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Original Research

A prospective study of antenatal anxiety and depression in pregnant women with polycystic ovary syndrome

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Abstract

Background: Women with polycystic ovary syndrome (PCOS) experience higher rates of depression and anxiety. There is limited research relating to perinatal mental health in women with PCOS. Studies suggest PCOS is associated with a higher prevalence of perinatal mental health disorders. Perinatal guidelines currently do not recognise PCOS as a risk factor for perinatal mental health disorders. We aimed to prospectively assess the prevalence of mental health disorders in pregnant women with PCOS.

Methods: Consenting pregnant women, with and without PCOS, were invited to participate. Standardised validated questionnaires were carried out including Generalised Anxiety Disorder-7 (GAD-7), Patient Health Questionnaire-9 (PHQ-9) and Edinburgh Postnatal Depression Scale (EPDS).

Results: Fifty-one with PCOS and 49 without PCOS responded. Pregnant women with PCOS had a higher mean (SD) anxiety score (GAD-7) than those without PCOS (8.2 [6.7] vs. 5.89 [4.7], $p = 0.04$). Pregnant women with PCOS had higher mean (SD) depression scores than those without PCOS on EPDS (9.1 [6.4] vs. 6.4 [4.5], $p = 0.02$) but not PHQ-9 score (median (IQR) 4 (3–9) vs. 4 (2–7.5), $p = 0.25$). Women with PCOS were more likely to experience moderate/severe anxiety (PCOS 34%, control 20%) and moderate/severe depression (PCOS 34%, control 20%) symptoms than women without PCOS. Twenty-nine percent of pregnant women with PCOS had an EPDS score >13 showing significantly higher rates of severe depression (PCOS 29%, control 12%, $p = 0.03$).

Conclusion: Our findings suggest a higher prevalence of perinatal depression and anxiety in women with PCOS. Our findings may suggest increased need for screening for mental health disorders in women with PCOS.

Keywords: Polycystic ovary syndrome; perinatal mental health disorders; anxiety; depression

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Background

Polycystic ovary syndrome (PCOS) affects approximately 10% of women of reproductive age (Yin *et al.*, 2021). PCOS is associated with a range of long-term health consequences. However, the psychological sequelae including anxiety, depression and body image distress are often overlooked in the general population but particularly in pregnancy. It is widely recognised in the literature that women with PCOS generally experience a higher incidence of mental health disorders, particularly depression (28–64%) and anxiety (34–57%) (Deeks *et al.*, 2010). Women with comorbid PCOS and infertility have even higher levels of depression (Koric *et al.*, 2021).

The international evidence-based guideline for the assessment and management of polycystic ovary syndrome 2023 included relevant systematic and narrative reviews, which informed this guideline on prevalence, screening, diagnostic assessment and treatment of emotional well-being in women with PCOS (Teede *et al.*, 2023). They give no specific recommendations on perinatal mental illness in women affected by PCOS other than 'targeted screening during the antenatal and postnatal periods in PCOS is aligned with recommendations in the general population'. General perinatal guidelines currently do not recognise PCOS as a risk factor for perinatal mental health disorders, and the international evidence-based PCOS guideline noted inadequate evidence in this area (NHMRC, 2018).

Anxiety and depression are more common among pregnant women than in the non-pregnant population (Hinds *et al.*, 2021). National guidelines vary, but US and UK guidelines recommend routine screening for common mental health disorders for all adults and adolescents, particularly those with chronic physical health problems and in the perinatal period (NICE 2009, 2011, 2014; Siu *et al.*, 2016; Siu 2016). However, PCOS is not specifically recognised or highlighted as a risk factor for perinatal mental health disorders, perhaps because of a lack of research in this area. A 2019 meta-analysis studying pregnancy complications in PCOS found no study looking at antenatal mental health in women with PCOS either as a pregnancy complication or as a risk factor for pregnancy and birth complications (Bahri Khomami *et al.*, 2019).

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A recent article providing an expert opinion on the clinical management of pregnancy in women with PCOS also highlighted the lack of studies on antenatal mental health problems in women with PCOS (Bahri Khomami *et al.*, 2022).

There are various screening tools suggested for identification of antenatal mental health disorders including the Edinburgh Postnatal Depression Scale (EPDS) suggested to be completed at the antenatal booking visit (NHMRC, 2018) (not used antenatally in the Republic of Ireland). The Patient Health Questionnaire-9 (PHQ-9), GAD-7 or adaptions of the EPDS specific to anxiety disorders have also been used antenatally (Wang *et al.*, 2021; Rondung *et al.*, 2024). A study at our institution previously used Generalised Anxiety Disorder-7 (GAD-7) and PHQ-9 for the screening, during the coronavirus disease 2019 pandemic, of antenatal anxiety and depression, respectively, with valid meaningful results (Hinds *et al.*, 2021). There are no specific tools to screen for anxiety in pregnant women. The PHQ-9 is useful in capturing somatic symptoms and the EPDS is more sensitive to depressive symptoms co-existing with anxiety during early pregnancy (Zhong *et al.*, 2014). One study comparing both the PHQ-9 and the EPDS suggests benefits in the simultaneous administration of both screening tools to improve clinical identification of antepartum depressive disorders (Zhong *et al.*, 2014).

Overall, there is a lack of studies on perinatal mental health in PCOS, and this study therefore aimed to prospectively assess anxiety and depression in pregnant women with PCOS, to assess if there is a need to screen for common perinatal mental disorders in women with PCOS and develop guidelines for management of perinatal mental health disorders in this high-risk group.

Methods

Participant recruitment

Women who were pregnant with an underlying diagnosis of PCOS as well as controls were recruited from the antenatal clinics and wards of a large tertiary referral maternity hospital between April 2022 and November 2023. Patients were identified with non-probability convenience sampling by screening patients' pregnancy booking history for women with PCOS and selecting women who had already undergone testing for gestational diabetes. Patients meeting the criteria were contacted either by phone or in person at outpatient clinics or inpatient ward settings to introduce and discuss the study. Those interested were provided with study details and the questionnaire via email, allowing time for consideration before deciding to participate.

Inclusion/exclusion criteria

The inclusion criteria were:

- Over 18 years of age.
- Pregnant women who had adequate English proficiency to communicate.
- Completed testing for gestational diabetes.
- For women recruited to the PCOS group, diagnosis of PCOS was according to the Rotterdam Criteria (Teede *et al.*, 2018) (presence of two of three of the following criteria: oligo-anovulation, hyperandrogenism and polycystic ovaries [≥12 follicles measuring 2–9 mm in diameter and/or an ovary volume >10 mL in at least one ovary]).
- Capacity to provide informed consent.

The exclusion criteria were:

- Unable or unwilling to provide informed consent.
- No English language knowledge.
- Intellectual impairment.
- Unable to read or write.
- Unable to participate in follow-up.

Study design

The study was designed as a prospective patient cohort study using a standardised electronic questionnaire of pregnant women with and without PCOS. PCOS diagnosis was based on participants' medical records, and PCOS features/symptoms were also confirmed as part of study questionnaire. Participants completed a standardised electronic questionnaire including demographics, pregnancy details and assessment tools: the General Anxiety Disorder-7 (GAD-7), Patient Health Questionnaire-9 (PHQ-9) and Edinburgh Postnatal Depression Scale (EPDS). The questionnaire duration was estimated at 10–15 minutes to complete. Potential participants were invited by three assigned obstetrics specialty training doctors who educated participants on the study and disseminated the questionnaire and patient information leaflet from a dedicated research email. Participant consent was assumed by the participant's submission of a completed questionnaire.

Sample size

The proposed sample size of $n = 73$ was determined based on the estimation that approximately 5% ($n = 335$ per annum) of pregnant patients attending the tertiary hospital ($n = 6700$ per annum) had PCOS. This calculation considered a 95% confidence interval and a 5% margin of error, derived using a sample size equation to come up with this approximate desired sample size.

Outcomes

The study aimed to prospectively assess the prevalence of mental health disorders in pregnant women with PCOS using standardised questionnaires. The study also aimed to identify associated factors with those experiencing mental health disorders by examining demographics.

Statistical analysis

Data were analysed using GraphPad Prism version 10. Both parametric and non-parametric data are reported as mean and standard deviation (SD). A p-value <0.05 was considered statistically significant. A Student t-test was used to compare parametric data, and the Mann–Whitney test was used to compare non-parametric data. A chi-squared test was used to assess the difference in anxiety and depression severity between groups.

Ethical approval

The study received ethical approval from the Coombe Hospital Research Ethics Committee ensuring adherence to ethical guidelines when conducting the research.

Results

Demographics/background history (Table 1)

Seventy-four patients were identified with PCOS and were invited to participate. Fifty-one of these completed the study (68.9% of

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Table 1. Participant demographics and background history

	Control	PCOS	*P*-value
Age (mean ± SD)	32 (±6)	33 (± 5)	0.49
Gestational age at time of study completion (mean ± SD)	34 (± 5)	31.4 (± 7)	0.04
Parity	37% nulliparous 63% multiparous	41% nulliparous 59% multiparous	0.71
Gestational diabetes mellitus	18% ($n = 9$)	39% ($n = 20$)	0.0014
Pre-existing type 1/type 2 diabetes mellitus	2% ($n = 1$)	22% ($n = 11$)	
Marital status	49% ($n = 24$)	67% ($n = 34$)	0.28
Single	10% ($n = 5$)	6% ($n = 3$)	
In a relationship/co-habituating	40.8% ($n = 20$)	27.5% ($n = 14$)	
Employment status	14% unemployed ($n = 7$)	12% unemployed ($n = 6$)	0.84
Diagnosis of depression	4 (8.2%)	14 (27.5%)	0.011
Diagnosis of anxiety	11 (22.4%)	20 (39.2%)	0.12
Diagnosis of eating disorder	0	3 (5.9%)	N/A
Previous medication use for mental health	10 (20.4%)	15 (29.4%)	0.3
Receiving psychological support	6 (12%)	8 (16%)	0.6

PCOS, Polycystic ovary syndrome.

PCOS patients). Ninety-one control patients were identified without PCOS and were invited to participate, and 49 responded (53.8% of control patients). Women with PCOS had a more than threefold higher prevalence of pre-pregnancy depression (27.5% vs. 8.2%, $p = 0.011$) and a non-significant higher prevalence of anxiety (Table 1). Women with PCOS were more likely to be diagnosed with gestational diabetes mellitus during the index pregnancy (39% vs. 18%, $p = 0.0014$) (Table 1). The mean gestational age when completing the questionnaire differed statistically (34 weeks in control patients vs. 31.4 weeks in PCOS patients, $p = 0.04$).

Anxiety and depression

There was significantly higher overall anxiety in pregnant women with PCOS (Table 2). There was increased moderate/severe anxiety (34% vs. 20%, Table 2) in pregnant women with PCOS; this difference was close to being statistically significant, χ^2 (1, $n = 100$) = 3.52, $p = .06$.

There were higher depression scores in pregnant women with PCOS using EPDS compared to controls (9.1 vs. 6.4, $p = 0.02$, Table 3). Twenty-nine percent of pregnant women with PCOS had EPDS scores >13 compared to 12% without PCOS indicating increased rates of severe depression; this difference was statistically significant, χ^2 (1, $n = 100$) = 4.44, $p = 0.03$

When depression was scored using PHQ-9 in pregnant women with PCOS versus controls, the difference in the scores did not reach statistical significance (5.1 vs. 6.4, $p = 0.25$, Table 4). There was increased moderate to severe depression (34% vs. 20%, Table 4) in pregnant women with PCOS compared to controls.

Table 2. Anxiety score differences between control and polycystic ovary syndrome (PCOS) for Generalised Anxiety Disorder-7 (GAD-7)

GAD 7 (mean ± SD)	Control	PCOS	*P*-value
Mean (SD)	5.89 (4.7)	8.2 (6.7)	0.04
Mild (5–9)	14 (29%)	18 (35%)	–
Moderate (10–14)	6 (12%)	6 (12%)	0.06
Severe (15–21)	4 (8%)	11 (22%)	

Table 3. Depression score differences between control and polycystic ovary syndrome (PCOS) for Edinburgh Postnatal Depression Score (EPDS)

EPDS (mean ± SD)	Control	PCOS	*P*-value
Mean (SD)	6.4 (4.5)	9.1 (6.4)	0.02
Score ≥10 (moderate)	9 (18%)	18 (49%)	–
Score ≥13 (severe)	6 (12%)	15 (29%)	0.03

Table 4. Depression score differences between control and polycystic ovary syndrome (PCOS) for Patient Health Questionnaire-9 (PHQ-9)

PHQ 9	Control	PCOS	*P*-value
Mean ± SD	5.1 (5.1)	6.4 (6.4)	0.25
Mild (5–9)	14 (29%)	18 (35%)	–
Moderate (10–14)	6 (12%)	6 (12%)	–
Severe (15–21)	4 (8%)	11 (22%)	–

Discussion

This study sought to prospectively assess the prevalence of mental health disorders in pregnant women with PCOS. A recent expert review on management of PCOS in pregnancy highlighted the lack of literature on mental health disorders in women with PCOS (Bahri Khomami *et al.*, 2022), prompting conduction of this study. They highlighted a recent meta-analysis that found no study investigating mental health as a complication or risk factor in pregnant women with PCOS (Bahri Khomami *et al.*, 2019).

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Two cohort studies found an association between PCOS and antenatal and postnatal depression and anxiety with a higher prevalence of mental health disorders in women with PCOS in the peripartum period but did not assess the severity of these in comparison to women without PCOS (Koric *et al.*, 2021; Tay *et al.*, 2019). One US population-based prospective cohort study found that clinical PCOS was associated with a higher prevalence of postpartum depressed mood and anhedonia, although prenatal depression and anxiety partially mediated this association (Koric *et al.*, 2021). This study used a self-designed questionnaire rather than a validated tool, although the questions included were similar. They suggested women with PCOS had a 32% higher prevalence of prenatal depression or anxiety and a 76% higher prevalence of postpartum depression. For this reason, this study placed emphasis on the need for prenatal psychological screening among women with PCOS. They found overall that after controlling for age, BMI, ethnic background, educational level and marital status, PCOS had a 1.76 higher adjusted prevalence ratio for symptoms of postpartum depression. Another Australian population-based cohort study, part of the Australian Longitudinal Study on Women's Health, had similar findings with women with PCOS self-reporting statistically significantly higher rates of antenatal depression, antenatal anxiety, postnatal depression and postnatal anxiety (Tay *et al.*, 2019). After controlling for influencing factors, they suggested that PCOS had a positive association with antenatal depression/anxiety however their study showed there was no association with postnatal depression/anxiety, contradicting the US study. This study relied on self-reported data and did not use validated questionnaires. Both studies looked at the prevalence of mental health disorders in pregnant/postpartum women with PCOS compared to women without PCOS but did not assess the severity of the conditions, as with our study.

Our findings suggest a higher prevalence of perinatal depression and anxiety in women with PCOS. The observed higher incidence of depression and anxiety in pregnant women with PCOS aligns with existing literature indicating an elevated risk of mental health disorders in this population (Yin *et al.*, 2021; Deeks *et al.*, 2010). Our findings show a significant increase in both depression and anxiety scores in pregnant women with PCOS compared to the control group. This is on a background of a statistically higher baseline rate of diagnosed depression in women with PCOS versus controls ($p = 0.011$) widely accepted in the literature (Yin *et al.*, 2021) but no statistical difference in baseline anxiety diagnosis ($p = 0.12$). This emphasises the need for heightened awareness among healthcare providers regarding the mental health challenges faced by pregnant women with PCOS.

Thirty-four percent of women screened positive on the GAD-7 scoring system with a score >9 suggesting moderate to severe anxiety. Thirty-six percent of women screened positive on the PHQ-9 scoring system with a score >9 suggesting moderate to severe depression. The percentage of women receiving psychological support was similar for women with PCOS than controls despite a higher burden from mental health conditions. With over one-third of the population of pregnant women with PCOS in this study experiencing moderate-severe anxiety and depression, this highlights the importance of screening for mental health conditions in this sub-population of women in primary care and antenatal setting with a referral for perinatal mental health assessment where anxiety or depression is identified.

Women were recruited after they completed testing for gestational diabetes. This was incorporated into the study design to assess if a concurrent diabetes diagnosis had an effect on the prevalence of antenatal anxiety and depression in women with PCOS. As expected, there was a higher incidence of diabetes in women with PCOS compared to controls ($p = 0.0014$). While there have been studies suggesting a potential relationship between diabetes and pregnancy, there is currently poor quality evidence to assess whether diabetes in pregnancy is a risk factor for anxiety and depression in pregnancy (Wilson *et al.*, 2020; Ross *et al.*, 2016; Galbally *et al.*, 2020; OuYang *et al.*, 2021).

The study's limitations include a relatively small sample size and the potential for selection bias given the non-probability convenience sampling method. There may be a non-response bias, with an overall response rate of 39.4% of participants not motivated to engage with the survey which may have been due to active mental illness. Additionally, the study did not explore potential contributing factors such as socio-economic status or the impact of PCOS symptom severity on mental health outcomes.

In conclusion, our study contributes to the emerging literature on perinatal mental health in women with PCOS, demonstrating a higher prevalence of depression and anxiety during pregnancy. These findings underscore the importance of recognising PCOS as a risk factor for perinatal mental health disorders and advocate for increased screening and the development of guidelines specific to this population. Women with PCOS should be considered at increased risk for perinatal anxiety and depression. Further research with larger sample sizes and exploration of contributing factors is warranted to inform comprehensive care for pregnant women with PCOS.

Author's contributions. Ruairí Floyd: study design, data collection/recruitment, manuscript editing.
Nessa Hughes: data collection/recruitment, manuscript editing.
Lisa O'Sullivan: data collection/recruitment, manuscript editing.
David Hevey: study design, manuscript editing.
Niamh Murphy: study design, manuscript editing.
Catherine Hinds: study design, manuscript editing.
Lisa Owens: study design, manuscript editing.

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Competing interests. The authors declare no competing interests.

Ethical standards. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committee on human experimentation with the Helsinki Declaration of 1975, as revised in 2008. The study received ethical approval from the Coombe Hospital Research Ethics Committee.

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