

**PREVALENCE OF INDIVIDUALS DIAGNOSED TO HAVE CAPD FOR A  
PERIOD OF TWO YEARS AT AIISH (JUNE 2017 – JULY 2019)**

**SHREYAS S RAM**

**18AUD035**

**This Dissertation is submitted as a part of fulfilment**

**For the Degree of Master of Science in Audiology**

**University of Mysore, Mysore**



**July 2020**

## **Certificate**

This is to certify that this dissertation entitled “**PREVALENCE OF INDIVIDUALS DIAGNOSED TO HAVE CAPD FOR A PERIOD OF TWO YEARS AT AIISH (JUNE 2017 – JULY 2019)**” is bonafide work submitted in part fulfilment for the degree of Master of Science (Audiology) of the student registration No. 18AUD035. This has been carried out under supervision and guidance of the faculty of this institute and has not been submitted earlier to any other University for the award or any other Diploma or Degree.

Mysuru  
July, 2020

**Dr. M. Pushpavathi**

**Director**

All India Institute of Speech and Hearing  
Manasagangothri, Mysuru – 570006

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Mysuru  
July, 2020

**Dr. Chandni Jain**  
**Guide**  
Reader in Audiology  
Department of Audiology  
All India Institute of Speech and Hearing  
Manasagangothri, Mysuru – 570006

## **Declaration**

This is to certify that this dissertation entitled “**PREVALENCE OF INDIVIDUALS DIAGNOSED TO HAVE CAPDFOR A PERIOD OF TWO YEARS AT AIISH (JUNE 2017 – JULY 2019)**” is result of my own study under the guidance of Dr. Chandni Jain, Reader in Audiology, Department of Audiology, All India Institute of Speech and Hearing, Mysuru and has not been submitted earlier to any other University for the award or any other Diploma or Degree.

Mysuru

July, 2020

**Registration No. 18AUD035**

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## Abstract

Central auditory processing disorder (CAPD) refers to difficulties in the processing of audible signals that are not attributable to impaired hearing sensitivity or mental impairment. CAPD involves the deficit in processing of auditory information and if not rehabilitated properly it will lead to difficulty in communication, understanding etc. The demographic characteristics of pediatric CAPD and its prevalence are still debatable. Due to varied definition and differences in the diagnostic criteria for CAPD, the approximate prevalence measure varies from 0.5% to 1.0% to 7% of the population. Thus; a retrospective study on prevalence in individuals with CAPD was conducted. A total of 3537 cases with ear related problems reported to Audiology OPD at All India Institute of Speech and Hearing from June 2017 to July 2019 between the age range of 6-18 years. Out of these, 32 cases were diagnosed with CAPD and these data was available for review. Thus, the prevalence of individual with CAPD reported in this duration was 0.7%. The results also revealed that among them, the prevalence was more in males and in individuals of lower socio-economic status. The major symptoms reported in them were poor academic performance and difficulty following commands or instructions. The data also revealed that speech perception in noise was the most affected process followed by binaural integration in these individual.

*Key words: Central auditory processing disorder, Prevalence, Gap detection test, Speech perception in noise, Dichotic consonant vowel test, Masking level difference*

## Chapter 1

### Introduction

Central auditory processing disorder (CAPD) is defined as “difficulties in the perceptual processing of auditory information in the central nervous system and neurobiological activity that underlies that processing and gives rise to the electrophysiological auditory potentials.” (ASHA, 2005). CAPD refers to difficulties in the processing of audible signals that are not attributable to impaired hearing sensitivity or mental impairment. This processing includes tasks involving perception, cognition and linguistics which results in efficient comprehensive communication of passive (e.g. conscious and unconscious, mediated and unmediated) capacity for attending, discriminating and recognizing acoustic signals, followed by transforming and communicating the data on an ongoing basis through both the peripheral and central nervous systems. At suitable perceptive and conceptual concentrations, the filtered, sorted and combined data gets collected and effectively stored using phonological, pragmatic, semantic and syntactic understanding and add significance to a stream of data (ASHA, 1990)

Diagnosing CAPD varies based on the assessment, instruments and criteria used. Numerous researchers have given different criteria for diagnosing CAPD (American Academy of Audiology, 2010; American Speech-Language-Hearing Association, 2005; Bellis, 2003; British Society of Audiology, 2011; Dawes & Bishop, 2009; McArthur, 2009; Wilson & Arnott, 2013). The demographic characteristics of pediatric CAPD and its prevalence are still debatable. Due to varied definition and differences in the diagnostic criteria for CAPD, the approximate prevalence measure varies from 0.5% to 1.0% to 7% of the population (Chermak & Musiek 1997; Hind et al., 2011) to 96% (diagnostic criteria by ASHA, 2005) in children.

Nagao et al. (2016), also reported that the prevalence of CAPD was two times higher for children studying in private schools compared to the children studying in public schools. In another study the prevalence estimates of CAPD was higher in males compared to females (Chermak & Musiek, 1997). The summary of the prevalence rates reported by various researchers is given in Table .1.1.

Studies have also shown that children with CAPD have various co morbid conditions. Sharma et al. (2009) stated that 94% of the children diagnosed with CAPD had a comorbid language or reading impairment. Neijenhuis et al. (2003) reported that 30% of the children had reading and writing difficulties who were diagnosed with CAPD, 90% of them had speech and language problems, and 10% had attention deficit hyperactive disorder. It was also reported that 60% of the children diagnosed with CAPD had two or more associated problems.

Table 1.1

*The prevalence of CAPD reported across studies*

<b>Author</b>	<b>Year</b>	<b>Population</b>	<b>Results</b>
Musiek, Gollegly , Lamb , & Lamb .	1990	School aged children	Prevalence rate: 7%
Chermak&Musiek	1997	School aged children	Prevalence rate: 2-5% CAPD higher in males compared to females
Dobrzanski-Palfrey & Duff,	2007	Adults older than 60 years of age	Prevalence rate: 20-30%
Sharma	2009	School-aged children (7–12 years)	Co morbid conditions along with CAPD like language impairment, and reading disorders in 47% children
Muthuselvi &Yathiraj	2009	School-aged children	Prevalence rate: 3.2%
Hind et al.	2011	Children and adults	Prevalence rate: 0.5–1.0%
Wilson &Arnott	2013	School aged children	Prevalence rate: 7.3%–96%
Nagao , Reigner, & Padilla	2016	School aged children Mean age of 9.8 years for boys and 9.7 years for girls	CAPD prevalence was 1.94 per 1,000 children

**1.1 Need for the Study**

Most of the studies mentioned above related to the prevalence and demographic characteristics of pediatric CAPD are done by Western countries and there is very less

information about the prevalence data of children diagnosed with CAPD in India. In an Indian study by Muthuselvi and Yathiraj (2009) they reported that around 3.2% of school going children were at risk for CAPD. Researchers have also reported negative effects of CAPD on school performance (Chermak & Musiek, 1997; Muthuselvi & Yathiraj, 2009) which needs programs of early intervention. Coles et al. (1984) stressed that resource allocation required statistics on the incidence of the situation for the growth of intervention programs and study under any conditions. To build the right infrastructure, assessment protocols and CAPD intervention strategies, it is therefore crucial to understand the prevalence of CAPD, like any other condition.

## **1.2. Aim of the Study**

The study aims to estimate the prevalence of CAPD in children who reported to AIISH, Mysuru between June 2017 to July 2019.

## **1.3. Objectives of the Study**

- To determine the total number of CAPD cases reported at AIISH, Mysuru between June 2017 to July 2019
- To estimate age and gender predominance in CAPD cases.
- To analyze the data based on socioeconomic status.
- To analyze the data based on primary and secondary complaints reported in CAPD cases.
- To analyze the data in terms of different audiological findings.

## Chapter 2

### Review of Literature

Central auditory processing disorder (CAPD) is defined as “difficulty in processing the auditory information perceptually in the central nervous system and underlying neurobiological activity and gives rise to the electrophysiological auditory potentials.” (ASHA, 2005). CAPD are deficits in the processing of audible signals that are not attributable to impaired hearing sensitivity or mental impairment (ASHA, 1990). The prevalence and demographic characteristics of pediatric CAPD mentioned is reported mainly in the western countries and there are less studies that provide information related to the prevalence data on CAPD in children in India. To create suitable infrastructure, intervention strategies and assessment protocols for CAPD, it is therefore crucial to understand the incidence of CAPD, like any other condition.

#### 2.1. Prevalence of CAPD

The demographic and prevalence characteristics of pediatric CAPD are still debatable. Because of unclear definition of CAPD and differences in the diagnostic criteria for CAPD, the prevalence rate varies from 0.5% to 1.0% to 7% of the population approximately (Chermak & Musiek, 1997).

Nagao et al. (2016) studied total of 243 children (149 boys & 94 girls) and referred them for a CAPD evaluation. The mean age was 9.7 year for girls and 9.8 year for boys. In those 243 children, 94 children showed either one or another auditory processing difficulty in the areas of auditory figure ground, auditory closure, binaural integration, temporal processing and binaural separation. The study showed that the CAPD prevalence was 1.94 per 1,000 children. It was also

reported that the incidence of CAPD among the children attending private schools was double than that of the children attending public schools.

Hind et al. (2011) found the prevalence of individuals having hearing difficulties even with normal hearing threshold. Most commonly, the primary care doctors referred adults and school-age children for any difficulties listening in noise or following a conversation, and younger children for speech production problems. In this study, they concluded that the prevalence of normal cases was 5.1% among the children and 0.9% among all adults. It was also found that the prevalence was 4.0% for younger adults (17 – 60 years, n 1025). Overall, they estimated the prevalence of CAPD among children and adults to be about 0.5 – 1.0% of the general population.

Wilson and Arnott (2013) conducted a study to know how a potential CAPD diagnosis in a large sample of children referred for CAPD assessment is affected by nine different diagnostic criteria. This study was done on 150 children (94 boys & 56 girls; ages 7.0–15.6 years) with normal peripheral hearing who had undergone a CAPD assessment. The assessment was done using dichotic digits, low-pass filtered speech, competing sentences and frequency pattern test with non-linguistic and linguistic report. Children were divided into who are having CAPD or not based on nine different sets of diagnostic criteria that were taken from position statements, published technical reports and selected research. Results revealed that the prevalence rates of potential CAPD diagnosis in children ranged between 7.3% and 96.0% for the strict and lenient criteria respectively. Prevalence predictions vary widely across countries. In New Zealand, there is some consensus by expert stakeholders that the prevalence of CAPD is around 5% in children (Esplin & Wright, 2014).



## **2.2. Prevalence of CAPD in Indian Population**

The studies mentioned above which provides information regarding the prevalence and demographic characteristics of pediatric CAPD are mostly western and there is a dearth of studies regarding the prevalence data on CAPD in children in India. In an Indian study by Muthuselvi and Yathiraj (2009) SCAP was administered on 3120 children and they reported that around 3.2% of school going children were at risk for CAPD.

Maggu and Yathiraj (2013) also conducted a study to find out the relationship between two screening tools to detect CAPD: screening checklist for auditory processing (SCAP) and screening test for auditory processing (STAP). The study included 400 school-going children (218 males, 182 females) who were in grades III–VIII in three schools, aged 8–13 years. Among 400 children, 49 (12.3%) children were at-risk for CAPD on the SCAP and 64 (16%) were to be at-risk on the STAP. The study revealed a relatively strong association between the SCAP and the STAP. Nonetheless, both screening methods should be assessed in order to identify more at-risk children for APD.

## **2.3.Co-Morbidity of CAPD**

Studies have shown that children with CAPD have various co morbid conditions. Neijenhuis et al. (2003) reported that 30% of the children with CAPD also had writing and reading difficulties, 90% had speech and language problems, and 10% had attention deficit hyperactive disorder. It was also reported in the same study that 60% of the children had two or more associated problems.

Sharma et al. (2009) studied the comorbidity of auditory processing, language, and reading disorders. They tested 68 children who had developed CAPD and had normal nonverbal

IQ scores of 80 or more using auditory, language, reading, attention, and memory measures. The results showed that language impairment and reading disorder commonly co-existed with CAPD. Attention and memory are related to performance on few auditory processing tasks but only explain a small amount of the variance in scores. The study states that a comprehensive assessment is needed across age range to know the difficulties experienced by children with APD.

Skarzynski et al. (2015) studied the usefulness of the dichotic digit test in detecting central hearing disorders in school-age children. Screening test was done on 76429 children between the age range of 7-12 years. The study revealed that there is a right ear advantage and a higher incidence of other disorders such as dyslexia was also reported by these authors.

Thus it can be concluded from the above studies that CAPD individuals present with various comorbid conditions and the most common include reading and writing difficulties.

#### **2.4 Audiological findings in CAPD**

CAPD assessment involves test battery to identify lesion and to define the functional auditory deficits in central auditory nervous system. Routine audiological evaluation should be done prior to the assessment of central auditory processes (Charmek & Musiek, 1977).

Behavioral central tests that are used to assess central auditory processing abilities include; dichotic tests to assess binaural integration and separation, temporal processing tests to assess temporal resolution and temporal patterning, binaural interaction tests and monoaural low redundancy speech tests to assess auditory closure.

Studies have shown that auditory closure is the most affected ability in children with CAPD. The most common test to assess auditory closure is speech perception in noise (SPIN).

Lagace (2010) illustrated psychometric functions of SPIN test based on the hypothetical CAPD group, intending to find the underlying source of speech perception in noise problems in same group. They concluded that in CAPD population, SPIN-like tests conceivably be utilized to assess difficulties with perceiving speech in noise and nature of deficit underlying it.

Keith (1999) reported that basic difficulty in individuals with CAPD is that any speech signal presented in the conditions that are less than optimal is difficult to understand. Similarly, Chermak (2002) characterized individuals with CAPD as having trouble perceiving spoken language in the presence of competing signal or in noisy backgrounds and in reverberating conditions. Bamiou et al. (2001) in their review article regarding causes and clinical features of auditory processing disorders, reported that difficulty understanding speech was one of the frequently encountered symptoms in children having CAPD.

Muthuselvi and Yathiraj (2009) correlated screening checklist for auditory processing (SCAP) scores obtained with CAPD test battery [speech perception in noise test (SPIN) , gap detection test (GDT), masking level difference (MLD), dichotic CV (DCV)] results of 42 children using Pearson moment product correlation. Study revealed that individual data points were clustered and showed less variation for SPIN scores but SCAP scores were scattered for other test like GDT, MLD, DCV.

Thus from the above literature it can be concluded that speech perception in noise is the most affected ability in children with CAPD.

## **Chapter 3**

### **Methods**

The study was conducted at All India Institute of Speech And Hearing, Mysuru. The aim of the study was to estimate the prevalence of CAPD who reported to AIISH. A registered based study was done to study the prevalence of CAPD by reviewing the case files of those who visited the institute presenting the complaint of difficulty in perception from last 2 years (June 2017 to July 2019).

The OPD data was used for the retrospective analysis. The total number of individuals visiting the Audiology OPD during the time above was noted. The case numbers of individuals diagnosed as CAPD was noted down from the client database management software (CDMS).

The case file was reviewed for:

- Demographic details i.e. the age, gender, socioeconomic status, occupation and the regional background.
- The primary and secondary complaints.
- The grade he/she is studying.
- Medical history of the individual.
- Audiological findings including results of pure tone audiometry, speech audiometry, immittance, acoustic reflexometry, auditory brainstem response.
- Results on various auditory processing diagnostic tests.

## **Chapter 4**

### **Results**

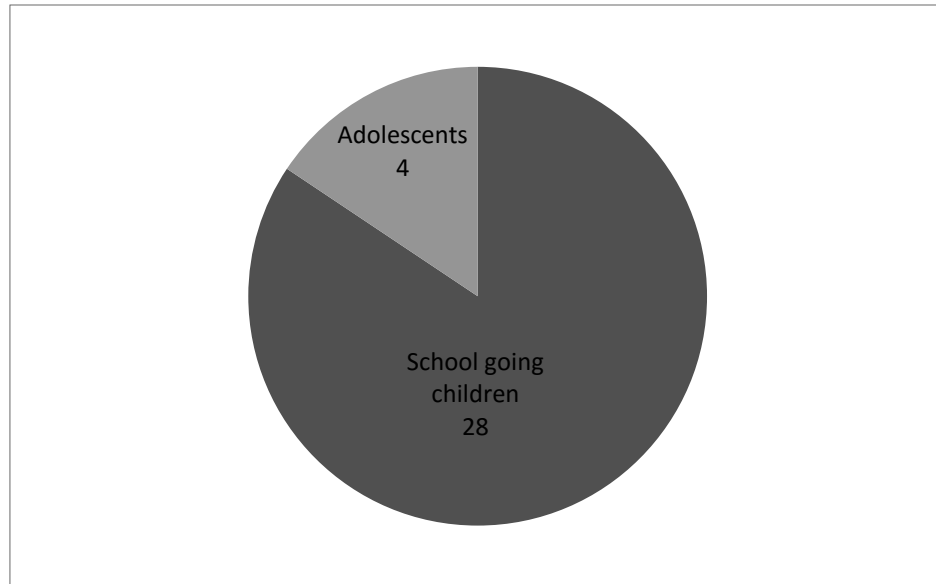
The study was conducted with the aim of determining the prevalence of central auditory processing disorder (CAPD) reported at All India Institute of Speech And Hearing, Mysuru. A registered based study was done to study the prevalence of CAPD. A retrospective case analysis was carried out by reviewing the case files of those who visited the institute presenting the complaint of difficulty in understanding and academic difficulties from June 2017 till July 2019. The results of the study are discussed below.

#### **4.1. Prevalence of CAPD**

A total number of 32082 people were reported to audiology OPD between June 2017 till July 2019. Out of these, 3537 cases were in the age range of 6-18years. Out of all 32 cases in the age range of 6 to 18 years diagnosed to have CAPD. The demographic details and audiological findings of these cases documented. Thus, it can be estimated from the above data that the prevalence of CAPD is 0.7 %.

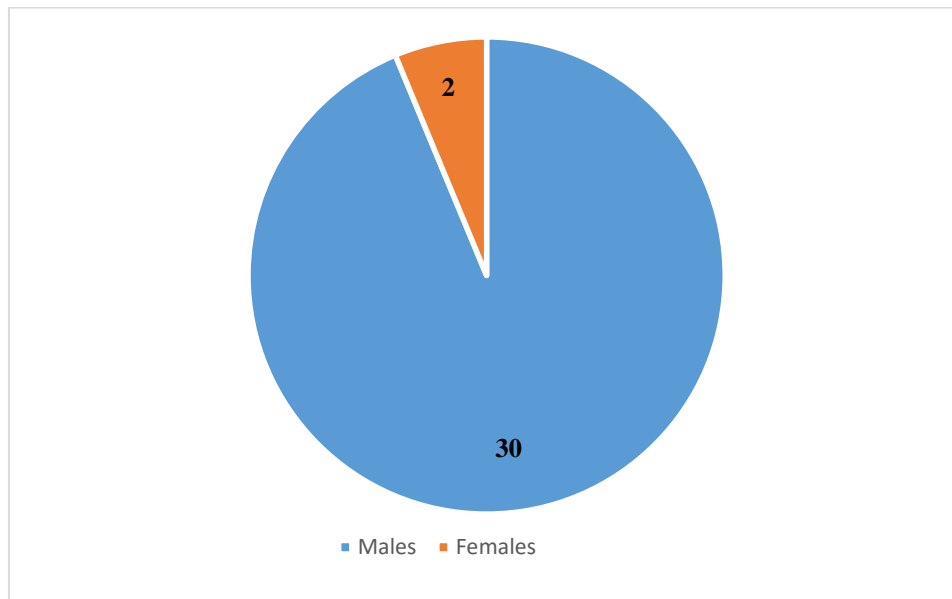
#### **4.2. The age and gender wise analysis of CAPD**

The data was analyzed in two age groups namely school going children (5.1-12 years) and adolescents (12.1-18 years). Results revealed that more school going children reported to have CAPD followed by adolescents as evident from Figure 4.1.



*Figure 4.1:* Number of individuals with CAPD among school going children and adolescents

The prevalence of CAPD in individuals across gender revealed that more number of males reported to have processing problems than females as shown in the Figure 4.2



*Figure 4.2:* Number of males and females with CAPD

#### 4.3. Analysis based on socio-economic status

The data of CAPD was analyzed in terms of socio-economic status and were divided into three income slabs namely, slab I with income less than ₹10,000/-, slab II with the income of ₹10,000/- to ₹20,000/- and slab III with the income of more than ₹20,000/-. Results revealed that the prevalence of CAPD was maximum in slab I and was least in slab III, as shown in Figure 4.3.

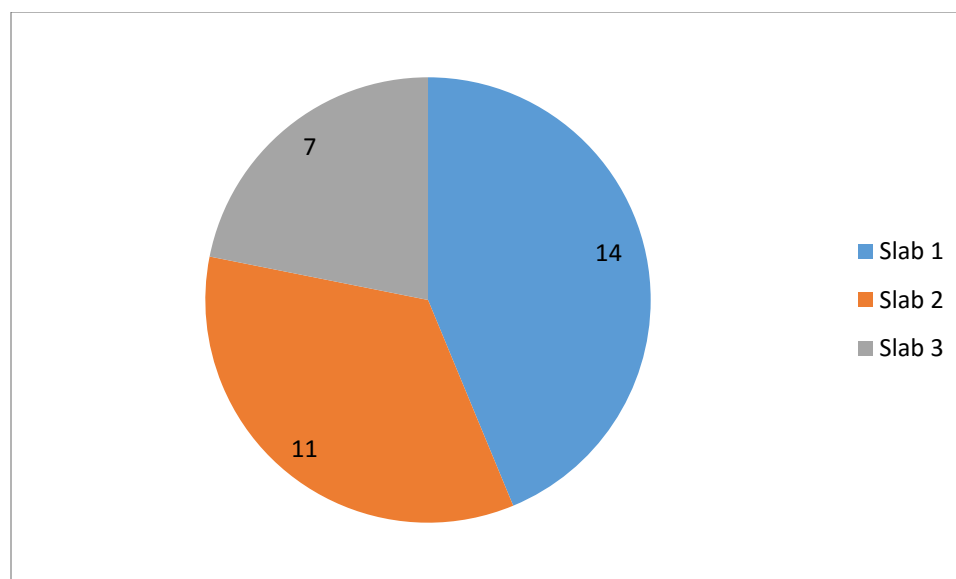


Figure 4.3: Number of individuals with CAPD across different income slabs

#### 4.4. Analysis based on primary and secondary complaints in CAPD

The data was analyzed for primary complaints reported by the guardians in children with CAPD. It was noted that poor academic performance was the major complaint reported for all the 32 CAPD cases. The secondary complaint included difficulty following instructions, dysfluent and unintelligible speech and intellectual disability as shown in Figure 4.4.

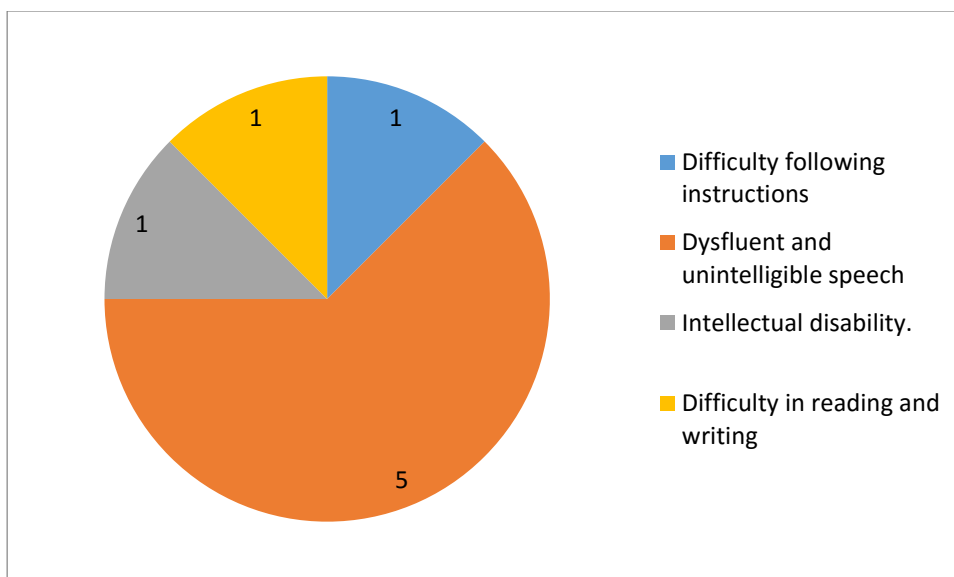


Figure 4.4: Number of individuals with different secondary complaints in CAPD cases

#### 4.6. Analysis based on different audiological findings in CAPD

##### 4.6.1: Analysis based on routine audiological evaluation

Analysis was done for the degree and type of hearing loss in CAPD. Out of 32 (64 ears) individuals with CAPD, all individuals underwent audiological evaluation except 2 as it was not available in the case reports. Out of these 60 ears 58 had normal hearing sensitivity in both ears and 2 ears had minimal hearing loss. The degree of hearing loss was categorized as normal, slight/minimal, mild, moderate, moderately severe, severe and profound hearing loss, based on Goodman's classification (1965) modified by Clarke (1981).

Analysis was also done based on the type of tympanogram seen in CAPD cases. Out of 64 ears 60 ears were tested. Hence, tympanometry findings of 60 ears out of which 30 right ear and 30 left ear is documented. The type of tympanogram was categorized as Type A, As, Ad, B, C and Cs. It



was noted that maximum number of individuals with CAPD had Type A tympanogram in both ears, as shown in the Table followed by As ,C and Ad

**Table 4.1:** *Different types of Tymapnogram seen in CAPD cases*

<b>Tympanogram</b>	<b>Right ears</b>	<b>Left ears</b>
A	23	26
As	5	3
Ad	1	0
B	0	0
C	0	0
Cs	1	1
<b>Total</b>	30	30

Analysis was also done based on auditory brainstem response (ABR) results in CAPD cases. Out of 64 ears, ABR was done on 58 ears. Hence, ABR findings of 58 ears out of which 29 right ear and 29 left ear is documented. The results revealed that none is the cases showed indication of retrocochlear pathology based on ABR findings. Analysis based on otoacoustic emissions (OAEs) findings revealed that all the ears showed normal OAE findings indicating normal outer hair cell functioning in all the cases.

#### **4.6.2: Analysis based on various diagnostic tests of CAPD evaluation**

CAPD evaluation was done on all the clients using behavioral test battery. Diagnostic tests to assess various central auditory processes were done on the clients for the diagnosis of CAPD.

Auditory closure was assessed using speech perception in noise test (SPIN), temporal resolution was

assessed using gap detection test (GDT), temporal patterning was assessed using duration pattern test (DPT), binaural integration was assessed using dichotic CV test and binaural interaction was assessed using masking level difference (MLD). Analyses was done based on the test results of these tests.

SPIN test to assess auditory closure deficits was done on all 32 cases (64 ears). The results of SPIN test as shown in Figure 4.5 shows that most of the cases failed in the SPIN test (84% failed in right ear and 81% failed in left ear).

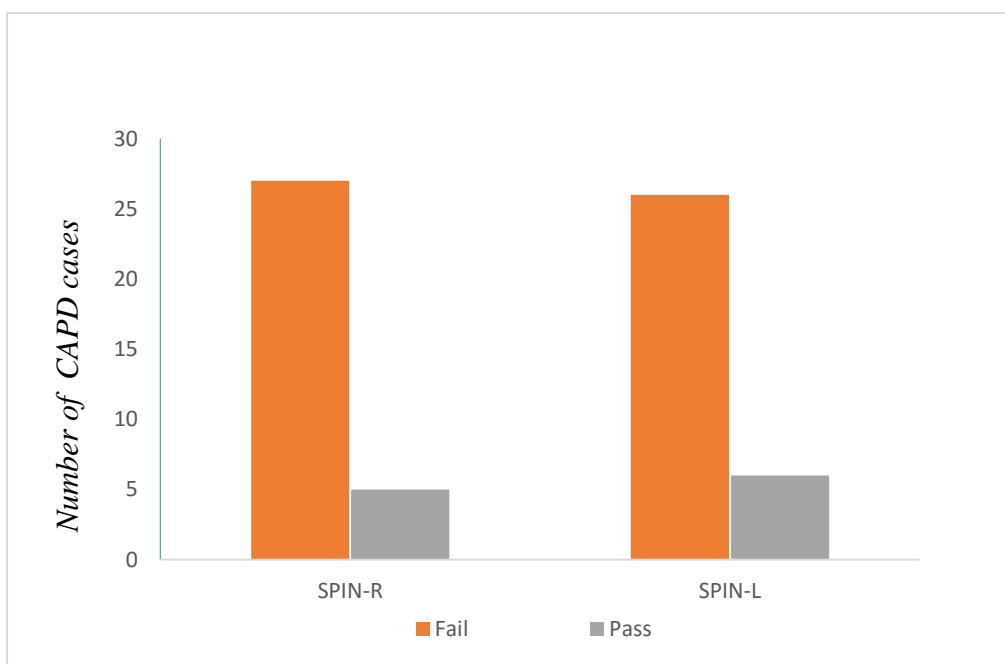
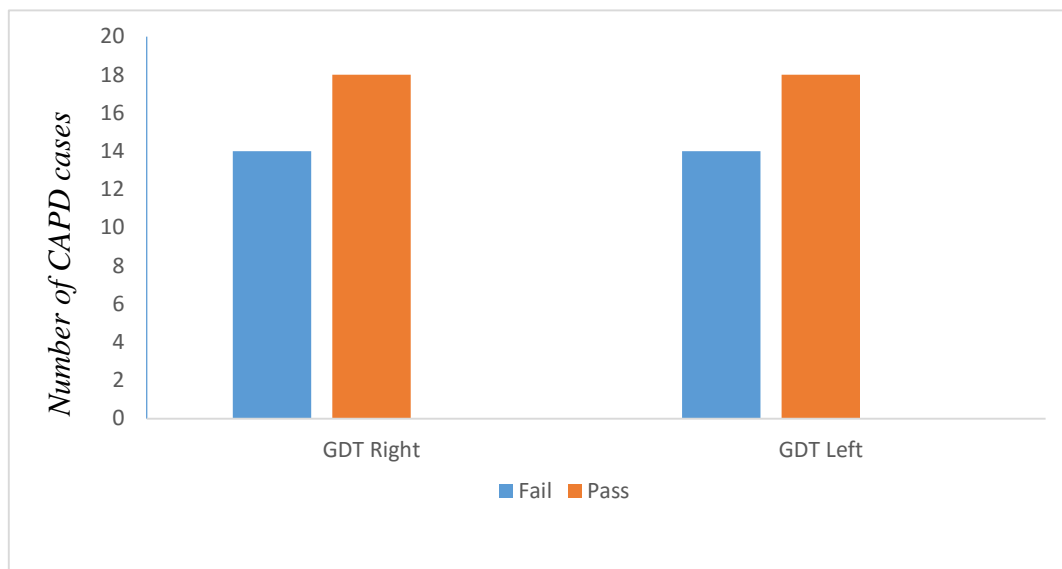


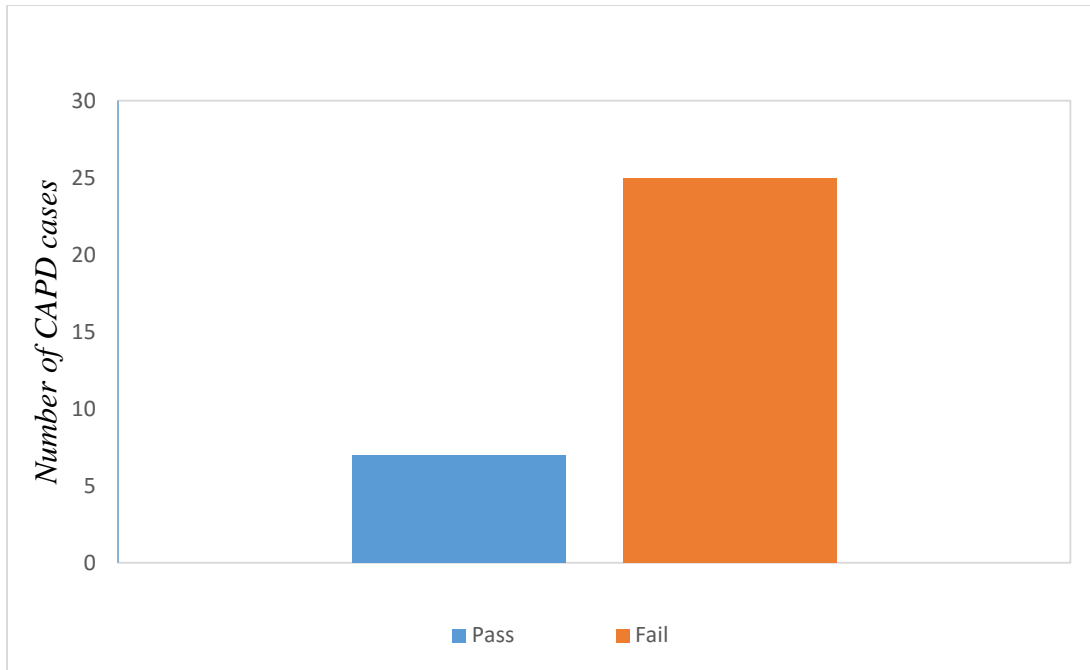
Figure 4.5: Number of CAPD cases who passed and failed the SPIN test

GDT test to assess temporal resolution was carried out for all 32 cases (64 ears). Data showed that the number of individuals passed in GDT was more than number of individuals failed in GDT (43% individuals failed GDT in both ears).



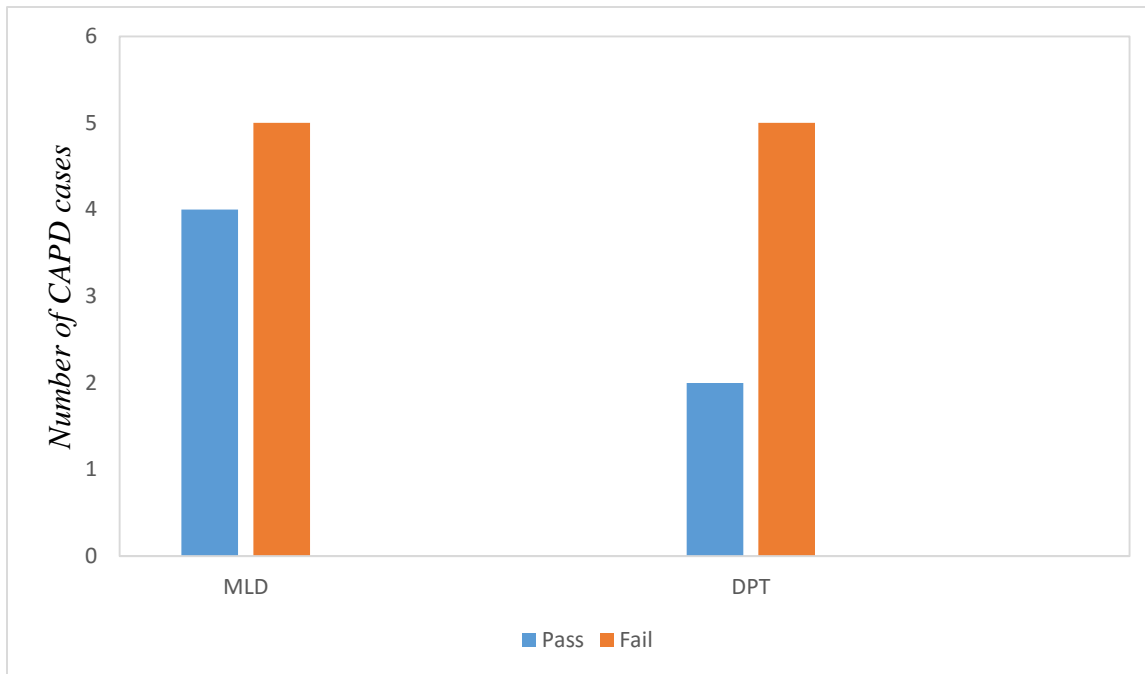
*Figure 4.6:* Number of CAPD cases who passed and failed the GDT test

Dichotic CV test to assess binaural integration was also carried out on all 32 cases (64 ears). From Figure 4.7 it can be noted that most of the clients performed poor on dichotic CV test (78% failed in DCV test).



*Figure 4.7:* Number of CAPD cases who passed and failed the DCV test

MLD and DPT tests were done on few cases. MLD was performed on 9 cases and in that 4 passed and 5 failed. DPT was done for 7 cases and in that 2 were passed and 5 were failed. The results of which is depicted in Figure 4.8.



*Figure 4.8:* Number of CAPD cases who passed and failed the MLD and DPT test

## **Chapter 5**

### **Discussion**

The present study was conducted with the aim to determine the prevalence of CAPD in children who reported to AIISH, Mysuru between June 2017 to July 2019. The data was analyzed based on the age, gender, socioeconomic status, various associated complaints, audiological findings and CAPD evaluation. The data was analyzed to determine the number of individuals and percentage of individuals with CAPD in each of the domains. The results of the study are discussed below:

#### **5.1. Prevalence of CAPD**

The prevalence of CAPD cases between the age 6 to 18 years reported to AIISH from June 2017 to July 2019 was 0.7 %. This prevalence is in agreement with Hind et al (2011) study where it was estimated that the prevalence of CAPD among children and adults to be about 0.5 – 1.0 % of the general population. In contrast few studies reported higher prevalence compared to the present study (Musiek et al., 1990; Wilson & Arnott, 2013). These difference in the prevalence of CAPD could be attributed to various factors including the criteria used for the diagnosis of CAPD, age, lack of awareness etc.

#### **5.2 The age and gender wise analysis of CAPD**

In the present study the prevalence of CAPD was seen for children and adolescents till 6 - 18 years of age. Findings reveal that prevalence was more in school going children compared to adolescents. This is in consensus with other prevalence studies done across various parts of India

Muthuselvi and Yathiraj (2009) they reported that around 3.2% of school going children were at risk for CAPD.

The prevalence of CAPD across gender showed that it was more in males than females in the present study. Similar findings have been reported by Chermak and Musiek (1997), where they also reported that CAPD was higher in males compared to females. So, this indicates that males are more prone to get CAPD compared to females.

### **5.3. Analysis based on socio-economic status**

In the present study, the prevalence of CAPD was more for lower socio-economic status that is for individuals from slab I with an income of less than Rs10, 000/-. Lower socio-economic status has been one of the reasons for major risk factor followed by slab 2. There are no studies as such related to relationship between socio economic status and prevalence of CAPD. In the present study the high prevalence of CAPD in lower socioeconomic status could be attributed to the poor hygiene leading to recurrent otitis media which is one of the major cause of CAPD.

### **5.4. Analysis based on primary and secondary complaints in CAPD**

In the present study, poor academic performance was the primary complaint seen in all the cases diagnosed with CAPD and difficulty following instructions, dysfluent and unintelligible speech, intellectual disability, difficulty in reading writing and difficulty were some of the secondary complaints reported. Sharma (2009) reported that children diagnosed with CAPD have a comorbid language or reading impairment. Even Neijenhuis et al. (2003) reported that 30% of the children with CAPD had writing and reading difficulties, 90% had language and speech problems, and the other 10% had attention deficit hyperactive disorder. In the same study it was reported that 60% of the children had two or more associated problems. In the present study also

children diagnosed with CAPD had associated complaints as mentioned above. Vilela et al. (2016) also stated that if there was a (central) auditory processing disorder associated with speech disability, children appeared to have poorer scores on phonological tests and greater incidence of speech disability was correlated with a higher risk of a child developing a (central) auditory processing disorder.

### **5.5. Analysis based on different audiological findings in CAPD**

In the present study it was reported that all children diagnosed with CAPD had hearing sensitivity within normal limits except for one who had minimal hearing loss. Studies have shown that individuals with CAPD normally have normal peripheral hearing. The diagnosis of CAPD is confirmed when the speech perception difficulties are seen in the presence of normal peripheral hearing and deficits in one or several central auditory processing skill areas (Munguia, 2014). Sally and Hind (2011) in their study also found that normal pure tone thresholds A type tympanogram were obtained in most cases.

In the present study it was seen that majority of the children had A type of tympanogram followed by As, Ad, and Cs and nobody reported with B type. It is almost common to have these type of tympanogram when it is normal hearing sensitivity. In the present study, it was also noted from the ABR results that none of them had any retrocochlear pathology (RCP). ABR is a test of lower brainstem lesion thus it will not be able to detect any lesion above brainstem.

### **5.6. Analysis based on diagnostic tests of CAPD**

In the present study it was noted that the most common deficit seen in children with CAPD is speech perception in noise followed by binaural integration. Gap detection was the least affected deficit. These results are in consensus with the literature (Maggu & Yathiraj,



2014). Studies have shown that auditory closure is the most affected ability in children with CAPD (Maggu & Yathiraj, 2014). Lagace (2010) reported that in CAPD population, SPIN-like tests should be utilized to assess difficulties with perceiving speech in noise and nature of deficit underlying it.

Keith (1999) reported that basic difficulty in individuals with CAPD is that any speech signal presented in the conditions that are less than optimal is difficult to understand. Similarly, Chermak (2002) characterized individuals with CAPD as having trouble perceiving spoken language in the presence of competing signal or in noisy backgrounds and in reverberating conditions. Bamiou et al., (2001) in their review article regarding causes and clinical features of auditory processing disorders, reported that difficulty understanding speech was one of the frequently encountered symptoms in children having CAPD. However, in a study by Maggu and Yathiraj (2014) they revealed that the screening test for auditory processing (STAP) findings showed auditory memory subsection of the STAP is more impacted followed by the dichotic CV later by speech-in-noise subsection. Authors reported that gap detection was the least affected ability in individuals with CAPD, which is similar to the results of the present study.

## Chapter 6

### Summary and Conclusion

CAPD is a neurological disorder in which a person has difficulty interpreting sounds received by the ears, particularly the phonemes of speech. CAPD involves the deficit in processing of auditory information and if not rehabilitated properly it will lead to difficulty in communication, understanding etc. The demographic characteristics of pediatric CAPD and its prevalence are still debatable. Due to varied definition and differences in the diagnostic criteria for CAPD, the approximate prevalence measure varies from 0.5% to 1.0% to 7% of the population. Thus; a retrospective study on prevalence in individuals with CAPD was conducted. A total of 3537 cases with learning and other problems reported to Audiology OPD between the age range of 6-18 years at All India Institute of Speech and Hearing from June 2017 to July 2019. Out of these, 32 cases were diagnosed with CAPD. Thus, the prevalence of CAPD reported to AIISH in this duration was 0.7%.

#### **The salient results of the present study were:**

- Prevalence of CAPD was more in males than females.
- CAPD was found most prevalent in lower socio economic status compared to higher socioeconomic status.
- CAPD population mostly came with complaint of poor academic performance and the various secondary complaints reported in them were unintelligible speech, dysfluent speech etc.

- Most of the CAPD cases had hearing sensitivity within normal limits with 'A' Type of tympanogram.
- No retro cochlear pathology was seen in any of the CAPD cases.
- Prevalence of normal OAE functioning seen in both ears for all CAPD cases.
- Among the diagnostic tests to assess CAPD, speech perception in noise was the most affected and gap detection was the least affected ability in individuals with CAPD.

### **6.1 Clinical implications**

- The study provides the information regarding the different audiological findings seen in individuals with CAPD.
- It provides necessary information about the major complaints and associated problems seen in CAPD, so that appropriate management or referral can be made.
- The study provides an insight about the vulnerable population who can get CAPD (eg. children and males or people from lower socio-economic background)
- Thus, the study highlights the need to make people aware about the problems seen in CAPD, its consequences and rehabilitate early for the same.

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# Prevalence

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