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Incidence and risk factors of postpartum hemorrhage in women of advanced maternal age: a systematic review and meta-analysis with implications for nursing intervention strategies

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ADMINISTRATIVE INFORMATION**Support** - None.**Review Stage at time of this submission** - Preliminary searches.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202670028**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 11 July 2026 and was last updated on 11 July 2026.**INTRODUCTION**

Review question / Objective This systematic review and meta-analysis aims to quantify the pooled incidence of postpartum hemorrhage (PPH) in women of advanced maternal age, identify and synthesize the associated risk factors, and provide evidence-based support for developing targeted nursing intervention strategies.

Condition being studied Postpartum hemorrhage (PPH) in women of advanced maternal age.

METHODS

Participant or population Women of advanced maternal age, defined as those aged 35 years or older at the time of delivery, regardless of parity or mode of delivery.

Intervention Not applicable (this systematic review synthesizes observational studies on risk factors and incidence, not an intervention).

Comparator Not applicable (observational study; no specific comparator group is defined — risk factor analysis compares exposed versus non-exposed status within the population).

Study designs to be included Observational studies (cohort, case-control, and cross-sectional studies) that report the incidence of postpartum hemorrhage and/or risk factors in women of advanced maternal age.

Eligibility criteria Inclusion criteria: (1) Participants: women of advanced maternal age (≥ 35 years at delivery); (2) Outcomes: studies reporting incidence of postpartum hemorrhage (PPH) and/or odds ratios (OR) with 95% CI for risk factors; (3) Study design: observational studies (cohort, case-control, cross-sectional). Exclusion criteria: Case reports, case series with < 30 cases, reviews, conference abstracts, studies focusing solely on a specific disease unless data for advanced maternal age could be extracted separately, and duplicate publications.

Information sources PubMed, Web of Science, Cochrane Library, China National Knowledge Infrastructure (CNKI), Wanfang Data, VIP Database, and SinoMed. Additional studies were identified by manually searching the reference lists of included studies and relevant reviews.

Main outcome(s) The primary outcome is the pooled incidence of postpartum hemorrhage (PPH) in women of advanced maternal age. PPH is defined as blood loss ≥ 500 mL after vaginal delivery or ≥ 1000 mL after cesarean section, or as defined by individual included studies. Secondary outcomes include the odds ratios (ORs) with 95% confidence intervals for major risk factors, such as uterine atony, macrosomia, placenta previa, hypertensive disorders of pregnancy, placenta accreta, thrombocytopenia, history of abortion, and anxiety (Self-Rating Anxiety Scale score ≥ 50).

Quality assessment / Risk of bias analysis The methodological quality of cohort and case-control studies will be assessed using the Newcastle-Ottawa Scale (NOS). Cross-sectional studies will be evaluated using the quality assessment scale recommended by the Agency for Healthcare Research and Quality (AHRQ). Two reviewers will independently perform the assessments; disagreements will be resolved by discussion or a third reviewer.

Strategy of data synthesis Meta-analyses will be performed using R software. The pooled incidence of postpartum hemorrhage will be calculated using a random-effects model with double arcsine transformation. For risk factors, pooled odds ratios (ORs) and 95% confidence intervals will be computed using a random-effects model when heterogeneity is substantial ($I^2 > 50\%$); otherwise, a fixed-effects model will be applied. Heterogeneity will be assessed using the Cochran Q test and I^2 statistic. Subgroup analyses will be conducted by mode of delivery, geographic region, study design, and publication year to explore sources of heterogeneity. Publication bias will be assessed by funnel plots, Egger's test, Begg's test, and Peters' test for risk factors with ≥ 10 studies. Sensitivity analyses will include leave-one-out analysis and comparison of random-effects versus fixed-effects model results.

Subgroup analysis Subgroup analyses were planned to explore potential sources of heterogeneity in the pooled PPH incidence. The following subgroups will be examined:

(1) mode of delivery (cesarean section only, vaginal delivery only, mixed deliveries);

(2) geographic region (northern China vs. southern China);

(3) study design (case-control, cohort, cross-sectional);

(4) publication year (≥ 2021 vs. < 2021).

Sensitivity analysis Sensitivity analyses will be performed by: (1) omitting each study individually (leave-one-out analysis) to evaluate its influence on the pooled estimate; and (2) comparing results from random-effects models with those from fixed-effects models to assess the robustness of the findings.

Country(ies) involved China.

Keywords Advanced maternal age; Postpartum hemorrhage; Incidence; Risk factors; Meta-analysis.

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