RESEARCH PAPER

Maternal Reproductive Disorders and Their Contribution to Preterm Birth Rates: A Gynaecological Analysis

SHAZIA ANJUM[1], *Dr.Chandan Kumar Dubey[2], Dr.J.Sandhya[3], Kiran Velukuri[4], Dr. Biju Sidharthan[5]

[1*]MBBS, MS (Obs & Gyne), Jamia Hamdard, New Delhi Hamdard Institute of medical science and research & HAHC Hospital, Email ID : zubishazia@gmail.com Orcid Id : 0009-0006-7694-005X

[2] Assistant Professor, Department Special Education, Faculty of Education, SGT University Email ID: chandan_sbsc@sgtuniversity.org

[3]Assistant Professor (SG), Department of Biotechnology, Nanomaterials, Green Chemistry, Nanotherapeutics, Hindustan institute of technology and Science Email ID: jsandhya@hindustanuniv.ac.in , Orcid ID: 0000-0001-5240-0098,

[4]Professor in physiotherapy, Apollo college of Physiotherapy, Chittoor, Email ID: kvnave@gmail.com , Orcid ID:0009-0003-6371-4895

[5]Scientist Plant Breeding and Genetics, Genome editing College of Agriculture, Kerala Agricultural University City / Pincode: 680656, Email ID: biju.s@kau.in

Abstract

Preterm birth, defined as delivery before 37 weeks of gestation, is a major contributor to neonatal morbidity and mortality worldwide. Multiple maternal health conditions, particularly reproductive and gynaecological disorders, play a significant role in the development of premature labour. Understanding the relationship between maternal disorders and preterm birth is essential for improving maternal–fetal health outcomes. This review aims to evaluate the contribution of maternal reproductive disorders to preterm birth rates, analyse the underlying biological mechanisms, and highlight clinical management strategies that may reduce the risk of adverse pregnancy outcomes. A comprehensive review of published literature was conducted using recent studies addressing maternal reproductive health conditions and pregnancy outcomes. Evidence from epidemiological studies, clinical research, and systematic reviews was analysed to identify key maternal factors associated with preterm birth and their potential mechanisms. The analysis indicates that several maternal reproductive disorders, including metabolic abnormalities, hypertensive conditions, infections, autoimmune diseases, and chronic systemic illnesses, significantly increase the risk of preterm birth. These disorders can disrupt normal pregnancy physiology through inflammatory activation, hormonal imbalance, placental dysfunction, and impaired immune regulation. Additionally, assisted reproductive technologies (ART)and maternal comorbidities may further influence pregnancy outcomes by altering uterine and placental environments. Maternal reproductive disorders represent critical determinants of preterm birth and related neonatal complications. Early identification of high-risk pregnancies, effective management of maternal health conditions, and improved prenatal care services are essential for reducing preterm birth rates. Continued research into the pathophysiological mechanisms linking maternal disorders to premature delivery will support the development of targeted preventive strategies and improve maternal and neonatal healthcare outcomes.

Keywords: Assisted Reproductive Technology, Hypertensive Disorders, Maternal Infections, Metabolic Disorders, Preterm Birth

How to cite this article: Anjum S, Dubey CK, Sandhya J, Velukuri K, Sidharthan B. Maternal Reproductive Disorders and Their Contribution to Preterm Birth Rates: A Gynaecological Analysis. Int J Drug Deliv Technol. 2026;16(20s): 430-441. DOI: 10.25258/ijddt.16.20s.51

1. Introduction

Preterm birth, which is defined as birth before 37 completed weeks of gestation, is a major concern in the country and a major public health issue worldwide because of its link with neonatal morbidity, mortality and long-term developmental complications. Despite our advances in obstetric care and improvement in care for mother and baby, however, the rate of preterm birth is continuing to increase in many parts of the world and represents a large burden of obstetric care on the neonatal intensive care admission rates and expenditure on healthcare services worldwide. Globally millions of babies are born prematurely each year with wide regional variations depending on socioeconomic factors, access to healthcare, environmental exposures and maternal health conditions[1]. Understanding the determinants of preterm birth is therefore of critical importance when it comes to improving maternal-fetal outcomes and guiding the prevention of preterm birth.

The aetiology of preterm birth is multi-factorial and involves complex interactions of maternal, fetal, environmental and healthcare related factors. Epidemiological evidence shows that maternal reproductive health conditions, obstetric complications

*Author for Correspondence: abillawaria@gmail.com

and chronic systemic diseases play an important role in the risk of having an early delivery. Environmental exposures such as air pollution have also been implicated as a cause of the incidence of preterm births, with studies also suggesting the sex-specific vulnerability of fetuses. These results suggest the complexity of preterm birth and the requirement for intensive studies aimed at maternal reproductive disorders and associated pathophysiological mechanisms[2].

Maternal reproductive health plays a key role in deciding the fate of pregnancy. Disorders of the reproductive system can cause hormonal imbalance, a change in the functioning of the uterus, placenta, and immune system in pregnancy. Assisted reproductive technologies (ART), which are being used more frequently to treat infertility, have brought new considerations of obstetric outcomes. Although ART has led to better reproductive success rates, there has been some evidence that pregnancies that have been achieved as a result of such interventions may have higher risks of complications, including preterm birth and neonatal morbidity[3]. Investigations on ART results have made it clear that assessment of maternal factors, embryo implantation, and placental development are needed in correlation with pregnancy duration and neonatal health.

Quality antenatal care is still an important determinant of pregnancy outcomes. Effective maternal healthcare systems facilitate early identification of risk factors, monitoring of maternal health, and management of risk factors for premature delivery that may arise. Studies conducted in different areas have shown that a lack of antenatal care and low access to healthcare can make a significant contribution to the probability of an adverse outcome, such as preterm birth and low birth weight. Consequently, the improvement of maternal health care services and the enhancement of the timeliness of interventions are important strategies for the reduction of preterm birth rates worldwide.

Maternal lifestyle and nutritional status also have an effect on pregnancy. Adequate nutrition during pregnancy is responsible for the growth of the fetus, the placenta, and the hormones. Conversely, nutritional deficiencies or an improper dietary pattern may be a factor in enhanced susceptibility to pregnancy complications such as gestational diabetes, hypertension, and fetal growth restriction, all of which are linked to a higher risk of delivering preterm babies [5]. Maternal metabolic health is thus a critical component of reproductive outcome and should be taken into account both in the prevention and in the clinical management.

Hypertensive disorders of pregnancy are another major contributor to adverse maternal and neonatal outcomes. Conditions such as preeclampsia and gestational hypertension are often related to placental insufficiency and fetal growth restriction, and medically indicated preterm delivery. Pharmacological interventions such as antenatal corticosteroid therapy have been used to enhance fetal lung maturation in pregnancies at risk of preterm birth to highlight the importance of appropriate clinical management at the right time for the mitigation of neonatal complications[6].

Advances in reproductive medicine have also increased the knowledge of maternal factors affecting the outcome of pregnancy. Systematic reviews examining the impact of ART have illustrated the potential associations between fertility treatments & increased risk of neurological/developmental complications of baby born, suggesting underlying maternal health conditions/treatment protocol as contributing factors to the adverse effects in their offspring [7]. These findings give further support for careful evaluation of maternal reproductive health in pregnancies that are conceived by medical intervention.

Maternal metabolic conditions such as obesity have also become an important determinant of obstetric complications. The epidemiological studies have established a strong relationship between maternal obesity and gestational diabetes, hypertensive disorders and preterm birth, and the change in metabolic profiles among other things8. Such circumstances could be the disruptions in the placental work and in the inflammatory process and in finality to the pregnancy period and fetus growth.

Infectious diseases in pregnancy are another important risk factor of preterm birth. Other infections including malaria and viral infections may trigger inflammatory reactions in the body which may weaken the integrity of the placenta and trigger premature labouring in the uterus. It has been experimentally demonstrated that the release of immune mediators due to infection can disrupt the tolerance between the mother and the fetus, and can lead to poor pregnancy outcomes9. Through these processes, there is a complex mechanism of maternal immune-fetal development interaction during pregnancy.

Both maternal and environmental determinants are observed to co-exist with preterm and low birth weight. It has been observed as a result of population based studies that maternal age, nutritional status, medical comorbidities, and social economic conditions are significant contributors to low birth weight and early birth10. The importance of understanding these determinants is that it would provide us with information about the overall coverage of reproductive disorders in the mothers, and the role played by the mothers when it comes to the outcome of the pregnancy. Such a complex condition like preterm birth requires carrying out an in-depth examination of reproductive disorders among mothers to learn about their contribution to pregnancy complications. Different physiological processes can influence gestational duration with gynaecological disorders, metabolic diseases, infectious diseases and systemic maternal diseases. The purpose of this review is to examine how maternal reproductive disorders contribute to preterm birth rate in a gynaecological perspective, and with respect to underlying mechanisms, clinical

consequences, and potential preventive and control measures.

Objectives of the Review

- To examine the major maternal reproductive and gynaecological disorders that are related to increased risk of preterm birth and adverse pregnancy outcomes.
- To elucidate the basic biological mechanisms, including inflammatory, hormonal, metabolic, and immunological pathways, whereby maternal disorders contribute to premature labour.
- To assess existing clinical management and preventive measures to reduce the rate of preterm birth and improve maternal and neonatal health indicators.

2. Pathophysiology of the Preterm Birth

Preterm birth is the result of a complicated interaction of biological processes involving maternal, fetal and placental systems. The pathophysiology of premature labour is multifactorial and involves inflammatory activation, hormonal imbalance, uteroplacental dysfunction and immune dysregulation. These mechanisms may occur separately or as a whole, which finally trigger the uterine contractions, cervical dilation, and rupture of membranes before the completion of normal gestational development[11]. Understanding the biological pathways of preterm birth is fundamental to determining risk factors and promoting productivity-enhancing, preventative interventions in maternal healthcare.

One of the main mechanisms believed to be involved in spontaneous preterm birth is inflammation of the maternal-fetal interface. To monitor the different immune interactions behaviours of the fetus are some inherent features of pregnancy that intelligently control the tolerance to the growing fetus, without abolishing the ability to respond to infections. The disruptions of this balance have the potential to trigger the inflammatory cascades within the tissues of the placenta and fetal membranes. These responses stimulate the release of cytokines, prostaglandins, and matrix-degrading enzymes that promote uterine contractility and cervical ripening, resulting in premature initiation of labor[12]. Chronic inflammatory conditions in maternal tissues may therefore impose a susceptibility to premature delivery.

Maternal systemic diseases can also play a role in the pathophysiological mechanisms of preterm birth. Autoimmune disorders, including connective tissue diseases, may cause problems in maternal immune control and may disturb the placental development of blood vessels. These disturbances may lead to altered placental perfusion and higher inflammatory activity, which are associated with poor pregnancy outcomes, including preterm birth. In such conditions, maternal antibodies and inflammatory mediators may cross the placental barrier and affect fetal development and further complicating the pregnancy progression.

Infectious diseases during pregnancy seizure into premature labor between other important ways. Mothering immune responses may be provoked by viral infections and the presence of bacterial pathogens and other life agents of microbial origin, which activate the inflammatory signal transduction in growth areas. When immune activation takes place at the maternal-fetal interface, this may trigger prostaglandin and other mediators involved in uterine contractions and rupture of the membranes[13]. The severity and magnitude of the onset of infection will often determine the degree to which pregnancy outcomes are affected.

In addition to inflammation and infection, preterm birth susceptibility may be the result of genetic factors. Genetic abnormalities and chromosomal disorders that influence fetal development can lead to the possibility of early delivery, especially when it is coupled with a failure to grow in size or with the placenta. Studies examining genetic contribution to neonatal morbidity have shown the associations between congenital disorders and high incidence of preterm delivery and small for gestational age infants[14]. These findings suggest that these fetal genetic factors might interact with maternal health conditions to affect the duration of gestation in a manner suggested by a model in Figure 1.

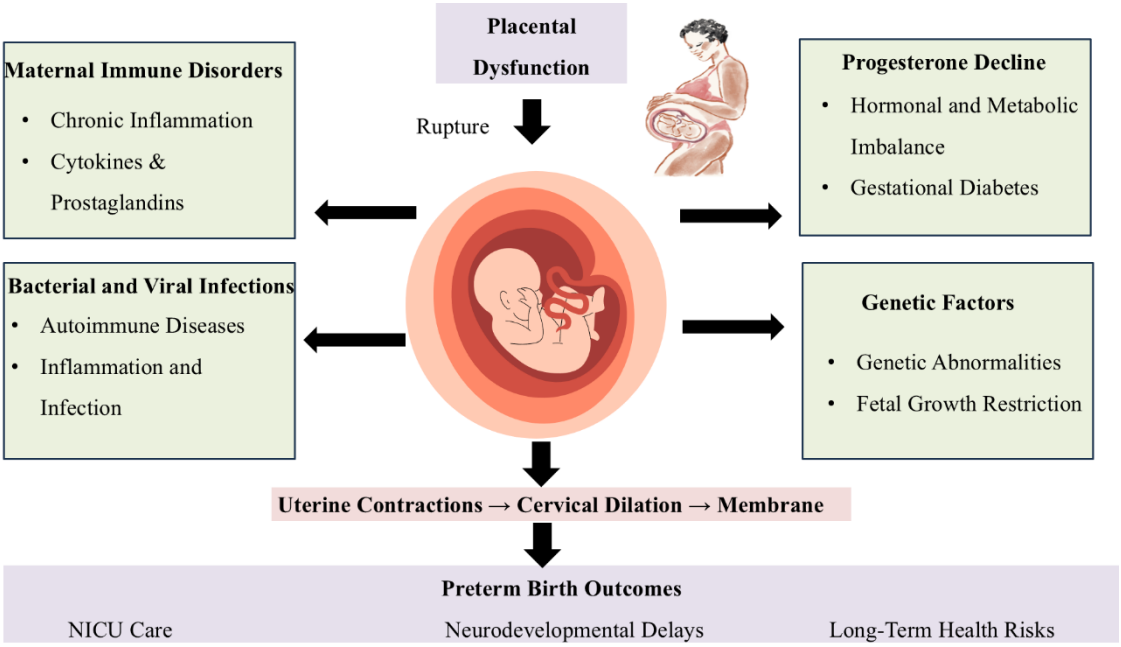

Figure 1: Pathways linking maternal reproductive disorders to preterm birth and associated neonatal outcomes

3. Assisted Reproductive Technologies and Pregnancy Risks

Assisted reproductive technologies (ART) have led to a markedly increased management of infertility and the successful pregnancy of a large number of couples. Techniques like in vitro fertilisation (IVF), intracytoplasmic sperm injection and embryo transfer have become widely implemented across the world. Despite all these improvements, pregnancies that are conceived using ART are often considered to have higher risks of obstetric complications such as preterm birth, low birth weight, and neonatal morbidity. The rise in the prevalence of such outcomes has resulted in the research of physiological and clinical mechanisms that may be contributing to adverse pregnancy outcomes following fertility treatments[15].

Several studies have suggested that the relationship between ART and preterm birth is affected by both factors related to HIV treatment and underlying maternal conditions. Women receiving fertility treatment have many preexisting reproductive disorders, hormonal abnormalities, or structural abnormalities that may interfere with implantation and with placental growth. In addition, ART procedures may affect early embryonic development and signalling pathways in the uterus, which are essential in the maintenance of pregnancy. Evidence from systematic reviews has suggested an increased incidence of neurological complications and premature delivery of infants conceived using assisted reproductive methods, though issues concerning the mechanisms underlying these associations are still under study[16].

Gestational carrier pregnancies also give another view on reproductive technologies and pregnancy outcomes. In such cases, the embryos created through ART will be implanted into a surrogate uterus, and a pregnancy will take place in women who may not be able to carry a pregnancy themselves. Studies of gestational carrier pregnancies have shown that although many of the pregnancies are successful, some obstetric complications occur, including preterm birth and hypertensive disorders. These data therefore suggest that maternal physiological influences and placental development continue to play important roles in determining pregnancy fates, even with external reproductive embryo sources[17].

Ethnic and population-based studies have thus also examined the relation between reproductive technologies and neonatal outcomes. Research that has examined birth outcomes in various populations suggests that maternal health status, socioeconomic conditions and access to healthcare can alter the risk of preterm birth in pregnancies that are conceived through fertility treatments[18]. Such findings should lead to an increased interest in social determinants of health in assessing reproductive outcomes and in formulating strategies for maternal care. Major maternal risk factors for preterm birth are summarised in Table 1.

Table 1: Maternal and environmental risk factors associated with preterm birth

Risk Factor	Description	Impact on Pregnancy Outcome	Key References
Maternal age	Advanced maternal age or adolescent pregnancy	Increased obstetric complications and preterm birth risk	1,2

Environmental exposure	Air pollution and environmental toxins	Increased risk of premature delivery and fetal growth restriction	2
Poor antenatal care	Limited access to maternal healthcare services	Higher incidence of adverse pregnancy outcomes	4
Nutritional imbalance	Inadequate maternal diet or micronutrient deficiency	Low birth weight and preterm birth	5
Maternal obesity	Elevated body mass index during pregnancy	Increased risk of metabolic and obstetric complications	8

In addition to the traditional fertility treatments, technological innovations such as telehealth services have increased the capability of healthcare providers to monitor and assist pregnant women undergoing reproductive treatments. The telemedicine platforms enable patients and clinicians to stay in touch continuously and thereby prevent early medical complications of the pregnancy and access medical help in time whenever the need arises. Systematic reviews have shown that antenatal telehealth services have the potential to improve maternal monitoring and play a role in improving neonatal outcomes, especially in high-risk pregnancies where clinical follow-up is expected to be frequent[19].

Despite the benefits of ART, it is important to be mindful of the fact that the number of pregnancies conceived by ART has a complex maternal health profile. Advanced maternal age, endocrine disorders and infertility-linked disorders may independently heighten the likelihood of a preterm birth as well as other obstetric complications. Therefore, the management of ART pregnancy needs careful monitoring and individualised clinical approaches to minimise risks and improve pregnancy outcomes.

Overall, ART have helped to revolutionise reproductive medicine and increase the options for successful conception. However, such technologies also raise novel clinical issues on maternal health, placental development and fetal growth. Continued research is needed to further understand the biological mechanisms through which ART procedures are associated with preterm birth and how best to maximise maternal and neonatal outcomes with pregnancies that are accomplished using fertility treatments[20].

4. Maternal Metabolic and Endocrine Abnormalities

Maternal metabolic and endocrine disorders are important causes of adverse pregnancy outcomes, including preterm birth. During pregnancy, there is a considerable physiological adaptation of metabolic regulation for the support of fetal growth and development. Disruptions in maternal metabolic balance could therefore affect the placenta function, hormonal signaling and inflammation pathways that will end up affecting gestational duration. Several metabolic conditions, such as gestational diabetes, obesity and endocrine dysfunction, have been identified as important risk factors for preterm birth and related complications[21].

Gestational diabetes mellitus (GDM) is one of the most common metabolic diseases that is faced during pregnancy. It is defined by impaired glucose tolerance caused by hormonal changes that make a person less responsive to insulin. The elevated maternal glucose levels can influence the development of the placental vascular system and growth pattern of the fetus, leading to a higher chance of developing placenta hyperplasia, such as fetal macrosomia, hypertension and premature delivery with increased development of gestational diabetes mellitus[22]. Early screening and management of GDM are therefore important parts of maternal healthcare for the reduction of risk of adverse pregnancy outcomes.

Maternal obesity has also become a major public health issue in the area of reproductive health. Increased body mass index (BMI) pre-pregnancy or during pregnancy has been linked to a wide variety of obstetric complications, including gestational diabetes, hypertensive disorders and premature delivery. Extraneous fat support leads to chronic low-grade inflammatory reactions in addition to deficiencies of metabolism, both of which could disrupt normal placenta activity. These metabolic disturbances may disturb nutrient transport oxygen delivery and endocrine signaling between mothers and fetus[23].

In addition to obesity and diabetes, other metabolic conditions may have an effect on pregnancy outcomes. For example, metabolic dysfunction-associated fatty liver disease has been associated with poor maternal and neonatal outcomes in women with gestational diabetes. This condition represents systemic metabolic imbalance and can result in further liver function, insulin sensitivity and lipid metabolism problems during pregnancy[24]. These metabolic changes may intensify inflammatory processes and cause comorbidities such as preterm birth. Metabolic and endocrine conditions linked to premature delivery are shown in Table 2.

Table 2: Metabolic and endocrine disorders contributing to preterm birth

Disorder	Pathophysiological Mechanism	Pregnancy Complications	References
Gestational diabetes mellitus	Insulin resistance and hyperglycemia	Fetal growth abnormalities and preterm birth	15
Maternal obesity	Chronic inflammation and metabolic imbalance	Hypertensive disorders and premature delivery	8

Metabolic fatty liver disease	Altered lipid metabolism and insulin resistance	Placental dysfunction and adverse outcomes	36
Endocrine hormonal imbalance	Altered progesterone and estrogen signaling	Increased uterine contractility and premature labor	35
Abnormal glucose regulation	Disrupted circadian metabolic patterns	Increased risk of gestational complications	15

5. Hypertensive and Cardiometabolic Pregnancy Disorders

Hypertensive disorders of pregnancy are one of the major causes of maternal and neonatal morbidity in the world. These conditions include chronic hypertension, gestational hypertension and preeclampsia which are characterized by increased blood pressure and vascular dysfunction during pregnancy. Hypertensive disorders can affect the circulation of the placenta and hinder the growth and development of the foetus, often resulting in complications such as intrauterine growth restriction, premature delivery and neonatal morbidity increase [25].

Placenta insufficiency is one of the leading processes that past hypertensive disorders are playing a role in preterm birth. The supply of oxygen and nutrients to the foetus might be decreased in pregnancies characterized with hypertension, abnormal placenta implantation, and a decrease in uteroplacental blood flow. This complication will very often necessitate early birth to avoid severe complications on the part of the mother or the fetus. Medically, preterm birth in cases related to hypertensive disorders in most instances is necessitated to protect maternal health and enhanced survival of the baby[26].

It has also been established that children born of mothers with hypertensive pregnancy disorders have long-term neurologic and developmental effects. Indeed, as an example, researchers have identified maternal hypertension to be related to offspring risks of intellectual disabilities, unconditioned on other defects like fetal growth restriction. These outcomes have shown the impactfulness of effective control of maternal health to prevent acute and indirect obstacles.

The likelihood of neurological complications in children due to chronic hypertension in pregnancy is also definite, such as cerebral palsy. In most cases, premature birth mediates these associations since prematurely born infants are more prone to neurological damage due to the underdevelopment of organ systems[27]. It demonstrates that there is a close correlation between maternal cardiovascular system health and the neurological performance of the fetus.

There are some risk factors like diabetes and obesity are apparently combined with cardiometabolic disorders, which excessive makes the woes of the pregnancy. Research results examining cardiometabolic phenotype in pregnant women have demonstrated that metabolic syndrome, insulin resistance and vascular dysfunction cumulatively impact the emergence of hypertensive complications. These circumstances can also co-exist with the inflammatory pathways and endothelial damage to add to the placental damage and lead to the development of premature labour.Pharmacological intervention has an important role to play in the management of hypertensive disorders in pregnancy. Antenatal corticosteroids, for example, are often used to promote premature maturation of the lungs of babies who are likely to be born prematurely. Clinical studies have found that corticosteroid therapy can improve neonatal respiratory outcomes and decrease mortality in infants who were born prematurely from hypertensive complications[28]. However, tight monitoring is necessary to ensure that maternal and fetal health are not compromised in the treatment.

Preventive measures to minimise hypertensive disorders during pregnancy have also been addressed clinically. Low-dose aspirin therapy, better prenatal screening and lifestyle interventions are among the approaches suggested for women with a high risk of developing preeclampsia or other hypertensive complications[28]. Early identification of CVD risk factors before pregnancy can also help contribute to better maternal outcomes. Major hypertensive and cardiometabolic conditions associated with preterm birth are summarized in Table 3.

Table 3: Hypertensive and cardiometabolic disorders associated with preterm birth

Disorder	Key Pathophysiological Feature	Pregnancy Outcome	References
Chronic hypertension in pregnancy	Vascular dysfunction and placental insufficiency	Preterm birth and neonatal complications	23
Hypertensive pregnancy disorders	Endothelial dysfunction and inflammation	Neurodevelopmental risks in offspring	27
Gestational diabetes mellitus	Abnormal glucose metabolism	Fetal growth abnormalities and preterm birth	15
Maternal obesity	Chronic metabolic inflammation	Increased obstetric complications	8
Cardiometabolic risk factors	Impaired placental blood flow	Preterm birth disparities	40

6. Maternal Infections and Immune-Related Disorders

Maternal infections during pregnancy are a significant cause of preterm birth across the globe. Infectious

diseases have the potential to upset the delicate immunological balance that is required for successful pregnancy and to set off inflammatory reactions that induce premature delivery. Pathogens of the reproductive tract, placenta or systemic maternal circulation can trigger production of cytokines and prostaglandins that induce uterine contractions and rupture of the membranes.

Bacterial infections are one of the most common causes of preterm birth associated with inflammation. Microorganisms colonising the reproductive tract may ascend into the uterus and infect fetal membranes, causing conditions such as chorioamnionitis. These infections stimulate maternal immune responses that cause weakening of the membranes that surround the foetus, as well as premature contraction of the uterus. Studies have shown that there are strong associations between pathogens of the genital tract and adverse pregnancy outcomes, including spontaneous preterm birth[29].

Viral infections during pregnancy are also of importance in maternal-fetal health. Some viruses pathogens can cross the placental barrier and affect fetal tissues directly, whereas a few cause systemic maternal inflammation that has indirect effects on pregnancy. The immune reaction elicited during a viral infection may result in turning on the pathways to promote early delivery, especially when infections occur during critical stages of fetal development[30].

Emerging infectious diseases have further brought the vulnerability of pregnant women to immune-mediated complications to the limelight. As an illustration, respiratory viral infections are reported to increase the likelihood of the occurrence of obstetric complications, such as preterm delivery and fetal distress. These infections could modify the maternal immune responses and disturb the placental function and ultimately affect gestational duration+.

Parasitic infections are also a cause of pregnancy complications in some parts of the world. In regions where malaria is endemic, pregnant women are at higher risk of infection of the placenta and inflammatory damage. Experimental investigations evidenced that mediators equally generated in case of an infection by malaria can interfere with the functioning of the placenta and aid in causing rather unfortunate pregnancy results in the form of reduced birth weight and premature delivery.

Chronic infections, such as viral infections, such as hepatitis or the human immunodeficiency virus (HIV), can also play a role in the outcome of pregnancy through complex immunological processes. These infections might change maternal immune control and make people prone to secondary infections/inflammations during pregnancy. Research looking at maternal viral infections has brought up the potential effects of these infections on fetal development and neonatal health[32].

Maternal infections and immune-related conditions contributing to premature delivery are presented in Table 4.

Table 4: Maternal infections and immune-related conditions linked to preterm birth

Condition	Mechanism Affecting Pregnancy	Pregnancy Outcome	References
HIV infection during pregnancy	Immune suppression and inflammatory activation	Low birth weight and preterm birth	12,13
Hepatitis C infection	Viral inflammation and maternal comorbidity	Increased risk of preterm birth	16
SARS-CoV-2 infection	Systemic inflammatory response	Adverse pregnancy outcomes	17
Placental inflammatory disorders	Activation of immune mediators	Premature labor and fetal complications	21
Genital tract infections	Microbial invasion of reproductive tissues	Premature rupture of membranes	29

The maternal immune system is faced with the extremely difficult task of balancing tolerance of fetal antigens with defence against pathogens. Failure to maintain this balance may result in excessive inflammatory reactions that weaken the process of pregnancy maintenance. Immune-mediated mechanisms, therefore play a central role in the development of infection-related preterm birth.

7. Chronic Maternal Diseases and Comorbidity of Reproductive

Chronic maternal diseases are another important group of diseases that can affect the course of pregnancy and predispose the woman to preterm delivery. Women with underlying systemic diseases often develop complications during pregnancy because of changes in the immune system, metabolic disorders, and impaired regulation of blood vessels. These conditions may interfere with placental development and the physiology of the uterus and ultimately cause adverse maternal and neonatal outcomes. Chronic maternal illnesses, therefore, constitute an important field for research in reproductive health and obstetric medicine[33].

Autoimmune disorders are one of the most important chronic conditions affecting the outcome of pregnancy. Diseases such as mixed connective tissue disease cause abnormal immune stimulation and systemic inflammation that can cause problems in relation to the implantation of the placenta and foetal growth. Studies looking at pregnancies in women with autoimmune conditions have shown an increased risk of complications such as growth restriction of the foetus, premature birth and miscarriage. These conditions may

modify maternal immune tolerance of fetal tissues and favour inflammatory responses within the placenta, which compromise fetal development.

Long-term systemic illnesses linked with post viral syndromes have also become a possible cause of complications with reproductive health. For example, a recent study on the reproductive health effects of long COVID has found multiple physiological disturbances such as endocrine dysfunction, cardiovascular instability and inflammatory abnormalities. These factors could influence menstrual function, fertility and pregnancy outcome so that chronic post-infectious conditions may have an indirect impact on the risk of premature delivery[34].

Rheumatological disorders such as axial spondyloarthritis are another example of the effects of chronic inflammatory diseases on pregnancy. The conditions are characterised by chronic inflammatory disease in the musculoskeletal system but also systemic immunity. Women with rheumatological diseases have demonstrated high levels of obstetric complications, such as low birth weight and preterm birth. These risks may have to do with the activity of inflammatory cytokines and changes in immune regulation that alter normal maternal-fetal interactions[35].

In addition to autoimmune and inflammatory diseases, chronic gastrointestinal disorders may also affect pregnancy outcome. Conditions such as idiopathic chronic pancreatitis can cause metabolic problems and nutritional deficiencies that can interrupt the growth and development of the fetus. Women with chronic pancreatic disorders may experience complications such as malabsorption, changes in glucose metabolism and systemic inflammation, all of which may contribute to premature delivery or fetal growth abnormalities[36].

Cardiovascular diseases are another key group of chronic maternal diseases that are linked to poor pregnancy outcomes. Pregnancy places significant physiological stress on the cardiovascular system because of an increase in the volume of blood and the metabolic demands. Women with underlying cardiac disease may therefore be at heightened risk of complications, including heart failure, insufficiency of the placenta and preterm birth. Socioeconomic factors may also play a role in the outcome in pregnant women with cardiovascular disease, inasmuch as access to healthcare and social support systems can impact the management of high-risk pregnancies[37]. Chronic maternal diseases and reproductive comorbidities influencing pregnancy outcomes are shown in Table 5.

Table 5: Chronic maternal diseases and reproductive comorbidities affecting pregnancy outcomes

Chronic Condition	Pathophysiological Effect	Pregnancy Outcome	References
Mixed connective tissue disease	Immune dysregulation affecting placental function	Adverse pregnancy outcomes	11
Axial spondyloarthritis	Chronic systemic inflammation	Increased risk of pregnancy complications	37
Chronic pancreatitis	Metabolic and nutritional disturbances	Obstetric complications and preterm birth	25
Maternal cardiac disease	Reduced uteroplacental circulation	Neonatal morbidity	38
Long COVID and related disorders	Endocrine and immune disruption	Reproductive health complications	31

8. Neonatal and Long Term Consequences of Prematurity

Preterm birth is highly correlated with: Risks of neonatal morbidity and long term health complications. Infants born too early often have some vital organs, such as the lungs, brain and immune system, not fully developed. Consequently, the former infants often have to be provided with specific medical attention in neonatal intensive care units and face severe developmental issues in the long term. It is therefore essential that the consequences of preterm birth are understood so that neonatal care and long-term health outcomes can be improved.

Among the most important problems that are connected with preterm birth, the increased risk of genetic and developmental diseases in the born babies may be mentioned. Studies have revealed that the babies who are born prematurely or those born prematurely and at the same time, small relative to their gestational age, might develop more genetic abnormalities and congenital disorders. The conditions can increase morbidity and mortality during the early life of an individual and may need long-term medical care[38].

Neurological complications are also frequent in the preterm babies due to insufficient development of the central nervous system at birth. Premature birth may abbreviate important stages in the development of the brain, thereby exposing the child to neurological abnormalities and developmental retardation. It has been found that prematurely born babies are potentially vulnerable to complications including cerebral palsy when the mother has health challenges like persistent high blood pressure during pregnancy[39].

Along with the neurological conditions, alterations of preterm birth have been linked to tolerable cognitive and developmental disabilities in the long term. Children born prematurely may have difficulties learning, paying attention and regulating their behaviour as children and young people[40]. These may be affected by a combination of biological factors related to premature birth coupled with environmental factors such as access to healthcare and educational support[41].

Recent studies also have found links between maternal hypertensive diseases during pregnancy and neurodevelopmental disorders in children. For example, studies have shown that children born to mothers with hypertensive pregnancy disorders are at increased risks of having intellectual disabilities and developmental disorders later on in life[42]. These results demonstrate the significance of maternal health in pregnancy in determining the future of children as shown in Figure 2.

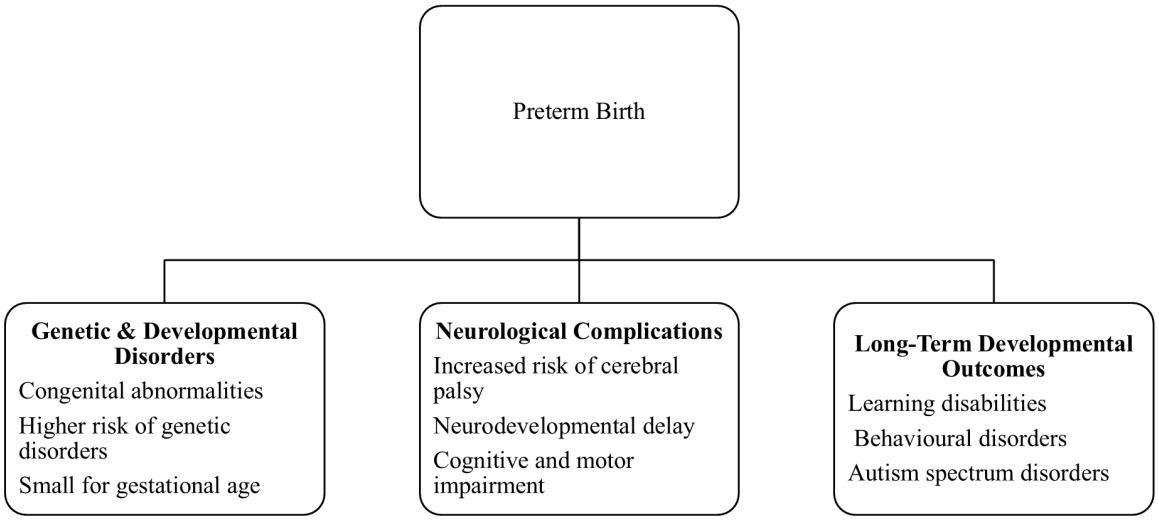

Figure 2: Neonatal morbidity and long-term outcomes associated with preterm birth

9. Clinical Management and Prevention Strategies

Effective clinical management and prevention strategies are necessary for the reduction of the global burden of preterm birth. Because preterm birth is the result of many interacting risk factors, the most successful prevention will require a comprehensive approach to address the health of the mother, prenatal care, and early identification of complications of pregnancy. Advances in obstetric medicine have resulted in the development of a number of interventions to ameliorate maternal-fetal outcome and lessen the rate of premature delivery[43].

Antenatal care occupies a key role in identifying women at risk of preterm birth and ensuring that they are correctly monitored throughout pregnancy. Regular prenatal visits provide an opportunity for healthcare providers to check the health of a mother, her development, and possible early signs of pregnancy complications. Studies have shown that high quality antenatal care services can have a significant impact on improving pregnancy outcomes by allowing the timely diagnosis and management of maternal health conditions[44].

In recent years, telehealth technologies have become useful tools in improving prenatal care delivery. Telemedicine vehicles allow healthcare professionals to remotely keep track of women in pregnancy, administer health education, and recognize possible complications without having to see them very often[45]. The review and analysis of the quality of antenatal telehealth services have indicated that these services demonstrate positive outcomes in the conflict of maternal surveillance and newborn results, especially in the conditions reportedly associated with the availability of healthcare centres amid the shortage of reaching them[46]. Key preventive approaches and clinical management strategies used to reduce the risk of preterm birth are outlined in Table 6.

Table 6: Clinical management and prevention strategies for preterm birth

Strategy	Description	Clinical Benefit	References
Antenatal corticosteroid therapy	Administration of corticosteroids in high-risk pregnancies	Improved fetal lung maturation	6
Telehealth prenatal monitoring	Remote monitoring and consultation during pregnancy	Early detection of complications	20
Lifestyle modification	Balanced nutrition and maternal health optimization	Reduced metabolic and obstetric risks	5
Evidence-based obstetric guidelines	Implementation of standardized clinical protocols	Reduced iatrogenic preterm birth	45
Early prenatal screening	Identification of high-risk pregnancies through routine monitoring	Improved maternal–fetal outcomes	4

Conclusion

Preterm birth is a significant issue of health concern in the world since it is closely associated with neonatal

morbidity, mortality and developmental issues. The results presented in the current review indicate that maternal reproductive diseases are significant factors that determine the outcomes of pregnancy and the possibility of preterm birth. Several maternal disorders like metabolic disorders, hypertensive disorders, infections, autoimmune disorders and chronic systemic disorders can disrupt the normal maternal-fetal interactions and, instead, play a role in the pathological processes that would lead to the onset of early labor. Such disorders usually include the problems of the placenta, the immune system and hormone balance and these eventually influence the stability of a pregnancy. The increased prevalence of ART has introduced the extra dimension to the necessity of the comprehension of the factors on maternal health and their impact during the gestation period and the fetus. Although such technologies have enhanced the fertility outcome, close observation in the outcome of pregnancy that is achieved with the same methods is necessary to reduce the potential risks that may arise as a consequence of preterm birth. Prevention of preterm birth needs complex approaches in maternal healthcare aimed at preventing risks early before delivery, improved antenatal healthcare and proper clinical care of maternal condition. The modifiable risk factors, including maternal nutrition, metabolic health and prevention of infections should also be part of the prevention strategies. Further studies of the mechanisms that correlate maternal reproductive disorders and preterm birth will aid in the creation of intervention strategies and enhanced clinical practices that could help minimize preterm birth. To decrease the levels of preterm birth, and to improve the conditions of maternal and neonatal health, it will be necessary to strengthen maternal healthcare systems and encourage multidisciplinary approaches to the regulation of pregnancy.

References

1. Bentov Y, Schenker J. IVF and pregnancy outcomes: the triumphs, challenges, and unanswered questions. Journal of Ovarian Research. 2025;18(1):228. DOI: 10.1186/s13048-025-01692-5
2. Zhang Z, Li L, Pan D, Liu T, Ju X, Li Q, et al. Sex differences in preterm birth and the impact of particulate matter pollution: A retrospective cross-sectional study of the Global Burden of Disease 2021. Science Progress. 2025;108(4):368504251387238. DOI: 10.1177/00368504251387238
3. Lavin T, Ocheke AN, Betran AP, Adeniran AS, Ezenkwele E, Nwachukwu DC, et al. Analyzing caesarean sections through the Robson classification in Nigeria: a prospective nationwide study in referral level facilities. EClinicalMedicine. 2025;87:103427. DOI: 10.1016/j.eclinm.2025.103427
4. Abanga EA, Ziblim AM, Boah M. Antenatal care quality and pregnancy outcomes in the northern region of Ghana: a mixed-methods analysis. BMC Pregnancy and Childbirth. 2025;25(1):810. DOI: 10.1186/s12884-025-07915-3
5. Hart KH, Hill AJ, Gonzalez JT, De La Hunty A, Gallagher AM, Stanner SA. Diet in pregnancy: A review of current challenges and recommendations. Nutrition Bulletin. 2025;50(3):365-410. DOI: 10.1111/nbu.70016
6. Ushida T, Fuma K, Katsuki S, Tano S, Matsuo S, Imai K, et al. Antenatal corticosteroid treatment for women with hypertensive disorders of pregnancy: A population-based study in Japan. Journal of Obstetrics and Gynaecology Research. 2025;51(7):e16364. DOI: 10.1111/jog.16364
7. Chen X, Zhou P. Impact of assisted reproductive technology on the risk of cerebral palsy: A systematic review and meta-analysis. Pakistan Journal of Medical Sciences. 2025;41(5):1526-1535. DOI: 10.12669/pjms.41.5.11961
8. Pellonperä O, Meinilä J, Nevalainen J, Sormunen-Harju H, Metsälä J, Gissler M, et al. Regional differences in the prevalence of obstetric complications in relation to maternal obesity and food purchases. Acta Obstetricia et Gynecologica Scandinavica. 2025;104(7):1274-1285. DOI: 10.1111/aogs.15075
9. Durán-Rodriguez AT, Almeida MPO, Ferreira FB, Lozano-Trujillo LA, Gomes AO, Cariaco Y, et al. Macrophage migration inhibitory factor contributes to adverse outcomes of experimental gestational malaria across pregnancy stages. American Journal of Pathology. 2025;195(7):1223-1241. DOI: 10.1016/j.ajpath.2025.03.004
10. Mettananda S, Herath H, Thewage A, Nanayakkara K, Liyanage I, Udani KS, et al. Composition, determinants, and risk factors of low birth weight in Sri Lanka. PLoS ONE. 2025;20(2):e0318554. DOI: 10.1371/journal.pone.0318554
11. Yoshida T, Takeda J, Ishii S, Matsushita M, Tamura N, Itakura A. Pregnancy with mixed connective tissue disease: Exploration of factors influencing live birth outcomes. PLoS ONE. 2024;19(12):e0303318. DOI: 10.1371/journal.pone.0303318
12. Ellis RP, Evans C, Wedderburn CJ, Prendergast AJ. Children who are HIV exposed-uninfected: does maternal ART regimen matter? Current Opinion in HIV and AIDS. 2024;19(6):316-322. DOI: 10.1097/coh.0000000000000883
13. Fleșeriu T, Meliț LE, Mărginean CO, Văsieșiu AM. The negative impact of maternal HIV infection on birth outcomes—myth or reality? Pathogens. 2024;13(9):808. DOI: 10.3390/pathogens13090808
14. Bomback M, Everett S, Lyford A, Sahni R, Kim F, Baptiste C, et al. Genetic disorders and their association with morbidity and mortality in early preterm small for gestational age infants. American Journal of Obstetrics and Gynecology. 2024;232(5):487.e1-487.e14. DOI: 10.1016/j.ajog.2024.09.101

15. Bravo R, Lee KH, Nazeer SA, Cornthwaite JA, Bartal MF, Pedroza C. Glucose circadian rhythm assessment in pregnant women for gestational diabetes screening. International Journal of Obesity. 2024;49(1):118-124. DOI: 10.1038/s41366-024-01636-x
16. Cheedalla A, Berry M, Abdelwahab M, Cowen J, Stiles A, Mason I, et al. Hepatitis C virus infection in pregnant individuals with opioid use disorder and its association with preterm birth. American Journal of Perinatology. 2024;42(5):599-604. DOI: 10.1055/a-2413-2306
17. Doss JD, Diveley E, Zhang F, Scheffer A, Huang R, Jackson D, et al. Pregnancy outcomes following antepartum infection with SARS-CoV-2. Pregnancy Hypertension. 2024;37:101152. DOI: 10.1016/j.preghy.2024.101152
18. Matsuzaki S, Masjedi AD, Matsuzaki S, Anderson ZS, Erickson KV, Mandelbaum RS, et al. Obstetric characteristics and outcomes of gestational carrier pregnancies. JAMA Network Open. 2024;7(7):e2422634. DOI: 10.1001/jamanetworkopen.2024.22634
19. Pervin S, Kearney L, Giudice S, Holzapfel S, Denaro T, Dyer J, et al. Being a First Nations baby is not independently associated with low birthweight in a large metropolitan health service. Australian and New Zealand Journal of Obstetrics and Gynaecology. 2024;64(6):608-618. DOI: 10.1111/ajo.13843
20. Kurnaz D, Şenoğlu A, Karaçam Z. The impact of antenatal telehealth services on maternal and neonatal outcomes before and during the COVID-19 pandemic: A systematic review and meta-analysis. Midwifery. 2024;134:104017. DOI: 10.1016/j.midw.2024.104017
21. Robinson JF, Das S, Khan W, Khanam R, Price JT, Rahman A, et al. High rates of placental inflammation among samples collected by the Multi-Omics for Mothers and Infants consortium. American Journal of Obstetrics and Gynecology. 2024;232(2):230.e1-230.e19. DOI: 10.1016/j.ajog.2024.04.034
22. Ferrari AJ, Santomauro DF, Aali A, Abate YH, Abbafati C, Abbastabar H, et al. Global incidence, prevalence, years lived with disability, disability-adjusted life-years and healthy life expectancy for 371 diseases and injuries in 204 countries and territories. The Lancet. 2024;403(10440):2133-2161. DOI: 10.1016/S0140-6736(24)00757-8
23. Huang YC, Lin HC, Chang YT, Tsai ML, Chang YC, Wang LW. Preterm birth increases cerebral palsy hazards in children of mothers with chronic hypertension in pregnancy. Pediatrics and Neonatology. 2024;65(6):539-545. DOI: 10.1016/j.pedneo.2023.10.009
24. Bento GFC, Da Silva MG, Menon R, Richardson LS. Feto-maternal interface organ-on-chip: a new technology to study ascending infection. Methods in Molecular Biology. 2024;2781:105-117. DOI: 10.1007/978-1-0716-3746-3_10
25. Kumbhar G, Chowdhury SD, Benjamin S, Kurien RT, Thomas A, Dutta A, et al. Pregnancy outcomes in patients with early-onset idiopathic chronic pancreatitis. Digestive Diseases and Sciences. 2023;69(1):256-261. DOI: 10.1007/s10620-023-08174-y
26. Amyx M, Philibert M, Farr A, Donati S, Smárason AK, Tica V, et al. Trends in caesarean section rates in Europe from 2015 to 2019 using Robson's classification. BJOG. 2023;131(4):444-454. DOI: 10.1111/1471-0528.17670
27. Wang LW, Lin HC, Tsai ML, Chang YT, Chang YC, et al. Maternal hypertensive pregnancy disorders increase childhood intellectual disability hazards independently from preterm birth. Early Human Development. 2023;185:105856. DOI: 10.1016/j.earlhumdev.2023.105856
28. De Graaff E, Sadler L, Lakhdhir H, Simon-Kumar R, Peiris-John R, Burgess W, et al. Perinatal related mortality among women of South Asian ethnicity in Aotearoa New Zealand. BMC Pregnancy and Childbirth. 2023;23(1):535. DOI: 10.1186/s12884-023-05840-x
29. Gamberini C, Juliana NCA, De Brouwer L, Vogelsang D, Al-Nasiry S, Morré SA, et al. Association between adverse pregnancy outcomes and non-viral genital pathogens among women in sub-Saharan Africa. Frontiers in Reproductive Health. 2023;5:1107931. DOI: 10.3389/frph.2023.1107931
30. Wang LW, Lin HC, Tsai ML, Chang YT, Chang YC. Preterm birth and small for gestational age potentiate association between maternal hypertensive pregnancy and childhood autism spectrum disorder. Scientific Reports. 2023;13(1):9606. DOI: 10.1038/s41598-023-36787-w
31. Pollack B, Von Saltza E, McCorkell L, Santos L, Hultman A, Cohen AK, et al. Female reproductive health impacts of Long COVID and associated illnesses. Frontiers in Rehabilitation Sciences. 2023;4:1122673. DOI: 10.3389/fresc.2023.1122673
32. Costa-Borges N, Nikitos E, Späth K, Miguel-Escalada I, Ma H, Rink K, et al. Pilot study of maternal spindle transfer for repeated IVF failures in couples with idiopathic infertility. Fertility and Sterility. 2023;119(6):964-973. DOI: 10.1016/j.fertnstert.2023.02.008
33. Bruno AM, Allshouse AA, Metz TD, Theilen LH. Hypertensive disorders of pregnancy before and after aspirin guideline publication in individuals with pregestational diabetes mellitus. AJOG MFM. 2023;5(4):100877. DOI: 10.1016/j.ajogmf.2023.100877
34. Schubert J, Timmesfeld N, Noever K, Behnam S, Vinturache A, Arabin B. Impact of maternal BMI and gestational weight gain on maternal and neonatal outcomes in twin pregnancies. Acta

Obstetricia et Gynecologica Scandinavica. 2022;102(2):181-189. DOI: 10.1111/aogs.14485
35. Vidal MS, Lintao RCV, Severino MEL, Tantengco OAG, Menon R. Spontaneous preterm birth: involvement of multiple feto-maternal tissues and pathways. Frontiers in Endocrinology. 2022;13:1015622. DOI: 10.3389/fendo.2022.1015622
36. Chai TY, Deng D, Byth K, George J, Pasupathy D, Cheung NW. Metabolic dysfunction-associated fatty liver disease and adverse pregnancy outcomes in women with gestational diabetes mellitus. Diabetes Research and Clinical Practice. 2022;191:110038. DOI: 10.1016/j.diabres.2022.110038
37. Meissner Y, Strangfeld A, Molto A, Forger F, Wallenius M, Costedoat-Chalumeau N, et al. Pregnancy and neonatal outcomes in women with axial spondyloarthritis. Annals of the Rheumatic Diseases. 2022;81(11):1524-1533. DOI: 10.1136/ard-2022-222641
38. Carland C, Panelli DM, Leonard SA, Bryant E, Sherwin EB, Lee CJ, et al. Association of neighborhood income with clinical outcomes among pregnant patients with cardiac disease. Reproductive Sciences. 2022;29(10):3007-3014. DOI: 10.1007/s43032-022-00978-z
39. Freaney PM, Harrington K, Molsberry R, Perak AM, Wang MC, Grobman W, et al. Temporal trends in adverse pregnancy outcomes in birthing individuals aged 15 to 44 years in the United States. Journal of the American Heart Association. 2022;11(11):e025050. DOI: 10.1161/jaha.121.025050
40. Hedderson MM, Xu F, Dayo OM, Liu E, Sridhar S, Lee C, et al. Contribution of maternal cardiometabolic risk factors to racial-ethnicity disparities in preterm birth subtypes. AJOG MFM. 2022;4(3):100608. DOI: 10.1016/j.ajogmf.2022.100608
41. Lee JC, BadellTingleff T, Vikanes Å, Räisänen S, Sandvik L, Murzakanova G, Laine K. Risk of preterm birth in relation to history of preterm birth. BJOG. 2021;129(6):900-907. DOI: 10.1111/1471-0528.17013
42. Kawwass JF. Impact of endometrial preparation for frozen embryo transfer on maternal and neonatal outcomes. Reproductive Biology and Endocrinology. 2022;20(1):40. DOI: 10.1186/s12958-021-00869-z
43. Goodman DJ, Saunders EC, Frew JR, Arsan C, Xie H, Bonasia KL, et al. Integrated versus nonintegrated treatment for perinatal opioid use disorder. AJOG MFM. 2021;4(1):100489. DOI: 10.1016/j.ajogmf.2021.100489
44. Maslin K, McKeon-Carter R, Hosking J, Stockley L, Southby C, Shawe J, et al. Preterm births in South-West England before and during the COVID-19 pandemic. European Journal of Pediatrics. 2021;181(2):859-863. DOI: 10.1007/s00431-021-04265-y
45. Valencia CM, Mol BW, Jacobsson B. FIGO good practice recommendations on modifiable causes of iatrogenic preterm birth. International Journal of Gynecology and Obstetrics. 2021;155(1):8-12. DOI: 10.1002/ijgo.13857
46. Papapanou M, Papaioannou M, Petta A, Routsi E, Farmaki M, Vlahos N, et al. Maternal and neonatal characteristics and outcomes of COVID-19 in pregnancy: An overview of systematic reviews. International Journal of Environmental Research and Public Health. 2021;18(2):596. DOI: 10.3390/ijerph18020596