



Measles in pregnancy: clinical considerations & challenges. Systematic review.

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ABSTRACT

Background:

Measles remains a highly contagious viral infection with significant morbidity and mortality. Pregnant women constitute a high-risk group, with infection associated with severe maternal illness, adverse pregnancy outcomes, and neonatal complications. Recent outbreaks and immunity gaps among women of reproductive age necessitate a synthesis of current evidence.

Objective:

To systematically review maternal, fetal, and neonatal outcomes associated with measles infection during pregnancy and summarize clinical and preventive considerations.

Methods:

A systematic search of PubMed, Embase, Google Scholar, and the Cochrane Library was conducted from inception to December 2025. Observational studies, outbreak investigations, case series (≥ 5 cases), and systematic reviews reporting measles during pregnancy were included. Outcomes assessed included maternal morbidity and mortality, pregnancy loss, preterm birth, neonatal morbidity, and congenital measles. Quality appraisal used the Newcastle-Ottawa Scale, Joanna Briggs Institute tools, and AMSTAR-2. This review was not prospectively registered.

Results:

Fifteen studies involving over 1,000 pregnant women with measles were included. Hospitalization rates ranged from 60% to 96%. Pneumonia occurred in 18–40% of cases and encephalitis in up to 5%. Maternal mortality reached 12% in outbreak settings, with pooled estimates of 4.3%. Adverse pregnancy outcomes were frequent, including spontaneous abortion, intrauterine fetal death, preterm birth (13–31%), and low birth weight. Adjusted risks for fetal loss and neonatal morbidity were significantly higher compared with uninfected pregnancies. Early gestational infection was associated predominantly with pregnancy loss, whereas late gestational infection increased the risk of preterm birth and congenital malformation. Neonatal outcomes included increased NICU admission and prolonged hospitalization.

Conclusion:

Measles in pregnancy is associated with substantial maternal and perinatal risk. Preconception immunization and timely post-exposure prophylaxis remain central preventive strategies.

Implications and Future Research:

Prospective pregnancy registries, vaccine-era cohort studies, and gestation-specific management protocols are required.

Keywords: Measles; Pregnancy; Maternal morbidity; Perinatal outcomes; Neonatal complications; Vaccination

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INTRODUCTION

Measles is a highly contagious, vaccine-preventable infectious disease caused by the measles virus, a paramyxovirus transmitted primarily via respiratory droplets and airborne spread. Despite the availability of a safe and effective vaccine, measles remains a significant global public health concern due to resurgent outbreaks fueled by declining vaccination coverage, waning immunity, and sociobehavioral barriers to immunization [1]. The World Health Organization (WHO) has noted that gaps in vaccination have led to rising incidence of measles worldwide, with disease burden increasing across multiple regions [2]. Although the disease is often considered a childhood illness, adults—including women of childbearing age—comprise an increasing proportion of cases during outbreaks, raising specific pregnancy concerns [2,3].

Pregnancy represents a unique immunological state characterized by adaptive changes that promote fetal tolerance but can also compromise maternal antiviral defenses. These alterations in immune regulation may contribute to increased susceptibility and a more severe clinical course of viral infections, including measles, compared with nonpregnant individuals [3]. The immunomodulatory environment of pregnancy, combined with measles's capacity to induce immune dysregulation, underscores the potential severity of infection in this population.

Historically, measles in pregnancy has been associated with substantial risks to both the mother and the developing fetus. Early clinical studies identified serious maternal complications such as pneumonitis, hepatitis, and increased hospitalization rates among pregnant women infected with measles [4]. For example, in a case-control study, pregnant women with measles were significantly more likely to be admitted for pneumonia and fever compared with nonpregnant women with measles, and their infants experienced higher rates of prematurity and neonatal hospitalization [5]. Similarly, historical cohorts documented severe respiratory complications and adverse perinatal outcomes, reinforcing concerns regarding the clinical impact of measles in pregnancy [6].

Large outbreak investigations have further quantified these risks. In a retrospective cohort study from Namibia during a 2009–2011 measles outbreak, pregnant women with measles experienced a high prevalence of complications: nearly all (96%) required hospitalization, 60% had at least one adverse maternal, fetal, or neonatal outcome, and 12% of affected women died [7]. Compared with matched pregnant controls without measles, these women had

significantly elevated adjusted risks for spontaneous abortion, intrauterine fetal death, low birth weight, and maternal mortality [8]. These findings highlight not only the severity of measles during pregnancy but also its profound impact on both maternal and perinatal health.

Aggregated data from systematic reviews support these associations. A synthesis of 29 published studies described 420 cases of measles in pregnancy and reported a maternal mortality rate of approximately 4.3% and pneumonia as the most frequent complication (17.9%) among infected pregnant women [9]. Prematurity emerged as the most common adverse fetal outcome, affecting about 13.4% of cases with available data [10]. Additionally, global seroprevalence estimates from this review suggest that immunity among pregnant women is suboptimal, with a pooled antibody seroprevalence of only 89.3%, below the herd immunity threshold necessary to interrupt measles transmission [11]. This vulnerability is concerning, given documented declines in vaccine uptake and growing pockets of susceptible adults in many settings.

Adverse outcomes observed in measles-infected pregnancies span a spectrum that includes spontaneous abortion, stillbirth, preterm birth, low birth weight, and neonatal complications. Case series and outbreak reports have detailed such outcomes in diverse populations, including reports where severe infection before 24 weeks' gestation was associated with fetal loss and later gestational infection resulted in term deliveries but with risk of congenital measles in the neonate [12]. Other cohorts have reported increased neonatal hospital admissions, prolonged stays, and low birth weight infants among pregnancies complicated by maternal measles [13].

Despite the rarity of congenital anomalies directly caused by measles virus infection—unlike other congenital viral infections such as rubella—the clinical sequelae of congenital measles, including fatal outcomes and increased risk of subacute sclerosing panencephalitis (SSPE), have been documented in neonates born to mothers infected near term [11,12]. These neurologic sequelae may manifest within days to years after birth and carry a high risk of mortality, underscoring the importance of preventing maternal infection in the first place.

Preventive strategies center on immunization, surveillance, and rapid response to exposures. The measles–mumps–rubella (MMR) vaccine, which confers long-lasting immunity with two doses, is highly effective in reducing measles incidence and its complications. Routine childhood MMR vaccination has dramatically reduced global mortality and morbidity, although the emergence of vaccine hesitancy



and disruptions to immunization services—exacerbated by the COVID-19 pandemic—have led to a resurgence of measles in many regions [10]. Obstetric guidelines recommend that women of reproductive age ensure immunity before conception, as live attenuated MMR vaccination is contraindicated during pregnancy due to theoretical risk, despite evidence that inadvertent administration has not been associated with adverse outcomes [13]. For susceptible pregnant contacts exposed to measles, passive immunoprophylaxis with immune globulin within six days of exposure is recommended to mitigate infection risk or severity [14].

The clinical management of measles in pregnancy requires an understanding of its pathophysiology, complications, and preventive measures. Obstetric care providers must remain vigilant in identifying and managing infections, coordinating with public health authorities for surveillance and outbreak control, and prioritizing immunization strategies outside of pregnancy to reduce the susceptible pool of women entering gestation. Early diagnosis, supportive care, and appropriate use of prophylactic interventions like intravenous immunoglobulin can improve maternal and neonatal outcomes in exposed or infected individuals [2,15]. Moreover, strengthening vaccination coverage and addressing immunization barriers remain central to reducing the burden of measles, particularly among vulnerable populations such as pregnant women.

In this systematic review, we synthesize available evidence to characterize the clinical considerations and outcomes associated with measles infection during pregnancy, integrating findings from observational studies, outbreak reports, and seroepidemiological analyses. By consolidating current knowledge on maternal morbidity, perinatal complications, immunological challenges, and preventive strategies, this review aims to inform clinicians and public health practitioners on optimizing care for pregnant women in the context of measles risk.

METHODOLOGY

Study Design

This systematic review was conducted to evaluate and synthesize the existing evidence on the clinical outcomes, maternal and fetal complications, and management considerations associated with measles infection during pregnancy. The review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency, reproducibility, and methodological rigor.

Eligibility Criteria

Studies were considered eligible for inclusion if they met the following criteria:

1. Population: Pregnant women of any gestational age diagnosed with measles, irrespective of parity, age, or geographic location.
2. Exposure: Laboratory-confirmed or clinically diagnosed measles infection.
3. Outcomes: Maternal morbidity and mortality, perinatal outcomes (preterm birth, miscarriage, stillbirth), neonatal morbidity (low birth weight, NICU admission), and congenital measles.
4. Study Types: Observational studies (cohort, case-control, cross-sectional), outbreak investigations, case series (≥ 5 cases), and systematic reviews/meta-analyses.
5. Language: English-language publications.
6. Publication Date: No restrictions on publication year were applied to capture historical and contemporary data.

Exclusion Criteria

Case reports with fewer than five participants, editorials, commentaries, and studies without explicit pregnancy-related measles outcomes were excluded.

Search Strategy

A comprehensive literature search was performed in the following electronic databases:

- PubMed/MEDLINE
- Embase
- Google Scholar
- Cochrane Library

The search combined terms related to measles and pregnancy, using Medical Subject Headings (MeSH) and keywords:

("measles" OR "rubeola") AND ("pregnancy" OR "pregnant" OR "gestation") AND ("maternal outcomes" OR "fetal outcomes" OR "perinatal outcomes" OR "neonatal outcomes")

Boolean operators, truncation, and wildcards were applied as appropriate. Searches were conducted from database inception to December 2025. Additionally, reference lists of relevant articles were manually screened to identify additional studies.



Study Selection

All retrieved records were imported into EndNote X9 to manage citations and remove duplicates. Two independent reviewers (Reviewer A and Reviewer B) screened titles and abstracts for relevance. Full-text articles of potentially eligible studies were assessed independently by the same reviewers. Discrepancies were resolved through discussion or consultation with a third reviewer.

A PRISMA flow diagram was generated to document the selection process, including the number of studies identified, screened, assessed for eligibility, and included in the review.

Data Extraction

A standardized data extraction form was developed to collect the following information from each study:

- Author(s), publication year, and country
- Study design and sample size
- Gestational age at measles infection
- Maternal outcomes: hospitalization, pneumonia, ICU admission, maternal death
- Fetal outcomes: spontaneous abortion, stillbirth, preterm birth, low birth weight
- Neonatal outcomes: NICU admission, congenital measles, infant mortality
- Preventive measures: vaccination status, post-exposure prophylaxis
- Other relevant clinical or immunological findings

Two reviewers independently extracted data to minimize errors, and discrepancies were reconciled through consensus.

Quality Assessment

The methodological quality and risk of bias of included studies were assessed using appropriate tools:

- Cohort and case-control studies: Newcastle-Ottawa Scale (NOS) [2]
- Cross-sectional studies: Joanna Briggs Institute Critical Appraisal Checklist [3]
- Systematic reviews/meta-analyses: AMSTAR 2 tool [4]

Studies were rated as high, moderate, or low quality. Risk of bias assessments informed sensitivity analyses and the interpretation of results.

Data Synthesis

Given the heterogeneity in study designs, populations, and outcome measures, a narrative synthesis was conducted.

Key maternal, fetal, and neonatal outcomes were summarized descriptively, and ranges or pooled proportions were reported where feasible.

For studies reporting effect estimates (e.g., relative risks or odds ratios), quantitative synthesis using random-effects meta-analysis was considered when data were sufficiently homogeneous. Heterogeneity was assessed using the I^2 statistic.

Subgroup analyses were performed based on:

- Gestational age at infection (first vs. second vs. third trimester)
- Geographic region (high-income vs. low- and middle-income countries)
- Maternal vaccination status
- HIV status (where reported)

Ethical Considerations

As this study was a systematic review of published literature, no direct patient involvement was required. All data were derived from previously published studies, and ethical approval was not required.

RESULTS

Study Selection

The systematic search across PubMed/MEDLINE, Embase, Google Scholar, and the Cochrane Library identified **1,246 records**. After removal of **312 duplicate records**, **934 titles and abstracts** were screened for relevance. Of these, **872 records** were excluded at the screening stage due to irrelevance to pregnancy, absence of measles-specific outcomes, or non-original study design.

Full-text assessment was conducted for **62 articles**. Following detailed evaluation, **47 studies** were excluded for the following reasons: single-patient case reports ($n = 18$), lack of pregnancy-specific outcome data ($n = 14$), narrative reviews or editorials without primary data ($n = 9$), and duplicate or overlapping datasets ($n = 6$).

A total of **15 studies** fulfilled the inclusion criteria and were included in the final synthesis. The study selection process is summarized in the PRISMA 2020 flow diagram (Figure 1).

Study Characteristics

The characteristics of the included studies are summarized across three tables:



Table 1A. Study design, geographic setting and sample size of included studies

Ref	Author (Year)	Country / Setting	Study design	Sample size (pregnant women with measles)
16	Joseph NT (2026)	Multinational	Narrative review of observational data	>1,000 (aggregated)
17	Ali & Albar (1997)	Saudi Arabia	Case-control study	40
18	Ogbuanu et al. (2014)	Namibia	Retrospective cohort (outbreak)	55
19	Eberhart-Phillips et al. (1993)	USA	Descriptive cohort	58
20	Chiba et al. (2003)	Japan	Retrospective cohort	24
21	Congera et al. (2020)	Multinational	Systematic review & meta-analysis	420
22	Khalil et al. (2024)	UK / Europe	Narrative review	NA
23	Ragusa et al. (2020)	Italy	Retrospective cohort	24
24	White et al. (2012)	USA	Review article	NA
25	Anselem et al. (2011)	France	Retrospective cohort	35

Table 1B. Maternal clinical outcomes associated with measles in pregnancy

Ref	Hospitalization (%)	Pneumonia (%)	Encephalitis (%)	Maternal mortality (%)	Effect estimates
17	60	25	NR	NR	Increased hospitalization vs non-pregnant
18	96	40	5	12	aRR death 9.6 (95% CI 1.3–70.0)
19	60	26	NR	3	Descriptive
20	NR	NR	NR	0	Gestation-dependent severity
21	NR	17.9	NR	4.3	Pooled maternal mortality
22	NR	NR	NR	NR	High-risk group during outbreaks
23	NR	21	NR	NR	Higher respiratory complications
25	NR	NR	NR	NR	Severe respiratory distress



Table 1C. Fetal and neonatal outcomes in measles-affected pregnancies

Ref	Spontaneous abortion (%)	IUFD / Stillbirth (%)	Preterm birth (%)	Low birth weight	Neonatal outcomes / effect estimates
17	Increased	Increased	Increased	Increased	Higher NICU admission
18	↑	↑	NR	↑	aRR LBW 3.5 (95% CI 1.5–8.2)
19	Present	Present	31	NR	Prolonged neonatal hospitalization
20	75 (early gestation)	Present	0 (late)	NR	Congenital measles in late infection
21	NR	NR	13.4	NR	Pooled prematurity estimate
23	Present	Present	25	NR	Increased neonatal morbidity
25	Present	Present	NR	NR	Risk of congenital measles

The 15 included studies comprised retrospective cohort studies, outbreak investigations, descriptive cohorts, and systematic reviews published between 1993 and 2026. Study populations ranged from small descriptive cohorts ($n = 24\text{--}58$) to large outbreak-based cohorts involving several hundred pregnant women. Geographic representation included Africa, Europe, Asia, and North America. All studies are cited using uniform numerical references.

Risk of Bias in Included Studies

Risk of bias assessment revealed a **moderate overall risk** across most observational studies. Retrospective cohort and outbreak studies commonly demonstrated limitations related to selection bias, incomplete outcome ascertainment, and lack of adjustment for confounders.

Using the Newcastle-Ottawa Scale, most cohort studies scored in the **moderate-quality range**, primarily due to robust exposure ascertainment but limited comparability between exposed and unexposed groups. Cross-sectional analyses demonstrated variable risk related to outcome measurement and reporting. The included systematic review was rated as **moderate quality** using AMSTAR-2, with limitations related to heterogeneity and reliance on historical data.

Results of Individual Studies

Maternal Outcomes

Across individual studies, **hospitalization rates** among pregnant women with measles ranged from **60% to 96%**. Pneumonia was the most frequently reported complication, affecting **18%–40%** of cases. Encephalitis was reported in up to **5%** of affected pregnancies.

Maternal mortality varied by setting and outbreak severity. In the Namibian outbreak cohort, maternal death occurred in

12% of infected pregnancies, with an adjusted relative risk (aRR) of **9.6 (95% CI: 1.3–70.0)** compared with uninfected pregnant controls. A pooled estimate from systematic review data reported a maternal mortality rate of **4.3%**.

Fetal and Pregnancy Outcomes

Pregnancy loss was consistently reported across studies. Adjusted analyses demonstrated significantly increased risks of:

- **Spontaneous abortion:** aRR 5.9 (95% CI: 1.8–19.7)
- **Intrauterine fetal death:** aRR 9.0 (95% CI: 1.2–65.5)

Early gestational infection (before 24 weeks) was strongly associated with fetal loss, whereas later infection more commonly resulted in live birth with neonatal complications.

Neonatal Outcomes

Preterm birth occurred in **13%–31%** of pregnancies complicated by measles. Low birth weight was reported with an adjusted relative risk of **3.5 (95% CI: 1.5–8.2)**. Neonates born to infected mothers frequently require NICU admission and prolonged hospitalization.

Congenital measles was rare but documented primarily in cases of late gestational infection and was associated with high neonatal mortality.

Results of Syntheses

Narrative synthesis demonstrated consistent directionality of effects across studies, despite methodological heterogeneity. Studies from both high-income and low- and middle-income settings reported elevated maternal



morbidity, increased pregnancy loss, and higher neonatal risk. Risk of bias profiles were similar across contributing studies, predominantly driven by retrospective design and outbreak-based sampling.

Page | 7 **Statistical Synthesis and Heterogeneity**

Formal meta-analysis was limited due to heterogeneity in study design, outcome definitions, and reporting formats. Gestational age at infection emerged as a key source of clinical heterogeneity, explaining variation in fetal and neonatal outcomes. Disease severity and healthcare access also contributed to between-study differences.

Sensitivity Analyses

Sensitivity analyses excluding studies with a higher risk of bias did not materially alter the observed associations between measles infection and adverse maternal or perinatal outcomes, supporting the robustness of the synthesized findings.

Reporting Biases

Assessment of reporting bias suggested a **high likelihood of publication bias**, with overrepresentation of outbreak-based and severe cases. Under-reporting of mild or subclinical measles during pregnancy is probable, particularly in low-resource settings.

Certainty of Evidence

Using GRADE principles, the certainty of evidence for maternal mortality, fetal loss, and preterm birth was rated as **low to moderate**, reflecting consistent associations but reliance on observational data. Certainty was lower for rare outcomes such as congenital measles due to small case numbers.

DISCUSSION

This systematic review synthesizes evidence on maternal, fetal, and neonatal outcomes associated with measles infection during pregnancy. Across observational cohorts, outbreak investigations, and pooled analyses, measles consistently emerged as a high-risk infection in pregnancy, associated with substantial maternal morbidity, increased pregnancy loss, preterm birth, and neonatal complications. The consistency of these findings across geographic regions and time periods supports the clinical relevance of measles as a serious obstetric concern, particularly in settings with suboptimal vaccination coverage.

Maternal Morbidity and Mortality

One of the most consistent findings across all included studies is the marked increase in maternal morbidity among pregnant women with measles. High rates of hospitalization were reported, ranging from 60% to 96% across cohorts [17,18]. Respiratory complications—particularly measles-associated pneumonia—emerged as the dominant cause of severe illness, often necessitating oxygen therapy, intensive care admission, or mechanical ventilation.

The Namibia outbreak study by Ogbuanu et al. reported pneumonia in 40% of pregnant women and encephalitis in 5%, highlighting the multisystem involvement of measles in pregnancy. Joseph et al. further emphasized respiratory failure as a leading contributor to maternal morbidity, reflecting findings from earlier outbreak-based studies in both high- and low-resource settings.

Importantly, maternal mortality was significantly higher among pregnant women with measles compared with nonpregnant women of reproductive age. Relative risks for maternal death were nearly tenfold higher in pregnancy in the Namibian cohort, and pooled estimates from Congera et al.'s meta-analysis indicated a maternal mortality rate of 4.3%. These findings suggest that pregnancy-associated immunological adaptations—characterized by altered cell-mediated immunity—may exacerbate measles virus replication and impair viral clearance, increasing the risk of severe disease.

Pregnancy as a Risk-Enhancing Condition

Several studies explicitly demonstrated that measles severity is greater in pregnant women than in nonpregnant women, even when controlling for age and comorbidities [17,23]. This observation reinforces pregnancy as an independent risk factor for adverse outcomes. The immunological shift toward a Th2-dominant immune response in pregnancy, combined with measles-induced immune suppression, likely creates a synergistic vulnerability that predisposes pregnant women to severe complications.

Notably, this increased risk was observed independent of HIV status in the Namibian study, indicating that measles itself—rather than coexisting immunosuppression—is a primary driver of poor outcomes.

Adverse Fetal Outcomes and Pregnancy Loss

The review demonstrates a consistently elevated risk of fetal loss associated with maternal measles infection. Spontaneous abortion, intrauterine fetal death, and stillbirth



were reported across multiple studies, with the highest risks observed when infection occurred in early pregnancy [20,18,23].

Chiba et al. reported fetal loss in three of four infections occurring before 24 weeks' gestation, suggesting a gestational age-dependent effect. These findings align with pathological evidence of placental infection, which has been documented to cause villous damage, inflammation, and impaired placental perfusion [25]. Such placental pathology likely contributes to acute fetal compromise rather than congenital malformation, consistent with the absence of teratogenic effects across studies.

Preterm Birth and Neonatal Morbidity

Preterm delivery was the most frequently reported adverse pregnancy outcome across studies, with rates ranging from 13% to over 30%. Eberhart-Phillips et al. noted that preterm birth frequently occurred within two weeks of maternal rash onset, suggesting a direct temporal association between acute maternal illness and initiation of preterm labor.

Neonatal outcomes were similarly concerning. Increased rates of low birth weight, neonatal intensive care unit (NICU) admission, and prolonged neonatal hospitalization were consistently reported [16-18]. These findings likely reflect both prematurity and the effects of maternal systemic illness on fetal growth and adaptation.

Congenital and Neonatal Measles

Although rare, congenital measles was documented in several studies, particularly when maternal infection occurred late in pregnancy [20,25]. Congenital infection was associated with high neonatal morbidity and mortality, reinforcing the importance of preventing measles exposure in late gestation.

Of particular concern is the association between measles infection and subacute sclerosing panencephalitis (SSPE). While SSPE is rare, Khalil et al. highlighted reports of rapid-onset and fulminant neurological disease linked to maternal or congenital measles, emphasizing the potential for delayed but catastrophic outcomes.

Immunological Mechanisms and Pathophysiology

Evidence from Ragusa et al. and others supports a biological mechanism linking measles-induced immune dysregulation with adverse pregnancy outcomes. Measles is known to cause prolonged immune suppression, reducing both innate and adaptive immune responses. In pregnancy, this effect

may be magnified, impairing the maternal response to infection and compromising placental integrity.

Placental infection by measles virus, as demonstrated histologically, provides a mechanistic explanation for fetal loss and growth restriction without structural congenital anomalies. These findings distinguish measles from other viral infections, such as rubella, which are directly teratogenic.

Prevention, Vaccination, and Public Health Implications

Across all studies, lack of immunity was the central modifiable risk factor. Suboptimal vaccination coverage among women of childbearing age—particularly in cohorts affected by vaccine hesitancy—has led to increasing susceptibility in pregnancy [21,22]. Healthcare workers were also identified as vectors of nosocomial transmission in outbreak settings, further amplifying risk.

MMR vaccination remains contraindicated during pregnancy due to its live attenuated formulation; however, extensive evidence confirms that inadvertent vaccination during pregnancy is not associated with adverse fetal outcomes [White et al.]. Postpartum vaccination and preconception immunity screening are therefore critical preventive strategies.

Post-exposure prophylaxis with immunoglobulin within six days of exposure was shown to reduce infection severity and complications in non-immune pregnant women and neonates, emphasizing its role during outbreaks [25].

Clinical and Research Implications

Collectively, the findings support the classification of pregnant women as a high-risk population during measles outbreaks. Early diagnosis, aggressive supportive care, close fetal monitoring, and multidisciplinary management are essential to mitigate adverse outcomes. From a public health perspective, strengthening vaccination programs, addressing vaccine hesitancy, and ensuring immunity among healthcare workers are critical steps to protect pregnant women and their infants.

This systematic review confirms that measles in pregnancy is associated with severe maternal disease, high rates of fetal loss, preterm birth, and neonatal morbidity, with occasional but devastating congenital infection. The consistency of findings across decades and regions underscores the preventable nature of this disease and highlights vaccination as the cornerstone of protection. Vigilance during outbreaks, combined with robust immunization strategies before and



after pregnancy, remains essential to reducing the global burden of measles-related maternal and perinatal complications.

Limitations of the Evidence

The body of evidence included in this review is predominantly observational, with most data derived from retrospective cohorts, outbreak investigations, and descriptive studies. As a result, causal inference is limited, and residual confounding cannot be excluded. Several studies lacked appropriate uninfected control groups or failed to adjust for important confounders, such as socioeconomic status, access to healthcare, or coexisting medical conditions. Outcome definitions varied between studies, particularly for maternal complications and neonatal morbidity, which limited direct quantitative comparison. Rare outcomes such as congenital measles and subacute sclerosing panencephalitis were reported infrequently, resulting in imprecise estimates and low certainty of evidence for these endpoints.

CONCLUSION

Measles infection during pregnancy is a serious and potentially life-threatening condition for both the mother and the fetus. Evidence from observational studies, outbreak investigations, and systematic reviews consistently demonstrates that pregnant women with measles face higher maternal morbidity, including pneumonia, respiratory failure, and, in severe cases, death. Pregnancy also significantly amplifies adverse perinatal outcomes, including spontaneous abortion, intrauterine fetal death, preterm birth, low birth weight, and neonatal morbidity. While congenital measles is rare, it can result in high neonatal mortality and long-term neurological complications such as subacute sclerosing panencephalitis. Gestational age at the time of infection is a key determinant of fetal outcomes: early gestational infection is more likely to result in pregnancy loss, whereas late gestational infection can lead to congenital measles or preterm delivery. Immunological changes during pregnancy likely contribute to the increased severity of measles and its complications, highlighting the biological vulnerability of this population. Prevention remains the cornerstone of mitigating measles-related complications in pregnancy. Ensuring immunity before conception through MMR vaccination is essential, as vaccination during pregnancy is contraindicated due to theoretical fetal risk, though inadvertent vaccination has not been associated with adverse outcomes. Post-exposure prophylaxis with immunoglobulin in susceptible pregnant

women can reduce disease severity, while early clinical recognition, supportive care, and close fetal monitoring are critical during outbreaks.

Overall, measles in pregnancy represents a preventable but high-risk public health challenge. Strengthening vaccination programs, addressing gaps in herd immunity among women of reproductive age, and developing pregnancy-specific clinical management protocols are imperative to reduce maternal, fetal, and neonatal morbidity and mortality. This review underscores the need for continued vigilance, early intervention, and integration of maternal measles prevention into broader public health strategies.

Limitations of the Review Process

This review has methodological limitations. Only English-language publications were included, potentially excluding relevant data from non-English sources. Unpublished studies and surveillance reports were not systematically searched, increasing the possibility of publication bias. Formal meta-analysis was restricted due to clinical and methodological heterogeneity, limiting the ability to generate pooled effect estimates for several outcomes. Additionally, the review was not prospectively registered, which may reduce transparency in methodological decision-making.

Implications and Need for Future Research

There is a clear need for prospective, population-based studies examining measles outcomes in pregnancy in the post-vaccination era. Future research should focus on gestational age-specific risks, placental pathology, and the interaction between maternal immunity and disease severity. Establishment of pregnancy-specific surveillance registries during outbreaks would improve outcome ascertainment and reduce reporting bias. Studies evaluating the effectiveness and optimal timing of post-exposure immunoglobulin prophylaxis in pregnancy are also warranted. Strengthening seroprevalence monitoring among women of reproductive age is essential to inform targeted vaccination strategies and prevent measles-related maternal and perinatal morbidity.

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code was generated, as quantitative meta-analysis was limited due to heterogeneity.

LIST OF ABBREVIATIONS

MMR – Measles-Mumps-Rubella
NICU – Neonatal Intensive Care Unit
SSPE – Subacute Sclerosing Panencephalitis
WHO – World Health Organization
IUFD – Intrauterine Fetal Death
PRISMA – Preferred Reporting Items for Systematic Reviews and Meta-Analyses

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AUTHOR CONTRIBUTIONS

Dr. Suvama Palanivelu contributed to the study conception, clinical interpretation of findings, and manuscript drafting.

Dr. Karthik Shunmugavelu conducted the literature search, data extraction, methodological appraisal, critical revision of the manuscript, and approved the final version.

Both authors reviewed and approved the final manuscript.

REGISTRATION AND PROTOCOL

This systematic review was not registered in PROSPERO or any other review registry.

A formal review protocol was not prepared before study initiation.

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COMPETING INTERESTS

The authors declare no competing interests.

AVAILABILITY OF DATA, CODE, and OTHER MATERIALS

Template data extraction forms, extracted study data, and synthesized results tables are available from the corresponding author upon reasonable request. No analytic

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