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Antenatal risk stratification in placenta accreta spectrum: incremental value, external validation, prespecified-threshold diagnostic accuracy, and maternal outcome prediction — a protocol for a systematic review and meta-analysis

Li, Y.

ADMINISTRATIVE INFORMATION

Support - No support.

Review Stage at time of this submission - Preliminary searches.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202690121

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 28 September 2026 and was last updated on 28 September 2026.

INTRODUCTION

Review question / Objective Among pregnant individuals undergoing antenatal assessment for suspected or high-risk placenta accreta spectrum (PAS), what is the discriminative performance of clinical, ultrasound, MRI, radiomics, artificial-intelligence and multimodal models; do AI, radiomics or multimodal models provide incremental predictive information beyond clinically relevant existing assessment in the same patients; how stable is performance in independent temporal or geographic validation; what sensitivity and specificity are achieved at prespecified clinical thresholds; and how well do these models predict invasion severity and clinically important maternal outcomes?

Condition being studied Pregnant individuals undergoing antenatal or preoperative assessment for suspected or high-risk PAS, including placenta previa or low-lying placenta, previous caesarean delivery, referral/high-risk populations, and confirmed PAS cohorts used for severity or maternal-outcome prediction.

METHODS

Participant or population Clinically relevant simpler or existing assessment evaluated in the same participants, including clinical-only models, expert or radiologist assessment, conventional imaging findings, ultrasound-only models, MRI-only models, or clinical-imaging assessment.

Intervention MEDLINE/PubMed
Embase
Web of Science Core Collection
Cochrane Library.

Comparator 1. Absolute AUC/C-statistic for PAS presence.
2. Same-cohort paired ΔAUC.
3. Change in discrimination during independent external validation.

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4. Sensitivity and specificity at thresholds prespecified before evaluation.

Study designs to be included PAS invasion severity or subtype; blood loss ≥1000, ≥1500, ≥2000 and ≥2500 mL; massive or rapid transfusion; hysterectomy; ICU admission; severe maternal composite outcomes; calibration; and decision-curve/net-benefit measures.

Eligibility criteria PROBAST+AI will be used for prediction-model development and evaluation. Prespecified-threshold diagnostic-accuracy estimates will be assessed using QUADAS-3 at the selected-estimate level. Two reviewers will conduct assessments independently, followed by consensus.

Information sources AUC/C-statistics will be transformed to the logit scale and pooled using restricted maximum-likelihood random-effects models. Hartung-Knapp-Sidik-Jonkman inference will be used when at least three independent effects are available and between-study variance is non-zero; otherwise Wald-type inference will be used. Same-cohort incremental-value analyses will use paired ΔAUC. Independent validation analyses will distinguish internal/held-out-to-external from development-to-external comparisons. Prespecified-threshold datasets with defensible TP, FP, FN and TN will be synthesized using sensitivity/specificity meta-analysis and supportive bivariate/HSROC modelling. Clinically non-equivalent maternal outcomes will remain separate.

Main outcome(s) Before protocol registration, exploratory scoping searches, pilot study selection, pilot data extraction, and exploratory statistical analyses were undertaken to refine the clinical question, model taxonomy, comparators, estimands, and statistical plan. These activities were undertaken solely for protocol development and will not constitute the final screening dataset or confirmatory synthesis. After registration, the formal database searches will be completed or rerun, records will undergo systematic eligibility assessment, final data will be independently verified, prespecified risk-of-bias assessments will be completed, and confirmatory meta-analyses will be conducted according to the registered protocol.

Quality assessment / Risk of bias analysis I checked all the required fields on the form before sending it.

Strategy of data synthesis A clinically ordered, estimand-specific synthesis will be used. AUC/C-statistics for PAS presence, invasion severity, blood-loss thresholds, and major maternal outcomes will be analysed separately. AUC values will be transformed to the logit scale and pooled using restricted maximum-likelihood random-effects models. Hartung-Knapp-Sidik-Jonkman inference will be used when at least three independent effects are available and between-study variance is greater than zero; otherwise Wald-type inference will be used. Heterogeneity will be described using I^2 and τ^2 where estimable.
Same-cohort incremental-value analyses will use paired ΔAUC, defined as AUC of the AI, radiomics, or multimodal model minus AUC of the clinically relevant comparator. The primary synthesis will include only comparisons with directly reported or reliably recoverable paired uncertainty, such as DeLong statistics, paired confidence intervals, covariance information, or paired bootstrap estimates. Point-estimate-only comparisons will be described separately.
External validation will be analysed by comparing the same unchanged model between the reference and independent validation populations. Internal/held-out-to-external and development-to-external comparisons will be analysed separately because they represent different sources of performance change.
For studies using thresholds prespecified before evaluation and reporting valid TP, FP, FN, and TN data, sensitivity and specificity will be synthesized using random-effects methods with supportive bivariate/HSROC modelling. Clinically non-equivalent outcomes will not be combined into a single overall effect. Meta-analysis will be withheld when clinical or statistical exchangeability is inadequate.

Subgroup analysis Prespecified subgroup analyses will examine model or input family (clinical, ultrasound, MRI, radiomics, AI, and multimodal models), validation stage (development/apparent, internal or held-out validation, temporal external validation, and geographic external validation), prospective versus retrospective study design, reference standard, comparator type in same-cohort analyses, and clinically relevant case spectrum. Where sufficient data are available, analyses will also consider high-risk referral populations versus broader clinical populations. Meta-regression will only be considered when at least 10 sufficiently independent studies or study families are available for the investigated covariate.No.

Sensitivity analysis Sensitivity analyses will assess the robustness of the primary findings. Leave-one-study-out or leave-one-study-cluster-out analyses will be performed for sufficiently large

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and clinically coherent AUC or ΔAUC syntheses. Additional analyses will exclude studies judged at high risk of bias, studies with uncertain cohort overlap, models using predictors unavailable at the intended antenatal decision point, and studies in which the diagnostic threshold was re-optimized in the evaluation dataset.

External-validation analyses will be repeated after restriction to geographic external validation. Diagnostic-accuracy analyses will be repeated using only directly reported patient-level 2×2 data where possible. Same-cohort ΔAUC analyses will be repeated after restriction to comparisons with directly reported paired precision.

For sufficiently large diagnostic-accuracy datasets, Deeks funnel-plot asymmetry may be explored. Conventional funnel plots and trim-and-fill will only be considered exploratory in sufficiently large and clinically comparable univariate synthesis groups.

Language restriction No.

Country(ies) involved China.

Keywords placenta accreta spectrum; antenatal prediction; ultrasound; magnetic resonance imaging; radiomics; artificial intelligence; multimodal model; external validation; meta-analysis.

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