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Pregnancy Outcomes in Women With Endometriosis: A Systematic Review and Meta-Analysis of Maternal and Neonatal Complications

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Abstract

Endometriosis may influence pregnancy beyond its established association with infertility by affecting placentation, gestational duration, maternal health, and neonatal outcomes. This systematic review and meta-analysis aimed to determine whether endometriosis is associated with adverse maternal, fetal, and neonatal complications. PubMed/Medical Literature Analysis and Retrieval System Online (MEDLINE), Scopus, Web of Science, and Google Scholar were searched from inception to June 30, 2026, using controlled vocabulary and free-text terms related to endometriosis and pregnancy outcomes. Comparative observational studies involving pregnant women with and without endometriosis were included. Two reviewers independently screened studies, extracted adjusted effect estimates, and assessed risk of bias using Risk of Bias in Non-randomized Studies-of Exposures (ROBINS-E). Random-effects meta-analysis was performed when at least three clinically comparable studies provided extractable data; the remaining outcomes were synthesized narratively. Ten studies were included. Women with endometriosis had significantly higher odds of placenta previa (pooled OR 2.98, 95% CI 2.00-4.45; I^2=34.5%) and a higher risk of preterm birth (pooled adjusted OR/RR sensitivity estimate 1.24, 95% CI 1.14-1.36; I^2=10.2%). Narrative findings also suggested increased frequencies of hypertensive disorders, hemorrhage, cesarean delivery, fetal growth abnormalities, stillbirth, neonatal intensive care admission, and respiratory morbidity, although consistency varied. Endometriosis is associated with clinically important obstetric and neonatal risks, particularly placenta previa and preterm birth, supporting individualized antenatal surveillance and delivery planning.

Categories: Obstetrics/Gynecology, Pediatrics, Epidemiology/Public Health
Keywords: endometriosis, maternal outcomes, neonatal complications, placenta previa, preterm birth

Introduction And Background

Endometriosis is a chronic inflammatory gynecological condition with estrogen dependency in which tissue resembling normal endometrial tissue is found outside of the uterine cavity [1]. Usually, the lesions are found in the ovaries, pelvic peritoneum, uterosacral ligaments, rectovaginal septum, and adjacent pelvic structures [2]. Clinical presentation and clinical severity are highly variable between women with the condition, and it is often complicated by dysmenorrhea, chronic pelvic pain, dyspareunia, abnormal uterine bleeding, and infertility [3]. Endometriosis can present as superficial peritoneal disease, ovarian endometrioma, or deep infiltrating lesions and has various patient symptom patterns as well as different locations and reproductive consequences [4]. Delay in diagnosis, and the fact that symptoms may vary or be difficult to detect in most cases without invasive tests, may make clinical management and reproductive counseling difficult [5].

In the past, the impact of endometriosis on the reproductive system has been primarily discussed in terms of diminished fertility. Distortion of pelvic anatomy, adhesion, altered tubo-ovarian relationships, inflammation of the pelvic environment, loss of follicular development, loss of oocyte competence, and altered endometrial receptivity may cause a reduction in spontaneous conception probability [6]. Assisted reproductive techniques have allowed many women with endometriosis-related infertility to conceive. Absence of conception does not mean that the disease has no biological or anatomical effects [7]. Long-lasting inflammatory, endocrine, vascular, and structural changes may persist throughout pregnancy and affect embryo implantation, placental growth, uterine adaptation, fetal growth, and delivery (time and mode) [8].

These steps of coordinated decidualization, trophoblast invasion, remodeling of spiral arteries, immune

tolerance, and vascular development in the placenta are important for successful pregnancy [9]. Progesterone resistance, dysregulation of cytokines, oxidative stress, angiogenic imbalance, abnormal uterine contractility, and decidual dysfunction have all been found to be related to endometriosis [2]. Such mechanisms may provide a biological explanation for the observed associations between endometriosis and adverse pregnancy outcomes. Altered decidualization, inflammatory signaling, and abnormal placentation have been proposed as potential pathways linking endometriosis with complications such as placenta previa, placental abruption, hypertensive disorders, fetal growth abnormalities, and preterm labor; however, a direct causal relationship has not been established [10]. Other factors such as pelvic adhesions, past surgery, deep infiltrating disease, and abnormal pelvic anatomy may contribute to operative delivery difficulties and may be associated with increased rates of cesarean delivery, bleeding, or other complications during labor [11].

A wide variety of maternal and neonatal outcomes have been studied in women with endometriosis during pregnancy. Maternal complications reported include placenta previa, placental abruption, and hypertensive disorders, as well as gestational diabetes, antepartum hemorrhage, postpartum hemorrhage, and cesarean delivery [12]. Endometriosis could be clinically relevant after conception due to the demands for coordinated implantation, decidualization, placental development, vascular adaptation, and immune regulation during pregnancy [3]. It has been suggested that these processes are the factors that may be implicated in the correlation of endometriosis and poor obstetric outcomes [9]. Pelvic deformities from disease or previous surgery can also affect the positioning, function, and delivery of the placenta. These mechanisms offer a justification for considering pregnancy outcomes other than infertility [10].

Several maternal and neonatal complications, such as placenta previa, preterm birth, hypertension, bleeding, cesarean section, fetal growth abnormalities, stillbirth, and neonatal morbidity, have been evaluated in published evidence [8]. Associations have not been consistent, and evidence is different for each outcome. Existing observational evidence suggests that associations with placenta previa and preterm birth are more consistently reported, whereas findings for hypertensive disorders, gestational diabetes, fetal growth abnormalities, and neonatal complications remain variable across studies. The uncertainty about the most consistent complications of endometriosis has been caused by the fact that different study populations, different definitions of endometriosis, different methods of reproduction, and different methods of analysis have been used. Previous systematic reviews and meta-analyses have examined adverse pregnancy outcomes associated with endometriosis; however, gaps remain due to inconsistent diagnostic criteria, variability in outcome definitions, differences in confounder adjustment, and limited evaluation of individual maternal and neonatal outcomes. These limitations have made it difficult to establish the consistency of outcome-specific associations. The present review aims to address these gaps through an updated synthesis of maternal, fetal, and neonatal outcomes, distinguishing findings suitable for quantitative analysis from those requiring narrative evaluation.

Objectives of the review

This systematic review and meta-analysis aimed to determine whether endometriosis is associated with an increased risk of adverse maternal, fetal, and neonatal outcomes during pregnancy. Particular emphasis was placed on placenta previa, preterm birth, and other clinically relevant obstetric and perinatal complications, such as placental disorders, hypertensive and metabolic complications, hemorrhagic complications, operative delivery, fetal growth abnormalities, and fetal and neonatal morbidity.

Review

Methodology

Study Design and Reporting Framework

The purpose of this systematic review and meta-analysis was to examine maternal, fetal, and neonatal outcomes in women during pregnancy with endometriosis. The methodology was designed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement [13]. Quantitative synthesis was preceded by the development of the review question, eligibility criteria, outcomes, screening procedures, data-extraction framework, risk-of-bias assessment, and statistical analyses. Non-randomized comparative studies were included in the review, as the association of maternal endometriosis and pregnancy outcomes is mainly studied in observational epidemiologic studies. During the review, methodological changes were made, which were resolved by consensus and recorded for transparency and reproducibility. PRISMA-2020 is the latest main reporting structure for systematic reviews.

Eligibility Criteria

The Population, Exposure, Comparator, and Outcomes (PICO) framework was used to define eligibility. The population consisted of pregnant women with singleton or mixed pregnancy populations for whom singleton findings were separately extractable. Clinically diagnosed, surgically confirmed, imaging-detected, or administratively coded endometriosis was used as the diagnosis to define exposure. Comparators were

pregnant women without endometriosis. Eligible outcomes included placenta previa, placental abruption, preterm birth, hypertensive disorders, gestational diabetes, cesarean delivery, antepartum and postpartum hemorrhage, fetal growth restriction, low birth weight, small-for-gestational-age birth, stillbirth, admission to the neonatal intensive care unit, and neonatal respiratory morbidity. Comparative outcome data reports were eligible if they were cohort, case-control, registry-linkage, or population-based studies. Reviews, case reports, conference abstracts, and non-English publications were not included.

Electronic Databases and Information Sources

Using a comprehensive electronic literature search, literature was reviewed in PubMed/Medical Literature Analysis and Retrieval System Online (MEDLINE), Scopus, Web of Science Core Collection, and Google Scholar from the inception of the database to 2026. Eligible studies and relevant systematic literature reviews (SLRs) were manually searched from reference lists to identify studies not identified in the database searches. Grey literature and recently indexed literature were supplemented with Google Scholar to find these items, and the results were analyzed in the reverse order of relevance until no further potentially eligible studies were found. Only human research in English was included in the search. There was no restriction on the country, healthcare context, number of samples, or published or unpublished status in the initial database search. All retrieved records were exported to a reference-management file for deduplication and screening.

Search Strategy and Boolean Operators

The search strategy combined controlled vocabulary, including Medical Subject Headings where applicable, with free-text terms related to endometriosis and pregnancy outcomes. The principal PubMed search syntax was: (“Endometriosis” [MeSH] OR endometriosis OR endometriotic) AND (“Pregnancy” [MeSH] OR pregnancy OR pregnant OR gestation OR obstetric) AND (“Pregnancy Outcome” [MeSH] OR “pregnancy outcome” OR maternal OR neonatal OR perinatal OR “placenta previa” OR preterm OR premature OR preeclampsia OR haemorrhage OR “gestational diabetes” OR cesarean OR “fetal growth restriction” OR “low birth weight” OR stillbirth). Boolean operators OR and AND combined synonyms and conceptual groups, respectively. Database-specific search syntax and truncation operators were adapted for Scopus and Web of Science, while keyword-based searches were used for Google Scholar. The complete database-specific search strategies, search dates, and applied eligibility restrictions are provided in the Appendices.

Study Selection

Duplicate citations were eliminated, and all records were retrieved from all sources and combined before screening. Titles and abstracts were independently screened by two reviewers using the predetermined criteria. Potentially relevant records were taken to full-text assessment. To ensure the eligible study design, exposure to endometriosis, a comparator group, and/or extractable maternal or neonatal outcome data were independently examined through full-text articles. Comparisons were made between studies that shared a common population, recruitment period, sample size, and/or outcome definition, and the most complete or methodologically most appropriate study was selected for each synthesis. If there was disagreement at either screening stage, it was discussed and, when required, cross-referenced with a third reviewer. The reasons for excluding full-text articles were documented, and the selection process was illustrated with a PRISMA 2020 flow diagram.

Data Extraction and Outcome Classification

Data were abstracted by two reviewers independently using a standardized and pilot-tested data extraction form. The variables extracted were author, year of publication, country, type of study design, period of recruitment, source of data, number of patients, definition of endometriosis, comparator characteristics, conception method, parity, maternal age, definitions of outcome, period of follow-up, covariates adjusted in models, effect measure, point estimate, and 95% confidence interval. Confounding was minimized by using adjusted estimates rather than unadjusted estimates. Maternal outcomes consisted of placental disorders, hypertensive disorders, gestational diabetes, hemorrhage, and cesarean delivery. Perinatal/neonatal outcomes included: preterm birth, fetal growth abnormalities, stillbirth, neonatal intensive care admission, and respiratory morbidity. The values that were extracted from the tables and figures were cross-checked with the supplementary files and the study text before the analysis.

Risk-of-Bias Assessment

Two reviewers independently evaluated the risk of bias in each study using the Risk of Bias in Non-randomized Studies-of Exposures (ROBINS-E) tool, which is specifically designed for observational studies that aim to estimate the effects of an exposure [14]. This tool was suitable given the evidence presented, which included cohort, case-control, registry-linkage, and other types of observational comparisons of maternal exposure to endometriosis. All outcome-specific estimates were analyzed across seven areas: confounding, exposure measurement, participant selection, post-exposure interventions, missing data, outcome measurement, and selection of the reported result. Judgments were made at the domain level and

overall level and rated as low risk, some concerns, high risk, or very high risk. Clarifications were made by consensus. The recommended tool for non-randomized epidemiological studies is ROBINS-E, a dedicated exposure-assessment tool.

Statistical Analysis and Evidence Synthesis

Meta-analysis was conducted if the study characteristics of three or more studies were sufficiently similar with respect to populations, outcomes, and association measures adjusted for. Measure-specific synthesis was done for adjusted odds ratios wherever possible. Reported 95% confidence intervals were converted into natural log estimates of effects and standard errors. To account for clinical and methodological variability of studies, random-effects models were adopted. The Cochrane's Q test, I^2, and between-study variance were used to assess statistical heterogeneity. For preterm birth, adjusted odds ratios (ORs) and risk ratios (RRs) were combined in a random-effects sensitivity analysis using the rare-outcome approximation, rather than treating the pooled estimate as a single measure-specific effect. This approximation was considered because ORs and RRs may be similar when outcome frequencies are low. Estimates were pooled on the logarithmic scale, and differences in outcome frequency and study design were considered limitations of this approach. Studies that provided extractable and sufficiently similar statistical data were entered in the quantitative synthesis, while studies that provided sufficient, but not extractable, statistical data and/or lacked compatible effect estimates, variance measures, or consistent outcome definitions were retained in the narrative synthesis. Syntheses with fewer than 10 studies were not analyzed with funnel plots or regression-based tests because they would be underpowered for such analyses.

Risk-of-Bias Visualization

Traffic-light and summary plots were used to present domain-level ROBINS-E judgments. Each study was evaluated across the seven ROBINS-E domains, and judgments were categorized as low risk, some concerns, high risk, very high risk, or no information. The traffic-light plot was used to represent the domain-specific judgment for each study included; the summary plot was used to represent the distribution of the judgments across all of the studies within a domain. Before manuscript inclusion, all figures have been checked against the completed ROBINS-E assessment forms.

Results

Study Selection

The literature search identified 337 records across PubMed/MEDLINE, Scopus, Web of Science, and Google Scholar. After removing 39 duplicates, 298 records underwent title and abstract screening. Sixty-three full-text articles were assessed for eligibility, and 53 were excluded because they did not satisfy the inclusion criteria, lacked adequate pregnancy outcome data, or were published in non-English languages. Ten studies fulfilled the predefined criteria and were included in the final systematic review, with eligible outcome-specific datasets subsequently incorporated into the quantitative meta-analysis. Figure *1* shows the PRISMA 2020 flow diagram illustrating study identification, screening, eligibility assessment, and final inclusion in the systematic review and meta-analysis.

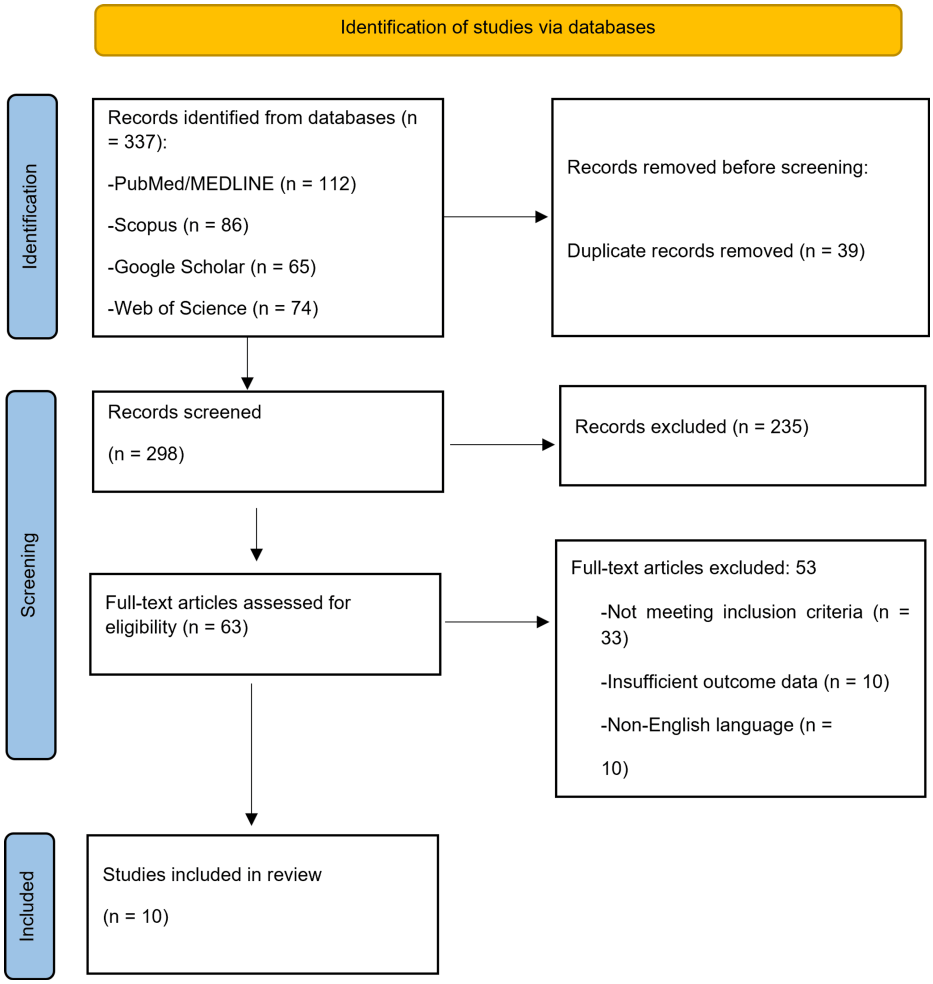


FIGURE 1: PRISMA 2020 flow diagram of the study-selection process

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; MEDLINE: Medical Literature Analysis and Retrieval System Online

Characteristics of the Included Studies

All 10 studies were done in Japan, Germany, Australia, Italy, Iran, South Korea, France, and the U.S. Case-control studies, prospective studies, retrospective studies, registry linkage, and population-based studies were all included as study designs. Sample sizes ranged from 250 participants to over 1.25 million deliveries. Exposed women included those who had been diagnosed with endometriosis by either a clinical or surgical diagnosis or administrative data; the comparison groups included women without a diagnosis of endometriosis. Placenta previa, preterm birth, hypertensive disorders, hemorrhage, cesarean delivery, gestational diabetes, fetal growth, and neonatal morbidity were among the outcomes measured. Table *1* shows the detailed PICO-based characteristics of the included studies, including study design, population, endometriosis exposure, comparator groups, and reported maternal and fetal/neonatal outcomes.

Study	Country, setting, and design	Study period and population	Population	Endometriosis exposure	Comparator	Maternal outcomes	Fetal/neonatal outcomes
Miura et al. [15]	Japan; single-center case-control study at Nagoya University Hospital	Deliveries from 2010-2017; 2,769 women, including 80 with endometriosis and 2,689 controls	Women who delivered at a tertiary university hospital; pregnancies with maternal and neonatal outcome information	Endometriosis diagnosed before pregnancy or ovarian endometriosis identified during the first trimester. Exposed women included 49 with previous surgery, and 31 managed medically or without treatment	Women without diagnosed endometriosis	Placenta previa, postpartum hemorrhage, hypertensive disorders, gestational diabetes, placental abruption, mode of delivery, and operative complications	Gestational age, preterm birth, birth weight, low birth weight, fetal growth, Apgar scores, umbilical artery pH, and neonatal intensive care unit admission

Téoule et al. [16]	Germany; retrospective cohort study at Ulm University Hospital	16,033 primiparous singleton pregnancies; 118 exposed and 15,915 controls	Primiparous women with singleton pregnancies delivering at a tertiary-care university hospital	Histologically confirmed endometriosis diagnosed before conception following laparoscopic surgery; adenomyosis was documented separately in a subgroup	Primiparous women without endometriosis	Primary outcomes: cesarean delivery and preterm birth; key secondary outcome: placenta previa. Additional delivery and pregnancy characteristics were assessed.	Gestational age, preterm birth before 37 weeks, birth weight, neonatal sex, and other available neonatal outcomes
Ibiebele et al. [17]	Australia; population-based cohort using linked New South Wales hospital, perinatal mortality, and assisted reproductive technology records	578,221 index singleton pregnancies during 2006-2015	Female residents of New South Wales aged 15-45 years with a singleton pregnancy reaching at least 20 weeks or a birth weight of at least 400 g	Hospital-recorded endometriosis, examined according to assisted reproductive technology use: endometriosis without ART and endometriosis with ART	Women without endometriosis, separated into pregnancies conceived without ART and with ART	Antepartum hemorrhage, placenta previa, placental abruption, maternal morbidity, induction of labor, cesarean delivery, and planned birth	Preterm birth, low birth weight, small-for-gestational-age birth, large-for-gestational-age birth, stillbirth, and neonatal morbidity
Harada et al. [18]	Japan; prospective nationwide cohort within the Japan Environment and Children's Study	Pregnancies enrolled during 2011-2014; analytical population of 96,655 women, including 3,517 with endometriosis	Pregnant women enrolled in a large national birth cohort with information on medical history, conception, pregnancy, and delivery	Self-reported or medically documented history of endometriosis before or during pregnancy; adenomyosis was evaluated as a separate exposure	Pregnant women without a history of endometriosis	Composite obstetric complications, placenta previa, placental abruption, hypertensive disorders, gestational diabetes, premature rupture of membranes, and mode of delivery	Preterm birth, very preterm birth, fetal growth outcomes, and other perinatal complications
Porpora et al. [19]	Italy; prospective observational cohort at a single institution	425 spontaneously conceived pregnancies; 145 women with endometriosis and 280 controls	Women with spontaneous pregnancies followed for obstetric and neonatal outcomes	Clinically or surgically diagnosed endometriosis; information collected on disease type, location, adenomyosis, previous surgery, and endometriotic lesions	Women with spontaneous pregnancies and no endometriosis	Miscarriage, threatened miscarriage, threatened preterm labor, placental abruption, pregnancy-induced hypertension, preeclampsia, hemoperitoneum, and cesarean delivery	Preterm delivery, neonatal condition, birth weight, fetal well-being, and other neonatal complications
Shahmoradi et al. [20]	Iran; hospital-based case-control study at Hazrat Rasoul Akram Hospital, Tehran	Deliveries from February 2015 to December 2019; 250 women, including 125 cases and 125 controls	Women delivering at the study hospital with retrievable maternal, delivery, and neonatal data.	Endometriosis documented in hospital records; additional assessments considered deep endometriosis, rectal involvement, adenomyosis, and previous surgical treatment	Women without endometriosis matched or selected from the same hospital population.	Placenta previa, placenta accreta, placental abruption, preeclampsia, gestational diabetes, postpartum hemorrhage, cesarean delivery, and other maternal complications	Preterm birth, small-for-gestational-age birth, neonatal intensive care unit admission, and other neonatal outcomes
Lim et al. [21]	South Korea; nationwide retrospective population-based cohort using the Korean Health Insurance Review and Assessment Service database	Singleton deliveries from January 2014 to October 2019; 1,251,597 pregnancies, including 32,951 with endometriosis and 1,218,646 controls	Women with singleton deliveries recorded in the national health insurance database.	Endometriosis identified through healthcare diagnostic records before or during the defined exposure period.	Women without an endometriosis diagnosis	Preterm labor, preeclampsia, gestational diabetes, placenta previa, placental abruption, antepartum hemorrhage, postpartum hemorrhage, blood transfusion, uterine artery embolization, cesarean delivery, and cesarean hysterectomy	Preterm birth, fetal growth restriction, stillbirth, and other perinatal outcomes available in the administrative database
Marcellin et al. [22]	France; prospective multicenter exposed-unexposed cohort	1,351 singleton pregnancies followed before 22 weeks; 470 exposed and 881 controls	Women with singleton pregnancies continuing beyond 22 weeks of gestation	Surgically and phenotypically characterized endometriosis: superficial peritoneal endometriosis, ovarian endometrioma, or deep endometriosis	Pregnant women without endometriosis recruited from the same participating centers	Preeclampsia, placenta previa, postpartum hemorrhage, threatened preterm labor, premature rupture of membranes, cesarean delivery, and other obstetric complications	Primary outcome: preterm birth between 22 weeks and 36 weeks plus 6 days; small-for-gestational-age birth and other neonatal outcomes
	United States;	Deliveries from 2013-2017;	Women with deliveries recorded	Endometriosis identified through All-Payers Claims	Women	Pregnancy-induced hypertension, preeclampsia or	Preterm birth, low birth weight, small-for-gestational-age

Farland et al. [23]	Massachusetts registry-linkage cohort	91,825 deliveries, including 1,560 women with endometriosis	in Massachusetts vital records linked to hospital, claims, and ART databases	Database diagnoses before the index delivery; infertility and ART use were examined as potential modifiers	without endometriosis or uterine fibroids	eclampsia, gestational diabetes, placental abnormalities, cesarean delivery, and other pregnancy complications	birth, respiratory morbidity, prolonged neonatal hospitalization, and other adverse neonatal outcomes
Gebremedhin et al. [24]	Australia; population-based retrospective cohort using Western Australian linked perinatal and hospital data	468,778 women contributing 912,747 singleton live births during 1980-2015; 19,476 exposed live births among 8,874 women	Women with singleton live births recorded in the Western Australian Midwives Notification System	Maternal endometriosis identified through linked hospital morbidity records using diagnostic coding before the relevant pregnancy	Singleton live births among women without recorded endometriosis	Preeclampsia and placenta previa; analyses also considered medically assisted reproduction as a potential explanatory factor	Preterm birth before 37 weeks, with stratified analyses according to medically assisted reproduction

TABLE 1: Characteristics of the included studies

ART: assisted reproductive technology; NIC: neonatal intensive care unit

Risk-of-Bias Assessment

The included studies generally demonstrated acceptable methodological quality, although the strength of evidence varied across designs. The strengths of large population-based or registry-linked cohorts included representative samples, objective ascertainment of outcomes, and multivariable adjustment, which led to low risk of bias. Single-center case-control and observational studies were more likely to be subject to selection bias, residual confounding, and lack of generalizability. The main concerns were variation in the ascertainment of endometriosis, exposure to assisted reproductive technology, parity, and coping strategies. None of the studies was excluded due to methodological quality. Figure *2* shows the domain-level ROBINS-E risk-of-bias judgments for the included studies across seven bias domains, with green indicating low risk and yellow indicating some concerns.

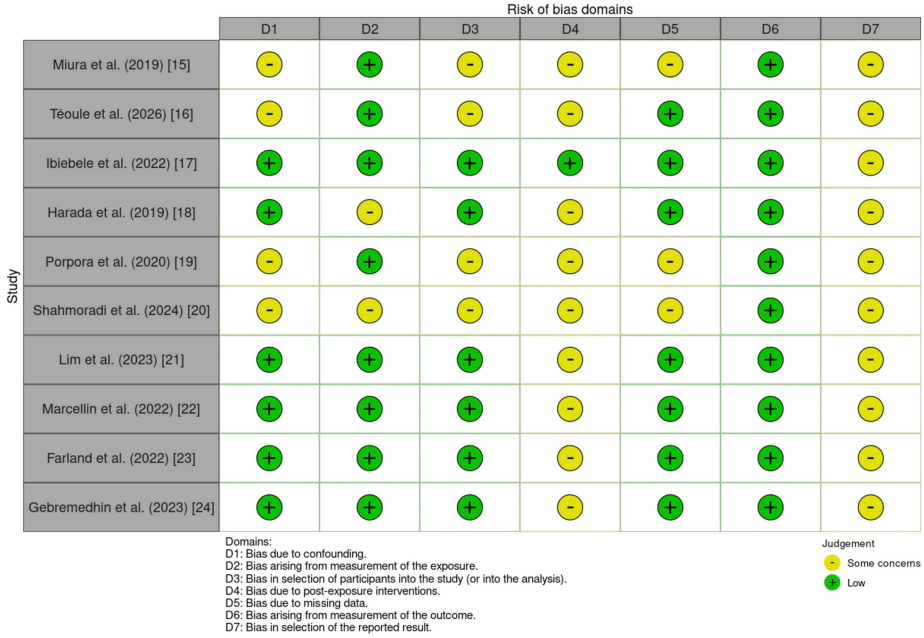


FIGURE 2: Risk-of-bias assessment of the included studies

[15-24]

Association Between Endometriosis and Placenta Previa

The random-effects meta-analysis demonstrated a significant association between endometriosis and placenta previa, with a pooled adjusted odds ratio of 2.98 (95% CI: 2.00-4.45). Statistical heterogeneity was

low to moderate (I^2=34.5%). These findings indicate higher odds of placenta previa among women with endometriosis compared with pregnant women without endometriosis. Figure 3 presents the forest plot of the pooled association between endometriosis and placenta previa.

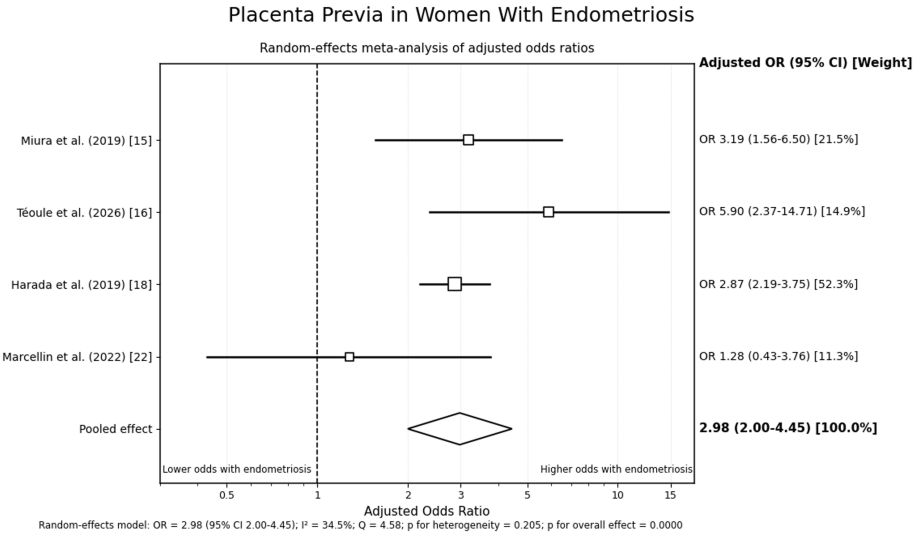


FIGURE 3: Forest plot of placenta previa risk in women with and without endometriosis

[15,16,18,22]

Association Between Endometriosis and Preterm Birth

The limited analysis of preterm birth was performed using five clinically similar cohorts. Study-level adjusted estimates varied between 0.75 and 1.32. For the random-effects model, there was a significant association between endometriosis and preterm birth with a pooled adjusted mixed-measure sensitivity estimate of 1.24 (95% CI: 1.14-1.36). Statistical heterogeneity was low (I^2=10.2%, Q=4.45, p=0.348). Adjusted odds ratios and risk ratios were combined using the rare-outcome approximation; therefore, the pooled estimate was interpreted as a sensitivity analysis rather than a uniform measure-specific primary analysis. Figure 4 shows the random-effects sensitivity analysis of adjusted effect estimates for preterm birth among women with and without endometriosis.

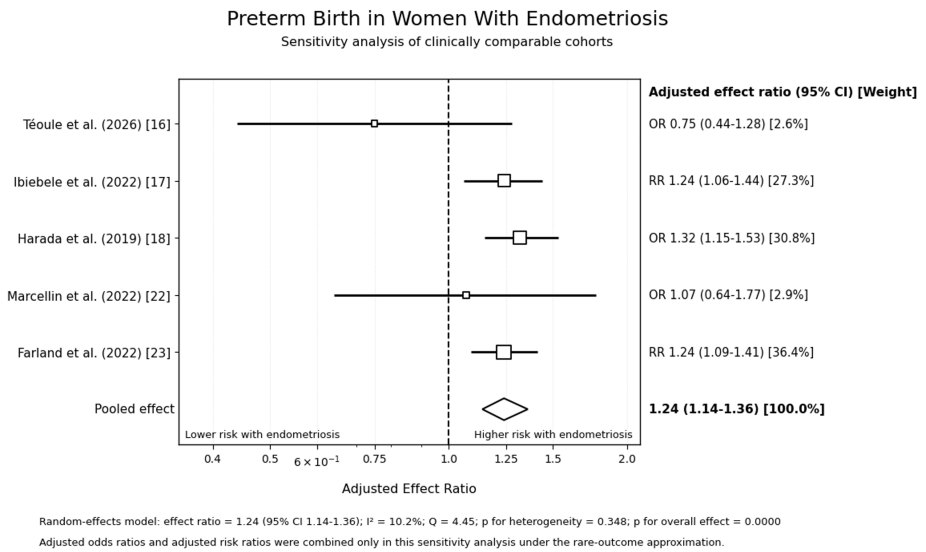


FIGURE 4: Forest plot of preterm birth risk in women with and without endometriosis

[16-18,22,23]

Additional Maternal and Neonatal Outcomes

The remaining studies measured the incidence of hypertensive disorders, gestational diabetes, cesarean delivery, antepartum and postpartum hemorrhage, placental abruption, fetal growth restriction, low birth weight, small-for-gestational-age birth, stillbirth, admission to the neonatal intensive care unit, and neonatal respiratory morbidity. For most outcomes, the direction of the difference was in favor of greater obstetric/neonatal risk in women with endometriosis, but the difference was not statistically significant. Limited numbers of studies, definition problems, effect measure problems, and significant heterogeneity prevented quantitative pooling. The findings from these were kept in the narrative synthesis to capture the broader range of pregnancy complications.

Discussion

The results of this systematic review and meta-analysis suggest an increased risk of selected adverse pregnancy outcomes in women with endometriosis, particularly placenta previa and preterm birth. The pooled analysis revealed almost three times the odds of placenta previa among women with endometriosis, with low to moderate heterogeneity. This finding is clinically relevant because placenta previa is associated with antepartum bleeding, operative delivery, postpartum hemorrhage, the need for transfusion, and increased maternal and neonatal morbidity. These findings suggest an association between endometriosis and placenta previa, although differences in study populations and clinical characteristics should be considered when interpreting the results [25].

There is a biological association between endometriosis and placenta previa [26]. Endometriosis can change the uterine and pelvic microenvironment by inducing chronic inflammation, resistance to progesterone, failure of decidualization, and abnormal endometrial receptivity [19]. These modifications could affect the selection of the implantation site and the morphology of the placenta [21]. The localization of the placenta may be abnormal due to previous pelvic surgery, adhesions, a change in uterine tone, and/or distortion of the pelvic anatomy [24]. Although the pooled findings suggest an association across studies, differences in study design, exposure ascertainment, and covariate adjustment may influence the estimates. Low to moderate statistical heterogeneity does not establish that the underlying risk is identical across clinically diverse populations.

The pooled adjusted mixed-measure sensitivity estimate for the preterm birth analysis was 1.24 with low heterogeneity, suggesting an association between endometriosis and a higher likelihood of preterm delivery, although the estimate should not be interpreted as a conventional risk ratio. This smaller association compared with placenta previa may reflect the involvement of maternal, placental, fetal, and treatment-related factors. Earlier delivery might be due to endometriosis-associated inflammation, changes in immune regulation, placentation, the rupture of membranes, and increased obstetric intervention [27]. Although the included studies reported odds ratios and risk ratios, the low degree of heterogeneity does not establish equivalence between these effect measures.

The preterm birth results are generally consistent with previous observational syntheses, which found increased preterm birth rates in women with endometriosis [16]. Other evidence suggests that the association might remain after controlling for maternal age, parity, infertility, and assisted reproduction technology. The present analysis pooled adjusted estimates from clinically comparable groups, although differences in adjustment strategies may remain [19]. The sensitivity analysis combined adjusted odds ratios and risk ratios using the rare-outcome approximation, and the resulting estimate should be interpreted cautiously because these measures are not directly interchangeable.

Beyond placenta previa and preterm birth, the narrative synthesis examined other maternal and neonatal complications [20]. The majority of these studies found higher rates of hypertensive disorders, gestational diabetes, placental abruption, antepartum or postpartum hemorrhage, cesarean delivery, fetal growth restriction, low birth weight, stillbirth, admission to the neonatal intensive care unit, and respiratory morbidity [20,22]. However, the statistical significance and consistency of these associations varied across studies because of differences in sample size, diagnostic criteria, outcome definitions, disease phenotype, and covariate adjustment.

The findings are consistent with earlier research indicating that women with endometriosis have an increased likelihood of cesarean delivery [28]. This association may be related to placenta previa, previous pelvic surgery, adhesions, deep disease, maternal preference, clinician caution, and increased obstetric intervention [13]. Previous evidence has also described associations with hemorrhagic and placental complications, although the underlying mechanisms remain uncertain [29]. Evidence regarding hypertensive disorders, gestational diabetes, fetal growth abnormalities, and neonatal morbidity was less consistent, suggesting that these outcomes may also be influenced by comorbidities, reproductive characteristics, and differences between study populations [30].

Recent evidence published after the predefined literature search cut-off of June 30, 2026, provides additional context for these findings. A subsequent systematic review and meta-analysis involving 24 cohort studies reported an association between endometriosis and preterm birth (RR 1.36, 95% CI 1.26-1.46), although substantial heterogeneity was observed [31]. Similarly, a population-based cohort study reported increased odds of preterm birth among women with histologically confirmed endometriosis (aOR 1.43, 95% CI 1.37-1.50), alongside other adverse obstetric and neonatal outcomes [32]. These findings are broadly consistent with the present review; however, both studies were published after the original search period and were therefore not included in the quantitative synthesis.

The results of this study have clinical implications. Endometriosis may be considered during preconception assessment and antenatal risk stratification, particularly regarding placental location and the possibility of preterm delivery [27]. Ultrasound evaluation of placentation, monitoring for bleeding, and awareness of the risk for preterm labor may be considered as potential clinical measures in affected pregnancies. These are proposed clinical considerations, as the observational evidence does not establish whether intensified surveillance improves maternal or neonatal outcomes. Additional factors relevant to delivery planning include placenta previa, previous pelvic surgery, and deep infiltrating disease. Individualized obstetric management should therefore consider disease history, mode of conception, placental findings, and other relevant clinical factors.

Limitations and Future Recommendations

The interpretation of the findings is limited by the observational design of all included studies, as the pooled estimates may be affected by residual confounding and exposure misclassification. The definition and severity of endometriosis varied according to the diagnostic methods used, including surgical confirmation, self-report, clinical diagnosis, and administrative coding. Differences in maternal age, parity, assisted reproductive technology, adenomyosis, previous surgery, outcome definitions, and covariate adjustment also affected comparability across studies. The limited number of studies included in each meta-analysis restricted the assessment of publication bias and additional subgroup analyses. Furthermore, the preterm birth sensitivity analysis combined adjusted ORs and RRs, which are not directly interchangeable and may introduce uncertainty in interpreting the pooled estimate.

Future studies should adopt prospective, multicenter designs with consistent diagnostic criteria and standardized definitions of maternal and neonatal outcomes and endometriosis phenotypes. Analyses should distinguish between spontaneous and assisted conceptions and consistently adjust for relevant factors, including maternal age, parity, comorbidities, previous surgery, and adenomyosis. Individual patient data meta-analyses or sufficiently powered disease-specific studies may help clarify whether endometriosis location, severity, or treatment history influences pregnancy outcomes.

Conclusions

The systematic review and meta-analysis show that endometriosis is associated with an increased risk of certain adverse pregnancy outcomes, including placenta previa and preterm birth. Overall, the combined results indicated almost three times greater odds of placenta previa and a small but statistically significant

association with preterm birth in women with endometriosis compared with those without. The wider narrative synthesis also suggested possible associations with other maternal and neonatal complications, including hypertensive disorders, hemorrhagic complications, cesarean section, fetal growth abnormalities, stillbirth, admission to the neonatal intensive care unit, and respiratory morbidity. These findings suggest that endometriosis may be considered during individualized antenatal risk assessment and delivery planning, although the benefits of intensified surveillance have not been established by the included observational studies. Due to the observational nature of the studies, the findings should be interpreted cautiously because of differences in exposure definitions, effect measures, and covariate adjustment across studies. Overall, the results underscore the clinical importance of endometriosis beyond its impact on fertility and highlight its associations with placentation, gestational duration, maternal morbidity, and neonatal outcomes.

Appendices

Database-specific search strategies

The complete search strategies used for PubMed/MEDLINE, Scopus, Web of Science Core Collection, and Google Scholar, including search dates and eligibility restrictions.

Database	Complete search strategy	Search date	Filters and restrictions
PubMed/MEDLINE	("Endometriosis"[MeSH] OR endometriosis OR endometriotic) AND ("Pregnancy"[MeSH] OR pregnancy OR pregnant OR gestation OR obstetric) AND ("Pregnancy Outcome"[MeSH] OR "pregnancy outcome" OR maternal OR neonatal OR perinatal OR "placenta previa" OR preterm OR premature OR preeclampsia OR haemorrhage OR "gestational diabetes" OR cesarean OR "fetal growth restriction" OR "low birth weight" OR stillbirth)	June 30, 2026	Human pregnancy studies; comparative observational designs
Scopus	TITLE-ABS-KEY(endometriosis OR endometriotic) AND TITLE-ABS-KEY(pregnancy OR pregnant OR gestation OR obstetric) AND TITLE-ABS-KEY("pregnancy outcome" OR maternal OR neonatal OR perinatal OR "placenta previa" OR preterm OR premature OR preeclampsia OR haemorrhage OR "gestational diabetes" OR cesarean OR "fetal growth restriction" OR "low birth weight" OR stillbirth)	June 30, 2026	Human pregnancy studies; comparative cohort, case-control, registry-linkage, and population-based designs
Web of Science Core Collection	TS=(endometriosis OR endometriotic) AND TS=(pregnancy OR pregnant OR gestation OR obstetric) AND TS=("pregnancy outcome" OR maternal OR neonatal OR perinatal OR "placenta previa" OR preterm OR premature OR preeclampsia OR haemorrhage OR "gestational diabetes" OR cesarean OR "fetal growth restriction" OR "low birth weight" OR stillbirth)	June 30, 2026	Human pregnancy studies; comparative observational designs
Google Scholar	"endometriosis" "pregnancy outcomes"; "endometriosis" "placenta previa"; "endometriosis" "preterm birth"; "endometriosis" "maternal" "neonatal"; "endometriosis" "gestational diabetes"; "endometriosis" "fetal growth restriction"; "endometriosis" "stillbirth"	June 30, 2026	Human pregnancy studies; comparative observational designs

TABLE 2: Database-specific search strategies, search dates, and eligibility restrictions

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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