

High risk of psychological disorders: anxiety and depression in adolescent girls with polycystic ovary syndrome

Abstract

Study objective: This study is aimed to assess the prevalence of psychological disorders among different racial/ethnic group of normal weight and overweight adolescents with polycystic ovary syndrome (PCOS) from a state in southeastern US.

Design, setting, and participants: The data of 157,459 adolescents were collected through “the Patient Cohort Explorer” system at the University of Mississippi Medical Center (UMMC) from January 2013 to December 2019. Unidentified patients were searched with diagnosis code for PCOS, age, race/ethnicity, and associated diagnosis including weight gain, anxiety, depression, ADHD, and behavioral concerns.

Interventions: None.

Main outcome measures: Prevalence of PCOS and psychological disorders.

Results: A total of 712 adolescents with PCOS were diagnosed in clinics during the period of study. Collected data indicated that prevalence of PCOS in adolescents seen in clinics was less than 1% with no significant difference by race or ethnicity. Almost 45% of patients suffered from one or more psychological disorders. (Anxiety: 18%, Depression: 16%, ADHD: 9%).

Conclusions: Results from this study provide the first evidence of prevalence of PCOS and psychological disorders in adolescents with PCOS in a southern state. Our findings of a high prevalence of psychological disorders suggest that early screening for mental health symptoms must be considered during primary care clinical assessment of adolescents with PCOS. Left undiagnosed and/or untreated, chronic anxiety and depression may exacerbate mental health issues in this vulnerable population.

Keywords: polycystic ovary syndrome, adolescent, anxiety, depression, attention-deficit/hyperactivity disorder

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Mohadetheh Moulana PhD,^{1,2} Crystal S Lim PhD,¹ Anju P Sukumaran MD³

¹Departments of Psychiatry and Human Behavior, USA

²Women's Health Research Center, USA

³Pediatric-Endocrinology, University of Mississippi Medical Center, USA

Correspondence: Mohadetheh Moulana, Division of Neurobiology and Behavior Research, Department of Psychiatry and Human Behavior, University of Mississippi Medical Center, 2500 North State Street, Jackson, MS 39216, USA, Tel 601-984-6696, Fax 601-984-6931, Email mmoulana@umc.edu

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Introduction

Polycystic ovary syndrome (PCOS) is the most common endocrine disorder among women of reproductive age.¹⁻³ It is characterized by ovulatory dysfunction, presence of polycystic ovaries, and hyperandrogenism. PCOS is associated with cardiovascular, obesity, metabolic disorders,⁴⁻⁶ and chronic inflammation.^{7,8} Being overweight or obese is a common problem in the adult and adolescent PCOS population which escalates the clinical extremity of the syndrome and increases the risk for metabolic disorders.⁹ In addition to reproductive and metabolic concerns, PCOS is also associated with psychological disorders, such as anxiety, depression, bipolar disorder, social phobia, and even suicidal ideation.¹⁰⁻¹² Several reports have indicated that the prevalence of anxiety and depression in women with PCOS is significantly higher than age-matched non-PCOS women¹³⁻¹⁸ and unfortunately, these comorbidities impact women's health across the life span.¹⁹ Metabolic and psychological consequences of PCOS are not restricted to the adult population only as the onset of PCOS occurs during adolescence. The diagnosis of PCOS as early as adolescence indicates that the physiological complications may be found at early ages and appropriate management strategies can be incorporated in the treatment plan to address the physiological impediments.²⁰ However, comorbid psychological disorders in adolescents with PCOS remain

under-diagnosed or even un-diagnosed, and consequently un-treated. Limited studies have been conducted on adolescents with PCOS and associated mental health morbidities across the world.²¹ However, not only is well established data lacking to demonstrate associated comorbidities in adolescents with PCOS, but also no data has been found regarding the prevalence of PCOS in adolescents in the Southeastern US, which experiences significant health disparities.

The aim of this study was to investigate the prevalence of PCOS and associated psychological disorders, specifically anxiety and depressive disorders, among a sample of adolescents with PCOS in an academic medical center in Mississippi. To the best of our knowledge, this is the first study that evaluates the prevalence of PCOS and associated psychological disorders in an adolescent age group in Mississippi.

Methods

De-identified data was reviewed to examine the number of adolescent females (age less than or equal ≤ 18 years) with PCOS ($n=712$) who were seen in medical clinics at the University of Mississippi Medical Center (UMMC) for 7 years (January 2013 to December 2019). Of note, UMMC is the only academic medical center in the state of Mississippi and has numerous pediatric specialty

and general specialty practices where adolescent patients with PCOS may receive care. The data were collected through “the Patient Cohort Explorer” system at UMMC. This is a research tool through the electronic health record, EPIC, where researchers can obtain a list of unidentified patients based on either patient, encounter, or data filters. The final diagnosis of PCOS was determined by the medical provider treating the patient. Standard criteria for diagnosis of PCOS in adolescents includes: irregular menstrual cycle or hyperandrogenism or both. Identification of ovarian cysts by ultrasound was not performed for all patients. Unidentified patients were searched with diagnosis code for PCOS (ICD-10 E28.2). Then demographic factors like age, ethnicity, and race were added to the data filters. Additional diagnosis codes were added for abnormal weight gain, anxiety, depression, and behavioral concerns. Inclusion criteria included diagnosis of PCOS

based on medical records and being younger than or equal to 18 years old.

Results

Data showed that total of 485,141 females were seen at UMMC clinics over the seven years of study including a total of 157,459 individuals (2-18) years old. From 2915 individuals with PCOS diagnosis, a total of 712(24%) were less than 18 years of age. The PCOS adolescent group consists of 338 (47.4%) African Americans, 325 (45.6%) White, and 49 (7%) other minorities (Table 1). Records indicated that the prevalence rate of PCOS among the population was 0.45% (95% CI: 0.42 - 0.49), African American 0.48% (95% CI: 0.43 - 0.54), and White 0.55% (95% CI: 0.49 - 0.61) (Table 2).

Table 1 De-identified data from the “Patient Cohort Explorer” System

	Total population	African American	White
Female 2-18 years	157459	70167	58952
Anxiety	7519	2170	4547
Depression	5221	2147	2584
ADHD	21052	8589	10237
Other Psychological Disorders	589	261	290
Weight Gain	5295	2,998	1668
Weight Gain + Anxiety	232	89	117
Weight Gain + Depression	237	108	101
Weight Gain + ADHD	668	345	260
PCOS	712	338	325
PCOS + Anxiety	129	43	79
PCOS + Depression	116	47	63
PCOS + ADHD	67	22	41
PCOS + Other Psychological Disorders	8		
PCOS + Weight Gain	283	140	121
PCOS + Weight Gain + Anxiety	48	18	25
PCOS + Weight Gain + Depression	47	18	24
PCOS + Weight Gain + ADHD	2		

Table 2 Prevalence of PCOS and Psychological Disorders among female adolescents 2-18years old in the State of Mississippi (Females 2-18, n=157,459; PCOS, n=712).Abbreviation;Weight Gain (Wt),Attention-deficit/hyperactivity disorder (ADHD)

Female (2-18)	Total population prevalence rate (95% CI)	African American prevalence rate (95% CI)	White prevalence rate (95% CI)
PCOS	0.45 (0.42 - 0.49)	0.48 (0.43 - 0.54)	0.55 (0.49 - 0.61)
PCOS + Anxiety	18.12 (15.36 -21.15)	12.72 (9.36 - 16.75)	24.31 (19.74-29.35)
PCOS + Depression	16.29 (13.65 - 19.21)	13.91 (10.4 - 18.06)	19.38 (15.23 - 24.11)
PCOS + ADHD	9.40 (7.40 - 12.00)	6.50 (4.10 - 9.70)	13.00 (9.20 - 17.00)
PCOS + Other Psychological Disorders	0.28 (0.03 - 1.01)	-	-
PCOS + Wt	39.75 (36.13 - 43.45)	41.42 (36.12 - 46.88)	37.23 (31.96 - 42.74)
PCOS + Wt + Anxiety	6.74 (5.01 - 8.84)	5.33 (3.19 - 8.29)	7.69 (5.04 - 11.15)

Table Continued...

Female (2-18)	Total population prevalence rate (95% CI)	African American prevalence rate (95% CI)	White prevalence rate (95% CI)
PCOS + Wt + Depression	6.6 (4.89 - 8.68)	5.33 (3.19 - 8.29)	7.38 (4.79 - 10.79)
PCOS + Wt + ADHD	-	-	-
Non-PCOS + Anxiety	4.69 (4.59 - 4.80)	3.03 (2.91 - 3.16)	7.58 (7.37 - 7.80)
Non-PCOS + Depression	3.24 (3.16 - 3.33)	2.99 (2.87 - 3.12)	4.28 (4.11 - 4.44)
Non-PCOS + ADHD	13.00 (13.00 - 13.00)	12.24 (12.10 - 12.60)	16.30 (16.20 - 16.60)
Non-PCOS + Wt	3.18 (3.10 - 3.27)	4.07 (3.93 - 4.22)	2.62 (2.50 - 2.76)
Non-PCOS + Wt + Anxiety	0.12 (0.10 - 0.14)	0.10 (0.08 - 0.13)	0.16 (0.13 - 0.19)
Non-PCOS + Wt + Depression	0.12 (0.10 - 0.14)	0.13 (0.10 - 0.16)	0.13 (0.10 - 0.16)
Non-PCOS + Wt + Other Psych	-	-	-

Collected data showed that both anxiety and depression were higher in age-matched PCOS adolescents compared to adolescents without PCOS; anxiety [18% (95% CI: 15.36–21.15) vs 4.69% (95% CI: 4.59 – 4.80)], depression [16.29% (95% CI: 13.65 – 19.21) vs 3.24% (95% CI: 3.16 - 3.33)]. Anxiety and depression disorders in adolescents with PCOS were significantly more common in Whites (24.31% vs 12.72%, $P<0.001$; 19.38% vs 13.91%, $P=0.04$ respectively) compared to the African American group.

The prevalence rate for anxiety and depression among age-matched non-PCOS adolescents seen at UMMC in the same period were 4.69% (95% CI: 4.59 - 4.80) and 3.2% (3.16 - 3.33), respectively. Anxiety and depression in this subset were more common among White as well. Interestingly, It was found that ADHD was observed less in PCOS adolescents 9.4% (95% CI: 7.40 - 12.00) compared to non-PCOS adolescents with 13% (95% CI: 13.00 - 13.00).

Moreover, data revealed that 39.75% (95% CI: 36.13 - 43.45) of adolescents with PCOS (n=283) were overweight. From this group (n=48) 6.74% (95% CI: 5.01 - 8.84) were diagnosed with anxiety and (n=47)6.6% (95% CI: 4.89-8.68) were diagnosed with depression. In addition, White patients were found to have higher rate of anxiety and depression in spite of showing less percentage of weight gain (Table 2).

Conclusion

The present study, for the first time, revealed the prevalence rate of PCOS in the young girls that received healthcare at UMMC clinics. The main finding was that the prevalence rate for PCOS in this adolescent population is less than PCOS in this age group in the United States (0.8% - 2%),^{21,22} India (12%),²³ and Iran (3%)²⁴. However, this result may be an underestimate due to adolescents with PCOS remaining un-diagnosed and un-treated, therefore further studies are required for earlier identification and diagnosis of PCOS in this age group. According to this study, there was no significant difference between racial groups with respect to the prevalence of PCOS, in contrast to other studies that have reported an estimated prevalence between 7%-10%^{1,2} that varies slightly by race with White women at the highest risk.²²

Our results showed that 40% of the adolescent patients with PCOS were overweight regardless of race/ethnicity, which is consistent with the body of evidence suggesting an association of obesity and overweight with PCOS in adolescents,²⁵ However, we were unable

to find a positive correlation between weight and psychological disorders in overweight adolescent females with PCOS, in contrast to Milsom and colleagues study that reported a significant association between psychological disorders and elevated weight in adolescents with PCOS in New Zealand²¹ as well as study in adult overweight women with PCOS by Hollinrake et al.¹⁴ This could also be from the lack of access to mental health providers for the screening, diagnosis, and treatment of psychological disorders in this geographic area of the US.

Another observation was that adolescent girls with PCOS in Mississippi are at an increased risk for psychological disorders compared to the age-matched non-PCOS females. This is similar to previous reports that have demonstrated a negative impact of PCOS on quality of life, emotional well-being,²⁶ and increased psychological challenges of teenagers with PCOS.²⁷ The association of anxiety and depression with PCOS in young girls in our study supports the conclusion of previous studies in teenagers^{17,28,29} and adult women with PCOS^{10-12,14,30-32} however, it is in contrast to Milsom and colleagues' study who found no association of depression with PCOS in adolescents.²¹

Final observation was the association between anxiety, depression and PCOS in adolescents which varied slightly by race and ethnicity although, it was not statistically significant. Our results suggest that PCOS may have less impact on the development of psychological disorders in African American adolescents than White adolescents. This could be due to the difference in the diagnosis of psychological disorders and/or could also be related to the increased barriers to access and receive mental health care for patients who are racial/ethnically diverse. More prospective studies are needed to further examine this finding. Comparing the current data from the later study that have reported dissimilar PCOS prevalence rate and lower percentage of psychological concerns,²¹ suggest and support the heterogeneity features of PCOS. Therefore further studies with larger samples are required to validate these findings.

PCOS management requires multidisciplinary expertise due to its complexity and heterogeneity. Given that, anxiety and depression are major psychological complications of PCOS, assessing symptoms is highly recommended as early as possible among adolescents with PCOS. Early detection of depression and anxiety and an appropriate treatment plan will reduce the potential use of alcohol, tobacco, and other drugs by adolescents with PCOS since they may be used to temporarily alleviate their symptoms. Although the percentage

of adolescents with PCOS diagnosed with mood disorders are not extremely higher than adolescents without PCOS in the current population, this study is an important step towards understanding the importance of diagnosing psychological disorders as early as possible. The findings suggest that teenage girls with PCOS should be targets for psychological screening, care, and treatment.

In conclusion, the results of this study highlight the significance of screening all adolescents with PCOS for emotional, behavioral, and psychological concerns as there is an increased risk for psychological disorders. It is evident that due to the high prevalence of associated anxiety and depression in adolescents with PCOS, the physical and psychological concerns of these patients should be addressed in numerous ways. First, health care providers in primary care and endocrinology clinics must consider mental health assessment and screening of adolescent girls with PCOS besides the routine physical and laboratory examination, in order to evaluate and identify potential psychological disorders. Second, identified patients must be referred to specialists for more-in-depth evaluation, diagnosis, counseling sessions, and treatment. However, access to evidence based psychological treatments is often limited in underserved settings, such as the geographic area where this study was conducted. Medical specialists treating PCOS in adolescents should identify appropriate local referral sources for patients to receive appropriate psychological treatments. Third, it would be important to educate families about PCOS and associated psychological disorders to reduce the stress, anxiety, and depression in this group of young patients.

Cognitive behavioral treatments and relaxation techniques have been adapted to treat psychological symptoms in women with PCOS^{33,34} and could be modified to address developmental specific differences in adolescents. Group support groups and treatments in PCOS-specific practices may also help patients improve coping with their medical and psychological symptoms. Other medical treatments, such as medication, weight loss, and treatment of specific PCOS symptoms may also result in reduced symptoms of anxiety and depression.³⁴ Thus, assessment of psychological symptoms should occur throughout the medical treatment to determine whether additional psychological treatments may be necessary. This study is the first to examine the prevalence rate of PCOS in adolescents receiving medical treatment in Mississippi, which emphasizes the significance of the issue and paves the way for further studies.

The findings in this report are subject to limitations. First, data is limited to the patients that have been diagnosed with PCOS in UMMC clinics only, which limits the generalizability of the findings to the entire adolescent population in Mississippi and the United States. Second, data is limited to 7years, more time would be ideal to examine the prevalence rate of PCOS in a larger number of adolescents. Third, the number may be under-estimated since many patients are either not diagnosed or followed by primary care provider. Therefore, additional research is required to examine a larger population of adolescents in Mississippi and to understand the underlying risk factors of associated psychological disorders in adolescents with PCOS.

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Conflicts of interest

No conflicts of interest, financial or otherwise, are declared by the authors.

Ethical approval

The project does not meet the definition of human subject research. In the current study only existing, de-identified, un-linkable data was reviewed. Therefore, IRB approval was not obtained.

Informed consent

In the current study only existing, de-identified, un-linkable data was reviewed. Therefore, informed consent was not obtained.

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