# Anti-müllerian hormone as a diagnostic biomarker for polycystic ovary syndrome and polycystic ovarian morphology: a systematic review and meta-analysis

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**Importance:** As part of the 2023 international evidence-based polycystic ovary syndrome (PCOS) guideline, this meta-analysis investigated the inclusion of Anti-Müllerian hormone (AMH) levels in the diagnostic criteria for PCOS.
**Objective:** To answer the following three questions: 1) Are AMH levels effective in diagnosing PCOS in adult women? 2) Are AMH levels effective in diagnosing PCOS in adolescents? Are AMH levels effective in diagnosing polycystic ovarian morphology (PCOM)?
**Data Sources:** Searches were conducted in six databases until July 31, 2023.
**Study Selection and Synthesis:** Eligible studies were those conducted in humans, published in English, and reporting sensitivity, specificity, and/or area under the curve values. Extracted data included study population, age, body mass index, AMH assay, cut-off value of AMH levels, sensitivity, specificity, and area under the curve values. The risk of bias was assessed using the quality assessment of diagnostic accuracy studies tool. A random effects model was used to test diagnostic accuracy.
**Main Outcomes:** Pooled sensitivity and specificity to use AMH levels for PCOS diagnosis in adults as well as adolescents and for detecting PCOM in adults.
**Results:** Eighty-two studies were included. The adult AMH-PCOS meta-analyses (n = 68) showed a pooled sensitivity and specificity of 0.79 (95% confidence interval [CI], 0.76–0.82; $I^2$ = 86%) and 0.87 (95% CI, 0.84–0.89; $I^2$ = 91%). The adolescent AMH-PCOS meta-analysis (n = 11) showed a pooled sensitivity and specificity of 0.66 (95% CI, 0.58–0.73; $I^2$ = 74%) and 0.78 (95% CI, 0.71–0.83; $I^2$ = 45%). The adult AMH-PCOM meta-analysis (n = 7) showed a pooled sensitivity and specificity of 0.79 (95% CI, 0.72–0.85; $I^2$ = 94%) and 0.87 (95% CI, 0.78–0.93; $I^2$ = 94%).
**Conclusion and relevance:** This study investigated the most profound change in the 2023 international evidence-based PCOS guideline, which now recommends AMH levels for defining PCOM in adults in accordance with the diagnostic algorithm. Antimüllerian hormone levels alone are insufficient for PCOS diagnosis and are nonspecific for PCOM in adolescents. Multiple factors influence AMH levels and cause heterogeneity as well as limitations in this study. Consequently, no international cut-off value could be recommended, emphasizing the need for research on more individualized cut-off values. (Fertil Steril® 2024;122: 727–39. ©2024 by American Society for Reproductive Medicine.)
**El resumen está disponible en Español al final del artículo.**

**Key Words:** PCOS, PCOM, AMH

Received March 6, 2024; revised May 23, 2024; accepted May 28, 2024; published online June 27, 2024.
Supported by the Centre for Research Excellence in Women's Health in Reproductive Life and the Australian National Health and Medical Research Council (NHMRC); supported by partners, including the American Society for Reproductive Medicine, the Endocrine Society, the European Society of Endocrinology, and the European Society of Human Reproduction and Embryology.
Supported in part by National Health and Medical Research Council fellowship (to H.T.), Australia.
Supported in part by National Health and Medical Research Council fellowship (to A.M.), Australia.
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Fertil Steril® Vol. 122, No. 4, October 2024 0015-0282

https://doi.org/10.1016/j.fertnstert.2024.05.163

Polycystic ovary syndrome (PCOS) is a prevalent endocrine disorder that affects women of reproductive age, with a reported occurrence rate of 12% (1–3). Women with PCOS may exhibit various features related to reproduction, endocrinology, metabolism, dermatology, and psychosocial well-being (1, 4–6). Polycystic ovary syndrome is a heterogeneous syndrome, resulting in various phenotypes that are exacerbated by obesity, ethnic differences, and changes in clinical features over time. The diversity makes identifying and managing PCOS challenging, leading to dissatisfaction among patients worldwide (7).

In the 2003 Rotterdam criteria, polycystic ovarian morphology (PCOM) was included as a criterion for the diagnosis of PCOS. In 2018, the Rotterdam criteria evolved into the universally accepted international guideline diagnostic criteria for PCOS. These criteria consist of any two of three key features: oligo- or anovulation, clinical and/or biochemical hyperandrogenism, and/or PCOM on ultrasound in adults, although other relevant disorders are excluded (8). The definition of PCOM, including ovarian volume and/or the number of follicles per ovary (FNPO), using ultrasound examination is challenging. Cut-off values for PCOM were revised in the 2018 international PCOS guideline depending on the ultrasound machine used. In addition the guideline acknowledged the controversy and challenges associated with this diagnostic criterion, particularly in the adolescent population, where ultrasound is no longer recommended for diagnosis (9). The accuracy and reproducibility of FNPO measurements depend on the skills of the ultrasound operator as well as the instrument used. Advancements in equipment have improved sensitivity and FNPO counts, including the ability to detect smaller follicles in the ovary (9). The choice of transabdominal ultrasound over transvaginal ultrasound can also affect accuracy, and some women may find transvaginal ultrasound unacceptable or too invasive. The 2018 and 2023 international PCOS guidelines recommend not using ultrasound to diagnose PCOS among women with a gynecological age <8 years (<8 years after menarche) because of the presence of multiple follicles in the ovaries in this age group and the risk of overdiagnosis (9). On the other hand, as follicle numbers decrease with increasing age, including in those with PCOS, the cut-off values for PCOM may need adjustment accordingly (10). Last but not least, different protocols for the assessment of PCOM are used all over the world, which makes it challenging to compare data from different parts of the world (11).

Given these ultrasound challenges, antimüllerian hormone (AMH) levels have been proposed as an alternative marker for PCOM as well as for diagnosing PCOS. Antimüllerian hormone is a dimeric glycoprotein and predominantly secreted by granulosa cells of the preantral and small antral ovarian follicles (12). AMH inhibits the recruitment of follicles from the primordial follicle pool. It also seems to inhibit aromatase activity, which is responsible for the conversion of androgens into estrogens. Finally, it has an inhibitory effect on follicle-stimulating hormone-dependent follicle growth. Therefore, increased AMH levels can contribute to ovulatory dysfunction because of the accumulation of antral follicles and to hyperandrogenism because of aromatase inhibition, which are both often observed in women with PCOS (13–15). Convincingly, it has been shown that women with PCOS have higher levels of AMH compared with ovulatory women without PCOS (16, 17). In addition, strong correlations have been observed between follicle number on ultrasound and circulating AMH levels in PCOS (16, 18). However, significant heterogeneity exists between studies addressing the role of AMH levels as a diagnostic marker in PCOS, leaving the diagnostic role of this hormone unclear. The aim of this study was to assess the diagnostic accuracy of AMH for PCOS as well as the accuracy for the detection of PCOM. This work was used to update the international evidence-based PCOS guideline (1, 2).

## MATERIALS AND METHODS

This systematic review and meta-analysis is an update of a prior review (19) and was conducted to inform recommendations in the updated 2023 international evidence-based guideline for the assessment and management of PCOS (1). This meta-analysis aimed to answer the following three questions:

- Is AMH effective in diagnosing PCOS in adult women?
- Is AMH effective in diagnosing PCOS in adolescents?
- Is AMH effective in detecting PCOM in adults?

### Search strategy

For the prior review, a search was performed up to January 2017 and these results were integrated into the present review (19). In this update, a systematic search strategy was designed by a biomedical information specialist, and relevant studies published between January 1, 2017, and July 31, 2023 were identified in EMBASE, Medline ALL, Web of Science Core Collection, Cochrane Central Register of Controlled Trials, CINAHL, and PsycINFO. Detailed information on the search strategy is listed as Supplemental Material, available online (Supplemental Appendix, available online).

### Study selection

After identifying and excluding duplicate studies, two investigators (K.H. and Y.L.) independently reviewed all retrieved articles by title and abstract using COVIDENCE (https://www.covidence.org). The inclusion criteria for studies were as follows: AMH level was used as a predictor for PCOS or PCOM (including in case-control studies), and sensitivity, specificity, and/or area under the curve (AUC) values were calculated and reported; published in English; full-text available; and performed in humans. After excluding articles on the basis of title and abstract, the same two investigators (K.H. and Y.L.) independently performed the full-text screening. Other systematic reviews and meta-analyses about this topic were screened also to identify additional studies and were labeled as "identified through other sources" (Supplemental Fig. 1, available online).

## Methodological quality assessment

Two investigators (K.H. and Y.L.) assessed risk of bias using the quality assessment of diagnostic accuracy studies tool (20). The overall risk of bias in each study was classified as high, moderate, or low. Certainty of the evidence for each outcome was determined according to the grading of recommendations assessment, development, and evaluation (GRADE) guidelines approach (21).

## Data extraction

The data were extracted independently by two investigators (K.H. and Y.L.). The extracted data included the first investigators' name, publication year, study design, study population (including diagnostic criteria for PCOS and characteristics of the control population), country, mean age and body mass index (BMI) of the case as well as control groups, statistically significant differences in age and BMI between cases as well as controls, whether the use of oral contraceptives was excluded, the AMH assay used, cut-off value for AMH level, sensitivity, specificity, and AUC values. Serum AMH values were standardized to AMH levels in nanograms per milliliter using the following conversion formula: 1 pmol/L = 0.14 ng/mL.

## Data analysis

Review Managers V.5.4 (Cochrane Collaboration) was used to pool the data for diagnostic accuracy in terms of sensitivity and specificity. Hierarchical random effects models combined the estimates of sensitivity and specificity. The summary point was estimated with the use of a generalized linear mixed model (GLMM) approach with a bivariate model in R (Version 4.2.2), according to the Cochrane Handbook for Systematic Reviews of Diagnostic Test Accuracy (Version 2.0, 2022) (22). The GLMM contained random effects in addition to the usual fixed effects. A GLMM with covariates was used for comparing two groups in the subgroup analyses to investigate possible explanations for heterogeneity. Subgroup and sensitivity analyses were performed to compare the pooled sensitivity and specificity in the following categories: studies with "high risk of bias" and those with "moderate or low risk of bias"; studies where PCOM was excluded in the control group and studies in which PCOM was not excluded; studies stratified by different AMH assays; studies in which age was similar between cases and controls (matched or not statistically significantly different) and those in which age was different between cases and controls; and studies in which BMI was similar between cases and controls (matched or not statistically significantly different) and those in which BMI was different between cases and controls. Deek's funnel plot asymmetry test was used to evaluate the publication bias.

## Role of funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, the writing of the report, or the decision to submit the article for publication.

# RESULTS

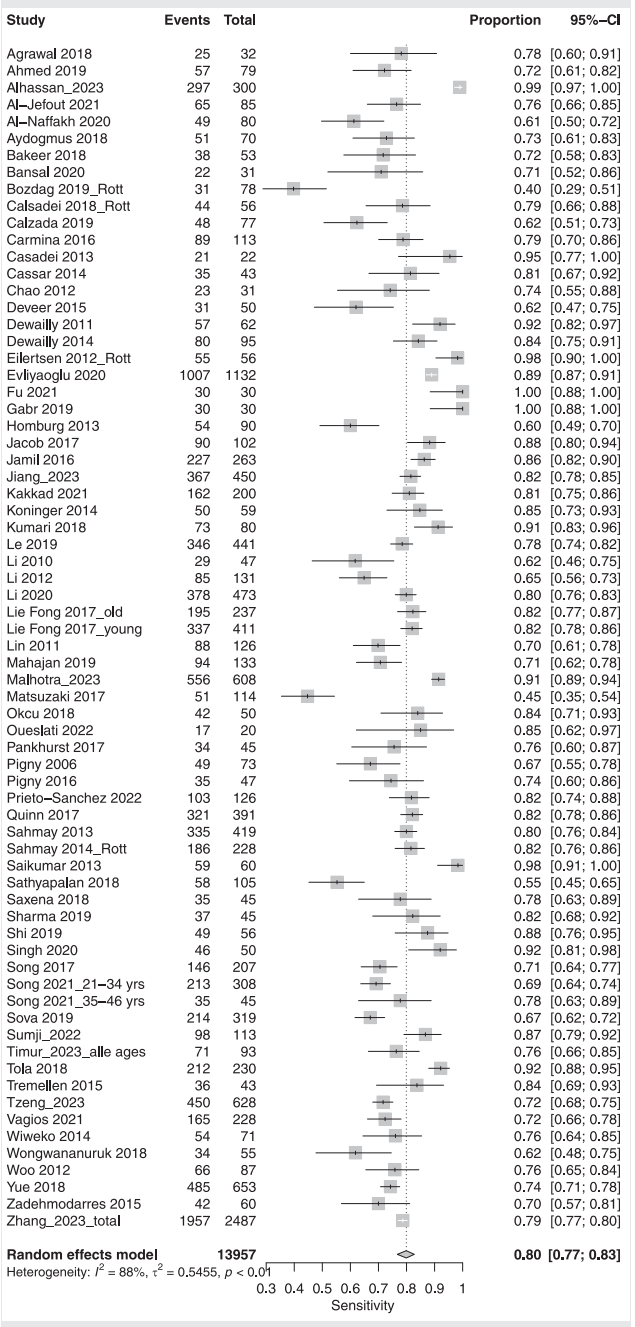
A total of 975 studies were identified using electronic database searches. After removing two duplicates, 973 studies were screened by title and abstract (Supplemental Fig. 1). In total, 875 studies were excluded on the basis of their title and abstract screening. Of the remaining 98 studies that underwent full-text screening, 50 were excluded on the basis of full-text, leaving a total of 48 included studies. An additional eight studies were identified using other sources, and 26 studies were included from the previous 2018 guideline review, bringing the total to 82 studies included in this meta-analysis.

Details of the included studies are shown in Supplemental Table 1 (available online) (PCOS in adults and adolescents) and Supplemental Table 2 (PCOM in adults). There were 68 studies included in the meta-analysis for PCOS in adults (15, 23–89) (the study of Lie Fong et al. (56) and Song et al. (76) included multiple cohorts and were therefore included in the meta-analysis twice), 11 for PCOS in adolescents (76, 90–99), and seven for PCOM in adults (31, 41, 88, 100–103) (the study of Dietz de Loos et al. (101) included two cohorts and was therefore included twice in the meta-analysis). With regard to the diagnostic accuracy of AMH levels for the diagnosis of PCOS in adults, 66 studies used Rotterdam criteria and two used National Institute of Health criteria for PCOS. Of these, four studies were classified as low risk of bias, 41 as moderate, and 23 studies as high risk of bias. For the diagnostic accuracy of AMH levels for the diagnosis of PCOS in adolescents, eight studies used Rotterdam criteria and three studies used National Institute of Health criteria for PCOS; two studies were classified as low risk of bias, five studies as moderate, and four studies as high risk of bias.

The GRADE evidence was rated as having moderate certainty that AMH levels are not reliable as a marker for the diagnosis of PCOS, which was attributable mostly to the serious risk of bias and imprecision (Supplemental Table 3). With regard to the diagnostic accuracy of AMH for detecting PCOM, six studies used the diagnostic cut-off values of $\geq 12$ follicles per ovary or an ovarian volume $>10$ mL. One study used the cut-off value of $\geq 12$ follicles per ovary as the only criterion (Supplemental Table 2). Four studies were classified as low risk of bias, one study as moderate risk of bias, and two as high risk of bias. The GRADE evidence was rated as having moderate certainty that AMH levels can be used as a diagnostic marker for detecting PCOM because there was no serious risk of bias, no serious inconsistency, no serious indirectness, and no serious imprecision (Supplemental Table 3).

The sensitivities, specificities, and AUC values of the AMH level for the diagnosis of PCOS in adults for all the individual studies (n = 68) are shown in Supplemental Table 1. In meta-analysis, we found a pooled sensitivity of 0.80 (95% confidence interval [CI], 0.77–0.83) and a pooled specificity of 0.87 (95% CI, 0.84–0.89), with high heterogeneity ($I^2$ = 88% for sensitivity and $I^2$ = 87% for specificity; Figs. 1 and 2). The summary point is depicted

## FIGURE 1




A forest plot of pooled sensitivity of antimüllerian hormone levels as a marker for the diagnosis of polycystic ovarian syndrome in adults. CI, confidence interval.

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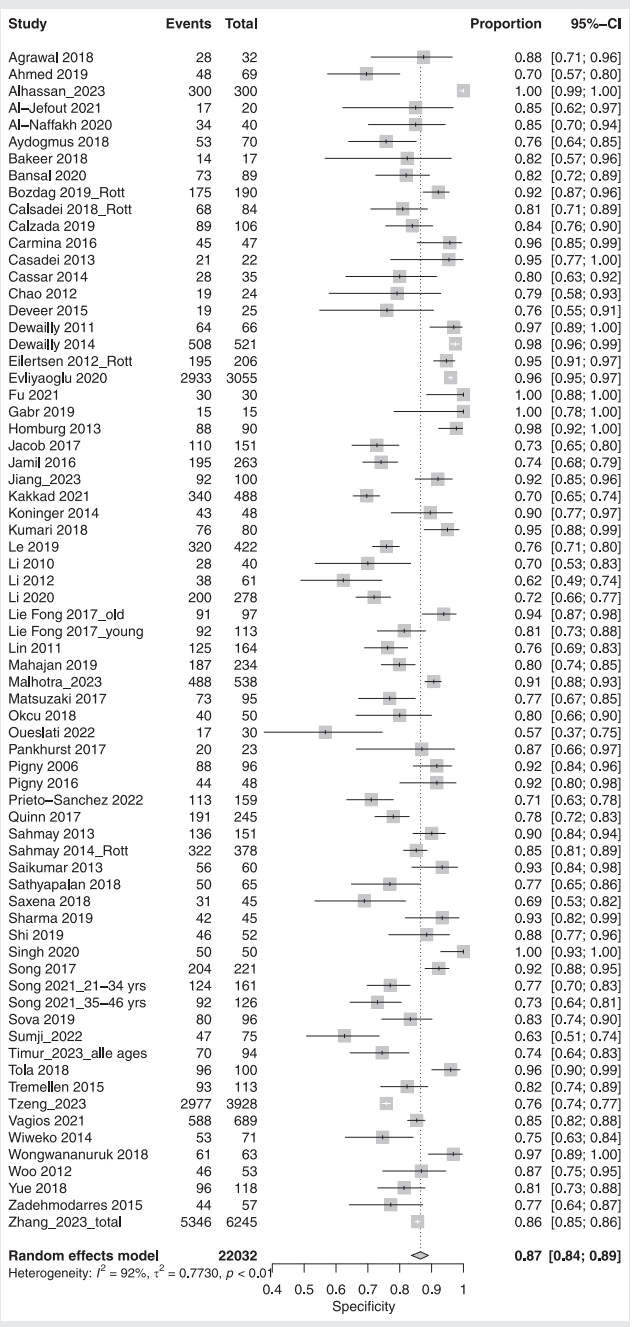
## FIGURE 2




A forest plot of pooled specificity of antimüllerian hormone levels as a marker for the diagnosis of polycystic ovarian syndrome in adults. CI, confidence interval.

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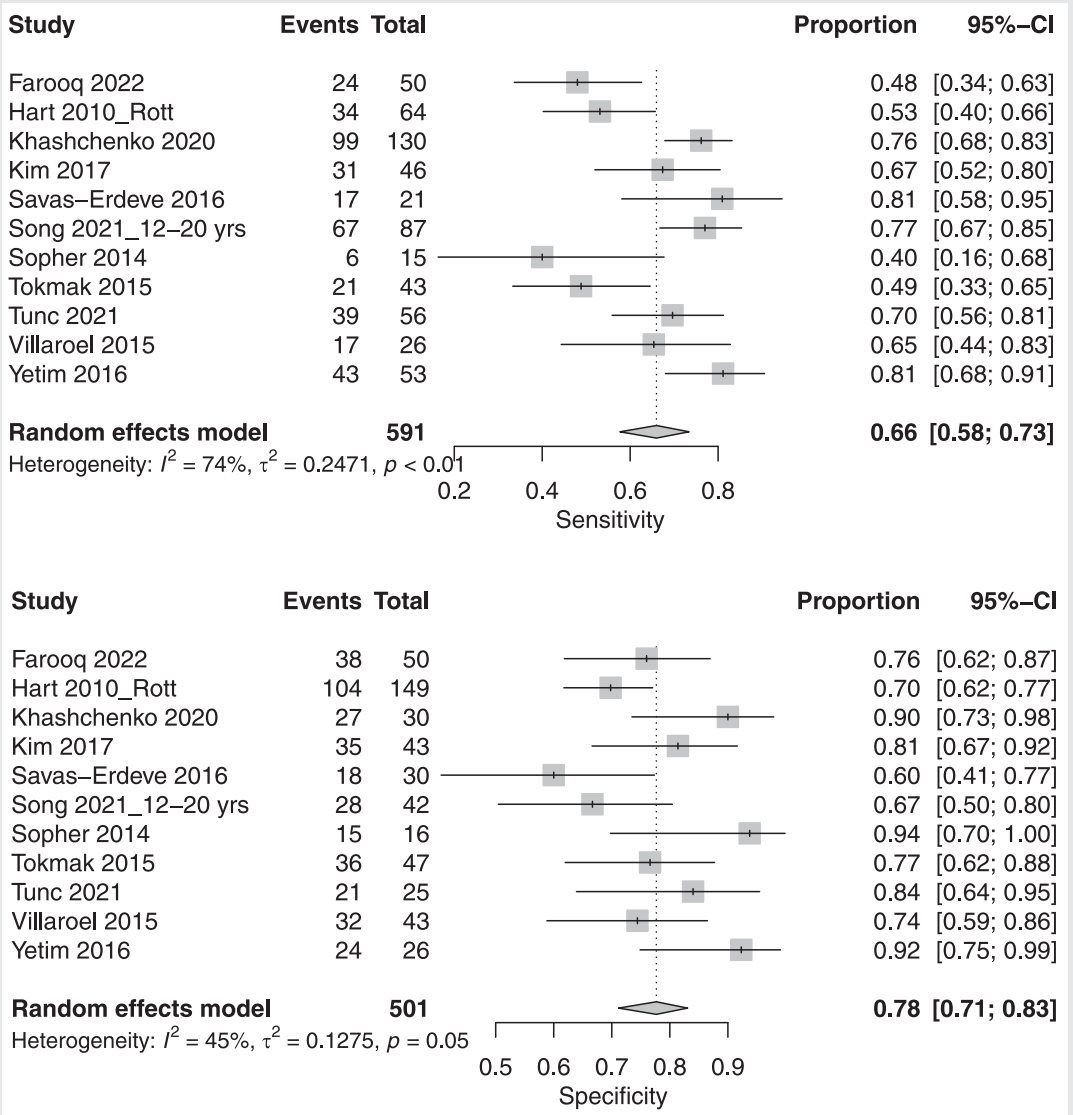
on the summary receiver operating characteristic (ROC) curve (Supplemental Fig. 2). Deek's funnel plot was generated to evaluate the potential risk of publication bias (Supplemental Fig. 3). The statistical analysis showed no significant publication bias ($P$=.877).

In a subgroup analysis, we divided the analysis on the basis of studies ranked as "low or moderate risk of bias" and "high risk of bias." In the group, including studies with low or moderate risk of bias (n = 47), we found a pooled sensitivity of 0.80 (95% CI, 0.76–0.83) and a pooled

specificity of 0.86 (95% CI, 0.82–0.89) (Supplemental Table 4). In the group including studies with a high risk of bias (n = 23), the pooled sensitivity was 0.80 (95% CI, 0.74–0.85) and the pooled specificity was 0.88 (95% CI, 0.83–0.91). No statistically significant difference was found between the sensitivity and specificity of both results ($P$=.98 and $P$=.58, respectively). In a second subgroup analysis, there was a higher pooled sensitivity and pooled specificity in studies where PCOM was excluded in the control group (n = 24) and studies where PCOM was not excluded or not known when it was excluded (n = 44) (sensitivity 0.87 [95% CI, 0.81–0.91; $I^2$ = 86%] vs. 0.76 [95% CI, 0.72–0.79; $I^2$ = 88%]; $P$<.001), specificity (0.91 [95% CI, 0.85–0.95; $I^2$ = 89%] vs. 0.84 [95% CI, 0.81–0.87; $I^2$ = 93%]; $P$=.02) (Supplemental Table 4). In a third subgroup analysis, pooled sensitivity and pooled specificity were compared among the three most commonly used assays, including enzyme-linked immunosorbent assay (ELISA) assays, except for high-sensitivity assays (n = 34), Elecsys immunoassays (n = 10), and automated immunoassays (n = 14). Pooled sensitivity was significantly different between the ELISA except for the highly sensitive assays (0.84 [95% CI, 0.79–0.88]), the Elecsys immunoassays (0.75 [95% CI, 0.64–0.83]), and the automated immunoassays (0.75 [95% CI, 0.70–0.79]), all with $P$ values <.001 (Supplemental Table 4). The specificity was only

## FIGURE 3




A forest plot of pooled sensitivity and pooled specificity of antimüllerian hormone levels as a marker for the diagnosis of polycystic ovarian syndrome in adolescents. CI, confidence interval.

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significantly different between the "Elecsys immunoassay" and the "automated immunoassay" (0.84 [95% CI, 0.77–0.89] vs. 0.82 [95% CI, 0.77–0.86]; $P<.001$) (Supplemental Table 4). In two other subgroup analyses, we found no differences in pooled sensitivity or pooled specificity between studies, stratified on the basis of whether age or BMI were significantly different or similar between cases and controls (Supplemental Table 4).

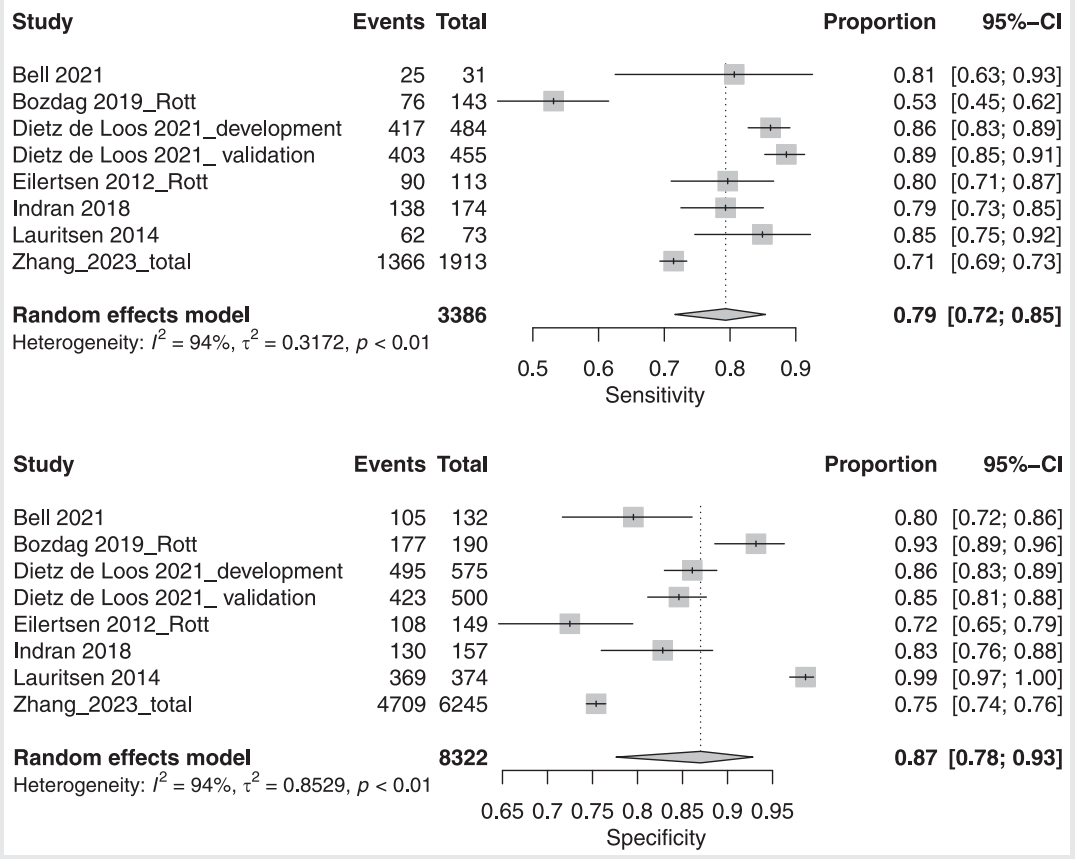
Pooled analysis in adolescents (n = 11 studies) showed a sensitivity and specificity of 0.66 [95% CI, 0.58–0.73] and 0.78 [95% CI, 0.71–0.83], respectively, for the use of AMH levels as a substitute for PCOS diagnosis (Fig. 3). The heterogeneity between studies was $I^2 = 74\%$ in the sensitivity analysis and $I^2 = 45\%$ in the specificity analysis. The summary point is depicted on the summary ROC curve (Supplemental Fig. 4). No subgroup analysis could be performed for these studies because of the small number of studies in adolescents. Deek's funnel plot was generated to evaluate the potential risk of publication bias (Supplemental Fig. 5). The statistical analysis showed no significant publication bias ($P=.636$).

Seven studies investigated the diagnostic accuracy of AMH levels as a marker for detecting PCOM in adults (Supplemental Table 2). Pooled analysis showed a sensitivity of 0.79 (95% CI, 0.72–0.85), with a heterogeneity of $I^2 = 94\%$, and a pooled specificity of 0.87 (95% CI, 0.78–0.93), with a heterogeneity of $I^2 = 94\%$ (Fig. 4). The summary point is depicted on the summary ROC curve (Supplemental Fig. 6). A Deek's funnel plot was generated to evaluate the potential risk of publication bias (Supplemental Fig. 7). No statistical analysis could be performed because of the low number of studies.

## DISCUSSION

Since 2003, PCOM has been widely used as one of the diagnostic criteria for PCOS (104), but its use in practice has remained controversial because of challenges surrounding ultrasound examinations. There is a need for an alternative marker for determining PCOM, and AMH levels have been proposed as such a marker. Previously published meta-analyses on this topic mainly focused on the role of AMH levels as a diagnostic marker for PCOS, not necessarily as an indicator for PCOM (105–107). In this comprehensive systematic review and meta-analysis, we assessed both outcomes. In adults, we have shown a pooled sensitivity and specificity of 0.80 and 0.87 for the use of AMH levels

## FIGURE 4




Forest plot of pooled sensitivity and pooled specificity of antimüllerian hormone levels as a marker for detecting polycystic ovarian morphology. CI, confidence interval.

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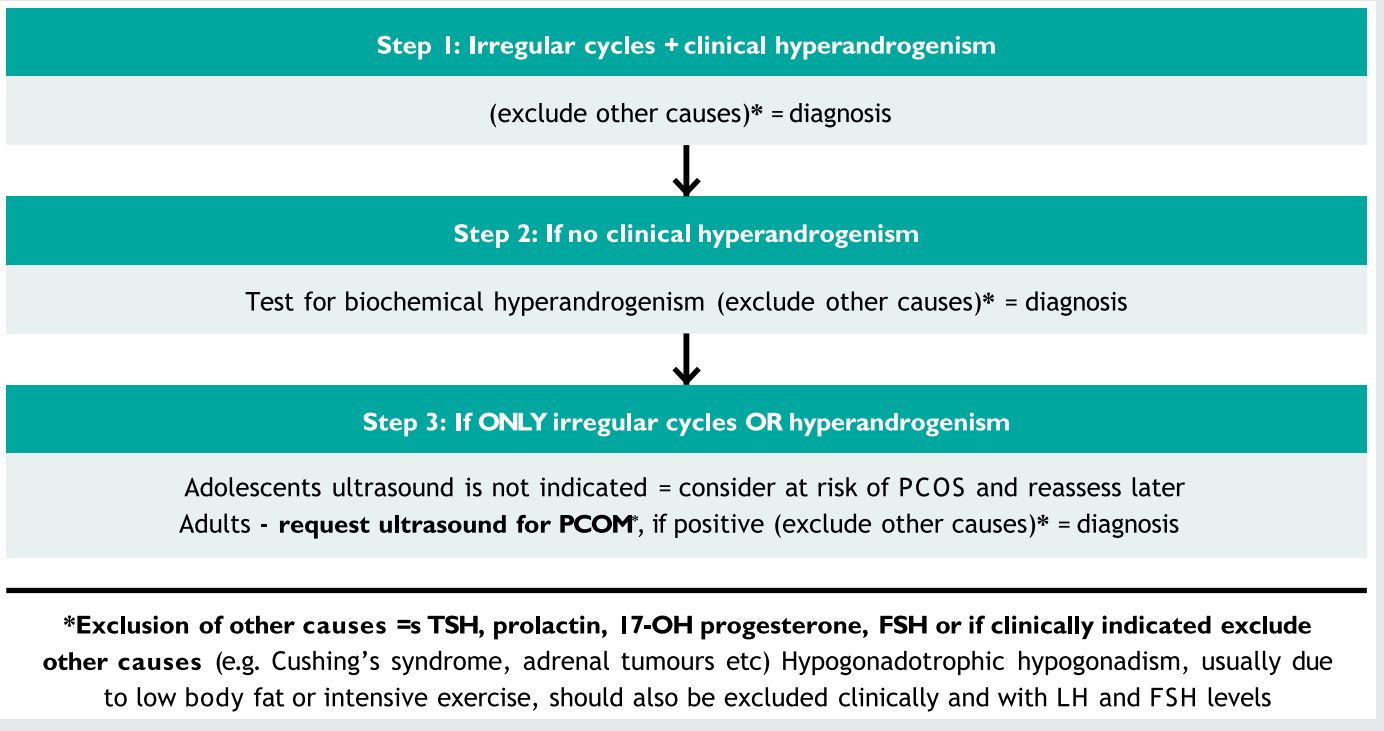
## FIGURE 5




Algorithm for screening and diagnostic assessment in polycystic ovary syndrome (PCOS) according to the 2023 international evidence-based PCOS guideline. FSH = follicle-stimulating hormone; LH =luteinizing hormone; PCOM = polycystic ovarian morphology; TSH = thyroid stimulating hormone. Adapted from "Recommendations from the 2023 international evidence-based guideline for the assessment and management of polycystic ovary syndrome."(1)

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as an isolated marker in PCOS diagnosis, and a pooled sensitivity and specificity of 0.79 and 0.87 for the use of AMH levels as an indicator for PCOM, respectively. The overall GRADE strength of the evidence was moderate, indicating that AMH levels are not a reliable marker to predict PCOS and that AMH levels can be used to detect PCOM.

We found a significant heterogeneity among the studies. Multiple factors contributed to this high heterogeneity. Two of these factors include differences in age and BMI. It is well known that AMH levels decrease with increasing age (108, 109). Even in women with PCOS, who seem to have a prolonged reproductive lifespan and a delayed menopause, AMH levels still decline over time (10, 18). Similarly, women with a higher BMI appear to have lower AMH levels in the general population as well as in PCOS (110, 111). There were differences in BMI and age among the included study populations, and not all studies matched their cases and controls for these variables. The use of hormonal contraceptives may also influence AMH levels, just as it does with other sex steroid levels. Not all studies excluded women who used hormones in the 3 months preceding the study, although it is known that hormonal contraceptives can suppress AMH levels (112). It is important to be aware of these factors when using AMH levels as an indicator for PCOM.

An additional factor that likely contributed to the observed heterogeneity is the use of various AMH assays, with automated platforms and ELISA assays being the most commonly used. It has been shown previously by us and others that AMH levels can differ between the different assays (113–115). In our subgroup analysis, we confirmed significant differences in sensitivity and specificity among these three assays. Ideally, a universal AMH assay would be used worldwide, or agreed-on international standards would be developed. However, until then, hospitals and laboratories should determine population-based and age-specific cut-off values with their own assay, just as occurred in the studies included in this meta-analysis, which indicate adequate sensitivity and specificity for clinical use. In this context, no single cut-off value is recommended in the international guideline.

Furthermore, outcomes in the included studies and the observed heterogeneity may have been influenced by the way the case groups and control groups were defined. Conducting ROC analysis, including PCOS cases with and without PCOM, assesses AMH levels as a diagnostic marker for PCOS and not PCOM. To assess AMH levels as a substitute for PCOM per se, PCOM must be included in the cases and excluded in the controls. Many studies have not clearly described what has been included or excluded in the case or control groups. This factor contributed to limiting recommendations to PCOM detection rather than to PCOS diagnosis.

Because there is no standardized single cut-off value for AMH levels in diagnosing PCOS or detecting PCOM, most studies did not predetermine a threshold but calculated an optimal threshold for their included cohort using the Youden's index. Because of the significant heterogeneity among the studies, a wide range of thresholds has been proposed, related to all the above-mentioned contributing factors. These thresholds in the individual studies ranged from 0.81 ng/mL to 10 ng/mL in all age categories. In a previous published meta-analysis, an AMH level of 4.7 ng/mL was suggested as the preferred threshold level for PCOS diagnosis (107). This recommendation was based on extracted data from 10 studies. In addition, for detecting PCOM, different thresholds have been tested in previously published studies (101, 116). It is important to realize that the threshold levels also depend on the observable characteristics of the included patients with PCOS and controls and might therefore be population-specific. Of all the included studies that investigated the cut-off value of AMH levels for PCOM, only one study (Bell et al. [100]) used the FNPO cut-off value of 20. This is a limitation because it would be preferable to have more studies using the cut-off value of 20 with the newer ultrasound probes with a frequency >8 MHz.

Finally, our work informed guideline recommendations that serum AMH levels should not be used in adolescents because specificity and accuracy are limited. Previous systematic reviews and meta-analyses did not include adolescents. Only Tsukui et al. (117) conducted a meta-analysis on AMH levels as a substitute for PCOS, specifically in adolescents. Here, the meta-analysis of 11 studies assessing the accuracy of AMH levels for the diagnosis of PCOS in adolescents revealed a pooled sensitivity value of 0.66 and a pooled specificity value of 0.78. This occurs in the context of pubertal transition, where PCOM is not uncommon and the hypothalamic ovarian axis is still maturing (118). Accurate transvaginal assessment is often also not ideal, especially considering that many adolescents are not yet sexually active. As such, it is recommended that diagnosis in adolescents relies on both oligoanovulation and hyperandrogenism, as per the guidelines. Further research is needed in this area.

The exclusive inclusion of English-language articles may have caused bias, representing a limitation of this study. Another limitation of this meta-analysis is that the pooled sensitivity and pooled specificity are based on studies with significant heterogeneity. Performing subgroup analysis did not reduce the heterogeneity but showed differences in pooled sensitivity and specificity. Furthermore, we scored multiple studies with a high or moderate risk of bias, and these studies were also included in the analysis. However, limiting our analysis to include only studies with a low or moderate risk of bias, we found similar results. We also could not conduct reliable sensitivity or subgroup analyses by certain aspects, such as the use of oral contraceptives, as this was inadequately reported in most studies. Lastly, we could not establish a cut-off value from various ROC curves calculated in different studies with different cohorts. This underscores the potential importance of developing individualized cut-off values or algorithms.

## CONCLUSIONS

In conclusion, this meta-analysis demonstrated that AMH level is a reasonably sensitive and specific marker for detecting PCOM in adults, although it lacks accuracy for PCOM in adolescents. Moreover, the AMH level is

unsuitable as a single diagnostic test for a heterogeneous and multicomponent diagnosis, such as PCOS. Heterogeneity among the studies was observed, mainly because of different AMH threshold levels, assay types, and variations in age, BMI, and control group characteristics, with the need for further research to strengthen the current evidence. On the basis of these results, AMH levels alone are not recommended for the diagnosis of PCOS in the 2023 international evidence-based guidelines for the assessment and management of PCOS. However, it could be considered an endocrine substitute for the ultrasound assessment of PCOM. Therefore, AMH is incorporated into the guideline diagnostic algorithm (Fig. 5), where it is indicated in those with either (but not both) irregular cycles or hyperandrogenism (1). This substantive change in diagnostic criteria for such a common condition is expected to reduce inconvenience and the cost of diagnosis. This work has also identified research priority areas moving forward.

## Acknowledgments

The authors thank Sabrina T.G. Meertens-Gunput, Ph.D. and Maarten F.M. Engel, Ph.D. from the Erasmus Medical Center Library for developing and updating the search strategies.

## CRediT Authorship Contribution Statement

**Kim van der Ham:** Writing – original draft, Visualization, Investigation, Formal analysis, Data curation. **Joop S.E. Laven:** Writing – review & editing, Supervision, Conceptualization. **Chau Thien Tay:** Writing – review & editing, Project administration, Conceptualization. **Aya Mousa:** Writing – review & editing, Project administration, Conceptualization. **Helena Teede:** Writing – review & editing, Supervision, Conceptualization. **Yvonne V. Louwers:** Writing – original draft, Investigation, Formal analysis, Data curation.

## Declaration of Interests

K.V.D.H. has nothing to disclose. J.S.E.L. reports grants from Ansh Labs, Webster, Tx, USA, from Ferring, Hoofddorp, NL, from Roche Diagnostics, Rotkreuz, Switzerland, from Merck, Schiphol-Rijk, NL, and personal fees from Ferring, Hoofddorp, NL, from Titus Healthcare, Hoofddorp, NL, from Gedeon Richter, Groot-Bijgaarden, Belgium, from Ansh Labs, Webster, TX, USA, from Roche Diagnostics, Rotkreuz, Switzerland, and is an unpaid board member and president of the AE-PCOS Society, and a member of the ASRM Research Integrity Committee, outside the submitted work. C.T.T. receives funding from the Australian National Health and Medical Research Council supported Centre for Research in Women's Health in Reproductive Life. A.M. receives fellowship (salary) funding from the Australian National Health and Medical Research Council. H.T. receives funds from fellowship (salary) and grants from the Australian National Health and Medical Research Council and Australian Federal Government. Y.V.L. has nothing to disclose.

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**Hormona antimülleriana como biomarcador diagnóstico para el síndrome de ovario poliquístico y la morfología ovárica poliquística: una revisión sistemática y metaanálisis**

**Importancia:** Como parte de la guía internacional 2023 basada en la evidencia para el síndrome de ovario poliquístico (SOP), este meta-análisis investigó la inclusión de los niveles de la hormona antimülleriana (HAM) en los criterios diagnósticos para el SOP.

**Objetivo:** Responder a las tres preguntas siguientes: 1) ¿Son eficaces los niveles de HAM para diagnosticar el SOP en mujeres adultas? 2) ¿Son eficaces los niveles de HAM para diagnosticar el SOP en adolescentes? ¿Son eficaces los niveles de HAM para diagnosticar la morfología ovárica poliquística (PCOM)?

**Fuentes de datos:** Se realizaron búsquedas en seis bases de datos hasta el 31 de julio de 2023.

**Selección y síntesis de estudios:** Los estudios elegibles fueron los realizados en humanos, publicados en inglés y que informaban de los valores de sensibilidad, especificidad y/o área bajo la curva. Los datos extraídos incluyeron la población del estudio, la edad, el índice de masa corporal, el ensayo de HAM, el valor de corte de los niveles de HAM, la sensibilidad, la especificidad y los valores del área bajo la curva. El riesgo de sesgo se evaluó mediante la herramienta de evaluación de la calidad de los estudios de precisión diagnóstica. Se utilizó un modelo de efectos aleatorios para probar la precisión diagnóstica.

**Desenlaces principales:** Sensibilidad y especificidad agrupadas para utilizar los niveles de HAM para el diagnóstico del SOP en adultos y adolescentes y para detectar el PCOM en adultos.

**Resultados:** Se incluyeron 82 estudios. Los metaanálisis AMH-SOP en adultos (n=68) mostraron una sensibilidad y especificidad agrupadas de 0,79 (intervalo de confianza [IC] del 95%, 0,76-0,82; $I^2$ =86%) y 0,87 (IC del 95%, 0,84-0,89; $I^2$ = 91%). El meta-análisis HAM-PCOS en adolescentes. (n= 11) mostró una sensibilidad y especificidad agrupadas de 0,66 (IC 95%, 0,58-0,73; $I^2$ = 74%) y 0,78 (IC 95%, 0,71-0,83; $I^2$ = 45%). El metaanálisis AMH-PCOM en adultos (n = 7) mostró una sensibilidad y especificidad agrupadas de 0,79 (IC 95%, 0,72-0,85; $I^2$ = 94%) y 0,87 (IC 95%, 0,78-0,93; $I^2$ = 94%).

**Conclusión y relevancia:** Este estudio investigó el cambio más profundo en la guía internacional de 2023 sobre el SOP basada en la evidencia, que ahora recomienda los niveles de HAM para definir el SOP en adultos de acuerdo con el algoritmo diagnóstico. Los niveles de hormona antimülleriana por sí solos son insuficientes para el diagnóstico del SOP y son inespecíficos para el SOP en adolescentes. Múltiples factores influyen en los niveles de HAM y causan heterogeneidad, así como limitaciones en este estudio. En consecuencia, no se pudo recomendar ningún valor internacional de corte, lo que subraya la necesidad de investigar sobre valores de corte más individualizados.