

# Factors associated with deaf-mutism in children attending special schools of rural central India: A survey

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## ABSTRACT

**Background:** Effects of hearing loss on the development of a child's ability to learn, to communicate, and to socialize can be devastating. If no auditory rehabilitation is done by peri-lingual period, the child develops permanent speech problems. The cases included in this category will be those having hearing loss more than 90 dB in the better ear or total loss of hearing in both the ears. Brainstem Evoked Response Audiometry (BERA)/Auditory Brainstem response (ABR) has been established as the most reliable screening tool for hearing assessment in neonates. **Objectives:** To perform a questionnaire-based survey of parents of children attending special schools for deaf-mutism, to find out the major medical, socio-demographic, and health service-related risk factors for deaf-- mutism. To perform screening for all these children in special schools for deaf and mute to get the major cause leading to their deaf-mutism in a given rural area in central India. **Methodology:** A cross-sectional study was done with deaf and mute students from special schools. A questionnaire was used to assess any complications in the antenatal, perinatal, and postnatal period. Thorough otorhinolaryngologic clinical examination was carried out with special attention to branchial arch anomalies and BERA was done to evaluate the deafness in individual and appropriate response is mentioned. **Result:** This study concluded neonatal septicemia, prematurity, low birth weight, consanguinity, and birth asphyxia as the most common risk factor for deafness in children. In this study, waiting for improvement on behalf of parents and misguidance by doctors posed the most common additional risk factor for mutism. Financial constraint and taking the matter of lack of hearing lightly were the most important reasons, which forced parents to opt for special schools and their inability to utilize the benefit of the cochlear implant.

**Keywords:** Brainstem evoked response audiometry, deaf, mute, school

## Introduction

Hearing is necessary for the development of language, speech, and cognitive skills. Effects of hearing loss on the development of a child's ability to learn, to communicate, and to socialize can be devastating. Hearing impairment is an invisible handicap and hence its effects are not visible to others, so deafness in a child often goes unnoticed. Since exposure to a normal acoustic environment is required for maturation of peripheral and central auditory pathways, a significant reduction of sensory

input induces both anatomical and physiological alterations of auditory pathways.<sup>[1,2]</sup> If no auditory rehabilitation is done by perilingual period, the child develops permanent speech problems.

The World Health Organization (WHO) definition of "deafness" refers to the complete loss of hearing ability in one or two ears. The cases included in this category will be those having hearing loss more than 90 dB in the better ear or total loss of hearing in both the ears. The WHO definition of "hearing impairment" refers to both complete and partial loss of ability to hear.<sup>[3,4]</sup> There are numerous factors leading to deafness in the neonatal period and early childhood, which are more common in a developing country like India. These comprise of various antenatal, perinatal, and postnatal factors.

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Mutism occurs secondary to non-rehabilitation of deafness.<sup>[5-7]</sup> This could be due to inadequate medical services that are overstretched or absent in rural areas, illiteracy, poverty, old customs and beliefs, decreased doctor–patient ratio, lack of knowledge regarding hearing milestones, and scarce finances among many others.<sup>[8]</sup> Little money spent on prevention of deafness and its rehabilitation, can prevent this major burden of handicap in our society.

Brainstem Evoked Response Audiometry (BERA)/Auditory Brainstem response (ABR) has been established as the most reliable screening tool for hearing assessment in neonates since its first use in 1978 for this purpose. And its ability to detect retrocochlear deafness makes it ideal for our screening process and hence has been used in our study.

Hence, this study is being undertaken to identify medical, socio-demographic, and health service-related risk factors for deaf–mutism among children attending a special school of rural central India. Performed through a questionnaire-based survey. The screening was done to know the prevalent cause of deafness.

This study focuses on various social and medical risk factors for deafness, the impact of early screening, primary care and primary management, rehabilitation measures, targeted to improve the outcome, in terms of mutism, of a child being born deaf. This study is important to decrease the disease burden of deaf–mutism, at least the latter, which is preventable in most cases, by early rehabilitation, and also deafness, to some extent.

## Methodology

### Ethics

Prior to the commencement, the study was approved by the Institutional Ethics Committee, to carry out the proposed research work at Jawaharlal Nehru Medical College and Acharya Vinoba Bhave Rural Hospital, Sawangi (Meghe), Wardha. [Letter no. - DMIMS (DU)/IEC/2019/8002].

### Study design

Cross-sectional study.

### Study population

50 deaf–mute children attending special schools, between 3-18 years of age.

### Study period

From May 2019–July 2019.

### Selection criteria

All children admitted to special school for deaf and dumb in and around Wardha district, who use sign language, whose parents consented to participate in the study.

### Study settings

The study was conducted in the Department of Ear, Nose, and Throat (ENT) of Acharya Vinoba Bhave Rural Hospital, Sawangi (Meghe), Wardha, attached to Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha. The study participants included deaf–mute children attending special schools in and around Wardha district, in the age group of 3-18 years of age, given that whose parents are willing to give consent to participate in the study. Informed consent was taken from the parents regarding their questionnaire and examination of their child (Annexure-1). History taking and examination was done using the pre-designed proforma (Annexure-2). The data were statistically organized.

Fifty subjects were studied over the period of 2 months. For data collection of the sample, complete birth history including prenatal, perinatal, and postnatal history was noted to find out various exogenous congenital risk factors of deafness and history regarding previous illness, treatment, immunization, and accident was noted. A detailed history was elicited including demographic parameters like religion, occupation, income, and education. Thorough otorhinolaryngologic clinical examination was carried out with special attention to branchial arch anomalies and BERA was done to evaluate the deafness in individual and appropriate response in mentioned. In cases of children having deafness with other associated anomalies, mental retardation, cardiac diseases, and syndromes, pediatric consultation was obtained to confirm the syndrome related to hearing loss. A detailed systemic examination was carried out. Detailed workup of an individual case was carried out when the family members were also suffering from deafness, they were interviewed to search for genetic associations. All the details were rerecorded in pretested, semi-structured, paper-based questionnaire. For data compilation and analysis, Microsoft Excel was used.

### BERA

The ABR protocol consists of testing each ear at 110, 100, 90, 80, 70, 60, 50, and 40 dB HL. An infant was considered to have passed the ABR test if a replicable wave V response was present at 40 dB HL in both ears/each ear.

Monoaural auditory stimulus consisting of rarefaction clicks of 100  $\mu$ s) was delivered through electrically shielded earphones at the rate of 11.1/s. Responses to 2000 click presentation were averaged. The data were analyzed for identification of the type of hearing loss.

## Observation and Results

This study was conducted in the Department of ENT at Acharya Vinoba Bhave Research Hospital, Datta Meghe Institute of Medical Sciences (Deemed University) Sawangi (Meghe) Wardha, Maharashtra, India, and the questionnaire was answered by parents of 50 willing participants from deaf and dumb schools in Wardha district. BERA as a screening modality for hearing

loss (HL) in children was evaluated and the analysis of the questionnaire was prepared to study the extent of hearing loss and to determine the factors causing deafness and additional factors causing mutism in children of rural central India.

## BERA

In all 50 participants, it was seen as an absence of wave Vth formation at 110 dB, implying profound sensorineural hearing loss.

On evaluating the questionnaire, the following observations were seen.

### I. Sociodemographic

In this study, out of 50 participants, 24 (48%) were males and 26 (52%) were females. Thirty-three (66%) of the head of the family had completed middle school and 17 (34%) had studied till high school. Thirty (60%) belonged to a farming family and 20 (40%) belonged to laborer's family [Table 1].

### II. Risk factors for deafness

In this study, in the antenatal period, the use of an ototoxic drug (6%) followed by infection to mother (2%) were the most common risk factors.

In perinatal/intranatal period birth asphyxia (10%), followed by prolonged or obstructed labor (8%) were the most common risk factors.

In the postnatal period, neonatal septicemia (16%), prematurity (14%), low birth weight (12%), history of fever (6%), hyperbilirubinemia (4%), exposure to ototoxic drugs and neonatal meningitis (2%) were the common risk factors for hearing impairment.

In social history, 10% had a history of consanguineous marriage and 6% had positive sibling history.

And no identifiable risk factor was seen in 2% of participants, suggesting mutation [Table 2].

A total of 88% of students gave a history of delayed milestones, implying defects in other aspects of growth and development.

### III. Additional factors for mutism

In this study, 4 years (60%) was the most common age of the first consultation. Delayed responses by parents (88%) and misguidance by the doctors (12%) were the reasons for the late first consultation. Cochlear implant was advised to all 50 (100%) participants but none (0%) took the advice. Taking lightly (58%), financial constraint (32%), and inaccessibility to a proper facility (10%) were factors that led to a lack of proper treatment and eventual mutism of participants [Table 3].

**Table 1: Distribution of sociodemographic factors**

Factors	No. of Children	Percentage (%)	
Gender	Male	24	48
	Female	26	52
Education (Head of Family)	Middle School	33	66
	High School	17	34
Occupation (Head of Family)	Farmer	30	60
	Laborer	20	40

**Table 2: Distribution of risk factors causing deafness**

Risk Factors	No. of Children	Percentage (%)	
Antenatal	History of infection to mother	1	2
	History of use of ototoxic drugs by the mother during pregnancy	3	6
	Low Apgar score (birth asphyxia)	5	10
Perinatal/ Intranatal	Prolonged/obstructed labor	4	8
	LBW for GA	6	12
	Prematurity	7	14
Postnatal	Neonatal septicemia	8	16
	Neonatal meningitis	1	2
	Hyperbilirubinemia	2	4
	Ototoxic medications	1	2
	History of fever	3	6
Social	History of Consanguineous Marriage	5	10
	Sibling history	3	6
No identifiable risk factor	1	2	
Total	50	100	

## Discussion

Hearing loss in children constitutes a considerable handicap because it is an invisible disability and compromises the optimal and personal achievement of a child. If the diagnosis is delayed by 24 to 36 months of age, which is common in the rural and illiterate population, after this age even rehabilitation procedures (like hearing aids, cochlear implant, speech therapy, psychological intervention on the family) are unable to ensure complete development of speech, thus preventing the full participation of a deaf child in social living. Outcomes in various domains of children like communication skills, education, behavior, family interaction, psychological health and quality of life can be improved if intervention is done in the first 6 months of life for the ones with moderate or greater permanent bilateral hearing loss.<sup>[9]</sup> Moreover, patients who managed with a cochlear implant at a younger age (<3 years) had a significantly better result than those treated later.<sup>[10]</sup> Pediatric HL is a major concern in India due to the high incidence of HL in this age, high birth rate, lack of facilities, and awareness for early diagnosis. According to the National Commission on Population 2010, over 25,000 children are born deaf every year in India. In about 30% of these children,

Table 3: Distribution of additional factors for mutism

Factors		No. of Children	Percentage (%)
Age at first consultation	2	10	20
	3	8	16
	4	30	60
	5	2	4
Reason for late first consultation	Waiting to start speaking	44	88
	Misguidance by doctor for late hearing assessment	6	12
Cochlear implant advised		50	100
Children being benefited with the hearing aid		0	0
	Taking Lightly	29	58
Why parents opted for special school over cochlear implant	Financial Constraint	16	32
	Inaccessibility	5	10

parents are not aware of deafness.<sup>[11-13]</sup> According to a study by Suniti Chakrabarti *et al.*, the estimated prevalence of profound sensorineural loss is 0.58 per 1000 children.<sup>[14]</sup>

To ensure timely therapy, a goal is to establish the diagnosis of severe neonatal hearing impairment before 6 months.<sup>[15-16]</sup> The best process for identification of deafness is neonatal hearing screening. If all newborns could not be screened due to infrastructural problems, then at least high-risk newborns must be screened. However, 50% of children with moderate to profound congenital hearing loss exhibit no risk factors for hearing loss.<sup>[17]</sup> With the ever-growing number of candidates for hearing screening, especially in a country like India, due to a high birth rate, there is a need for screening modality for hearing assessment, which is reliable, but at the same time requires less time and expertise.

BERA though time-consuming is an accurate test for early detection of neural conduction irregularities in the auditory pathway. It gives an estimate of degree and type of hearing impairment. It helps to find the cause of delayed speech. In this study, all students were suffering from profound sensorineural hearing loss, supporting the fact of their late detection, counseling, and subsequently causing mutism.

As seen in this study, septicemia, prematurity, low birth weight, and birth asphyxia counts for the most common risk factors for deafness and consanguinity makes the most common risk factor in social cases. These results are in contrast to studies by Apurva Pawade *et al.*, PM Hippargekar *et al.*, Shalzy MK *et al.*, and Minja BM *et al.*, which recorded hyperbilirubinemia and pneumonia, meningitis, and ototoxicity as major factors of deafness. Thus, implying the diversity in regions, countries, and cultures. Our study depicted the scenario in rural central India in contrast to the abovementioned ones in the northern region and in Alexandria and Tanzania.<sup>[18-20]</sup>

The average age of detection of hearing loss as seen in this study is 3.48 years, which is in relation to studies done by PM Hippargekar *et al.*, Shalzy MK *et al.*, and in contrast to the study by Col RS Bhaduria *et al.*, where they concluded average age of detection of hearing loss as 2.8 years. This signifies different

approaches of the region and overall lack of awareness and concern regarding the early ENT examination and sensitization of doctors regarding the aspect of hearing loss.<sup>[18-20]</sup>

One of the major causes of mutism in this study corresponds to lack of appropriate guidance by the medical authorities as was mentioned by parents in the questionnaire that even tertiary level centers failed to guide them properly and lead to a significant delay in diagnosis of hearing loss and eventual mutism of individual. It depicts the lag in the governmental scheme against hearing loss and the lack of professional approach to medical authorities with respect to the aspect of ENT examination.

Also, lack of awareness and education about the risk factors of deafness to parents caused a huge hesitation in the approach of parents in regards to their child's lack of response to sound commands. There's a need to provide a nationwide education and awareness in this matter.

And financial constraint and inaccessibility form the major causes for not opting for the cochlear implant by the parents therefore the government must aim at providing these facilities more transparently to these affected populations effectively.

- Hearing impairment is an invisible handicap and hence its effects are not visible to others, so deafness in a child often goes unnoticed
- Septicaemia, prematurity, low birth weight and birth asphyxia count for the most common risk factors for deafness and consanguinity make the most common risk factor in social cases
- Study has attempted to find out risk factors for deafness and additional risk factors for mutism, which include lack of appropriate guidance by the medical authorities, at even tertiary level centers, leading to a significant delay in diagnosis of hearing loss
- Financial constraint and inaccessibility form the major causes for not opting for the cochlear implant by the parents
- The study highlights the need for good obstetric care, health education regarding risk factors for deafness, important being consanguinity, early hearing screening in infants, and rehabilitation in the perilingual period.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

## References

1. Col RB, Col SN, Pal DK. A survey of deaf mutes. *Med J Armed Forces India* 2007;63:29-32.
2. Jen PH, Sun XD. Influence of monaural plugging on postnatal development of auditory spatial sensitivity of inferior collicular neurons of the big brown bat, *Eptesicus fuscus*. *Chin J Physiol* 1990;33:231-46.
3. Martínez-Pérez B, De La Torre-Díez I, López-Coronado M. Mobile health applications for the most prevalent conditions by the World Health Organization: review and analysis. *J Med Internet Res* 2013;15:e120.
4. Varshney S. Deafness in india. *Ind J Otol* 2016;22:73.
5. Joint Committee on Infant Hearing. Year 2007 position statement: Principles and guidelines for early hearing detection and intervention programs. *Pediatrics* 2007;120:898-921.
6. Aiyer RG, Parikh B. Evaluation of auditory brainstem responses for hearing screening of high-risk infants. *Indian J Otolaryngol Head Neck Surg* 2009;61:47-53.
7. Tin W, Lin Z, Swe-, Mya NK. Deaf mute or Deaf. *AJMBR*. 2017;3:10-9.
8. Kumar S. Deafness and its prevention—Indian scenario. *Indian J Pediatr* 1997;64:801-9.
9. Satish HS, Kumar RA, Viswanatha B. Screening of newborn hearing at a tertiary care hospital in South India. *Indian J Otolaryngol Head Neck Surg* 2019;71:1383-90.
10. Jallu AS, Hussain T, Hamid WU, Pampori RA. Prelingual deafness: An overview of treatment outcome. *Indian J Otolaryngol Head Neck Surg* 2019;71:1078-89.
11. Nagapoornima P, Ramesh A, Rao S, Patricia PL, Gore M, Dominic M. Universal hearing screening. *Indian J Pediatr* 2007;74:545-9.
12. Ross DS, Dollard SC, Victor M, Sumartojo E, Cannon MJ. The epidemiology and prevention of congenital cytomegalovirus infection and disease: Activities of the Centers for Disease Control and Prevention Workgroup. *J Womens Health* 2006;15:224-9.
13. Ho PT, Keller JL, Berg AL, Cargan AL, Haddad J Jr. Pervasive developmental delay in children presenting as possible hearing loss. *Laryngoscope* 1999;109:129-35.
14. Chakrabarti S, Ghosh N. Prevalence of severe and profound sensorineural hearing loss in school children in West Bengal, India. *Indian J Otolaryngol Head Neck Surg* 2019;71(Suppl 2):1099-106.
15. Homer JJ, Linney SL, Strachan DR. Neonatal hearing screening using the auditory brainstem response. *Clin Otolaryngol Allied Sci* 2000;25:66-70.
16. Shehata-Dieler WE, Dieler R, Keim R, Finkenzeller P, Dietl J, Helms J. Universal hearing screening of newborn infants with the BERA-phone. *Laryngorhinootologie* 2000;79:69-76.
17. White KR. Universal newborn hearing screening using transient evoked otoacoustic emissions: Past, present, and future. *Semin Hear* 1996;17:171-82.
18. Pawde A, Chaurpagar R, Aggarwal S, Agarwal A, Dabhekar S. A cross sectional study of clinical profile of deaf mute children at tertiary care center. *Int J Otorhinolaryngol Head Neck Surg* 2017;3:826.
19. Hippargekar PM, Garad K. Factors Associated With Delayed Detection Of Profound SNHL in Rural Children. 2017.
20. Shazly MK, Kamel NM, Hassanein MH, Salama OE, Nawar NM. Risk factors related to deaf-mutism among pupils attending the Alexandria governmental deaf-mute schools. *J Egypt Public Health Assoc* 1995;70:381-95.

## Annexure-1: Informed Consent Form

### Department Of Ear, Nose and Throat

I.....Age.....Sex.....and resident of..... render this Consent in full sanity without any compulsion of any kind. I have been explained by Doctor, Department of Ear, Nose and Throat in detail in my own language regarding the procedure in well advance. I am fully aware of the facilities available in this institute, which has been frankly told to me by staff of this department. I understand the procedure and am willing to undertake the questionnaire and also the examination for my child.

Identification mark:-

WITNESS: -

NAME:-

SIGNATURE OR THUMB IMPRESSION

DATE:-

TIME:-

PLACE:-

SIGNED IN THE PRESENCE OF DOCTOR/NURSE.

....., जिल्हा ....., चेहऱ्याची .....वर्षवयोगटातील“name of the topic” प्रबंधसाठी.....तामदतकरण्याससहमतआहे. प्रक्रियामलामाझ्याभाषेतसमजवून, माझ्यादृष्टीनेमलास्पष्टकेलीआहे. मीयेथेमाझ्यासंमतीनेयाअभ्यासातसंपूर्णसमर्थनदेण्याचेवचनदेतआहे.

नातेवाईक/रुग्ण:

दनांक:

अंगठ्याचाछापा / स्वाक्षरी

**Note:** This written informed consent was taken in patients own language.

## Annexure-2: Questionnaire

### Socio-demographic characteristics

- Sex (male, female)
- Age (in years or the date of birth).

### In regards to the head of family:-

- Education level (years of education they have completed)
- Employment status/Occupation of father (not working-not seeking work, paid work, unemployed-seeking work, looking after the house/family, soldier/student, retired)
- Income (Monthly)
- Knowledge regarding hearing milestones (yes, no)
- History of consanguineous marriage.

### Use of health services

- Is there functioning health service available (yes, no)
- Is functioning health service easily accessible (yes, no)
- Did you visit the doctor during pregnancy regularly (yes, no)
- Use of medicines - Use of different health services.
- Have you been hospitalized during the last years – Hospitalization
- Did you consult any doctor for hearing impairment or speech problem of the child (yes, no)
- What was the advice of the doctor –
- Why was the advice not followed –

### Physical health and Functioning Status

#### Birth History of child:

- Mother registered (Yes/No)
- Delivery at (home or hospital)
- Mode of delivery (Normal/CS/Forceps)
- History of prolonged labor (Yes/No)
- H/o hyperbilirubinemia at birth (yes [put level]/no)
- H/o prematurity (gestational age < 37 weeks) (yes/no)
- H/o low birth weight (<1.5 kgs) (yes/no)
- H/o neonatal septicemia or fever at birth (yes/no)
- Any condition requiring NICU admission (yes/no)
- Meconium stained fluid (yes/no)
- Baby cried immediately after birth or not (birth asphyxia – Apgar score).

#### Antenatal

- H/o fever or rash in mother to rule out in utero infections such as rubella, cytomegalovirus, herpes, toxoplasmosis, syphilis.
- H/O use of ototoxic drugs by the mother during pregnancy (yes/no)
- H/O excessive intake of alcohol by the mother during pregnancy (yes/no)
- H/o Multiple pregnancies (yes/no)
- H/o Eclampsia in mother (yes/no)
- H/o Systemic disease in mothers like diabetes mellitus, hypothyroidism, and hypertension.
- Previous h/o stillbirth (yes/no).

#### Perinatal:

- H/O prolonged/hazardous labor (yes/no)

- Was the delivery normal and if not what were the problems encountered
- Any illness that necessitated admission of the child in a neonatal (yes/no)
- Intensive care unit (NICU) immediately after birth (yes/no)
- Birth weight of the baby below 1500 Gm (yes/no)
- Apgar score below 4 at 1 min or 6 at 5 min after birth.

**Postnatal:**

- Any illness requiring hospitalization for 48 hours or more in the first 4 weeks of birth (yes/no)
- H/o receiving ototoxic drugs by child (yes/no)
- H/o fever with altered sensorium (to rule out bacterial or tubercular meningitis) (yes/no)
- Any other history of high-grade fever (to rule out typhoid, mumps, measles, other viral fever associated with hearing loss) (yes/no)
- H/o delayed milestones (motor and language milestones) (yes/no)
- Any recognizable syndrome at birth where hearing loss is a known component of a syndrome like down syndrome etc., (yes/no)
- Presences of any craniofacial anomalies of the pinna and the ear-canal (yes/no).

**Other questions related to deaf-mutism:-**

1. Was the deafness present at Birth or did it occur later?
2. What was the age of mother at the birth of deaf-mute child?
3. Was the deafness accompanied by any other disability?
4. Was there a family history?
5. At what age was the deafness detected?
6. At what age did the child get a hearing aid?
7. Did the child benefit from the hearing aid?

Had any counseling been given regarding the next child?