female No (%)	Total No (%)	
HD None	32 (88.89)	42 (93.33)	74 (91.36)	Fisher Exact Test = 0.50 $df = 1$ $p = 0.38$
Slight HD	4 (11.11)	3 (6.67)	7 (8.64)	
Moderate HD	1 (2.78)	1 (2.22)	2 (2.46)	$\chi^2 = 1.42$ $df = 2$ $p = 0.49$
Severe HD	7 (19.44)	14 (31.11)	21 (25.93)	
Profound HD	28 (77.78)	30 (66.67)	58 (71.61)	

The children were put into four age-groups. Among the children with HD aged 5-7 years, 8 (53.33%) were males while 7 (46.67%) were females. Among the children with HD aged 8-10 years, 9 (34.62%) were males while 17 (65.38%) were females. Among the children with HD aged 11-13 years, 12 (42.86%) were males while 16 (57.14%) were females. Among the children with HD aged 14-15 years, 7 (58.33%) were males while 5 (41.67%) were females. There was no statistically significant difference in the age group distribution of children with HD by level of hearing impairment ($\chi^2 = 3.77$, $DF = 6$; $p = 0.71$). The distribution of children without HD (comparison group) was identical to that

of the children with HD. There was no significant difference in the distribution of children between the different age-groups (Pearson $\chi^2 = 4.93$, $df = 3$; $p = 0.18$). The gender and age distribution of all children in this study has been summarized in figure 1.

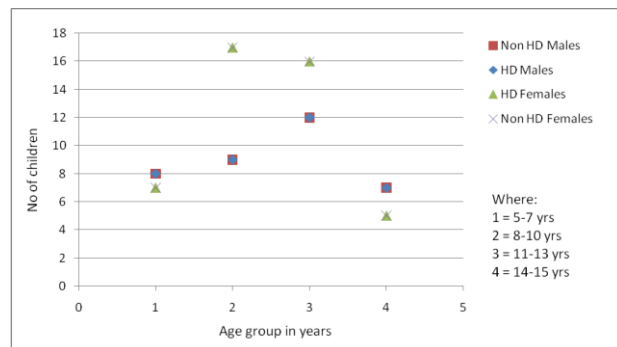


Figure 1: Age-group and Gender distribution of children
The age distribution of the children by level of hearing has been summarized in Table 3.

Table 3: Age distribution of children by level of hearing

	Number of Children (%)				χ^2 $p \leq 0.05$
	5-7 Yrs	8-10 yrs	11-13 yrs	14-15 yrs	
HD None	14 (93.33)	24 (92.31)	26 (92.86)	10 (83.33)	$\chi^2=1.16$ $df = 3$ $p= 0.76$
Slight HD	1 (6.67)	2 (7.69)	2 (7.14)	2 (16.67)	$\chi^2=3.77$ $df = 6$ $p= 0.71$
Moderate HD	1 (6.67)	0 (0)	1 (3.57)	0 (0)	
Severe HD	2 (13.33)	8 (30.77)	7 (25.00)	4 (33.33)	
Profound HD	12 (80.00)	18 (69.23)	20 (71.43)	8 (66.67)	

4. Discussion

The mean age for the males was 10.22 years while females had a mean age of 10.36 years. A study by Ohito et al. 1993 in Nairobi reported a slightly higher mean age of disabled children [15]. Males had a mean age of 11.5 years and females had a mean age of 11.8 years. The difference seen in this study may be attributed to the disability. This study targeted hearing disabled children only whereas the study by Ohito et al. encompassed children with various disabilities.

The male to female ratio for the children was 1:1.25 which differs from other studies that report a higher incidence of hearing disability in males compared to females. Local studies done by Ohito et al. in Kenya [15], and by Simon et al. in Tanzania [16], reported male to female ratios of disabled children as 1: 0.79 and 1: 0.85 respectively. The difference found in this study may possibly be attributed to the recent emphasis on educating the girl-child in Kenya, leading to a higher number of females being enrolled in schools across the country. A WHO Global report in 2009 stated HD among children to have a male to female ratio of 1:1 [17].

Majority of the disabled children in this study suffered from profound deafness (71.6%) followed by children with severe hearing disability (25.9%) then those with moderate disability (2.5%). WHO Global report states moderate hearing disability to be 83.8%, while severe hearing

disability to be 8.1% and profound hearing disability to be 8.1% [17]. The global statistics selects the whole population as the study subjects whereas this study selected children in special schools only, in which case, children with moderate impairment may not have attended the special schools. In addition, children with another disability in addition to HD were excluded from this study. These two reasons may therefore account for a difference in the respective prevalences found in this study.

In this study, 7 children were found to have Slight hearing impairment. Though these children do not have HD, it is a health concern. Noise-induced deafness is one of the leading causes of a reduction in hearing capacity and may even lead to Hearing Disability [1]. Further investigation would be warranted to ascertain the type and possible cause of the Slight hearing impairment among these 7 children.

5. Conclusion

Profound hearing impairment was the most prevalent form of hearing disability in this study, while moderate hearing impairment was the least prevalent. Among children without hearing disability 7 (8.64%) children unknowingly had slight hearing impairment and this raises concern.

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