

# Quality of life and psychological well being in polycystic ovary syndrome

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**BACKGROUND:** Polycystic ovary syndrome (PCOS) is associated with poor quality of life (QoL) and high levels of depression. Existing research is confounded by small sample sizes and inconsistent use of control groups. **METHODS:** Depression and QoL were assessed in women with PCOS and healthy controls ( $n = 1359$ ). The polycystic ovary syndrome health-related QoL questionnaire (PCOSQ) was modified to include an acne subscale. **RESULTS:** Seventy-one percentage of women with PCOS who were taking anti-androgen (AA) medication and 67% not taking AA medication were classified as depressed. Women with PCOS had lower QoL on all seven factors of the modified PCOSQ (emotional disturbance, weight, infertility, acne, menstrual symptoms, menstrual predictability and hirsutism). Weight was the largest contributor to poor QoL for women taking and not taking AA medication. Women taking AA medication, independent of diagnosis, generally had better QoL than women not taking them. **CONCLUSIONS:** This large study refines our understanding of depression and QoL in PCOS and demonstrates the need to regularly review the psychological health of women with PCOS.

*Keywords:* depression; quality of life; polycystic ovary syndrome; acne; infertility

## Introduction

Polycystic ovary syndrome (PCOS) affects ~20% of women of reproductive age in Western society (Balen and Michelmore, 2002; Michelmore *et al.*, 1999) and is, therefore, the most common endocrine disorder in such women (Balen *et al.*, 2006a). At least 90% of women attending fertility clinics with failure to ovulate have PCOS (Balen *et al.*, 2006b). PCOS is associated with reduced quality of life (QoL) (Elsenbruch *et al.*, 2003). Many of the symptoms are painful, uncomfortable, unpredictable and are associated with characteristics culturally defined as unfeminine and undesirable (for instance, hirsutism, obesity, acne and infertility). In addition, the disorder is associated with biochemical disturbances which in themselves can lead to mood disturbances (Tsilchorozidou *et al.*, 2004).

Thematic analysis of interviews with women with PCOS have revealed 'freakishness' as a predominant theme (Willmott, 2000; Kitzinger and Willmott, 2002). This reflects a perceived inability to conform to 'normal' feminine parameters. Reduced QoL in PCOS is associated with sexual dissatisfaction, life dissatisfaction, depression, anxiety, aggression, bodily pain, infertility, weight difficulties, menstrual irregularity and poorer interpersonal functioning (Kitzinger and Willmott, 2002; Trent *et al.*, 2002, 2003, 2005; Elsenbruch

*et al.*, 2003). Hirsutism, menstrual irregularity and infertility have been shown to be the most distressing symptoms in adults with PCOS (Kitzinger and Willmott, 2002), whereas weight difficulties have been identified as the most distressing symptom in adolescents and young women with PCOS (Trent *et al.*, 2002, 2003, 2005). It has been proposed that women with PCOS might be at an increased risk of eating disorders given the propensity for obesity in PCOS. Michelmore *et al.* (2001) failed to find evidence of an association between the two disorders whereas other researchers have (McSherry, 1990; Jahanfar *et al.*, 1995; Raphael *et al.*, 1995).

The prevalence of depression in PCOS is high (Rasgon *et al.*, 2003; Trent *et al.*, 2002, 2003, 2005; Weiner *et al.*, 2004; Hahn *et al.*, 2005). This is likely to be due to high levels of both state (acute) and trait (chronic) depression (Weiner *et al.*, 2004). There is confusion regarding which features of the disorder are the largest contributors to depression. Rasgon *et al.* (2003) found that higher levels of insulin resistance and higher body mass indices (BMIs) were associated with depression in women with PCOS. Hahn *et al.* (2005) found that obesity and hirsutism but not acne, infertility or testosterone levels were associated with reduced QoL. They also found that although insulin resistance initially correlated with QoL, when BMI was used as a covariate, this became non-significant

because BMI and insulin resistance are correlated. Weiner *et al.* (2004) demonstrated a curvilinear relationship between testosterone levels and depression in women with and without PCOS. The most severe depression was associated with testosterone levels just outside the normal female range; testosterone levels higher or lower than this were associated with lower levels of depression. This may explain the discrepant findings between Hahn *et al.* (2005) and Rasgon *et al.* (2003). Rasgon *et al.* (2003) also demonstrated that women with PCOS taking oral contraceptives were significantly less depressed than those not taking oral contraceptives.

The polycystic ovary syndrome health-related QoL questionnaire (PCOSQ) (Cronin *et al.*, 1998) is the only specific measure for assessing health-related QoL in PCOS (Jones *et al.*, 2002). It comprises 26 items requiring responses rated on a seven-point Likert scale. Cronin *et al.* (1998) and Guyatt *et al.* (2004) found it to have five factors: emotional disturbances, hirsutism, weight difficulties, infertility and menstrual difficulties, whereas Jones *et al.* (2004) found that the menstrual factor could be divided into menstrual symptoms and menstrual predictability. It has good reliability (Guyatt *et al.*, 2004; Jones *et al.*, 2004; McCook *et al.*, 2005), but its validity is weakened by the lack of an acne subscale (Jones *et al.*, 2004). It has been found to be sensitive to changes in PCOS symptomatology over time in a treatment trial (Guyatt *et al.*, 2004). In a study of 128 women with PCOS with a mean group age of 30.4 years, the area of greatest concern was found to be weight concerns followed by, in descending order, menstrual difficulties, infertility, emotional disturbance and hirsutism (McCook *et al.*, 2005). To date, the PCOSQ has only been used in four published studies, none of which included an acne subscale (Guyatt *et al.*, 2004; Jones *et al.*, 2004; Schmid *et al.*, 2004; McCook *et al.*, 2005).

Overall, despite the paucity of research into QoL in PCOS, it is clear that PCOS does have a significant impact on QoL. However, factors that contribute to this are unclear. There is some indication that obesity and testosterone may be important. The existing research is confounded by poor sample sizes, failure to include control groups, failure to adequately control for group differences that may affect QoL [especially anti-androgen (AA) medication] and failure to include an acne subscale in the PCOSQ. The current research assesses QoL in a large sample of women with and without PCOS stratified according to use of AA medication. The aims are to: (i) provide an estimate of the prevalence of depression in a large community sample of women with PCOS, (ii) determine whether the factor structure of the PCOSQ can be reproduced in a large sample and whether items relating to acne form an additional factor and (iii) determine the QoL of women with PCOS compared with controls, taking into account depression and the use of AA medication.

## Materials and Methods

Ethical approval was obtained from Harrogate Local NHS Research Ethics Committee, locality issues were approved by Leeds (West) Local NHS Research Ethics Committee and management approval was granted by Leeds Teaching Hospitals NHS Trust Research and

Development Department. The research presented here is part of a larger study also assessing neuropsychological functioning in PCOS (Barnard *et al.*, under review). All data were collected via an internet website.

## Participants

Four groups of women were recruited: 192–224 women with PCOS not taking AAs, 177–200 women with PCOS taking AAs, 504–548 healthy women not taking AAs and 356–387 healthy women taking AAs. Ranges are provided because some women failed to complete all items within the modified PCOSQ but did complete the Zung depression scale. The primary recruitment strategy was via e-mail and the internet. The study webpage was registered with a number of internet search engines and e-mails were sent to numerous webgroups requesting participants. Recruitment of the PCOS group was supplemented by contacting 27 national and international support groups and charities, 26 of whom agreed to advertise the research to their members. In particular, the leading UK PCOS charity, 'Verity', placed an advert in their 'In Touch' magazine and on their website. Recruitment was complemented with poster advertisements and with a snowball technique, whereby each woman recruited was asked to recruit a friend. The study website was accessed 1871 times.

Owing to the nature of the research, diagnosis was self-reported. Women were diagnosed by different physicians who may have applied slightly different criteria. The Rotterdam diagnostic criteria are likely to categorize more women with PCOS than earlier criteria (The Rotterdam ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group, 2004). Thus, a respondent who had been told by a medical practitioner that they have PCOS according to the Rotterdam or earlier criteria was indeed likely to have had PCOS. The study required women to confirm that their diagnosis of PCOS had been medically verified, otherwise they were excluded. Women were also excluded if they were pregnant, peri- or post-menopausal, had no ovaries, were unsure whether they had ovaries or were taking hormone replacement therapy. Groups were stratified according to use of AA medication. A variety of medications fell within the AA category: oral contraceptives, contraceptive implants, contraceptive injections, metformin and agnus castus.

## Measures

The PCOSQ was modified for the current research to include an acne subscale. Acne items were presented according to the format of the other items in the scale. Acne items were:

- (i) To what extent was acne a problem for you in the last 2 weeks?
- (ii) How much time during the last 2 weeks did you feel unattractive because of acne?
- (iii) How much time during the last 2 weeks did you feel depressed as a result of acne?
- (iv) In relation to your last menstruation, how much was acne a problem for you?

Responses are scored on a seven-point Likert scale with low scores reflecting worse QoL. The Zung self-rating depression scale was used to assess depressive symptomatology (Zung, 1965). This is a widely used self-report scale, often used in clinical and research settings (Martelli and MacMillan, 1989; Gregory, 1994; Dugan *et al.*, 1998; Kaneda, 1999; Endler *et al.*, 2000). It contains 20 items which participants are required to rate on a four-point Likert scale. Index scores below 50 reflect no depression, 50–59 reflect mild depression, 60–69 reflect marked to moderate depression and scores of 70 or greater reflect severe to extreme depression.

A study-specific questionnaire was used to collect data pertaining to current medical diagnoses, medication use, BMI, menstrual frequency and regularity.

### Statistical analyses

All data were analysed using SPSS version 14.0 (SPSS Inc., Chicago, IL, USA). Group differences were analysed with univariate ANOVA, MANCOVA and  $\chi^2$  tests. MANCOVA had two between-subject factors (diagnosis and depression) and one covariate (age). Diagnosis had four levels (PCOS no AA, PCOS AA, control no AA, control AA) and depression had two levels (high, low). In accordance with an approach outlined by D'Alonzo (2004), depression was used as a factor rather than a covariate because its use as a covariate would have violated the homogeneity of regression slopes assumption (Stevens, 2002). The depression factor was created by recoding depression scores as high or low categorical variables according to where they fell in relation to the combined mean of the groups. The dependent variables were total score for each factor of the modified PCOSQ. Gabriel's *post hoc* test was used to explore significant main effects. *Post hoc* analyses involved six comparisons (i) PCOS no AA and PCOS AA, (ii) PCOS no AA and control no AA, (iii) PCOS no AA and control AA, (iv) PCOS AA and control no AA, (v) PCOS AA and control AA and (vi) control no AA and control AA. Principal component analysis with varimax rotation and Cronbach's  $\alpha$  were used to determine the factor structure and split-half reliability, respectively, of the modified PCOSQ. Separate correlations were calculated according to AA use for the PCOS groups. Significant differences between the AA and no AA groups in terms of strength of correlation were explored using Fisher's Z-transformation (Ferguson, 1981).

## Results

### Sample characteristics

Demographic data concerning age, BMI, number of comorbid medical conditions, number of prescribed medications and number of menses in the preceding 12 months are summarized in Table 1.

There was a significant main effect of age ( $F_{3,1358} = 54.889$ ,  $P < 0.001$ ) representing greater age in the two groups not taking AAs (Table 1). *Post hoc* analyses revealed significant differences between all the groups in terms of age (all  $P$ -values  $\leq 0.001$ ) with the exception of (i) the PCOS no AA and control no AA groups and (ii) the PCOS AA and control AA groups.

With the exception of the two PCOS groups, all groups differed in terms of BMI ( $F_{3,4918} = 107.347$ ,  $P < 0.001$ ; all *post hoc*  $P$ -values  $\leq 0.009$ ). The PCOS groups had greater BMIs than the control groups (Table 1). The groups also

differed in terms of the proportion of women classified as obese (BMI  $\geq 30$ ) ( $\chi^2_3 = 249$ ,  $P < 0.001$ ) with substantially more obese women in the PCOS groups. Forty-eight percentage of the PCOS no AA group, 51% of the PCOS AA group, 14% of the control no AA group and 7% of the control AA group were classified as obese.

There were significant differences between the groups in terms of number of comorbid medical conditions in addition to PCOS ( $F_{3,1355} = 65.969$ ,  $P < 0.001$ ), medication use in addition to AAs ( $F_{3,1355} = 77.938$ ,  $P < 0.001$ ) and the number of menses experienced in the preceding 12 months ( $F_{3,1360} = 48.058$ ,  $P < 0.001$ ). *Post hoc* analyses revealed significant differences between all groups (all  $P$ -values  $\leq 0.019$ ) except the control AA and control non-AA groups for comorbid conditions and medication use. With regard to menses, there were significant differences between all groups (all  $P$ -values  $< 0.001$ ) with the exception of the two PCOS groups and the two control groups. The means are given in Table 1.

Severity of depression, according to the Zung depression scale, is shown in Table 2. Table 2 also shows the proportions of women who self-reported a diagnosis of depression or anxiety.

There was a significant main effect of depression ( $F_{3,1346} = 79.033$ ,  $P < 0.001$ ). Both PCOS groups were significantly more depressed than the control groups (all  $P$ -values  $< 0.001$ ), but there were no significant differences between the two PCOS groups or between the two control groups. There was also a significant association between diagnosis and severity of depression ( $\chi^2_9 = 203$ ,  $P < 0.001$ ) with more cases of mild, moderate and extreme depression in the two PCOS groups (Table 2). Specifically, 67% of the PCOS no AA group, 71% of the PCOS AA group, 37% of the control no AA group and 30% of the control AA group had some level of depression. These figures are substantially higher than those calculated on the basis of the percentage of women who reported having depression when specifically asked about this (Table 2). There was an association between diagnosis and self-reported anxiety ( $\chi^2_3 = 107$ ,  $P < 0.001$ ) with a greater number of cases of anxiety in the PCOS groups.

### Modified PCOSQ

The modified PCOSQ was analysed by means of principal component factor analysis with varimax rotation using the combined data from both PCOS groups ( $n = 409$ ). Although the reliability of factor analysis is dependent on sample size, factor analysis is relatively stable with sample sizes greater

**Table 1:** Sample characteristics stratified by diagnostic group

	PCOS no AA		PCOS AA		Control no AA		Control AA	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (years)	31	6.5	29	5.6	31	7.9	26	5.11
BMI (kg/m <sup>2</sup> )	31	10.23	32	9.4	25	5.12	23	4.30
Number of medical conditions	1.01	1.11	1.19	1.36	0.36	0.66	0.41	0.70
Number of medications	0.16	0.38	0.79	0.78	0.08	0.27	0.07	0.28
Number of menses in 12 months	7.87	4.04	7.93	4.29	10.53	3.36	10.43	3.48

**Table 2:** Percentage of women self-reporting anxiety and depression and levels of depression according to Zung self-report depression scale

	PCOS no AA	PCOS AA	Control no AA	Control AA
Zung score <sup>a</sup>	55 (12.36)	57 (12.29)	46 (11.26)	45 (10.82)
Zung: not depressed	33	29	63	70
Zung: mild depression	27	30	24	20
Zung: moderate depression	29	23	9	7
Zung: extreme depression	10	18	4	3
Depression: Self-report	26	31	11	9
Anxiety: Self-report	28	29	9	6

<sup>a</sup>mean (SD).

than 300 (Tabachnick and Fidell, 2001; Field, 2003). The overall Kaiser–Meyer–Olkin measure of sampling adequacy was 0.906 and all Kaiser–Meyer–Olkin values for the individual items were greater than 0.782, thus exceeding the recommendation of at least 0.6 for reliable factor analysis (Tabachnick and Fidell, 2001). Bartlett’s test of sphericity

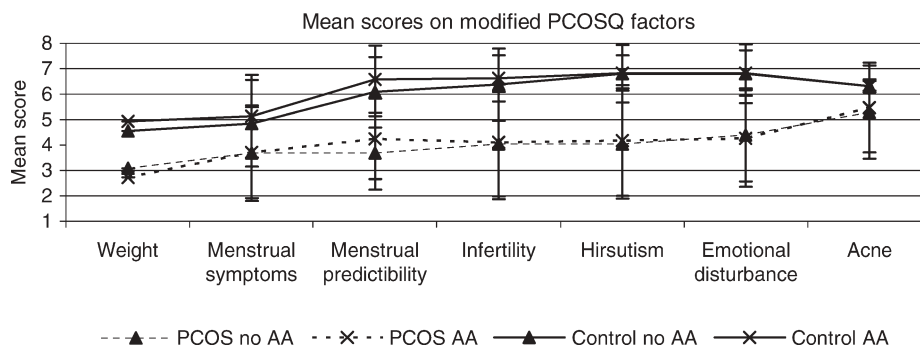
was highly significant ( $P < 0.001$ ), indicating that the variables correlated with one another. Hence, preliminary analyses confirmed the appropriateness of principal components factor analysis with this data.

The modified PCOSQ was found to have seven factors. The percentage variance explained for rotated factor matrices ranged from 6% to 17% per factor with the seven factors explaining 80% of the overall variance. Table 3 depicts the factor loading (after rotation) of each item. The factor loadings of the individual items all exceeded 0.258, recommended as the significance threshold for a sample size of 400 (Stevens, 2002) and were, therefore, all highly significant. Consideration of each factor revealed the following themes (percentages refer to the variance explained by each factor): emotional disturbance 17%, hirsutism 16%, weight difficulties 13%, acne 12%, infertility 9%, menstrual symptoms 7% and menstrual predictability 6%. With the exception of the acne factor, which was developed for this study, these factors correspond to those identified by Jones *et al.* (2004). The items loading on each factor are also very similar to those identified by Jones *et al.* (2004). The discrepancies were: (i) ‘fear of getting cancer’ which loaded on the emotions factor in the current research whereas it previously loaded on the infertility factor (Jones *et al.*, 2004) and (ii) ‘tiring easily’ which loaded on the weight factor in the current research and on the emotions factor in Jones *et al.* (2004) study.

**Table 3:** Factor loadings from modified PCOSQ principal components analysis

Item	Factor						
	1	2	3	4	5	6	7
Depressed as a result of having PCOS	0.844 <sup>a</sup>						
Moody as a result of having PCOS	0.828 <sup>a</sup>						
Low self-esteem as a result of PCOS	0.824 <sup>a</sup>						
Worried about having PCOS	0.824 <sup>a</sup>						
Self-conscious as a result of having PCOS	0.814 <sup>a</sup>						
Lack of control over the situation with PCOS	0.782 <sup>a</sup>						
Afraid of getting cancer	0.422 <sup>b</sup>						
Difficulties staying at your ideal weight		0.923 <sup>a</sup>					
Trouble dealing with weight		0.921 <sup>a</sup>					
Frustration in trying to lose weight		0.914 <sup>a</sup>					
Concerned about being over weight		0.909 <sup>a</sup>					
Felt unsexy because overweight		0.851 <sup>a</sup>					
Tired easily		0.410 <sup>b</sup>					
Growth of visible hair on upper lip			0.875 <sup>a</sup>				
Growth of visible hair on your face			0.873 <sup>a</sup>				
Growth of visible hair on chin			0.858 <sup>a</sup>				
Embarrassment about excessive body hair			0.841 <sup>a</sup>				
Growth of visible body hair			0.794 <sup>a</sup>				
Felt unattractive because of acne				0.940 <sup>b</sup>			
Acne				0.911 <sup>b</sup>			
Acne <sup>c</sup>				0.909 <sup>b</sup>			
Depressed as a result of acne				0.846 <sup>b</sup>			
Concerned about infertility problems					0.915 <sup>a</sup>		
Afraid of not being able to have children					0.899 <sup>a</sup>		
Sad because of infertility problems					0.891 <sup>a</sup>		
Menstrual cramps <sup>c</sup>						0.819 <sup>a</sup>	
Abdominal bloating <sup>c</sup>						0.731 <sup>a</sup>	
Headaches <sup>c</sup>						0.665 <sup>a</sup>	
Irregular menstrual periods <sup>c</sup>							0.892 <sup>a</sup>
Last menstruation period <sup>c</sup>							0.880 <sup>a</sup>

<sup>a</sup>Fall into the same factor structure as Jones *et al.* (2004).<sup>b</sup>Fall into a different factor structure from Jones *et al.* (2004).<sup>c</sup>Refers to the last menstruation.



**Figure 1:** Mean scores for each modified PCOSQ factor

Figure 1 depicts the mean score for each factor (low scores represent worse QoL). MANCOVA revealed significant multivariate effects of diagnosis ( $F_{21,3633} = 44.778$ ,  $P < 0.001$ ), depression ( $F_{7,1209} = 38.134$ ,  $P < 0.001$ ), an interaction between diagnosis and depression ( $F_{21,3633} = 7.885$ ,  $P < 0.001$ ) and age was a significant covariate ( $F_{7,1209} = 11.370$ ,  $P < 0.001$ ). Univariate analyses revealed main effects for all the factors in terms of both diagnosis and depression (all  $P$ -values  $< 0.001$ ) such that PCOS groups had worse QoL than controls and high-depressed groups had worse QoL than low-depressed groups. The significant multivariate covariate, age, was attributable to effects on the menstrual symptoms, menstrual predictability, acne, infertility and hirsutism factors (all  $P$ -values  $< 0.001$ ). The multivariate interaction of depression and diagnosis resulted from significant univariate interactions on the infertility ( $P < 0.001$ ), emotional disturbance ( $P < 0.001$ ) and hirsutism factors (all  $P$ -values = 0.049).

The infertility factor showed a significant univariate interaction between depression and diagnosis ( $F_{3,1215} = 7.111$ ,  $P < 0.001$ ) as well as main effects of diagnosis ( $F_{3,1215} = 183.557$ ,  $P < 0.001$ ) and depression ( $F_{1,1215} = 50.233$ ,  $P < 0.001$ ). Both PCOS groups had significantly lower QoL than controls on this factor. Within the controls, there was no effect of depression. However, PCOS high-depressed women had significantly lower QoL than PCOS low-depressed women, irrespective of AA use. The same pattern emerged for the emotional disturbance factor. Hirsutism showed significant main effects of depression ( $F_{1,1215} = 29.361$ ,  $P < 0.001$ ) and diagnosis ( $F_{3,1215} = 179.558$ ,  $P < 0.001$ ) and a significant interaction ( $F_{3,1215} = 2.623$ ,  $P = 0.049$ ). PCOS groups had significantly worse QoL on this factor than controls, irrespective of AA use. Although PCOS no AA women did not differ according to level of depression in hirsute-related QoL, PCOS AA high-depressed women had significantly lower QoL than PCOS AA low-depressed women.

Mean factor scores (Fig. 1) show that weight management, and then menstrual symptoms, was the greatest areas of concern for all groups. There is an interesting distinction of the menstrual predictability factor between groups taking and not taking AA medication, with the two no AA groups classifying it as of greater concern than the AA groups. This is likely to reflect a positive effect of AA medication on regularizing menses. Infertility was the third most troubling symptom

for the PCOS AA group and the fourth most troubling symptom for the PCOS no AA group whereas it was the fifth most troubling symptom for the two control groups. Emotional disturbance and acne were the areas of least concern for the two PCOS groups whereas hirsutism and emotional disturbance were the areas of least concern for the two control groups.

Modified PCOSQ total factor scores were correlated with each other and with age, BMI and Zung scores separately for those women with PCOS taking AAs and not taking AAs (Table 4). The PCOS AA group demonstrated significant positive correlations between all of the modified PCOSQ factors. The PCOS no AA group demonstrated significant positive correlations between all of the modified PCOSQ factors with the exception of acne and hirsutism, menstrual symptoms and hirsutism, infertility and hirsutism and infertility and weight. Depression was significantly negatively correlated with all modified PCOSQ factors (i.e. higher levels of depression correlated with lower QoL) in both groups with the exception of no AA hirsutism and no AA BMI factors. BMI was significantly negatively correlated with weight concerns, emotional disturbance and menstrual predictability for both groups (i.e. higher BMI associated with lower QoL). It was also negatively correlated with acne, infertility, hirsutism, menstrual symptoms, depression and age for the AA group. Age was positively correlated with infertility for both groups and with acne, BMI and menstrual predictability in the no AA group and negatively correlated with hirsutism in the AA group. All of these significant age correlations reflect improved QoL with increasing age except the BMI and hirsutism correlations, which reflect increasing BMI with age and increased hirsutism with age, respectively. There were a number of significant differences in the strength of the AA correlations and the no AA correlations, all of which reflected stronger correlations for the AA group. Specifically, the strength of the correlations between BMI and hirsutism ( $Z_r = 2.017$ ,  $P = 0.044$ ), emotional disturbance ( $Z_r = 3.335$ ,  $P < 0.001$ ), menstrual symptoms ( $Z_r = 2.370$ ,  $P = 0.018$ ) and acne ( $Z_r = 2.510$ ,  $P = 0.012$ ) were all significantly stronger for the AA group. As were the correlations between menstrual symptoms and weight ( $Z_r = -2.095$ ,  $P = 0.036$ ), infertility ( $Z_r = -2.030$ ,  $P = 0.042$ ) and emotional disturbance ( $Z_r = -2.166$ ,  $P = 0.030$ ).

The split-half reliability of the modified PCOSQ was assessed using Cronbach's  $\alpha$  on the combined data for all

**Table 4:** Correlations between modified PCOSQ factors, depression, age and BMI

		Weight	Infertility	Hirsutism	Emotional disturbance	Menstrual symptoms	Menstrual predictability	BMI	Depression Total	Age
Acne	No AA	<i>0.14</i>	<b>0.25</b>		<b>0.32</b>	<b>0.31</b>	<b>0.22</b>		<b>-0.31</b>	<b>0.24</b>
	AA	<b>0.22</b>	<b>0.20</b>	<b>0.17</b>	<b>0.29</b>	<b>0.19</b>	<b>0.28</b>	<i>-0.19</i>	<b>-0.27</b>	
Weight	No AA			<b>0.21</b>	<b>0.51</b>	<b>0.28</b>	<b>0.19</b>	<b>-0.47</b>	<b>-0.35</b>	
	AA		<b>0.30</b>	<b>0.25</b>	<b>0.56</b>	<b>0.47</b>	<i>0.15</i>	<b>-0.60</b>	<b>-0.41</b>	
Infertility	No AA				<b>0.43</b>	<i>0.16</i>	<b>0.29</b>		<b>-0.21</b>	<b>0.29</b>
	AA			<b>0.20</b>	<b>0.55</b>	<b>0.36</b>	<b>0.38</b>	<b>-0.25</b>	<b>-0.35</b>	<i>0.16</i>
Hirsutism	No AA				<b>0.38</b>		<i>0.14</i>			
	AA				<b>0.47</b>	<b>0.22</b>	<i>0.17</i>	<b>-0.31</b>	<b>-0.36</b>	<b>-0.25</b>
Emotional disturbance	No AA					<b>0.37</b>	<b>0.41</b>	<i>-0.18</i>	<b>-0.48</b>	
	AA					<b>0.55</b>	<b>0.37</b>	<b>-0.49</b>	<b>-0.58</b>	
Menstrual symptoms	No AA						<b>0.23</b>		<b>-0.39</b>	
	AA						<b>0.41</b>	<b>-0.28</b>	<b>-0.41</b>	
Menstrual predictability	No AA							<i>-0.17</i>	<b>-0.22</b>	<i>0.17</i>
	AA							<i>-0.16</i>	<b>-0.26</b>	
BMI	No AA									
	AA								<b>0.28</b>	<b>0.26</b>

Only those that are significant are included. Bold  $r$  values:  $P \leq 0.01$ ; italicized  $r$  values:  $P \leq 0.05$ .

four diagnostic groups. Cronbach's  $\alpha$  based on the standardized items for the scale as a whole was 0.733 indicating good reliability (Field, 2005). Furthermore, deletion of any items within the scale served to marginally reduce reliability.

## Discussion

This research explored QoL and psychological well being in women with PCOS relative to healthy controls. Both groups were stratified according to AA-use and, where appropriate, depression. The first aim was to provide an estimate of the prevalence of depression in this large sample. The Zung depression scale was employed because internet use of this measure is permitted. Women with PCOS were significantly more depressed than controls with over two-thirds experiencing some level of depression. Where depression was present, it tended to be more severe in PCOS groups than in control groups. There were considerable discrepancies between the number of women classified as depressed according to the Zung depression scale and the number of women who reported that they had a diagnosis of depression. There are a number of potential explanations for this discrepancy. First, the Zung depression scale may have overestimated depression. Unpublished data using the Beck depression inventory (Beck *et al.*, 1996) and the Zung scale in the same face-to-face clinical sample suggest that the Zung scale does not over-classify depression in PCOS as both scales found equivalent levels of depression in this condition (data available from authors). Secondly, some women may have chosen to withhold a diagnosis of depression, although it has been shown that computer-based research enhances candidness (Turner *et al.*, 1998). Thirdly, women with PCOS may not have known that they were depressed. Nonetheless, regardless of which figures are considered (self-report or Zung), there is at least a 2-fold difference in prevalence rates between women with and without PCOS. Consideration of the characteristics of the women with PCOS provides insight into the possible causes of depression. Specifically, women with PCOS were more likely

to suffer from comorbid medical disorders, to take larger quantities of medication, to have higher BMIs and to have difficulties with hirsutism, acne, menstruation and infertility. When these symptoms were present, their manifestation was perceived to be more severe by women with PCOS than by controls.

The second aim was to determine whether the factor structure of the PCOSQ could be reproduced and whether items relating to acne formed an additional factor. This research makes an important contribution to the validation of the PCOSQ because of the incorporation of the acne subscale and its use in a large sample stratified according to depression and AA use. The modified PCOSQ had a very similar factor structure to that found in previous research. The individual items loading on each factor were also very similar to those found in previous research. Overall, seven factors were identified: emotional disturbance, hirsutism, weight concerns, infertility, menstrual symptoms, menstrual predictability and acne. The identification of two menstrual factors is in line with the findings of Jones *et al.* (2004) but not with those of the research team who developed the scale (Cronin *et al.*, 1998; Guyatt *et al.*, 2004). The addition of the acne subscale strengthened the face validity of the scale and accounted for 12% of the variance.

The third aim was to determine the QoL of women with PCOS compared to controls, while taking into account AA medication. The two PCOS groups had significantly worse QoL than control groups on all seven factors of the modified PCOSQ. There were no significant differences between the two PCOS groups. Weight difficulties were the greatest contributory factor to reduced QoL in the PCOS groups. They were also the greatest contributory factor in the control groups; however, weight concerns were more severe in the PCOS groups, thus demonstrating an effect of diagnosis. Previous research with the PCOSQ has also shown weight to be the largest contributor to reduced QoL in PCOS (Guyatt *et al.*, 2004; Jones *et al.*, 2004; McCook *et al.*, 2005); however, previous studies failed to include healthy control groups. Menstrual symptoms were the second biggest

area of concern for all groups. AA users, regardless of PCOS status, generally reported better QoL than non-AA users. This is likely to be due to a combination of positive effects of AAs on QoL and systematic differences between women who do and do not take AAs. For instance, AAs have been shown to directly improve QoL by reducing premenstrual symptomatology in women who do not have PCOS (e.g. Borenstein *et al.*, 2003). Non-AA users in both groups scored worse than AA users in terms of QoL on the infertility subscale. Infertility is likely to be the causal factor affecting QoL in this case since women trying to conceive would not choose to take oral contraceptives.

PCOS is clearly associated with depression and reduced QoL. This has important implications for the treatment and management of PCOS. Treatment of depression, although important in its own right, will have a positive effect on the medical management of PCOS. For example, depression reduces motivation (American Psychiatric Association, 1999) yet good motivation is key to compliance with medication and the dietary management of PCOS (Willmott, 2000). Interventions for depression should be chosen on a case-by-case basis and should be targeted at the main contributors to depression for each woman. For example, effective hair removal in hirsute women has been shown to improve self-esteem and QoL (Keegan *et al.*, 2003) and decrease anxiety and depression (Elsenbruch *et al.*, 2003; Clayton *et al.*, 2005). Similarly, reducing acne via AA treatments will benefit women who are distressed by this symptom. Treatment of depression is likely to have a positive effect on other features of the disorder, including weight management, insulin resistance and endocrine disturbances. These comorbidities should be assessed during depression intervention studies.

The internet provides a fantastic research resource and was a particular asset to the current research as much larger samples were recruited than would have been possible otherwise. Advantages of internet research include acceptability, affordability and anonymity (Turner *et al.*, 1998). In addition, respondents have been shown to be more honest when responding to computer administered surveys than to traditional interviewer-administered methods (Turner *et al.*, 1998). However, internet research is open to selection biases and consequent weaknesses in external validity. In particular, the research is generally only available to those with access to an internet-enabled computer. In addition, there may be systematic differences between women who do and do not choose to participate in internet research. A number of reviews have compared internet samples to samples collected in other ways (e.g. postal and telephone surveys) and found that, on the whole, internet samples tend to be fairly comparable to non-internet samples (Best *et al.*, 2001; Mathy, 2002; Braithwaite *et al.*, 2003; Ross *et al.*, 2005). One exception to this is that internet samples tend to be younger and better educated (Ross *et al.*, 2005).

In conclusion, this research has highlighted the poor health-related QoL and high levels of psychological distress found in a large free-living cohort of women with PCOS. The research has demonstrated that acne forms a unique factor in the modified PCOSQ and contributes to the variance

in health-related QoL in this condition. The discrepancy between self-report levels of depression and those identified according to the Zung depression scale highlights the need to explore this issue further and to establish valid measures for assessing depression in PCOS. In addition, intervention studies, aimed at depression, are urgently needed. Finally, the psychological health of women with PCOS should be reviewed regularly.

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