



Evaluation of the Relationship between ADHD and Comorbid Psychiatric Conditions: A Comprehensive Study on a Large Cohort

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ABSTRACT

This study delves into the psychiatric complexities accompanying Attention-deficit or Hyperactivity Disorder (ADHD), scrutinizing the prevalence and nature of comorbidities amid diverse gender categories, including transgender and non-binary individuals. Under the expert guidance of MD Adeel Sarwar, this research examined data from 1,528 participants collected *via* the ADHDtest.ai website, employing standardized diagnostic tools to delineate ADHD and concurrent psychiatric conditions.

A stark prevalence of anxiety disorders was noted, particularly in non-binary (63.2%) and transgender individuals (37.5%). This point towards a dire need for specialized healthcare provisions catering to these populations. The analysis also unveiled a notable pattern: 44.97% of females with an ADHD diagnosis did not report pre-existing conditions, marking a unique presentation of ADHD within this group. These findings underscore the complexity of ADHD as it intertwines with other conditions, necessitating gender-specific considerations in both diagnostic frameworks and treatment modalities.

Mirroring the National Institute of Mental Health's stance on ADHD comorbidity, the study underscores an imperative for adopting a multifaceted evaluative approach to bolster clinical outcomes. This research expands our understanding of ADHD's intricate psychiatric landscape, pressing the need for further studies into its comorbid disorders and the impacts these have on individualized treatment strategies.

Contrasting with Caye et al. (2016) study, which was contingent on the assumption that adult ADHD must originate in childhood, this investigation adopts a gender-inclusive lens to challenge long-standing diagnostic norms. The prior study, utilizing the 1993 Pelotas Birth Cohort Study, tracked 5,249 Brazilian youths into young adulthood (18-19 years), aligning with DSM-5 criteria to identify ADHD symptoms both in childhood and adulthood, and acknowledged a distinct trajectory for the disorder beyond childhood.

In comparison, our current study, engaging a cohort primarily from the USA, UK, and Canada, broadens the demographic focus and reaffirms the nuanced gender distribution-observing a male predominance in childhood ADHD diagnoses versus a female predominance in young adulthood. This investigation reinforces the perspective that adult ADHD may represent a divergent developmental path, not solely an extension from childhood, and supports the hypothesis of distinct ADHD trajectories across life spans.

Keywords: ADHD; Psychiatric comorbidity; Gender diversity; Transgender mental health; Non-binary issues; ADHD in females; DSM-5; Gender-specific diagnosis; Gender-inclusive research; Comorbidity patterns

INTRODUCTION

This research delves into the nuances of Attention-Deficit or Hyperactivity Disorder (ADHD), a neurodevelopmental

condition characterized by inattention, impulsivity, and hyperactivity. While the Diagnostic and statistical manual of mental disorders, fifth edition (DSM-5), traditionally considers ADHD as a condition originating in childhood and extending

Received:	09-November-2023	Manuscript No:	ipqpc-23-18273
Editor assigned:	13-November-2023	PreQC No:	ipqpc-23-18273 (QC)
Reviewed:	27-November-2023	QC No:	ipqpc-23-18273
Revised:	04-December-2023	Manuscript No:	ipqpc-23-18273 (R)
Published:	11-December-2023	DOI:	10.36648/1479-1064.31.5.36

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Citation Sarwar A, Vitetta F (2023) Evaluation of the Relationship between ADHD and Comorbid Psychiatric Conditions: A Comprehensive Study on a Large Cohort. Qual Prim Care. 31:36.

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into adult life, this investigation deviates from earlier works, such as the 2016 study by Caye et al., which concentrated on the progression of ADHD from childhood to young adulthood. Instead, this study turns a critical eye towards the breadth of psychiatric comorbidities that coexist with ADHD, paying special attention to a spectrum of gender identities, encompassing transgender and non-binary individuals. This shift in focus acknowledges the layered complexities of ADHD and its intersection with broader psychiatric and gender identity issues.

This investigation delineates the prevalence and heterogeneity of psychiatric comorbidities within a population diagnosed with ADHD, drawing upon an analytical cohort of 1,528 subjects from the ADHDtest.ai online diagnostic tool. Captured in 2023, this dataset reflects a spectrum of ADHD severity as quantified by a bespoke algorithm categorizing conditions from mild to severe.

The data, meticulously anonymized for privacy, was collated with the explicit intention to dissect the intricate nexus between ADHD and concomitant psychiatric disorders, scrutinizing gender-specific variations in clinical presentation and comorbidity profiles. This study eschews the traditional research trajectories and instead embarks on a novel investigative route by incorporating the experiences of transgender and non-binary individuals into the ADHD discourse-populations historically marginalized in psychiatric epidemiology.

In stark contrast to the work of Caye et al., this research augments the conventional ADHD paradigm by centering on the experiences of females with severe ADHD manifestations. The nuanced approach seeks to elucidate distinct comorbidity patterns endemic to this subset, hence broadening the understanding beyond the established male-dominant ADHD narrative.

Through a methodologically rigorous lens, this research endeavours to refine the clinical landscape of ADHD diagnosis and therapeutic stratagems. It advocates for an enriched diagnostic rubric and the advancement of treatment modalities that are comprehensive, embracing the entirety of gender identities and their intersecting psychiatric trajectories.

Data Gathering

In the process of data collection for this study, ADHDtest.ai has adhered strictly to ethical standards to ensure the integrity of our research and the confidentiality and rights of all participants:

Compliance with guidelines and regulations: All methods involved in the study were carried out in accordance with relevant guidelines and regulations. The research design, data collection, and analysis procedures were developed to meet the highest standards of ethical research conduct.

Institutional approval: All experimental protocols were thoroughly reviewed and approved by the R&D department from Roketsan University.

Informed consent: Informed consent was obtained from all subjects involved in the study. Consent was given through an

affirmative action by starting the ADHD online assessment, which included a clear affirmation that some of their anonymized data may be used for research purposes. This process was designed to ensure that participants were making an informed decision to contribute to the study.

Confidentiality of data: The identity and personal information of all participants remain strictly confidential. In the transition from data collection to analysis, all datasets were anonymized to prevent any possibility of tracing data back to individual participants. This measure was taken to uphold the privacy of participants while allowing for the valuable insights from their data to contribute to the broader research community's understanding of ADHD.

METHODS

The study cohort comprised 1,528 participants, recruited through the ADHDtest.ai website. The participants were diverse in gender, including 756 females (49.5%), 378 males (24.7%), 36 non-binary (2.4%), 32 transgender (2.1%), and 326 with an unknown or undisclosed gender (21.3%). The distribution is as specified in [Table 1](#).

Table 1: Gender distribution of study participants

Gender	Participants	Percentage (%)
Total	1,528	100
Female	756	49.50
Male	378	24.70
Non-binary	38	2.50
Transgender	32	2.10
Unknown gender	326	21.30

The diagnosis of ADHD was ascertained using a proprietary algorithm from the ADHDtest.ai website, which utilizes standardized diagnostic tools and criteria consistent with the DSM-5 guidelines. Upon identification of ADHD, participants disclosed any pre-existing conditions and underwent further evaluation to confirm any co-occurring psychiatric conditions.

This two-tiered diagnostic approach allowed for a thorough investigation into the prevalence and nature of psychiatric comorbidities within the ADHD population, with a particular focus on the impact of gender diversity on these comorbid conditions.

Comprehensive Results across All Cohorts

Out of the 1,528 participants evaluated, a significant majority, 1,258 individuals, were diagnosed with various degrees of ADHD, ranging from Mild to Severe, representing 82.3% of the total cohort. The investigation into comorbid psychiatric conditions among those diagnosed with ADHD revealed the following prevalence rates ([Table 2](#)).

Table 2: Prevalence of comorbid psychiatric conditions among participants diagnosed with ADHD

Conditions	Percentages of the participants diagnosed with ADHD
Anxiety	40.40%
OCD	12.50%
Insomnia	11.30%

PTSD	8.60%
Autism	6.20%
Dyslexia	4.10%
Substance Abuse	4.10%
Bipolar Disorder	4.00%
BPD	3.50%
Dysgraphia	0.60%

The analysis of the cohort, comprising 1,528 participants, table 2 reveals a substantial prevalence of psychiatric comorbidities among individuals diagnosed with ADHD. Notably, anxiety disorders emerge as the most common comorbidity, affecting 40.4% of those diagnosed with ADHD. This finding is consistent with extent literature that posits a significant neurobiological overlap between ADHD and anxiety disorders, suggesting potential commonalities in their pathophysiology [1].

Obsessive-Compulsive Disorder (OCD): It was identified in 12.5% of the ADHD sample. The co-occurrence of OCD and ADHD, which may share neurobiological underpinnings, presents a diagnostic challenge, emphasizing the need for differential diagnostic criteria that can disentangle the symptomatology of these conditions. Insomnia was prevalent in 11.3% of the ADHD population, aligning with previous research that has documented disrupted circadian rhythms in individuals with ADHD, which may contribute to sleep initiation difficulties.

Post-Traumatic Stress Disorder (PTSD): It was present in 8.6% of the cohort. The intersection of ADHD and PTSD, particularly in the context of early-life trauma, underscores the complex interplay between neurodevelopmental disorders and environmental stressors [2].

Autism Spectrum Disorder (ASD): It was found in 6.2% of individuals with ADHD. The symptomatic convergence of ADHD and ASD points to a potentially shared etiological basis, warranting further investigation into their common genetic and neurodevelopmental pathways [3,4].

Dyslexia: It was observed in 4.1% of the ADHD-diagnosed participants. The association between ADHD and dyslexia may be attributed to overlapping genetic vulnerabilities and neuroanatomical deviations, suggesting a syndromic relationship between these conditions.

Substance abuse: It was reported in 4.1% of the sample, reflecting the established link between ADHD's impulsivity and the propensity for substance use disorders.

Bipolar disorder: It was identified in 4% of the ADHD cohort. The symptomatic overlap, particularly in impulsivity, suggests a shared genetic predisposition, which could inform both diagnosis and treatment modalities.

Borderline Personality Disorder (BPD): It was found in 3.5% of the ADHD sample. The commonalities in impulsivity and emotional dysregulation between BPD and ADHD highlight the necessity for clinicians to be vigilant of this comorbidity.

Dysgraphia: Dysgraphia present in 0.6% of the cohort, and ADHD are both linked to neurodevelopmental disruptions, although the precise nature of their relationship remains to be

elucidated.

The data-driven insights from this analysis contribute to a growing body of evidence that ADHD does not exist in isolation but is frequently accompanied by a range of psychiatric comorbidities. The significant gender-specific findings also prompt a re-evaluation of potential biases in the diagnosis and treatment of ADHD, advocating for a more nuanced approach that considers gender as a variable in clinical practice.

The intricate relationship between ADHD and its comorbidities invites ongoing research, particularly into the genetic, neurobiological, and environmental factors that contribute to this complexity. These findings endorse the potential benefits of early intervention strategies that could pre-empt or attenuate the development of comorbid psychiatric conditions, thereby improving the prognosis for individuals with ADHD.

Comorbid Conditions in Non-binary, Transgender, and Female Individuals Diagnosed with Severe ADHD

In this cohort, the distribution of gender identity and the associated prevalence of comorbid psychiatric conditions demonstrated a notable variance. Specifically, 32 transgender individuals (12.2%), 38 non-binary individuals (10.5%), and 756 females (77.3%) were assessed through the ADHDtest.ai platform and received a diagnosis ranging from mild to severe ADHD. Detailed analysis indicated that anxiety was the most prevalent comorbid condition across non-binary (63.2%) and transgender individuals (37.5%), whereas it was the second most common in females (37.3%), just after those with no pre-existing conditions (44.97%).

Autism Spectrum Disorder (ASD) was identified in 26.3% of the non-binary group and 31.3% of the transgender group, highlighting a significant overlap with ADHD in these populations. Notably, PTSD also featured prominently, affecting 26.3% of non-binary and 25% of transgender individuals diagnosed with ADHD.

In the female cohort, comorbidities such as Obsessive-compulsive Disorder (OCD) and Insomnia were present in 7.94% and 5.82% of individuals, respectively, while PTSD was observed in 3.17%. Less common conditions like bipolar disorder, Borderline Personality Disorder (BPD), and substance use disorders each accounted for a smaller fraction of the cohort.

When considering ADHD without the presence of comorbid psychiatric conditions, the rates were 28.6% in transgender, 38.9% in non-binary, and 23.3% in female individuals, indicating a lower prevalence of isolated severe ADHD. These gender-related disparities in the prevalence of comorbid psychiatric conditions were statistically significant ($P < 0.05$), emphasizing the intricate clinical picture of severe ADHD within diverse gender identities.

Comorbid Conditions in Non-binary Individuals Diagnosed with ADHD

Methodology: Data from 38 non-binary individuals diagnosed with ADHD ranging from mild to severe were collected and analysed. Each participant's psychiatric history was reviewed to identify and quantify comorbid conditions (Table 3).

Table 3: Frequency and percentage of comorbid conditions in non-binary individuals diagnosed with ADHD

Comorbid Condition in Non-Binary Individuals	Frequency (n=38)	Percentage (%)
Anxiety	24	63.2
Autism	10	26.3
PTSD	10	26.3
Insomnia	10	26.3
Dyslexia	4	10.5
Dyscalculia	4	10.5
OCD	2	5.3
BPD	2	5.3
Dysgraphia	2	5.3
Substance	2	5.3

RESULTS

The prevalence of comorbid conditions such as Anxiety (63.2%), Autism (26.3%), and PTSD (26.3%) was significant. The data in Table 3 revealed notable instances of insomnia, dyslexia and dyscalculia.

DISCUSSION

The pronounced prevalence of Anxiety among non-binary individuals with Severe ADHD, observed at 63.2%, is indicative of the heightened vulnerability to anxiety disorders within this group. The co-occurrence with autism and insomnia suggests a complex interplay of neurodevelopmental and psychiatric conditions that may share common etiological factors.

The data highlights the need for an intersectional perspective in mental healthcare that recognizes the unique mental health challenges of non-binary individuals. The review by Thrower et al., indicates a higher prevalence of ASD and ADHD in those with gender dysphoria, with ASD rates in transgender populations estimated at 6-26%, mirroring figures found in psychiatric settings.

These conditions can impact the assessment and treatment of gender dysphoria, illustrating the importance of considering neurodevelopmental disorders in gender health services. The link between ASD, ADHD, and gender dysphoria, although not fully understood, calls for further research using rigorous diagnostic criteria to enhance care for gender-diverse individuals with these conditions [5].

Comorbid Conditions in Transgender Individuals Diagnosed with ADHD

Methodology: A sample of 16 transgender individuals with Severe ADHD was studied. Pre-existing psychiatric diagnoses were recorded and analysed for prevalence and patterns.

Results: Anxiety (37.5%) and Autism (31.3%) emerged as significant comorbidities. Additionally, a substantial proportion of participants exhibited symptoms that extended beyond their severe ADHD diagnosis (Table 4).

Table 4: Prevalence of comorbid conditions in transgender individuals with severe ADHD

Comorbid Condition in Transgender Individuals	Frequency (n=32)	Percentage (%)
Anxiety	12	37.5

Autism	10	31.3
PTSD	8	25
Dyslexia	6	18.8
Insomnia	2	6.3
Dyscalculia	2	6.3
Dyspraxia	2	6.3
Substance	2	6.3

Discussion: The findings in Table 4 underscore the intricate interplay between ADHD and psychiatric comorbidities within the transgender community. With the prevalence of anxiety and autism spectrum disorders as significant comorbidities, the data reflect a compounded vulnerability, likely intensified by the psychosocial stressors accompanying gender dysphoria and transition-related processes.

This complexity is further illuminated by research from Kaiser Permanente, which highlights that ADHD and depressive disorders are diagnosed more frequently in transgender youth than in their cisgender counterparts. According to this study, entitled “ADHD and depressive disorders more frequently diagnosed in transgender youth,” attention deficit disorders were found to be 3 to 7 times more common and depressive disorders 4 to 7 times more common in transgender and gender-nonconforming youth.

The stark contrast in prevalence rates demands a reassessment of diagnostic approaches for ADHD to capture the full breadth of symptomatology in transgender individuals. Such evidence advocates for a holistic and nuanced model of care that recognizes the intersecting dimensions of gender identity and mental health, aiming to support the unique challenges faced by this community [6].

Attention-deficit or Hyperactivity Disorder (ADHD) in Females

Methods: This study conducted a comprehensive analysis of data from 756 females diagnosed with severe ADHD to determine the frequency of comorbid conditions and to understand the clinical presentation of ADHD in this demographic.

Results: The investigation revealed that a significant number of females (44.97%) had no additional psychiatric conditions, while Anxiety was the most prevalent comorbidity (37.3%). Other conditions such as OCD, insomnia, and PTSD were also prevalent, as shown (Table 5).

Table 5: Comorbid conditions in females with severe ADHD

Comorbid Condition in Females	Frequency (n=756)	Percentage (%)
No pre-existing	340	44.97
Anxiety	282	37.3
OCD	60	7.94
Insomnia	44	5.82
PTSD	24	3.17
Bipolar	20	2.65
Autism	16	2.12
BPD	12	1.59

Substance	12	1.59
Dyslexia	4	0.53
Dysgraphia	2	0.26
Schizophrenia	2	0.26

Discussion: Reflecting on the clinical presentation of ADHD in women and girls, our data aligns with the findings of Quinn and Madhoo (2014), who underscored the unique manifestation of ADHD in this population [7].

The research findings suggest that ADHD may manifest differently in females, with a notable portion not exhibiting additional psychiatric conditions. The high incidence of Anxiety as a comorbidity highlights the unique mental health challenges faced by females with Severe ADHD. Furthermore, the study by Quinn and Madhoo elucidates that anxiety and depression, common comorbidities in female patients with ADHD, can lead to missed or misdiagnosis. This is particularly concerning as females with ADHD who are not properly diagnosed and treated experience the same negative consequences as their male counterparts, including poor academic performance and behavioural problems [8].

CONCLUSION

While aligning with the National Institute of Mental Health (NIMH)'s publication on Attention-deficit or Hyperactivity Disorder (ADHD), this analysis extends the discourse by shedding light on the nuanced manifestations of comorbidities across different gender identities. The study corroborates the high incidence of comorbid psychiatric disorders with ADHD, as reported in the "Patient characteristics, comorbidities, and medication use for children with ADHD with and without a co-occurring reading disorder: A retrospective cohort study" study in 2011. However, this research contributes novel insights into the gender-specific prevalence and expression of these comorbidities, particularly highlighting the distinct patterns observed in female, non-binary, and transgender individuals.

The significant comorbidity percentages within the ADHD-diagnosed participants underscore the complexity of ADHD as a multifaceted condition that intersects with gender identity in ways that are not yet fully understood. The data reveals that while some comorbid conditions like anxiety and mood disorders are common across all groups, the frequency and combination of comorbidities can vary significantly, suggesting the influence of gender-related factors in the presentation and progression of ADHD.

The research emphasises the necessity for a comprehensive, gender-informed evaluative approach to ADHD, one that recognizes the unique challenges and needs of individuals across the gender spectrum. It advocates for the refinement of diagnostic criteria and treatment modalities to accommodate the diverse experiences of those with ADHD, ensuring that all individuals receive personalized care that addresses both their ADHD and the full range of associated psychiatric conditions.

The research findings underscore the imperative for ongoing scholarly investigation into the confluence of ADHD, gender,

and comorbidity. This endeavour is critical for enhancing the collective comprehension of ADHD and for guiding clinical practices to accommodate the intricacies of gender in mental health. The study advocates for a more comprehensive and discerning approach to mental health care, which promises to markedly enhance the quality of life for individuals with ADHD, irrespective of gender.

DATA AVAILABILITY

The study analysed data from the ADHDtest.ai website, which comprised a cohort of 1,528 individuals diagnosed with Severe ADHD across various gender identities. The datasets generated and/or analysed during the current study are available in the ADHD test.ai repository, accessible at <https://adhdtest.ai/research-data.csv>. In the event of the file being unavailable from the specified source, the data can be made available from the corresponding author upon reasonable request.

ACKNOWLEDGEMENT

None.

CONFLICT OF INTEREST

None.

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