

SCHOOL SCREENING REPORT ON COMMUNICATION DISORDERS:

At-risk prevalence rate of Hearing and Speech-Language disorders in school children

Report: 2008 - 2020

DEPARTMENT OF PREVENTION OF COMMUNICATION DISORDERS

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A Publication of the Department of Prevention of Communication Disorders

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FOREWORD

With the motto to reach people directly and facilitate prevention of communication disorders, the Department of Prevention of Communication Disorders (POCD) at AIISH majorly focuses on creating awareness, early identification and management of individuals with communication disorders. The department has contributed immensely to the epidemiological aspects of communication disorders in India through research and has publications in national and international journals.

As a part of secondary prevention activities, the department of POCD has been conducting School screening program since 2008. Many prevalence studies on communication disorders in school children have reported significantly higher percentage (around 15%) prevalence rates. In addition, impact of communication disorders on children is not less than a '*looming epidemic*' owing to its widespread effects. Communication disorder in a child can result in scholastic backwardness along with poor cognitive skills. Further, it can impact child's social interaction and even psychological wellbeing. Moreover "*today's children are tomorrow's future*". Hence, we consider school screening program as one of the key activities of the department which enables early identification and thus early rehabilitation of children at risk for communication disorders.

I am happy to present a '*SCHOOL SCREENING REPORT ON COMMUNICATION DISORDERS: At-risk prevalence rate of Hearing and Speech-Language disorders in school children*'. It is an epidemiological report generated from the School screening programme by the Department of Prevention of Communication disorders between 2008 and 2020. In this report, the authors discuss various communication disorders, its occurrence in school children, and the importance of screening programs in school settings. Furthermore, the objectives of school screening programs, the protocol used, and the statistical outcome of the programme are reported. We seldom see statistical reports with large sample size in the literature. Hence the large amount of data considered is the highlight of this report.

I am confident that the readers will appreciate the work and gain a better understanding of communication disorders in school-aged children. This report was prepared by Dr.Sreedevi, Dr. Arunraj K., Dr. Vasantha Lakshmi M.S., Dr. Sandeep Maruthy, Ms. Spoorthi, T., Ms. Srividya S., and Ms. Ankita S. They have worked extremely hard in compiling the data, verifying it, analysing it, and writing this report. Their contribution is sincerely acknowledged and appreciated. The unattended errors in print and references, if any, are regretted despite best efforts. This volume, like all AIISH in-house publications, will be uploaded to the AIISH digital library portal for use by all. You may please visit our website: www.aiishmysore.in for the same.

Dr. Pusphavathi M
Director & Publisher

All India Institute of Speech and Hearing, Mysuru

The All India Institute of Speech and Hearing (AIISH) is a pioneering national organisation dedicated to human resource development, research, clinical care, and public education in the field of communication disorders. The

Vision:

To be a world-class institute for human resource development, conducting need-based research, striving for excellence in clinical services, creating awareness and public education in the field of communication disorders.

Mission:

To promote, sustain and provide globally-competitive, ethically sound human resource, quality education, original research, clinical services and public awareness in the field of communication disorders.

Key Objectives:

The major objectives of the institute are to impart professional training, render clinical services, conduct research and educate the public on issues related to communication disorders such as hearing impairment, intellectual disability, voice disorders, fluency disorders, phonological and language disorders.

Functions and Duties:

a. Develop manpower in the field of speech and hearing and related areas throughout the country. b. Conduct basic and applied research in the field of communication disorders c. Offer clinical care on communication disorders. d. Provide public education on prevention of communication disorders.

Accomplishments:

- College with Potential for Excellence by University Grants Commission
- Centre for Advanced Research by University Grants Commission, Govt. of India Science & Technology Institute by the Department of Science and Technology, Govt. of India
- Centre of Excellence in the area of deafness by World Health Organization
- Nodal Centre for Implementation of Prevention and Control of Deafness by Ministry of Health & Family Welfare, Govt. of India
- Centre of Excellence by the Ministry of Health & Family Welfare, Govt. of India.
- 'A' Grade accreditation by the National Assessment and Accreditation Council, University Grants Commission, Govt. of India
- Collaborative Organization for the Rashtriya Bal SwasthyaKaryakram (RBSK), a Govt. of India scheme under the Ministry of Health & Family Welfare.
- Member, World Hearing Forum, WHO

Department of Prevention of Communication Disorders

The Department of Prevention of Communication Disorders (POCD) is an outreach department that was established in 2008 at the All India Institute of Speech and Hearing, Mysuru with the goal of reaching out to people directly and facilitating the prevention of various communication disorders. The department primarily focuses on raising awareness about communication disorders, as well as on prevention, early detection, and management of people with communication disorders across all age groups.

Objectives of the department:

A. Public Education: *Primary Prevention* – Educating the public through sensitization/orientation programs/webinars thereby creating awareness on communication disorders among different sections of society.

B. *Clinical Services*

Secondary Prevention – Early identification and assessment of communication disorders through various screening and diagnostic procedures.

Tertiary Prevention – Early rehabilitation and management of communication disorders.

C. Research: *Epidemiological research*- The staff in the department are actively involved in conducting epidemiological research related to communication disorders.

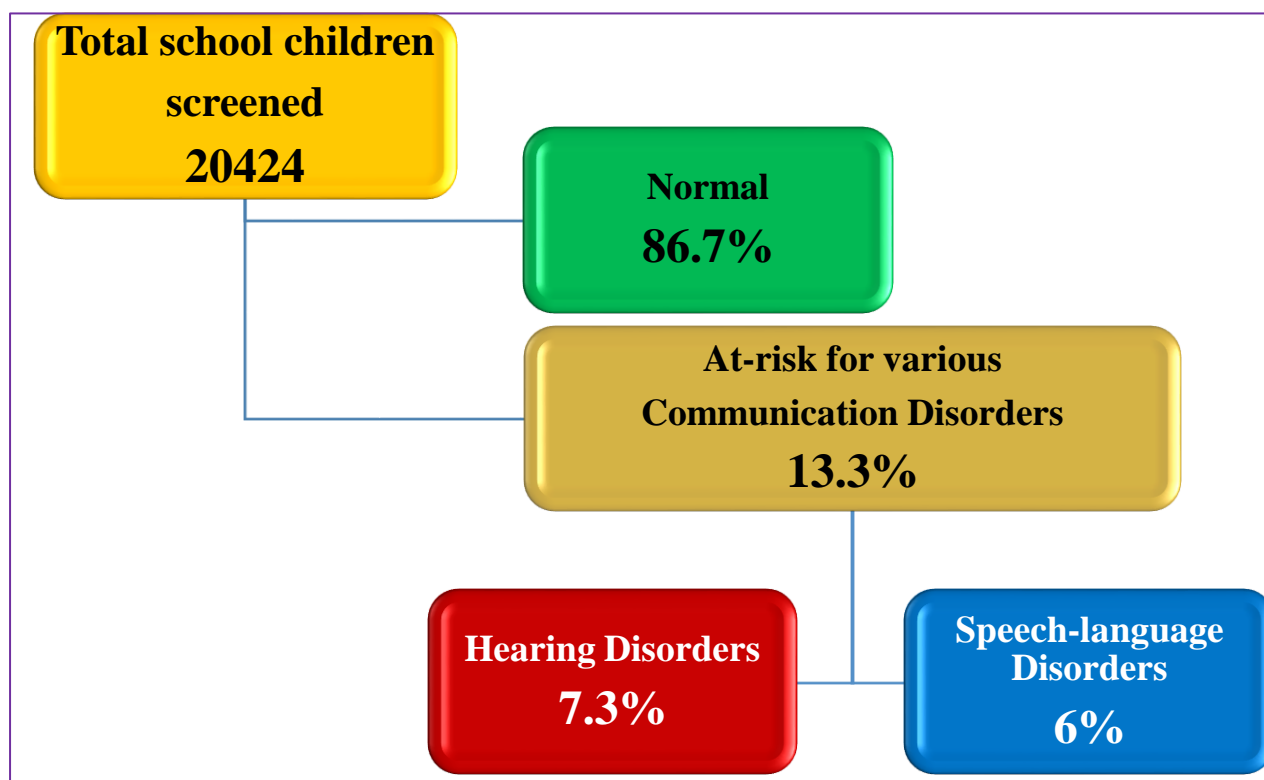
D. *Human Resource Development* - Out-reach clinical training of UG & PG students to prevent, early identify, diagnose & rehabilitate different communication disorders.

Major activities of the department:

The activities are majorly concentrated in and around AIISH as well as in extension centres (across states & rural areas) to meet the major objectives of prevention, early identification and rehabilitation of communication disorders. This include

1. New-born screening program
2. School Screening program
3. Industrial screening program
4. Elderly screening program
5. Bed-side screening for cognitive, communicative and swallowing disorders
6. Screening Camp
7. Diagnostic follow up and rehabilitation services
8. Extension centres – New-born screening centres and Outreach Service centres
9. Sensitization/Orientation Programs

REPORT OVERVIEW OF SCHOOL SCREENING PROGRAMME



Most common Hearing and Speech-language disorders identified in school children

Sl. No.	Disorders	Number of children at-risk per 1000
Hearing disorders		
1	Hearing loss	15
2	Middle ear problems	09
3	Both hearing loss and middle ear problems	49
Specific middle ear conditions		
1	Impacted wax	31
2	Otitis media	11
3	Tympanic membrane abnormalities	07
4	Eustachian tube dysfunction	05
Speech-language disorders		
1	Learning disability	25
2	Spoken language disorders (includes conditions due to Cerebral palsy and Intellectual disability)	15
3	Fluency disorder	10
4	Speech sound disorders (includes Cleft lip and palate)	08
5	Voice disorder	02

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Section 1

COMMUNICATION DISORDERS

Communication is the active process of exchanging information, thoughts, desires and ideas. The development of speech, language and hearing components are most essential for verbal communication. The speech, language and hearing components evolve from childhood through puberty in a progressive hierarchical stage. These skills develop rapidly in early stage of development and later slowdown in school age years. Any interruption in the normal development of these components will lead to communication disorders.

Communication disorders can manifest in the hearing, language, and/or speech processes. It can be congenital (i.e. since birth) or acquired in nature. Disorders can range from mild to profound in severity depending on the complexity of the impairment. These disorders are attributed to factors such as genetic factors, sensory-motor issues, environmental factors, emotional concerns, socio-economic factors etc. The communication disorders can result in a primary disability, or it may be secondary to other disabilities. For instance, speech and language disorders can occur secondary to hearing disorders, intellectual disability etc.

Communication skills develop in a child from birth. It is essential for children's learning, interaction with others, and even while playing. Communication disorders can have an impact on a child's academic performance, social skills, psychological well-being, and even cognitive abilities. A child's poor academic performance can include issues with reading, writing, spelling, grammar, and arithmetic skills, among other things. Raghavendra and Reddy (2020) investigated potential risk factors for scholastic backwardness in children and discovered communication disorders as a key risk factor. According to some reports, delaying the diagnosis of certain middle ear conditions, such as recurrent otitis media, causes auditory deprivation, which may lead to Central Auditory Processing Disorder (Bahader, 2019). Further, it can lead to reading and writing difficulties and poor academic performance of children.

If communication disorders go undiagnosed, they can seriously impact peer relationships and personality development, resulting in psychological problems. Even conditions like stuttering and vocal abuse in school-aged children have been shown to

impact their self-esteem and social performance (Berchiatti et al., 2020; Campano et al., 2021; Eggers et al., 2021). As a result, early detection and treatment of communication disorders is crucial for a child's normal development of academic skills, cognitive skills, social skills, and even psychological well-being. There is a plethora of evidence highlighting the positive outcomes and benefits of early detection and intervention (Kennedy et al., 2006; Yoshinaga-Itano et al., 2018; Ching et al., 2017).

Many programmes have been implemented around the world to achieve this goal (Maas, 2000; Wroblewska-Seniuk et al., 2017). Screening program refers to the procedure used to identify individuals at risk for the disorder in the chosen population based on a set of criteria and protocols. Screening programmes are mandated by law in various countries, and some have adopted it to serve the purpose (Skarżyński & Piotrowska, 2012). A screening programme typically consists of an assessment checklist and simple test batteries. Depending on the population being tested, various types of screening are performed, School Screening being a significant one among them.

1.1. School screening program and its importance

School screening, according to the American Speech and Hearing Association (ASHA), is an important tool for identifying children at risk for communication disorders. School screening falls under the category of secondary prevention, which focuses on early detection and thus effective rehabilitation of the disorder. Another goal of this programme could be to educate teachers and children about the prevention of communication disorders. School screening programmes have grown in popularity in recent decades owing to the research reports on incidence and prevalence of communication disorders in children.

School screening programmes for communication disorders typically include children in all grades (Kindergarten through High School). Various audiological and speech-language tests are used to identify the communication disorders. The pass or refer status of a screened children are determined using a set of protocols and predefined criteria. As a result, children who are suffering from or at risk of developing a disorder are identified, and appropriate measures are implemented. Thereby, children suffering from a disorder or at risk of disorder, who require comprehensive assessment, are identified and suitable measures are taken accordingly.

There is no uniform protocol and criteria followed globally. Programs are designed to meet the needs of specific regions. The European consensus emphasises the importance of mandatory entry-level audiological and speech-language screening for all children admitted to school, as well as the need for the same whenever a problem is reported (Skaryski & Piotrowska, 2012). The World Health Organization recently published a report on school screening. According to the report, every child should be screened at entry, kindergarten, and at school grades of 1, 2, 3, 7 and 11.

Many studies in literature have highlighted the importance of school screening program. Stanton-Chapman et al. (2002) suggested that children should be screened to identify developmental disabilities. Concerning hearing impairment, the New-born screening program emphasizes on screening all the new-born babies before 1 month of age for identification of communication disorders. However, due to a lack of sufficient manpower, infrastructure, and other resources in developing countries such as India, many new-borns are not screened. As a result, they may be at risk for a communication disorder in future. In such conditions preschool and school are the places where a large number of children can be screened, including those who may have missed the new-born screening.

There have been studies that show an increase in the incidence of late-onset hearing loss and many middle ear disorders such as otitis media in school-aged children (Barreira-Nielsen et al., 2016; Fitzpatrick, Al-Essa, et al., 2017). Usually conditions like late onset hearing loss, Unilateral hearing loss and Bilateral mild hearing loss goes undetected. In such cases, school screening becomes an important tool for identifying those children, monitoring them, and recommending further comprehensive evaluation. Fitzpatrick et al. (2017) discovered that a significant number of children had late-onset, acquired, or late-identified hearing loss while researching the characteristics of children with hearing loss at school. As a result, long-term post-neonatal monitoring is required to ensure proper rehabilitation and meet optimal amplification needs (Fitzpatrick et al., 2020). This can be achieved by monitoring children at their school via screening programs.

1.2. School screening for communication disorders in India

Many school screening programmes for communication disorders have been implemented in India over the last few decades. When carefully reviewing the

programmes, it is clear that they were constantly upgraded in terms of the protocol used and even the pass-fail criteria used over time. Indeed, in recent years, efforts have been made to assess the feasibility of using tele-practice to conduct school screening programmes (Raman et al., 2019). There are numerous epidemiological studies in the literature that discuss the distribution of children at risk for communication disorders who are identified through school screening programmes.

In the year 2015, the Department of Prevention of communication disorder of AIISH, Mysuru released its first report on distribution of communication disorders in children. Data from a total of 2010 children were studied by Arunraj et al., (2016). The overall prevalence of children at risk for communication disorders was found to be 14.2%. Language, speech, hearing, and multiple disorders were found to have a prevalence of 6.9 percent, 3.7 percent, 3.4 percent, and 0.3 percent, respectively. Similar percentage is also reported by Shanbal, Arunraj and Reddy (2015)

Sharma et al. (2019) investigated the prevalence of hearing loss in school-aged children aged 8 to 14 in Jodhpur, Rajasthan. 140 children out of 1200 were found to have hearing loss. Saini et al. (2020) investigated the prevalence of hearing disorders among school-aged children in Dehradun's rural areas. A total of 1003 children were screened, and the prevalence of hearing disorders was found to be 19.6%. The majority of children with hearing disorders had conductive hearing loss, with the majority of them having a mild degree of hearing loss. The most common condition (79.2%) was ear wax, followed by middle ear infections, i.e. Chronic suppurative otitis media (CSOM).

Varsha et al. conducted a study on school children from 22 schools in Chengalpettu district, Tamil Nadu state, in 2020. A total of 1453 children were identified as being at risk for communication disorders. Ravi et al. (2021) studied 2304 school children (aged 6 to 16 years) from rural areas of Ballari district in Karnataka. They found a 4.29 % overall prevalence of communication disorders, 3.25% being hearing disorders, and 1.04%, speech-language disorders.

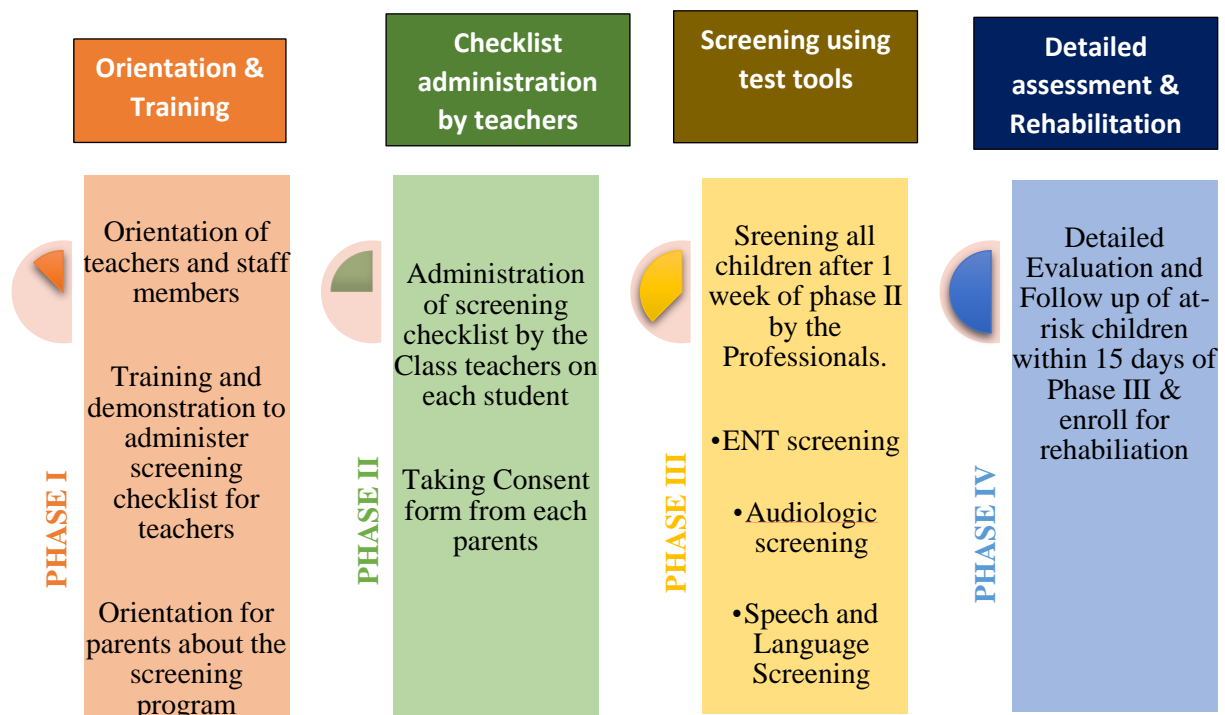
Section 2

SCHOOL SCREENING PROGRAMME OF AIISH

The goal of the school screening programme is to identify children at-risk for communication disorders, assess them in detail, and enrol them in rehabilitation if they are found to have communication disorders.

2.1. School Screening Protocol

The department of Prevention of Communication Disorders at AIISH have been conducting school screening program for the last fourteen years. A systematic four phase protocol is followed, as indicated below:



Phase I: Orientation and Training

All the teachers in the schools will be oriented regarding the various communication disorders especially that are prevalent in school children and school teachers. Followed by which the administration procedure of 'Screening Checklist on hearing and Speech and Language disorders' will be demonstrated. During the orientation programme, all

teachers will also be trained on teaching strategies for any child with a communication disorder, as well as classroom modifications and disorder-specific suggestions.



Orientation to School teachers on Communication Disorders

Phase II: Administration of screening checklist by Teachers

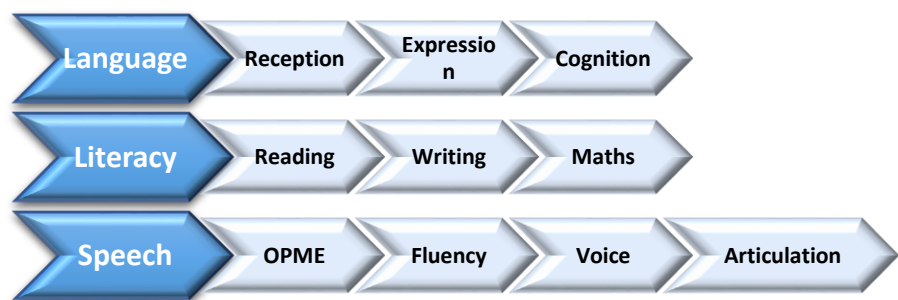
The screening checklist includes 14 questions covering Hearing, Speech, Language, Voice, and Fluency (Annexure 1). These questions will be administered to school children by their teachers in order to identify those who are at risk for communication disorders. This will ensure that teachers are able to identify schoolchildren who are at risk for any type of communication disorder and, as a result, will be able to provide additional care to the children.

Phase III: Administration of screening tests

After the completion of administration of Checklist by the school teachers (Phase II), Phase III will be implemented by conducting Screening test by the Professionals (Audiologist/ Speech-Language Pathologist and ENT specialist). Screening tests are administered in quiet, well-lit rooms within the school premises, using the calibrated equipment. Subjective calibration is performed on-site to ensure that noise levels are within acceptable limits.

This screening test was conducted on all school children regardless of the results of the screening checklist. The screening test consists of the following components:

ENT examination	ENT specialist examines the status of the ear nose and Throat, and provides clearance for further testing.
Hearing Screening	<p>Pure tone Audiometry - 4 frequencies (500 Hz, 1kHz, 2kHz and 4kHz) at fixed intensity of 25 dB HL. If the child hears in all the frequencies will be considered as 'PASS' while even if child did not respond for one frequency will be considered as 'REFER'.</p> <p>Tympanometry at 226 Hz probe tone. Child will be referred if: B or C type tympanogram; Tympanometric width >250 daPa for 3-12 years and >275 daPa for <3-year-old; Static compliance <0.2mmhos; Ear canal volume of >1.0cm³.</p> <p>Reflex measurements at 1000 Hz at 100 dB in Screening mode. Presence of Reflex - 'PASS'; Absence of reflex - 'REFER'.</p>
Speech and Language Screening	<p>Standardized Diagnostic test tools will be used in which certain critical questions that indicates any of the communication disorders are administered, i.e. Informal screening tests from the available Diagnostic test tool will be performed. Areas that are considered in the informal screening test are shown below:</p>





Ear Examination by an ENT Specialist



Hearing testing by an Audiologist

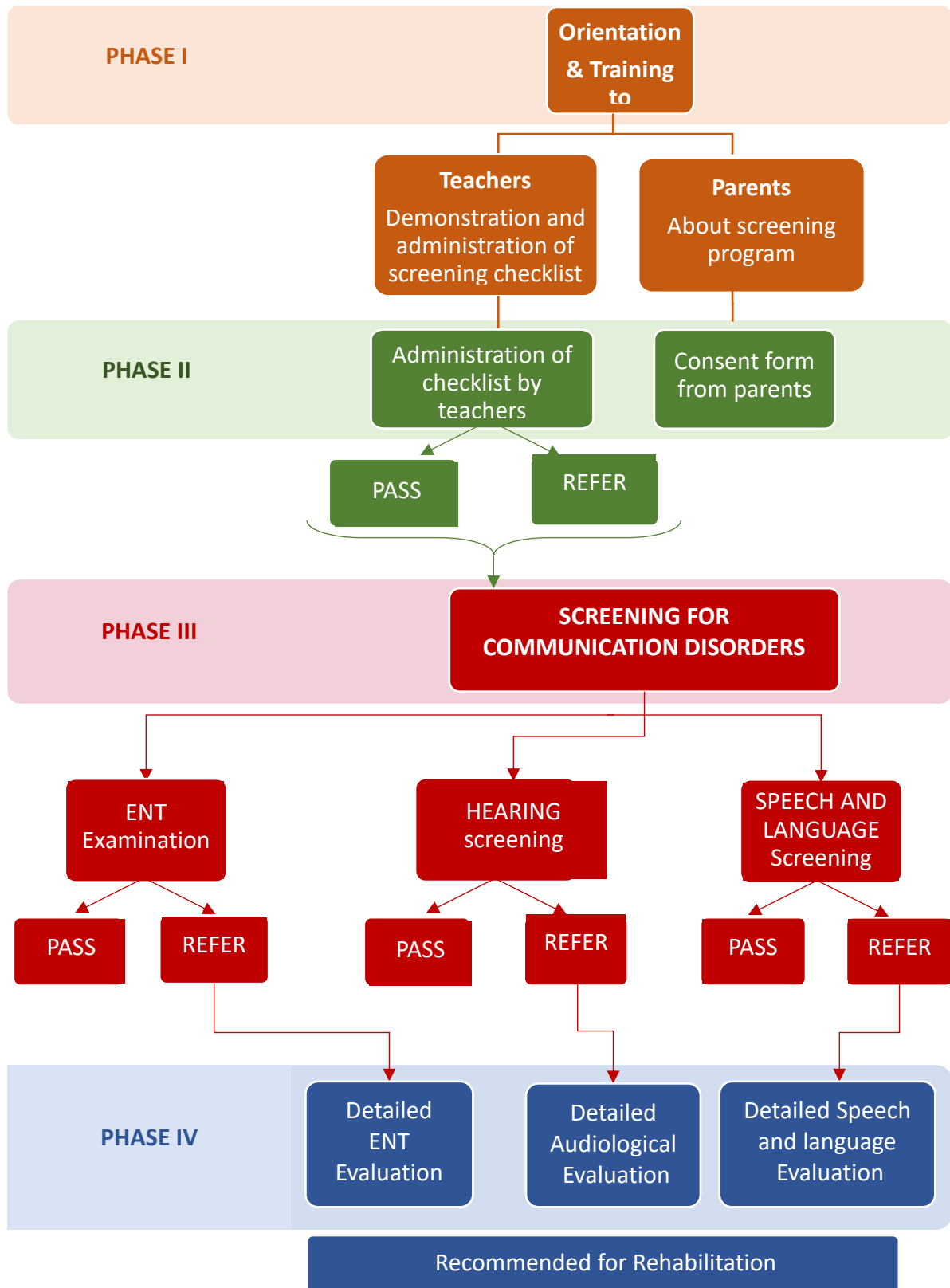


Examination of Speech and language Skills by an Speech-Language Pathologist

Phase IV: Detailed assessment and Rehabilitation

Those children identified as at-risk during the Phase III stage, i.e. professional-administered screening test, will be referred to AIISH, Mysuru or a nearby tertiary hospital for a comprehensive assessment and further rehabilitation. The results will be communicated to the headmasters, concerned class teachers, and parents, who will be encouraged to undergo further evaluation as soon as possible. Telephonic follow up is

made within a week is made to ensure that all of the children have received diagnostic testing. Flowchart below depicts the stages of school screening program.



Flowchart of different phases of School screening program

Section 3

ANALYSIS OF THE SCHOOL SCREENING DATA: 2008 TO 2020

The current report provides data of School screening carried out in and around different districts of Karnataka between the year 2008 and 2020. In this cross-sectional study, a total of 20,424 school going children (Boys - 10639; Girls - 9785) from Kindergarten to Pre-university were screened for Communication disorders. The sample for this study was comprised of a group of students enrolled in 137 government schools (10882 Children) and 48 Private schools (9542 Children). Table 1 depicts the demographic details of the school children.

Table 1. Demographic data of children participated in the study.

Type of School	Gender	Grades					Total Sample
		Kindergarten	Primary	Higher Primary	High School	Pre-University	
Government	Boys	551	1416	1727	1665	88	5447
	Girls	436	1517	1619	1806	57	5435
	Total	987	2933	3346	3471	145	10882
Private	Boys	1361	1570	1314	923	24	5192
	Girls	680	1438	1199	979	54	4350
	Total	2041	3008	2513	1902	78	9542
Total		3028	5941	5859	5373	223	20424

In the current report, school children who had undergone screening, i.e. Phase III stage were studied to determine the proportion of at-risk children for communication disorders, i.e. Hearing and Speech-Language disorders. The data was analysed based on gender (boys vs. girls), school type (public vs. private), and grade level (Kindergarten, Primary, Higher Primary, High school, Pre-University).

The data was tabulated and subjected to statistical analysis, using the Statistical Package for the Social Sciences (SPSS), version 26. Descriptive analysis was performed to study the distribution of communication disorders across gender, school type and grade level. The association between categorical variables was studied using the Pearson's Chi-square test of association and z test for comparison of column proportions using

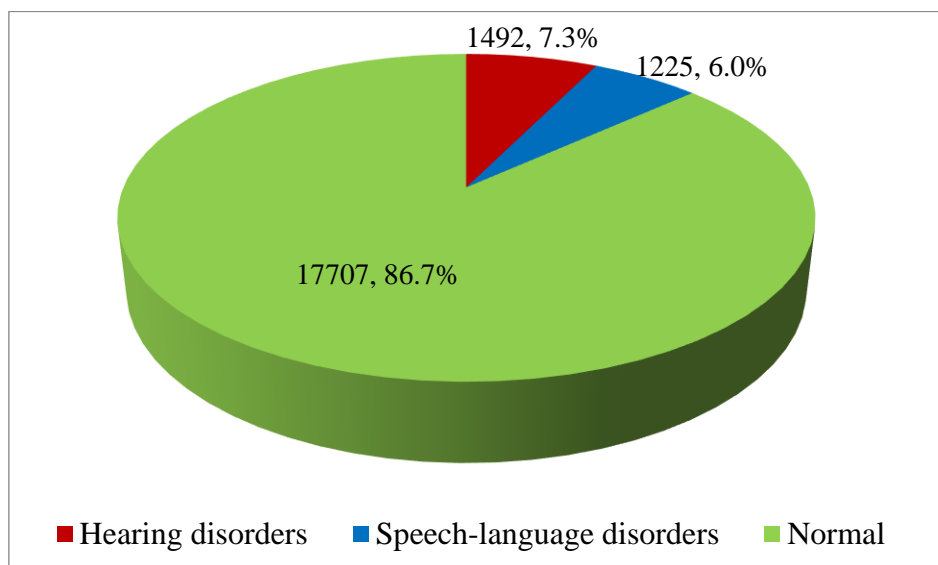
Bonferroni's adjusted p - values. Statistical results were interpreted at 0.05 level of significance.

Section 4

OUTCOME OF THE SCHOOL SCREENING DATA

The report presents the screening data of 20,424 school going children between the years 2008 and 2020. The data was analyzed to estimate communication disorders across gender, grades and type of schools. Among the total screened, 17707 (86.7%) school children passed the screening, while 2717 (13.3%) are at-risk of various communication disorders. These communication disorders include Hearing disorders and Speech-language disorders. The distribution of these communication disorders in school children are shown in Figure 1. Among those identified with at-risk, Hearing disorders (7.3%) are found to be higher followed by Speech-Language disorders (6.0%).

Figure 1: *Distribution of communication disorders in school children*



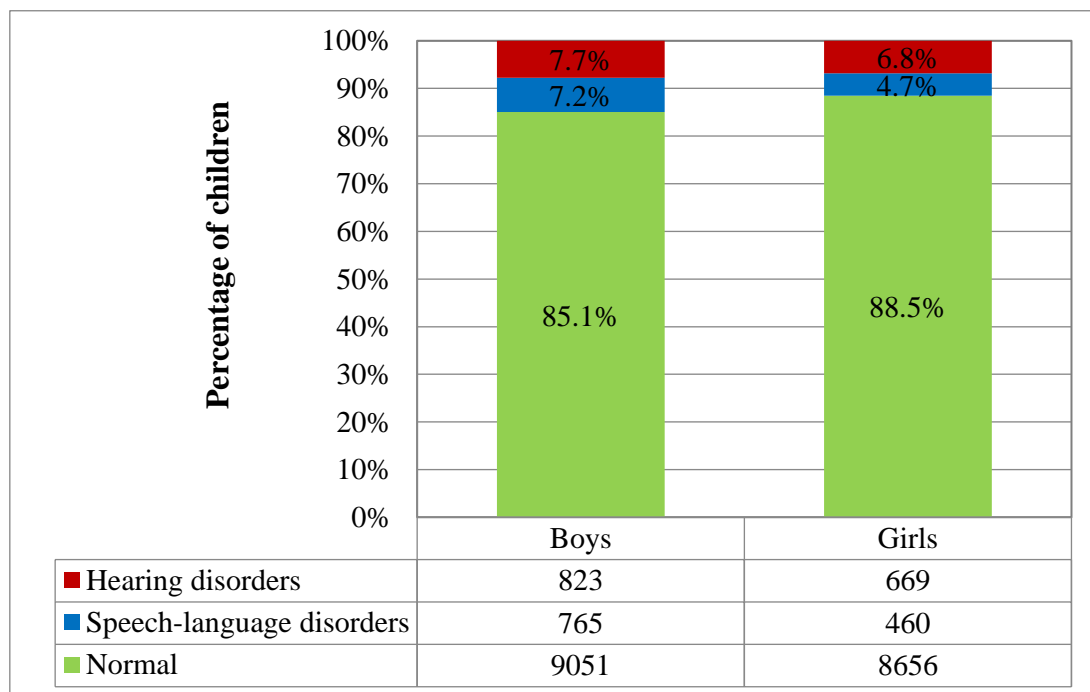
Further, statistical analysis was done to study the proportion of school going children at-risk for communication disorders across gender, type of schools and grades. The outcome of these conditions are delineated in the following sections.

4.1. Communication disorders and Gender:

Higher proportion of communication disorders in boys than girls

Figure 2 depicts the gender-wise distribution of school children at-risk for communication disorders. The proportion of individuals at-risk for communication disorders was found to be higher in boys (14.9%) than in girls (11.5%). Further, analysis between disorders revealed that boys had more proportion of at-risk individuals than girls in both hearing and speech-language disorders, with a notable difference in speech-language disorders.

Figure 2: *Distribution of communication disorders in school children between gender*



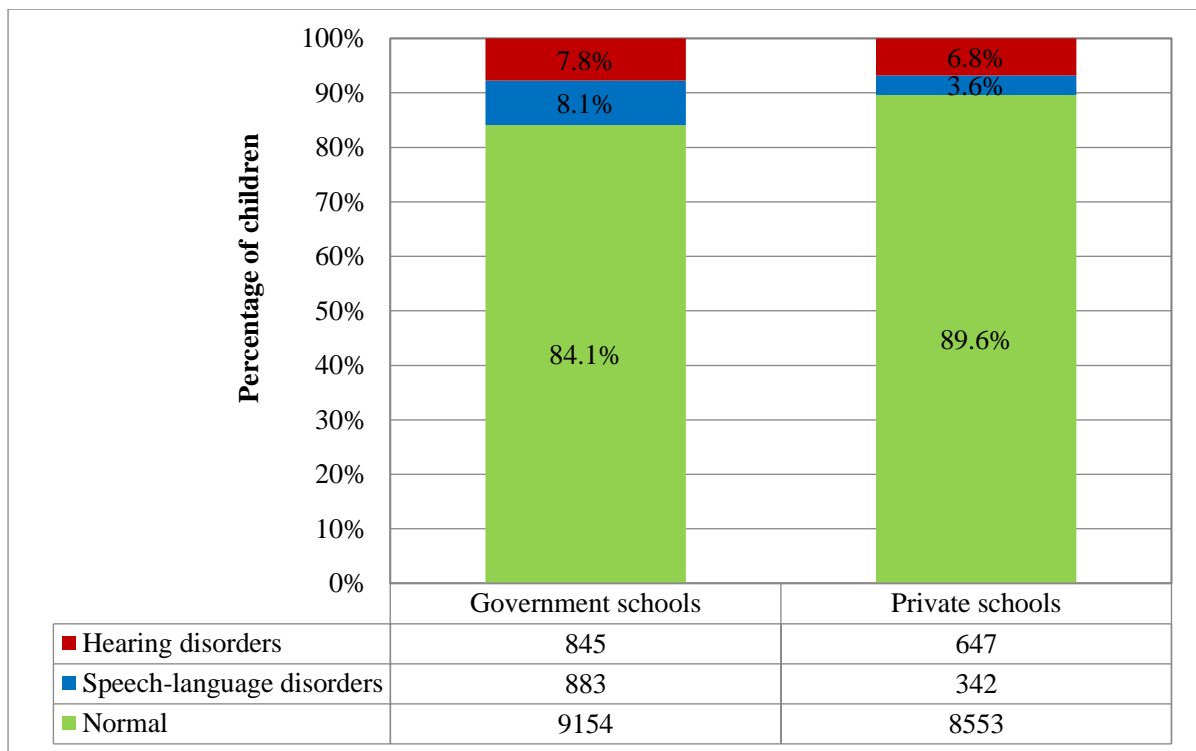
The Chi-square test of association was performed to check the association between the communication disorders and gender. Results showed a significant association between disorders and gender [$\chi^2 (2) = 65.051, p < 0.05$]. This was followed by the z test for comparison of column proportions using Bonferroni's adjusted *p*-values, which showed that the proportion of both hearing and speech-language disorders in boys was significantly higher compared to girls. This indicates that the risk for communication disorders is more in boys than in girls.

4.2 Communication disorders and Type of schools:

The proportion of children at-risk for communication disorders with respect to the type of schools, i.e. Government and Private is shown in Figure 3. Higher proportion of this was found in government schools (15.9%) than in private schools (10.4%). In comparison between the disorders, though both hearing and speech-language disorders were high in Government schools, the difference was more noticeable in speech-language disorders, as shown in Figure 3.

Higher proportion of children at-risk for communication disorders in Government schools than Private schools

Figure 3: *Distribution of communication disorders in school children between the type of schools*



The Chi-square test of association was administered to study the association between disorders and type of schools. Results showed a significant association between the two [$\chi^2 (2) = 198.537, p < 0.05$]. The z test for comparison of column proportions using Bonferroni's adjusted p - values, showed that the proportion of both hearing and speech-language disorders was significantly higher in Government schools compared to private schools.

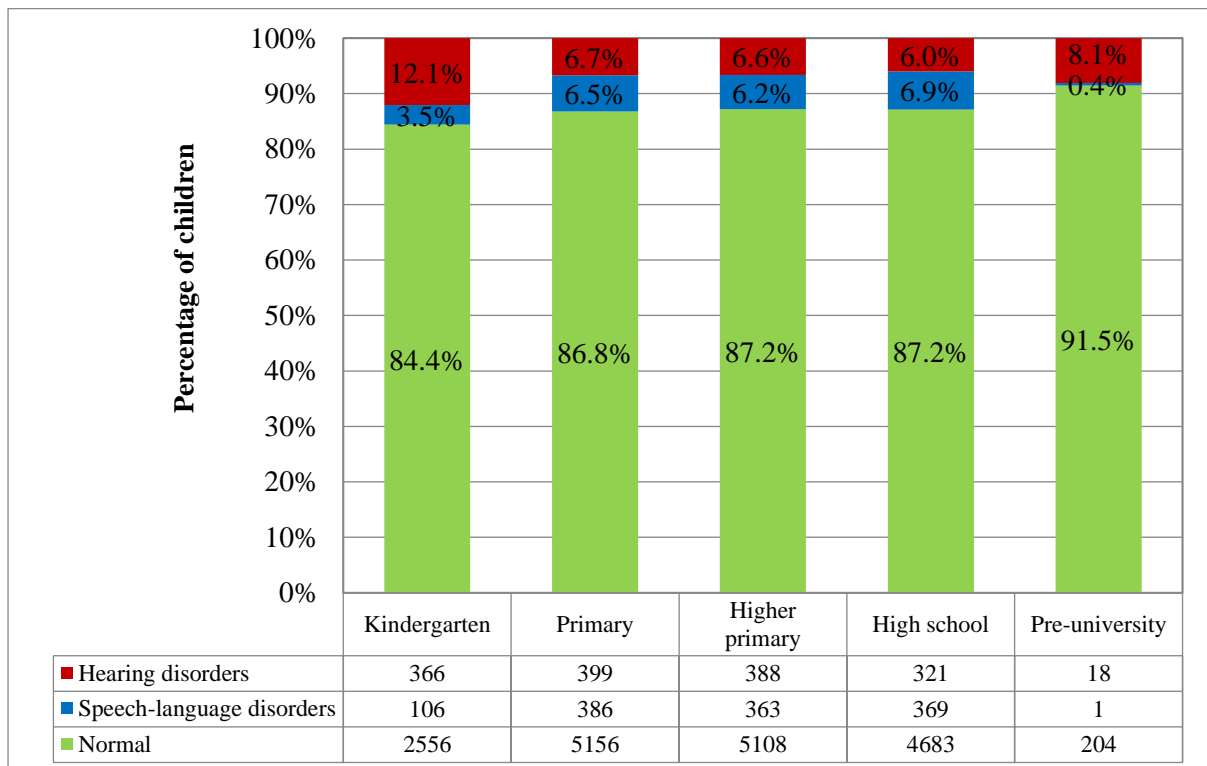
4.3 Communication disorders and Grades:

Proportion of children at-risk for communication disorders reduced as the grade level progressed

Analysis of at-risk for communication disorders among different grades showed higher percentage of communication disorders in Kindergartens' (15.6%). It was observed in the data that as the grade progressed to higher level, the proportion of children at-risk for communication disorders reduced, as shown in Figure 4.

The Chi-square test of association to studied the association between disorders and grade showed a significant association between the two [$\chi^2 (8) = 169.826, p < 0.05$]. The z test for comparison of column proportions using Bonferroni's adjusted p -values, showed that the proportion of hearing disorders was higher in Kindergarten followed by Pre-university compared to other three grades. Speech-language disorders identified were significantly more in primary, higher primary and high school compared to Kindergarten and Pre-university.

Figure 4: *Distribution of communication disorders in school children between Grades*



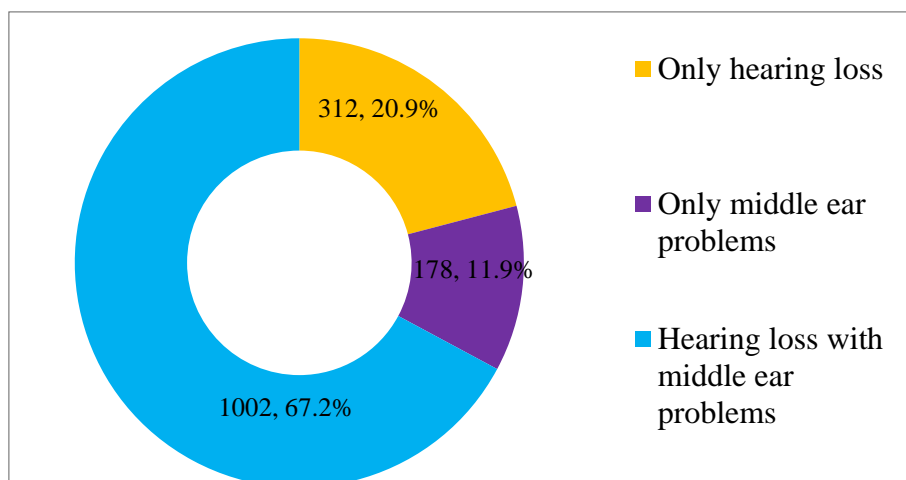
4.4. Proportion of school going children at-risk for Hearing disorders:

7.3%
of school going
children at risk
for hearing
disorders

Among the total number of children (out of 20424) screened, 1492 (7.3%) were found to have hearing disorders, which included children with hearing loss as well as middle ear conditions such as impacted wax, Otitis media, Tympanic membrane abnormalities, and so on. The occurrence of abnormalities/ hearing loss bilaterally (both ears in 979 children, 65.62%) was higher compared to unilateral (either right or left ear in 513 children, 34.38%).

Among these children, 312 (20.9%) had only hearing loss ranging from mild to profound, indicating more of sensorineural type, without any middle ear problems; 178 (11.9%) children had only middle ear conditions; and 1002 (67.2%) children had both hearing loss and middle ear conditions. Figure 5 depicts the details of the hearing disorders in school children.

Figure 5: *Distribution of Hearing disorders (Hearing loss, Middle ear problems or both) in school children*



A total of 1180 children (1002 hearing loss with middle ear problems and 178 with middle ear problems only) had middle ear problems with or without hearing loss. Figure 6 depicts the number of children with various types of middle ear problems. The common problem in school going children is impacted wax followed by Otitis media, Tympanic membrane (TM) abnormalities and Eustachian tube (ET) dysfunction.

Figure 6: *Distribution of middle ear problems in school children*

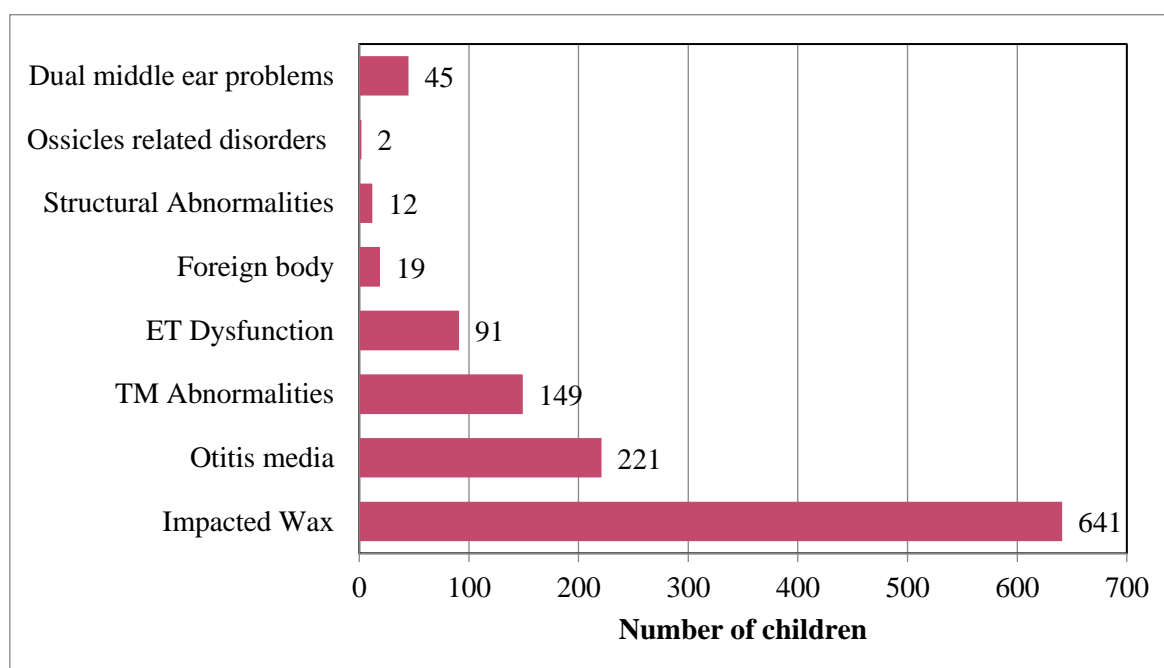


Table 2 gives details of middle ear problems in school children in either (unilateral) or both ears (bilateral) with or without hearing loss. The percentages are calculated for total of 20424 showing the proportion of school children having various middle ear problems. Most of the children had impacted wax (3.2%), otitis media (1.1%), and tympanic membrane abnormalities (0.7%).

Table 2: *Number (percentage) of school children out of 20424 having various types of middle ear problems*

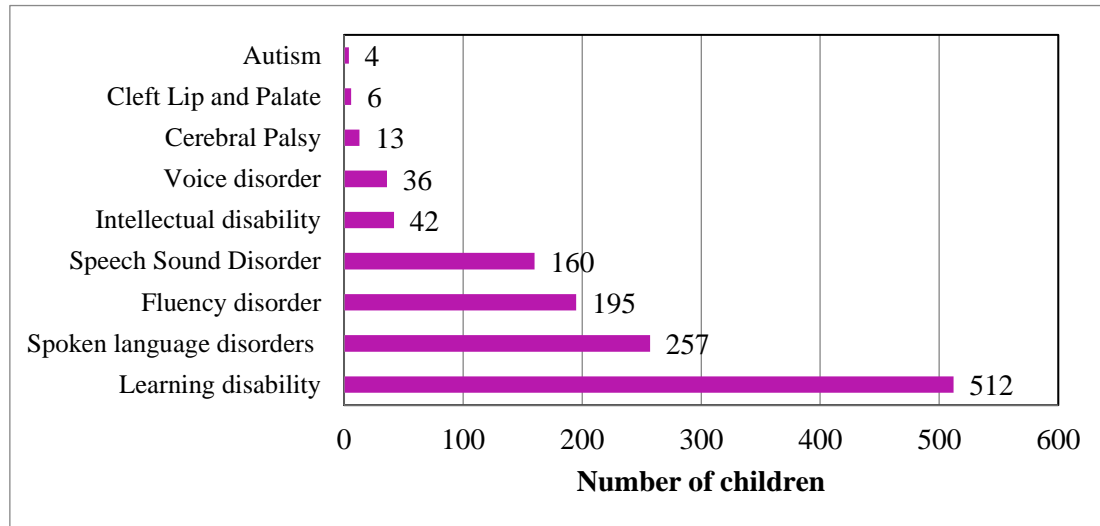
Middle ear problems	Bilateral	Unilateral
Impacted Wax	380 (1.90%)	261 (1.30%)
Otitis media	119 (0.60%)	102 (0.50%)
TM Abnormalities	79 (0.40%)	70 (0.30%)
ET Dysfunction	38 (0.20%)	53 (0.30%)
Foreign body	04(0.02%)	15 (0.07%)
Structural Abnormalities	-	12 (0.06%)
Ossicles related disorders	02(0.01%)	-
Dual middle ear problems	45 (0.20%)	-
Total	1180 (5.80%)	

4.5. Proportion of school going children at-risk for Speech-Language disorders:

6%
of school going children
at risk for speech-
language disorders

A total of 1225 (6%) out of 20424 school children were found to be at risk for speech-language disorders. Figure 7 depicts the different types of Speech-language disorders seen in school going children.

Figure 7: *Distribution of Speech-language disorders in school children*



As indicated in Figure 7, learning disabilities are the most common among school children, followed by Spoken language disorders, Fluency disorders (Stuttering), Speech sound disorders (pronunciation difficulties), and others. Table 3 gives details of speech and language disorders in school children calculated out of 20424 children.

Table 3: *Percentage of school children out of 20424 at-risk for various types of speech and language disorders*

Speech and Language disorders	Percentage
Learning disability	2.51
Spoken language disorders	1.26
Fluency disorder	0.95
Speech Sound Disorder	0.78
Intellectual disability	0.21
Voice disorder	0.18
Cerebral Palsy	0.06
Cleft Lip and Palate	0.03
Autism	0.02
Total	6.00

SECTION 5

IMPLICATIONS OF THE SCHOOL SCREENING FINDINGS

In the School screening report, a high prevalence rate of 13.3 percent in a sample of 20,424 school children was found to be at risk for communication disorders. Communication disorders that include hearing disorders and Speech-Language disorders are becoming a public health concern and a widespread problem. There are approximately 466 million individuals worldwide who suffer from hearing loss, with 34 million of them being children, as estimated by the World Health Organization (2019). In India, the prevalence rates are reported to be on the higher side. According to the 2011 Census of India, India has a total of 2.21 percent disabled population, with 18.9 percent of these having hearing loss and 7.45 percent having speech and language disorders.

The current study looked at the prevalence rate of at-risk school children for communication disorders. The findings indicated a high prevalence rate of hearing disorders and speech-language disorders among school going children. This will have a significant negative impact on the child's language and social development, academic performance, cognitive skills, psychological well-being, and overall development (Butler, 2007). Due to their impaired communication abilities such children are unlikely to begin their education on time, and are more likely to drop out of school without completing their education (Martinez, 2017). According to reports, approximately 89.8 percent of children with disabilities do not have access to or are unable to receive pre-school intervention services (Bokova & Bush, 2012). Thus, a lack of timely detection, inability to purchase or obtain assistive technologies and learning materials, and inaccessible intervention services are likely to be the causes of higher rate of illiteracy and poverty among the disabled population (Ansari, 2021). Furthermore, 21.9 percent of the Indian population is poor, whereas 30–40 percent of the disabled population is poor (United Nations Report, 2019). According to the World Health Organization (2021), untreated hearing loss costs the global economy US\$ 980 billion per year excluding the costs of hearing devices.

Such a significant burden on the child, concerned relatives, and to the Nation can be alleviated only if communication disorders are detected early in life and adequate timely rehabilitation is undertaken. Thus, the importance of school screening program cannot be understated.

Communication is the essence of life and hearing is the most needed prerequisite for normal speech and language development. Hence, India is striving to implement the universal newborn screening programme for communication disorders through national level programmes such as RBSK, and NPPCD to ensure early detection and rehabilitation at various levels. However, such program needs in-depth monitoring for effective functioning and reach out to the public. Furthermore, newborn screening should be made mandatory in all maternity hospitals to ensure proper identification of hearing loss and reducing the consequences by initiating rehabilitation at the appropriate age.

Not just during the infancy period, children need to be monitored on their hearing and speech-language skills on a regular basis throughout their developmental period as they are vulnerable for many acquired conditions also

New born hearing screening is still in its nascent stages in India. Hence, numerous new borns/infants do not undergo the screening as a mandatory procedure and also there are high chances of late onset or acquired communication disorders. Many epidemiological studies have found that the increased prevalence of communication disorders in school-aged children is primarily due to the presence of preventable otological conditions such as impacted wax, otitis media, fungal infections, and foreign body insertions, all of which result in decreased hearing sensitivity (Shaheen et al., 2012; Chadha et al., 2013; Shankar & Swaroop, 2015; Parvez, et al., 2016). The current study also revealed a high prevalence of ear-related disorders and hearing loss, which could have been avoided if detected early and treated. Furthermore, in school-aged children, the risk for speech-language disorders, particularly learning disabilities and stuttering, requires immediate attention and regular monitoring. Due to this higher prevalence, it is recommended that school screening programs for communication disorders be mandated as a routine activity across the country.

Hearing is essential for all types of learning that occur in the course of a person's life. Hearing loss jeopardizes effective learning because all formal learning and educational activities in schools are mediated through the sense of hearing. Furthermore, effective communication necessitates good speech-language skills, which boosts students' confidence in learning and career development. Thus, identifying communication disorders in children of pre-school or school age and providing

appropriate intervention undoubtedly help to improve academic performance, employability, and quality of life of the young generation of the country.

Therefore, screening programs to identify any kind of communication disorders should be initiated to support quality educational and learning programs.

Communication disorders that is educationally detrimental can be accurately diagnosed and treated with a systematic and planned screening programs. Furthermore, developing and implementing school-based communication disorder screening programs will raise knowledge on types of communication disorders as well as treatment options among school administrators, teachers, parents, and students. As a result, there is a pressing need to create and implement an early detection and intervention programme for children with communication disorders in school settings, regardless of socioeconomic backgrounds. Periodic screening during the school years by Audiologists and Speech-Language pathologists is recommended, as hearing and speech-language impairments can set in at any age during childhood. This can ensure good academic achievement and quality of life to the individuals concerned.

REFERENCES

- Ansari, M. S. (2021). Hearing screening program for school going children in India: necessity, justification, and suggested approaches. *The Egyptian Journal of Otolaryngology*, 37(1), 1-7.
- Arunraj, K., Reddy, M.S., Sunitha E., Savithri, S. R., Barman, A., & Shanbal, J. C. (2016). School Screening - Distribution of Communication disorders in School Children. All India Institute of Speech and Hearing, Mysuru.
- Bahader, I. (2019). Longstanding effect of recurrent Otitis Media with effusion on central auditory processing in Children. PsyArXiv.
<https://doi.org/10.31234/osf.io/8q7kp>
- Barreira-Nielsen, C., Fitzpatrick, E., Hashem, S., Whittingham, J., Barrowman, N., & Aglipay, M. (2016). Progressive Hearing Loss in Early Childhood. *Ear and Hearing*, 37(5), e311–e321. <https://doi.org/10.1097/AUD.0000000000000325>
- Berchiatti, M., Badenes-Ribera, L., Ferrer, A., Longobardi, C., & Gastaldi, F. G. M. (2020). School adjustment in children who stutter: The quality of the student-teacher relationship, peer relationships, and children's academic and behavioral competence. *Children and Youth Services Review*, 116, 105226.
- Bokova, I., & Bush, L. (2012) Literacy is key to unlocking the cycle of poverty. *Houston Chronicle*. [Online] <https://www.chron.com/opinion/outlook/article/Literacy-is-key-to-unlocking-the-cycle-of-poverty-3848564.php>. Accessed: 01-Feb-2022
- Butler, I. (2012). Identification and management of childhood hearing loss. *CME: Your SA Journal of CPD*, 30(9), 314-317.
- Campano, M., Cox, S. R., Caniano, L., & Koenig, L. L. (2021). A Review of Voice Disorders in School-Aged Children. *Journal of Voice*.
<https://doi.org/10.1016/j.jvoice.2020.12.018>
- Census of India (2011). Official Website of Census of India, Office of the Registrar General & Census Commissioner, India, Ministry of Home Affairs, Government of India <https://censusindia.gov.in/>. Accessed: 01-Feb-2022
- Chadha, S. K., Sayal, A., Malhotra, V., & Agarwal, A. K. (2013). Prevalence of preventable ear disorders in over 15 000 schoolchildren in northern India. *The Journal of Laryngology & Otology*, 127(1), 28-32.
- Ching, T. Y. C., Dillon, H., Button, L., Seeto, M., Buynder, P. V., Marnane, V., Cupples, L., & Leigh, G. (2017). Age at Intervention for Permanent Hearing Loss and 5-Year Language Outcomes. *Pediatrics*, 140(3). <https://doi.org/10.1542/peds.2016-4274>

- Eggers, K., Millard, S., & Kelman, E. (2021). Temperament and the Impact of Stuttering in Children Aged 8–14 Years. *Journal of Speech, Language, and Hearing Research*, 64(2), 417–432.
- Fitzpatrick E. M., Nassrallah F., Vos Bénédicte, Whittingham JoAnne, & Fitzpatrick Jessica. (2020). Progressive Hearing Loss in Children With Mild Bilateral Hearing Loss. *Language, Speech, and Hearing Services in Schools*, 51(1), 5–16.
https://doi.org/10.1044/2019_LSHSS-OCHL-19-0013
- Fitzpatrick, E. M., Al-Essa, R. S., Whittingham, J., & Fitzpatrick, J. (2017). Characteristics of children with unilateral hearing loss. *International Journal of Audiology*, 56(11), 819–828. <https://doi.org/10.1080/14992027.2017.1337938>
- Fitzpatrick, E. M., dos Santos, J. C., Grandpierre, V., & Whittingham, J. (2017). Exploring reasons for late identification of children with early-onset hearing loss. *International Journal of Pediatric Otorhinolaryngology*, 100, 160–167.
<https://doi.org/10.1016/j.ijporl.2017.06.039>
- Kennedy, C. R., McCann, D. C., Campbell, M. J., Law, C. M., Mullee, M., Petrou, S., Watkin, P., Worsfold, S., Yuen, H. M., & Stevenson, J. (2006). Language Ability after Early Detection of Permanent Childhood Hearing Impairment. *New England Journal of Medicine*, 354(20), 2131–2141. <https://doi.org/10.1056/NEJMoa054915>
- Maas, W. (2000). Early detection of speech and language delays in the Netherlands. The case for integrating primary and secondary prevention. *Child: Care, Health and Development*, 26(2), 150–162. <https://doi.org/10.1046/j.1365-2214.2000.00175.x>
- Martínez, E. (2017). *"I Had a Dream to Finish School": Barriers to Secondary Education in Tanzania*. Human Rights Watch. [Online]
https://www.hrw.org/sites/default/files/report_pdf/tanzania0217_insert_lowres_spreads.pdf. Accessed: 01-Feb-2022
- Parvez, A., Siddiui, A. R., Khan, Z., Hasmi, S. F., & Khan, M. S. (2016). Prevalence of hearing impairment among primary school children in rural and urban areas of Aligarh, Uttar Pradesh, India. *Int J Com Med Public Heal*, 3(5), 1273-1277.
- Raghavendra, K., & Reddy, A. V. (2020). Etiology and risk factors for scholastic backwardness in children—A retrospective study. *Indian Journal of Child Health*, 7(3), 125–129.
- Raman, N., Nagarajan, R., Venkatesh, L., Monica, D. S., Ramkumar, V., & Krumm, M. (2019). School-based language screening among primary school children using telepractice: A feasibility study from India. *International journal of speech-language pathology*, 21(4), 425-434.

- Ravi, S. K., Sumanth, P., Saraswathi, T., Chinoor, M. A. B., Ashwini, N., & Ahemed, E. (2021). Prevalence of communication disorders among school children in Ballari, South India: A cross-sectional study. *Clinical Epidemiology and Global Health*, 12, 100851.
- Saini, S., Bist, S. S., & Kumar, L. (2020). Prevalence and etiological factor of hearing impairment among school going children in rural area of district, Dehradun. *International Journal of Otorhinolaryngology and Head and Neck Surgery*, 6, 680. DOI: 10.18203/issn.2454-5929.ijohns20201282.
- Shaheen, M. M., Raquib, A., & Ahmad, S. M. (2012). Prevalence and associated socio-demographic factors of chronic suppurative otitis media among rural primary school children of Bangladesh. *International journal of pediatric otorhinolaryngology*, 76(8), 1201-1204.
- Shanbal, J. C., Arunraj, K., & Reddy, M. S. (2015). Distribution of Communication Disorders in Primary School Children. *Journal of the All India Institute of Speech & Hearing*, 34.
- Shankar, N. R., & Swaroop, D. M. (2015). A study of the prevalence of ear diseases in school children of rural Tumkur district, Karnataka. *Journal of Evolution of Medical and Dental Sciences*, 4(32), 5506-5512.
- Sharma, R., Teharia, R. K., Purohit, N.C., & Kumar, J. (2019). Study of prevalence of hearing loss in school going children between ages 8 to 14 years of Jodhpur (Rajasthan).
- Skarżyński, H., & Piotrowska, A. (2012). Prevention of communication disorders-- screening pre-school and school-age children for problems with hearing, vision and speech: European Consensus Statement. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research*, 18(4), SR17-21. <https://doi.org/10.12659/msm.882603>
- Stanton-Chapman, T. L., Chapman, D. A., Bainbridge, N. L., & Scott, K. G. (2002). Identification of early risk factors for language impairment. *Research in developmental disabilities*, 23(6), 390-405. [https://doi.org/10.1016/s0891-4222\(02\)00141-5](https://doi.org/10.1016/s0891-4222(02)00141-5)
- United Nations, Sustainable Development Goals Report. 2019. Goal 4 of the United Nation's Sustainable Development Goals (UNSDGs) 2030. <https://unstats.un.org/sdgs/report/2019/The-Sustainable-Development-Goals-Report-2019.pdf>
- Varsha, N. S., Sowmiya, R., Prasitha, P., & Praveena, J. (2020). Prevalence of speech language and hearing impairment in school going children of rural area: a longitudinal study. *Int J Com Med Pub Heal*, 7 (10), pp. 4043-4047. DOI:10.18203/2394-6040.ijcmph20204374

World Health Organization (2019). Deafness prevention[Online]. Available <https://www.who.int/deafness/en/>. Accessed: 01-Feb-2022

World Health Organization (2021). Deafness and hearing loss[Online]. Available <https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss>. Accessed: 01-Feb-2022

Wroblewska-Seniuk, K. E., Dabrowski, P., Szyfter, W., & Mazela, J. (2017). Universal newborn hearing screening: Methods and results, obstacles, and benefits. *Pediatric Research*, 81(3), 415–422. <https://doi.org/10.1038/pr.2016.250>

Yoshinaga-Itano, C., Sedey, A. L., Wiggin, M., & Mason, C. A. (2018). Language Outcomes Improved Through Early Hearing Detection and Earlier Cochlear Implantation. *Otology & Neurotology*, 39(10), 1256–1263. <https://doi.org/10.1097/MAO.0000000000001976>

ANNEXURE 1

Checklist for Communication disorders in School children

School Name & Address:

**Teacher's Name:
Section:**

Student's Name:

Class &

Instructions: This screening checklist consists of questions to identify communication disorders (Speech language and hearing) in school children. The screening checklist has to be filled for each child and all the questions must be addressed appropriately. If the answer to **any** of the statement is 'YES', you are requested to put a ✓ mark for that question and hand it over to us.

S.No	Questions	Yes	No
1.	Student has any difficulty in hearing, finds it difficult to hear in noisysituation and require repetitions to understand what is being said?		
2.	Student often substitute one sound for another, (For eg: tar for car, poon forspoon etc) or often omit or miss a sound while saying words? (eg: un for bun, do for dog, ca for cat)		
3.	Student repeat a particular sound or word multiple times so that it is understood by everyone?		
4.	Student does not mingle with his/her classmates and he/she is not able to speak as good as his/her peers?		
5.	Student appear to be lost in his/her own world or engaged in repetitivemovements with no purpose?		
6.	Student repeat sounds or words, (eg: pa pa pa.....pen or my bag is lost),prolong a sound or a word while talking or get stuck while speaking?(eg: bbbb....ba..bat)		
7.	Student exhibit behaviours such as nervousness, tension, excessive eyeblinking, nose flaring while talking with teachers or friends?		
8.	Student has any difficulty in walking, sitting or in performing physical activities appropriately or exhibit tremors, involuntary movements etc.?		
9.	Student has difficulty in writing, holding books/other objects, picking up small objects or exhibit drooling (Saliva coming out from mouth)?		

10.	Student's voice is different from other students' voice?		
11.	Student complains that he/she is unable to get his voice out or he/she has stopped speaking completely?		
12.	Does the student have any difficulty in paying attention to the lessons or general instructions in the class, but appears to be smart in other activities?		
13.	Student is makes a lot of spelling errors like interchanging the letters, omitting letters or mirroring letters?		
14.	Student exhibit problems in copying and difficulty in reading? Eg: reading letter by letter, missing letters while copying from board, etc		