A Systematic Review and Meta-analysis of Polycystic Ovary Syndrome and Mental Health among Black Asian Minority Ethnic populations

Authors

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Abstract

Background: Polycystic Ovary Syndrome (PCOS) is a chronic and a common gynaecological condition impacting women of reproductive age. Women with PCOS

have hormonal, ovulatory and metabolic dysfunction resulting in multiple symptoms. The correlation between hormonal disbalance and the impact on women's mental health (MH) has been researched for decades. However, the prevalence among different ethnicities has not been fully evaluated.

Methods: A systematic methodology was developed, and a protocol was published in PROSPERO (CRD42020210863) and a systematic review of publications between 1st January 1990- 30th January 2021 was conducted. Multiple electronic databases were explored using keywords and MeSH terms. The finalised dataset was analysed using statistical methods such as random-effect models, subgroup analysis and sensitivity analysis.

Findings: We included 30 studies reporting on 3,944 PCOS women. Majority of studies addressed depression anxiety, and common mental health. Studies had fair to poor methodological quality and includes observational studies and Randomised Clinical Trials (RCTs). Overall, 17% (95% CI: 7% to 29%) of women with PCOS have clinical diagnosis of major or severe depression; 33% (95% CI: 26% to 40%) have elevated depressive symptoms or a clinical diagnosis of depression; 41% (95% CI: 28% to 54%) report anxiety symptoms, and 31% (95% CI: 15% to 51%) have a form a common mental health or are takingpsychiatric medication for anxiety and / or depression. The use of various tools to assess mental health symptoms was among the reasons for the substantial heterogeneity across studies.

Interpretation:

PCOS is associated with an increased risk of mental health disorders including depressive s, anxiety, and other mental health disorders. While BAME populations account for about 20% of most of the samples studied, stratification by ethnicity was rarely attempted which made it difficult to elucidate the MH impact of PCOS on different communities.

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Keywords: Polycystic Ovary Syndrome, PCOS, BAME, Mental Health, Women's Health and Wellbeing

Introduction

Polycystic ovary syndrome (PCOS) is the most common endocrine disorder in women of reproductive age with significant reproductive, metabolic, and psychological implications. An estimated 8-13% of women of reproductive age are

affected,[1-5] with a widely quoted similar prevalence between different ethnicities.[6] The Rotterdam criteria,[5,7] which incorporates a combination of signs and symptoms of androgen excess, ovarian dysfunction and polycystic ovarian morphology on ultrasound is the globally accepted diagnostic criteria for PCOS. The phenotype between different ethnicities, can vary markedly[5,8,9] with PCOS sufferers from Hispanic, East Asian, South Asian and Middle Eastern backgrounds displaying higher prevalence of symptoms associated with hyperandrogenism[8,9] than their White counterparts. The precise aetiology of the syndrome is unclear, although evidence suggests a genetic predisposition, and a role of environmental variables including diet and lifestyle factors.[10,11] The pathophysiology involves a dysfunctional hypothalamic-pituitary-ovarian axis, with inappropriate gonadotropin-releasing hormone (GnRH) pulsatility and increased pituitary secretion of luteinizing hormone (LH).[12] Those affected with PCOS present with a wide spectrum of clinical symptoms and features, which can be reproductive (oligomenorrhoea, hirsutism, subfertility), metabolic[13,14] (insulin resistance, type 2 diabetes, metabolic syndrome), and psychological[15,16] (depression, anxiety and low quality of life).

PCOS, due to its diversity in clinical presentation, remains undiagnosed in up to 70% of women,[3] this may lead to various clinical sequelae that impact and complicate women's long-term health. For example women with PCOS have an increased risk of consequential complications such as type 2 diabetes mellitus, cardiovascular disease, endometrial cancer, pregnancy complications and psychological conditions.[17-20]

One area lacking in PCOS research are the MH correlates of the syndrome. The limited evidence available suggests that women with PCOS have higher rates of

depression, anxiety, binge eating disorders, bipolar disorder and other psychological symptoms,[21-23] most likely due to the androgenic, reproductive, and metabolic disorders or due to the associated symptoms of the disorder.[24,25] Current treatment for PCOS focuses on physical symptom control and reducing complication rates.[26] At a global level, currently, there is limited recognition of mental health (MH) symptoms in women with PCOS.[5] However, background MH sequelae may significantly impact treatment adherence and patient quality of life.[5]

MH disorders account for 14% of global burden of disease.[27] Yet significant disparities persist in providing access to MH services for Black, Asian and Minority Ethnic (BAME) populations.[28] This is further exacerbated by the underreporting of MH symptoms in BAME individuals who are less likely to contact their general practitioner regarding their MH compared to their White British counterparts.[28] This can be explained by a combination of personal and environmental factors, including inability to recognise MH symptoms, cultural identity and stigma, language barrier and poor communication with healthcare professionals.[28] Therefore, the prevalence of MH disturbances in BAME women with PCOS remains unclear. The MH symptom prevalence rates may differ significantly across races and ethnicities for women with PCOS in the form of either symptoms and/or psychiatric disorders. Understanding the multifactorial and heterogenic nature of PCOS presentation in BAME women is crucial to improve clinical and patient reported outcomes.

An assessment of the existing evidence is vital to generate comprehensive knowledge and clinical practice improvements that are suitable for BAME

populations. Therefore, a systematic review was designed and developed within this study.

Methods

A systematic methodology was developed and peer reviewed prior to publication in PROSPERO in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Research question

To assess the prevalence of the disease sequalae between PCOS and mental health symptoms and disorders among BAME populations.

Search Strategy

The search strategy involved multiple databases of EMBASE, PubMed, PsycINFO, Science direct and Web of Science from inception to the 30th of May 2021. The searches were conducted through references initially followed by the review al their abstracts and tracking of citations.

Eligibility criteria

All peer review publications in English were included to this study. Key words and MeSH terms included *depression, polycystic ovary syndrome, PCOS, bipolar, dysthymia, major depressive disorder, anxiety, psychosis, somatic symptoms,*

psychotic disorders, trauma, stress, post traumatic stress (PTSD), obsessive-compulsive spectrum disorders, ethnic minorities, BAME, BME and eating disorders. Studies that included a psychiatric diagnosis or MH symptomatologies based on a clinically structured diagnostic interview and/or clinically accepted screening tools were eligible for this study. Meeting abstracts were excluded if there was no full paper available.

Data extraction and analysis

Predefined clinical variables were used as part of the data extraction of rates of depression, anxiety, stress, schizophrenia, psychosis and PTSD within the search strategy. An evidence synthesis methods protocol was developed and has been shown as supplementary document 1. The data extraction process was completed as per the PRISMA guidelines whilst, the refinement protocol has been shown in the supplementary document 1. The extracted data was reviewed using Endnote and Microsoft Excel by 3 reviewers prior to the statistical analysis. All studies collated were categorised based on MH symptoms versus psychiatric disorders and, where possible synthesised based on prevalence and 95% confidence intervals. Prevalence tables were developed to indicate any subgroup categories including geographical location, race, heterogeneity, age, obesity scores and ethnicity. Systematically included studies that did not meet the meta-analysis criteria due to insufficient statistical data or poor quality were narratively synthesised and analysed based on the disease, family, clinician and patient perspective. The narration would include the reporting of common themes including potential barriers to identify and report any themes or sub-themes that may be present in clinical guidelines.

Outcomes

The primary outcome was to assess the odds ratios and p-values associated with a possible mental health symptomatologies and/or psychiatric disorders among PCOS BAME populations.

Statistical analysis plan

Depression was measured by a range of scales and several tools including the Diagnostic and Statistical Manual of Mental Disorders (DSM)[29]; the Patient Health Questionnaire (PHQ)[30]; the Hospital Anxiety and Depression (HAD)[31]; Beck Depression Inventory (BDI)[32]; Montgomery Åsberg Depression Rating Scale (MADRS-S)[33]; Center for Epidemiologic Studies Depression (CES-D)[34]; Reynolds Adolescent Depression Scale, 2nd Edition(RADS-2)[35]; Quick Inventory Depressive Symptomatology (QIDS)[36]; Self-Reported Questionnaire Scale-20 (SRQ-20)[37]; the Generalized Anxiety Disorder (GAD)[38]; the International Neuropsychiatric Interview (MINI),[39] use of antidepressants or use of anti-anxiety medication; a diagnosis by a MH professional, and self-reported history of depression.

The types of mental illness considered by most studies were anxiety, depression, both anxiety and depression, and generalised mental wellbeing. The prevalence of these was synthesised using a meta-analysis.

For the purpose of this study, depression was defined as a major depression diagnosis or elevated depressive symptoms, as reported within the systematically included studies. The diagnosis of major depressive disorder (MDD) was based on clinical review which included suicidal ideations, or provided a definition of MDD based on thresholds of tools used, for example, BDI ≥ 17, CES-D ≥ 24.[40,41] Elevated depression included clinical depression, antidepressants use, and / or a threshold for mild to moderate depression based on the scale used for assessment, for example BDI ≥ 11, HAD-D ≥ 8, and CES-D ≥ 16. For anxiety, a combinational approach was used where the use of the term anxiety or use of anxiety medications were pooled together, due to overlapping definitions, and lack of clear cuts for severity levels. Generalised mental wellbeing on the other hand was defined, as having both depression and anxiety, use of medication for psychiatric disorders as reported within the studies, self-reported MH symptoms, or reported under the term “common mental health” (CMH) by a study authors based on scales such as SF-36.[42-44]

A Random-effects models were used to calculate overall summary estimates of anxiety, depression, and CMH in PCOS patients.[45] The routine “metaprop” of the software STATA’s (V.16) which provides pooled summary of proportions and 95% confidence intervals based on Newcombe exact binomial estimation was used.[46,47] The routine also estimates the I-squared statistics which describes the percentage of

variation across studies that is due to heterogeneity rather than chance. (Higgins et al. 2003)[48]

All studies systematically included demonstrate a range of study designs including of observational and randomised clinical trials (RCTs). Where comparisons were made between PCOS and non-CPOS groups in a study, only the PCOS groups were included. At situations where PCOS population were stratified by certain criterion, for example body mass Index (BMI) or age, the strata were combined where the sample size was smaller than 30 for each group, and an overall prevalence was calculated. For larger groups, each was treated a separate group. Sensitivity analyses in addition, were used to highlight differences across strata where a criterion proven to have an impact on heterogeneity.

Publication bias was assessed using funnel plots and Egger test, for symmetry and small study effects where the number of studies exceeded the recommended 10.[49,50]

Risk of Bias (Quality assessment)

The Newcastle-Ottawa-Scale (NOS) was used to assess the risk of bias (RoB) for all systematically included studies as demonstrated within the RoB table.

Sensitivity analysis

Sensitivity analysis was used to explore causes of heterogeneity. BMI, and tool of assessment of assessments were used for stratification.

Results

Figure 1 displays the estimated prevalence and 95% confidence intervals (CI) for the mental health conditions classified as: (a) Major depressive disorder, (b) Elevated existing depression, (c) Anxiety and (d) Common mental health.

Overall, major depressive disorder affected 17% of PCOS patients, and vary between 0% to 67%. All studies except two have estimated a prevalence ≥ 10%. The higheset prevalence was reported in a Swedish study, followed by two Middle Eastern (ME) studies, with a prevalnce of 67%, 29%, and 22% for the three studies respectively.[51-53] Substantial heterogenity, I^2 of 93.98% was reported between regions, also considerably high within USA studies, I^2 of 71.33% but the two ME studies were homogeneous, Figure 1 (a).

Depression was summarised from 24 studies, including 3157 women with PCOS. The estimated average was 33% (95% CI: 26% to 40%). Where the estimated prevalance was startified by region, fairly similar estimates on average, were noted across regions, with India being the only exception where the the highest prevalence of 64% (95% CI: 55% to 73%) was reported. Substantial heterogeneity observed within regions and between regions. The overall hetrogenity was 93.24%.

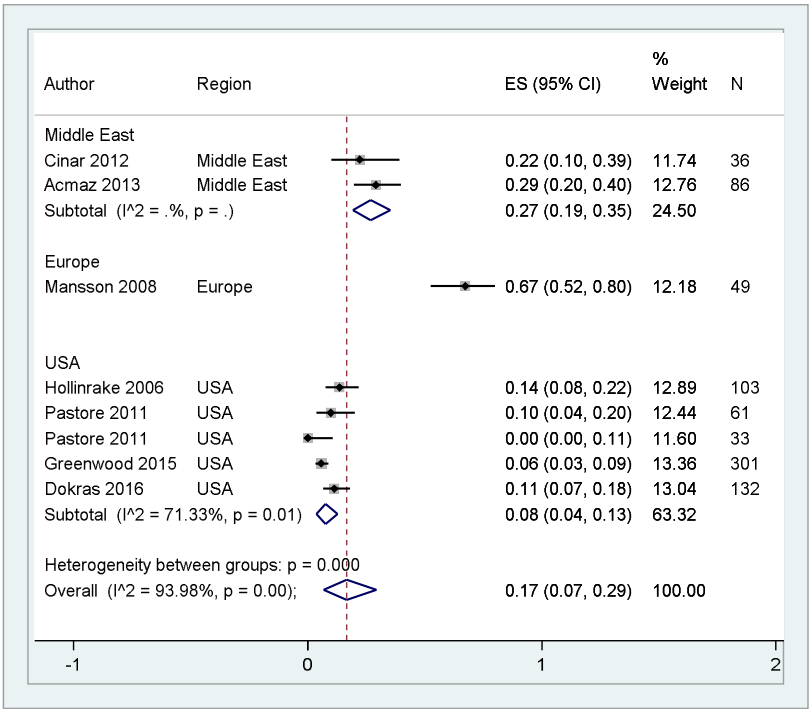
For anxiety, Figure 1 (C), the highest prevalnce of 75% was seen in a USA study, with 78% white and 22% non-white, mean age 33 years (SD: 7.5), followed by a prevalance of 74% in a European study with 80% white, 18% Asian, age 33 years (7.4), while the two studies didn't report BMI.[54,55] Middle East, and Australia/ NZ

follow with an estimated averages of 42% and 38% respectively, and the overall estimated prevalnce was 41% (95% CI: 28% to 54%).

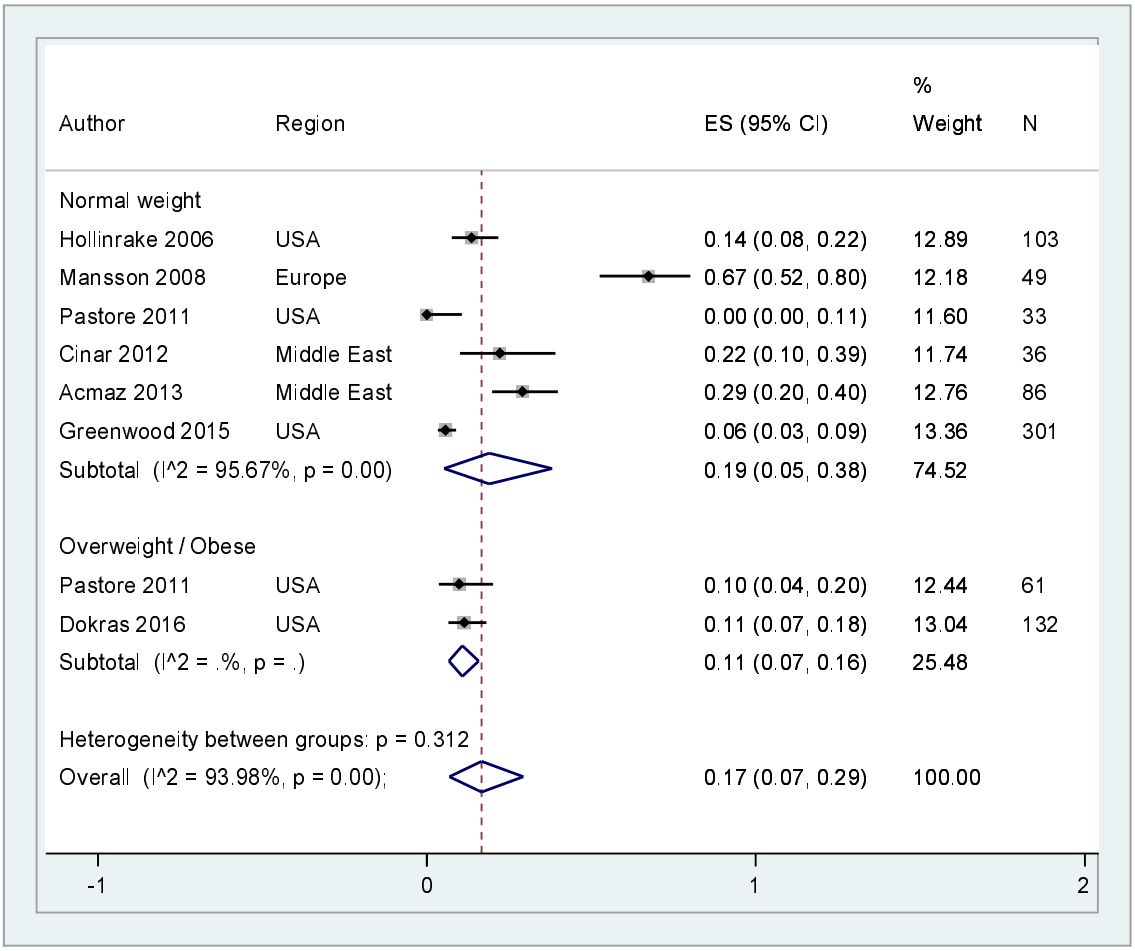
Figure 1 (d), common mental health overall prevalence was 31% (95% CI: 15% to 51%). Substantial heterogeneity shown by USA studies, only one study from ME, and one from Brazil were included. A substantial lack of consistency across studies was reflected by a heterogeneity I^2 of 97.29%.

Figure 1. The Prevalence of Mental Health Indicators in Women with PCOS

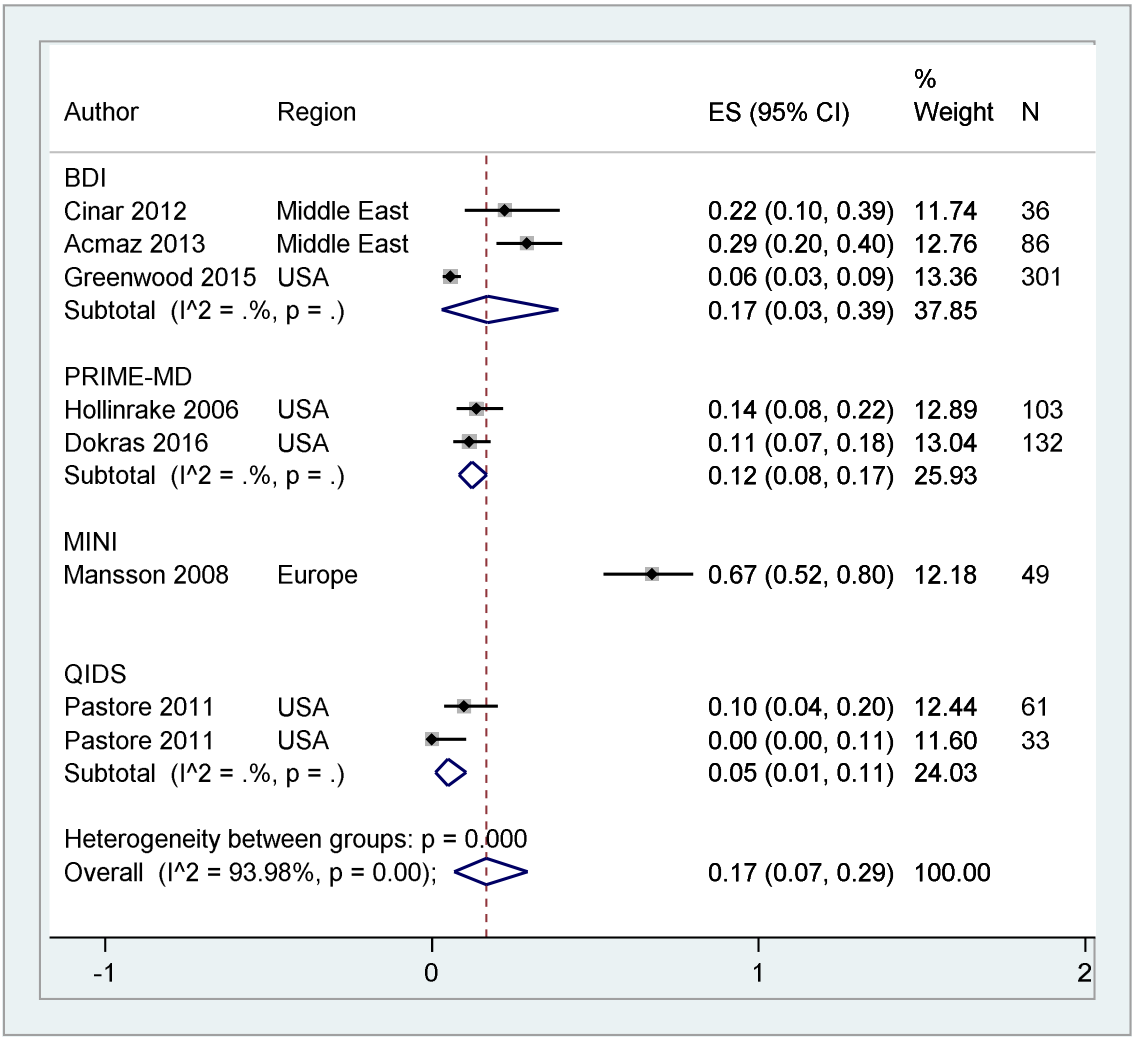
(a) Major depression by region



Supplementary a1: Major depression by BMI (sensitivity)



Supplementary a2: Major depression by assessment tool (sensitivity)



QIDS: Quick Inventory of Depressive Symptomatology-Self Report 16, [1]

MINI: MINI International Neuropsychiatric Interview,[3]

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412 (b) Elevated depression by region

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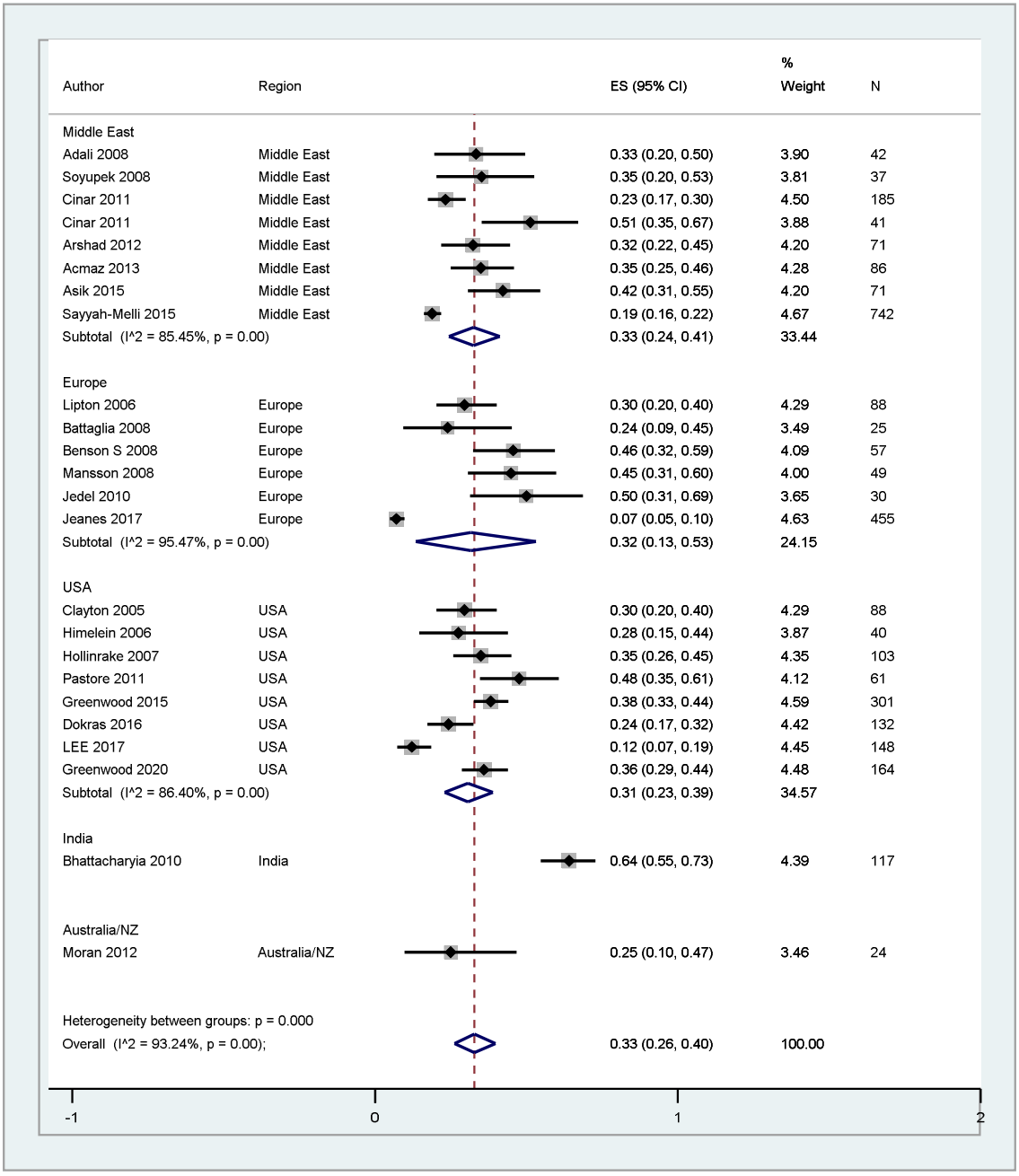

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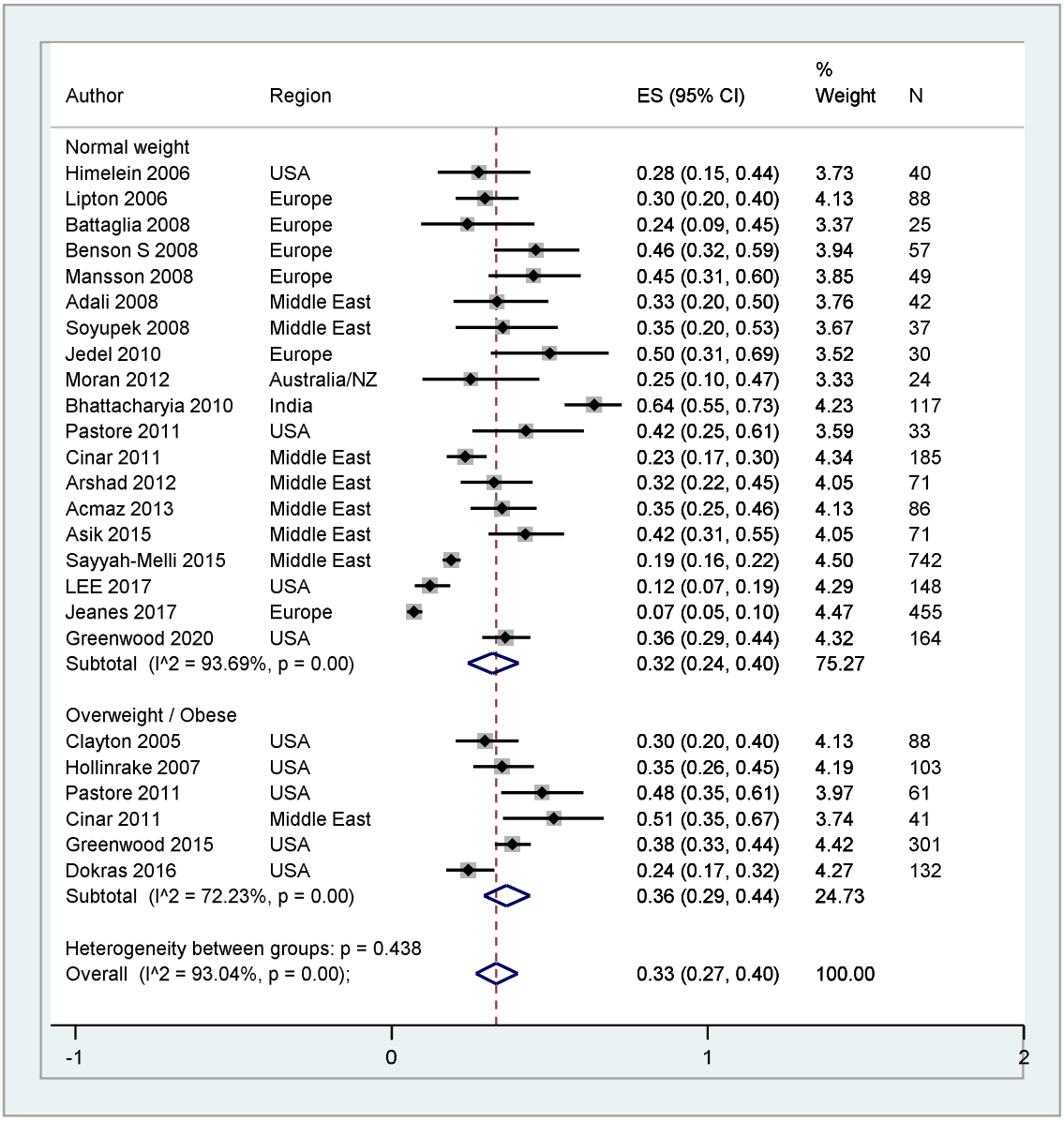
Supplementary b1: elevated depression by BMI (sensitivity)



426 Supplementary b2: elevated depression by assessment tool (sensitivity)

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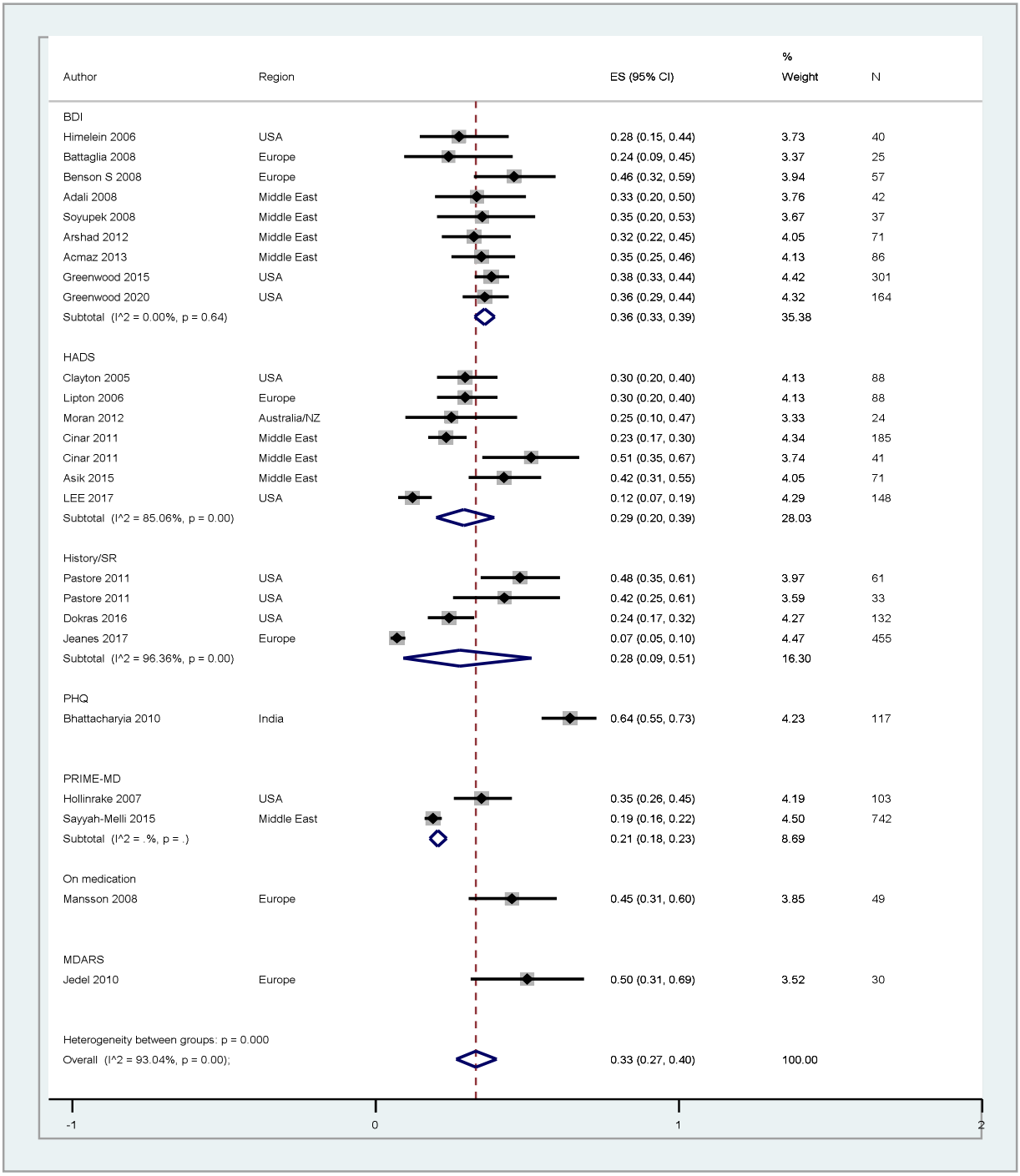

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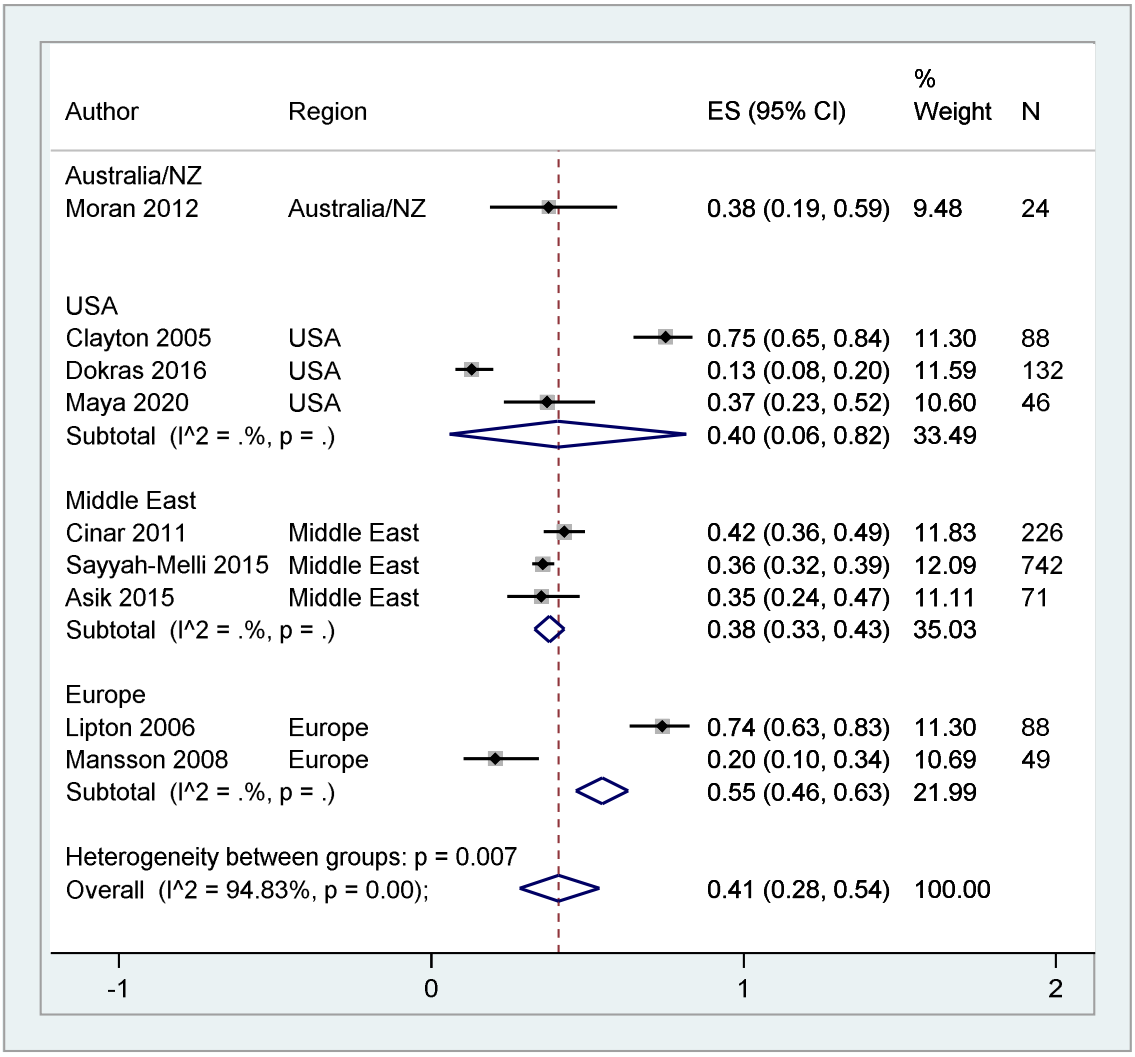
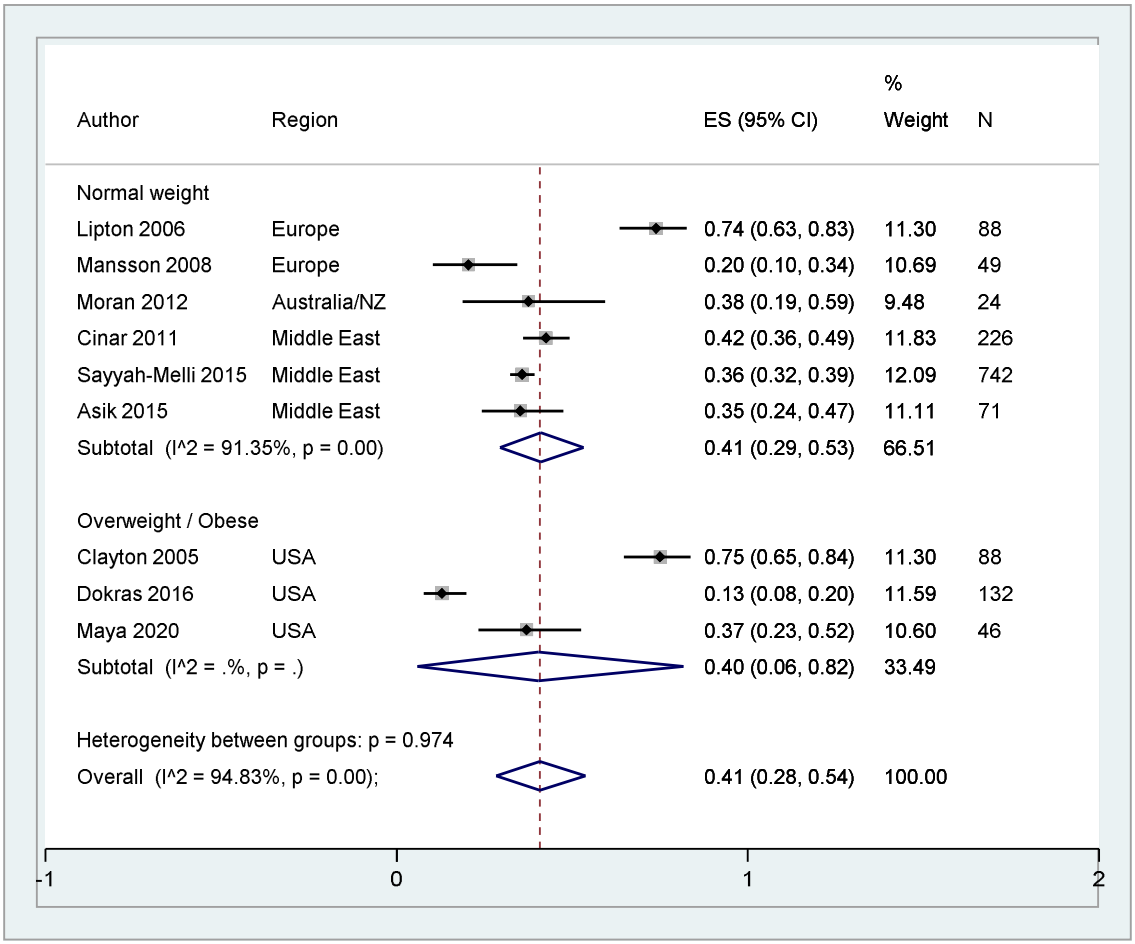
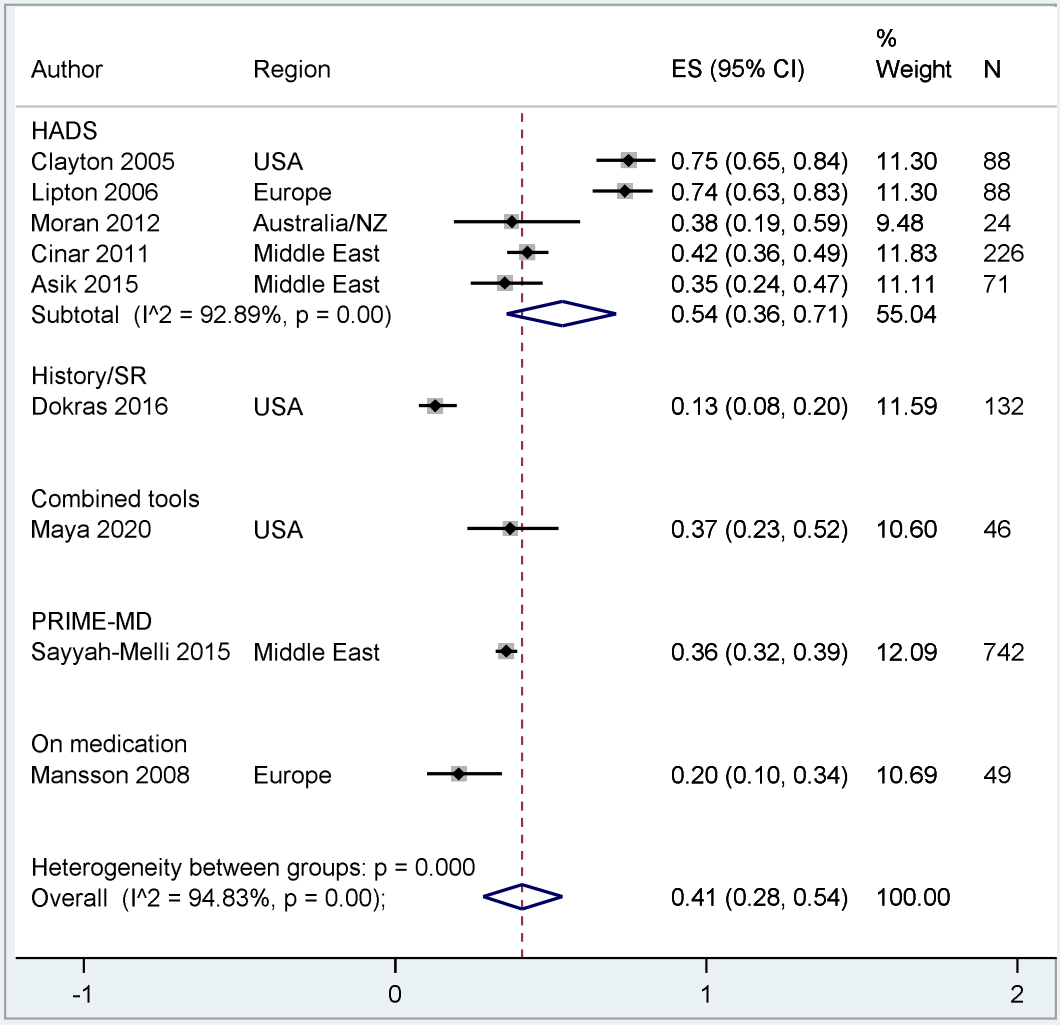
(c) Prevalence of anxiety by region



Supplementary c1: Prevalence of anxiety by BMI (sensitivity)



Supplementary c2: Prevalence of Anxiety by assessment tool (sensitivity)



461 (d) Common mental health by region

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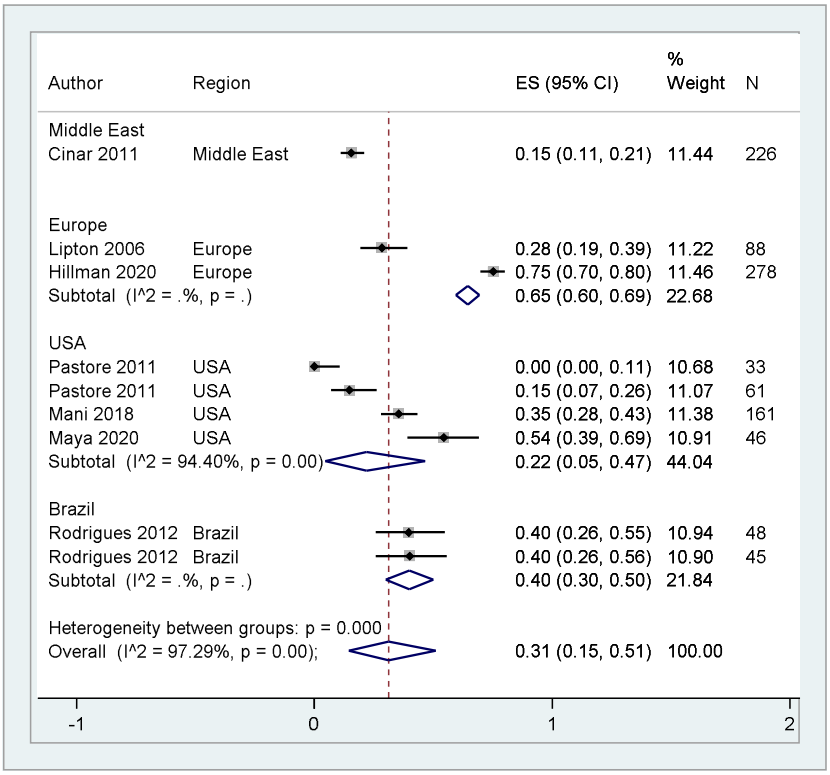

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465 Supplementary d1: Common mental health by BMI (sensitivity)

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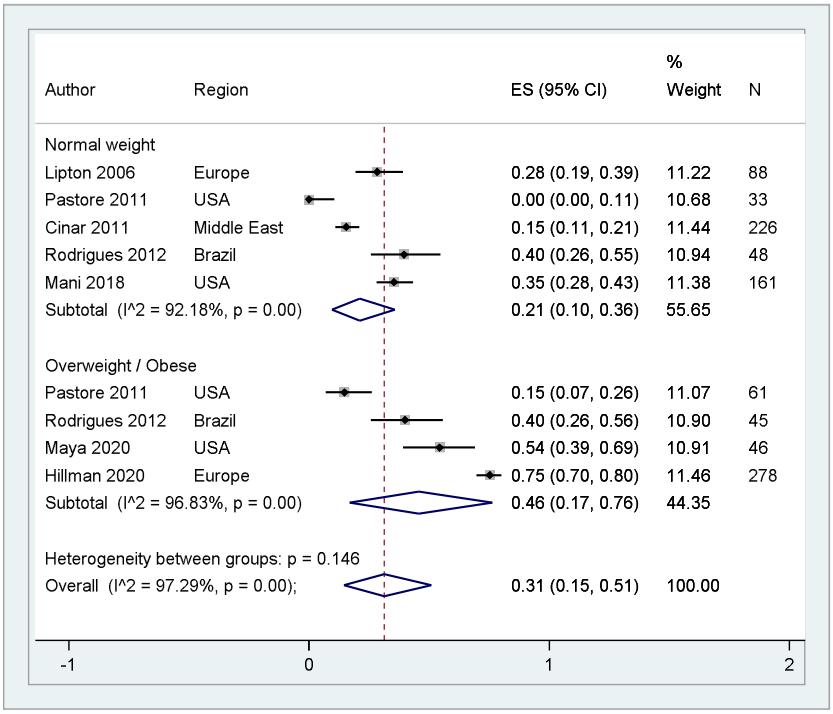
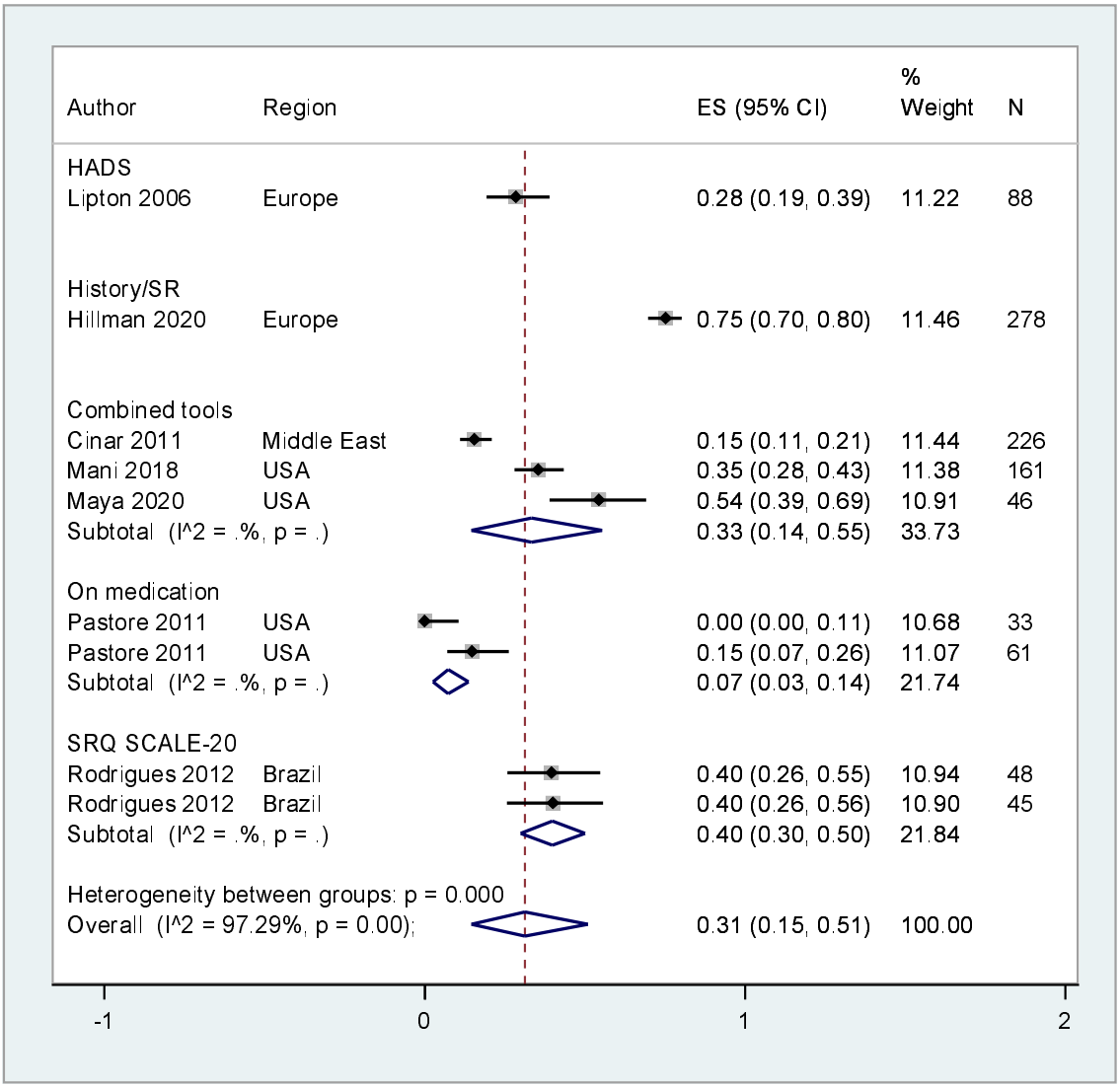


Supplementary d: Common mental health by assessment tool (sensitivity)



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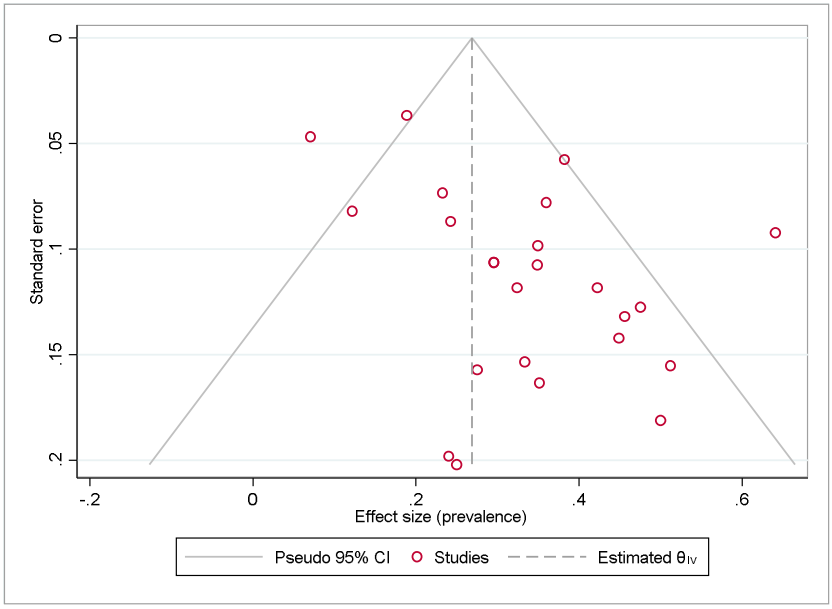
472 SRQ SCALE-20: Self-reported questionnaire scale-20, 2

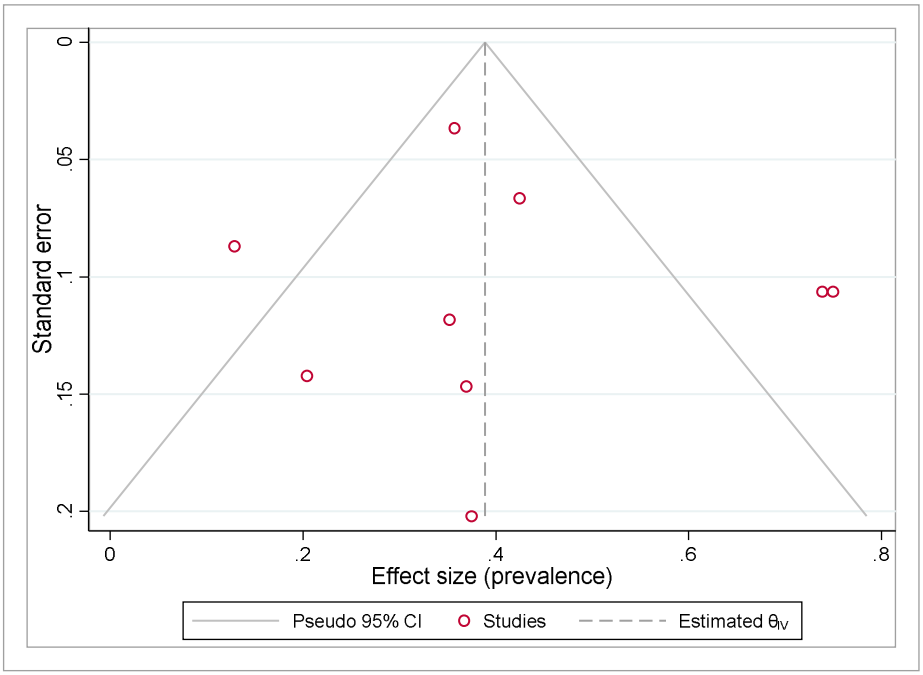
FIGURE 2.

(a) Funnel Plot (Prevalence of elevated depression)



Note. The figure visually supports an asymmetrical shaped funnel plot. The no small study effect null hypothesis (H0: no small-study effect) may therefore be rejected. Using Egger test of H0: no small-study effects, p value = 0.004.

(b) Funnel Plot (Prevalence of anxiety)



(c)

Note. The figure visually supports the symmetry of the effect size distribution. The correlation between effect size and the corresponding standard error was not strong, Egger's test p value = 0.65 supporting no small-study effect (symmetry) hypothesis.

Discussion

The meta-analysis identified 11 studies which reported a 20% prevalence of common MH symptoms of anxiety and depression primarily. However, there was substantial heterogeneity across all studies which is reflected by I^2 of 97.29%. Sources contributing to this heterogeneity may include differences in age range, body mass index (BMI), region, study design (including psychiatric assessments

used), sample size and methodology, population ethnicity and other characteristics. The narrative synthesis identified several key themes including symptoms of depression and anxiety, as well as diagnosed conditions of eating disorders, bipolar disorder, PTSD and psychotic disorders as demonstrated in Table x.

Despite being the most common reproductive endocrine disorder that spans through the entire reproductive life of a woman, PCOS is often associated with a significant negative patient experience, including delayed diagnosis, that could attribute to exacerbation of symptoms.[56-58] Due to the chronic nature of the disease, challenges with persistent treatment adherence is a common issue, but lifestyle changes can be useful to decrease the long-term consequences of the disease. However, once diagnosed, only 19% of women report being aware of all conditions associated with PCOS following discussions with their general practitioner (GP).[59] The typical symptoms of PCOS such as disturbed menstrual cycles, hirsutism, male-pattern baldness, acne, obesity, and infertility[12,60-63] could have a further negative impact on patient self-esteem leading to psychological burden. However, narrative accounts point to considerable emphasis on a few symptoms such as infertility by the clinicians, rather than taking a holistic view on all important features of the condition,[59] such as the long term physical and mental health sequalae, and the effect of diagnosis and treatments on quality of life of the woman. PCOS is also associated with a higher rate of psychiatric disorders.[56] In keeping with this, our meta-analysis reported 31% prevalence of common MH symptoms and diagnoses in women with PCOS. Similarly, Hillman et al. found an overwhelming 74.9% of women diagnosed with PCOS in their study, to have reported that the condition has adversely affected their MH.[59] However, despite the considerable negative effect on

525 psychological wellbeing, as many as 34.9% of women in the study chose not to
526 discuss associated MH symptoms with their GP.[59] An important factor contributing to
527 this may be the ethnic background of the patient. Hillman et al. report that caucasian
528 women in UK diagnosed with PCOS were more likely to discuss their MH with their
529 GP when compared with asian women in UK with PCOS (odds ratio [OR] = 1.66;
530 95% confidence interval [CI] = 1.04 to 2.63).[59] Clinicians and healthcare providers
531 should better evaluate the needs of BAME communities. This would allow
532 personalised care to be delivered in a culturally sensitive way, which may improve
533 overall patient and clinical outcomes.
534 Around 1 in 6 adults in England meet the diagnostic criteria for common MH
535 disorders.[64] BAME ethnic groups are more likely to be detained under the Mental
536 Health Act compared to their White British counterparts, and this can be explained
537 by higher rates of mental illness observed and poorer levels of support.[65] Several
538 studies have explored beliefs about mental illness within BAME communities, and
539 the barriers faced when accessing care. Factors which account for poor presentation
540 rates with mental illness amongst the BAME community include associated stigma,
541 including those with PCOS, poor English language skills, previous negative
542 experiences with healthcare professionals, and being aware of available services.[66]
543 The MH of patients with PCOS may be severely impacted by these issues and
544 reluctance to seek help may further exacerbate pre-existing psychiatric conditions, or
545 limit the recognition of new MH symptoms. Therefore, a thorough assessment of MH
546 illness risk is particularly important in BAME women with PCOS. In agreement, the
547 Royal College of Obstetricians and Gynaecologists (RCOG) recommends the routine
548 screening for psychological symptoms in all women with PCOS.[67] Yet, our meta-
549 analysis depicts that there is limited number of studies exploring psychological

comorbidities in PCOS patients, both in UK and worldwide. Additionally, our meta-analysis was unable to meet most pre-planned outcomes, including the effects of ethnicity and race on MH sequelae in PCOS women, due to the lack of data identified within systematically pooled studies. This was largely due to the non-reporting of patient race and ethnicity in PCOS studies examining patient MH.

The two most identified MH conditions amongst PCOS patients in our systematic review were depression and anxiety. Indeed, several existing studies comment on the high risk of both existing and new diagnoses of depression in women with PCOS.[68,69] Our meta-analysis confirmed these findings, as major depression affected 17% of PCOS patients, and elevated existing depression affected 33%, with a considerably high heterogeneity in both subthemes within and between regions. Existing literature in the field measuring true prevalence of depression in BAME patients with PCOS is contradictory. This meta-analysis could not pool race or ethnicity with the data due to differences in research study designs and clinical practices, as well as the lack of BAME patient representation within studies. Therefore, the true prevalence of elevated existing depression and newly diagnosed major depression amongst BAME PCOS women could not be estimated. However, our narrative synthesis identified certain races/ethnicities to carry higher rates of depression than Caucasian PCOS patients.

Anxiety disorders include generalised anxiety disorder, panic disorder, separation anxiety disorder, social anxiety disorder and specific phobias[70] and may impair daily functioning. Women are twice as likely to develop anxiety disorders than men,[70] with women with PCOS have a significantly higher prevalence of generalised anxiety symptoms than women without PCOS.[71] This study revealed that there are a small

number of published studies commenting on anxiety prevalence in women with PCOS. Of these, we identified 41% prevalence of generalised anxiety disorder among women with PCOS, however, heterogeneity was high at 94.83%. This heterogeneity extended to results from different regions suggests lack of difference between geographical locations in prevalence of anxiety amongst women with PCOS. Similar to our depression subtheme analysis, we were unable to establish the prevalence of anxiety amongst different ethnicities and races in women with PCOS due to lack of robust data.

Eating Disorders (EDs) have high prevalence particularly in young women worldwide.[72] Body image disturbances and self-esteem are central to the development of common EDs and conditions that may affect body image has been found to contribute to the development of EDs.[73] The body dissatisfaction associated with features such as weight gain, hyperandrogenism, hirsutism, acne, and androgenic alopecia often contribute to disturbed body image perception linked with EDs. Existing literature, although informative on the relationship between PCOS and EDs, struggles to report findings on ethnic differences in ED and PCOS. Only two observational studies were identified addressing EDs in BAME PCOS patients,[74,75] and although they report an increased risk of disordered eating habits in PCOS women compared with the control populations, in agreement, one study found Black, Hispanic and Mixed race women with PCOS to have higher EDE-Q scores (a self-rating questionnaire of the range and severity of ED features) compared with White women[75] yet the other reported EDs to be similar in the BAME PCOS population.[75] However, discordant methodology and the use of external cohorts from a different country, makes the available evidence to be substandard to draw firm conclusions

on the specific prevalence of EDs in BAME women with PCOS, indicating the need for further research to understanding ethnic differences in PCOS and associated EDs.

Psychotic disorders, such as schizophrenia have been reported to be significantly more prevalent in patients with PCOS in a national study in Sweden.[76] However, there is a dearth of studies investigating the associations between conditions. Although people from BAME background had been reported to experience a higher prevalence rate of psychosis[77] compared to the Caucasian population in UK, only one cohort study explored the prevalence of psychotic disorders in Taiwanese PCOS patients,[78] and reported no statistical difference in prevalence of schizophrenia between the two populations.[78] This highlights the need for future high quality studies to assess psychotic illnesses relevant to PCOS amongst different ethnicities.

Bipolar disorder (BD) has been reported to be more prevalent in women with PCOS[79] compared to the general population and since it carries a 12-fold increased risk of suicide,[80] it is especially important to examine any causative common mechanistic relations between the two conditions. However, there is a caveat, in that there is a reported high prevalence of menstrual disorders in women receiving treatment for BD.[81] Therefore, accounting for confounding variables such as medication and pre-existing conditions is vital in studies that assess prevalence of MH sequalae, such as BD, in BAME PCOS women. A study from Kashmir Valley[82] reported BD rates of 2.72% compared to 0.00% in control participants while a nationwide cohort study from Taiwan[78] found no significant alteration in prevalence of BD in PCOS women compared to a control population. Further research is thus

required in order to develop understanding of the prevalence in different populations, as associations cannot be drawn with the limited data available.

This systematic review had further revealed the heterogeneity of diagnosing psychiatric disorders. Clinicians have adopted 8 different self-report questionnaires in their methodologies highlighted by this review. This limits our study's generalisability as well as any estimate of prevalence of a given psychiatric disorder.

Overall, although most studies used Rotterdam Criteria in the diagnosis of PCOS,[5] 4 studies adopted the National Institutes of Health Criteria, 1990 to diagnose PCOS, which will bring obvious diagnostic bias.[83-86] Future studies should strive to adapt internationally accepted, standardised criteria for the diagnosis of both PCOS and MH disorder to avoid sampling bias.

Medical practitioners may not be aware of the impact different cultures may have on patient's reporting of both physical and psychiatric symptoms . In general, members of BAME communities are less likely to engage with MH services or seek help before symptoms severely impact their function.[87,88] Simkhada et al. found that members of Nepali and Iranian communities report improved MH care and support by healthcare professionals who were trained on different cultural practices.[89] Furthermore, clinicians in the study stated that a better understanding of different cultures to be beneficial for providing a culturally sensitive service. Therefore, training healthcare professionals in cultural norms within BAME communities is vital to better understand their knowledge and beliefs of MH symptoms, thereby allowing clinicians to provide a holistic, effective treatment approach when working with diverse

populations. Cultural competency training may also increase patient trust in clinicians and lead to early discussions of how PCOS may be affecting patients psychosocially within distinct BAME communities. This will therefore aid in early detection and effective and lasting treatment of MH sequelae of PCOS and personalise patient clinical care.

Limitations

Several limitations affected our systematic review and meta-analysis findings. Whilst studies listed often identified severe emotional distress amongst PCOS women, some of this was self-reported and therefore subjective, without the presence of a clinical diagnosis. This may mask the true prevalence of common MH conditions, such as depression and anxiety, amongst women with PCOS. A further limitation includes the high heterogeneity observed across all subtheme meta-analyses. Several sources of heterogeneity were behind the variations across estimates. These include the range of scales used, the choice of threshold, although many are equivalent but nonetheless, some disagreement remains and contributes to variations. Other factors such as differences in age range, body mass index (BMI), region, study design, sample size and methodology, population ethnicity and other charactersitics, and the established unobserved heterogeneity, all tapping into the differences observed across studies.

The cultural differences in reporting MH symptoms across different regions, potentially further impacted by complex interaction with stigma and accepted norms within BAME communities may have specific effects on different populations. Moreover, the difference in reporting MH symptoms and diagnoses is a further limitation of all studies included in this review. Several diverse assessment tools

were used in the assessment of risk of key psychiatric disorders, including self-reported symptoms, self-reported use of psychiatric medication and clinical diagnosis, thereby introducing heterogeneity in studies included in this review. This may limit the generalisability of the data obtained, may mask the true prevalence of a given psychiatric disorder due to questionnaires' tendency to screen rather than diagnose.

Conclusion

This study demonstrates the lack of ethnic minority representation in research studies conducted among PCOS patients exploring a possible MH sequalae. To determine if there is a bi-directional relationship between PCOS and MH conditions among ethnic minorities, comprehensive research studies should be designed and conducted as part of a global initiative. A key attribute to the changing needs within women's physical and MH is the migratory patterns that changes the regional and global population. The associated nuances influence both clinical practice and the access to the health-care system, and therefore, regular, and careful scrutiny of contemporary evidence is essential to optimise the overall clinical care offered to these patients. As a result, cultural appropriation based training should be made available and accessible to healthcare professionals within primary and secondary care settings.

Data sharing statement

All data used within this study has been publicly available. The authors will consider the sharing the dataset gathered upon request.

Contributors

GD and DKH developed the systematic review protocol and embedded this within the ELEMI project's evidence synthesis phase. GD, VB, DKH, SR, + SA wrote the first draft of the manuscript. This was furthered by PP, AS, WG, NT, YZ, JS and SR. KM, GD, YZ, VB and JS shared database searches, study selection and extraction for analysis. SA and GD conducted the analysis including the design of the statistical analysis plan. GD, YZ, DKH, PP, KE, WG, NT, YZ, JS, KM, VR, AS, PB, HM, AM, WG and KM critically appraised and finalised the manuscript. All authors approved the final version of the manuscript.

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Supplementary Materials

All supplementary materials associated with this article can be found in the attached Appendices.

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