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Prevalence of attention deficit hyperactivity disorder among primary school children in Cachar, Assam, North-East India

Abstract

Background: Attention deficit hyperactivity disorder (ADHD) is characterised by a pattern of diminished sustained attention and higher levels of impulsivity in a child or adolescent than expected for someone of that age and developmental level. **Aims**: Our study aims at the following- (i) To identify the prevalence of ADHD among children in primary schools. (ii) To identify the gender difference, age distribution, and distribution of socioeconomic class in the prevalence of ADHD. (iii) To identify the subtypes of ADHD. (iv) To assess the presence of any comorbid illnesses and to assess the association of various comorbidities with the subtypes of ADHD. **Materials and methods**: Three hundred children aged between six and 11 years were selected from two schools in Cachar district, Assam, India. The presence of ADHD was assessed by using the Conner's Abbreviated Rating Scale (CARS) given to parents and teachers, and then reassessment for typing of ADHD and any comorbidies were done by the Vanderbilt scale. **Statistical analysis**: Statistical analysis was done by Graph Pad prism for windows version 6.01 and Statistical Package for the Social Sciences (SPSSv22). Descriptive statistics was used to summarise the data. **Results**: The prevalence of ADHD among primary school children was found to be 12.66%. Prevalence was found to be higher among the boys, those belonging to lower middle socioeconomic class, and in the age groups of seven and eight years. **Conclusion**: The prevalence of ADHD is high among primary school children.

Keywords: Parents. School Teachers. Comorbidity.

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INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is a neuropsychiatric condition affecting pre-schoolers, children and adolescents, and even adults all over the world. In ADHD, "there is a persistent pattern of inattention, hyperactivity-impulsivity, or both".[1] Such behaviours are also age-inappropriate. There are three subtypes of ADHD which are usually of inattention, hyperactive-impulsive, and combined inattentive/hyperactive impulsive.[2] It is also the most frequently occurring mental health disorder in children.[3,4] Estimated prevalence is found to be in between four to eight per cent.[5] It is well-known that ADHD is associated with psychiatric and developmental disorders such as oppositional defiant disorder (ODD), conduct disorder, anxiety disorders, depressive disorders, and speech and learning disorders.[2] In children with ADHD, there is significant limitation in functioning across different settings. The affected children exhibit constellation of behavioural problems depending on the type of ADHD and the comorbidities. The parents or caregivers of these children also face varying degrees of stress and disharmony in their day to day life.

There are many studies conducted worldwide to check the prevalence of ADHD and its associated comorbidities, but regarding Indian context, such studies are limited. While most of the studies done so far are on clinically referred cases, and the major drawbacks of those studies were small sample size and failure to use a definite diagnostic criteria.

In India, the prevalence of ADHD has been reported from 1.6 to 17.9%.[6,7] While school based study on children between the ages of six to 11 years from India (Kerala) reported the prevalence as 11.3% with the highest prevalence between nine to ten years.[8] Another study reveals a wide range of prevalence rates between two and 17%.[9] A similar study done in North India on children between the ages of ten to 15 years reported the prevalence to be six per cent.[10] ADHD is characterised by heterogeneity and involves various other comorbid psychiatric disorders. International studies have shown comorbidities ranging from 60-100%. The most common comorbidity in children with ADHD reported in these studies has been ODD, ranging from 50-60%. ODD is reported to be higher in the combined subtype and significantly lower in inattentive subtype.[11]

In an Indian study, the conditions associated with ADHD were found to be poor academic performance, reading difficulty, writing difficulty, behavioural difficulties, and poor social behaviour.[8] Apart from these, another Western study, revealed that comorbid rates of ADHD and anxiety disorders was approximately 25% in both community and clinical samples[11]. Some other comorbidities associated with ADHD were conduct disorder, bipolar affective disorder, major depressive disorder, communication disorder, substance use disorder, obsessive compulsive disorder (OCD), elimination disorder, social phobia, and separation anxiety disorder.[12] Another study reported that ADHD was also associated with comorbidities, especially disruptive behaviour disorders.[9]

Our study aims at selecting primary school going children of Cachar district, Assam, India and adjoining areas, and to find out the prevalence of ADHD in this part of the country. To the best of our knowledge, this study would be first of its kind in this area.

Aims and objectives

(i) To identify the prevalence of ADHD among children in primary schools.
(ii) To identify the gender difference, age distribution, and distribution of socioeconomic class in the prevalence of ADHD.
(iii) To identify the subtypes of ADHD.
(iv) To assess the presence of any comorbid illnesses and to assess the association of various comorbidities with the subtypes of ADHD.

MATERIALS AND METHODS

Sample

The sample consisted a total of 400 primary school going students between six to 11 years of age selected randomly from two different schools in Cachar district, Assam, India.

Inclusion criteria

1. Students from both the sexes were included.
2. Every fifth student according to the roll number was selected to avoid selection bias as far as possible.

Exclusion criteria

1. Students below the age of six years and above 11 years.
2. Students having any other diagnosed medical illness.
3. Those students whose parents did not give consent to participate in the study or students who could not reproduce the proforma.

Tools

1. Conner's Abbreviated Rating Scale (CARS): This is a rating scale that consists of several behavioural parameters for the diagnosis of ADHD. This was rated by both the parents and the teachers. In this scale, those who scored above 15 by both teachers and parents are levelled to have ADHD features.[13]
2. Vanderbilt ADHD Rating Scale (VADRS): This scale has two versions- one for the teacher (VADTRS) and the other for parent (VADPRS). These scales are meant for confirmation of ADHD as well as for typing of ADHD and also to screen other comorbid conditions associated with ADHD, like ODD, conduct disorder, anxiety, mood disorders, or any other learning disabilities.

VADRS are based on the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria for ADHD diagnosis and include versions specific for parents and teachers. This rating scales effectively distinguish between children with and without ADHD and also assess accurately the subtypes of ADHD.

Parent rating scales (VADPRS)

The DSM-5 criteria is adapted for the home setting and it is a 55-question rating scale. In addition, the VADPRS also includes screening questions for conduct disorder, ODD, anxiety, and depression.

Teacher rating scales (VADTRS)

The DSM-5 criteria is adapted for the school setting and it is a 43-question rating scale. The teacher version also includes screening for mood and anxiety symptoms, learning disability, and rating of the child's classroom performance.

The illustration of psychometric properties and clinical utility of both the versions have been done in several studies ever since the introduction of the teacher rating scale in 1998[14] and the parent rating scale in 2003.[15] These were further reconfirmed via recent clinical studies in 2013.[16,17] Recent studies have also reported that VADPRS may be helpful in assessing children who meet or do not meet diagnostic criteria for those comorbidities like conduct disorder, ODD, anxiety and depression.[18]

3. Prasad's classification of social class: [19] This scale was developed by B.G. Prasad, which is an income based scale and so it needs to be constantly updated. It helps in measuring the socioeconomic class of an individual in community. This scale can be used on both urban and rural population, and it is based on the per capita income of the individual. There are five social classes as mentioned below:

I. upper class
II. upper middle class
III. middle class
IV. lower middle class
V. lower class

Methodology

Before conducting the study, approval from the Institutional Human Ethics Committee (IHEC) was obtained. This was a cross-sectional study involving 400 primary school children aged between six and 11 years (first to fourth standard) selected on a random basis from two different schools in Cachar district. At the outset, permission from the school authority was obtained. A written informed consent form was given to the parents through the children. Out of 400 students, only 300 students finally participated in the study either because some of their parents did not give consent and some of them could not reproduce the interview sheet. This sample consisted of 177 boys and 123 girls.

The sample was also broadly divided into two groups based on their socioeconomic status:

(a) 150 children selected from a government-aided school with Bengali as its medium of instruction, belonging to either lower or middle socioeconomic status.
(b) 150 children selected from a different school, which followed English as their medium of instruction, belonging to middle or higher socioeconomic status. This was done to avoid selection bias. All the tools were translated into Bengali and then translated back to English for ensuring correct translation. This was done for the convenience of parents and teachers. The flow chart below schematically represents the methodology of sample selection (Figure 1).

CARS was given to the teachers and to the parents of the children. Based on the score obtained as per both the teachers and parents rating, presence of ADHD was identified. For the children identified in the study as having ADHD, VADTRS and VADPRS were given to the teachers and their parents to identify the subtypes of ADHD, and to screen some comorbid conditions like ODD, conduct disorder, learning disorder, anxiety/depression, and impairment in classroom behaviour performance. Both the scales (CARS and VADRS) were given to both parents and teachers to compare the teacher's and parent's rating scores.

Statistical analysis

Appropriate data was collected, tabulated, and statistical analysis was done by GraphPad prism for windows version 6.01 and Statistical Package for the Social Sciences (SPSSv22) (SPSS Inc., Chicago, USA).[20] Descriptive statistics was used to summarise the data. Fisher's Exact test and Pearson's Chi-square test were applied to find out the p-value and the statistical significance, wherever necessary. The significance was determined at $p<0.05$.

RESULTS

Prevalence of ADHD

The case records of 300 children who have met the inclusion and exclusion criteria were analysed. The majority were boys (n=177) and others were girls (n=123). Out of 300 students, 38 students were found to have ADHD based on CARS scoring as per both teachers and parents, so prevalence of ADHD among primary school going children in this region was found to be 12.66%.

Gender difference, age wise distribution, and distribution of socioeconomic class of ADHD

ADHD was more prevalent in the boys than in the girls. Total number of boys selected were 177, of which 32 had ADHD. So prevalence of ADHD in the boys was 18.07%. Total number of girls selected were 123, of which six had ADHD. Hence prevalence of ADHD in the girls was 4.87%. In total, among the 38 children identified as having ADHD, 84.21% (32) were boys while 15.79% (six) were girls. The boy: girl ratio being 5:1.

Age-wise stratification of ADHD

Children with ADHD were also stratified on the basis of their age into six groups. The prevalence rate in each age group was identified and shown in Figure 2. The children were predominantly between the age groups of seven and eight years.

ADHD and socioeconomic status

In our study, out of 300 children, 164 children belonged to higher socioeconomic class, 134 children belonged to middle socioeconomic class and only two children belonged to lower socioeconomic class. The middle class was again divided into lower middle (57), middle (56), and upper middle class (21). The majority of the ADHD patients were found belonging to lower middle socioeconomic class (21.05%), followed by upper middle (19.04%), middle (10.71%), and lastly in higher class (9.75%). However, on applying Student's paired t test, this difference in prevalence among different socioeconomic class, was found to be statistically not significant (p=0.1234).

Subtypes of ADHD

The subtypes of ADHD among the school children were assessed as per VADRS. There are three subtypes of ADHD, namely ADHD inattentive type (ADHD-IT), ADHD hyperactive type (ADHD-HT), and ADHD combined type (ADHD-CT) which includes the features of both inattentive type and hyperactive type. The most common subtype in our study groups was combined (65.79%) followed by inattentive (23.69%) and then hyperactive (10.52%).

Comorbidities with ADHD

Out of 38 ADHD children, 34 were found to have one or more than one comorbidities at a time, while remaining

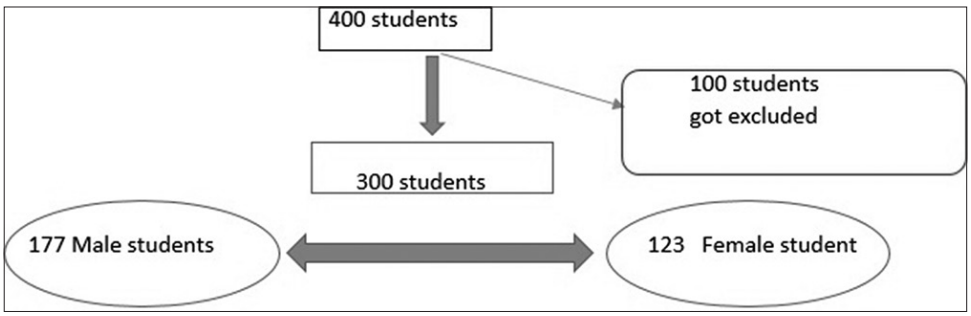

Figure 1: The flow chart schematically represents the methodology of sample selection.

four children do not have any associated problem, i.e. 84.5% reported the presence of one or more than one comorbidities. As per VADRS, we attempted to assess the other comorbidities with ADHD. The presence of comorbidities that could be screened with the help of this scale were: ODD/conduct disorder, anxiety/depression, learning disability, and impairment in classroom behaviour performance. The most common comorbidity in our study was the ODD/conduct disorder (76.31%), followed closely by learning disability (65.78%), impairment in classroom behaviour performance (50%), and least prevalent was anxiety/depression (18.42%) (Table 1).

In our study, when the individual comorbidities were analysed against gender, using Fisher's Exact test, anxiety/depressive disorder was found to be more in girl children with ADHD and that was statistically significant. Rest of the comorbidities were more in boy children with ADHD but those were statistically not significant (Table 2).

Subtypes of ADHD and associated comorbidities

As we can see, 96% of combined type, 75% of hyperactive type, and 22.22% of inattentive type had ODD/conduct disorder. While 55.5% of inattentive type, 25% of hyperactive type, and only four per cent of combined type had anxiety/depression. While learning disability was most common in combined type (72%), followed by inattentive type (66.6%) and hyperactive type (25%). Also, 56% of combined type, 50% of hyperactive type, and 33.3% of inattentive type had impairment in classroom behaviour performance (Table 3).

Thus, when overall comorbidities were analysed according to the subtypes, an association was found. Thereafter, individual comorbidities against subtype were analysed and it was found that ODD to be significantly more associated with the combined type (96%) and anxiety/depression to be significantly more associated with the inattentive type of ADHD (55.55%) while learning disability and classroom behaviour performance were more common with the combined type (72% and 56% respectively) (Table 4).

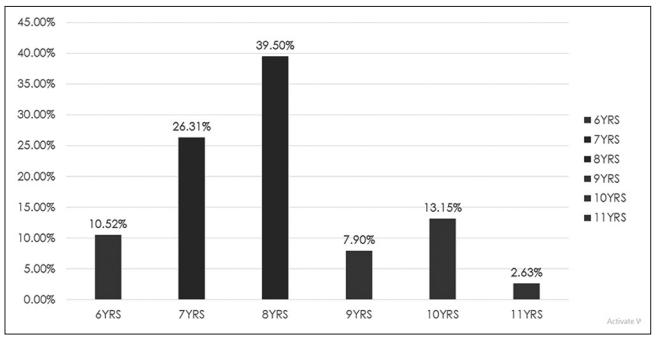

Figure 2: Distribution of attention deficit hyperactivity disorder (ADHD) among different age groups.

DISCUSSION

The prevalence of ADHD in the present study was 12.66% which is in accordance with other studies conducted in developing country like India.[8] This is consistent with that of several studies which showed a wide range of prevalence rates between two per cent and 17%.[6,7] The boy to girl ratio in the current study was found to be 5:1, which is also in accordance with another study that show that ADHD is more common in boys than in girls.[8] This result of gender difference in the present study is similar to that of earlier studies, which reports the ratio ranging from 10:1 in clinically referred sample and 3:1 in a community sample.[21] In our study, ADHD was predominantly found in the age groups of seven and eight years. This finding is consistent with a previous study which have reported increased prevalence of ADHD among children aged seven years or lesser.[22]

In the current study, CARS scoring by both teachers and parents were found to be almost similar and only those which have less discrepancy were chosen. This study also revealed a significant variation in the prevalence of ADHD between the children from higher and those from the middle socioeconomic status. Majority of the students belonged to a lower middle socioeconomic strata (21.05%). Several studies showed that ADHD is more common in lower socioeconomic strata,[8] which is different from the findings in the current study. This is probably because in the current study, the majority of the students belonged to middle or higher socioeconomic strata and only 0.66% belonged to lower socioeconomic strata. Although in current study, the findings were statistically not significant, the fact that the socioeconomic background is one of the important risk factors for the development of ADHD is further strengthened by the reports in the present study.[23]

When the subtypes were analysed, the most common subtype was found to be the combined type (65.79%) followed by inattentive type (23.69%) and hyperactive/impulsive type (10.52%), which was in accordance with other studies.[24] ADHD is a condition that is almost always associated with one or other comorbidities. Studies from India have reported the rate of comorbidities in children with ADHD to be in the range of 40-86.3%.[12] In our study, the rate of comorbidities in ADHD children was found to be 84.21%, which have either one or more than one comorbidities.

There are several studies, wherein many other comorbidities such as major depressive disorder, borderline

Table 1: Percentage prevalence of various types of comorbidities in our study group

Comorbidities	Boy (n=32)	Girl (n=6)	Total	Prevalence % (n=38)
Oppositional defiant disorder/conduct disorder	26	3	29	76.31
Anxiety/depression	2	5	7	18.42
Learning disability	22	3	25	65.78
Classroom behaviour performance	17	2	19	50

intellectual functioning, seizures, enuresis, disorders of written expression and mathematics, etc. were assessed. In India, a study on a clinic based sample in 2000 and later in 2013 in a community based sample, different comorbidities like academic difficulties, difficulties related to peers, and behavioural problems were mentioned.[8,22] But in those studies, despite presence of difficulties that were highlighted, no clinical diagnosis of these comorbidities was made. In the present study also, only four comorbidities were screened and no clinical diagnosis was made. The four comorbidities were ODD/conduct disorder, anxiety/depression, learning disorder, and impairment in classroom behaviour performance, which were assessed. The most common comorbidity associated with ADHD was found to be ODD/conduct disorder (76.3%), followed by learning disability (65.78%), then impaired classroom behaviour performance (50%), and anxiety/depression (18.42%). In one study, the most common comorbid condition was found to be ODD followed by anxiety and reading disorder.[24] Thus, our study is also in accordance to the previous findings. The results of international studies reviewed by Biederman *et al*.,[11] reported 30-50% of ADHD cases to be accompanied by conduct disorder, 15-75% by mood disorders, and 25% by anxiety disorders. Palaniappan *et al*.,[12] in their study conducted structured interviews in children with ADHD and found ODD as the most common disorder (25%) followed by anxiety disorders, like obsessive compulsive disorder (OCD0 (8.3%), separation anxiety (1.7%), and social phobia (1.7%). So, our study is similar to the findings by both international and Indian studies.

Besides, many studies have revealed that the development of antisocial personality is also comorbid with ADHD. Diagnosing such multifactorial neuropsychiatric condition in the children and intervening at the earliest will definitely help the children improve their academic and behaviour performance, and prevent the development of numerous other comorbid conditions.

This study, however, did not show any kind of statistically significant difference in the subtypes of ADHD among boys and girls. A study by Biederman *et al*.[21] has shown that girls were more likely to have predominantly inattentive type of ADHD than boys. However, of the four associated comorbidities, anxiety/depression was found to be more among girls than boys and it was statistically significant.

When comorbidities were studied according to subtype, majority of studies have found the combined type to have higher ratio of comorbid disorders than the other two types of ADHD. Our study also showed presence of ODD/conduct disorder to be more associated with combined subtype of ADHD while anxiety/depression to be more associated with inattentive subtype of ADHD, and these were statistically significant. Moreover, learning disability and impaired classroom behaviour performance were more common with the combined subtype; but, those were statistically not significant. This is not in accordance with a study which revealed disruptive behaviours like conduct disorder and ODD were higher in the hyperactive group.[7]

Table 2: Distribution of various types of comorbidities across the gender

Comorbidities	Boy (n=32)	Girl (n=6)	p-value
Oppositional defiant disorder/conduct disorder	26	3	0.1311, NS
Anxiety/depression	2	5	0.0002, S
Learning disability	22	3	0.3924, NS
Classroom behaviour performance	17	2	0.6599, NS

NS: Not significant, S: Significant

Limitations of our study

- No structured interview was meant to arrive at a diagnosis of both ADHD and the associated comorbidities.

Table 3: Subtypes of ADHD and associated comorbidities

Comorbidities	Subtypes of ADHD		
	ADHD-CT (n=25)	ADHT-IT (n=9)	ADHD-HT (n=4)
Oppositional defiant type/conduct disorder	24 (96%)	2 (22.22%)	3 (75%)
Anxiety/depression	1 (4%)	5 (55.55%)	1 (25%)
Learning disability	18 (72%)	6 (66.66%)	1 (25%)
Classroom behaviour performance	14 (56%)	3 (33.33%)	2 (50%)

ADHD: Attention deficit hyperactivity disorder, CT: Combined type, IT: Inattentive type, HT: Hyperactive type

Table 4: Association of comorbidities according to subtypes of ADHD

Comorbidities	Subtypes of ADHD			Chi-square	df	p-value
	ADHD-CT	ADHD-IT	ADHD-HT			
Oppositional defiant disorder/conduct disorder	24 (96%)	2 (22.22%)	3 (75%)	16.903	6	0.0096, S
Anxiety/depression	1 (4%)	5 (55.55%)	1 (25%)			
Learning disability	18 (72%)	6 (66.66%)	1 (25%)			
Classroom behaviour performance	14 (56%)	3 (33.33%)	2 (50%)			

ADHD: Attention deficit hyperactivity disorder, CT: Combined type, IT: Inattentive type, HT: Hyperactive type, df: Degree of freedom, S: Significant, NS: Not significant

- This is a cross-sectional study and not a longitudinal one.
- No follow-up was done of the students who were diagnosed with ADHD and its comorbidities.

Strength of the study

- The major limitations in the previous studies are that the identification of ADHD was made from samples through clinically referred cases. Our study has been done through community sampling and it has provided us a more uniform view about the prevalence of ADHD in this area.
- Since children with this disorder spend a large amount of time at school; school history and teachers' reports are important in evaluating the symptoms and forming a diagnosis.

To the best of our knowledge, this study is one which is first of its kind in this region, and the findings are almost similar with most studies conducted in a similar age group and other parts of the country. The high prevalence of this multifactorial childhood disorder, in which poverty may be a risk factor, the high rate of comorbidities, multiple comorbidities, and the difference in comorbidities according to gender and subtype, and thereby making the diagnosis a more complex in nature and further also adds to the existing literature.

Conclusion

We conclude that ADHD is one of the highly prevalent neuropsychiatric disorders in childhood and is associated with clinically significant impairment in multiple aspects of life. For early diagnosis and handling the illness better, it is essential to design an intervention programme, wherein all the areas of impairment in children with ADHD can be identified in details. Further, methodological rigorous studies, both longitudinal and cross-sectional, are supposed to be done to understand this disabling childhood disorder.

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