

# Adult ADHD and Co-occurring Mental Health Challenges Among Medical Students: A Cross-Sectional Study from Bangladesh

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## Research Article

**Keywords:** Adult ADHD, Medical Students, Mental Health, Depression, Anxiety, Stress, Academic Functioning, Bangladesh

**Posted Date:** July 7th, 2026

**DOI:** <https://doi.org/10.21203/rs.3.rs-10243973/v1>

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**Additional Declarations:** The authors declare no competing interests.

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# Abstract

## Background

Adult Attention-Deficit/Hyperactivity Disorder (ADHD) is increasingly recognized as a significant, yet under-diagnosed, challenge for medical students, potentially impairing academic and professional success. This study aimed to determine the prevalence of adult ADHD among medical students in Bangladesh and assess its associations with mental health status and academic functioning.

## Methods

This cross-sectional study was conducted among 487 medical students (MBBS/BDS) across Bangladesh using a stratified convenience sampling technique. Participants were screened using the World Health Organization (WHO) Adult ADHD Self-Report Scale (ASRS-v1.1). Mental health status was assessed via the Generalized Anxiety Disorder-7 (GAD-7), Patient Health Questionnaire-9 (PHQ-9), and Perceived Stress Scale (PSS-10). Academic and career functioning were evaluated through structured questions. Data was analyzed using non-parametric tests, including Wilcoxon rank-sum, Pearson's Chi-squared, and ordinal logistic regression to identify independent predictors of ADHD symptom severity.

## Results

The prevalence of probable adult ADHD was 34.9% ( $n = 170$ ). Students screening positive for ADHD reported significantly higher levels of anxiety (mean 11.6 vs. 6.2;  $p < 0.001$ ), depression (mean 15.0 vs. 8.5;  $p < 0.001$ ), and perceived stress (mean 24.6 vs. 20.3;  $p < 0.001$ ) compared to the negative group. Additionally, the ADHD-positive group demonstrated poorer academic functioning ( $p < 0.001$ ). Ordinal logistic regression identified anxiety (OR = 1.113), perceived stress (OR = 1.100), depression (OR = 1.083), and male sex (OR = 1.484) as significant independent predictors of ADHD symptom severity. First-year students were at significantly higher risk compared to other cohorts ( $p < 0.05$ ).

## Conclusions

A high proportion of Bangladeshi medical students screen positive for ADHD, which is strongly associated with adverse mental health outcomes and academic underperformance. These findings underscore the urgent need for routine mental health screening and targeted support services in medical curricula to mitigate the "hidden burden" of undiagnosed ADHD.

## 1. Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by developmentally inappropriate and impairing levels of inattention, hyperactivity, and impulsivity that

usually first appears in childhood<sup>1-3</sup>. ADHD is frequently diagnosed among children but rarely acknowledged in adults, especially those who have never been treated as children<sup>4,5</sup>. Approximately, 60%-70% of children diagnosed with ADHD will still experience symptoms in adulthood<sup>6,7</sup>. Previous reviews have found a high prevalence of ADHD among people worldwide. An umbrella review estimated the prevalence of adult ADHD to be around 3.1%<sup>8</sup>, while another study found that the global prevalence of symptomatic adult ADHD was 6.76%<sup>9</sup>. The hyperactivity and impulsiveness of such individuals tend to decrease with age, but the attention deficit remains the same<sup>10</sup>. The symptoms of adult ADHD sometimes coincide with those of other mental disorders, making diagnosis challenging<sup>11,12</sup>. Overlapping neurobiological, genetic, and neuropsychological pathways were also found to be important contributors to this comorbidity in a thorough analysis, which makes proper diagnosis and treatment more difficult<sup>13</sup>. As a result, many people continue to be underdiagnosed and mistreated, which has a detrimental impact on their general well-being, professional functioning, and academic achievement<sup>14</sup>. Additionally, the burden of mental comorbidities associated with adult ADHD is well established. Previous studies have reported that adult with ADHD are more likely than the non-ADHD to have co-occurring mental disorders such as anxiety, stress and depression<sup>15</sup>.

Medical students, on the other hand, are considered more vulnerable due to their continuous exposure to academic pressure and improper sleep, both of which may play a crucial role in the development of ADHD<sup>16,17</sup>. Systematic and national studies report ADHD or probable ADHD in roughly 7–45% of medical students, usually higher than general adult<sup>18-20</sup>. Several studies explicitly define unrecognized or undiagnosed ADHD as a "hidden burden" among medical student<sup>18,19,21</sup>. ADHD in medical students is linked to academic underperformance, lower GPA, delayed graduation, higher dropout, and residency match difficulties<sup>22,23</sup>. Students report difficulty sustaining attention in long lectures/clinicals, time-management problems, incomplete work, and disorganization<sup>22</sup>. Moreover, other mental health challenges associated with ADHD such as stress, anxiety and depression may further impair academic performance, increase the risk of burnout, even leading to severe outcomes such as suicidal ideation.<sup>24-26</sup> The accurate recognition, assessment, and management of adult ADHD are crucial for providing optimal care to affected individuals.

The prevalence of mental health issues among medical students in Bangladesh is significant and well-documented. Studies among Bangladeshi medical students have demonstrated a substantial mental health burden, with high prevalence of depression, anxiety, and stress<sup>27,28</sup>. A significant mental health burden, including high rates of suicide thoughts and moderate-to-severe depression, has been shown in research, especially among females, first-year students, and those living away from family<sup>29,30</sup>. Despite the fact that poor mental health status can increase the risk of ADHD development, the prevalence of adult ADHD and its associated mental health status among medical students has rarely been investigated in Bangladesh. Therefore, we conducted this study to determine the prevalence of adult ADHD, depression, anxiety, and perceived stress among medical students and to assess the

associations between ADHD screening status and mental health outcomes, academic stress, and career functioning in Bangladesh.

## 2. Methods

### 2.1. Study Design and Participants

This was a cross-sectional survey conducted among the medical students enrolled in the 5-year Bachelor of Medicine, Bachelor of Surgery (MBBS) and Bachelor of Dental Surgery (BDS) program in Bangladesh. Data were collected from Public medical and dental colleges, Private medical and dental colleges and Army-affiliated medical colleges across various geographical divisions including Dhaka, Chattogram, Sylhet and Rajshahi to ensure a representative national sample using a stratified convenience sampling technique. Participants who declined to provide informed consent, had enrolled from foreign country or were under the age of 18 were excluded.

### 2.2. Sample size determination and sampling procedure

The sample size required for this study was determined by using Cochran's formula to estimate a single population proportion, assuming 34.8% ( $\approx 0.35$ ) prevalence rate among the population based on a previous study<sup>18</sup>, 95% CI, 5% margin of error, at alpha 0.05.

$$n = \frac{z^2 pq}{d^2}; n = \frac{1.96^2 \times 0.35 \times (1 - 0.35)}{0.05^2} \approx 350$$

The formula produced  $n = 350$ . After adding 10% for non-response, the final calculated sample size was 385 medical students.

### 2.3. Data collection tools and measurements

Data were collected through a structured, anonymous online questionnaire using Google Forms. The online format was selected to facilitate participation from students across multiple institutions while maintaining participant privacy and reducing potential social desirability bias when responding to sensitive mental health questions. Electronic informed consent was obtained before participants accessed the questionnaire. The sample size was calculated to be 385 using Cochran's formula. Hence, a structured questionnaire was used, and a total of 488 people filled out the questionnaire. Due to missing values, 487 participants were included in the final analysis. The questionnaire organized into six sections: sociodemographic, Academic and Career Functioning, ADHD, Anxiety, Stress and Patient Health Questionnaire. The demographic questionnaire included items on participants' age, sex, year of study, type of medical college (public or private), and place of residence, monthly family income, source of financial support, personal income from paid work, and parental education levels. It also collected information on childhood and current living environment, including area of upbringing and household characteristics such as family size and presence of elderly dependents. Lifestyle factors such as smoking, alcohol and caffeine use, other substance use, sleep duration.

Academic and career functioning were assessed using eight structured questions covering participants' academic performance and related functional difficulties. These included overall academic performance compared to classmates, difficulties in meeting deadlines due to concentration problems, frequency of missed classes due to inability to focus or feeling overwhelmed, and perceived impact of attention and organizational difficulties on academic grades. Participants were also asked about the level of stress experienced before exams or presentations, ranging from "Never" to "Always." In addition, the survey included items assessing satisfaction with academic or career progress and concerns regarding whether ADHD-like symptoms may limit future professional success.

We assessed adult ADHD using the World Health Organization (WHO) Adult ADHD Self-Report Scale, Version 1.1 (ASRS-v1.1), a validated 18-item screening instrument aligned with DSM criteria for adult ADHD. we included Part A (6-item screener) which is considered the most predictive component for identifying probable adult ADHD and is used as the primary screening tool in research settings<sup>31</sup>. If four or more marks appear on this scale in Part A, it indicates that the patient's symptoms are highly consistent with adult ADHD.

Using Generalized Anxiety Disorder 7 <sup>32,33</sup>, the severity of anxiety symptoms among participants were measured. Each component was scored from 0 to 3, and the total score ranges from 0 to 21. A cutoff score of  $\geq 10$  indicates generalized anxiety disorder<sup>33</sup>.

The Perceived Stress Scale was used to assess the degree to which situations in respondents' life over the past month are appraised as stressful, unpredictable, and uncontrollable<sup>34</sup>. It's a widely used tool for analyzing variables like perceived stress. On a five-point scale, participants were asked to rate each item, ranging from 0 never to 4 very often. The corresponding scores were added together, with values ranging from 0 to 40. Higher scores were expected to suggest a more severe stress.

We measured depression using the Patient Health Questionnaire-9 (PHQ-9), a 9-item screening instrument determining severity levels of depressive symptomatology<sup>35-37</sup>. Each component had a score ranging from 0 to 3, with 0 denoting 'Never', 1 designating 'Several days', 2 denoting 'More than half the days', and 3 indicating 'Nearly every day'. The total score spans from 0 to 27, with a score of  $\geq 10$  indicative of depression.

## **2.4 Ethical approval and consent for participation**

Ethical approval was obtained from North South University's institutional ethical review board (Ref. No:).Participants were first notified about the purpose of the study. They were also informed that they had the right to withdraw their participation at any time. The anonymity and confidentiality of their data would be maintained. At the end of each day of data collection, the data were examined and rechecked to ensure that questionnaires were filled out completely and consistently.

## **2.5. Statistical Analysis**

Data were analyzed using R version 4.6.0. Normality was assessed using the Shapiro-Wilk test; all continuous variables showed significant deviation from normality ( $p < 0.05$ ), justifying the use of non-parametric methods throughout.

Reliability analysis: Internal consistency of each scale was assessed using Cronbach's alpha, with  $\alpha \geq 0.70$  indicating acceptable reliability.

ASRS scores were categorized using the established cutoff: scores 0–13 were classified as Negative (Low Negative: 0–9; High Negative: 10–13) and scores 14–24 were classified as Positive (Low Positive: 14–17; High Positive: 18–24). In our sample, 170 participants (34.8%) screened positive for ADHD symptoms

In group comparisons differences in continuous variables (GAD-7, PHQ-9, PSS-10, and Academic Career scores) between ADHD-positive and ADHD-negative groups were assessed using the Wilcoxon rank-sum test (Mann-Whitney U test) due to the non-normal distribution of the data as confirmed by Shapiro-Wilk tests (all  $p < 0.05$ ). Categorical variables (Academic Satisfactory Binary) were compared using the Pearson's Chi-squared test. Results are presented as mean (standard deviation) for continuous variables and frequency (percentage) for categorical variables. Statistical significance was set at  $p < 0.05$  (two-tailed).

Ordinal logistic regression identified factors associated with ADHD symptom severity across four ordered categories (Low Negative, High Negative, Low Positive, High Positive). The proportional odds assumption was verified using the Brant test (omnibus  $\chi^2 = 10.65$ ,  $df = 16$ ,  $p = 0.83$ ). The model included GAD-7, PHQ-9, and PSS-10 scores as continuous predictors, and sex and year of study as categorical predictors. Results are presented as odds ratios (OR) with 95% confidence intervals (CI)

Spearman's rank correlation coefficient ( $\rho$ ) was used to examine bivariate relationships between all continuous variables, including ASRS (Total ASRS Score), GAD-7 (Total GAD 7 Score), PHQ-9 (Total PHQ9 Score), PSS-10 (Total PSS10 Score), and Academic Functioning (Total Academic career score). Spearman's correlation was chosen over Pearson's correlation due to the non-normal distribution of the data, as confirmed by Shapiro-Wilk tests (all  $p < 0.05$ ).

Binary logistic regression was performed as a sensitivity analysis to identify factors associated with ADHD screen positivity using the standard clinical cutoff (ASRS score  $\geq 14$ ). The outcome was dichotomized as Positive (categories 3 and 4) versus Negative (categories 1 and 2). The model included GAD-7, PHQ-9, and PSS-10 scores as continuous predictors, and sex and year of study as categorical predictors. Results are presented as odds ratios (OR) with 95% confidence intervals (CI). Statistical significance was set at  $p < 0.05$  (two-tailed).

### 3. Results

Table 1

Demographic characteristics of medical students by ADHD symptom screening status (N = 487)

| Characteristic                                                                                                                                                    | Overall<br>N = 487 <sup>1</sup> | Negative<br>N = 317 <sup>1</sup> | Positive<br>N = 170 <sup>1</sup> | p-value <sup>2</sup> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------------|----------------------------------|----------------------|
| Sex                                                                                                                                                               |                                 |                                  |                                  | 0.9                  |
| Female                                                                                                                                                            | 307<br>(63%)                    | 199<br>(63%)                     | 108<br>(64%)                     |                      |
| Male                                                                                                                                                              | 180<br>(37%)                    | 118<br>(37%)                     | 62<br>(36%)                      |                      |
| Year of study                                                                                                                                                     |                                 |                                  |                                  | 0.2                  |
| 1st                                                                                                                                                               | 86<br>(18%)                     | 54 (17%)                         | 32<br>(19%)                      |                      |
| 2nd                                                                                                                                                               | 75<br>(15%)                     | 54 (17%)                         | 21<br>(12%)                      |                      |
| 3rd                                                                                                                                                               | 104<br>(21%)                    | 73 (23%)                         | 31<br>(18%)                      |                      |
| 4th                                                                                                                                                               | 66<br>(14%)                     | 37 (12%)                         | 29<br>(17%)                      |                      |
| 5th                                                                                                                                                               | 156<br>(32%)                    | 99 (31%)                         | 57<br>(34%)                      |                      |
| Type of medical college                                                                                                                                           |                                 |                                  |                                  | > 0.9                |
| Public BDS                                                                                                                                                        | 20<br>(4.1%)                    | 14<br>(4.4%)                     | 6 (3.5%)                         |                      |
| Public MBBS                                                                                                                                                       | 226<br>(46%)                    | 148<br>(47%)                     | 78<br>(46%)                      |                      |
| Private BDS                                                                                                                                                       | 6<br>(1.2%)                     | 4 (1.3%)                         | 2 (1.2%)                         |                      |
| Private MBBS                                                                                                                                                      | 235<br>(48%)                    | 151<br>(48%)                     | 84<br>(49%)                      |                      |
| Family type                                                                                                                                                       |                                 |                                  |                                  | 0.12                 |
| extended family                                                                                                                                                   | 1<br>(0.2%)                     | 0 (0%)                           | 1 (0.6%)                         |                      |
| I live with my both parents and little sis and maternal grandma but my paternal family are not financially but all type of thing they are dependent on my parents | 1<br>(0.2%)                     | 0 (0%)                           | 1 (0.6%)                         |                      |
| <sup>2</sup> Pearson's Chi-squared test; Fisher's exact test                                                                                                      |                                 |                                  |                                  |                      |

| Characteristic                                                               | Overall<br>N = 487 <sup>1</sup> | Negative<br>N = 317 <sup>1</sup> | Positive<br>N = 170 <sup>1</sup> | p-value <sup>2</sup> |
|------------------------------------------------------------------------------|---------------------------------|----------------------------------|----------------------------------|----------------------|
| Joint family                                                                 | 82<br>(17%)                     | 57 (18%)                         | 25<br>(15%)                      |                      |
| No siblings marry yet..so all of we are living in a one shield of our parent | 1<br>(0.2%)                     | 1 (0.3%)                         | 0 (0%)                           |                      |
| Nuclear                                                                      | 397<br>(82%)                    | 257<br>(81%)                     | 140<br>(82%)                     |                      |
| Separate                                                                     | 1<br>(0.2%)                     | 1 (0.3%)                         | 0 (0%)                           |                      |
| Separately joint                                                             | 1<br>(0.2%)                     | 0 (0%)                           | 1 (0.6%)                         |                      |
| Single family                                                                | 1<br>(0.2%)                     | 0 (0%)                           | 1 (0.6%)                         |                      |
| Small                                                                        | 1<br>(0.2%)                     | 0 (0%)                           | 1 (0.6%)                         |                      |
| With mother and sister                                                       | 1<br>(0.2%)                     | 1 (0.3%)                         | 0 (0%)                           |                      |
| Monthly total family income                                                  |                                 |                                  |                                  | 0.051                |
| ≤ 25000                                                                      | 80<br>(16%)                     | 58 (18%)                         | 22<br>(13%)                      |                      |
| ≥ 100000                                                                     | 68<br>(14%)                     | 42 (13%)                         | 26<br>(15%)                      |                      |
| 25,001–50,000                                                                | 128<br>(26%)                    | 88 (28%)                         | 40<br>(24%)                      |                      |
| 50,001–99,999                                                                | 91<br>(19%)                     | 48 (15%)                         | 43<br>(25%)                      |                      |
| Prefer not to say                                                            | 120<br>(25%)                    | 81 (26%)                         | 39<br>(23%)                      |                      |
| Diagnosed mental health condition                                            |                                 |                                  |                                  | 0.009                |
| No                                                                           | 394<br>(81%)                    | 265<br>(84%)                     | 129<br>(76%)                     |                      |
| Prefer not to say                                                            | 39<br>(8.0%)                    | 27<br>(8.5%)                     | 12<br>(7.1%)                     |                      |
| <sup>2</sup> Pearson's Chi-squared test; Fisher's exact test                 |                                 |                                  |                                  |                      |

| Characteristic                                               | Overall<br>N = 487 <sup>1</sup> | Negative<br>N = 317 <sup>1</sup> | Positive<br>N = 170 <sup>1</sup> | p-value <sup>2</sup> |
|--------------------------------------------------------------|---------------------------------|----------------------------------|----------------------------------|----------------------|
| Yes                                                          | 54<br>(11%)                     | 25<br>(7.9%)                     | 29<br>(17%)                      |                      |
| <sup>1</sup> n (%)                                           |                                 |                                  |                                  |                      |
| <sup>2</sup> Pearson's Chi-squared test; Fisher's exact test |                                 |                                  |                                  |                      |

### 3.1. Demographic Characteristics by ADHD Screening Status

Demographic Characteristics by ADHD Screening Status of the 487 medical students included in the analysis, 170 (34.9%) screened positive for ADHD symptoms based on the ASRS cutoff score of  $\geq 14$ , while 317 (65.1%) screened negative. The demographic characteristics of the study population are presented in Table 1.

The sample was predominantly female (63.0%), with no significant sex difference observed between the ADHD-positive and ADHD-negative groups ( $p = 0.9$ ). The distribution across years of study was similar between groups ( $p = 0.2$ ), though a slightly higher proportion of fourth-year students screened positive (17.1%) compared to the negative group (11.7%).

Notably, participants who reported a diagnosed mental health condition were significantly more likely to screen positive for ADHD (17.1% vs. 7.9%,  $p = 0.009$ ). Conversely, those without any prior mental health diagnosis were more prevalent in the negative screening group (83.6% vs. 75.9%). This finding underscores the substantial comorbidity between ADHD symptoms and other mental health conditions among medical students.

Monthly family income showed a borderline significant association with ADHD screening status ( $p = 0.051$ ). A higher proportion of participants in the middle-income bracket (50,001–99,999 BDT) screened positive (25.3%) compared to the negative group (15.1%), while those in the lowest income bracket ( $\leq 25,000$  BDT) showed a lower positive screening rate (12.9% vs. 18.3%). No significant differences were observed for type of medical college ( $p > 0.9$ ) or family type ( $p = 0.12$ ).

Table 2  
Comparison of mental health and academic functioning scores between medical students screening positive and negative for ADHD symptoms (N = 487)

| Characteristic                                                  | ASRS Screening Result           |                                  |                                  | p-value <sup>2</sup> |
|-----------------------------------------------------------------|---------------------------------|----------------------------------|----------------------------------|----------------------|
|                                                                 | Overall<br>N = 487 <sup>1</sup> | Negative<br>N = 317 <sup>1</sup> | Positive<br>N = 170 <sup>1</sup> |                      |
| Total GAD – 7 Score                                             | 8.1 (5.63)                      | 6.2 (4.84)                       | 11.6 (5.30)                      | < 0.001              |
| Total PHQ – 9 Score                                             | 10.8 (6.66)                     | 8.5 (5.60)                       | 15.0 (6.43)                      | < 0.001              |
| Total PSS – 10 Score                                            | 21.8 (5.64)                     | 20.3 (5.63)                      | 24.6 (4.48)                      | < 0.001              |
| Total Academic career score                                     | 15.8 (2.96)                     | 16.4 (2.89)                      | 14.6 (2.72)                      | < 0.001              |
| Academic Satisfactory Binary                                    |                                 |                                  |                                  | < 0.001              |
| Not Satisfactory                                                | 222 (46%)                       | 114 (36%)                        | 108 (64%)                        |                      |
| Satisfactory                                                    | 265 (54%)                       | 203 (64%)                        | 62 (36%)                         |                      |
| <sup>1</sup> Mean (SD); n (%)                                   |                                 |                                  |                                  |                      |
| <sup>2</sup> Wilcoxon rank sum test; Pearson's Chi-squared test |                                 |                                  |                                  |                      |

## 3.2. Mental Health and Academic Functioning by ADHD Screening Status

Table 2 presents the comparison of mental health scores and academic functioning between medical students who screened positive (n = 170) and negative (n = 317) for ADHD symptoms based on the ASRS cutoff score of  $\geq 14$ .

In Anxiety (GAD-7) students in the ADHD-positive group reported significantly higher anxiety symptoms (Mean = 11.6, SD = 5.30) compared to the ADHD-negative group (Mean = 6.2, SD = 4.84),  $p < 0.001$ . The mean difference of 5.4 points represents a clinically meaningful elevation in anxiety symptoms, with the positive group scoring above the clinical cutoff for mild anxiety ( $\geq 10$ ).

In case of depression (PHQ-9) is similarly, the ADHD-positive group showed significantly higher depression scores (Mean = 15.0, SD = 6.43) compared to the negative group (Mean = 8.5, SD = 5.60),  $p < 0.001$ . The mean score of 15.0 in the positive group falls within the moderately severe depression range, while the negative group's mean of 8.5 falls within the mild depression range.

Perceived stress was significantly higher in the ADHD-positive group (Mean = 24.6, SD = 4.48) compared to the negative group (Mean = 20.3, SD = 5.63),  $p < 0.001$ . Both groups scored within the moderate stress range (14–26), though the positive group approached the high stress threshold ( $> 26$ ).

The ADHD-positive group had significantly lower total academic career scores (Mean = 14.6, SD = 2.72) compared to the negative group (Mean = 16.4, SD = 2.89),  $p < 0.001$ , indicating poorer self-reported academic functioning. Furthermore, a substantially higher proportion of students in the ADHD-positive group reported unsatisfactory academic performance (63.5%,  $n = 108$ ) compared to the negative group (36.0%,  $n = 114$ ),  $p < 0.001$ . Conversely, only 36.5% ( $n = 62$ ) of the positive group reported satisfactory academic functioning compared to 64.0% ( $n = 203$ ) in the negative group.

These findings demonstrate that medical students screening positive for ADHD symptoms experience significantly higher levels of anxiety, depression, and stress, and report substantially poorer academic functioning compared to their ADHD-negative peers. The large effect sizes across all measures underscore the significant mental health burden and academic challenges faced by this population.

Table 3  
Ordinal logistic regression: Factors associated with ADHD symptom severity

| Characteristic           | OR    | 95% CI      | p-value |
|--------------------------|-------|-------------|---------|
| GAD-7 score (anxiety)    | 1.113 | 1.060–1.169 | < 0.001 |
| PHQ-9 score (depression) | 1.083 | 1.041–1.127 | < 0.001 |
| PSS-10 score (stress)    | 1.100 | 1.055–1.149 | < 0.001 |
| Sex                      |       |             |         |
| Male (vs. Female)        | 1.484 | 1.029–2.145 | 0.035   |
| Year of study            |       |             |         |
| 2nd year (vs. 1st)       | 0.528 | 0.291–0.956 | 0.035   |
| 3rd year (vs. 1st)       | 0.731 | 0.421–1.268 | 0.265   |
| 4th year (vs. 1st)       | 0.780 | 0.422–1.438 | 0.425   |
| 5th year (vs. 1st)       | 0.585 | 0.350–0.976 | 0.040   |

### 3.3. Factors Associated with ADHD Symptom Severity

Ordinal logistic regression revealed significant independent predictors of ADHD symptom severity across four ordered categories (Table 3). The proportional odds assumption was satisfied (Brant test  $p = 0.83$ ).

All three mental health measures showed significant associations. Each one-point increase in GAD-7 score was associated with 11.3% higher odds of more severe ADHD symptoms (OR = 1.113, 95% CI: 1.060–1.169,  $p < 0.001$ ), followed by PSS-10 (OR = 1.100, 95% CI: 1.055–1.149,  $p < 0.001$ ) and PHQ-9 (OR = 1.083, 95% CI: 1.041–1.127,  $p < 0.001$ ).

Male sex was associated with 48% higher odds of more severe symptoms compared to females (OR = 1.484, 95% CI: 1.029–2.145,  $p = 0.035$ ). Compared to first-year students, second-year (OR = 0.528, 95% CI: 0.291–0.956,  $p = 0.035$ ) and fifth-year students (OR = 0.585, 95% CI: 0.350–0.976,  $p = 0.040$ ) had significantly lower odds. No significant differences were observed for third or fourth-year students.

These findings indicate that anxiety, depression, and stress are independent predictors of ADHD symptom severity, with anxiety showing the strongest effect. Male sex and first-year status represent high-risk groups requiring targeted intervention.

### 3.4. Forest Plot

The forest plot (Fig. 1) visually summarizes the ordinal logistic regression results. All three mental health measures showed significant positive associations with ADHD severity, with anxiety demonstrating the strongest effect (OR = 1.113), followed by stress (OR = 1.100) and depression (OR = 1.083). Male sex was associated with 48% higher odds of more severe symptoms (OR = 1.484). Compared to first-year students, second-year (OR = 0.528) and fifth-year students (OR = 0.585) had significantly lower odds. The confidence intervals for third and fourth-year students crossed the null line, indicating non-significant associations. These findings highlight anxiety as the most impactful predictor and identify male sex and first-year status as key risk factors requiring targeted intervention.

Table 4  
Spearman's correlation matrix of mental health and academic measures

| Variable             | ASRS   | GAD7   | PHQ9   | PSS10  | Academic |
|----------------------|--------|--------|--------|--------|----------|
| ASRS (ADHD)          | 1.000  | 0.565  | 0.566  | 0.469  | -0.345   |
| GAD-7 (Anxiety)      | 0.565  | 1.000  | 0.723  | 0.602  | -0.405   |
| PHQ-9 (Depression)   | 0.566  | 0.723  | 1.000  | 0.555  | -0.421   |
| PSS-10 (Stress)      | 0.469  | 0.602  | 0.555  | 1.000  | -0.346   |
| Academic Functioning | -0.345 | -0.405 | -0.421 | -0.346 | 1.000    |

### 3.5. Correlation Between Mental Health and Academic Measures

Spearman's rank correlation analysis revealed significant interrelationships between ADHD symptoms, anxiety, depression, stress, and academic functioning (Table 4, Fig. 2). All mental health measures showed significant positive intercorrelations ( $p < 0.001$ ), with the strongest correlation between GAD-7 and PHQ-9 scores ( $p = 0.723$ ), indicating substantial anxiety-depression comorbidity. ASRS scores showed moderate positive correlations with PHQ-9 ( $p = 0.566$ ), GAD-7 ( $p = 0.565$ ), and PSS-10 ( $p = 0.469$ ). Academic functioning showed significant negative correlations with all mental health measures ( $p < 0.001$ ), with depression demonstrating the strongest negative association ( $p = -0.421$ ), followed by anxiety ( $p = -0.405$ ), stress ( $p = -0.346$ ), and ADHD symptoms ( $p = -0.345$ ). These findings highlight the

interconnected nature of mental health symptoms among medical students and their collective impact on academic performance.

## 4. Discussion

### 4.1. Prevalence of Adult ADHD Among Medical Students

In this study, 34.8% of medical students ( $n = 170/487$ ) screened positive for adult ADHD symptoms based on the ASRS-v1.1 total score cutoff of  $\geq 14$ . This prevalence is notably higher than the global estimate of symptomatic adult ADHD of 6.76% in the general population<sup>9</sup>, confirming that medical students represent a distinctly high-risk group. Our finding closely aligns with a large systematic review of 29 studies across 17 countries, which reported ASRS-based ADHD prevalence in medical students ranging widely from 1.7% to 38.9%, with higher rates consistently associated with screening instruments rather than structured clinical interviews<sup>19</sup>. A cross-sectional study of Pakistani medical students using the full ASRS-v1.1 similarly found a prevalence of 34.8%<sup>18</sup>, providing strong regional corroboration for our findings. Studies from Saudi Arabia have reported comparable rates, with 38.86% of medical students screening positive in one large multi-center survey<sup>38</sup>, and 23.3% in another institutional study where a stricter ASRS Part A cutoff was applied<sup>39</sup>.

The elevated prevalence observed in our sample and in the broader literature may reflect several intersecting mechanisms. First, the intense cognitive demands of medical education — including sustained attention during long lectures, complex clinical decision-making, and constant information processing — may act to unmask latent ADHD symptomatology that might go undetected in less demanding environments<sup>19</sup>. Second, selection effects may play a role: individuals with subclinical ADHD traits such as heightened novelty-seeking and risk-taking may be disproportionately drawn to demanding, high-stakes careers<sup>17</sup>. Third, the ASRS, while highly sensitive and validated for screening purposes, captures a broad spectrum of attentional and impulsivity symptoms that may overlap with normal stress reactions in this population, potentially inflating prevalence estimates compared to gold-standard clinical diagnoses<sup>40</sup>. Despite this caveat, the burden of undiagnosed ADHD in medical students is real and functionally significant, as demonstrated by our academic functioning data.

### 4.2. ADHD and Mental Health Comorbidities: Anxiety, Depression, and Stress

A central finding of this study is the markedly elevated burden of anxiety, depression, and perceived stress among students who screened positive for ADHD. Students in the ADHD-positive group had significantly higher GAD-7 scores (mean 11.6 vs. 6.2), PHQ-9 scores (mean 15.0 vs. 8.5), and PSS-10 scores (mean 24.6 vs. 20.3), with all differences statistically significant ( $p < 0.001$ ). These findings are consistent with — and in many ways reinforce — a growing international literature documenting the strong comorbidity between ADHD and mood and anxiety disorders in student populations.

A large cross-sectional study of 4,882 Chinese medical students found that ADHD symptoms, particularly inattention, were independent risk factors for anxiety and were significantly associated with depression and suicidal behaviors<sup>26</sup>. More recently, a Brazilian cross-sectional study of medical students reported that those with positive ASRS screens had significantly higher anxiety scores (median 16.0 vs. 8.0;  $p < 0.01$ )<sup>41</sup>, mirroring the magnitude of the anxiety difference observed in our cohort. Our finding that the ADHD-positive group had a mean PHQ-9 score of 15.0 – within the moderately severe range – is further corroborated by clinical research showing that adults with comorbid ADHD and depression exhibit significantly more severe depressive presentations than those with depression alone, with higher PHQ-9 scores emerging as a key predictor of ADHD comorbidity in depressed patients<sup>42</sup>.

The ordinal logistic regression analysis extended these group-comparison findings by demonstrating that anxiety (GAD-7), depression (PHQ-9), and perceived stress (PSS-10) are each independent predictors of ADHD symptom severity across ordered categories. Anxiety showed the strongest effect (OR = 1.113 per unit increase), followed by perceived stress (OR = 1.100) and depression (OR = 1.083). This dose-response relationship – where each incremental increase in a mental health score was associated with a proportional increase in the odds of greater ADHD severity – suggests that these conditions do not simply co-occur coincidentally but rather may share and reinforce common neurobiological pathways including dysregulation of dopaminergic and noradrenergic systems<sup>26</sup>. The Spearman correlation matrix provided additional support, revealing moderate positive associations between ASRS scores and GAD-7 ( $\rho = 0.565$ ), PHQ-9 ( $\rho = 0.566$ ), and PSS-10 ( $\rho = 0.469$ ), all significant at  $p < 0.001$ .

A notable pattern in our data was the high co-occurrence of anxiety and depression ( $\rho = 0.723$ ), reflecting the well-established clinical overlap between these disorders in young adults under academic stress<sup>43</sup>. ADHD may act as a shared diathesis – a predisposing vulnerability – that amplifies susceptibility to both anxiety and depressive states when students encounter the heightened stressors of medical training, consistent with the "stress-sensitization" hypothesis proposed in prior literature<sup>17</sup>. The Trinidad and Tobago study of medical students similarly identified poor sleep quality, anxiety (prevalence 65.4%), and depression (73.2%) as all positively correlated with ADHD positivity<sup>17</sup>, further underscoring the clustering of these disorders within this population.

### **4.3. ADHD and Academic Functioning**

Students who screened positive for ADHD reported significantly lower academic functioning (mean 14.6 vs. 16.4;  $p < 0.001$ ), and a substantially higher proportion of ADHD-positive students reported unsatisfactory academic performance (63.5% vs. 36.0%;  $p < 0.001$ ). These findings substantiate the accumulated evidence that ADHD represents a significant and underappreciated barrier to academic success in medical education.

The systematic review by Lee and Zhang, encompassing 24,578 medical students across 17 countries, explicitly noted that ADHD in medical students is associated with significant functional impairments and

that the stressors inherent to medical education may either amplify ADHD symptoms or represent an environment that selects for individuals with ADHD-related traits<sup>19</sup>. In Saudi Arabia, ADHD-positive medical students showed a 14% increased risk of obtaining a failing GPA after adjustment for confounders<sup>38</sup>. A Mexican study using the ASRS similarly identified ADHD as one of the three most prevalent psychopathologies among medical students at 28%, co-occurring with depression in a pattern strongly mirroring our own data<sup>44</sup>.

ADHD-related academic impairments in medical education are thought to arise through multiple converging mechanisms: difficulties sustaining attention in extended lectures and clinical rotations, impaired working memory affecting recall in high-stakes examinations, executive dysfunction undermining time management and deadline adherence, and emotional dysregulation exacerbating exam anxiety<sup>19,41</sup>. The association between ADHD and academic dissatisfaction likely reflects not only objective performance deficits but also the subjective distress of struggling in a high-expectation environment without adequate institutional support or self-awareness of one's neurodevelopmental profile. The negative correlation between ASRS scores and academic functioning ( $\rho = -0.345$ ) observed in our Spearman correlation matrix aligns with the direction and magnitude reported across comparable studies.

## 4.4. Sex Differences in ADHD Symptom Severity

Our ordinal logistic regression identified male sex as an independent predictor of greater ADHD symptom severity (OR = 1.484, 95% CI: 1.029–2.145,  $p = 0.035$ ). This finding is consistent with well-established epidemiological patterns showing higher ADHD diagnosis rates in males across both childhood and adult populations. In a landmark twin-study analysis, Arnett et al. demonstrated that sex differences in ADHD symptom severity are genuine — attributable to both mean-level differences and greater variance in males — and are partially mediated through cognitive endophenotypes including processing speed, inhibition, and working memory<sup>45</sup>.

Neuroimaging evidence further supports biological underpinnings of sex-based differences in ADHD presentation. Agoalikum et al. found that adult males with ADHD showed distinct patterns of reduced dynamic functional network connectivity, particularly within visual and default-mode networks, compared to females<sup>46</sup>. These neurobiological differences may translate into the more externalized, hyperactive-impulsive symptom profile that is traditionally more recognizable and thus more frequently identified in clinical and self-report settings in males. However, it is important to note that our study population was predominantly female (63%), yet males showed greater symptom severity, suggesting that biological rather than representational factors may drive this difference.

Notably, the Saudi study by Alatawi found no significant gender association with ADHD screening positivity<sup>39</sup>, while the Palestinian university study also found no significant sex differences in ADHD prevalence<sup>47</sup>. This heterogeneity across studies may reflect differences in cultural expression of ADHD symptoms, differential help-seeking behaviors between sexes, and variability in how inattentive versus

hyperactive-impulsive subtypes present in academic settings across different sociocultural contexts. Our finding that male sex predicted greater symptom severity rather than greater prevalence per se suggests that, while both sexes carry similar screening rates in our sample, males may present with more impairing or higher-order ADHD symptom burdens.

## 4.5. Year of Study and ADHD Symptom Trajectory

Compared to first-year students, both second-year ( $OR = 0.528, p = 0.035$ ) and fifth-year students ( $OR = 0.585, p = 0.040$ ) showed significantly lower odds of greater ADHD symptom severity, while third- and fourth-year students did not differ significantly. This non-linear pattern is consistent with the notion that the transition to medical school – characterized by a sudden increase in academic demands, loss of familiar social supports, novel living arrangements, and uncertainty about professional identity – places first-year students at greatest vulnerability for ADHD symptom exacerbation or emergence.

This interpretation is supported by broader data on first-year university students. In a large Spanish university cohort, the median age of onset for adult ADHD was estimated at 14 years, and one-third of students with any mental disorder reported severe role impairment with only 12.6% receiving treatment<sup>43</sup>. The implication is that many students arrive at medical school with pre-existing undiagnosed ADHD, and the academic intensity of first year both unmasks symptoms and amplifies impairment. The intermediate years (3rd and 4th) showed non-significant trends, possibly reflecting a plateau in stress or accommodation to the academic environment, before fifth-year students – who may be in final clinical rotations with greater autonomy and motivation – again show symptom moderation.

In contrast, the Saudi study at the University of Tabuk found symptom frequency peaking in the third and fourth academic years and lowest in sixth-year students<sup>39</sup>. Similarly, in the Trinidad and Tobago study, ADHD positivity was highest in Year 3<sup>17</sup>. Taken together, these findings suggest that ADHD symptom burden in medical students is not static but follows a trajectory shaped by the specific stressors of each phase of training. The pattern in our cohort – with first-year students showing the highest risk – may partly reflect our Bangladeshi context, where the transition to competitive medical training from secondary schooling is especially abrupt and the academic culture may be particularly demanding for students with attentional vulnerabilities.

## 4.6. Socioeconomic Factors and Mental Health Diagnosis

A borderline significant association ( $p = 0.051$ ) was observed between monthly family income and ADHD screening positivity, with a higher proportion of middle-income students (50,001–99,999 BDT) screening positive compared to lower-income peers. Students reporting a pre-existing diagnosed mental health condition were significantly more likely to screen positive for ADHD (17.1% vs. 7.9%;  $p = 0.009$ ), which is consistent with the well-documented comorbidity burden in ADHD. The ASRS-positive students had higher psychiatric comorbidity in the Pakistani study<sup>18</sup>, and in a Palestinian university study, ADHD was significantly associated with having chronic health conditions and with poorer overall psychological well-being<sup>47</sup>. The income trend in our data may reflect that middle-income families – neither shielded by

wealth nor fully absorbed by material hardship — may experience particular educational pressure dynamics, though this interpretation requires longitudinal confirmation.

## 4.7. Strengths and Limitations

This study has several strengths. It represents one of the first large-scale, nationally representative cross-sectional studies examining adult ADHD prevalence alongside anxiety, depression, perceived stress, and academic functioning specifically among Bangladeshi medical students. The use of validated, widely used instruments (ASRS-v1.1, GAD-7, PHQ-9, PSS-10) allows for direct comparison with international studies. The multivariate analytical approach — including ordinal logistic regression with verification of the proportional odds assumption — provides robust inference about predictors of symptom severity beyond simple group comparisons.

Several limitations must be acknowledged. First, the cross-sectional design precludes causal inference: while anxiety, depression, and stress are strong predictors of ADHD severity, the directionality of these relationships cannot be established from these data. Second, the ASRS-v1.1 is a screening tool with high sensitivity but limited specificity; it is not a diagnostic instrument, and the true prevalence of clinically diagnosed ADHD in this population is likely lower than the screening-positive rate<sup>40</sup>. Third, the stratified convenience sampling strategy, though designed to ensure geographic diversity, may introduce selection biases if students at particular institutions systematically differ from those not sampled. Fourth, self-report data on academic functioning may be subject to reporting bias, particularly among students experiencing significant psychological distress. Fifth, data on current use of psychiatric medications and prior ADHD diagnosis were collected but not used to exclude participants, meaning some of the ASRS-positive students may already have a known diagnosis, potentially inflating the prevalence estimate of 'undiagnosed' ADHD.

## 4.8. Clinical and Educational Implications

The findings carry direct implications for medical education policy and student welfare services in Bangladesh. Given that 34.8% of students screened positive and that ADHD-positive status was strongly associated with impaired academic functioning, elevated depression, anxiety, and stress, medical colleges should consider implementing routine mental health screening programs using validated tools such as the ASRS and PHQ-9. Early identification would enable targeted academic accommodations — including extended examination time, reduced course load, and assignment flexibility — alongside referral pathways to mental health support<sup>19</sup>.

The finding that first-year students represent the highest-risk group for ADHD symptom severity underscores the particular vulnerability of the early transition phase and argues for the implementation of structured orientation programs, peer-mentoring schemes, and mandatory well-being check-ins in the first academic year<sup>39</sup>. Male students and those with pre-existing mental health diagnoses constitute subgroups that warrant prioritized surveillance and support. Institutional awareness of ADHD as a

neurodevelopmental condition – rather than a character flaw or lack of effort – is crucial to destigmatize help-seeking among this high-achieving, self-selecting population<sup>18,41</sup>.

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# Figures

Figure 1. Forest plot of factors associated with ADHD symptom severity from ordinal logistic regression  
(N = 487)

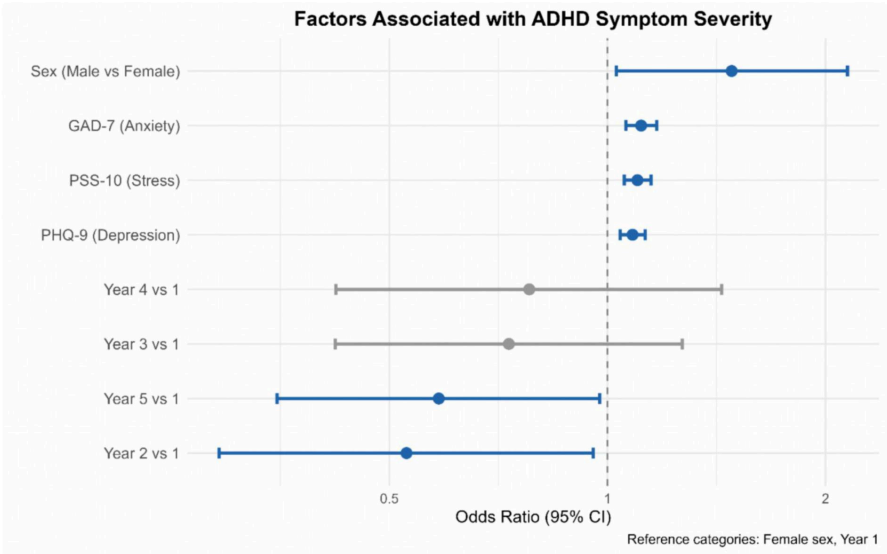


Figure 1

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Figure 2: Demographic Characteristics by ADHD Screening Status

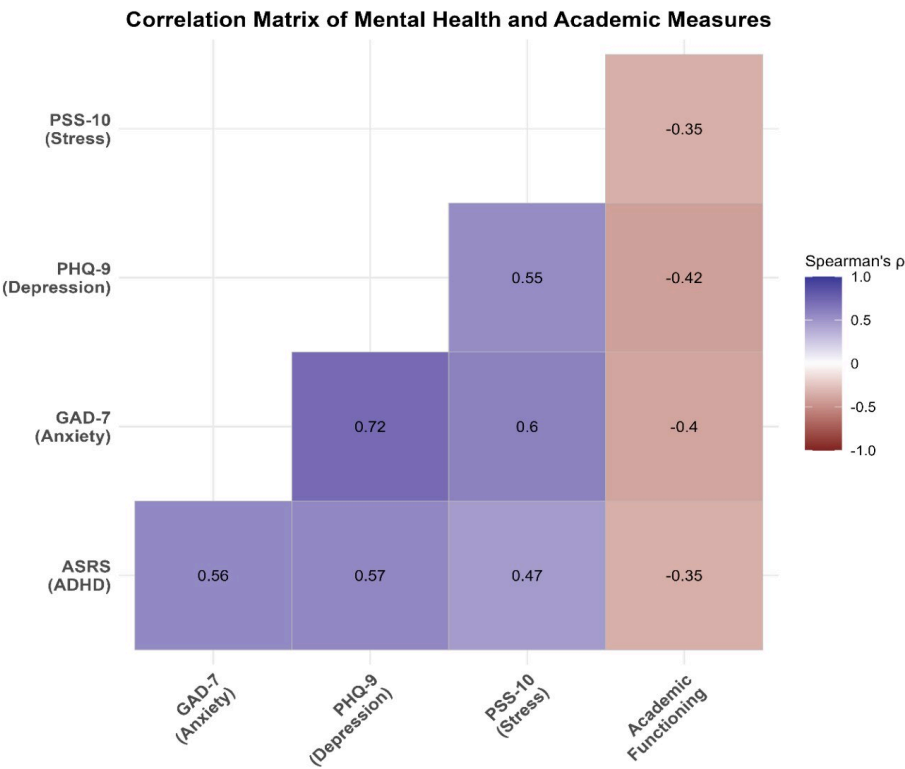


Figure 2

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