International Journal of Medical and Health Research
www.medicalsciencejournal.com
ISSN: 2454-9142
Received: 10-12-2025, Accepted: 28-01-2026, Published: 13-02-2026
Volume 12, Issue 1, 2026, Page No. 35-37

Impact of respiratory disorders on maternal and foetal outcomes: A comprehensive review

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Abstract
Respiratory disorders during pregnancy represent a significant clinical concern due to their potential to adversely affect both maternal health and Foetal development. Physiological changes in pregnancy, including increased oxygen demand, reduced lung capacity, and altered immune responses, can exacerbate pre-existing respiratory conditions or increase susceptibility to acute infections. Disorders such as asthma, chronic obstructive pulmonary disease (COPD), pneumonia, tuberculosis, influenza, and emerging viral infections including COVID-19 have been associated with increased risks of maternal morbidity, preterm birth, intrauterine growth restriction (IUGR), low birth weight, and perinatal mortality. Poorly controlled respiratory illness can lead to maternal hypoxemia, systemic inflammation, and placental insufficiency, thereby compromising Foetal oxygen and nutrient supply. This review synthesizes current evidence on the epidemiology, pathophysiology, maternal and Foetal outcomes, and management considerations of respiratory disorders in pregnancy, highlighting the importance of early diagnosis, multidisciplinary care, and optimized treatment strategies to improve pregnancy outcomes.

Keywords: Respiratory disorders, pregnancy, maternal health, foetal outcomes, asthma, pneumonia, hypoxemia

Introduction
Pregnancy is characterized by profound anatomical, physiological, and immunological changes that influence respiratory function (Ejikeme *et al*., 2025) [5]. Increased oxygen consumption, elevated diaphragm position, reduced functional residual capacity, and enhanced minute ventilation make pregnant women more vulnerable to respiratory compromise. Respiratory disorders during pregnancy are increasingly recognized as contributors to adverse maternal and Foetal outcomes, particularly in low- and middle-income countries where infectious diseases remain prevalent. Both chronic respiratory diseases and acute respiratory infections can disrupt maternal oxygenation and inflammatory balance, thereby affecting placental function and Foetal growth. Understanding the interaction between respiratory disorders and pregnancy is crucial for improving maternal–Foetal health outcomes (Howell and Powell, 2017) [9].

Physiological Changes in the Respiratory System During Pregnancy
Pregnancy induces adaptations in the respiratory system to meet increased metabolic demands (Khalua *et al*., 2019) [10]. Oxygen consumption increases by approximately 20–30%, while tidal volume and minute ventilation rise due to progesterone-mediated respiratory drive (Ejikeme *et al*., 2025) [5]. Functional residual capacity decreases as the uterus enlarges, reducing pulmonary reserve (Rubin *et al*., 1956) [18]. These changes can worsen symptoms in women with underlying respiratory diseases and limit compensatory mechanisms during acute respiratory illness, increasing the risk of hypoxemia and respiratory failure (Tewari *et al*., 2021) [19].

Common Respiratory Disorders in Pregnancy
1. Asthma
Asthma is the most prevalent chronic respiratory disorder encountered during pregnancy and can significantly influence maternal and Foetal outcomes if not adequately controlled. Hormonal and physiological changes during pregnancy may alter asthma severity, leading to either improvement or worsening of symptoms (Bonham *et al*., 2018) [2]. Poorly controlled asthma is strongly associated with an increased risk of pregnancy complications such as preeclampsia, gestational hypertension, preterm birth, low birth weight, and higher rates of cesarean delivery. Acute asthma exacerbations can result in maternal hypoxemia, which directly compromises Foetal oxygenation and may impair Foetal growth and development. Therefore, maintaining optimal asthma control through regular monitoring, adherence to prescribed medications, and avoidance of triggers is essential to ensure favorable maternal and Foetal outcomes (Vyawahare *et al*., 2023) [23].

2. Chronic Obstructive Pulmonary Disease (COPD)
Chronic obstructive pulmonary disease, although relatively uncommon among women of reproductive age, poses substantial risks when present during pregnancy (Liang *et al*., 2024) [11]. The disease is characterized by persistent airflow limitation and reduced pulmonary reserve, which may be further compromised by the physiological respiratory changes of pregnancy. Women with COPD are at increased risk of maternal fatigue, respiratory insufficiency, and exacerbations that may necessitate hospitalization (Chakraborty *et al*., 2014) [3]. Chronic hypoxemia associated with COPD can adversely affect placental oxygen transfer, leading to Foetal growth restriction, low birth weight, and preterm delivery. Careful clinical monitoring, smoking cessation, and individualized respiratory management are critical to minimizing adverse outcomes in pregnant women with COPD.

3. Respiratory Infections
Acute respiratory infections, including pneumonia, tuberculosis, influenza, and COVID-19, are significant

contributors to maternal morbidity and mortality during pregnancy. Pregnancy-associated immunological adaptations may increase susceptibility to severe infections and worsen disease progression. Pneumonia during pregnancy is linked to higher risks of preterm labor, low birth weight, Foetal distress, and neonatal intensive care unit admission. Tuberculosis remains a major concern in endemic regions and is associated with maternal anemia, intrauterine growth restriction (IUGR), preterm birth, and increased perinatal mortality. Viral respiratory infections, particularly influenza and COVID-19, can induce systemic inflammation, endothelial dysfunction, and placental injury, thereby negatively impacting Foetal development. Early diagnosis, appropriate antimicrobial or antiviral therapy, and preventive measures such as vaccination are essential to reduce complications and improve pregnancy outcomes (Tewari *et al*., 2025) [21].

Pathophysiological Mechanisms Affecting Maternal and Foetal Outcomes

Respiratory disorders impact pregnancy outcomes through multiple mechanisms. Maternal hypoxemia reduces oxygen delivery to the placenta, leading to Foetal hypoxia and impaired growth. Inflammatory cytokines released during respiratory illness can disrupt placental vascular development and trigger preterm labor. Additionally, increased maternal stress, fever, and metabolic disturbances further contribute to adverse outcomes such as miscarriage, stillbirth, and neonatal complications.

Maternal Outcomes

Pregnant women with respiratory disorders face increased risks of hospitalization, respiratory failure, preeclampsia, gestational diabetes, and cesarean delivery. Severe infections may necessitate intensive care support and mechanical ventilation, increasing maternal morbidity and mortality. Effective disease management and timely intervention are critical to prevent complications (Mehta *et al*., 2015) [14].

Foetal and Neonatal Outcomes

Foetal consequences of maternal respiratory disorders include intrauterine growth restriction, low birth weight, preterm birth, Foetal distress, and increased perinatal mortality. Neonates born to affected mothers may require intensive care and are at higher risk of respiratory distress, infections, and long-term developmental challenges (Pike *et al*., 2012) [17].

Management and Preventive Strategies

Management of respiratory disorders in pregnancy requires a multidisciplinary approach involving obstetricians, pulmonologists, and nutritionists. Key strategies include early diagnosis, regular monitoring, safe pharmacological therapy, vaccination against influenza and COVID-19, smoking cessation, and nutritional support. Maintaining adequate maternal oxygenation and controlling inflammation are central to improving pregnancy outcomes (Tewari *et al*., 2020) [20].

Future Perspectives and Research Needs

Further research is needed to establish standardized guidelines for managing respiratory disorders during pregnancy, particularly in resource-limited settings. Longitudinal studies exploring the long-term effects of maternal respiratory illness on offspring health are also warranted. Advances in personalized medicine and digital health tools may enhance monitoring and treatment adherence in pregnant women with respiratory diseases (Blakey *et al*., 2018) [1].

Table 1: Impact of Major Respiratory Disorders During Pregnancy on Maternal and Foetal /Neonatal Outcomes: Prevalence, Clinical Consequences, and Underlying Mechanisms

Respiratory Disorder	Prevalence/Notes	Maternal Outcomes	Foetal /Neonatal Outcomes	Key Mechanisms/Risk Factors	References
Asthma	Most common chronic respiratory disease in pregnancy (3.7–17% prevalence)	Increased risk of preeclampsia, gestational diabetes, cesarean delivery; higher exacerbations if uncontrolled	Preterm birth, low birth weight (LBW), intrauterine growth restriction (IUGR), small for gestational age (SGA), neonatal respiratory distress	Poor control leads to hypoxia, inflammation; bidirectional interaction with pregnancy physiology	Murphy *et al*. (2023); Vanders & Murphy (2015); Georgakopoulou *et al*. (2024); Wang *et al*. (2023) [8, 15, 22]
Pneumonia (bacterial/viral)	~1.5 per 1000 pregnancies; severe forms increase morbidity	Increased ICU admission, respiratory failure, maternal mortality (especially if severe)	Preterm delivery, LBW, increased perinatal mortality	Systemic inflammation, hypoxia; common in influenza or other viral infections	Mehta (2020) [13]; ACOG guidelines (various); systematic reviews on viral pneumonia
Influenza (including pH1N1)	Higher severity in pregnancy; incidence varies by season/pandemic	Increased hospitalization, severe illness, maternal death risk	Stillbirth (RR ~3.6), preterm birth (variable), Foetal death, LBW (especially in pandemics)	Direct viral effects, cytokine storm, reduced oxygen delivery	Mertz *et al*. (2017); Liu *et al*. (2021) [12]; Fell *et al*. (various meta-analyses)
Obstructive Sleep Apnea (OSA)	Increasing recognition; associated with obesity	Gestational hypertension, preeclampsia, gestational diabetes	Preterm birth (OR ~1.75–1.94), LBW (OR ~1.39–1.52), Foetal growth restriction, SGA, NICU admission	Intermittent hypoxia, oxidative stress, endothelial dysfunction, placental impairment	Ding *et al*. (meta-analysis); Pamidi *et al*. (meta-analysis); Fung *et al*. (2023–2025 updates)
Cystic Fibrosis (CF) & Severe Chronic Disease	Rare but high-risk if severe (e.g., FEV1 <60%, pulmonary hypertension)	High maternal mortality risk (3–15% in severe cases), deterioration in lung function	Poor outcomes in severe cases: preterm, LBW, IUGR	Underlying lung impairment, malnutrition, hypoxemia	Edenborough *et al*. (various); Mehta (2020) [13]
SARS-CoV-2 & Other Respiratory Viruses	Elevated risk of severe disease in pregnancy	Severe pneumonia, ARDS, maternal death, ICU admission	Preterm birth, stillbirth, LBW, neonatal complications	Inflammation, hypoxia; vertical transmission risk (low for most)	Various COVID-19 meta-analyses (2020–2025); respiratory virus burden reviews
General Respiratory Complications	Includes ARDS, pleural effusion, tuberculosis, bronchitis	Preeclampsia (14–20%), higher cesarean rates, ICU admission (3–5%), maternal mortality (1–2%)	IUD/stillbirth (5–6%), low APGAR, NICU admission (46%), preterm/IUGR	Exacerbations, infections; poor control worsens outcomes	Multiple Indian cohort studies (2020–2025); systematic reviews on complications

Conclusion

Respiratory disorders during pregnancy significantly influence maternal and Foetal outcomes through mechanisms involving hypoxemia, inflammation, and placental dysfunction. Early identification, effective disease control, and comprehensive prenatal care are essential to minimize risks and improve maternal–Foetal health. Integrating respiratory health into routine antenatal care can substantially reduce the burden of adverse pregnancy outcomes.

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