# Clinical Presentation and Treatment Outcomes in Adults with ADHD

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## *Abstract*

**Objectives**: This study aims to investigate the clinical presentation and treatment results in adults with ADHD, assess treatment outcomes of atomoxetine and methylphenidate in reducing the symptoms of ADHD, and identify clinical characteristics and predictors of treatment response.

**Methods:** This prospective study enrolled 171 adults with ADHD receiving treatment in a national clinical service at SQUH, Oman. Sociodemographic, clinical factors, and treatment history data were collected. The improvement was quantified using the ***Clinical Global Impressions Scale*** (CGI-I), performed 3 months after starting treatment. Statistical analysis used independent chi-square tests and t-tests, with significance set at $P < 0.05$.

**Results**: Most of the participants (60.8%) were men. Most of the attendees (n = 138) had methylphenidate versus (n = 33) atomoxetine. Clinical characteristics indicated that inattention was the most common presentation (66%) and (24%) had mixed hyperactivity and inattention. (72%) had at least one comorbidity. Using the CGI-Improvement scale, 84% of the medication-treated patients showed significant improvement. Subgroup analysis revealed positive responses in 18% for atomoxetine and 82% for methylphenidate. Both medications showed improvement, with methylphenidate showing a higher improvement rate (85%). Multivariate logistic regression identified male sex and the absence of a family history of ADHD as a predictor of response to treatment (OR 2.42, p=0.044, 95% CI 1.02 – 5.71) and (OR 2.93, p=0.020, 95% CI 1.18 – 7.28) respectively.

**Conclusions**: Atomoxetine and methylphenidate showed varying response rates and methylphenidate showed a higher treatment outcome of 85%. The study revealed an association between the absence of a family history of ADHD and a better response to methylphenidate or atomoxetine treatment, suggesting that family history may serve as a useful prognostic indicator in treatment decision-making.

**Keywords:** Adult ADHD; Treatment, Outcomes, Atomoxetine, Methylphenidate, CGI-Improvement Scale

## Introduction

ADHD represents a widespread neurodevelopmental disorder that manifests throughout life and transcends conventional perception as primarily a childhood disorder. Although substantial attention has historically been focused on ADHD in children and adolescents, recent years have seen a growing recognition of the persistence of symptoms into adulthood.[1] Song et al.[2] have reported a systematic review and meta-analysis of the global

prevalence of adult ADHD. The review covered from 2001 to 2019 and included 40 articles that met the study inclusion criteria. From articles drawn from 30 countries, the authors reported that around 6.76% of the general adult population appears to have adult ADHD, which translates to approximately 366.33 million affected adults around the world. Another study focused on populations from different countries is the WHO World Mental Health Survey; Fayyad et al.[3] reported that the prevalence of adult ADHD was found to constitute 2.8% of the sample (n=26,744). In a systematic review & meta-analysis covering the Middle East and North Africa region, Al-Wardat et al.[4] reported a prevalence of 13.5%. A recent study focused specifically on Oman, a country in the Arabian Gulf with approximately 5 million people, Bedawi et al.[5] reported a 5-year prevalence and clinical profile of ADHD among adult patients in a tertiary care hospital in Oman, analyzing 39,881 hospital visits, found that 1.77% were adults with ADHD, equivalent to 17.8 visits per 1,000 outpatients. This study reported that pharmacotherapies such as atomoxetine and methylphenidate, which are considered first-line treatments, are commonly prescribed in adults with ADHD. To date, little attention has been paid to the evaluation of the effectiveness of atomoxetine and methylphenidate in reducing symptoms of ADHD and identifying clinical characteristics and predictors of response to treatment. This undertaking not only fills knowledge gaps from different ethnic groups but also has the potential to lay the foundation for improving outcomes and informing clinical guidelines. Adult ADHD presents unique challenges due to its varied clinical presentations, coexisting psychiatric conditions, and the potential impact on multiple domains of daily functioning, as well as response to treatment.[1]

Ágnes Mészáros et al.[6] reported a meta-analysis of the therapeutic efficacy of pharmacological treatment for adult ADHD. The study included 11 clinical trials with double-blind parallel-group designs (n =1991). The results showed that active medications significantly improved ADHD symptoms compared to placebo, with a standardized mean difference (SMD) of 0.43 (95% CI, 0.24–0.62). Radonjic et al.[7] have reported a systematic review and meta-analysis that included randomized clinical trials investigating the efficacy, acceptability, and tolerability of non-stimulant medications in adults with ADHD, considering their use as monotherapy or as an adjunct to stimulants. The review reported that non-stimulant drugs were more effective in treating ADHD in adults compared to placebo. However, placebo had better acceptability and tolerability. Atomoxetine was less tolerated than placebo. A study by Cortese et al.[8] have compared the efficacy and tolerability of medications for attention deficit hyperactivity disorder (ADHD) in children, adolescents, and adults. The take-home message of this systematic review and network meta-analysis indicated that methylphenidate is preferred for children and adolescents. At the same time, amphetamines are recommended for adults as first-choice medications for short-term treatment of ADHD.

The aforementioned critical review of the literature has focused mainly on studies reflecting the population of the global north. Studies from the global south, including countries like Oman, are conspicuously absent. The lack of infrastructure partly explains why conducting randomized controlled studies in some countries of the global south is necessary. It has been widely recognized that ethnic and cultural factors are crucial, with most drugs being developed in the global north and their safety trials conducted in Western populations, leading to a limited understanding of accurate pharmacodynamic and pharmacokinetic profiles between different ethnic groups. To lay the foundations for a robust intervention study that includes genetic and epigenetic factors, sentinel studies are needed to explore the results and predictors of adult ADHD treatment among participants in tertiary care who regularly received atomoxetine and methylphenidate in the treatment of ADHD symptoms. Specifically, this study investigates the clinical presentation and treatment outcomes in adults with ADHD. Evaluate the treatment outcomes of atomoxetine and methylphenidate in reducing the symptoms of ADHD and identify clinical characteristics and predictors of response to treatment. The study observes and analyzes the outcomes of adult patients newly diagnosed with ADHD and routinely treated with atomoxetine and methylphenidate between January 1, 2020, and December 31, 2023. It involves naturalistic observation of the prescribed medication by the patient for ADHD symptoms.

## Methods

This is prospective among consecutive attendees in a tertiary care center. Routine treatments are provided in an outpatient tertiary psychiatric clinic within a tertiary teaching hospital in Muscat, Oman. In Oman, health services are universally free and provided by the Ministry of Health. The country's health care infrastructure for people with developmental disorders and psychiatric illnesses is concentrated in certain tertiary care facilities. The setting for this study is the only adult ADHD clinic in the country, serving all strata of Omani society.

Given that the primary outcome measure is the improvement in ADHD symptoms assessed using the ***Clinical Global Impressions Scale*** (described below), this aims to detect a moderate effect size (Cohen's d = 0.5) with a

significance level of 0.05 and a power of 80%. Within the standard deviation derived from previous studies,[5] the calculated sample size per group is approximately 90 patients. To account for potential dropouts and exclusions, the study has planned to enroll at least 120 participants during the prescribed time period (1st of January 2020 and 31st of December 2023). This sample size has the potential to detect significant clinical improvements attributable to ADHD medication, which, in turn, has the potential to testify to the robustness of the present study.

All participants in this study were referred from primary or secondary healthcare facilities in Oman to a specialized adult ADHD clinic. The study included adults (18 years or older) who had been diagnosed with ADHD and had undergone treatment for at least three months. To ensure that any observed improvements could be specifically attributed to the ADHD medication used during the study, certain participants were excluded. These exclusions included patients with psychometric evidence of comorbid intellectual disabilities., if the potential participant is deemed to have a history of scholastic skill problems, then his or her intellectual functioning was assessed using ***Raven's Progressive Matrices***, a non-verbal test to evaluate an individual's current reasoning ability and fluid intelligence. Scores on the Raven test are typically converted to percentile ranks using age- or grade-based norms.[9] Respondents who scored less than the 25th percentile rank were excluded. Other exclusions include potential participants who were taking other psychotropic medications, those who were not in compliance with prescribed medications for ADHD, and patients undergoing other psychotherapeutic or alternative and complementary drugs. Figure 1 illustrates the flow chart of the progress of adult subjects with ADHD in the study.

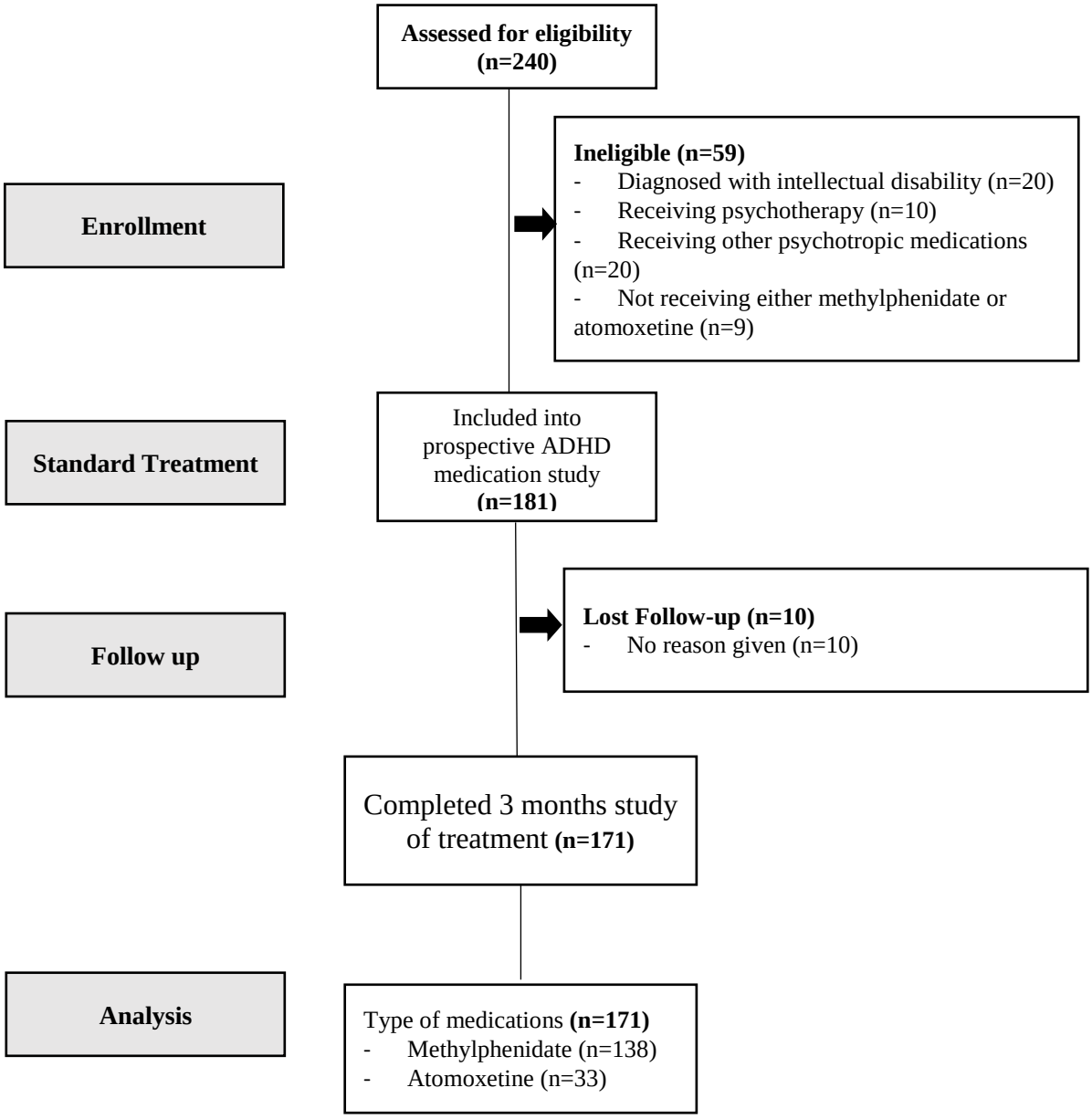


**Figure 1:** Flow diagram for study participants.

Sociodemographic information and other clinical variables were also sought: sex, marital status, and level of education. The risk factor, Body Mass Index BMI, was also sought. The World Health Organization has defined overweight and obesity as "abnormal or excessive fat accumulation that presents a health risk'[10]. Therefore, the body mass index (BMI) is conventionally used to denote the variation in obesity according to weight and height. For the presence context: Underweight, Normal, Pre-obesity. Participants were asked to narrate whether any member of the family has had something similar to ADHD or a history of specific developmental disorders of scholastic skills, Previous suicidal attempt, Previous forensic history, or previous history of admission to psychiatric services. The presence of comorbidity was taped via M.I.N.I: ***Mini International Neuropsychiatric Interview*** (Arabic version).[11] For theoretical reasons, the subscale for alcohol dependence, alcohol abuse, and substance dependence (non-alcohol) was used to seek the presence of substance use disorder. The scale for manic episodes and hypomanic episodes was used to tap into the presence of bipolar affective disorder, and so the subscales of major depressive episodes, generalized anxiety disorder, obsessive-compulsive disorder, and psychotic disorders were used to quantify the presence of these disorders. Other psychiatric comorbidities were lumped into 'any psychiatric comorbidity'. The presence of personality disorders was tapped via protracted interviews and collateral history within the background the individual has Maladaptive personality traits, Distorted perceptions of reality, abnormal behaviors, and distress across various aspects of life, including work, relationships, and social functioning and such temperament appears to deviations from cultural expectations in at least two areas: way of thinking.

Confirmatory diagnoses for the present ADHD were made by the clinical team. First, a comprehensive history of the patient's symptoms was retrospectively sought using the Wender ***Utah Rating Scale*** (WURS), which is a 25-item self-report checklist that adults should complete by evaluating a variety of childhood symptoms and behaviors consistent with ADHD that persist into adulthood[12] WURS is a Likert scale ranging from "not at all or very slightly" to "very much". A score of 46 was reported to indicate that ADHD was present during childhood[13] Second, the evaluation of current adult ADHD was acquired through the ***Conners Adult ADHD Diagnostic Interview*** for DSM-IV (CAADID).[14] The CAADID is a semi-structured diagnostic interview designed to assess adult ADHD according to the criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders. CAADID was conducted by a senior child psychiatrist.

In the present setting and during the naturalistic observation prescribed, stimulant medications, particularly methylphenidate, were typically the first-line treatment for adult ADHD Atomoxetine is also considered a viable first-line option in specific clinical scenarios. Such as patients with significant comorbid anxiety where stimulants may exacerbate symptoms, individuals with a history of substance use disorders, or those who prefer a non-stimulant due to the longer duration of action or concerns about stimulant side effects.

In our clinical practice, which adheres to a flexible, patient-centered approach, Atomoxetine is offered as an alternative first-line agent in such cases, rather than being reserved only for non-response to methylphenidate. The dose of medication was titrated according to the responses and tolerability of the individual patient. Patients started with a low dose, which was gradually increased until an optimal therapeutic effect with minimal side effects was achieved.

During the study period, participants were encouraged to refrain from all other treatments for ADHD. Before starting pharmacotherapy, participants were tested for substance misuse, a feat that was repeated at subsequent follow-up to avoid whether improvement was not assisted or not by illicit drugs. Follow-up evaluations every four weeks allowed adjustments in dosage to ensure the best possible results. In the Sultan Qaboos University Hospital ADHD clinic, patients received short or extended-release methylphenidate treatment with a daily dose of 20mg, gradually increasing according to tolerability and treatment response. 60mg was the maximum intake for some patients. This practice is in agreement with the NICE guidelines[15] that suggest an initial dose of 5-10mg daily for methylphenidate, then gradually increasing as needed with increments of 5-10mg weekly, up to 60 mg per day. According to the clinic's protocol, patients who receive adult ADHD medication are evaluated every four weeks after starting treatment. These follow-up sessions include evaluations of adherence to medication, symptomatology, functional outcomes, and adverse reactions.

In the present naturalistic observation, the ***Clinical Global Impressions Scale (C***GI-I)[16] was used to document the treatment outcome. It involves clinicians evaluating the severity and in the present context is ADHD symptoms. CGI-I is specifically focused on changes in a patient's symptoms and overall functioning compared to their baseline state. Improvement derived from clinical observations, from baseline to a period in which the patient is on the maximum dose of short- / long-acting methylphenidate or Atomoxetine. Regarding the established protocol, the "improvement" is quantified by a seven-point scale. Compared to the patient's condition before

starting the medication, the condition of this patient is: 1=very much improved since the start of treatment; 2=much improved; 3=minimally improved; 4=no change from baseline (the start of treatment); 5=minimally worse; 6=much worse; 7=very much worse since the start of treatment. For the present purpose, the response to ADHD medications was defined for patients who experienced a 'very good' to 'good improvement' in CGI, that composite score of CGI-I > 2.

Data were analyzed using IBM SPSS Statistics 29.0 (IBM Corp. Released 2022. IBM SPSS Statistics for Windows, version 29.0. Armonk, NY: IBM Corp.). Continuous information was presented using mean with standard deviation and categorical data using frequency and percentages. Categorical associations were compared using the Chi-square test, and continuous data between groups were compared using the independent T-test, and P-value <0.05 was considered statistical significance.

The approval for the study was obtained from the Medical Research Ethics Committer (MREC), College of Medicine and Health Sciences of Sultan Qaboos University, Muscat, Oman (MREC 2260). A written informed consent was acquired from the patient(s). The study was conducted following the principles outlined in the Declaration of Helsinki[17] and the American Psychological Association on ethical human research, including confidentiality, privacy, and data management.

## Results

The demographic characteristics of the participants are summarized in Table 1. A total of 171 participants were included in the study. The mean age of the sample was 25.79 ±6.84 years. Most were men, 61% and 39% were women. Inattention-type ADHD was the most common clinical presentation, 66%, while combined ADHD with hyperactivity and inattention occurred in approximately 24% of the patients. Substance use was found in about 29% of the patients and 24% of the study sample had a family history of ADHD. Depressive disorders and anxiety disorders were found in 18% and 26% of the patients, respectively, and almost three-quarters of the study sample had at least one comorbidity. Most of the patients received 81% methylphenidate and only 19% atomoxetine.

**Table 1:** Distribution of characteristics and association with improvement based on the Clinical Global Impressions Scale (CGI-I).

| Variables | Total (n=171) | Improvements | | p-value |
|---|---|---|---|---|
| | | Minimal / no improvement (n=28) | Improved / Very much improved (n=143) | |
| **Age** | 25.79±6.84 | 25.14±5.44 | 25.92±7.10 | 0.586 |
| **Gender** | | | | |
| Female | 67 (39.2) | 16 (57.1) | 51 (35.7) | 0.055 |
| Male | 104 (60.8) | 12 (42.9) | 92 (64.3) | |
| **BMI (n=153)** | | | | |
| Underweight | 18 (11.8) | 3 (12.5) | 15 (11.6) | 0.429 |
| Normal | 71 (46.4) | 13 (54.2) | 58 (45.0) | |
| Pre-obesity | 32 (20.9) | 6 (25.0) | 26 (20.2) | |
| Obesity | 32 (20.9) | 2 (8.3) | 30 (23.3) | |
| **Marital status** | | | | |
| Single | 141 (82.5) | 22 (78.6) | 119 (83.2) | 0.589 |
| Married | 30 (17.5) | 6 (21.4) | 24 (16.8) | |
| **Education (n=165)** | | | | |
| Less than high school | 16 (9.7) | 3 (11.5) | 13 (9.4) | 0.806 |
| High school | 66 (40.0) | 9 (34.6) | 57 (41.0) | |
| Bachelor's degree | 40 (24.2) | 8 (30.8) | 32 (23.0) | |
| Master's and Professionals | 43 (26.1) | 6 (23.1) | 37 (26.6) | |
| **Clinical presentation** | | | | |
| Hyperactivity | 17 (9.9) | 1 (3.6) | 16 (11.2) | 0.262 |
| Inattention | 113 (66.1) | 22 (78.6) | 91 (63.6) | |
| Mixed-type | 41 (24.0) | 5 (17.9) | 36 (25.2) | |
| **Substance use disorder** | | | | |
| Present | 50 (29.2) | 8 (28.6) | 42 (29.4) | 1.000 |
| Absent | 121 (70.8) | 20 (71.4) | 101 (70.6) | |

| | | | | |
|---|---|---|---|---|
| **Family history of ADHD** | | | | |
| Present | 41 (24.0) | 11 (39.3) | 30 (21.0) | 0.052 |
| Absent | 130 (76.0) | 17 (60.7) | 113 (79.0) | |
| **Psychotic disorders** | | | | |
| Present | 2 (1.2) | 1 (3.6) | 1 (0.7) | 0.301 |
| Absent | 169 (98.8) | 27 (96.4) | 142 (99.3) | |
| **Bipolar affective disorder** | | | | |
| Present | 24 (14.0) | 3 (10.7) | 21 (14.7) | 0.769 |
| Absent | 147 (86.0) | 25 (89.3) | 122 (85.3) | |
| **Personality Disorders** | | | | |
| Present | 27 (15.8) | 3 (10.7) | 24 (16.8) | 0.575 |
| Absent | 144 (84.2) | 25 (89.3) | 119 (83.2) | |
| **Depressive disorders** | | | | |
| Present | 30 (17.5) | 8 (28.6) | 22 (15.4) | 0.106 |
| Absent | 141 (82.5) | 20 (71.4) | 121 (84.6) | |
| **Anxiety disorders** | | | | |
| Present | 45 (26.3) | 11 (39.3) | 34 (23.8) | 0.103 |
| Absent | 126 (73.7) | 17 (60.7) | 109 (76.2) | |
| **OCD** | | | | |
| Present | 5 (2.9) | - | 5 (3.5) | 0.593 |
| Absent | 166 (97.1) | 28 (100.0) | 138 (96.5) | |
| **Any psychiatric comorbidity** | | | | |
| Present | 124 (72.5) | 22 (78.6) | 102 (71.3) | 0.496 |
| Absent | 47 (27.5) | 6 (21.4) | 41 (28.7) | |
| **History of specific developmental disorders of scholastic skills** | | | | |
| Present | 13 (7.6) | 2 (7.1) | 11 (7.7) | 1.000 |
| Absent | 158 (92.4) | 26 (92.9) | 132 (92.3) | |
| **Previous suicidal attempt** | | | | |
| Present | 10 (5.8) | 3 (10.7) | 7 (4.9) | 0.212 |
| Absent | 161 (94.2) | 25 (89.3) | 136 (95.1) | |
| **Previous forensic history** | | | | |
| Present | 1 (0.6) | - | 1 (0.7) | 1.000 |
| Absent | 170 (99.4) | 28 (100.0) | 142 (99.3) | |
| **Previous history of admission** | | | | |
| Present | 12 (6.3) | 3 (10.7) | 9 (6.3) | 0.418 |
| Absent | 159 (93.0) | 25 (89.3) | 134 (93.7) | |
| **Medication** | | | | |
| Atomoxetine | 33 (19.3) | 7 (25.0) | 26 (18.2) | 0.434 |
| Methylphenidate | 138 (80.7) | 21 (75.0) | 117 (81.8) | |

Moreover, Table 1 presents the treatment results on the CGI-I scale, a significant improvement was found in 84% (n=143) of the study sample. Further analysis showed that approximately 18% (n = 26) of patients receiving atomoxetine and 82% (n = 117) of patients receiving methylphenidate showed positive responses to treatment as defined by CGI-I. Further analysis indicates that patients treated with atomoxetine showed an improvement rate of 79% while methylphenidate showed an improvement rate of 85%.

Table 2 shows that the multivariate logistic regression model was significant ($p<0.001$), with Cox & Snell R2 explaining 7% of the variations. The study found that no family history of ADHD, male sex, no depression, and no anxiety were associated with a higher probability of response to treatment. However, sex and lack of a family history of ADHD remained a statistically significant predictor of response to treatment (OR 2.42, p=0.044, 95% CI 1.02 – 5.71) and (OR 2.93, p=0.020, 95% CI 1.18 – 7.28) respectively.

**Table 2:** Multivariate logistic regression analysis.

| Variables | Beta | S.E. | Sig. | Odds ratio | 95% confidence intervals |
|---|---|---|---|---|---|
| Male Sex | 0.883 | 0.439 | *0.044* | 2.42 | *1.02 – 5.71* |
| Absent family history of ADHD | 1.076 | 0.464 | *0.020* | 2.93 | *1.18 – 7.28* |
| Absence of Depressive Disorders | 0.693 | 0.525 | 0.186 | 2.00 | 0.72 – 5.59 |

| | | | | | |
|---|---|---|---|---|---|
| Absence of anxiety disorders | 0.507 | 0.475 | 0.286 | 1.66 | 0.65 – 4.21 |

## Discussion

This is a naturalistic observation of the routine treatment of ADHD medications. Ideally, a randomized controlled study would have been more robust and this would require attention in the future. In the present context, this sentinel study also presents clinical characteristics and predictors of response to treatment in adult patients with ADHD. To date, this is the first study of the Arab Gulf population.

The study analyzed 171 participants with a mean age of 25.79 years, of whom 61% were men and 39% were women. The preponderance of men in our study is consistent with the existing literature, which consistently indicates a higher prevalence of ADHD among men compared to women.[18] This is consistent with ADHD in children and adolescents, where more diagnoses of ADHD are reported in boys than in girls in the community. This trend has been reported to carry into adulthood because many adults who are diagnosed with ADHD usually owe the onset of their symptoms during childhood. Similarly, in the healthcare setting, Men and boys with ADHD tend to exhibit more overt hyperactivity and impulsivity, which are more noticeable and likely to be flagged by teachers, parents, and healthcare providers. In contrast, women and girls are more likely to have the inattention type of ADHD, which can be less conspicuous and more likely to be overlooked or misdiagnosed as anxiety or depression.[19] Cultural and social factors might strongly influence the use of healthcare for adults with ADHD. Social expectations and norms can influence the recognition and diagnosis of ADHD. Boy disruptive behaviours often require medical attention, while girl behaviours can be dismissed or attributed to other causes. In traditional Omani society, women are expected to be on the domestic front while men are a public fact of the family. Therefore, more studies are needed to rule out whether gender plays a role in healthcare utilisation among adults with ADHD.

In terms of the topologies of ADHD symptoms, the present study indicates that inattention-type ADHD was the most prevalent clinical presentation at 66%, followed by combined ADHD with hyperactivity and inattention at 24%. The increased prevalence of ADHD-type inattention in our sample echoes the findings of previous research, indicating a higher prevalence of ADHD-type inattention compared to ADHD-type hyperactivity among adults.[20] In the corpus of literature adult ADHD) has reported orthogonal subtypes such as predominantly inattentive, predominantly hyperactive-impulsive, and combined. There is evidence to suggest that these subtypes varied in association. LeRoy, Jacova, & Young[21] have reviewed the existing literature on neuropsychological functioning and subtypes of ADHD. They reported that variation in memory status was the only domain that differentiated ADHD-Inattentive and ADHD-Combined subtypes from controls.

Adult ADHD has been associated with substance misuse disorder. In a large population-based epidemiological study, Capusan et al.[22] have reported that ADHD symptoms were associated with an increased probability of all SUD outcomes, including nicotine, multiple drug use, and alcohol dependence. The present study indicates that substance use was present in 29% of the participants. However, it should be noted that drugs are screened to avoid the interaction of illicit drugs with the present treatment. The high prevalence of SUD in individuals with ADHD has previously been hypothesised to represent a form of self-medication.[23] Others have suggested that the predominant temperament of people with ADHD symptoms is largely in the direction of the characteristic of the impulsive trait known as the ‘behavioural activation system’ (BAS) which contrasts with the anxiety-prone ‘behavioural inhibition system’ (BIS). In substance abusers with ADHD symptoms, BAS-fun seeking was positively correlated with a variation in ADHD symptoms. According to Zayman et al.,[24] substance use may increase pleasure to reduce symptoms of ADHD rather than behavior due to impulsivity.

Ohnishi et al.[25] in the Japanese population has reported that > 50% of adult patients with ADHD have at least one comorbid psychiatric condition. In the critical review of the literature by Polanczyk et al.,[26] it was noted that the comorbidity rate is higher in adult patients with ADHD compared to children, and up to 80% of adults with ADHD report at least one comorbid psychiatric disorder.[27] This variation is likely due to differences in diagnostic methods and criteria. Our study sample exhibited a high prevalence of comorbid psychiatric disorders (72%). Depressive disorders and anxiety disorders were found in 18% and 26% of the participants, respectively, and nearly three-quarters had at least one comorbidity. Addressing these comorbidities requires a comprehensive treatment approach that not only focuses on the main symptoms of ADHD but also focuses on concurrent substance use disorders that can worsen functional impairment.

Most of our sample received methylphenidate, with only 19% prescribed atomoxetine. Our analysis of the treatment response of each drug revealed that patients treated with atomoxetine showed a substantial improvement rate of 79%. In comparison, those treated with methylphenidate exhibited an even higher improvement rate of 85%. In our study, the improvement rate with methylphenidate (85%) exceeded the response rate (76%) observed in another randomized controlled trial (RCT) that evaluated the response to methylphenidate treatment among adults with ADHD, compared to placebo (19%).[28]

Furthermore, the NICE guidelines[15] suggest lisdexamfetamine as a first-line option. However, it was not included in the study in this study because it was not available in our sitting. Adult ADHD patients who participated in the study began with a daily dose of 40 mg of atomoxetine and were titrated according to their response. Only after six weeks of non-response or intolerance to methylphenidate was used. According to the NICE guideline,[15] the suggested starting dose for atomoxetine is 0.5mg/kg/day for people under 70kg, which can be gradually be increased depending on response, with a maximum daily dose of 120 mg. For patients weighing more than 70 kg, the initial dose is 40 mg daily, followed by adjustments according to response.

Furthermore, we did not find a significant association between the type of medication and the results of treatment. However, our findings collectively suggest that both atomoxetine and methylphenidate are effective in reducing the symptoms of ADHD in adults. Our results are in line with previous studies on the efficacy of medications.[29]

The multivariate logistic regression model identified predictive factors for improvement within our study sample. Interestingly, the absence of a family history of ADHD has been shown to be a predictor of response to medications. This finding is consistent with the results of a previous study that showed a family history of ADHD correlated with non-adherence.[30] Furthermore, non-adherence was associated with a poorer response and fewer improvement in CGI-ADHD.[30]

Furthermore, the improvement observed among adults without a family history of ADHD indicates a possible genetic influence on treatment outcomes. This finding contributes a valuable dimension to ongoing research exploring the interplay between genetic and environmental factors in ADHD[31] and enriches existing knowledge on the subject.

Our study showed that men have a slightly higher improvement compared to women, which is consistent with previous research that revealed that women feel more impaired than men with similar levels of symptoms.[32] Furthermore, men generally have a higher density of dopamine receptors,[33] the main target of ADHD medications, which could contribute to a stronger response to treatment. These biological differences highlight the importance of considering gender-specific factors in ADHD management strategies, including custom dosing regimens and treatment approaches. More research is needed to elucidate the underlying mechanisms of gender differences in response to treatment to optimize therapeutic interventions for male and female patients with ADHD.

Furthermore, our sample showed a trend towards greater improvement among individuals without anxiety, which coincides with previous research suggesting that comorbid anxiety and bipolar disorders were associated with a decreased response to treatment,[34] and a worse clinical presentation.[35]

The modest percentage of variance explained by the regression model (5%) highlights the multifactorial nature of treatment outcomes in adult ADHD. Although identified factors provide valuable information, additional unexplored variables can contribute to the remaining variance, including genetic markers, psychosocial factors, and medication adherence. Future research could investigate these aspects to refine predictive models and improve our understanding of the factors that influence response to treatment.

Overall, this prospective study is constrained by its non-interventional design, which precludes the assessment of causal relationships. However, including all patients from Oman's only ADHD clinic, this study provides a comprehensive view of routine clinical practice & could reflect the generalizability of our research results. These findings provide practical guidance to clinicians and increase existing knowledge on the treatment outcomes of ADHD medication regimens.

## Conclusions

The study found that the CGI-Improvement scale showed an 84% improvement rate in adults with ADHD. The response rate varied between atomoxetine and methylphenidate, with methylphenidate showing the highest treatment response at 85%. The findings of the present study reveal a high prevalence of comorbid conditions in adults with ADHD, highlighting the importance of adopting a comprehensive treatment approach that addresses both ADHD symptoms and any concurrent mental health problems. By recognizing and treating comorbidities along with ADHD, clinicians can optimize treatment results and improve overall patient well-being. Furthermore, the study revealed an association between the absence of a family history of ADHD and a better response to methylphenidate or atomoxetine treatment, suggesting that a family history may serve as a useful prognostic indicator in treatment decision making.

## Disclosure

The authors declare that they have no competing interests. This research was not funded.

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