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# The Impact of Maternal Asthma on Pregnancy, Labor, and Neonatal Outcomes

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## ABSTRACT

**Background:** Asthma is a common chronic illness that can affect a mother's health, the course of labor, and the health of the unborn child. Preterm birth, respiratory problems in the newborn, and pregnancy difficulties have all been linked to inadequate asthma treatment.

**Objective:** To know the impact of maternal asthma on pregnancy complications, labor outcomes, and neonatal health by comparing outcomes between asthmatic and non-asthmatic pregnant women.

**Methodology:** A retrospective study was conducted at the Department of Obstetrics and Gynecology, King Abdullah Teaching Hospital, Mansehra, in collaboration with Rural Health Centre Havelian and Type-D Hospital, Haripur. In this study a comparison of 130 pregnant asthmatic women and 130 asthma-free controls was carried out.

**Results:** A total of 260 study participants were included in this study. Results showed that pregnancy outcomes in asthmatic women had a higher risk of preeclampsia (15% vs. 7%,  $p=0.04$ ) and preterm birth (18% vs. 10%,  $p=0.03$ ) with a higher prevalence of cesarean birth (35% vs. 22%,  $p=0.02$ ). Neonatal Outcomes in Newborns of asthmatic mothers had lower birth weights (2900g vs. 3100g,  $p=0.01$ ) and a higher rate of NICU admission (20% vs. 12%,  $p=0.03$ ). Pregnancies affected by asthma were associated with a significantly increased risk of neonatal respiratory complications, including transient tachypnea (12% in asthmatic pregnancies vs. 5% in non-asthmatic;  $p = 0.02$ ) and respiratory distress syndrome (10% vs. 4%;  $p = 0.03$ ).

**Conclusion:** Maternal asthma significantly increases the risk of pregnancy complications, operative delivery, and neonatal morbidity. Findings of the present study proposed the need for optimal asthma management, regular monitoring, and preventive interventions to improve maternal and neonatal outcomes.

**Keywords:** Pediatric Asthma; Neonatal Outcomes; Preterm Birth

## Introduction

**A**sthma, a chronic respiratory disease, is prevalent in all parts of the world. It affects millions of people, including large populations of women within their reproductive age. It is one of the most common medical conditions associated with pregnancy, posing special challenges for maternal and fetal health. The relationship between hormonal changes, immune changes, and respiratory changes that characterize pregnancy can affect asthma severity, whereby some women experience relief from symptoms while others have exacerbations that are well managed.<sup>1</sup> Uncontrolled asthma during pregnancy raises special concerns because of increased risks for maternal complications and adverse neonatal outcomes. Considerable advances have been made in the field of prenatal care and treatment of asthma; however, maternal asthma remains a crucial area of clinical research and care relevant to pregnancy, labor, and neonatal health.<sup>2</sup>

Pregnant women commonly face a higher risk of developing hypertensive disorders such as preeclampsia, gestational diabetes, and premature labor in the presence of asthma. The pathophysiology of asthma, which includes chronic inflammation of the airways, hyper-responsiveness, and bronchoconstriction, can get aggravated by certain physiological changes in pregnancy. The use of any medications for asthma during pregnancy is often a matter of great concern, with many women doubting adherence to treatment for fear of jeopardizing the safety of the fetus. However, inadequate control of asthma during pregnancy imposes a much greater risk to both mother and child than careful administration of appropriate medications. Impaired oxygenation due to exacerbations of asthma is related to fetal hypoxia, growth restriction, and increased instances of preterm delivery, emphasizing that asthma management is pivotal throughout the duration of a pregnancy.<sup>3</sup> Maternal asthma, especially when poorly controlled, can significantly impact labor and delivery. Women with inadequately managed asthma face a higher likelihood of requiring medical interventions such as labor induction, instrumental delivery, or cesarean section. The physical strain of labor may trigger bronchospasms or respiratory distress, necessitating vigilant monitoring and timely medical support. Additionally, chronic asthma-related systemic inflammation and oxidative stress can contribute to uteroplacental insufficiency, increasing the risk of fetal distress and meconium-stained amniotic fluid. Healthcare providers play a vital role in developing personalized care plans that optimize maternal respiratory health while minimizing risks to the newborn.<sup>4</sup> Maternal asthma significantly impacts neonatal outcomes, with studies linking it to an increased risk of intrauterine growth restriction (IUGR), low birth weight, and neonatal respiratory complications. Transient

tachypnea of the newborn (TTN) is more common in babies whose mothers have asthma, and they may need to be admitted to the neonatal intensive care unit (NICU) because of respiratory distress.<sup>5</sup> Additionally, emerging research suggests a higher likelihood of childhood respiratory disorders, including an increased predisposition to asthma and allergic conditions later in life. Maternal inflammation, hypoxia, and medication exposure during pregnancy play a crucial role in shaping neonatal respiratory health. Ensuring optimal asthma control, providing maternal education, and implementing early neonatal monitoring are essential strategies to reduce these risks and promote better long-term health outcomes for the child.<sup>6</sup>

A thorough impact observation by multidisciplinary approach will ensure an effective management of maternal asthma with pregnancy, labor, and neonatal outcomes. Such would include regular prenatal examinations with individual asthma action plans and full educational patients on medicines adherence and lifestyle modification, which are critical in the improvement of maternal and neonatal health. Despite advancement in parental care, the impact of Asthma on pregnancy and infant remain concern throughout the world. Different research conducted on this topic, but in the study area very little previous publication present on this topic. So, this study was conducted to know the impact of Asthma during pregnancy and final outcome of pregnancy.

## Objective

To know the impact of maternal asthma on pregnancy complications, labor outcomes, and neonatal health by comparing outcomes between asthmatic and non-asthmatic pregnant women.

## Methodology

A retrospective study was conducted at the Department of Obstetrics and Gynecology, King Abdullah Teaching Hospital, Mansehra, in collaboration with Rural Health Centre Havelian and Type-D Hospital, Haripur. The study was conducted from January 2023 to July 2023, included 260 study participants. These participants were divided into two groups, each comprising 130 individuals. One group comprised asthmatic patients, while the other comprised 130 non-asthmatic controls. The inclusion criteria included women aged 18-45 years with singleton pregnancies and documented prenatal care and Exclusion criteria excluded women with pre-existing chronic illnesses other than asthma, multiple pregnancies, or incomplete medical records.

A special proforma was designed for study purposes, and with each study case, interviews with healthcare providers were conducted to assess their perspectives on

asthma management during pregnancy. This collaborative approach ensured a comprehensive understanding of the subject matter. All patients were screened for relevant clinical information, including maternal, demographic and clinical characteristics (age, BMI, smoking history, asthma severity, medication use), pregnancy complications (preeclampsia, gestational diabetes, preterm birth, cesarean delivery), labor and delivery outcomes (mode of delivery, labor duration, complications), and Neonatal outcomes (birth weight, Apgar scores, admission, respiratory distress).

The descriptive statistics were given for continuous variables such as maternal age, BMI, and birth weight as mean  $\pm$  standard deviation (SD) if normally distributed, or as median (interquartile range, IQR) if skewed. The categorical variables included preeclampsia, cesarean delivery, or NICU admission which are presented as frequencies and percentages. Mann-Whitney U tests compared continuous outcomes between the asthmatic and non-asthmatic groups dependent on data distribution as assessed by the Shapiro-Wilk test. Categorical outcomes were compared using Chi-square tests or Fisher's exact tests (for small cell counts  $<5$ ).

Data analysis was performed using SPSS version 28.

Ethical study approval was obtained from the ethical board of King Abdullah Teaching Hospital, Mansehra.

## Results

The present study included a total of 260 pregnant women. For study purposes, all study cases were divided into two groups. One was Asthma Group ( $n=130$ ) and other was Control Group ( $n=130$ ) comprised of non-asthmatic pregnant women. The mean age of participants in the Asthma Group was  $28.5 \pm 4.3$  years, while in the Control Group it was  $29.0 \pm 4.1$  years ( $p = 0.42$ ). Since the p-value is greater than 0.05, there is no statistically significant difference in age between the groups. Mean BMI of the Asthma women was  $26.7 \pm 3.5$ , while of non-asthmatic BMI was  $25.9 \pm 3.2$  ( $p = 0.15$ ). A history of smoking (active smokers, passive smokers, and individuals exposed to smoke from wood or coal used for cooking or heating) was reported in 12% of the Asthma group and 8% of the other group ( $p = 0.28$ ). Overall, the p-values suggest that none of the listed characteristics differ significantly between the Asthma and Control groups (Table 1).

Table 1. Demographic and Clinical Characteristics of study cases

Characteristic	Asthma Group (n=130)	Control Group (n=130)	P-value
Age (years)	$28.5 \pm 4.3$	$29.0 \pm 4.1$	0.42
BMI (kg/m <sup>2</sup> )	$26.7 \pm 3.5$	$25.9 \pm 3.2$	0.15
Smoking History (%)	12%	8%	0.28

In the Asthma group, the incidence of preeclampsia was 15%, while in the control group, it was 7% ( $p$  - value = 0.04). Since the p-value is less than 0.05, this difference is statistically significant, suggesting that asthma may be associated with a higher risk of preeclampsia. According to  $p$  - value = 0.03, 10% of the control group and 18% of the Asthma group experience preterm delivery. According to this statistically significant difference, asthma may make premature birth more probable. The rate of cesarean delivery was 35% in the Asthma group compared to 22% in the control group ( $p$  - value = 0.02). This significant difference suggested that asthma was linked to a higher probability of cesarean delivery (Table 2).

Compared to the control group, which had a mean birth weight of  $3100 \pm 400$ g, the Asthma Group had a mean birth weight of  $2900 \pm 450$ mg ( $p$  - value = 0.01). Since the p-value was less than 0.05, this difference was statistically significant, suggesting that maternal asthma was associated with lower birth weight. Neonatal

Intensive Care Unit (NICU) admission was required for 20% of newborns in the Asthma group compared to 12% in the control group ( $p$  - value = 0.03). This significant difference suggested that maternal asthma may increase the risk of NICU admission. These findings indicated that maternal asthma was associated with lower birth weight and a higher rate of NICU admissions, highlighting potential risks for newborns of mothers with asthma (Table 3).

The incidence of preeclampsia increased with asthma severity. 8% in mild cases, 15% in moderate cases, and 25% in severe cases suggesting that more severe asthma was a risk factor for preeclampsia. The likelihood of preterm birth followed a similar trend, with rates of 10% (mild), 18% (moderate), and 28% (severe), indicating a higher risk among those with more severe asthma. The rate of cesarean delivery rises from 25% in mild asthma, 33% in moderate asthma, to 45% in severe asthma, suggesting that severe asthma contributed to a greater need for surgical delivery.

Table 2. Pregnancy and Labor outcomes among study cases

Outcome	Asthma Group (n=130)	Control Group (n=130)	P-value
Preeclampsia (%)	15%	7%	0.04
Preterm Birth (%)	18%	10%	0.03
Cesarean Delivery (%)	35%	22%	0.02

Compared to 5% in the control group, 12% of newborns in the Asthma group experienced transient tachypnea ( $p$ -value = 0.02). The statistically significant difference suggested that maternal asthma increased the risk of transient tachypnea in newborns. Respiratory Distress Syndrome (RDS) was reported in 10% of neonates from the Asthma group versus 4% in the control group ( $p$ -value = 0.03). This significant difference indicated a potential association between maternal asthma and a higher risk of neonatal RDS (Table 5).

Table 3. Neonatal Outcomes among study cases

Outcome	Asthma Group (n=130)	Control Group (n=130)	P-value
Birth Weight (g)	2900 ± 450	3100 ± 400	0.01
NICU Admission (%)	20%	12%	0.03

The present study analyzed the impact of maternal asthma on pregnancy complications, labor outcomes, and neonatal health, based on statistical comparisons between an Asthma Group (n=130) and a Control Group (n=130). Results showed that age, BMI, and smoking history (active smokers, passive smokers, and individuals exposed to smoke from wood or coal used for cooking or heating) do not significantly differ between the asthma and control groups according to the baseline data. This suggests that differences in pregnancy and neonatal outcomes are likely due to asthma itself rather than other confounding maternal characteristics. A study in 2022 have found that higher BMI is associated with worsened asthma control in pregnancy,<sup>8</sup> but in this dataset, BMI was

## Discussion

The prevalence of asthma is between 4 and 12% worldwide, making it one of the most prevalent chronic illnesses affecting expectant mothers. While well-controlled asthma typically does not lead to adverse pregnancy outcomes, poorly managed or severe cases are associated with a higher risk of maternal complications, preterm birth, fetal growth restriction, and neonatal respiratory problems.<sup>7</sup>

not significantly different between groups. Smoking is a known risk factor for adverse pregnancy outcomes and asthma exacerbations,<sup>9</sup> but in the present study, smoking rates were not significantly different.

The considerably greater prevalence of preeclampsia in the asthma group (15% vs. 7%,  $p=0.04$ ) raises the possibility that maternal asthma may increase the risk of pregnancy problems associated with hypertension. Premature Birth Asthmatic mothers had a significantly higher risk (18% vs. 10%,  $p=0.03$ ), which aligns with previous findings linking poor asthma control to premature labor by Blais et al., in 2013.<sup>10</sup> In Cesarean Delivery the higher rate of cesarean delivery (35% vs. 22%,  $p=0.02$ ) may be due to increased fetal distress or

Table 4. Maternal Asthma Severity and Pregnancy Outcomes in study cases

Severity	Preeclampsia (%)	Preterm Birth (%)	Cesarean Section (%)
Mild	8%	10%	25%
Moderate	15%	18%	33%
Severe	25%	28%	45%

Table 5. Neonatal Respiratory Complications among study cases

Outcome	Asthma Group (%)	Control Group (%)	P-value
Transient Tachypnea	12%	5%	0.02
Respiratory Distress Syndrome	10%	4%	0.03

physician concerns about respiratory stability in asthmatic mothers. A meta-analysis by Murphy et al. found that asthmatic women had a 1.5 times greater risk of preeclampsia compared to non-asthmatic women, which aligns with these findings.<sup>8</sup> Another study in 2021 also reported a higher rate of cesarean delivery among asthmatic mothers, particularly in those with uncontrolled asthma.<sup>11</sup>

Birth Weight of Newborns from the asthma group had significantly lower birth weights ( $p=0.01$ ), which may be related to hypoxia, systemic inflammation, or medication effects during pregnancy. A considerably higher percentage of newborns from asthmatic mothers required NICU admission (20% vs. 12%,  $p=0.03$ ), likely due to an increased incidence of respiratory distress. A study by Namazy et al. in 2020 found that asthmatic pregnancies were associated with a 150-200g reduction in birth weight, consistent with the findings in this study.<sup>12</sup> Another study in 2021 also reported that NICU admission rates were higher in neonates born to asthmatic mothers, particularly if asthma was poorly controlled during pregnancy.<sup>13</sup>

This study points out that as asthma severity increases, the risk of preeclampsia, preterm birth, and cesarean delivery also increases. This finding highlights the importance of asthma control during pregnancy to minimize such risks. In the present study women with severe asthma had a 25% rate of preeclampsia, which is more than three times higher than those with mild asthma (8%). Similar findings also demonstrated by a study conducted in 2022, that severe asthma increases the risk of preterm birth and hypertensive disorders, similar to these findings.<sup>14</sup> Similarly, the increased cesarean rate in severe asthma aligns with studies by Murphy et al. in 2022 which showed that severe asthma leads to more obstetric interventions.<sup>8</sup>

It was also found that Transient Tachypnea (TTN) was significantly more common in neonates from asthmatic mothers (12% vs. 5%,  $p=0.02$ ) as compared with non-asthmatic mother. This condition is often associated with delayed clearance of lung fluid, which may be linked to maternal asthma or cesarean birth. Respiratory Distress Syndrome (RDS) was also more frequent in asthmatic group (10% vs. 4%,  $p=0.03$ ), which could be due to preterm birth, intrauterine hypoxia, or steroid use during pregnancy. A similar study conducted in 2019 also found that maternal asthma increased the risk of neonatal

respiratory complications, particularly TTN and RDS, consistent with this data.<sup>15</sup> Another study by Blais et al. in 2013 also showed that poor asthma control during pregnancy was associated with an increased need for neonatal respiratory support.<sup>10</sup>

The present study provide further support for having maternal asthma, especially when the condition is poorly controlled or severe, as posing great risks to both maternal and neonatal health. This study showed that preeclampsia, preterm birth, lower birth weight, greater NICU admissions, and neonatal respiratory complications point strongly associated with asthma and it is very important to manage asthma effectively during pregnancy. Despite some maternal factors like BMI and smoking history being similar between both groups in the present study, but in fact these events are also strongly associated with asthma. These findings strongly proposed for close prenatal care, individualized asthma management plans, and interdisciplinary collaborations between obstetricians and pulmonologists for the best outcome for both mother and child.

## Conclusion

This study concluded that maternal asthma significantly increases the risk of adverse pregnancy outcomes, including preeclampsia (15% vs. 7%), preterm birth (18% vs. 10%), and cesarean delivery (35% vs. 22%). Neonatal outcomes are also affected, with a higher likelihood of low birth weight, NICU admission, and respiratory complications. This study highlighted that Asthma severity plays a crucial role, with worsening asthma associated with progressively poorer outcomes.

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