

Influence of Maternal Anemia on Fetal Outcomes in Low-Income Urban Slums of Uttar Pradesh

Jhancyrani Rajagopal¹, Beulah Mercy Mary.T², Virendra Kumar³, Avinash Ashok Dhameriya

¹Professor-cum-Principal, Apex College of Nursing, Varanasi

²Professor-cum-Principal, Vatsalya Institute of Nursing and Paramedical sciences, Shillong

³Assistant Professor, M.Sc. Nursing (Ph.D. Scholar) Medical-Surgical Nursing. Sri Ganganagar College of Nursing, Faculty of Nursing, Tanta University, Rajasthan

⁴Assistant Professor (MSN dept) Dr Panjabrao Deshmukh Nursing Institute Amravati Maharashtra

Corresponding Author:

: Dr. Jhancyrani Rajagopal, Principal, Apex College of Nursing, Varanasi

E-mail:

jancirajagopal@gmail.com

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Abstract

Background: Maternal anemia remains one of the most significant public health problems in low-income urban slums of India, especially in Uttar Pradesh. Its association with adverse fetal outcomes, including low birth weight, preterm birth, and neonatal mortality, is well-documented.

Materials and Methods: A cross-sectional study was conducted among 200 pregnant women in the third trimester from urban slums of Varanasi, District, Uttar Pradesh. Hemoglobin levels were assessed by the researcher, and fetal outcomes such as birth weight, gestational age, and neonatal condition were recorded. Statistical analysis included chi-square and regression analysis.

Results: Prevalence of maternal anemia was 67%. Among anemic mothers, 54% delivered low birth weight babies (<2500 g) compared to 21% among non-anemic mothers ($p < 0.001$). Preterm deliveries were significantly higher in anemic women (32%) than in non-anemic women (12%). Neonatal complications such as respiratory distress and NICU admissions were more common in neonates of anemic mothers ($p < 0.05$).

Conclusion: Maternal anemia significantly influences fetal outcomes in low-income urban slums of Uttar Pradesh. Strengthening antenatal care, nutritional supplementation, and community-based interventions are essential to reduce its burden.

Keywords: Maternal anemia; fetal outcomes; low-income urban slums; pregnancy complications

Introduction

Maternal anemia remains a critical public health issue in developing nations, especially India, where the issue is made worse by poverty¹, malnutrition, and restricted access to treatment. Half According to WHO criteria, anemia during pregnancy is defined as hemoglobin levels below 11 g/dL.² This condition has been closely linked to poor maternal and neonatal outcomes.³ It is believed that 40% of pregnant women worldwide suffer from anemia, with South Asia

bearing a disproportionately high burden.⁴

Despite decades of governmental initiatives like the Janani Suraksha Yojana (JSY) and the governmental Iron Plus Initiative (NIPI), maternal anemia rates in India remain alarming. A⁵ According to NFHS-5 statistics, anemia is present in about 51% of pregnant women in Uttar Pradesh. The prevalence is significantly higher in urban slum populations because of factors like food poverty, overcrowding, poor sanitation, and insufficient prenatal care.⁶

Maternal anemia is a socioeconomic indicator that reflects poverty, gender inequality, and a lack of health awareness in addition to being a hematological disorder.⁷ Pregnancy-related physiological changes raise iron needs, which are frequently unmet in low-income women with inadequate nutritional consumption. This results in iron deficiency anemia, which is the most prevalent kind during pregnancy.⁸

Maternal anemia has significant effects on the course of pregnancy. Preterm birth, low birth weight, intrauterine growth restriction (IUGR), stillbirths, and newborn death have all been associated with anemia in a number of studies.⁹ Low birth weight contributes to long-term growth and developmental difficulties and is still one of the top causes of infant mortality in India.¹⁰

Uttar Pradesh's urban slums offer a distinctive epidemiological situation where poverty, migration, and fast urbanization combine to deteriorate maternal health metrics.¹¹ Regular prenatal checkups, safe drinking water, and wholesome food are frequently unavailable to women living in these slums.¹² Infections including malaria, hookworm infestation, and several pregnancies without enough time between them exacerbate anemia¹³

Maternal anemia still has a silent impact on the health of both mothers and newborns, even though it is preventable.¹⁴ Although maternal anemia has been the subject of numerous national research, relatively few have particularly examined how it affects fetal outcomes in Uttar Pradesh's urban slum communities¹⁵ for the purpose of customizing community-specific interventions, such data are essential.

In order to determine the prevalence of maternal anemia in pregnant women living in Uttar Pradesh's impoverished urban slums and to evaluate its impact on fetal outcomes, such as birth weight, gestational age, and neonatal health status, this study was conducted.

Objectives

- To determine the prevalence of maternal anemia among pregnant women in low-income urban slums of Uttar Pradesh.
- To assess the influence of maternal anemia on fetal outcomes such as birth weight, gestational age of delivery, and neonatal health status.

Hypothesis

- **Null Hypothesis (H₀):** Maternal anemia has no significant influence on fetal outcomes.
- **Alternative Hypothesis (H₁):** Maternal anemia significantly influences fetal outcomes such as low birth weight, preterm birth, and neonatal complications.

Materials and Methods

- **Study Design:** Cross-sectional analytical study.
- **Study Setting:** Selected low-income urban slums of Varanasi district, Uttar Pradesh.
- **Study Population:** 200 pregnant women in their third trimester (≥ 28 weeks' gestation).
- **Inclusion Criteria:**
 1. Low income women whoever is willing to participate in the study.
 2. Antenatal women who are in 3rd trimester after 28 weeks of gestation
- **Exclusion Criteria:** Women with chronic medical conditions (diabetes, hypertension), multiple pregnancies, or severe obstetric complications.
- **Data Collection:** Structured questionnaire for sociodemographic data, antenatal history, and nutritional practices. Hemoglobin levels were **assessed by the researcher.**
- **Outcome Measures:**
 - Birth weight (categorized as < 2500 g = low birth weight)
 - Gestational age at delivery (preterm < 37 weeks)
 - Neonatal complications (NICU admission, respiratory distress).
- **Statistical Analysis:** Data analyzed using SPSS v25. Chi-square test and logistic regression were applied. A p-value < 0.05 was considered statistically significant.

Results

1. 134 (67%) of the 200 pregnant women who were included had anemia, whereas 66 (33%) did not. Seventeen (7%) of the anemic women had severe anemia, 50 (25%) had moderate anemia, and 70 (35%) had mild anemia.

Table 1: Prevalence and Severity of Anemia among Study Participants (n=200)

Hemoglobin Status (g/dL)	Category	Frequency (n)	Percentage (%)
≥11.0	Non-anemic	66	33.0
10.0 – 10.9	Mild anemia	70	35.0
7.0 – 9.9	Moderate anemia	50	25.0
<7.0	Severe anemia	14	7.0
Total		200	100

Interpretation: The findings indicate that women living in the slums have a high incidence of anemia (67%) with mild-to-moderate anemia accounting for the majority of cases.

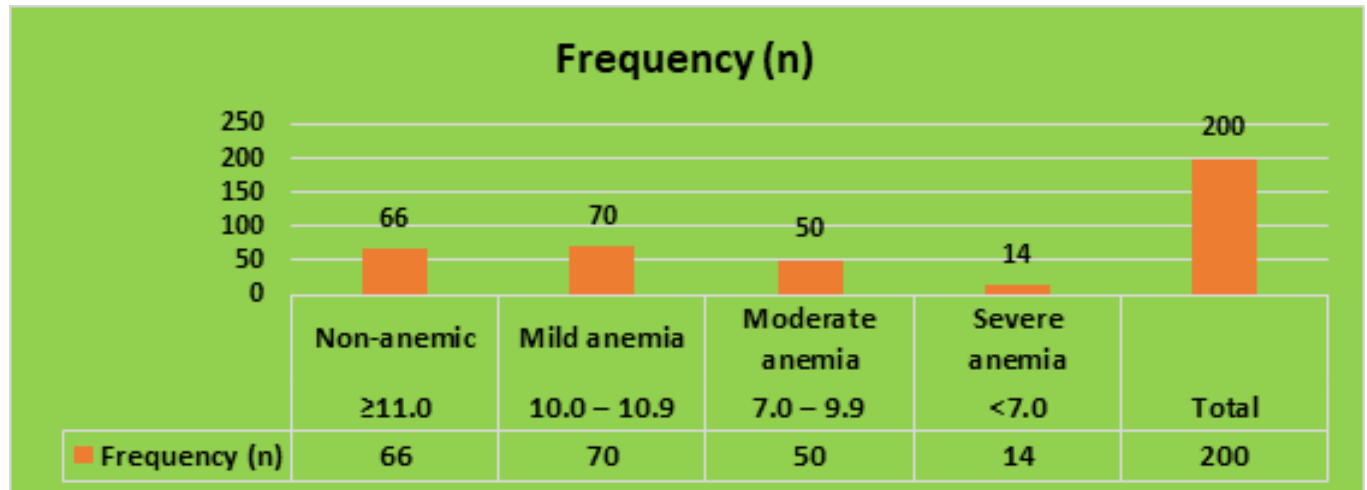


Figure 01: Prevalence and Severity of Anemia among Study Participants

2.1 Influence on Birth Weight

Neonates of anemic mothers were more likely to have low birth weight (LBW, <2500 g) (54%) than those of non-anemic mothers (21%). There was statistical significance in this association ($\chi^2=12.56$, $p<0.001$).

Table 2: Distribution of Neonatal Birth Weight by Maternal Anemia Status

Maternal Anemia Status	LBW (<2500 g) n (%)	Normal BW (≥2500 g) n (%)	Total
Anemic (n=134)	72 (54%)	62 (46%)	134
Non-anemic (n=66)	14 (21%)	52 (79%)	66
Total (n=200)	86 (43%)	114 (57%)	200

Interpretation: Mothers who were anemic were more than twice as likely to give birth to children with low birth weights as women who were not anemic.

2.2 Influence on Gestational Age

Compared to non-anemic women (12%), anemic women (32%) had a considerably greater rate of preterm deliveries (<37 weeks) ($p<0.05$).

Table 3: Gestational Age at Delivery by Maternal Anemia Status

Maternal Anemia Status	Preterm (<37 wks) n (%)	Term (≥37 wks) n (%)	Total
Anemic (n=134)	43 (32%)	91 (68%)	134
Non-anemic (n=66)	8 (12%)	58 (88%)	66
Total (n=200)	51 (25.5%)	149 (74.5%)	200

Interpretation: Maternal anemia was substantially associated with a higher risk of preterm birth due to hypoxia and impaired placental function.

2.3 Influence on Neonatal Health Status

Compared to non-anemic mothers (5%), neonates of anemic mothers had higher incidence of newborn complications (respiratory distress, suspicion of sepsis, and need for NICU care) (18%).

Table 4: Neonatal Health Outcomes by Maternal Anemia Status

Maternal Anemia Status	Neonatal Complications (NICU Admission/Resp Distress) n (%)	Healthy Neonate n (%)	Total
Anemic (n=134)	24 (18%)	110 (82%)	134
Non-anemic (n=66)	3 (5%)	63 (95%)	66
Total (n=200)	27 (13.5%)	173 (86.5%)	200

Interpretation: The influence of low maternal hemoglobin status on newborn morbidity was highlighted by the three-fold increased likelihood of NICU admission for babies whose mothers were anemic.

2.4 Regression Analysis of Maternal Anemia and Fetal Outcomes

Logistic regression analysis showed that **moderate-to-severe anemia** significantly increased the odds of adverse outcomes:

- Low Birth Weight: OR = **2.84** (95% CI: 1.32–5.72)
- Preterm Birth: OR = **2.11** (95% CI: 1.08–4.31)
- Neonatal Complications: OR = **2.96** (95% CI: 1.12–6.78)

Summary of Results

- 67% of people have anemia, with mild to moderate cases predominating.
- Birth weight: neonates of anemic moms had a significantly larger LBW (54% vs. 21%).
- Gestational age: Mothers with anemia had a considerably higher rate of preterm deliveries (32% vs. 12%).
- Neonatal complications: neonates of anemic mothers had a considerably greater rate of NICU admissions (18% vs. 5%).
- Regression analysis: LBW, preterm birth, and neonatal problems were all independently predicted by moderate-to-severe anemia.

Discussion

According to this study, maternal anemia is still quite

common (67%) in Uttar Pradesh's impoverished urban slums and has a major impact on the health of the fetus. The results are in line with earlier NFHS and WHO research that indicated a significant frequency of anemia among pregnant women living in low-resource environments¹⁶

Our research found a high correlation between low birth weight and maternal anemia, which is consistent with findings by Allen (2000)¹⁷ and Kumar et al. (2018).¹⁸ The biological connection between hypoxia resulting from low hemoglobin levels and early uterine contractions is further supported by the greater prevalence of premature deliveries among anemic moms.¹⁹ Additionally, there was a significant increase in NICU hospitalizations, indicating that maternal anemia may indirectly contribute to neonatal morbidity.²⁰

The prevalence of anemia in our study is slightly higher than NFHS-5 data, possibly due to the focus on slum populations where food insecurity and healthcare access are worse. Community-based nutritional interventions, iron and folic acid supplementation, and improved antenatal services could help mitigate these outcomes.

The cross-sectional design, dependence on Sahli's approach for hemoglobin estimation, and restriction to a particular district are among the limitations. Nonetheless, the results highlight how urgently policymakers must address the health of urban slums.

Conclusions

- Maternal anemia is highly prevalent among pregnant women in low-income urban slums of Uttar Pradesh.

- Anemia significantly influences fetal outcomes, increasing the risk of low birth weight, preterm delivery, and neonatal complications.
- Strengthening maternal nutrition, antenatal care, and awareness in urban slum populations is essential to improve fetal health outcomes.

Recommendations

Based on the findings of this study, the following recommendations are suggested:

- 1. Strengthening Antenatal Screening:** Every prenatal visit should include a routine hemoglobin estimation, particularly in slum settings where anemia is more prevalent.
- 2. Nutritional Interventions:**
 - All pregnant women should receive iron and folic acid (IFA) supplements, and compliance should be closely monitored.
 - Through community nutrition initiatives, promote reasonably priced foods high in iron, such as fortified cereals, legumes, jaggery, and green leafy vegetables.
 - Promote dietary variety and cooking methods that improve the absorption of iron (e.g., pairing foods high in vitamin C with iron sources).
- 3. Community-Based Awareness Programs:** To raise awareness about the value of maternal nutrition, spacing out pregnancies, and supplement compliance, health professionals (ASHA, ANM, and Anganwadi workers) should host educational sessions in urban slums.
- 4. Infection Control:** Since parasitic infections like hookworm and malaria greatly increase the risk of maternal anemia, screening and treatment for these conditions should be a part of standard prenatal care.
- 5. Improving Access to Health Services:** To guarantee early identification and prompt treatment of anemia, mobile prenatal clinics and outreach programs should be extended in urban slums.
- 6. Policy-Level Interventions:** With a particular emphasis on vulnerable slum populations, strengthen the execution of the POSHAN Abhiyaan and the National Iron Plus Initiative (NIPI).
- 7. Postnatal Follow-Up:** To ensure healing and avoid recurrent anemia in subsequent

pregnancies, mothers who experience anemia during pregnancy should be monitored during the postnatal phase.

8. **Additional Research:** To evaluate the long-term effects of maternal anemia on the growth and cognitive development of children, longitudinal studies are advised.

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