

## Prevalence and pattern of hearing loss in children in house-held national survey in Egypt

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### Abstract

**Background:** Normal hearing in children provides the primary source for acquisition of language, speech and cognitive skills. **Objectives:** To assess the prevalence of hearing loss and deafness among Egyptian children, since there are few hospital-based academic studies which give an idea about the magnitude of the problem in children. **Patients & Methods:** This study targeted the Egyptian children aged from birth till the age of 14 years; six governorates were selected by random sampling to conduct the study. The survey had 2 phases, Phase I was the screening field study where all subjects had ear examination, otoacoustic emission and tympanometry. In phase II, failed subjects from phase I were referred to tertiary centers to complete the diagnostic workup. The collected data was analyzed using the SPSS software. **Results:** A total of 1600 children aging between 0-14 years were screened in phase I of the study. 272 subjects were found to have hearing loss with OAE in this phase (17%). In phase II, 221 subjects (13.8%) were proved to have hearing loss with an overall false positive rate of OAE 3.18% (51 subjects). Comparing the results of the individual governorates, there was no significant difference between different governorates. Among these 221 subjects with hearing loss, 132 were males (59.7%) and 89 were females (40.3%). 190 subjects (85.9%) had conductive hearing loss and 31 subjects had sensorineural hearing loss (14.1%). 174 patients had bilateral hearing loss (78.7%) and 47 had unilateral hearing loss (21.3%). **Conclusion:** There is a significant effect of age on the occurrence of hearing loss especially in the age group 0 -4 which should direct attention to the importance of hearing screening in this age group.

*Keywords: Prevalence, hearing loss, deafness, children, Egypt, otoacoustic emission*

### Introduction

Hearing loss has a significant impact on both the individual and the society. In children, the problem is compounded since normal hearing provides the primary source for acquisition of language, speech and cognitive skills.

Hearing loss is the commonest birth defect, and moreover, it is usually difficult to detect due to its "invisible" nature. International statistics for children with hearing impairment are reported to be 2-6/1000 live birth according to Parving<sup>1</sup>. Bess et al, 1998, reported 11.3 % prevalence of minimal sensorineural hearing loss in school age children<sup>2</sup>. Niskar et al, 1998, found that 14.9 % of children had either low frequency or high frequency hearing loss in a hospital based study<sup>3</sup>.

In Egypt, there have been no national surveys on the prevalence of hearing loss and deafness but there are few hospital-based academic studies which give an idea about the magnitude of the problem. Studies done at Ain

Shams University during 1980s and 1990s found the prevalence of hearing loss around 10-15 %. In audiology unit at Ain Shams University neonatal screening program, by otoacoustic emission, found that 5 % of neonates had hearing loss<sup>4</sup>.

The etiology of hearing loss is either congenital (genetic or non genetic) or acquired but the data on the relative contribution of these causes to hearing loss is not available in Egypt. However, academic hospital based studies show hereditary causes, meningitis and middle ear infection to be the top common causes for hearing loss in children in Egypt.

No conclusive data or recommendations could be drawn on such limited studies in Egypt. Therefore, there was a big need to conduct current study on the national level.

**Subjects and Methods:**

This study is a household survey, which targeted the Egyptian children from birth to 14 years. The 2002 total Egyptian population was estimated around 70.3 millions. The targeted age group represented 35% of the total population, which is around 24.6 millions. Six governorates were selected by random sampling to conduct the study. These were: Alexandria, Marsa Matrouh, Daqahilia, North Sinai, Minia and Luxor. According to the estimated prevalence of hearing impairments, the minimal sample size required with 95% confidence interval and 1% error was 1600 individuals. The sample was chosen based on the multistage stratified clustering technique, using systematic random sampling techniques at each level. The sample was stratified proportional to the population in each governorate.

The survey was conducted in two phases. Phase I was the screening field study where all subjects had ear examination, otoacoustic emission and tympanometry. In phase II, failed subjects from phase I were referred to tertiary centers to complete the diagnostic workup. They had advanced ear examination, full audiological evaluation, CT scanning of the temporal bone, laboratory and genetic studies whenever needed.

The collected data was analyzed using the SPSS software. Significance levels were specified according to the 5% level with P-values less than 0.05 indicating significant association.

**Results:**

A total of 1600 children aging between 0-14 years were screened in phase I of the study. 272 subjects were found to have hearing loss with OAE in this phase (17%). In phase II, 221 subjects (13.8%) were proved to have hearing loss with an overall false positive rate of OAE 3.18% (51 subjects). Comparing the results of the individual governorates, there was no significant difference between different governorates.

Age yrs	Males			Females			Total		
	Sample	Fail	%	Sample	Fail	%	Sample	Fail	%
00-04	264	61	23.11	232	50	21.55	496	111	22.38
05-14	582	71	12.19	522	39	7.47	1104	110	9.96

Table 1: Showing hearing loss related to age and sex

Among these 221 subjects with hearing loss, 132 were males (59.7%) and 89 were females (40.3%). Sex had no effect on the occurrence of hearing loss since there was no significant statistical difference between the incidence of hearing loss in both genders (15.6% in males and 11.8% in females). Gender also had no effect regarding the type, degree or laterality of hearing loss. 190 subjects (85.9%) had conductive hearing loss and 31 subjects had sensorineural hearing loss (14.1%). 174 patients had bilateral hearing loss (78.7%) and 47 had unilateral hearing loss (21.3%). Among these 24 patients

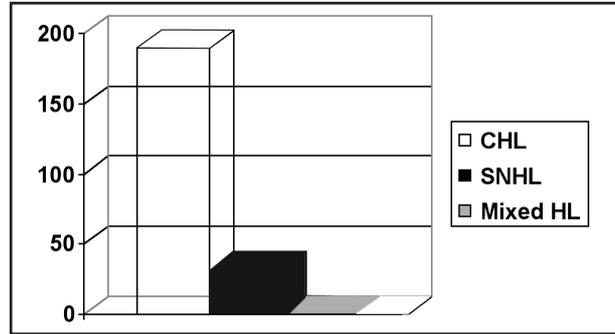


Figure 1: Types of hearing loss.

Bilateral	174	78.7%
Unilateral	47	21.3%
Unilateral right hearing loss	24	10.9%
Right hearing loss	198	89.6%
Unilateral left hearing loss	23	10.4%
Left hearing loss	197	89.1%

Table 2: Side of hearing loss

had right hearing loss (10.9%) and 23 had left hearing loss (10.4%) (Table 1). Regarding the degree of hearing loss, the majority of patients had mild hearing loss, with only 2 cases of dead ear diagnosed in the study. The degree of hearing loss in both the right and left ears is shown in (Table 2). There was no statistical significant difference indicating that the side of the disease had an effect on the type or degree of hearing loss.

Otitis media with effusion (OME) was the most common cause of hearing loss in this age group (147 patients, 66.5%). Other causes of hearing loss are summarized in (Table 3) showing number of subjects and percentages.

Degree of HL	Right ear		Left ear	
	Number	%	Number	%
Mild	157	79.3%	153	77.7%
Moderate	26	13.1%	28	14.2%
Severe	8	4%	10	5%
Profound	5	2.5%	6	3.10%
Dead ear	2	1.1%	0	0

Table 3: Degree of hearing loss in both ears

Etiology	Number	%
Otitis media with effusion	147	66.5
Eustachian tube dysfunction	20	9
Hereditary SNHL	20	9
Chronic suppurative otitis media	18	8.1
Congenital SNHL	11	5
Cholesteatoma	3	1.4
Acute otitis media	2	0.9

Table 4: Etiology of hearing loss

	Hearing loss	Age	Sex	Cause	Language	Governrate
1	Bil profound	2.8	Male	Congenital	Prelingual	Alexandria
2	Bil Profound	1	Female	Congenital	Prelingual	Alexandria
3	Bil profound	2.4	Female	Hereditary	Prelingual	Alexandria
4	Bil profound	1	Male	Congenital	Prelingual	Daqahilia
5	Bil profound	11	Female	Hereditary	Prelingual	Daqahilia
6	Dead+profound	12	Male	Autoimmune	Post	Daqahilia

Table 5: Descriptive data for potential cochlear implant candidates

## Discussion:

Hearing loss is a pervasive disability affecting nearly 250 million people around the globe, and 75 % of the sufferers living in the developing countries<sup>5</sup>. In the developed societies hearing loss became a common problem due to the combined effects of noise, aging and heredity<sup>6</sup>.

In the current study hearing loss in 0-14 year-old children was 13.8% of the 1600 surveyed population. Olusanya et al, 2004, used pure tone audiometry to survey 359 children in inner city of Lagos, Nigeria and found 13.9% hearing impairment<sup>7</sup>.

If undetected, hearing loss will negatively impact the cognitive development, literacy, and subsequently academic achievement. It is to be noticed that these social problems appear to be more frequent in children with mild or moderate hearing loss than in those with severe to profound hearing loss<sup>2</sup>.

The majority of hearing impaired children in the current study had mild degree of hearing loss. Mild hearing loss may not be noticed and even moderate losses may not impose a problem for people with excellent perceptual abilities and good coping skills. However, it will cause communication defects of most of those children that will be manifested in lower scholastic achievement. Preschool hearing assessment [screening] would be the only way to identify those children with mild or moderate hearing loss. Profound especially bilateral hearing loss was very minimal. This type of hearing loss required rehabilitation by cochlear implants. The lower incidence calls for less demand on national resources due to the increased cost of the implants.

Hearing loss may be estimated in terms of societal burden, effect on the person, and treatment needs. For purpose of estimating the societal burden of hearing loss, age specific rates of self (or family) reports are essential<sup>8</sup>.

In the current survey, hearing loss was evaluated by the OAE and PTA. For estimating the impact of hearing loss on the person, a PTA of 25 dB generally requires adaptive listening strategies. Active treatment is generally required at PTA of 40 dB or greater in both ears.

The fact that there is higher incidence of hearing loss among the age group 0-4 years should drive attention to the importance of screening protocol for this group,

this is because the earlier the diagnosis the better the prognosis for treatment and rehabilitation.

In the audiology unit at Ain Shams university neonatal screening program, found that 5 % of neonates had hearing loss screened by OAE, compared to 2.5 % in our current study which may be caused by the different sample, and included the percentage of possible false positive results with OAE<sup>4</sup>.

The prevalence of hearing loss in the school children in the current survey were 9.9 % which is higher than the older studies (5.3% in Alexandria, 1975, 4.5% in rural areas, Kolta, 1982) which should direct the health providers to investigate the rationale for that<sup>9,10</sup>.

Selly and co-workers reported that otitis media is considered as the commonest cause of childhood hearing loss in the developing countries<sup>11</sup>. Studies from Malaysia, India, Nigeria and Egypt reported prevalence rates of 13.8%-36.2% for OME among comparable school-aged populations<sup>12</sup>.

In the study conducted between 1997 and 2000, in Saudi Arabia, the prevalence of hearing loss in age 0.5-15 years was 13 % and also found that the commonest cause of hearing loss in children was OME<sup>13</sup>.

In this study, OME is the most common cause of hearing loss in this age group (66.5%). Adding Eustachian tube dysfunction [9%], chronic suppurative otitis media [8.1%] and acute otitis media (AOM) [1%] collectively show that infection is the major played in etiology of hearing loss in Egypt. Infection remains the commonest cause for hearing loss in developing countries according to the WHO data<sup>14</sup>.

This conclusion should be used to direct the national management plans. Primary care, general practitioners and pediatricians should play a very important role in the diagnosis and early proper treatment of acute otitis media to decrease the incidence of OME and consequently hearing loss. This also directs the attention towards medical treatment of hearing loss which implies lower cost and resources for the stakeholders and decisions makers.

Pneumatic otoscopy is the primary diagnostic method for the identification of OME, but tympanometry remains the gold standard because it is highly sensitive but unfortunately it is quite expensive to use as a routine screening tool<sup>15</sup>.

Unfortunately, school-aged children are rarely screened for hearing loss during the routine clinical examination and most of the school health authorities make no provision for the audiometric assessment. This can be attributed usually to the lack of the awareness among parents, school authorities, and health care providers. Selective screening based on the identification

of OME will facilitate the detection of a significant proportion of hearing impaired school entrants.

Screening is justifiable only when the required treatment is not only available but also affordable. There is a debate that the provision of hearing aids is expensive especially in the poor communities. However, it should be borne in mind that the hearing impaired can be significantly benefited from the basic intervention such as preferential seating in class rooms even without the use of hearing devices. Also, with the proper education they can be less likely to be misunderstood with the other interacting people especially in the difficult listening situations.

Moreover, selective screening based on risk factors has been advocated as a cost-effective alternative to universal screening in developing countries. The overwhelming burden of prevailing communicable and fatal diseases on the available limited resources in most communities further diverts attention away from routine auditory screening<sup>16</sup>.

Most of the sample disease group needed medical treatment which should direct the attention that hearing loss is mainly a medical problem that can be avoided by the improvement of the diagnostic and treatment abilities.

The second line of management needed was hearing aids but patients may have refused using them for cosmetic, traditional, or cost reasons. In the remote areas like North Sinai, Marsa Matrouh, Luxor, hearing aids are not readily available. Patients have to travel and re-travel in order to get the hearing aid if there is indication to be fixed.

In the United States, nearly 10.000 children have cochlear implants according to ASHA<sup>17</sup>. While in an academic study done at the audiology unit at Ain Shams University, found that 67/10.000 population suffering from severe disabling hearing loss<sup>18</sup>.

At Ain Shams University, it was found that about 30 % of this population did not benefit from hearing aid and needed cochlear implantation<sup>18</sup>. In the current study, there were 6 patients with potential benefit from cochlear implantation; there were 5 patients with pre-lingual hearing loss due to congenital or hereditary causes and only one patient with post-lingual loss due to auto-immune disease.

Tharwat and his colleagues, 1998, and Arts and others, 2002, stated that cochlear implants are needed for those patients with bilateral profound to total HL who could not be benefited with hearing aids and it is recommended to implant the younger children because of the high price of the cochlear implant<sup>19,20</sup>.

All infants and young children should be screened for the developmental delays or disabilities and intervention with the identified children and their families. Screening procedures should be incorporated into the ongoing health

care of the child as a part of the provision of a medical home. The primary pediatrician should develop a strategy to provide periodic screening in the context of office – based primary care. With parental agreement, referral of children with developmental delays in a timely fashion to the appropriate intervention and early childhood education programs.

Our study clarified that audiological evaluation is crucial for the diagnosis of hearing loss in school children which will improve markedly with the early management of the hearing loss.

### **Conclusion and recommendations:**

1. There is a significant effect of age on the occurrence of hearing loss especially in the age group 0-4 which should direct attention to the importance of hearing screening in this age group.
2. Improvement of the diagnostic and treatment skills of the health providers will improve the incidence of hearing loss and consequently early management.
3. Media should play a role in patient education and awareness about hearing aids. The government needs to increase the subsidization of the hearing aids dispensing. Increase parental awareness of developmental disabilities and resources for intervention by such methods as display and distribution of educational materials.
4. Fund raising is required for those currently in need for cochlear implants.
5. There is a great need for more qualified personnel for language and speech training especially in remote areas.

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