Proceedings of ICEIPI 2026 Symposium: Inclusive Education, Cultural Transformation, and the Ethical Dimensions of Learning
DOI: 10.54254/2753-7048/2026.LD34580

Prevalence and Gender Influencing Factors of ADHD Symptoms and Depression Comorbidity in College Students

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Abstract. In the context of college students' mental health problems, the comorbidity of attention deficit hyperactivity disorder (ADHD) and depression has become an important problem affecting the adaptation and development of students. In order to understand the current status of ADHD and depression comorbidity, gender differences and internal correlation, this study selected 30 college students in a university as the subjects. The ASRS-v1.1 scale and the PHQ-9 questionnaire were used for cross-sectional survey, and descriptive statistics and correlation analysis were used for data processing. The results showed that the positive rate of ADHD screening in college students was 16.7%, and most of them were moderate to severe depression. There was a strong positive correlation between ADHD symptoms and depression symptoms. Among the ADHD positive students, 71.43% were female, and the degree of depression was more serious in female with comorbid ADHD. Studies have shown that the comorbidity of ADHD and depression is common and closely related in college students, and females are at high risk of comorbidity, with significant gender differences. The mental health work of colleges and universities should strengthen the combined screening of ADHD and depression, and focus on the intervention of female groups.

Keywords: College students, Attention Deficit Hyperactivity Disorder, Depression, Comorbidities, Gender differences

1. Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by persistent inattention, hyperactivity and impulsivity. It and depression have become the types of mental disorders with high incidence in college students. The comorbidity of the two disorders is not only common, but also has a serious negative impact on the academic performance, social ability and quality of daily life of college students, which has become the focus of mental health work in colleges and universities. Studies have shown that about 7% of adult ADHD patients are complicated with depression, which is three times higher than that of healthy people, while the comorbidity rate of ADHD in children and adolescents is even higher, up to 48% [1]. The comorbidity of ADHD and depression also brings a series of adverse consequences, including high treatment costs, unsatisfactory drug treatment responses, and overall worse disease prognosis. At the same time, there is a significant overlap in the core symptoms of ADHD and depression, which also

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brings great challenges to clinical differential diagnosis [2]. In addition, ADHD is also highly associated with mood disorders such as bipolar disorder, further highlighting its central role in the impairment of emotional regulation [3].

It has been pointed out that ADHD, as a highly heterogeneous neurodevelopmental disorder, affects the whole life cycle, and comorbidity is one of its most significant clinical features -- about 70%-80% of ADHD patients will suffer from at least one other mental illness in their lifetime, among which depression is one of the most common types [4]. This high comorbidity rate is not accidental, but is closely related to the long-term damage of executive function and emotional regulation ability of ADHD, which will make individuals more likely to fall into emotional difficulties and develop depressive symptoms when facing the stress and challenge of college life.

In addition, the sex-specific characteristics of ADHD provide an important context for understanding the core questions of this study. The male to female ratio of ADHD in adolescents is about 2.4:1, and even as high as 4:1 in the population seeking medical advice. However, after entering adulthood, this ratio gradually approaches 1:1. This change is closely related to the conceit of ADHD symptoms, the delay of diagnosis and the increase of the active help-seeking rate in adult women [4]. This also suggests that in college students, the recognition rate of female ADHD patients may be lower, and their comorbidity with depression is more likely to be ignored.

Based on the above research background, this study focuses on the college students and proposes three core research questions: first, what is the actual status of the comorbidity of ADHD symptoms and depression in college students? Second, as a key demographic factor, what impact will gender have on the comorbidity relationship between ADHD symptoms and depression; Thirdly, what are the underlying neural and psychological mechanisms behind the comorbidity of ADHD and depression? This study aims to reveal the characteristics and rules of the comorbidity of ADHD and depression in college students through empirical investigation and analysis, and to provide a reference for mental health intervention in colleges and universities.

2. Research design and methods

2.1. Research design

This study adopts questionnaire survey, belong to the cross-sectional study design, the design can nodes at a certain time to synchronous measurement of multivariable, applicable to describe a group of people the status quo, characteristics, and the correlation between variables and the exploratory targets of this study.

Taking college students as the research object, the data were collected through standardized scales to explore the current situation of ADHD symptoms and depression comorbidity in college students, and analyze the influence of gender, so as to lay the foundation for further research on the causal relationship between the two and intervention strategies.

2.2. Research objects

In this study, 30 college students from a university were selected as the research objects, and the ratio of male to female was strictly controlled to 1:1, that is, 15 males and 15 females. By balancing the gender ratio, the basic conditions were provided for the subsequent analysis of the effect of gender on the comorbidity relationship.

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2.3. Research tools

Adult Attention deficit Hyperactivity Disorder Self-rating scale (ASRS-v1.1): The ASRS-V1.1 is A standardized tool for the assessment of adult ADHD symptoms, which is divided into part A (1-6 items) and part B (7-18 items). Through the way of self-report, the subjects' ADHD symptoms are assessed from the dimensions of inattention, hyperactive impulsivity and so on.

Patient Health Questionnaire (PHQ-9): The PHQ-9 is a commonly used tool for the assessment of depressive symptoms, which contains 9 items. According to the score, the degree of depression is divided into four levels: no depression (0-4 points), mild depression (5-9 points), moderate depression (10-14 points), and moderate to severe depression (15-19 points), which can effectively assess the severity of depressive symptoms in college students. The 9-item Patient Health Questionnaire (PHQ-9) is a widely used self-assessment tool for depression symptoms in China. The Chinese version of the PHQ-9 has been localized in different populations in China. The scale has good internal consistency, test-retest reliability and structure, criterion validity, and stable screening efficacy, which is suitable for depression screening and symptom severity assessment in the domestic population [5].

2.4. Research procedures and data analysis

The purpose, content and specifications of the study were explained to all participants before the test. Informed consent was obtained from the participants before the formal questionnaire survey was conducted. The collected questionnaires were screened and invalid questionnaires were excluded. SPSS statistical software was used to process the valid data. Descriptive statistics and Pearson product-moment correlation analysis were used to analyze the distribution characteristics of ADHD symptoms and depressive symptoms, the correlation between them and gender differences in college students.

3. Results of the study

3.1. Screening and assessment results of ADHD and depressive symptoms

In terms of ADHD screening, 4 subjects (16.7%) were positive in ASRS part A (items 1-6); In part B (7-18 questions), 6 subjects (18.3%) were positive; Combined with the results of part A and part B, a total of 7 children were positive for ADHD screening, and the comprehensive positive rate was 16.7%.

In the assessment of depressive symptoms, the results of PHQ-9 questionnaire showed that 11 subjects had no depression, 7 subjects had mild depression, only 1 subject had moderate depression (accounting for 8.3%), and 11 subjects had moderate or severe depression, accounting for 91.7%, indicating that depressive symptoms were generally serious in the study sample. Moderate and severe depression was the main type.

3.2. Correlation analysis between ADHD and depression comorbidity

Pearson product-moment correlation analysis was used to explore the correlation between the total score of ADHD symptoms and the total score of depression symptoms in college students. The results showed that there was a strong and significant positive correlation between the total score of ADHD symptoms and the total score of depression symptoms ($r = 0.78$, $p < 0.01$). The results showed that in the study sample, the more serious the ADHD symptoms of college students, such as

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inattention and hyperactivity, the more prominent the depressive symptoms, such as low mood and loss of interest, the more obvious the depressive symptoms, suggesting that there is a close positive correlation between the two symptoms. However, due to the cross-sectional design of this study, there is a strong positive correlation between the two symptoms. However, due to the cross-sectional design of this study, no definitive conclusion can be drawn on the causal direction of the interaction between the two symptoms, and follow-up longitudinal studies are needed to further verify.

3.3. Analysis of gender differences in ADHD patients

The gender distribution of 7 ADHD positive subjects was analyzed, and the results showed that there were 5 females, accounting for 71.43%, and only 2 males, accounting for 28.57%, that is, the ADHD positive subjects in the sample were mainly female. The average score of depression in female ADHD positive subjects was 19 points, which was at the level of moderate to severe depression, indicating that female ADHD patients were more likely to be accompanied by moderate to severe depression symptoms, and there were significant gender differences in the comorbidity of ADHD and depression.

4. Analysis of comorbidity mechanism and gender influencing factors

Genetic and neurocognitive basis: ADHD and depression share genetic susceptibility, and executive function deficits are the core neurocognitive mediators of their comorbidity [6]. Dysfunction of the prefrontal-striatal circuit not only causes attention and impulse control disorders, but also impairs emotional regulation, making individuals more likely to fall into depression. At the same time, the two diseases are highly overlapping in symptoms such as decreased attention and lack of energy, which is easy to lead to delayed diagnosis. Symptoms that have not been treated for a long time will form a vicious circle and further increase the psychological burden [7]. In addition, attachment pattern plays an important regulatory role in this association. For individuals with higher attachment anxiety level, the association between ADHD symptoms and depression and anxiety will be significantly amplified, while secure attachment can play a protective role to buffer the negative effects of ADHD on mental health [8].

The vicious circle and diagnostic delay caused by symptom overlap: ADHD and depression have obvious overlapping symptoms, such as inattention and decreased energy, which not only increase the difficulty of clinical differential diagnosis, but also easily lead to diagnostic delay -- depressive symptoms may mask the core symptoms of ADHD, or ADHD may be misclassified as a simple emotional problem. At the same time, symptom overlap can also form a vicious cycle, which can be explained by the stress sensitization model: negative life events such as academic frustration and social failure caused by ADHD can induce depression, while low mood and lack of motivation caused by depression can further impair cognitive function and aggravate ADHD symptoms, thus creating a vicious cycle of two-way reinforcement.

Differences in symptom presentation and diagnostic intervention: Female ADHD patients are mainly attention-deficit type, and the explicit symptoms of hyperactive impulse are relatively hidden, and their symptoms are easily misdiagnosed as "introverted", "sensitive" or "high academic pressure" by the outside world, resulting in a higher rate of diagnostic delay [9]. The long-term symptoms are not timely treated, and the individual is in the accumulation process of repeated experience of frustration and helplessness. In the cumulative process of repeated experiences of frustration and helplessness, individuals gradually form a cognitive model of learned helplessness, which increases the risk of depression. The symptoms of hyperactivity and impulsiveness in male

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ADHD patients are more obvious, and they are easier to be identified and treated early, which reduces the long-term erosion of emotion by chronic symptoms and the risk of depression to a certain extent.

Differences in neurophysiology and hormone levels: From the perspective of neurophysiology, there are innate differences in the emotional regulation circuit of the prefrontal-limbic system between females and males. The dysfunction of dopamine and norepinephrine related to ADHD causes more obvious damage to the emotional regulation circuit in females, which is more likely to break their emotional homeostasis and increase the susceptibility to depression. At the same time, the unique fluctuation of hormone levels in females, such as hormonal changes in the menstrual cycle and stress-related cortisol changes, will further amplify the negative impact of ADHD on mood and aggravation of depressive symptoms [10].

The moderating effect of attachment anxiety: relevant English literature studies have shown that attachment anxiety can significantly exacerbate the association between ADHD and depression/anxiety, and only in ADHD individuals with medium and high attachment anxiety, symptoms are associated with higher levels of psychological distress. Secure attachment can act as a "protective factor" to buffer the negative impact of ADHD on emotion. Combined with the results of this study, it is speculated that female ADHD individuals may be more likely to form an attachment pattern of attachment anxiety, which further magnises the risk of depression and becomes an important psychological mechanism for gender differences [8].

5. Innovation and deficiency of research

5.1. Innovation

This study focused on the special group of college students, systematically sorted out the current situation, core mechanism, and gender influencing factors of ADHD and depression comorbidity, and provided a comprehensive literature basis and empirical data for related research on the comorbidity of ADHD and depression in college students. At the same time, this study focuses on the role of gender in the comorbidity of ADHD and depression in college students, revealing the characteristics of the comorbidity of female ADHD patients, and providing new ideas for the subsequent targeted gender-based mental health intervention.

5.2. Deficiencies

Sample size and representativeness Limitations: The total sample size of this study was only 30, of which only 7 were positive for ADHD, which resulted in insufficient statistical power due to the small sample size. The reliability of the conclusions related to gender differences was limited, and the study results could not be generalized to a wider group of college students. To improve the representativeness of the study.

Limitations of study design: The cross-sectional study design used in this study can only reveal the association between ADHD and depressive symptoms and cannot infer causality. In addition, since both ADHD symptoms and depressive symptoms were reported by participants at the same time point, there is a potential threat of common method bias, which may artificially exaggerate the correlation between variables to some extent.

This study only focused on gender, while the comorbidity of ADHD and depression may also be affected by many factors such as family environment, academic pressure, social support, personality traits and so on. Follow-up studies can include more variables and construct a multi-factor model to

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reveal the influencing mechanism of the comorbidity of ADHD and depression in college students more comprehensively.

6. Research prospects

Based on the results and shortcomings of this study, follow-up studies can be carried out in many aspects. First, to expand the sample size and carry out multi-center and large-sample questionnaire surveys to verify the conclusions of this study and improve the universality of the study results; Second, longitudinal study design was used to track the development and changes of ADHD and depressive symptoms in college students for a long time, and to clarify the causal relationship and dynamic association pattern between them. The third is to incorporate multi-dimensional influencing factors such as family, school and society, and use EEG, fMRI and other neuroimaging methods in cooperation with medical schools or affiliated hospitals, combined with semi-structured in-depth interviews, to construct a comprehensive model of comorbidity influencing mechanisms covering biological, psychological and social levels. Combining research methods such as neurophysiological examination and in-depth interview, a more comprehensive mechanism model of comorbidity was constructed. The fourth is to develop targeted intervention strategies based on gender differences, such as early screening programs for female ADHD patients, emotional regulation intervention training, and behavior modification strategies for male ADHD patients, so as to provide scientific and feasible practical programs for the prevention, screening, and intervention of ADHD and depression comorbidity in colleges and universities.

At the same time, colleges and universities should strengthen the science popularization of mental health, improve the cognitive level of ADHD symptoms among teachers and students, reduce the misunderstanding and bias of ADHD, establish an early screening mechanism, and provide timely intervention for high-risk groups of ADHD and students with comorbid depression. In addition, the mental health service system of colleges and universities should be improved to provide professional psychological counseling and referral services for students with ADHD and depression comorbidity, so as to reduce the negative impact of comorbidity on the mental health and social function of college students and help the development of physical and mental health of college students.

7. Conclusions

The comorbidity of ADHD and depression is common in college students, and the depression symptoms are more serious in this sample, and the proportion of moderate and severe depression is very high. There is a strong positive correlation between ADHD symptoms and depression symptoms, and the two affect each other and intensify each other, which needs to be paid more attention to by the mental health work of colleges and universities.

There are significant gender differences in the comorbidity of ADHD and depression. Female ADHD patients account for a higher proportion in the study sample, and are more likely to be accompanied by moderate or severe depressive symptoms, which is the high-risk group of ADHD and depression comorbidity.

The core mechanisms of ADHD and depression comorbidity include shared genetic susceptibility, neurocognitive deficits, and diagnostic delay and vicious cycle of symptoms caused by overlapping symptoms. The influence of gender on comorbidity is reflected in many aspects such as symptom manifestations, diagnosis and intervention timing, neurophysiological characteristics, hormone levels, and attachment patterns.

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The comorbidity of ADHD and depression can lead to more serious functional impairment, higher treatment cost and worse prognosis. Compared with ADHD or depression alone, the comorbidity of ADHD and depression has more significant negative impact on the mental health and social function of college students.

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