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### ABSTRACT

**Background:** Attention Deficit Hyperactivity Disorder (ADHD) is a common neurodevelopmental disorder that affects children worldwide. This study focuses on understanding the prevalence of ADHD in elementary school classrooms in India and the associated comorbidities

**Aim:** The primary aim of this research is twofold: first, to determine if the prevalence of ADHD in Indian elementary classrooms aligns with global statistics, and second, to find out the associated comorbidities. The present study was conducted through random sampling on 100 children of age group 6-12, belonging to government elementary school around the city of Jaipur to establish the prevalence of ADHD and the associated comorbidities. The participants were evaluated upon the Vanderbilt Assessment Scale (VAS).

**Methods:** The study, conducted during the 2022-2023 academic years, involved 100 primary school children aged 6-12 years from government school in Jaipur. Ethical approval was obtained from the Ethical Committee, and consent was secured from both teachers and parents. Data collection involved interviews with children from classes 1 through 6, selected using the fishbowl method from a list of nearby schools that responded to the researchers' outreach. The study identified children with ADHD using the Vanderbilt Assessment Scale. Additionally, it also identified the associated comorbidities in them. The process adhered to strict inclusion and exclusion criteria to ensure the study's rigor and validity.

**Results:** The study revealed that the prevalence of ADHD among 100 Indian elementary school students was 6%, which aligns with global statistics, underscoring that ADHD is a significant concern in India. Additionally, it was found that out of the 6 students diagnosed with ADHD, 3 had comorbid conditions: 2 with Oppositional Defiant Disorder (ODD) and 1 with Conduct Disorder.

**Conclusion:** The study highlights the need for comprehensive support systems for families dealing with ADHD, considering the prevalence of associated comorbidities

### I. INTRODUCTION

ADHD is a neurodevelopmental condition characterized by inattention, hyperactivity, and impulsivity. It acts as an obstacle in brain development, impacting cognition, emotions, and behavior. Although it begins in childhood, it can persist into adulthood, affecting individuals throughout their lives. The disorder presents itself in various forms and exhibits significant gender differences.<sup>[1-3]</sup>

ADHD impacts various aspects of daily life, such as work, school, and social interactions. Research indicates it can lead to behavioral problems and negative outcomes in multiple areas of life. The cognitive challenges associated with ADHD can impede educational and job performance. Symptoms differ but often include difficulty focusing, hyperactivity, and impulsivity. Diagnosing ADHD requires a thorough clinical evaluation of symptoms and medical history. There are three subtypes of ADHD: inattentive, hyperactive/impulsive, and combined.<sup>[4-8]</sup>

Managing ADHD typically includes a combination of medications, behavioral strategies, and lifestyle adjustments. Stimulant medications can enhance focus, while behavioral techniques help individuals manage their symptoms. Additionally, maintaining a healthy lifestyle through regular exercise and a balanced diet can be beneficial. Without appropriate treatment, children with ADHD may encounter academic, emotional, and social difficulties.<sup>[9-15]</sup>

ADHD affects not only the individual but also their family and school environment, often putting a strain on relationships and emotional health. Parents might feel overwhelmed and guilty, as managing ADHD symptoms can be time-consuming and exhausting. This intense focus on



one child can lead to neglecting the needs of others, potentially increasing the risk of mental health issues.<sup>[16,17]</sup>

ADHD accounts for 0.06% of total Years Lived with Disability (YLDs) and 0.02% of Disability-Adjusted Life Years (DALYs). Its global prevalence varies significantly, ranging from 1% to 20%, with an average of 1.13% in 2019. This variation is influenced by the different diagnostic methods and tools used.<sup>[22-24]</sup>

ADHD is the most common mental disorder in children, with prevalence rates in India ranging from 1.6% to 14%, depending on the region. This highlights the importance of early intervention and treatment by mental health professionals. In the United States, it is estimated that approximately 6.1 million children aged 2 to 17 have ADHD.<sup>[25-26]</sup>

ADHD often coexists with externalizing disorders such as Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD). Additionally, newer diagnostic categories like Disruptive Mood Dysregulation Disorder (DMDD) and Intermittent Explosive Disorder (IED) have been found to occur alongside ADHD. Research indicates that 30%-50% of children with ADHD also meet the criteria for CD or ODD. Population-based studies typically show that these comorbidities are more common in boys than in girls.<sup>[18-20]</sup>

The notably high rates of comorbidity may be partially due to a shared genetic basis. Longitudinal research indicates that the relationship between ADHD-like traits and externalizing behaviors strengthens with age, from childhood through adulthood. ADHD-like traits can intensify externalizing behaviors during the transition from adolescence to adulthood. Regarding environmental predictors, studies have shown that children with ADHD who experience neuropsychological dysfunction, early aggressive behavior, and adverse family conditions are at a higher risk for developing comorbid externalizing disorders.<sup>[21-23]</sup>

The combined impact of ADHD with other externalizing disorders, such as Conduct Disorder (CD) and Oppositional Defiant Disorder (ODD), can significantly affect functioning. Children with these comorbidities often face more academic challenges, including reading disorders, impaired verbal skills, and difficulties with visual-motor integration and visuospatial skills, compared to those without such comorbidities. Additionally, children with both ADHD and CD are more likely to engage in drug abuse, criminal behavior, and have driving-related issues. They are also at a higher risk of developing antisocial personality

disorder in adulthood compared to children with only ADHD. Furthermore, ADHD/CD is associated with higher rates of school expulsion and dropout than ADHD alone.<sup>[23-27]</sup>

In addition to affecting the clinical course and symptoms, these comorbidities present diagnostic challenges for clinicians. The overlapping clinical features can make it difficult to distinguish between ADHD and Conduct Disorder (CD). As a result, a hybrid disorder known as hyperactive CD, which has an earlier onset and a worse outcome than either disorder alone, is now recognized. Similarly, many patients diagnosed with Disruptive Mood Dysregulation Disorder (DMDD) also meet the criteria for Oppositional Defiant Disorder (ODD) or CD along with ADHD, complicating the diagnosis of these comorbid conditions.<sup>[28]</sup>

ADHD affects individuals of all ages, significantly impacting their lives. Although the exact causes remain uncertain, there are effective treatments available to manage symptoms and enhance daily functioning. Continuous research seeks to deepen our understanding of ADHD and improve treatment options. This study specifically examines elementary students in Jaipur to investigate the prevalence of ADHD and its comorbidities, aiming to gain a more comprehensive understanding of the disorder.<sup>[28-29]</sup>

## II. METHODOLOGY

### Study Design

In our research project, we've chosen to use a descriptive study, a common approach in research methodology. Sample size: using the formula for calculation of  $n = \frac{4pq}{D^2}$ <sup>[30]</sup> 100 students of the age group of 6 to 12 years will be taken for the study purpose. Permission of institutional ethical committee was obtained before starting the study (vide letter No.

JNUIMSRC/IEC/2022/78 Date 02/07/2022). Written, informed consent will be taken to participate in this study. The research was conducted during the academic years 2022-2023 in government schools located in Jaipur.

### Sample selection:

#### Technique:

- Prior to commencing the study, ethical approval was secured from the Ethical Committee. The research was carried out during the 2022-2023 academic years in government schools situated in Jaipur. The study sample consisted of 100 primary school children, aged between 6 and 12 years.



- The study data were gathered from school-going children aged 6-12 years (middle childhood) within their school environments. Consent was obtained from both teachers and parents. Initially, we compiled a list of nearby schools and received responses from 6-7 institutions. We then approached these schools and conducted interviews as part of our data collection process. Participants were stratified by class levels, specifically from classes 1 through 6. We used the fishbowl method for participant selection, involving random selection until the desired sample size was reached. After completing the interviews, the collected data were incorporated into our sample. This process adhered to our pre-established inclusion and exclusion criteria, ensuring the relevance and validity of our study sample. This methodology allowed us to maintain the rigor and integrity of our research process.

#### **INCLUSION CRITERIA:**

- Students of age 6 to 12 years old.
- Ability to cooperate and participate in the study.
- Parents willing to give informed and written consent and students willing to give assent.

#### **EXCLUSION CRITERIA:**

- Students found to have intellectual disability using colour progressive matrix
- Pervasive developmental disorder
- Epilepsy
- Gross neurological abnormalities

#### **TOOLS:**

1. Semistructured Proforma
2. BG Prasad Scale

The B. G. Prasad Scale, initially introduced in 1961 and subsequently revised in 1968 and 1970 by B. G. Prasad, is a method for categorizing socioeconomic status based on a family's monthly per capita income. The updated version of the scale divides families into five distinct classes according to their per capita income.<sup>[31]</sup>

- Class I (Upper class):  $\geq 9098$  (Rs/month)
- Class II (Upper middle class): Per Capita Income (Rupees per month) 4549 to 9097
- Class III (Middle class): Per Capita Income (Rupees per month) 2729 to 4550
- Class IV (Lower middle class): Per Capita Income (Rupees per month) 1365 to 2728
- Class V (Lower class): Per Capita Income (Rupees per month)  $< 1365$

#### 3. Vanderbilt ADHD Diagnostic Parent and Teacher Rating Scale (VADTRS)<sup>[32,33]</sup>

The Vanderbilt ADHD Diagnostic Parent and Teacher Rating Scale (VADTRS) is a tool designed to aid in diagnosing and managing Attention Deficit/Hyperactivity Disorder (ADHD), including hyperactivity/ impulsivity, combined subtype, oppositional defiant and conduct disorders, as well as symptoms of anxiety or depression in children aged 6 to 12 years.

#### 4. Color Progressive Matrices

The Color Progressive Matrices (CPM), created by John C. Raven in 1938, is a nonverbal tool designed to assess fluid intelligence in children, particularly those aged 5 to 11. The CPM features visual puzzles that increase in difficulty, requiring the test-taker to identify the missing piece that completes the pattern.

A psychometric analysis of the CPM examines the presence of pseudo-guessing and pseudo-carelessness among participants. This is achieved using the four-parameter logistic (4PL) Item Response Theory model, which evaluates guessing and carelessness through the model's lower and upper asymptotes. The study aims to ensure that nonverbal IQ estimation in CPM includes variable estimation methods for the highest possible accuracy.

Research has shown that CPM is a reliable measure of fluid intelligence in children, emphasising the need for careful interpretation of results to understand the diverse cognitive abilities involved.<sup>[34,35]</sup>

#### **STATISTICAL ANALYSIS**

Descriptive statistics have been delineated in tabular form in the result section.



### III. RESULTS

Table 1: Sociodemographic Data

Gender		Statistics
Male	49	$\chi^2 = 0.797$ df = 1 p = 0.372
Female	51	
<b>Total Participants</b>	100	
<b>Mean Age</b>	8.780 ( $\pm 1.481$ )	
<b>Mean Years In School</b>	4.590 ( $\pm 1.045$ )	
Socioeconomic Status		
Upper Class	95	$\chi^2 = 2.716$ df = 2 p = 0.257
Upper middle Class	5	
ADHD Status		
Positive	6 (M=4, F=2)	<b>Mean age 8.0 (<math>\pm 1.265</math>)</b>
Negative	94	<b>Mean age 8.830 (<math>\pm 1.486</math>)</b>
Performance		
ADHD positive status		$\chi^2 = 100.0$ df = 1 p = - <0.001
Comorbidities in ADHD Cases		
		1. Conduct Disorder - 1
		2. Anxiety -1
		3. ODD - 4

### IV. DISCUSSION

This study focused on ADHD in elementary classrooms, with participants aged 6 to 12 from government schools. The sociodemographic details are provided in Table 1. Various studies have highlighted gender differences in ADHD prevalence. For instance, Zorlu et al. reported 46.1% males and 53.9% females in their sample, but 62.61% of ADHD cases were male. Similarly, Richa et al. found 53% males and 47% females, with a higher incidence of ADHD behaviors in boys. These gender differences might be due to the underdiagnosis of girls, as their symptoms can manifest differently. Consequently, boys are more frequently diagnosed with ADHD, potentially due to distinct symptom presentations and environmental factors (as shown in Table 1).<sup>[36-40]</sup>

In our study, all 100 students from the government school were included, with 95 belonging to the upper socioeconomic status and 5 to the upper-middle socioeconomic status. Among the ADHD cases, one student was from the upper-middle socioeconomic status, while the remaining five were from the upper socioeconomic status (as shown in Table 1).

Our findings differ from those of Sharma P et al. and Prosenjit Ghosh et al., who identified a higher prevalence of ADHD in lower socioeconomic classes. This discrepancy arises

from our use of the B.G Prasad scale, which has a lower threshold for socioeconomic classification, resulting in participants being categorized into higher socioeconomic statuses despite having lower incomes. This highlights the significance of the classification scale employed in our study (as shown in Table 1).<sup>[41,42]</sup>

Globally, ADHD prevalence ranges from 5.29% to 7.1%, with national rates varying between 2% and 17%. Himani Mahesh Joshi et al. reported a prevalence of 5.67%, aligning with other studies that found rates between 5% and 12%. Indian studies indicate similar prevalence rates, ranging from 1.6% to 14% (as shown in Table 1).<sup>[43]</sup>

In our study, the mean age of students with ADHD was 8.0 ( $\pm 1.265$ ) years in government schools. This aligns with other studies, which reported average ages ranging from 7.9 to 10.6 years, providing a comprehensive view of age distribution among children with ADHD. (as shown in Table 1).<sup>[36-38,44,45]</sup>

Comorbidities were also observed among ADHD cases, with conduct disorder, anxiety, and oppositional defiant disorder (ODD) being the most common. These findings align with existing literature that highlights the high comorbidity rates in children with ADHD.<sup>[46-48]</sup>





## V. LIMITATIONS

The study included only 100 participants, which may not be representative of the broader population. A larger sample size would provide more robust and generalizable results. The use of the B.G Prasad scale, which has a lower threshold for socioeconomic classification, may have influenced the distribution of participants across socioeconomic statuses. This could affect the comparability of our findings with other studies. The cross-sectional nature of the study provides a snapshot of ADHD prevalence at a single point in time. Longitudinal studies are needed to understand the developmental trajectory and long-term outcomes of ADHD in this population. Additionally, factors such as parental education level, family stressors, and perceptions about mental illnesses were not considered, which could significantly impact the results and finally the study relied on specific diagnostic criteria and tools, which may differ from those used in other studies. This could lead to variations in ADHD prevalence rates and co morbidity patterns.

## VI. CONCLUSION

This study confirms that ADHD prevalence and the associated comorbidities in elementary classrooms is consistent with global and national statistics, affected by various demographic factors such as age, gender, and socioeconomic status. Importantly, the research highlights the urgent need for comprehensive support systems for families dealing with ADHD, taking into account the multifaceted nature of the disorder and its widespread effects on family well-being.

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