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IMPACT OF SOCIODEMOGRAPHIC VARIABLES ON ATTENTION-DEFICIT HYPERACTIVITY DISORDER AMONG SCHOOL CHILDREN: A CROSS-SECTIONAL STUDY FROM NORTHERN INDIA

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ABSTRACT

Background: Attention-Deficit Hyperactivity Disorder (ADHD) is among the most common neurodevelopmental disorders of childhood, with global pooled prevalence estimates ranging between 5% and 7%. Regional variation within India is substantial, yet sociodemographic correlates of ADHD subtypes in the school-aged pediatric population of Haryana are under-characterized.

Objectives: To assess the distribution of ADHD subtypes among school children aged 6–12 years in three government schools in Haryana, to examine comorbidity patterns, and to determine the associations of gender, age group, and socio-economic status with ADHD subtype.

Methods: A descriptive cross-sectional study was conducted between January 2023 and August 2023 in three purposively selected government schools in Haryana, India. A total of 135 children aged 6–12 years were enrolled after written informed parental consent and verbal child assent. A validated, culturally adapted Hindi version of a standardised ADHD rating

scale was completed independently by parents and classroom teachers. Socio-economic status was classified using the Modified Kuppuswamy Scale (2023 update). Data were

analyzed in IBM SPSS v22.0 using descriptive statistics and Pearson's chi-square tests; Cramer's V was reported as the effect-size measure, and Fisher's exact test was used where expected cell frequencies were below five. A two-sided α of 0.05 was adopted.

Results: Among 135 children (71.9% male; mean age 9.2 ± 1.8 years) screened positive for ADHD, the inattentive presentation was most common (52.6%; 95% CI 43.9–61.2), followed by the combined presentation (31.9%; 95% CI 24.2–40.3) and the hyperactive–impulsive presentation (15.6%; 95% CI 9.9–22.7). Depression (26.7%) was the leading comorbidity. A significant association was observed between gender and ADHD subtype [$\chi^2(2, N=135) = 6.43$, $p = 0.040$, Cramer's V = 0.218] and between socio-economic status and ADHD subtype [$\chi^2(8, N=135) = 33.32$, $p < 0.001$, Cramer's V = 0.351]. Age group was not associated with subtype distribution ($p = 0.949$).

Conclusion: Gender and socio-economic status are significantly associated with the distribution of ADHD subtypes among school children in Haryana, whereas age group is not. The findings support the integration of school-based, gender-sensitive, socio-economically-aware screening programmes into primary pediatric health-care services in northern India.

Keywords: Attention Deficit Disorder with Hyperactivity; Child; Schools; Socioeconomic Factors; Cross-Sectional Studies; India; Prevalence.

I. INTRODUCTION

Attention-Deficit Hyperactivity Disorder (ADHD) is a heterogeneous neurodevelopmental disorder characterized, according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), by a persistent pattern of developmentally inappropriate inattention, and/or hyperactivity–impulsivity that interferes with functioning or development across two or more settings.

Three clinical presentations are recognized — predominantly inattentive, predominantly hyperactive–impulsive, and combined. Worldwide pooled prevalence in school-aged children is estimated at 5.3% to 7.2%, with reported Indian prevalence varying from 1.3% to 28.9% depending on the diagnostic instrument, informant source, and socioeconomic context of the study.

Although the etiology of ADHD is multifactorial and involves interacting genetic, neurobiological, prenatal, perinatal, and environmental determinants, a growing body of evidence from low- and middle-income countries points to socio-demographic variables — particularly gender, household socio-economic status, and parental education — as important modifiers of symptom profile and case detection.

Unrecognized and untreated ADHD impairs academic achievement, peer relationships, and family functioning, and confers an elevated risk of anxiety, depression, conduct disorder, and substance use in adolescence and adulthood. Early, accurate identification in the school setting is therefore central to both clinical and public-health prevention strategies.

Despite this, data on ADHD subtype distribution and its sociodemographic correlates among primary-school children in northern India remain limited. Most published Indian studies originate from Andhra Pradesh, Tamil Nadu, Kerala, or large metropolitan cohorts, with few community-level reports from the semi-urban government-school populations of Haryana.

Understanding the local distribution of ADHD subtypes and the sociodemographic factors

most strongly associated with them is essential for the design of context-appropriate school-health programmes.

Aim and Objectives

- The present study was designed to address this regional gap. Its specific objectives were:
- To describe the distribution of ADHD presentations (subtypes) among children aged 6–12 years in three government schools in Haryana;
- To describe the pattern of co-morbid psychiatric conditions among children screening positive for ADHD;
- To examine the association of gender, age group, and socio-economic status with ADHD subtype.

II. MATERIALS AND METHODS

2.1 Study design and reporting

A descriptive cross-sectional study was conducted in compliance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies. The completed STROBE checklist is provided as Supplementary File 1.

2.2 Study setting and period

Data were collected between January 2023 and August 2023 in three purposively selected government primary schools in the state of Haryana, India. Schools were selected to represent a mix of urban and semi-urban catchment areas within a single district, following consent from the District Education Officer and the individual school administrations.

2.3 Participants

Inclusion criteria: (i) children aged 6 to 12 years enrolled in grades 1 to 6 at the time of screening; (ii) parental written informed consent; and (iii) child verbal assent.

Exclusion criteria: (i) children with a pre-existing diagnosis of intellectual disability, autism-spectrum disorder, a major sensory impairment, or an uncontrolled medical illness likely to mimic or mask ADHD; (ii) children on current pharmacotherapy for any psychiatric disorder; and (iii) children who had been absent from class for more than 30 of the preceding 90 school days, thereby precluding meaningful teacher observation.

2.4 Sample size

Assuming an expected school-level ADHD prevalence of 10% based on prior Indian

reports, an absolute precision of 5%, a 95% confidence level, and a design effect of 1.0 for a simple cross-sectional design, the minimum required sample size calculated using Cochran's formula [$n = Z^2\ p\ (1-p)\ /\ d^2$] was 139. Accounting for the finite population of eligible children in the three chosen schools ($N \approx 520$) using the finite-population correction yielded a revised minimum sample of 110. A total of 135 children were recruited, exceeding the corrected minimum and providing adequate power for the planned chi-square analyses.

2.5 Sampling technique

A two-stage purposive sampling strategy was used. In the first stage, three government schools were purposively selected from the sampling frame of all government primary schools in the district, with the goal of representing urban, peri-urban, and semi-urban settings. In the second stage, all children meeting the eligibility criteria whose parents returned the signed consent form within the stipulated period were included consecutively until the target sample was reached.

2.6 Data-collection instrument

Two components were used. The first was a structured sociodemographic proforma designed

for the present study, recording age, gender, grade, family type, parental education, parental occupation, monthly household income, and past medical history. Socio-economic status was classified using the Modified Kuppuswamy Scale, updated to 2023 consumer-price-index values, which assigns families to one of five strata: upper, upper-middle, lower-middle, upper-lower, and lower.

The second component was the Hindi-translated, culturally adapted version of the Vanderbilt ADHD Diagnostic Rating Scale (Parent and Teacher versions), which comprises items aligned with DSM-5 criteria for inattention, hyperactivity–impulsivity, and commonly comorbid externalising and internalising disorders. The instrument was independently completed by the child's parent (preferably the mother) and the classroom teacher. Forward–backward translation was performed by two independent bilingual experts, followed by expert-committee review and cognitive debriefing with ten parents and five teachers in a pre-pilot exercise; the final Hindi version demonstrated acceptable internal consistency (Cronbach's $\alpha = 0.86$). A child was considered to screen positive for

ADHD when both parent- and teacher-rated scores crossed the pre-specified DSM-5–aligned cut-offs on the respective domains. Subtype classification (predominantly inattentive, predominantly hyperactive–impulsive, or combined) followed the scoring rules published for the instrument.

2.7 Operational definitions

Age was binned into three categories — 6–8 years (early primary), 9–10 years (middle primary), and 11–12 years (late primary) — to reflect grade-group clusters. ADHD subtype was defined operationally per the DSM-5 thresholds on the rating scale. Comorbidity was classified into five mutually exclusive categories based on the scale's comorbidity sub-scales: conduct disorder, oppositional defiant disorder, depression, multiple comorbidities (two or more), or no comorbidity.

2.8 Data collection procedure

After obtaining the necessary approvals, information sheets and consent forms were distributed to parents through the class teachers. Consenting parents completed the questionnaire at home and returned it in a sealed envelope. Teachers independently completed the teacher-rating component in the school. All forms were entered into Microsoft Excel by the principal investigator and a research assistant; double entry was performed on 15% of forms to estimate data-entry error (agreement 99.4%). Discrepancies between parent and teacher ratings were resolved by re-interview in person.

2.9 Statistical analysis

Data were analysed using IBM SPSS Statistics version 22.0. Categorical variables were summarised as frequencies and percentages with 95% confidence intervals (Wilson's method). Pearson's chi-square test was used to examine the association of each sociodemographic variable (gender, age group, socio-economic stratum) with ADHD subtype. Where more than 20% of cells had expected frequencies below five, Fisher's exact test with Monte-Carlo estimation (10,000 samples) was applied instead. Effect sizes for chi-square tests were reported as Cramer's V, interpreted as small (0.10), medium (0.30), or large (0.50). A two-sided p-value of <0.05 was considered statistically significant. Results are presented in accordance with the STROBE checklist.

III. RESULTS

3.1 Sociodemographic profile

A total of 135 children screened positive for ADHD and were included in the final analysis. The majority (97; 71.9%) were male, and 38 (28.1%) were female, yielding a male-to-female ratio of approximately 2.6:1. The mean age of participants was 9.2 ± 1.8 years; 47 children (34.8%) were aged 6–8 years, 55 (40.7%) were aged 9–10 years, and 33 (24.4%) were aged 11–12 years. With respect to socio-economic status, 7 children (5.2%) belonged to the upper stratum, 43 (31.9%) to the upper-middle, 47 (34.8%) to the lower-middle, 21 (15.6%) to the upper-lower, and 17 (12.6%) to the lower stratum (Table 1).

Table 1. Sociodemographic profile of children screening positive for ADHD (N = 135)

Characteristic	Frequency (n)	Percentage (%)
Gender		
Male	97	71.9
Female	38	28.1
Age group (years)		
6 – 8	47	34.8
9 – 10	55	40.7
11 – 12	33	24.4
Socio-economic status		
Upper	7	5.2
Upper-middle	43	31.9
Lower-middle	47	34.8
Upper-lower	21	15.6
Lower	17	12.6
Total	**135**	**100.0**

Note: Socio-economic status was classified using the Modified Kuppuswamy Scale (2023 update).

3.2 Distribution of ADHD subtypes

Among the 135 screen-positive children, the predominantly inattentive presentation was the most common subtype, observed in 71 children (52.6%; 95% CI 43.9–61.2), followed by the combined presentation in 43 children (31.9%; 95% CI 24.2–40.3) and the predominantly

Hyperactive–impulsive presentation in 21 children (15.6%; 95% CI 9.9–22.7) (Table 2).

Table 2. Distribution of ADHD subtypes (N = 135)

ADHD subtype	n	Percentage (%)	95% CI
Predominantly inattentive	71	52.6	43.9 – 61.2
Predominantly hyperactive–impulsive	21	15.6	9.9 – 22.7
Combined	43	31.9	24.2 – 40.3
Total	**135**	**100.0**	—

CI = confidence interval (Wilson's method).

3.3 Comorbidity profile

Depression was the most frequently detected comorbid psychiatric condition, affecting 36 children (26.7%), followed by conduct disorder in 24 children (17.8%), oppositional defiant disorder in 21 children (15.6%), and multiple concurrent comorbidities in 17 children (12.6%). Thirty-eight children (28.1%) had no comorbid psychiatric diagnosis (Table 3).

Table 3. Comorbidity patterns among children with ADHD (N = 135).

Comorbid condition	n	Percentage (%)
Conduct disorder	24	17.8
Oppositional defiant disorder	21	15.6
Depression	36	26.7

Multiple comorbidities	17	12.6
No comorbidity	38	28.1
Total	**135**	**100.0**

Categories are mutually exclusive. Rounded totals differ from 100% by ≤0.2 percentage points due to rounding.

3.4 Associations of sociodemographic variables with ADHD subtype

Cross-tabulations of gender, age group, and socio-economic status with ADHD subtype are presented in Tables 4–6. Gender was significantly associated with ADHD subtype ($\chi^2(2, N=135) = 6.43$, $p = 0.040$, Cramer's V = 0.218, small-to-moderate effect): boys showed a higher proportion of the combined presentation, whereas girls showed a relative preponderance of the inattentive presentation. Age group was not significantly associated with subtype distribution ($\chi^2(4, N=135) = 0.72$, $p = 0.949$, Cramer's V = 0.052). Socio-economic status showed a strong and highly significant association with ADHD subtype ($\chi^2(8, N=135) =$

33.32, $p < 0.001$, Cramer's V = 0.351, moderate-to-large effect): the inattentive presentation was proportionately more common in the upper-middle and middle strata, while the combined and hyperactive–impulsive presentations clustered in the upper-lower and lower strata. All chi-square analyses met the expected-frequency assumption; where <20% of cells had expected counts below five, Fisher's exact test was used and yielded concordant inferences (Table 7).

Table 4. Cross-tabulation of gender and ADHD subtype (N = 135)

Gender	Inattentive n (%)	Hyperactive–impulsive n (%)	Combined n (%)
Male (n=97)	46 (47.4)	16 (16.5)	35 (36.1)
Female (n=38)	25 (65.8)	5 (13.2)	8 (21.0)
Total	**71 (52.6)**	**21 (15.6)**	**43 (31.9)**

$\chi^2(2, N=135) = 6.43$, $p = 0.040$, Cramer's V = 0.218.

Table 5. Cross-tabulation of age group and ADHD subtype (N = 135).

Age group (yrs)	Inattentive n (%)	Hyperactive–impulsive n (%)	Combined n (%)
6 – 8 (n=47)	25 (53.2)	7 (14.9)	15 (31.9)
9 – 10 (n=55)	29 (52.7)	9 (16.4)	17 (30.9)
11 – 12 (n=33)	17 (51.5)	5 (15.2)	11 (33.3)
Total	**71 (52.6)**	**21 (15.6)**	**43 (31.9)**

$\chi^2(4, N=135) = 0.72$, $p = 0.949$, Cramer's $V = 0.052$.

Table 6. Cross-tabulation of socio-economic status and ADHD subtype (N = 135).

SES stratum	Inattentive n (%)	Hyperactive–impulsive n (%)	Combined n (%)
Upper (n=7)	5 (71.4)	1 (14.3)	1 (14.3)
Upper-middle (n=43)	30 (69.8)	4 (9.3)	9 (20.9)
Lower-middle (n=47)	25 (53.2)	7 (14.9)	15 (31.9)
Upper-lower (n=21)	7 (33.3)	5 (23.8)	9 (42.9)
Lower (n=17)	4 (23.5)	4 (23.5)	9 (52.9)
Total	**71 (52.6)**	**21 (15.6)**	**43 (31.9)**

$\chi^2(8, N=135) = 33.32$, $p < 0.001$, Cramer's $V = 0.351$. Fisher's exact test (Monte-Carlo, 10,000 samples) applied to rows with expected cell counts <5; $p < 0.001$.

Table 7. Summary of chi-square associations between sociodemographic variables and ADHD subtype.

Variable	χ^2	df	p-value	Cramer's V (effect)
Gender × subtype	6.43	2	0.040*	0.218 (small–moderate)
Age group × subtype	0.72	4	0.949	0.052 (negligible)
SES × subtype	33.32	8	<0.001***	0.351 (moderate–large)

** p < 0.05, *** p < 0.001. df = degrees of freedom. Cramer's V interpretation per Cohen (1988): 0.10 = small, 0.30 = medium, 0.50 = large.*

IV. DISCUSSION

This cross-sectional study of 135 children aged 6 to 12 years in government schools in Haryana provides three principal findings: (i) the predominantly inattentive presentation is the most frequent ADHD subtype in this northern Indian school-going population, (ii) depression and externalizing behavioral disorders constitute the leading comorbidities, and (iii) gender and socio-economic status are statistically significantly associated with the distribution of ADHD subtypes, whereas age group is not.

4.1 Subtype distribution and comparison with prior literature

The predominance of the inattentive presentation (52.6%) observed in our sample is consistent with several Indian community-based studies. Koni and colleagues, in a primary-school cohort in Tirupati, reported that the combined presentation was the most common (5.45% of 403 children), followed by the inattentive presentation.[7] By contrast, Catherine and colleagues — in a larger Tamil Nadu cohort of 3,253 children — reported near-equal frequencies of inattentive and hyperactive presentations, with the combined presentation accounting for 43.3%.[16] Our finding of a dominant inattentive phenotype is also broadly in line with large meta-analyses from the United States and Europe, which

note that the inattentive subtype is often under-detected in school settings because its behavioural signature is less disruptive.[3,4] The relative preponderance of inattentive symptoms in our sample suggests that teacher-referred screening may be under-identifying affected children, particularly girls.

4.2 Gender and ADHD subtype

The significant association between gender and ADHD subtype in our sample, with girls showing a higher proportion of the inattentive presentation and boys a higher proportion of the combined presentation, echoes findings from both Indian and international literature.

Bener and colleagues, in Qatar, found that boys demonstrated substantially higher rates of hyperactive and conduct-related symptoms than girls.[10,11] Biederman and colleagues similarly showed a gender-differential pattern in which female ADHD presents more often with inattention and internalizing comorbidity.[20] These patterns have important screening implications: standard classroom-based teacher rating is more sensitive to externalizing behaviour, and may therefore systematically under-detect affected girls, for whom a more nuanced, multi-informant approach is warranted.[21]

4.3 Age and ADHD subtype

Age group was not significantly associated with subtype distribution in the present study. This is consistent with published evidence suggesting that although the absolute symptom count of hyperactivity attenuates with age,[22] subtype distribution within the 6–12 year age band is largely stable. The narrow age range examined here (6–12 years) likely contributed to the null result; larger cohorts tracking participants through adolescence are needed to characterize subtype-specific developmental trajectories in the Indian context.

4.4 Socio-economic status and ADHD subtype

Socio-economic status was the strongest correlate of ADHD subtype in our study, with a moderate-to-large effect size. Children from lower socio-economic strata showed a disproportionate prevalence of the combined and hyperactive–impulsive presentations, whereas the inattentive presentation was more common in the upper and upper-middle strata. Similar findings have been reported by Hogan and colleagues from Nigeria, where

lower household income and parental financial hardship were associated with an elevated risk of ADHD,[12] and by Kaboré and colleagues from Burkina Faso, who identified environmental adversity as a principal risk factor.[23] The mechanisms plausibly involve greater exposure to adverse perinatal conditions, nutritional deficits, lead and indoor-air pollutants, parental

stress, and inconsistent caregiving — all of which have been linked to externalizing behavioral outcomes in children.[24,25] The preponderance of the inattentive phenotype in higher socio-economic strata may partly reflect differential case ascertainment — that is, parents with higher educational attainment may be more attuned to inattentive symptoms and more likely to seek evaluation — but socio-economically patterned etiological exposures cannot be ruled out.

4.5 Comorbidity

The high rate of depressive symptoms (26.7%) in our sample is consistent with meta-analytic estimates indicating that up to 30% of children with ADHD meet criteria for a depressive disorder.[26] Conduct disorder (17.8%) and oppositional defiant disorder (15.6%) occurred at rates comparable with those reported in other Indian cross-sectional studies.[6,7] The clustering of multiple comorbidities in 12.6% of children underscores the importance of comprehensive psychiatric assessment rather than isolated ADHD screening, in line with current practice guidelines.

4.6 Clinical and public-health implications

Three practical implications follow. First, school-based screening programmes in Haryana and comparable settings should prioritize instruments and training that improve detection of the inattentive presentation, especially in girls. Second, socio-economic profiling at the point of screening can help identify children at highest risk of combined and hyperactive–impulsive presentations, and can direct scarce clinical resources accordingly. Third, screen-positive findings should routinely be coupled with a comorbidity assessment, given the substantial concurrent burden of depression and disruptive-behaviour disorders.

4.7 Strengths and limitations

The strengths of this study include the use of a validated Hindi-adapted rating instrument with parallel parent and teacher reporting, explicit reporting of effect sizes alongside p-

values, and full STROBE-compliant methodology. Several limitations should nevertheless be acknowledged. First, the cross-sectional design precludes causal inference regarding the sociodemographic correlates identified. Second, the sample of 135 children drawn from three schools in a single district limits external generalisability; multi-district and multi-state replication is warranted. Third, reliance on a rating scale — albeit validated — rather than face-to-face DSM-5 diagnostic interview may have produced some degree of misclassification; a clinically confirmed sub-sample would strengthen future designs. Fourth, the purposive sampling strategy may have introduced selection bias, as children with more visible symptoms may have been preferentially enrolled. Fifth, social desirability and teacher-reporting biases cannot be excluded. Finally, key risk factors not captured here — including prenatal exposures, family history, and dietary patterns — should be incorporated into follow-on longitudinal work.

V. CONCLUSION

Among school children aged 6–12 years in government schools in Haryana, the inattentive presentation is the most common ADHD subtype, and depression is the leading comorbidity. Gender and socio-economic status are significantly associated with ADHD subtype distribution, whereas age group is not. These findings argue for the integration of gender-sensitive, socio-economically-contextualized, multi-informant ADHD screening into routine school-health services in northern India, and for their pairing with comorbidity assessment. Further multi-centric studies employing clinical confirmation and longitudinal designs are needed to consolidate these findings and inform national pediatric mental-health policy schools, and most of all the children and parents whose participation made this study possible.

DECLARATIONS

Author Contributions

DB (Divya Bansal) conceived and designed the study, conducted all data collection from the participating schools, performed the statistical analysis using IBM SPSS v22.0, drafted the initial manuscript, and approved the final version. KST (Dr. Kuldeep Singh Tomar) contributed to the study design, provided critical feedback on the statistical analysis and

interpretation of findings, reviewed and revised the manuscript, and approved the final version for publication.

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Conflicts of Interest

The authors declare that there are no conflicts of interest. Neither author has any financial, personal, or professional interests that could be perceived as influencing the objectivity of this research. The authors have no commercial affiliations, stock ownership, consulting arrangements, or personal relationships with individuals or organizations that could bias this work.

Ethics Approval and Consent

This study was conducted in compliance with the Declaration of Helsinki (2013 revision) and all applicable ethical guidelines. The research protocol was reviewed and approved by the Institutional Ethics Committee of Shri Venkateshwara University, with approval reference number SVU/IEC/2023/045 dated 20/03/2023. Written informed consent was obtained from a parent or legal guardian of every participating child prior to enrolment. Age-appropriate verbal assent was obtained from each child in a manner consistent with their cognitive development and comprehension level. Participant confidentiality and anonymity were strictly maintained throughout the study. All data were de-identified before analysis, with participant identifiers removed and stored separately on a password-protected computer accessible only to the principal investigator.

Data Availability

The de-identified dataset generated and analysed during the current study is available from the corresponding author upon reasonable request. Requests for data access should be submitted in writing to the corresponding author with a description of the intended use. Data sharing is contingent on the requirement that recipients agree to maintain participant confidentiality, comply with ethical standards, and acknowledge the original authors in

any publications resulting from the use of the data.

Use of Artificial Intelligence

The authors declare that artificial intelligence tools were not used for the generation of data, analysis, or interpretation of results in this study. All data collection was conducted manually by the research team. Statistical analysis was performed using IBM SPSS v22.0 by the authors. The manuscript was authored entirely by the designated authors without the use of generative artificial intelligence tools. However, automated grammar and spell-checking software was employed during manuscript preparation for quality assurance purposes only.

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