

## Original Research Article

**An epidemiological study of ear morbidities among primary school children in a rural area of Delhi**Kalika Gupta<sup>1</sup>, Gourav Kumar Goyal<sup>2</sup>, Suneela Garg<sup>3</sup><sup>1</sup>Assistant Professor of Community Medicine, Ananta Institute of Medical Sciences and Research Center, Rajsamand, Rajasthan, India<sup>2</sup>Assistant Professor of Pediatrics, Ananta Institute of Medical Sciences and Research Center, Rajsamand, Rajasthan, India<sup>3</sup>Director Professor, Department of Community Medicine, Maulana Azad Medical College, New Delhi, India

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**Abstract**

**Background:** Globally, more than 360 million population (nearly 5% of world's population) have disabling hearing loss and 32 million of them are children. Approximately 0.5-5 of every 1000 infants is born with or develops in early childhood disabling hearing loss. It is estimated that over 60% of the otological (ear) morbidities could be avoided through preventive measures, as stated by World Health Organization (2015). As per World health Organization report 2007, 6% of the population of India suffers with significant otological morbidities. Many ear morbidities have their origin in childhood and they may go unnoticed. Estimates indicate that by the age of 3 years at least half of children have experienced at least one episode of middle ear infection. Because it is a childhood illness, it requires close monitoring of signs and symptoms and it is often co-morbid with other infections of the upper or lower respiratory tract. **Method:** It was a cross sectional study conducted at a rural area based school of Delhi. A total of 368 primary school students, 5 to 11 years age, were included. Questionnaire was used to take history of ear morbidities, related risk factors and health seeking behaviour. Ear examination was performed using otoscope. Educational status of mother, immunization status, frequent cough-coryza, socio-economic status were found to be significant risk factors [p<0.05]. **Results:** Around 25 % of students had preventable ear morbidity. Cerumen impaction was the commonest morbidity followed by Chronic Suppurative Otitis Media. **Conclusion:** Preventable ear morbidities are prevalent among children. Health education pertaining to health seeking behaviour for ear hygiene and regular ear examination in schools can reduce the prevalence of ear morbidities.

**Keywords:** cerumen, otitis media, otological morbidities, rural

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**Introduction**

A person interacts with his or her surrounding environment through sensory experiences.

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The sense of hearing, in particular, fundamentally facilitates communication and nourishes social interaction. Hearing is the key to learning spoken language and is important for the cognitive development of the children. Hearing loss is a barrier to both, education and social integration[1-6]

**Burden**

Globally, more than 360 million population (nearly 5% of world's population) have disabling hearing loss and 32 million of them are children. Approximately 0.5-5 of every 1000 infants is born with or develops in early childhood disabling hearing loss. It is estimated that over 60% of the otological (ear) morbidities could be

avoided through preventive measures, as stated by World Health Organization (2015). An estimated two-third of the world's hearing impaired population are believed to be distributed among developing countries.<sup>9</sup> The prevalence of otological morbidities is greatest in South Asia, Asia Pacific and Sub-Saharan Africa. Prevalence of otological morbidity in South Asia in pediatric age group is 2.4% [7,8]

As per World Health Organization report 2007, 6% of the population of India suffers with significant otological morbidities.<sup>10</sup> Based on this, it is estimated that over 70 million persons in India are living with hearing loss equal to or greater than moderate degree. In practical terms, this implies that these people (with disabling hearing loss) would have difficulty in carrying out day to day activities such as routine conversation, listening to radio and television etc. Persons with higher degrees of hearing loss (severe or profound), may be able to only hear words shouted into the ears or not be able to hear at all [11]

According to Census of India, 2011, of all the people with hearing disability in India, around 8% belong to age group 5-9 years. Out of these, 70% belong to rural India and the rest are in urban India [12]

Children in the school-going age group (6-16 years) represent 25% of the population in the developing countries [13]. In India, this figure (children in school going age group) is around 20%.<sup>12</sup> School age is one of the most appropriate time for screening various morbidities in children since the majority of children gather in academic centers and they all can be examined [14]

#### **Ear morbidities**

A study of the pattern of ear morbidities in children is very important because, while some ear conditions are just causes of morbidity, others invariably lead to deafness. Also while some conditions such as sensorineural hearing loss or foreign body impaction are treatable others like acute otitis media and chronic otitis media are largely preventable [15-18]

In India, under Indian Council of Medical Research (ICMR), a cross sectional research was conducted among 13,800 children (2010-13) and Aggarwal A.K. et al [15] found that 14.4% of children suffer from impacted wax, acute and chronic suppurative otitis media together with otitis media with effusion constituted otological morbidity of 6.5%, fungal ear infection 0.3% and foreign body in ear 0.2%.

#### **Impact of unaddressed otological morbidities in children:**

Communication development and behavioral skills are influenced by a child's ability to hear. Hearing loss can also affect a child's social interactions, emotional

development, and academic performance. Children can exhibit varying degrees of difficulty in hearing and understanding environmental and speech sounds; significant problems listening and understanding in noisy and reverberant environments. Children typically exhibit delays and/or difficulty with tasks involving language concepts; auditory attention and memory, and comprehension; receptive and expressive language; syntax, semantics, and vocabulary development; speech perception and production, lower scores on achievement and verbal IQ tests; greater need for enrollment in special education or support classes; increased need for organization support in the classroom [19-22]

Children may have self-described feelings of isolation, exclusion, embarrassment, annoyance, confusion, and helplessness; [23] refuse to participate in group activities; act withdrawn or sullen; exhibit lower performance on measures of social maturity; have significant problems following directions [24]

There is a need to estimate the magnitude of various otological morbidities in school age children as well as to identify the various risk factors that play a role in the emergence of these morbidities. In line with the above background, the present study was carried out in the rural area of National Capital Region of India, Delhi. It attempted to find out the prevalence of common otological morbidities in rural school children. The study also aimed to find out the various risk factors for otological morbidities and the health care seeking behavior of parents of the school children with respect to ear morbidities. The findings of this study would go a long way in developing recommendations for reducing the burden of these preventable ear morbidities and the promotion of healthy health care seeking behavior among the people of developing countries.

#### **Methodology**

It was a cross-sectional, school based study conducted at 'Municipal Corporation of Delhi (MCD) Primary Co-ed school' in the village Barwala in North West Delhi, India. Study was conducted for a period of one year, Jan 2015 – Dec 2015.

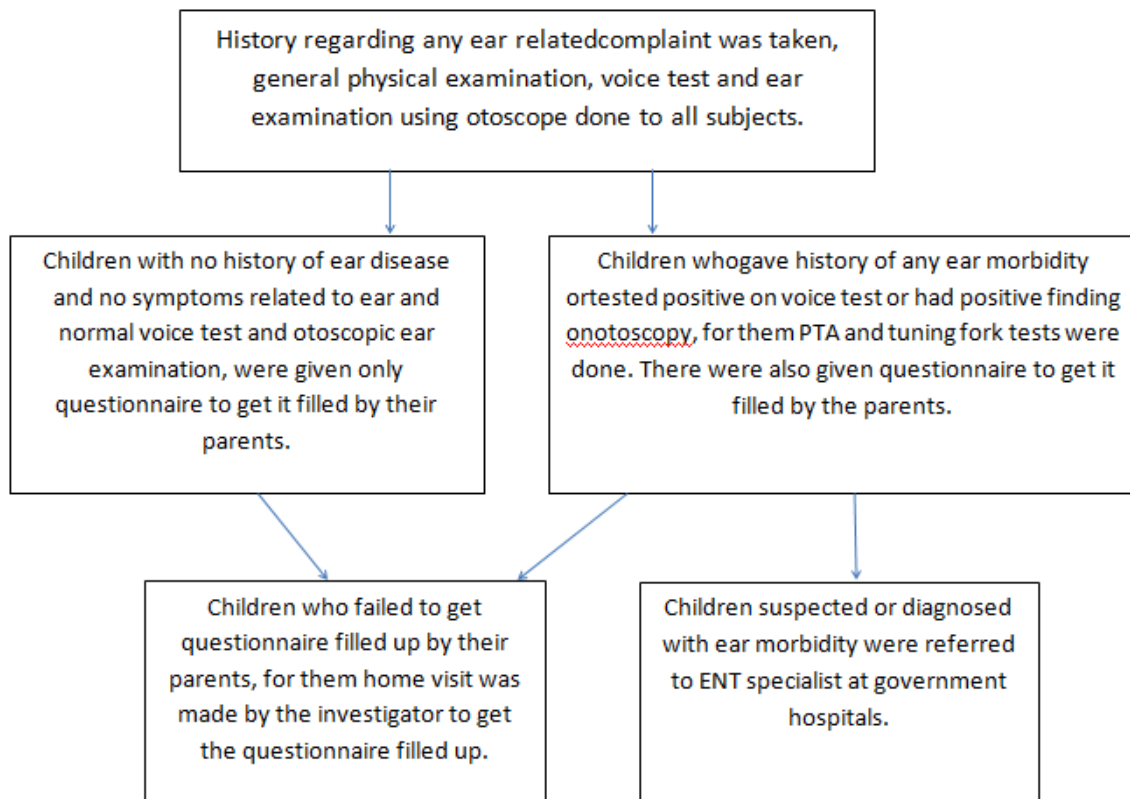
All students, in the selected sections, of each class from 1st to 5<sup>th</sup> of the selected school (age group 5 to 11 years) were taken into study, after taking consent from parents of all children and assent from the children in the age group 7-11 years. Those subjects residing outside Barwala were excluded from the study.

At 95% confidence level and taking the prevalence<sup>22</sup> of otological morbidities among Delhi children to be 21.5% and with a relative error of 20%, the sample size came out to be 365.

Study instruments included a predesigned and pretested, semi structured questionnaire in Hindi and English languages. The questionnaire contained sections on demographic and socio-economic information, risk factors for hearing disorders and health seeking behavior of subject's parents with respect to ear and hearing. Welch Allyn 3.5V halogen bulb battery operated otoscope was used for ear examination.

Sampling was done using the multi stage sampling technique. Among all the government schools present at these areas, by Simple Random Sampling, one school at Barwala was selected. Then again by Simple Random Sampling, two sections from each class 1st to 5th were selected. Each section had 35-50 students. All

#### Clinical assessment algorithm



#### STATISTICAL ANALYSIS

- The collected data was coded, compiled and entered in the Microsoft-Excel and then analyzed and statistically evaluated by using SPSS-PC-17 version.
- Quantitative data was expressed by mean and standard deviation.

the students in those selected sections were included in the study.

Subjects were provided with the description of project and informed assent [for age group between 7 yrs to 11 yrs] and informed consent from parents of all subjects were brought. Questionnaire was in English and Hindi and was given to the subject to get it filled by their parents. If the subject failed to get the questionnaire filled up by their parents, then subject's home was visited by the investigator. Examination of the children was done in school. The investigator was trained in ENT examination by the ENT specialists at Lok Nayak hospital and Maharishi Valmiki Hospital, PoothKhurd, Delhi for doing ear examination.

- Qualitative data was expressed by the percentages and difference between the proportions was observed by chi square test.

#### ETHICAL CONSIDERATIONS

- Informed assent and consent were taken from the study subjects and their parents, respectively.
- No pressure coercion was exerted on subjects or their parents for participation in the study.

Confidentiality and privacy were ensured at all stages.

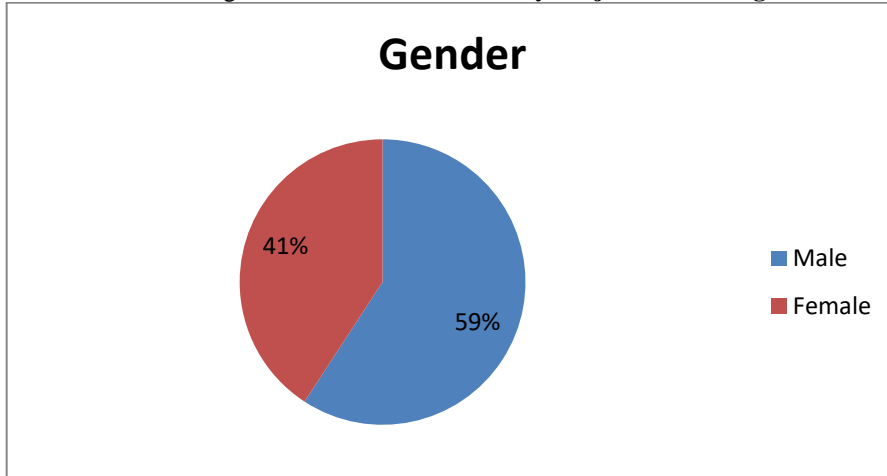
- Subjects who had positive examination findings were adequately referred for treatment.
- Subjects were free to leave the study at any time and no questions were asked.

**Results**

**Socio-demographic profile of study subjects:**

The subjects belonged to age group 5-11 years old. Mean age was 8 years (Standard Deviation, SD 1.7). The proportion of males was more (59.2%), thereby highlighting male gender preference in rural area. [Figure 1]

Figure 1: Distribution of study subjects according to sex



Amongst the families of the students, 15.2% had illiterate head of the family, 34.5% had head who had studied below high school and in rest of the families, the head was educated high school or above. When child’s mother’s educational status was determined, 26.6% of the mothers were found to be illiterate, 37.5% of mother had studied below high school and rest had

studied till high school or above. According to Modified Kuppuswamy scale<sup>84</sup>, 52.7% of the families belonged to lower middle socio-economic class. Around 59% families were joint families. The percentage of completely immunized children were 70.1%. [Table 1]

**Table 1: Socio-demographic profile of study population**

Gender	Rural N=368 (%)
Male	218 (59.2)
Female	150 (40.8)
<b>Socio-economic classes</b>	
Lower	4 (1.1)
Upper lower	127 (34.5)
Lower middle	187 (50.8)
Upper middle	50 (13.6)
<b>Type of family</b>	
Nuclear	151 (41)
Joint	217 (59)
<b>Educational status of head of family</b>	
Illiterate	56 (15.2)
Below high school	127 (34.5)
High school and above	185 (50.3)
<b>Educational status of mother</b>	
Illiterate	98 (26.6)
Below high school	138 (37.5)

High school and above	132 (35.9)
<b>Immunization status of the child</b>	
Fully immunized	258 (70.1)
Partial/incomplete immunized	110 (29.5)

### Prevalence of otological morbidities among rural and urban school children

Total prevalence of ear morbidity among the school children was 25.5%. Wax impaction in the ears was found to be most prevalent morbidity, 12.5%. Second

most common morbidity was CSOM, 6.8%. Next common morbidity was AOM, 3.5%. The prevalence of foreign body impaction into ear and otitis externa was 2.2% and 0.5%, respectively. [Table 2]

**Table 2: Prevalence of ear morbidity in study population**

Otological morbidity	Rural No.(%) N=368
Acute otitis media (AOM)	13 (3.5)
Chronic Suppurative Otitis Media (CSOM)	25 (6.8)
Foreign Body Impaction	8 (2.2)
Otitis externa	2 (0.5)
Cerumen impaction	46 (12.5)
<b>Total</b>	<b>94 (25.5)</b>

### Risk factors for otological morbidities

#### Gender:

In table below, it is seen that the prevalence of AOM, CSOM and wax impaction were more in females as compared to males. In school, most mentioned ear morbidities were more among girls reflecting the attitude of neglect towards the girl child. [Table 3]

**Table 3: Association between gender and various ear morbidities**

	Male N (%)	Female N (%)	Total N (%)	Chi-square value ( $\chi^2$ ), degree of freedom (df), p value
	218	150	368	
<b>AOM</b>	7 (3.2)	6 (4)	13 (3.5)	0.162, 1, 0.68
<b>CSOM</b>	11 (5)	14 (9.3)	25 (6.8)	2.5, 1, 0.10
<b>Otitis externa</b>	2 (0.9)	0	2 (0.5)	2.5, 1, 0.10,
<b>Foreign body</b>	6 (2.7)	2 (1.3)	8 (2.1)	0.162, 1, 0.68
<b>Wax impaction</b>	24 (11)	22 (14.6)	46 (12.5)	0.16, 1, 0.68

#### a) Educational status of mother

On analysis, statistical significant association was found between educational status of mother and ear morbidities. The prevalence of otological disorders decreased as literacy status of mothers increased.

**Table 4: Association between education of mother and various ear morbidities**

	Illiterate N (%)	Below high school N (%)	High school and above N (%)	Total N (%)	Chi-square value ( $\chi^2$ ), degree of freedom (df), p value
	98	138	132	368	
<b>AOM</b>	6 (6.1)	6 (4.3)	1 (0.8)	13 (3.5)	5.18, 2, 0.07
<b>CSOM</b>	16 (16.3)	9 (6.5)	0	25 (6.8)	23.0, 2, 0.01
<b>Otitis externa</b>	1 (1)	1 (0.7)	0	2 (0.5)	1.22, 2, 0.54

<b>Foreign body impaction</b>	7 (7.1)	1 (0.7)	0	8 (2.2)	15.67, 2, 0.01
<b>Cerumen impaction</b>	16 (16.3)	30 (21.7)	0	46 (12.5)	32.83, 4, 0.01

### Socio-economic class

On trying to find out association between socio-economic class of the family and the otological morbidity, statistically significant association was seen with respect to CSOM and wax impaction in ear. [Table 4]

**Table 4: Association between socio-economic status and various ear morbidities**

	Lower N (%)	Upper lower N (%)	Lower middle N (%)	Upper middle N (%)	Total	Chi-square value ( $\chi^2$ ), degree of freedom (df), p value
	4	127	187	50	368	
<b>AOM</b>	0	8 (6.3)	5 (2.7)	0	13 (3.5)	5.23, 3, 0.15
<b>CSOM</b>	0	17 (13.4)	6 (3.2)	2 (4)	25 (6.8)	13.4, 3, 0.01
<b>Otitis externa</b>	0	2 (1.6)	0	0	2 (0.5)	3.8, 3, 0.28
<b>Foreign body</b>	0	5 (3.9)	3 (1.6)	0	8 (2.2)	3.34, 3, 0.34
<b>Cerumen impaction</b>	2 (50)	32 (25.2)	9 (4.8)	3 (6)	46 (12.5)	35.8, 3, 0.001

### Type of family

It was found that otological morbidities were more prevalent among children who came from nuclear families as compared to those from joint families. This difference was statistically significant in all morbidities diagnosed except otitis extern and foreign body impaction. Statistically significant difference of prevalence for AOM, CSOM and wax impaction were observed between nuclear and joint family. Prevalence for AOM, CSOM and wax impaction among who belonged to nuclear family were 7.5%, 15.2% and 19.2% respectively. The corresponding figures for children belonging to joint families were much less, 0.5%, 0.9% and 7.8%.

**Table 5: Association between type of family and various ear morbidities**

	Nuclear family N (%)	Joint family N (%)	Total N (%)	Chi-square value ( $\chi^2$ ), degree of freedom (df), p value
	151	217	368	
<b>AOM</b>	12 (7.9)	1 (0.5)	13 (3.5)	14.64, 1, 0.01
<b>CSOM</b>	23 (15.2)	2 (0.9)	25 (6.8)	28.79, 1, 0.01
<b>Otitis externa</b>	2 (1.3)	0	2 (0.5)	2.9, 1, 0.16
<b>Foreign body</b>	3 (2)	5 (2.3)	8 (2.2)	0.04, 1, 1.00
<b>Cerumen impaction</b>	29 (19.2)	17 (7.8)	46 (12.5)	12.12, 2, 0.01

### a) Immunization history

From the table, we can see that completely immunized children were significantly protected against infective otological morbidities. [Table 6]

**Table 6: Association between immunization status and various ear morbidities**

	Completely immunized N (%)	Incompletely/ partially immunized N (%)	Total N (%)	Chi-square value ( $\chi^2$ ), degree of freedom (df), p value
	258	110	368	
<b>AOM</b>	4 (1.6)	9 (8.2)	13 (3.5)	9.95, 1, 0.01
<b>CSOM</b>	5 (1.9)	20 (18.2)	25 (6.8)	32.1, 1, 0.01
<b>Otitis externa</b>	0	2 (1.8)	2 (0.5)	4.69, 1, 0.08

**Coryza**

It was observed that children, who had frequent episodes of coryza, had higher prevalence of otological morbidities than among those who did not. Among children who had frequent coryza, 20.9% had CSOM and among those who didn't prevalence of CSOM was 2.2% [ $\chi^2=37.8$ , df=1, p=0.001]. [Table 7]

**Table 7: Association between coryza and various ear morbidities**

	Frequent episodes of coryza		Total N (%)	Chi-square value ( $\chi^2$ ), degree of freedom (df), p value
	Yes N (%)	No N (%)		
	91	277	368	
<b>AOM</b>	13 (14.3)	0	13 (3.5)	41.0, 1, 0.01
<b>CSOM</b>	19 (20.9)	6 (2.2)	25 (6.8)	37.8, 1, 0.01
<b>Otitis externa</b>	2 (2.2)	0	2 (0.5)	6.09, 1, 0.06
<b>Cerumen impaction</b>	28 (30.8)	18 (6.5)	46 (12.5)	40.37, 2, 0.001

**Health seeking behavior regarding otological morbidities**

On analysis, it was found that 78.8% of caregivers practiced ear cleaning for their kids. From table, we can make out that most of the caregiver used ear bud (43.8) for cleaning their child's ears. Second most common practice among caregivers was to use home remedies (26.4%) like mustard oil, or mixture of oil with onion or garlic paste, etc. Towel/hanky was used by 9.2%, matchstick/pencil by 11.1%, doctor by 3.3%, local ear cleaner by 4.6% and hydrogen peroxide ( $H_2O_2$ ) by 1.9% of caregivers. [Table 8]

**Table 8: Frequency of health seeking behavior among parents of study subjects**

	Frequency [%] N (%)
<b>Regular ear cleaning practice present</b>	290 (78.8)
<b>No regular ear cleaning practice</b>	78 (21.2)
<b>Total</b>	368 (100)
Various methods used to clean ears	
<b>Oil /Home remedies</b>	97 (26.4)
<b>Matchstick/pencil</b>	41 (11.1)
<b>Ear bud</b>	160 (43.8)
<b>Towel/Hanky</b>	34 (9.2)
<b>Hydrogen peroxide, <math>H_2O_2</math></b>	7 (1.9)
<b>Doctor/ear drops</b>	12 (3.3)
<b>Local ear cleaner</b>	17 (4.6)
<b>Total</b>	368

## Discussion

In the current study, 368 school children, 5-11 years old were included. Aggarwal A.K. et al [15] stated in their ICMR project that, tympanic membrane abnormality was present in 6.2% of the children <1 year old, 14.7% in 1-5 years old, 39.4% in 5-10 years old and 39.8 % in more than 10 years old. Hence, doing the present study in the age group 5-11 years was logical, as this population is at high risk for various preventable otological morbidities. Furthermore, around 5% to 21% of hearing loss due to various otological morbidities is seen in the age group 4 to 11 years old child. In the present study, the overall prevalence of otological morbidities came out to be 25.5% among rural school children. According to a Turkish study done in 2012 by Erdivanli OC et al[17], prevalence of otological morbidities was 14.7% in 4-6 years old and 13.9% in 7-9 years old. This prevalence is less compared to present study since small age groups were studied in the Turkish study. Minja BM et al in 1996, found the prevalence of ear morbidities was 21% among rural school children and 16.1% among urban school children in the age group 5-12 years old. Aggarwal AK et al[15] in 2013 reported 34% of rural children and 27.6% of urban children had ear morbidity, in 2005 Bandhopadhyay R et al[18], stating prevalence of 55.8 % in rural primary school children and 43% in urban primary school children. The higher overall ear morbidities in above mentioned studies are due to wider age range included in their study. The higher prevalence among rural based children can be attributable to their low socio-economic status, reduced accessibility to health care providers, more number of quacks running clinics successfully in rural area, poor awareness about ear morbidities and unhealthy health seeking behavior. In the present study, the prevalence of ASOM came out to be 3.5%, prevalence of CSOM was 6.8%, foreign body impaction prevalence was 2.2%, otitis externa was 0.5% and overall wax impaction prevalence was 12.5%. Chadha SK et al[19] in 2013, in their study on 5-12 years old kids, found prevalence of wax impaction to be 7.93%, CSOM 4.79%, ASOM 0.65% and foreign body 0.34%. Rijal AS et al[20] in their Nepal based study on 1-12 years old subjects, in 2011, reported higher prevalence of ear morbidities than the present study, wax impaction 40.2%, ASOM 24.3%, CSOM 17.7%, otitis externa 7.5% and foreign body impaction 2.3%. These vast differences in prevalence could possibly be accounted for by the fact that different inclusion and diagnostic criteria have been followed by different studies. In the current study, 59% of the participants were male and

41 % were females. The high preponderance of the males in the study group can be explained by the sex ratio of Delhi, being 866, as stated in Annual report on registration of births and deaths in Delhi, 2014. Shaheen M M et al [21] in their study done in 2012 on 4-12 years old school children, reported higher prevalence of CSOM in girls (5.7%) than boys (4.7%). The higher prevalence among girls than boys can be explained by social and familial indifference to them. In the present study, 89.3% of the subjects had literate head of the family (father was head in around 90% of the families) and 73.3 % had literate mother. These results are consistent with those of the Census of India, 2011 for Delhi (91% and 80% male and female literacy rates, respectively). We concluded that as the socio economic status of the family increased, the prevalence of ear morbidities decreased. Shaheen M Met al stated 63.6% of children with CSOM belonged to lower socio-economic class.

In the current research, otological morbidities were more prevalent among children who came from nuclear families as compared to those from joint families. In line with these findings, Srikanth et al[22] stated that caregivers from nuclear families were less aware about risk factors for OM and hence increased prevalence was seen. Completely immunized children were significantly protected against infective otological morbidities. ASOM was present in 1.6% of children who were completely immunized and in 8.2 % of children who were incompletely or unimmunized. It was observed that children, whose parents reported frequent episodes of coryza in their children, had higher prevalence of otological morbidities than among those who did not.

## Conclusion

Ear morbidities are a frequent menace seen among children in a developing country like India. Several socio-demographic factors if controlled, can significantly reduce the prevalence of preventable causes of ear morbidities among paediatric age group. Educational status of family members, immunization status, personal and environmental hygiene, frequent history of cough-coryza are all significantly associated with ear morbidities.

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