# Increased risk of disordered eating in polycystic ovary syndrome

Iris Lee, B.A.,[a] Laura G. Cooney, M.D.,[b] Shailly Saini, M.D.,[b] Maria E. Smith, B.S.,[a] Mary D. Sammel, Sc.D.,[b,d] Kelly C. Allison, Ph.D.,[c] and Anuja Dokras, M.D., Ph.D.[b]

[a] Perelman School of Medicine, [b] Department of Obstetrics and Gynecology, [c] Department of Psychiatry, and [d] Department of Biostatistics and Epidemiology and Center for Clinical Epidemiology and Biostatistics, Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania

**Objective:** To determine the prevalence of eating disorders (EDs) in women with polycystic ovary syndrome (PCOS) and the effects of EDs on health-related quality of life.
**Design:** Cross-sectional study.
**Setting:** University practice.
**Patient(s):** Women with PCOS (Rotterdam criteria; n = 148) and controls seen for routine gynecologic care (n = 106) from 2015 to 2016.
**Intervention(s):** Eating Disorder Examination-Questionnaire (EDE-Q), Night Eating Questionnaire (NEQ), Hospital Anxiety and Depression Scale, and Health-Related Quality of Life Questionnaire (PCOSQ).
**Main Outcome Measure(s):** EDE-Q and NEQ scores, prevalence of bulimia nervosa (BN), binge eating disorder (BED), and night eating syndrome (NES).
**Result(s):** Women with PCOS were at an increased risk for overall abnormal EDE-Q scores compared with controls (12.16% vs. 2.83%; odds ratio [OR], 4.75; 95% confidence interval [CI], 1.36, 16.58). Clinically significant elevated scores were noted for shape and weight concern. In unadjusted analysis, body mass index (OR, 1.06; 95% CI, 1.01, 1.11), elevated depression score (OR, 5.43; 95% CI, 1.85, 15.88), and elevated anxiety score (OR, 6.60; 95% CI, 2.45, 17.76) were associated with an abnormal EDE-Q global score. In the multivariable model, PCOS was associated with abnormal EDE-Q global score (adjusted OR, 4.67; 95% CI, 1.16, 18.80). Elevated EDE-Q scores inversely correlated with PCOSQ scores (r = −0.57). The prevalence of BN was 6.1%, of BED was 17.6%, and of NES was 12.9% in women with PCOS, with no differences compared with controls.
**Conclusion(s):** Women with PCOS, especially those with concurrent anxiety symptoms but independent of obesity, have a significantly increased risk of abnormal EDE-Q scores. Our findings suggest the need for routine screening for ED in this population. (Fertil Steril® 2017;107:796–802. ©2016 by American Society for Reproductive Medicine.)
**Key Words:** Polycystic ovary syndrome, eating disorder, anxiety, depression

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Polycystic ovary syndrome (PCOS) is the most common endocrine disorder affecting reproductive-age women (1). Its classic features include oligomenorrhea, hyperandrogenism, and polycystic appearing ovaries on ultrasound (2). PCOS is also associated with increased risks of obesity, insulin resistance and type II diabetes mellitus, and possibly cardiovascular disease (3). In addition to these well-recognized risks, women with PCOS are more likely to be affected by psychiatric disorders including depression and anxiety (4–7). Some studies have proposed that increased weight and poor body image may contribute to the increased risk of mood disorders among women with PCOS (7, 8).

Body image disturbances are also central to eating disorders (EDs) (9, 10), which include anorexia nervosa (AN), bulimia nervosa (BN), binge eating disorder (BED), and otherwise specified feeding and EDs, such as night eating syndrome (NES) (11). Patients with an ED tend to have large discrepancies between ideal and perceived body weight and shape, and their self-perception is significantly distorted (12, 13). BED is the most common ED, with a lifetime prevalence of 2% in the general population (14) and up to 20% among adults seeking help in weight loss clinics (15). BED is associated with diabetes mellitus, obesity, and hypertension, making this disease especially relevant for women with PCOS who are already at risk for similar sequelae (3, 16). Two other major EDs described in the *Diagnostic*

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Reprint requests: Anuja Dokras, M.D., Ph.D., 3701 Market Street, Philadelphia, Pennsylvania 19104 (E-mail: adokras@obgyn.upenn.edu).

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*and Statistical Manual of Mental Disorders*, fifth edition (DSM-5), are BN, with a lifetime prevalence of 1.5% in the United States, and AN, with a lifetime prevalence of 0.9% (17). An estimated 1.5% of the general population has NES (18). There is an independent relationship between ED and anxiety and depression (17). For example, up to 50% of individuals with a lifetime diagnosis of BN and 32% with BED have also experienced major depression, and close to 12% of those with BN or BED also have generalized anxiety disorder (17). Because of these shared comorbidities and the high prevalence of both depressive and anxiety symptoms in PCOS, the presence of ED needs to be investigated among patients with PCOS.

The existing literature, although limited, suggests that EDs are common in the PCOS population (7,19–22). One study reported a high prevalence of 21% for the diagnosis of any ED based on clinical interview (19). However, there is a notable paucity of studies that compare ED prevalence in women with PCOS to that in well-defined controls, apply contemporary diagnostic criteria to identify the PCOS population, use validated screening tools and diagnostic standards to evaluate for all EDs, and examine the influence of concurrent depression or anxiety. The aims of the present study were to determine the prevalence of disordered eating among women with PCOS as compared with controls, identify risk factors for this comorbidity, and characterize the effect of disordered eating on health-related quality of life.

## METHODS

### Subjects

We conducted a cross-sectional study of women ages 18–50 year old between August 2015 and August 2016. The PCOS group comprised women seeking management of PCOS at the Penn PCOS Center. Their diagnosis was made by the Rotterdam criteria (2) and confirmed by chart review. All consecutive women on the days of recruitment were approached for participation irrespective of the reason for the visit. The control participants were patients presenting for general gynecologic care at the University of Pennsylvania Health System. All women presenting for routine care were approached for participation and were excluded if they had menstrual irregularity or hirsutism. Pregnancy was an exclusion criterion for both groups. The University of Pennsylvania Institutional Review Board approved this study.

### Surveys

All participants were asked to complete the following surveys: the Eating Disorder Examination-Questionnaire (EDE-Q) (23), Night Eating Questionnaire (NEQ) (24), and the Hospital Anxiety and Depression Scale (HADS) (25). The PCOS group also completed the PCOS Health-Related Quality of Life Questionnaire (PCOSQ) (26), and the control participants answered questions on demographic information including psychiatric history, menstrual history, presence of hirsutism, and obstetric history. All surveys were administered during participants' routine clinic visits, and all participants signed an informed consent form.

Scoring for the questionnaires followed each tool's standard scoring system. For the EDE-Q, a global score or subscale score of 4 or higher is considered clinically significant (23). The four subscales are restraint, shape concern, weight concern, and eating concern. A score of 25 or higher on the NEQ is considered suggestive of NES (24). On the HADS, a score of 11 or higher indicates clinically significant anxiety or depressive symptoms (25). A diagnosis of AN was made by restriction of intake resulting in significantly low body weight (the DSM-4 cutoff of body mass index [BMI] $< 17.5$ was used for purposes of analysis, as the DSM-5 does not offer a discrete number) and disturbances in perception of weight. In addition, the section of the EDE-Q querying the frequency of binge episodes and inappropriate compensatory behaviors was used to evaluate for full BN and BED diagnostic criteria per the DSM-5. BN was diagnosed by recurrent binge episodes and compensatory behaviors such as vomiting or laxative use at least once a week; BED was diagnosed if there were recurrent binge episodes occurring at least once per week, but no compensatory behaviors. Notably, the DSM-5 criteria require the presence of such behaviors over the last 3 months, while the EDE-Q assesses only the last 28 days. Reported frequencies were considered representative of the last 3 months for the purposes of fulfilling diagnostic criteria. The diagnosis of NES was based on the proposed research diagnostic criteria (27), as the description in the DSM-5 is not fully enumerated. These included ingestion of more than 25% of daily intake after dinner (NEQ item 5) or nocturnal eating two or more times per week (NEQ items 9 and 12).

### Statistical Analysis

We performed a priori sample size calculations, powered to our primary outcome of an abnormal global EDE-Q score ($\geq 4$). No studies have reported the prevalence of disordered eating in women with PCOS using this as their outcome. However, one study showed an odds ratio (OR) of 6.03 for any ED diagnosed using the Mini International Neuropsychiatric Interview (28) in women with PCOS compared with controls (19). Using data from this study, we assumed a prevalence of ED in the control population of approximately 4%, a type 1 error rate of 5%, 80% power, and an enrollment ratio of 2:1 between those with PCOS and controls. Under these assumptions, we estimated that we would need approximately 201 total participants to detect a more conservative fivefold increase in the rate of ED between the PCOS and control groups.

Descriptive statistics were performed using Fisher's exact or $\chi^2$-tests for categorical variables and Student's *t*-tests for continuous variables. Multivariable logistic regression was performed to control for confounders. Although age was not associated with abnormal EDE-Q global or subscale scores in the current study, we included it in our final model because prevalence of individual ED has been shown to vary by age (17). Our groups differed in race and marital status, and there are limited data on how race and marital status affect ED risk (29). Both race and marital status were not found to be associated with either EDE-Q or specific ED diagnoses and were not included in our final model. Pearson correlation was

used to examine the relationship between PCOSQ scores and EDE-Q global scores. Statistical significance was defined as $P<.05$. STATA version 14.1 (StataCorp) was used.

## RESULTS

A total of 148 women with PCOS and 106 control participants completed all surveys. Of the PCOS participants, 85.1% had oligomenorrhea, 91.2% had hyperandrogenism, and 83.8% had polycystic ovaries. Although all women with PCOS met the Rotterdam criteria (2), 114 (77.0%) met National Institutes of Health criteria (30) and 135 (91.2%) met Androgen Excess and PCOS Society criteria (31). At the time of the study, 41.5% of the women with PCOS were taking metformin, 50.7% oral contraceptives, and 6.9% antihypertensives. The demographic characteristics for both groups are shown in Table 1. Participants with PCOS were significantly younger and had higher mean BMIs than controls. They were also more likely to be white and married or in a domestic partnership. There were no significant differences between groups for the remaining demographic variables.

**TABLE 1**

**Demographic data for women with polycystic ovary syndrome and control participants.**

| Variable | PCOS, n = 148 | Controls, n = 106 | *P* value |
|---|---|---|---|
| Age (y), mean ± SD | 28.12 ± 5.13 | 31.85 ± 8.09 | <.001 |
| BMI (kg/m$^2$), mean ± SD | 33.85 ± 8.90 | 26.82 ± 7.54 | <.001 |
| Race | | | .013 |
| White | 94 (63.51) | 52 (49.06) | |
| Black/African American | 36 (24.49) | 46 (43.40) | |
| Other | 18 (12.16) | 8 (7.54) | |
| Ethnicity | | | .782 |
| Not Hispanic or Latino | 134 (92.41) | 97 (91.51) | |
| Hispanic or Latino | 11 (7.59) | 9 (8.49) | |
| Employment | | | .252 |
| Unemployed, looking for job | 5 (3.42) | 9 (8.57) | |
| Unemployed, not looking for job | 9 (6.16) | 6 (5.71) | |
| Part-time employed/ student | 21 (14.38) | 19 (18.10) | |
| Full-time employed/ student | 111 (76.03) | 71 (67.62) | |
| Income ($) | | | .775 |
| 20,000 or less | 23 (15.97) | 18 (17.48) | |
| 20,001–50,000 | 45 (31.25) | 35 (33.98) | |
| 50,001–100,000 | 42 (29.17) | 24 (23.30) | |
| 100,001–150,000 | 24 (16.67) | 15 (14.56) | |
| >150,000 | 10 (6.94) | 11 (10.68) | |
| Education | | | .091 |
| Some high school | 2 (1.37) | 2 (1.90) | |
| High school degree or equivalent | 6 (4.11) | 12 (11.43) | |
| Some college | 36 (24.66) | 25 (23.81) | |
| College degree | 53 (36.30) | 32 (30.48) | |
| Some professional degree | 17 (11.64) | 5 (4.76) | |
| Professional degree | 32 (21.92) | 29 (27.62) | |
| Marital status | | | .007 |
| Single, never married | 94 (63.95) | 68 (64.15) | |
| Married or domestic partnership | 51 (34.69) | 28 (26.42) | |
| Divorced or separated | 2 (1.36) | 10 (9.43) | |
| Widowed | 0 (0) | 0 (0) | |

*Note:* Values presented as n (%), unless stated otherwise.

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Women with PCOS had significantly higher mean scores on the EDE-Q global scale and all four individual EDE-Q subscales ($P<.001$; Fig. 1). When examining the prevalence of clinically significant scores for each subscale (≥4), women with PCOS were more likely to report abnormal scores on the shape concern and weight concern subscales ($P<.001$; Table 2). In an unadjusted analysis, women with PCOS had increased odds of an abnormal global EDE-Q score (≥4) compared with controls (OR, 4.75; 95% confidence interval [CI], 1.36, 16.58). There was a higher risk of clinically significant anxiety (41.22% vs. 16.98%; $P<.001$) and depressive symptoms (12.16% vs. 3.77%; $P=.023$) in women with PCOS but no difference in abnormal NEQ scores between groups (Table 2).

Specific eating behaviors over the last 28 days were also reported in the EDE-Q. Women with PCOS reported significantly more binge episodes (3.49 vs. 1.71; $P=.011$) and more frequent episodes of compulsive exercise (2.23 vs. 0.51; $P<.001$) than controls in the past month. The responses to these survey questions were then used to evaluate fulfillment of the core DSM-5 criteria for BN, BED, and NES (Table 2). Neither group had any diagnoses of AN (Table 2).

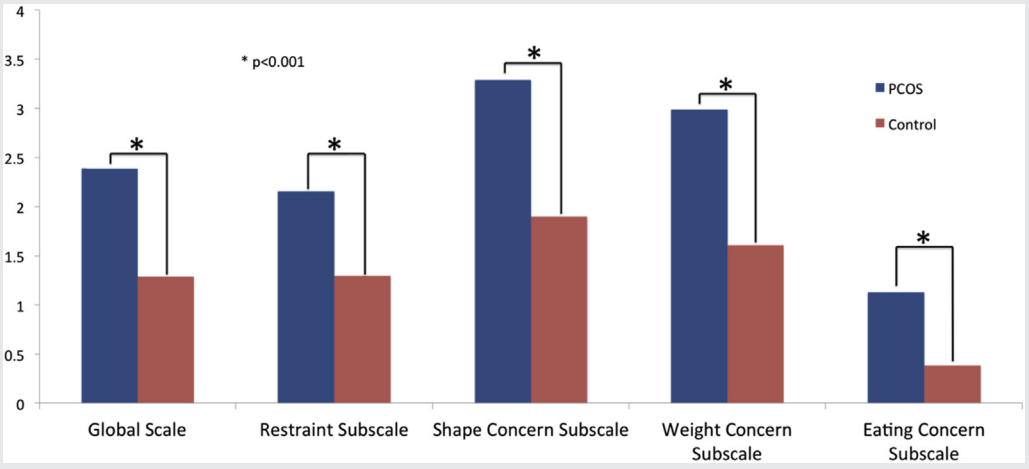
In unadjusted analysis, BMI (OR, 1.06; 95% CI, 1.01, 1.11), elevated depression score (OR, 5.43; 95% CI, 1.85, 15.88), and elevated anxiety score (OR, 6.60; 95% CI, 2.45, 17.76) were all associated with increased odds of an abnormal EDE-Q global score. In our multivariable model including age and BMI, PCOS continued to be significantly associated with an abnormal EDE-Q global score (adjusted OR [AOR], 4.67; 95% CI, 1.16, 18.80). After controlling for age and BMI, PCOS participants with elevated anxiety scores had an increased risk of an abnormal EDE-Q global score compared with those without (AOR, 5.91; 95% CI, 0.61, 56.9). This was higher than the odds of control women with anxiety symptoms having an abnormal EDE-Q score (AOR, 1.98; 95% CI, 0.16, 24.02). Given the low prevalence of depressive symptoms in our cohort, we were unable to estimate the association between depressive symptoms and disordered eating in PCOS participants compared with controls.

There was a significant inverse correlation between EDE-Q global score and overall PCOSQ score as well as with all PCOSQ domains, indicating that as EDE-Q scores increased, quality-of-life scores decreased (Table 3). Among the PCOSQ domains, the strongest correlations were found between the EDE-Q global score and the emotion and weight domains (Table 3).

## DISCUSSION

In the largest cross-sectional study to date to evaluate the prevalence of disordered eating in women with PCOS, we demonstrated that women with PCOS have over four times the risk of reporting disordered eating behaviors than controls. The ED scores were significantly higher for shape and weight concerns, and, overall, using DSM-5 criteria, we noted a high prevalence of BN, BED, and NES among our PCOS cohort. In addition, we identified a negative correlation

## FIGURE 1




Comparison of EDE-Q survey scores for women with PCOS and control participants.

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between EDE-Q global scores and health-related quality-of-life scores as measured by the PCOSQ screening tool. In keeping with the existing literature (5, 6), women with PCOS reported significantly more anxiety and depressive symptoms than the controls. We also found that after controlling for age and BMI, there was a higher risk of disordered eating in women with PCOS and concomitant anxiety symptoms.

There is limited literature on the risk of disordered eating in women with PCOS. Two small studies (20, 21), one including mostly adolescents, found no difference in the prevalence of abnormal screening scores between women with PCOS and controls. The majority of subjects with PCOS in these studies were lean or overweight compared with in our study. In a large community-based study, BED was significantly associated with obesity (17). In our study, although a majority of subjects were obese, we observed high ED scores independent of BMI. One study including women with PCOS (n = 49) reported a high prevalence of overall ED (21% vs. 4%) as noted in our study, with diagnoses confirmed by clinical interview (19). Another study (n = 103) reported a 12.6% prevalence of BED among women with PCOS compared with 1.7% in controls (7). We found a significant correlation between anxiety and depressive scores and EDE-Q scores. A recent Swedish registry study of 24,385 subjects

## TABLE 2

**Survey results for women with polycystic ovary syndrome and control participants.**

| Variable | PCOS, n = 148 | Controls, n = 106 | *P* value |
|---|---|---|---|
| Prevalence of abnormal EDE-Q score (no. ≥ 4) | | | |
| Global Scale | 18 (12.16) | 3 (2.83) | .010 |
| Restraint Subscale | 13 (8.78) | 4 (3.77) | .133 |
| Shape Concern Subscale | 61 (41.22) | 14 (13.33) | <.001 |
| Weight Concern Subscale | 47 (31.76) | 10 (9.52) | <.001 |
| Eating Concern Subscale | 10 (6.76) | 2 (1.90) | .130 |
| HADS score, mean ± SD | | | |
| Anxiety | 9.41 ± 5.08 | 6.72 ± 3.87 | <.001 |
| Depression | 4.84 ± 4.22 | 3.09 ± 3.21 | <.001 |
| Prevalence of abnormal HADS score (no. ≥ 11) | | | |
| Anxiety | 61 (41.22) | 18 (16.98) | <.001 |
| Depression | 18 (12.16) | 4 (3.77) | .023 |
| NEQ score, mean ± SD | 16.67 ± 6.18 | 14.88 ± 5.43 | .017 |
| Prevalence of abnormal NEQ score (no. ≥ 25) | 19 (12.83) | 7 (6.60) | .204 |
| DSM-5 diagnoses[a] | | | |
| All ED diagnoses | 42 (28.38) | 20 (18.87) | .079 |
| AN | 0 (0) | 0 (0) | 1.000 |
| BN | 9 (6.08) | 6 (5.66) | 1.000 |
| BED | 26 (17.57) | 11 (10.38) | .148 |
| NES | 19 (12.93) | 13 (12.38) | 1.000 |

*Note:* Date presented as n (%), unless stated otherwise.
[a] Diagnoses were based on symptom presence in the past 4 weeks as reported in the EDE-Q and NEQ responses.

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## TABLE 3

**Results of Health-Related Quality of Life Questionnaire scores and correlations with Eating Disorder Examination-Questionnaire global score.**

| Variable | PCOSQ score, mean ± SD | Correlation coefficient with EDE-Q global score | Correlation *P* value |
|---|---|---|---|
| Total PCOSQ Score | 19.98 ± 6.33 | −0.573 | <.001 |
| Emotions domain | 4.43 ± 1.48 | −0.513 | <.001 |
| Weight domain | 3.27 ± 1.93 | −0.799 | <.001 |
| Body hair domain | 3.99 ± 2.02 | −0.264 | .001 |
| Infertility domain | 4.17 ± 1.88 | −0.238 | .004 |
| Menstrual problems domain | 4.18 ± 1.43 | −0.243 | .003 |

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with PCOS and 243,850 age- and county-matched controls reported an increased risk of BN among women with PCOS, even after controlling for psychiatric comorbidity (AOR, 1.21; 95% CI, 1.03, 1.41) (4). Previous clinic-based studies found that depressed women with PCOS were more likely than nondepressed counterparts to have BED (7), and another study reported a positive association between high anxiety and ED scores (32). Overall, the existing evidence on either disordered eating or comprehensive ED diagnoses in women with PCOS suggests a significantly increased risk.

ED in the PCOS population poses an interesting dilemma because of the conflicting recommendations for women with PCOS to lose weight and for women with disordered eating to seek treatment, which does not always focus on intense weight loss. Studies have shown that excess body weight negatively impacts the clinical manifestations of PCOS, including insulin resistance, hyperandrogenism, and ovulatory dysfunction, and these abnormalities can be improved by successful weight loss (33, 34). However, counseling a woman with PCOS who also has disordered eating regarding weight management may require alternative strategies. Subjects with BED have less weight loss (35), more rapid weight regain (35, 36), and more attrition from weight loss treatments (35) than those without BED, and this is especially true in those with a concurrent affective disorder such as anxiety or depression (35). Furthermore, even among nonobese binge eaters, the presence of BED may be a risk factor for future development of obesity (37, 38). Weight loss may therefore be harder for a woman with both PCOS and disordered eating and require different management strategies.

Unfortunately, not only can weight loss recommendations for PCOS management be more difficult in the setting of a concurrent ED, but they may also interfere with ED treatment. It has long been theorized that dietary restriction increases the risk for onset of BN, and in laboratory studies, forced restraint leads to subsequent disinhibition with food (39). Several prospective studies have confirmed that dieting predicts future bulimic symptomatology (40, 41), and it is clear that when BN is present, referral for treatment should focus on remitting the core BN symptoms, not on weight loss. However, there is mixed evidence regarding the influence of dietary restriction on BED. A recent randomized controlled trial of 125 obese patients with BED compared behavioral weight loss (BWL) treatment, cognitive behavioral therapy (CBT), and a sequential (CBT then BWL) treatment (42). BWL resulted in clinically significant weight loss, while CBT did not, and although some participants in the BWL arm did have remission from binge symptoms, CBT produced significantly greater reductions in binge eating and had a more lasting effect at 12-month follow-up. Sequential treatment did not show an additive effect. There are limited data on the incorporation of CBT with weight loss strategies in women with PCOS. In a randomized trial we found that CBT with lifestyle changes improved weight loss outcomes and quality-of-life parameters in women with PCOS and depressive symptoms when compared with lifestyle management alone (43). Additionally, a small pilot study of 12 adolescents with both depression and PCOS found that CBT decreased both weight and depressive symptoms (44). However, the subjects were not screened for ED in either of these studies. Given the high prevalence of ED in women with PCOS, identification of these disorders before initiating a lifestyle modification program seems critical, as excessive focus on weight loss interventions may prove detrimental in women with ED. A more nuanced and sensitive approach may be accomplished by focusing on noncaloric changes in eating behaviors (e.g., eating regularly, grazing less), specific food choices, and physical activity in moderation for the sake of health, as opposed to overemphasizing one's weight as the primary focus. ED treatment ideally involves a large multidisciplinary team including nutritionists, mental health clinicians, dieticians, and general physicians (45), and knowledge of PCOS diagnosis will be crucial in management of these patients.

Our study has many strengths and addresses several gaps in the current literature. First, we prospectively screened women using gold standard screening tools for ED (23) and NES (24) and applied the core DSM-5 criteria to make diagnoses of specific ED. Next we used the widely accepted Rotterdam criteria to accurately diagnose PCOS; however, we were unable to determine the prevalence of ED in nonhyperandrogenic PCOS phenotypes as this group represented less than 10% of our study cohort. We also screened all subjects for anxiety and depression, as this allowed us to examine the effects of concomitant anxiety and depressive symptoms on the risk of disordered eating. Our study also has some limitations. Our patients with PCOS were recruited from a tertiary care referral PCOS center so our findings may not be generalizable to a community-based population. Our groups were also racially distinct, and although there are limited data on racial differences in EDs (46), some evidence suggests that persons of various racial groups may consider disordered eating attitudes and behaviors differently (47). Although we did not find any differences between races in the prevalence of disordered eating or of specific ED, it is possible that as our study size is small to detect these differences. Because of the cross-sectional design of our study, it was difficult to assess the possible mediating role or causality of depression and anxiety in increasing ED, although existing literature (17) suggests that these psychiatric comorbidities may be on the causal pathway for ED in the general population (48, 49). Given that confounding factors in our population may have affected our outcomes, replication of our study in other populations including community cohorts is needed.

High scores for disordered eating in our study were associated with worsened quality-of-life scores in all PCOSQ domains, suggesting that this psychological comorbidity negatively affects many aspects of quality of life. For the PCOS provider, this further highlights the irrefutable significance of ED in this patient population. Guidelines for primary care physicians recommend screening for ED among high-risk populations, including those with psychiatric disorders such as depression and anxiety, during routine visits (50). Currently the Australian PCOS guidelines recommend screening all women with PCOS for anxiety and depression and suggest screening for disordered eating (51). Recommended screening questions include queries on how the patient

feels about her body and eating, whether she participates in any disordered behaviors, and recent fluctuations in weight. Further screening with a validated screening tool or referral to a mental health professional should follow any concerning responses. Although our study showed significant associations specifically with obesity, anxiety, and depressive symptoms, the high overall prevalence of ED suggests the need to screen all women with PCOS for disordered eating.

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