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# ORIGINAL ARTICLE

## SURVEILLANCE OF HEARING IMPAIREMENT IN SCHOOL CHILDREN OF SLUM AREAS OF KURNOOL CITY; A.P

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**ABSTRACT: INTRODUCTION:** For a child, hearing and speech are essential tools of learning, playing and developing social skills. External sound and speech is used by infants and children to learn their communicating skills by imitation. In absence of perception of this external stimulus, they cannot develop speech and language. This results in delayed speech/language development, social problems and academic difficulty. Hearing loss, in varying degrees, affects two in every 100 children under the age of 18. The most effective treatment is achieved through diagnosis, early intervention by fitting suitable hearing aids. An early start on special education programs helps maximize a child's hearing which will give the child best of chances for successful speech and language development. **MATERIALS AND METHODS:** The study carried out to determine the hearing level, prevalence of loss of hearing and to identify its causes in schools of slums of Kurnool, Andhra Pradesh, India where the population is homogeneous in terms of occupation, socio-economic status, literacy, food habits and health related beliefs and practices. The children were of 5yrs to 15yrs in age. Totally 1041 children constituted the sample frame and underwent clinical examination and audiometry. **OBSERVATIONS:** Out of 440 students examined for HL 102 were had different causes for HL. 22.5% of children belonged to the age group of 5 to 8 ears. Presence of wax10.2%, ASOM 5.68%, Glue ear 3.4%, CSOM 3.4% were among the common causes. 39.09% children showed a loss of more than 25dB. 66.74% of the causes were preventable and curable at a district level Hospital. CONCLUSION: Analysis showed that 16.3% of these children have low-frequency or high-frequency hearing loss of at least 20dB hearing level in 1 or both ears. Among children in elementary, middle, and high school, audiometric screening should include low-frequency and high-frequency testing to detect hearing loss. As more than 50% of the causes of HL in this group is curable, its difficulties on speech and language might be controlled and treated via appropriate hearing screening protocol and program in every educational setting. The results obtained emphasize annual hearing screening programs for school-age children in order to promote health care and to prevent social and educational problems.

**KEYWORDS:** Hearing Loss, Surveillance of hearing impairment, Glue ear, ASOM, CSOM, Audiometry, PTA, High frequency HL, Conductive HL, Defective speech.

**INTRODUCTION:** Acute upper respiratory tract infections and its sequelae like asymptomatic middle ear fluid, discharging ear and adenoiditis are common human ailment. They cause morbidity and mortality especially in young children. This is a major ENT problem faced in India. Otitis media represents a diseases continuum that ranges from asymptomatic middle ear fluid to recurrent infection and middle ear fluid that persists for weeks and months. This may be involved in the development of bacterial meningitis and other central nervous system infections, or may lead to

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undertaking one or more of the most frequently performed operations of infancy and childhood, namely Myringotomy with or without tympanostomy tube insertion, adenoidectomy and tonsillectomy.

Almost 1/3rd of ENT outpatient department attendance is accounted by the pediatric subjects. In pediatrics around 1/5th of the problems are accounted by the ear, nose and throat [ENT) Disorders. Chronic supportive otitis media following an initial episode of acute Otitis media results in persistent discharge from middle ear through a tympanic perforation. This is a preventable hearing loss particularly in the developing world. Infection is usually a mixed microbial and secondary in nature derived from the external auditory canal or commensal flora of nasopharnyx.

Hearing loss of even 15 dB HL can create hearing disability in children and consequently impairment in their mental growth. Similarly Secretory otitis media developing during a critical period of development of speech and adaptation to the environment can create various disabilities like impaired speech, inability to pronounce consonants correctly in children. These disabilities can cause behavioral complications in six functional areas: mental maturity, perception, speech and speaking, cognition and general intelligence, academic achievement, and interpersonal behaviors.

One of the other impairments is unilateral hearing loss (UHL) that, if not examined, is normally detected later because one of the ears is healthy. For the impact of unilateral hearing loss on children's academic achievement, it was found that 30%of children with unilateral deafness lag at least 1.2 years behind their normal peers in terms of academic achievement. Unilateral hearing loss has remarkable effects on academic achievement, language development, and children's auditory perception.[1] Sara Schey concluded that "Clearly, there are lower educational rates of those who are severely to profoundly deaf or hard of hearing".

By considering the unpredictable difficulties, the best way to identify them would be individual assessment of children at risk. Due to the lack of knowledge and low cooperation of many parents, one of the appropriate times for prognosis, so-called screening, is the school age, because, at this age, majority of children gather in academic centers and they can all be examined.[2] According to the mentioned subjects and reasons, the Speech and Language Association of America (ASHA) has provided the following guidelines for screening. (i) The program should be run annually for children aged 3–9 years. (ii) After nine years of age, the program should be performed annually for children at risk.

Hence, in the present study, study of ENT problems with special reference to preventable causes of hearing loss was done in urban slum of Kurnool city as slum children are most neglected one and can be examined properly in school premises. The present study highlighted the need for a focused ENT checkup in school health survey.[3] In their study Azza A Taha et al concluded that the prevalence of HL did not differ across settings and was more common than reported in children from developed countries. This led us to conduct a study among the school children of slum areas of Kurnool City.

**AIMS AND OBJECTIVES:** To assess the hearing acuity in school children of slums in Kurnool city. A survey is conducted to study the relation of hearing impairment with age, preexisting diseases of the ear, familial incidence and other related medical problems in them to study and adopt preventive and curative measures to control hearing impairment.

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**MATERIALS AND METHODS:** The study was carried out in slums situated in the Urban Field Practice Area of Kurnool Medical College, Kurnool, and Andhra Pradesh, South India. The population in these slums is homogeneous in terms of occupation, socio-economic status, literacy, food habits and health related beliefs and practices. The study was carried out in school going children of these slums aged 5yrs to 15yrs. Study sample: There are 5 targeted schools situated within the field practice area. A total of 1041 children, were identified from slums, constituted the sampling frame.

With an estimated prevalence of 10%, an allowable error of -1% and stipulating a 95% confidence level, the required sample size obtained was 400. Assuming a non-response rate of 10%, the total number of children to be included in the study was estimated at 440.The study consisted of two parts: (a) Examination of children and (b) Home visits. Examination of children: Hearing examination of the children was carried out in the quietest room in the school premises, with the doors and windows closed. The ambient noise levels were estimated with the help of a Sound Level Meter prior to hearing examination.

As per the guidelines of the WHO Protocol, the examination consisted of inspection of the auricle and external auditory canal, followed by otoscopy and audiometry. The portable Pure-Tone Audiometer (make) was used to establish the hearing thresholds of the children. The thresholds were measured at 1, 2 and 4 kHz. The presentation of stimulus in the beginning was 60 dB HL at 1 kHz. If there was no response at that intensity, it was raised in 10 dB increments until the child responded.

On obtaining a positive response, the intensity of the stimulus was decreased in 10 dB increments until the child did not respond. Later on, it was increased in 5 dB increments until the child gave a positive response. Once the child confirmed the threshold on three consecutive occasions, it was recorded on the form. The thresholds were established at 2 and 4 kHz and then finally the threshold was established once again at 1 kHz. If the difference in the two readings at 1 kHz was more than 5 dB the whole procedure was repeated.

**CRITERIA FOR ASSESSMENT:** Inclusion criteria: 1. Children of age group 5 to 15yrs 2. They should belong to slums of Kurnool city. 3. Anatomical defects of auricle and the external ear canal. 4. Detection of abnormal cases of the ear canal and eardrum at the time of otoscopy examination.5. No response of either ear to at least one of the experimental frequencies. 6. Detection of type B or C Tympanogram. The standard field procedure was used for ENT examination.

The Various instruments used for the examination were horoscopy, tuning forks, thudicum nasal speculum, tongue depressor, torch etc. Hearing assessment was done by using tuning forks of frequency of 256 Hz, 512Hz and 1024 Hz for performing Rinnes test and Webers test in a quiet room. All the school children with abnormal TFT underwent the pure tone Audiometry. Exclusion criteria: 1. Children not fulfilling the above criteria were excluded. 2. Children having congenital defects. 3. Children having sensorineural deafness.

**RESULTS:** Distribution of children: The distribution of children according to age and sex is shown in the table below:

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| Age in completed years | Male number | percentage | Female number | percentage | Total number | percentage |
|---|---|---|---|---|---|---|
| 5-8 | 95 | 21.59% | 88 | 20% | 183 | 41.59% |
| 9-12 | 75 | 17.04% | 65 | 14.77% | 140 | 31.82% |
| 12-15 | 72 | 16.36% | 45 | 10.22% | 117 | 26.59% |
| **Total** | **242** | **55%** | **198** | **45%** | **440** | **100%** |

Table 1: Age and sex distribution of children

1 set of data=55% of 440 =242.
2nd set of data=45% of 440=198.
Difference=10%.

| | |
|---|---|
| 95% CI | 0.3% to 19.5 % |
| Chi-squared | 3.966 |
| DF | 1 |
| Significance level | P = 0.0464 |

Most of the children examined were boys (55%) and 41.59% of them belonged to the age group of 5to 8yrs old. All the 440 students were examined clinically by horoscopy findings noted and the following 102 students have hearing impairment. Students with Impacted wax were 45, with ASOM-25, with GLUE EAR -15, CSOM -15 and Others (e.g. FB)-02.

| **Cause of hearing impairment** | **Number of children** | **Percentage** |
|---|---|---|
| Impacted wax | 45 | 10.22% |
| ASOM | 25 | 5.68% |
| GLUE EAR | 15 | 3.40% |
| CSOM | 15 | 3.40% |
| OTHERS (F.B,FUNGUS,ETC) | 02 | 0.45% |

Table 2: HL according to cause of impairment (n=102)

| | |
|---|---|
| Chi-squared | 47.179 |
| DF | 4 |
| Significance Level | P <0.0001 |
| Contingency coefficient | 0.142 |

**CHI-SQUARE TEST RESULTS:** P value and statistical significance: Chi squared equals 0.000 with 4 degrees of freedom. The two-tailed P value e <0.0001 by conventional criteria; this difference is considered to be statistically significant.

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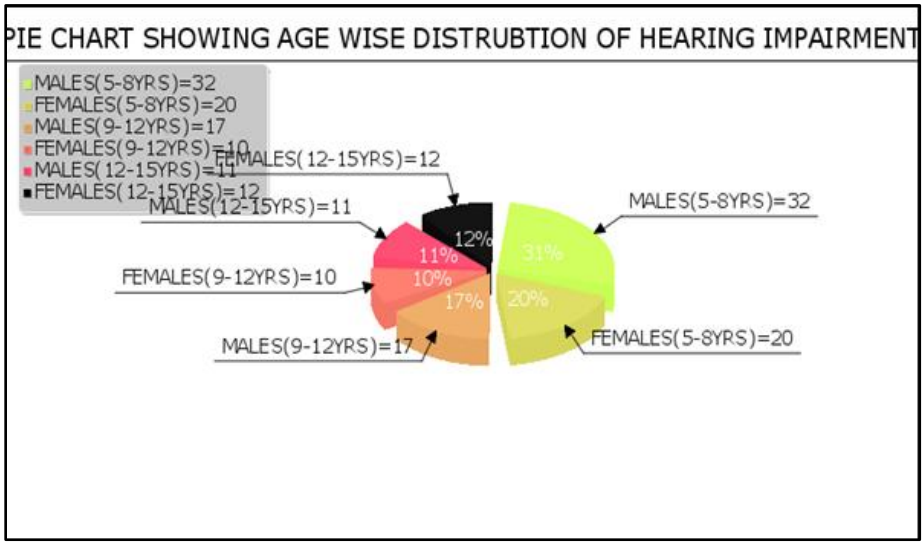
| Age in completed years | Male number | Percentage | Female number | percentage | Total number | Percentage |
|---|---|---|---|---|---|---|
| 5-8 | 32 | 7.27% | 20 | 4.54% | 52 | 11.81% |
| 9-12 | 17 | 3.86% | 10 | 2.27% | 27 | 6.13% |
| 12-15 | 11 | 2.50% | 12 | 2.72% | 23 | 5.22% |
| **Total** | **60** | **13.63%** | **42** | **9.54%** | **102** | **23.18%** |

TABLE 3: Age wise prevalence of hearing impairment

| | |
|---|---|
| Chi-squared | 10.236 |
| DF | 2 |
| Significance Level | P = 0.0060 |
| Contingency coefficient | 0.143 |




| Cause of hearing impairment | Male numbers affected | Male percentage affected | Female numbers affected | Female percentage affected |
|---|---|---|---|---|
| Impacted wax | 30 | 6.81% | 15 | 3.40% |
| ASOM | 14 | 3.18% | 11 | 2.50% |
| GLUE EAR | 8 | 1.81% | 7 | 1.59% |
| CSOM | 7 | 1.59% | 8 | 1.81% |
| OTHERS (F.B,FUNGUS,ETC) | 1 | 0.22% | 1 | 0.22% |
| **Total** | **60** | **13.63%** | **42** | **9.54%** |

TABLE 4: SEX WISE PREVALENCE OF HEARING IMPAIRMENT WITH CAUSES:

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| | |
|---|---|
| Chi-squared | 47.179 |
| DF | 4 |
| Significance Level | P < 0.0001 |
| Contingency coefficient | 0.142 |

**PIE DIAGRRAM REPRESENTING SEX WISE PERCENTAGES OF HEARING IMPAIRMENT: (TABLE 5)**

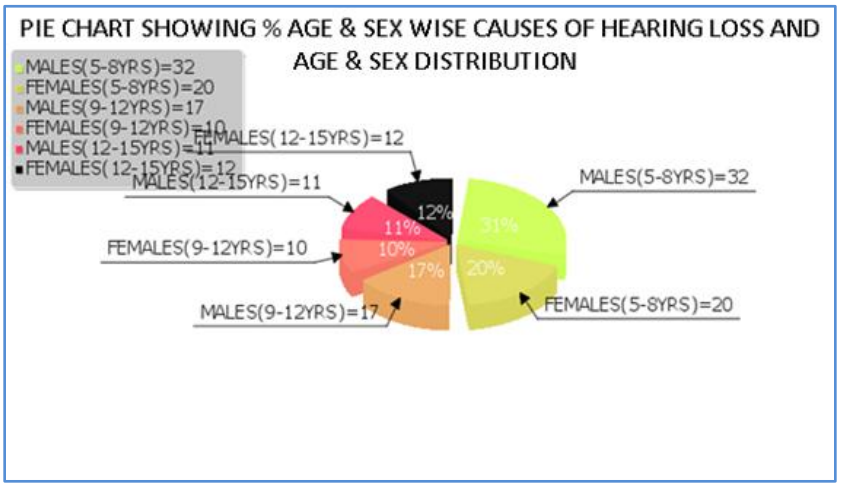
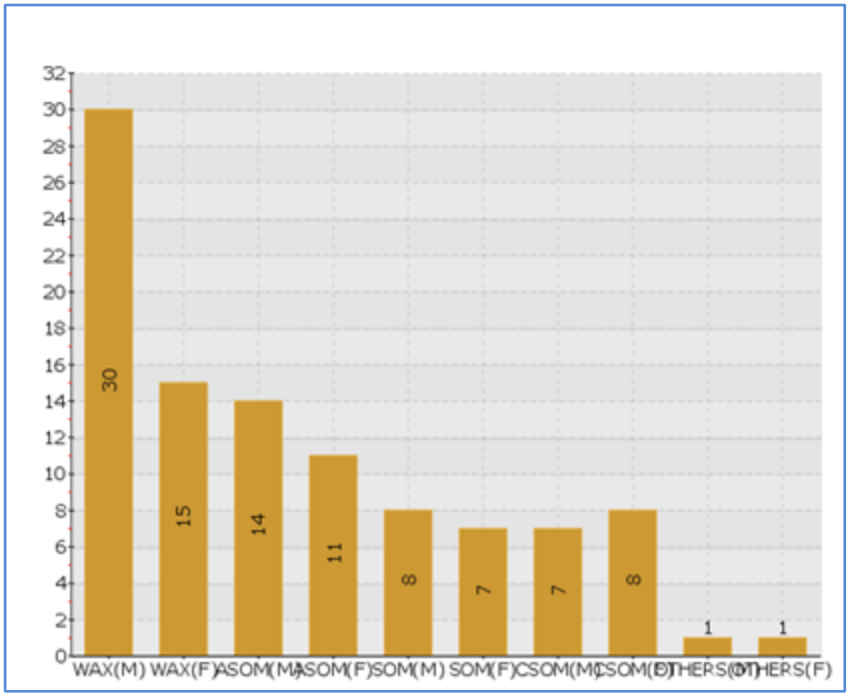



Table 6: BAR DIAGRRAM REPRESENTING SEX WISE NUMBERS OF HL: (n-102)



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| Age Group | 10-15 dB | 16-20dB | 21-25 dB | 26-30 dB | 31-35dB | Total | % | SD | % of HL > 25dB |
|---|---|---|---|---|---|---|---|---|---|
| 5-8 years | 4 | 6 | 8 | 10 | 13 | 41 | 40.19 | 3.286 | 22.5 |
| 8-12 years | 3 | 5 | 8 | 7 | 9 | 32 | 33.33 | 2.408 | 15.6 |
| 12-15 years | 2 | 5 | 8 | 7 | 7 | 29 | 28.43 | 2.387 | 13.7 |

Table 7: Showing the % of HL in relation to the age groups. (n=102)

**DISCUSSION:** The present study is a probability sample has shown that the prevalence rate of hearing loss in Kurnool slums is similar to other reported figures, in the literature and that the rate decreases as the children move through primary school, to secondary school with sexual preponderance in male children. Repeat audiometric testing four to six weeks after the screening test showed that the hearing loss was consistent in over 60% of the children, and the number of children with consistent losses increased by grade.

The reliability of the response of young children to audiometric screening is hard to judge. (4) As powerful as many of these tools may be, however, it is important that the diagnosis of hearing loss be based on the outcome of independent measures of auditory function, which serve to cross-check and complement one another. Failure to do so is likely to result in inaccurate or incomplete delineation of auditory function. (5) The location where the audiometric testing was done often left much to be desired and influenced the reliability of responses in particular; bone conduction tests are of little value if not done in a low-sound-level room.

The highly significant finding of earache in the children with hearing loss compared with the control group is an important indicator of ear pathology, but factors other than hearing loss may be involved in the recorded audiometric response.[3] The higher prevalence rate in the lower grades and the trend to increasingly consistent responses in older children suggest that the results may be influenced by the child's comprehension. However, a relationship between consistent hearing loss and social class has been noted, with higher consistency in the lower social classes. The meaning of this is obscure. (4) As previously discussed, children with unilateral, minimal and fluctuating conductive hearing loss are all at higher risk for school problems than children with normal hearing.

Therefore, identifying children with mild, high frequency, conductive or unilateral hearing loss using cost-effective, stringent screening protocols in early childhood, preschool or school settings are warranted, as is the identification of emerging high frequency hearing loss in early adolescence. Evidence-based hearing screening practices to identify all potentially educationally significant hearing loss can be justified; however, district level resources (e.g. screening program budget, personnel, educational audiology staff) and the willing involvement of medical and clinical audiology professionals in the community to accept and document outcomes for hearing screening referrals will ultimately shape the populations to be identified and the strength of the follow up practices.

(6) According to Blanchfield, et. al., as many as 738,000 individuals in the U.S. have severe to profound hearing loss. Of these, almost 8% are under the age of 18. (7) In developing countries, where the PDH Programme is especially targeted, there is a serious lack of accurate population-based data on the prevalence and causes of deafness and hearing impairment. (8) The number of Americans with a hearing loss has evidentially doubled during the past 30 years.

(9) The study conducted in Nigeria by A M Oyewumi and OR Adejumo mentioned in their abstract that the result revealed no significant impact of parent's socio-economic status on the affected children and significant difference among the hearing losses of pupils from low, medium and high population density areas.

**COMPARISON WITH OTHER STUDIES:**

1. (10) Niskar AS, Kieszak SM, Holmes A, Esteban E, Rubin C, Brody DJ, Prevalence of hearing loss among children 6 to 19 years of age: the Third National Health and Nutrition Examination Survey, Source: Epidemic Intelligence Service, Epidemiology Program Office, Centers for Disease Control and Prevention, Atlanta, GA 30341-3724, USA. abn0@cdc.gov. Journal of American Medical Association 279 (140), 1071-1075.

**ABSTRACT: CONTEXT:** Hearing loss in children influences the development of communication and behavioral skills, but few studies in the United States have used pure-tone audiometry to derive hearing loss prevalence estimates for children. OBJECTIVE: To describe the prevalence of hearing loss among US children by socio demographic characteristics, reported hearing loss, and audiometric screening factors. DESIGN: National population-based cross-sectional survey with an in-person interview and audiometric testing at 0.5 to 8 kHz.

**SETTING/PARTICIPANTS:** A total of 6166 children aged 6 to 19 years completed audiometry in the mobile examination center of the Third National Health and Nutrition Examination Survey conducted between 1988 and 1994.

**MAIN OUTCOME MEASURE:** Hearing loss, defined as audiometric threshold values of at least 16-dB hearing level based on a low or high pure-tone average. RESULTS: A total of 14.9% of children had low-frequency or high-frequency hearing loss of at least 16-dB hearing level, 7.1% had low-frequency hearing loss of at least 16-dB hearing level, and 12.7% had high-frequency hearing loss of at least 16-dB hearing level. Most hearing loss was unilateral and slight in severity (16- to 25-dB hearing level). Of those with measured hearing loss, 10.8% were reported to have current hearing loss during the interview.

**CONCLUSIONS:** This analysis indicates that 14.9% of US children have low-frequency or high-frequency hearing loss of at least 16-dB hearing level in 1 or both ears. Among children in elementary, middle, and high school, audiometric screening should include low-frequency and high-frequency testing to detect hearing loss.

2. (11) R. Kaplana, P. C Chamyal, Study of prevalence and aetiology of the hearing loss amongst school going children, Indian Journal of Otorhinolaryngology and Head and Neck surgery, June, 1997, Volume 49, 2 142-144.

**Abstract:** School survey study to assess the prevalence rates and aetiological factors causing hearing loss among children in and around Pune Cantonment covering urban and semi urban population has been carried out. We encountered deafness prevalence rate of 11.7% and chronic supportive otitis media (4.75% of the deaf children) the commonest cause.

Maximum number of patients was in age group of 6-11 years and semi urban children and those from lower socio-economic group had higher prevalence rate as compared to urban children and those from upper socio-economic group.

Relevant suggestions for prevention and management of deafness have been made. This study emphasizes the fact at most of the aetiological factors in causing hearing impairment in school going children are treatable and hence deafness can be prevented to a large extent if remedial measures are taken in time.

**CONCLUSIONS:** This study assessed the HL in school children through clinical and audiological assessment in slums of Kurnool city. The sample frame was of 1041 students and among them 440 students (Males- 242, females-198) underwent audiometry. The average age was. Data collected was analyzed using various statistical methods.

- There are children with HL and those at risk of having permanent HL.
- 41.59% of the children belonged to 5 to 8 years of age group.
- 39.9% (about 1 in 3children) has pure tone average of more than 25dB.
- 2.84% of the children had more than 35dB hearing loss.
- Socio economic status of parents has no impact o the HL of these children
- There are significant differences among HL detected in students from low, medium and high population density areas.
- 66.74% of the causes for HL could be treated if detected early.

It is concluded that the prevalence of HL in children of slum areas of Kurnool city is 1 out of 3 children and 1 out of 10 has mild HL. 66.74% of the causes are remediable. 2.84% of the children have more than 35dB loss.

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