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Determination of the Outcomes of Low Amniotic Fluid Volumes on Perinatal Mortality

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Abstract

Low amniotic fluid volume, or oligohydramnios, may be associated with obstetric complications and adverse neonatal outcomes, although the strength of these associations varies across clinical settings. This study aimed to determine the association between oligohydramnios and adverse perinatal outcomes among pregnant women in the third trimester. A prospective observational cohort study was conducted in the Department of Obstetrics and Gynecology, DHQ Teaching Hospital, Mirpur, Azad Jammu and Kashmir, Pakistan, from April to July 2026. Consecutive non-probability sampling was used to recruit 200 pregnant women, comprising an oligohydramnios group with an amniotic fluid index (AFI) <5 cm (n=100) and a normal-AFI group (n=100). Participants were followed until delivery, and maternal and neonatal outcomes were compared between the groups. Cesarean delivery (61.0% vs. 42.0%, p=0.008), intrapartum fetal distress (45.0% vs. 22.0%, p<0.001), low birth weight (34.0% vs. 18.0%, p=0.014), preterm delivery (28.0% vs. 12.0%, p=0.006), and a five-minute Apgar score <7 (38.0% vs. 20.0%, p=0.007) were more frequent in the oligohydramnios group according to the reported comparisons. Neonatal intensive care unit (NICU) admission and mean NICU length of stay were also higher. Perinatal mortality did not differ significantly in the reported analysis (6.0% vs. 1.0%, p=0.120). Third trimester oligohydramnios was associated with several adverse obstetric and neonatal outcomes in this cohort. These unadjusted findings support assessment alongside gestational age, maternal characteristics, and fetal status; they do not establish causality or an independent predictive effect.

Keywords: Oligohydramnios; amniotic fluid index; perinatology; fetal distress; cesarean delivery; low birth weight; neonatal intensive care.

1. INTRODUCTION

Amniotic fluid helps maintain the intrauterine environment required for fetal growth and development. It cushions the fetus against external mechanical forces, contributes to temperature regulation, permits fetal movement, and supports the development of the lungs, muscles, and skeletal system. Its protective functions also contribute to the conditions in which normal fetal development occurs throughout pregnancy. Estimating amniotic fluid volume is therefore an important component of antenatal assessment, particularly during the second and third trimesters, when ultrasound findings can be interpreted alongside other indicators of fetal well-being and maternal health [1–3].

Oligohydramnios refers to an amniotic fluid volume below the expected range for a particular stage of pregnancy. It may be associated with maternal, fetal, or placental conditions, including premature rupture of membranes, uteroplacental insufficiency, and abnormalities of fetal renal or urinary tract development. Ultrasound assessment generally uses the amniotic fluid index (AFI) or the single deepest vertical pocket, while fetal surveillance requires interpretation in the relevant clinical context [2–4]. The timing of diagnosis, severity of fluid reduction, associated complications, and underlying cause are clinically important. Studies have examined associations with fetal growth restriction, low birth weight, fetal distress during labor, low Apgar scores, and increased rates of cesarean delivery, although these relationships differ across populations and study designs [5, 6].

The reported frequency of oligohydramnios depends on the population studied, the diagnostic criteria applied, and gestational age at assessment. Hou et al. reported oligohydramnios in 4.4% of the term pregnancies included in their study; this proportion should not be assumed to apply to all antenatal populations [5]. The relationship between low amniotic fluid volume and maternal or fetal complications remains uncertain, particularly when oligohydramnios occurs without other identified complications. Some studies suggest that reduced fluid volume alone has limited independent predictive value and should not automatically prompt intervention without assessment of fetal condition. Fetal surveillance and the clinical evaluation of each pregnancy remain important when identifying pregnancies at risk [7, 8]. Other investigations have reported higher frequencies of adverse perinatal outcomes. Khan et al. reported low birth weight in 33.9% of exposed women compared with 18.2% of unexposed women. Their corresponding cesarean delivery rates were 60.3% and 42.1%, and the frequencies of low Apgar scores were 38.8% and 20.7%, respectively, with reported differences between groups at $p<0.05$ [9].

Associations between oligohydramnios and adverse perinatal outcomes may differ across populations and healthcare settings. Pregnancy outcomes can be influenced by access to antenatal care, maternal characteristics, the availability of diagnostic facilities, and local approaches to obstetric management. These factors are particularly relevant when interpreting findings from a hospital population in the local healthcare context. The present study therefore examined the association between oligohydramnios and adverse perinatal outcomes among women in the third trimester. Its findings may provide locally relevant evidence for risk assessment, antenatal monitoring, and timely clinical decision-making. Identifying pregnancies that require closer assessment may also help clinicians plan obstetric and neonatal care according to the overall maternal and fetal condition, rather than an isolated ultrasound measurement.

The specific objective was to compare adverse perinatal outcomes between pregnant women with oligohydramnios and those with a normal AFI during the third trimester, with particular attention to perinatal mortality and the accompanying obstetric and neonatal outcomes.

2. METHODS

This prospective observational cohort study was conducted in the Department of Obstetrics and Gynecology, DHQ Teaching Hospital, Mirpur, Azad Jammu and Kashmir, Pakistan, from April to July 2026. A total of 200 pregnant women were recruited consecutively using a non-probability sampling method and classified into two groups according to ultrasound findings: oligohydramnios, defined as AFI <5 cm (n=100), and normal AFI (n=100). Classification reflected the observed exposure and did not involve randomized treatment allocation. WHO sample-size software was used, with expected low-birth-weight frequencies of 33.9% and 18.2%, a 5% significance level, and 80% statistical power, as reported in the study description. Participants were followed until delivery to record maternal and neonatal outcomes. Institutional ethical clearance and informed consent were obtained before enrollment. Clinical characteristics and outcomes were documented using a structured data collection form.

Eligible participants were pregnant women aged 18–40 years, with parity <5 and a gestational age of 28–40 weeks estimated from the last menstrual period. Group I comprised women whose ultrasound findings met the study definition of oligohydramnios. Group II comprised women classified as having a normal AFI on ultrasound. The two groups were compared over the subsequent course of pregnancy through delivery.

Women were excluded if they had multiple pregnancies, fetal congenital anomalies, intrauterine fetal death, a large-for-gestational-age fetus, breech presentation, gestational diabetes, hypertension, a previous cesarean section, an abnormal placental location, or placental abruption. The supplied protocol described gestational diabetes using an oral glucose

tolerance test value >186 mg/dL and hypertension using blood pressure ≥140/90 mmHg. These criteria are reported as study eligibility criteria; the glucose threshold requires confirmation against the original testing protocol, including the glucose load and sampling time.

Following institutional ethical approval and written informed consent, demographic and obstetric information was collected using the structured study form. Recorded variables included maternal age, gestational age, parity, residence, occupation, and clinical features relevant to the pregnancy. Ultrasonography was used to assess amniotic fluid volume and classify participants according to AFI. Women were followed until childbirth, with cardiotocography used when clinically indicated to assess fetal well-being. Obstetric interventions and suspected intrapartum fetal distress were recorded during this period. Neonatal measurements included gestational age at birth, birth weight, the five-minute Apgar score, NICU admission, and NICU length of stay. Perinatal deaths were also recorded. However, the supplied study description did not specify the gestational-age threshold, observation period, or exact inclusion of stillbirths and early neonatal deaths in this outcome, which limits interpretation of the mortality comparison.

IBM SPSS Statistics version 26 was used for data analysis. Approximately normally distributed continuous variables were summarized as means and standard deviations; categorical variables were summarized as frequencies and percentages. Categorical outcomes were compared between the oligohydramnios and normal-AFI groups using the chi-square test or Fisher's exact test, as appropriate. Continuous variables were compared using independent-samples t-tests or suitable nonparametric tests according to their distributions. Statistical significance was defined as a two-tailed p-value ≤0.05. The results presented here are the reported unadjusted group comparisons. Although the study description referred to a planned multivariable logistic regression analysis, no corresponding model output or adjusted estimates were supplied. Consequently, regression results are not presented, and the associations should not be interpreted as independent effects after adjustment for potential confounding variables.

3. RESULTS

The study included 200 pregnant women recruited at 28–40 weeks of gestation. The cohort comprised 100 women with oligohydramnios and 100 women with a normal AFI, so each exposure group represented 50.0% of the study population. Selected maternal characteristics and gestational age at delivery are summarized in Table 1.

Table 1. *Maternal Age and Gestational Age at Delivery*

Parameter	Oligohydramnios (n=100)	Normal AFI (n=100)
Maternal age, years (mean ± SD)	27.4 ± 4.6	26.8 ± 4.2
Gestational age at delivery, weeks (mean ± SD)	37.2 ± 1.8	38.6 ± 1.4
Participants, n (%)	100 (50.0%)	100 (50.0%)

Mean maternal age was 27.4 ± 4.6 years in the oligohydramnios group and 26.8 ± 4.2 years in the normal-AFI group (Table 1). Mean gestational age at delivery was lower in the oligohydramnios group, at 37.2 ± 1.8 weeks compared with 38.6 ± 1.4 weeks (reported p<0.001). The supplied table did not contain the BMI, parity, or residence distributions needed to evaluate comparability for those characteristics.

Table 2. *Mode of Delivery and Intrapartum Fetal Distress*

Outcome	Oligohydramnios (n=100)	Normal AFI (n=100)	p-value
Cesarean delivery, n (%)	61 (61.0%)	42 (42.0%)	0.008
Vaginal delivery, n (%)	39 (39.0%)	58 (58.0%)	0.008
Intrapartum fetal distress on CTG, n (%)	45 (45.0%)	22 (22.0%)	<0.001

The delivery outcomes in Table 2 show a higher cesarean delivery rate among women with oligohydramnios than among women with a normal AFI (61.0% vs. 42.0%, reported p=0.008). Correspondingly, vaginal delivery occurred less frequently in the oligohydramnios group (39.0% vs. 58.0%). Suspected intrapartum fetal distress identified by cardiotocography was also more frequent among women with oligohydramnios (45.0% vs. 22.0%, reported p<0.001).

Table 3. *Birth Weight and Other Neonatal Outcomes*

Outcome	Oligohydramnios (n=100)	Normal AFI (n=100)	p-value
Low birth weight (<2,500 g), n (%)	34 (34.0%)	18 (18.0%)	0.014
Preterm delivery (<37 weeks), n (%)	28 (28.0%)	12 (12.0%)	0.006
Five-minute Apgar score <7, n (%)	38 (38.0%)	20 (20.0%)	0.007

The neonatal outcomes are summarized in Table 3. Low birth weight was more frequent among infants born to women

with oligohydramnios than among those born to women with a normal AFI (34.0% vs. 18.0%, reported p=0.014). Preterm delivery was also more frequent in the oligohydramnios group (28.0% vs. 12.0%, reported p=0.006). A five-minute Apgar score <7 was recorded for 38.0% of infants in Group I and 20.0% of infants in Group II (reported p=0.007).

Table 4. *NICU Use and Perinatal Mortality*

Outcome	Oligohydramnios (n=100)	Normal AFI (n=100)	p-value
NICU admission, n (%)	42 (42.0%)	21 (21.0%)	0.002
Duration of NICU stay, days (mean ± SD)	4.8 ± 2.2	2.6 ± 1.4	<0.001
Perinatal mortality, n (%)	6 (6.0%)	1 (1.0%)	0.120

NICU use and perinatal mortality are presented in Table 4. NICU admission was more frequent in the oligohydramnios group than in the normal-AFI group (42.0% vs. 21.0%, reported p=0.002). Mean NICU length of stay was also longer (4.8 ± 2.2 vs. 2.6 ± 1.4 days, reported p<0.001). Perinatal mortality was numerically higher in the oligohydramnios group (6.0% vs. 1.0%), but the reported comparison did not reach statistical significance (p=0.120).

Overall, oligohydramnios was associated with higher reported frequencies of cesarean delivery, intrapartum fetal distress, low birth weight, preterm delivery, low five-minute Apgar scores, and NICU admission. Mean NICU length of stay was also longer in this group. The reported analysis did not identify a statistically significant difference in perinatal mortality, although only seven deaths were recorded across both groups.

4. DISCUSSION

This study examined the association between third trimester oligohydramnios and adverse perinatal outcomes among 200 pregnant women attending DHQ Teaching Hospital, Mirpur, Azad Jammu and Kashmir, Pakistan. The reported comparisons indicated higher frequencies of cesarean delivery, intrapartum fetal distress, low five-minute Apgar scores, low birth weight, preterm delivery, and NICU admission in the oligohydramnios group. Mean NICU length of stay was also longer, whereas the reported difference in perinatal mortality was not statistically significant. These findings emphasize the relevance of amniotic fluid assessment within a broader evaluation of maternal and fetal risk. They should be considered alongside established approaches to antepartum fetal surveillance rather than interpreted as proof that a single fluid measurement determines the subsequent outcome [1].

Amniotic fluid supports fetal protection, movement, and development. Its assessment is an important component of ultrasound examination, particularly during the third trimester, when a reduced volume may accompany placental dysfunction, fetal urinary tract abnormalities, or ruptured membranes. Oligohydramnios was defined as AFI <5 cm in the present study. An alternative ultrasound measure is the single deepest vertical pocket, and differences between assessment methods can affect classification [2, 10]. Variation in diagnostic thresholds and outcome definitions may therefore contribute to differences across studies. Ultrasound findings should be interpreted together with maternal complications, fetal condition, and gestational age. This approach is particularly important when distinguishing isolated oligohydramnios from reduced fluid volume occurring alongside other recognized clinical problems.

Women with oligohydramnios had a higher reported cesarean delivery rate than women with a normal AFI (61.0% vs. 42.0%, p=0.008), with a correspondingly lower frequency of vaginal delivery. These findings indicate an association between oligohydramnios and operative delivery in this study population; they do not establish that low fluid volume directly caused the intervention. Reduced amniotic fluid may decrease cushioning around the umbilical cord and increase susceptibility to cord compression during contractions. Such changes can contribute to non-reassuring fetal heart-rate patterns and may influence decisions about delivery. However, the present analysis cannot distinguish the effects of fetal status, clinician decision-making, and other clinical factors on the cesarean rate. Hou et al. examined delivery mode and perinatal outcomes following a diagnosis of oligohydramnios at term, providing a relevant comparison while also illustrating the importance of population and management differences [5].

Intrapartum fetal distress was reported more frequently in the oligohydramnios group than in the normal-AFI group (45.0% vs. 22.0%, p<0.001). One possible explanation is that reduced fluid volume increases susceptibility to umbilical cord compression during labor, with resulting fetal heart-rate changes that prompt closer surveillance or obstetric intervention. This mechanism is plausible but was not directly evaluated in the present study. Cardiotocographic findings also require interpretation alongside the clinical assessment rather than being treated as a definitive diagnosis in isolation. Differences in monitoring practices and thresholds for intervention can influence the frequency of recorded fetal distress. The findings therefore support attention to intrapartum assessment while retaining the distinction between low amniotic fluid volume and demonstrated fetal compromise [4, 11].

According to Table 3, low birth weight occurred in 34 of 100 infants in the oligohydramnios group (34.0%) and 18 of 100 infants in the normal-AFI group (18.0%), with a reported p-value of 0.014. These values indicate an unadjusted association between oligohydramnios and birth weight <2,500 g. Low amniotic fluid volume may accompany impaired

fetal growth or placental insufficiency, but low birth weight can also reflect an earlier gestational age at delivery rather than restricted growth alone. Mean gestational age at delivery was lower in the oligohydramnios group (37.2 $\pm$ 1.8 vs. 38.6 $\pm$ 1.4 weeks, reported $p<0.001$). Consequently, the observed difference in low birth weight may partly reflect the greater frequency of preterm delivery. The available comparisons do not establish an association that is independent of gestational age or other maternal and fetal characteristics.

The low-birth-weight frequencies in the present cohort were 34.0% among women with oligohydramnios and 18.0% among women with a normal AFI. These figures are close to, but distinct from, the 33.9% and 18.2% reported by Khan et al. for exposed and unexposed women, respectively [9]. Their findings provide a locally relevant comparison concerning reduced amniotic fluid volume and birth weight. Nevertheless, numerical similarity alone does not establish that the populations or underlying risks were equivalent. Comparisons between studies should account for participant selection, gestational age, obstetric management, and the operational definitions used for exposure and outcomes.

Preterm delivery was more frequent among women with oligohydramnios than among women with a normal AFI (28.0% vs. 12.0%, reported p=0.006). This difference may reflect maternal or fetal conditions associated with reduced fluid volume, decisions to deliver earlier because of clinical concerns, or a combination of these factors. The association does not establish that oligohydramnios directly initiated spontaneous preterm labor. Fetal surveillance findings, other pregnancy complications, and local management protocols can all influence the timing of delivery. Reviews of isolated oligohydramnios have examined obstetric intervention and neonatal outcomes in defined gestational-age groups [6, 12, 13]. Interpreting the present findings therefore requires a distinction between spontaneous preterm birth and medically indicated early delivery, which was not available in the reported results.

A five-minute Apgar score <7 was recorded in 38.0% of infants in the oligohydramnios group and 20.0% of infants in the normal-AFI group (reported p=0.007). A low Apgar score is not a specific measure of intrapartum hypoxia, although it may indicate difficulty with neonatal adaptation or the need for resuscitative support. The higher frequency in the oligohydramnios group could be related to fetal heart-rate abnormalities, earlier gestational age at birth, low birth weight, or other neonatal factors. These explanations cannot be separated using the reported unadjusted comparisons. The findings should therefore be interpreted in relation to the infant's overall clinical condition and the circumstances of birth rather than as a specific indicator of a single mechanism of fetal compromise.

NICU admission was more frequent in the oligohydramnios group than in the normal-AFI group (42.0% vs. 21.0%, reported p=0.002). Mean NICU length of stay was also longer (4.8 $\pm$ 2.2 vs. 2.6 $\pm$ 1.4 days, reported $p<0.001$). These findings suggest greater use of specialist neonatal care among infants born to women with oligohydramnios in this hospital population. The additional care requirements may be related to prematurity, low birth weight, low Apgar scores, or other perinatal complications. However, institutional admission policies, available resources, and clinical judgment also influence NICU use. The higher admission rate cannot therefore be attributed solely to a direct effect of oligohydramnios on neonatal morbidity. Interpretation of the length-of-stay comparison also requires confirmation of the denominator used to calculate each group mean.

Studies from different healthcare settings have reported varying associations between oligohydramnios and perinatal outcomes. Shiferaw et al. examined maternal and perinatal outcomes in late-term and post-term pregnancies in Ethiopia, illustrating the importance of evaluating defined clinical populations [7]. Dammer et al. investigated isolated oligohydramnios diagnosed using the single deepest pocket method, providing evidence from a different ultrasound classification approach [8]. Figueroa et al. examined fetal, neonatal, and maternal outcomes in low- and middle-income countries, where access to antenatal surveillance and neonatal services may differ from that in other settings [14]. These studies offer useful comparisons, but their results should not be assumed to transfer directly to every hospital population. Local patterns of clinical practice and the availability of healthcare resources remain relevant when interpreting both intervention rates and neonatal outcomes.

Perinatal mortality was recorded in 6.0% of the oligohydramnios group and 1.0% of the normal-AFI group. Although the number of deaths was higher among women with oligohydramnios, the reported comparison was not statistically significant (p=0.120). This result requires cautious interpretation because only seven deaths occurred across the two groups, limiting the precision of the comparison. Failure to reach statistical significance does not demonstrate that mortality risks were equal, nor does it exclude a clinically important difference. Comparisons with other studies also require a consistent definition of perinatal mortality, including the relevant gestational-age threshold, the duration of neonatal follow-up, and whether both stillbirths and early neonatal deaths were included. These details were not specified in the supplied study description.

Rabie et al.'s systematic review and meta-analysis distinguished oligohydramnios in complicated pregnancies from oligohydramnios in otherwise uncomplicated pregnancies, emphasizing the importance of associated clinical conditions when interpreting perinatal outcomes [6]. Similarly, Rossi and Prefumo reviewed isolated oligohydramnios at term and after term, addressing a population that may differ from women with additional maternal or fetal risk factors [13]. These distinctions are relevant to the present cohort because an association observed across a broad clinical population cannot

automatically be attributed to fluid reduction alone. Reduced amniotic fluid volume occurring with fetal growth restriction, maternal disease, or abnormal fetal surveillance should be considered separately from genuinely isolated oligohydramnios. Clear exposure definitions are essential for meaningful comparisons between studies.

The management of isolated oligohydramnios also requires attention to the circumstances in which it is diagnosed. Shrem et al. examined isolated oligohydramnios at term as an indication for labor induction, assessing associations with obstetric intervention and neonatal outcomes [12]. Levin et al. subsequently investigated whether induction should be offered after 36 weeks in pregnancies with isolated oligohydramnios, further emphasizing the relevance of gestational age to management decisions [15]. The present observational findings should be interpreted within that broader clinical context. They support assessing gestational age, fetal condition, maternal health, and other obstetric indications together, while avoiding the inference that the AFI measurement alone determines the optimal timing or mode of delivery.

Longer-term outcomes also merit consideration when interpreting the significance of oligohydramnios. Dorot et al. examined the relationship between isolated oligohydramnios and subsequent neurological morbidity in offspring, extending assessment beyond the neonatal period [16]. Their study addresses a different follow-up horizon from the immediate outcomes reported here and should not be taken as evidence that this cohort experienced the same later complications. Whelan et al. compared neonatal outcomes in pregnancies with resolved and persistent oligohydramnios, highlighting the importance of its clinical course and persistence over time [17]. Together, these research questions indicate that a single measurement may not describe the full exposure history. Further investigation is needed to clarify how the duration, severity, and persistence of reduced fluid volume relate to outcomes at birth and during subsequent childhood.

The clinical interpretation of amniotic fluid measurements has also been examined in broader reviews and care frameworks. Huri et al. discussed amniotic fluid disorders from prenatal management through neonatal outcomes, providing a clinical context for evaluating the underlying causes and consequences of abnormal fluid volume [3]. Liabsuetrakul and Meher addressed intrapartum care algorithms for liquor abnormalities, including oligohydramnios, and considered structured assessment and timely clinical action [11]. These perspectives are relevant because monitoring strategies and intervention thresholds may influence the observed frequencies of fetal distress and cesarean delivery. The present study did not directly compare management algorithms, so its results cannot establish which surveillance or intervention strategy produces the best outcomes.

Several limitations affect interpretation of this study. The single-center setting and consecutive non-probability sampling limit generalizability to other clinical populations. Differences in gestational age at delivery may partly explain the observed frequencies of low birth weight, low Apgar scores, and NICU admission. Adjusted effect estimates were not reported, so it remains uncertain whether the associations would persist after accounting for gestational age and other potential confounders. The small number of perinatal deaths also limits reliable comparison of mortality. The available description does not fully specify the normal-AFI range, the mortality observation period, or the denominator for mean NICU length of stay. Future multicenter prospective studies should use standardized ultrasound criteria, clearly defined outcomes, and separate spontaneous from medically indicated preterm delivery. Multivariable analyses would allow estimation of adjusted associations. Evidence concerning the accuracy and clinical interpretation of ultrasound fluid measurements should also inform comparisons between AFI-based studies and those using other assessment methods [10, 18].

Overall, the present cohort showed higher reported frequencies of cesarean delivery, intrapartum fetal distress, low five-minute Apgar scores, NICU admission, preterm delivery, and low birth weight among women with oligohydramnios. Mean NICU length of stay was also longer in this group. The reported difference in perinatal mortality was not statistically significant, although the absolute number of deaths was greater among women with oligohydramnios. These findings may inform individual risk assessment and planning for antenatal, intrapartum, and neonatal observation in the local setting. They should be considered alongside the overall maternal and fetal condition, including gestational age and other complications. Because the study was observational and adjusted estimates were unavailable, causal conclusions and claims of independent prediction are not justified. Larger multicenter investigations using consistent diagnostic definitions, complete follow-up, and appropriate statistical adjustment would help clarify the relationships and strengthen the evidence relevant to clinical management.

5. CONCLUSION

In this cohort of women in the third trimester, oligohydramnios was associated with higher reported frequencies of cesarean delivery, intrapartum fetal distress, NICU admission, low five-minute Apgar scores, low birth weight, and preterm delivery. Infants in the oligohydramnios group also had a longer mean NICU stay. Perinatal deaths were more frequent in this group, but the reported mortality comparison did not reach statistical significance. The study therefore identified associations with several obstetric and neonatal outcomes without establishing a statistically significant mortality difference. These findings support considering low amniotic fluid volume alongside fetal growth, surveillance findings, maternal characteristics, and gestational age when assessing clinical risk and anticipating neonatal care needs. They do not establish a causal relationship or show that oligohydramnios independently predicts every adverse outcome. The

difference in gestational age at delivery, absence of adjusted effect estimates, and small number of deaths constrain interpretation. Larger multicenter prospective studies with standardized definitions, clearly documented follow-up, and appropriate multivariable analyses are needed to clarify these associations and their implications for clinical management.

Author Contributions

All authors contributed equally to the conception, development, preparation, and revision of the manuscript. All authors reviewed and approved the final version of the manuscript.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Data Availability

This study analyzed clinical data from pregnant women and their infants at DHQ Teaching Hospital, Mirpur, Azad Jammu and Kashmir, Pakistan. Aggregate findings are reported in the tables and text of this article. Individual-level clinical records are not included in the manuscript. Any access to such records must comply with participant confidentiality requirements and applicable institutional ethical approvals.

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