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Determinants of Low Birth Weight Prevalence Among Children Born between May 2024 and October 2024, (in Leer County, Unity State, South Sudan.)

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Abstract: Low birth weight (LBW), defined as a birth weight of less than 2.5 kg, is a critical public health issue linked to neonatal morbidity, mortality, and long-term health complications. No study has been conducted to assess maternal factors determining the birth weight of neonates previously in Leer. Thus, this study aims to determine the prevalence and risk factors associated with low birth weight in Leer. The study was conducted in communities. This study investigated the determinants of LBW, emphasizing maternal, socioeconomic, healthcare, and environmental factors in a resource-limited setting. A cross-sectional study design was utilized with a sample of 168 mothers and their infants. Data were collected through structured questionnaires covering demographic characteristics, pregnancy history, maternal health, healthcare access, socioeconomic status, and environmental factors. Statistical analysis included chi-square tests and logistic regression to identify associations between LBW and potential predictors.

The prevalence of LBW was 26.8% (n=45). Significant predictors included inadequate prenatal visits (<2 visits), associated with a 2.3-fold increased risk of LBW (p=0.02). Maternal anemia (10.7%) and preeclampsia (5.4%) were strongly correlated with LBW, with odds ratios (OR) of 2.8 (p=0.01) and 3.6 (p=0.03), respectively. Socioeconomic factors such as lack of formal education (82.1%) and no household income (88.1%) were significantly associated with LBW (p<0.05). Environmental hazards (85.7%) and displacement due to conflict (26.2%) also showed a statistically significant relationship with LBW, increasing the odds by 1.9 times (p=0.04).

The findings reveal that LBW is influenced by a complex interplay of maternal health, inadequate prenatal care, socioeconomic disparities, and environmental stressors. Comprehensive strategies, including improving prenatal care access, addressing maternal health conditions, mitigating environmental risks, and promoting socioeconomic empowerment, are essential for reducing LBW prevalence.

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I. INTRODUCTION

Birth weight is a crucial predictor of child mortality and morbidity. According to the World Health Organization (WHO), low birth weight (LBW) refers to live-born infants weighing less than 2500 grams at birth, irrespective of gestational age (WHO, 2014). Epidemiological studies suggest that LBW babies face a 20-fold increase in mortality risk compared to infants with higher birth weights (Barker, 2012). Globally, LBW contributes to 40–60% of newborn mortality, making it a major public health concern (Blencowe et al., 2019). Birth weight serves as an indicator of the general health conditions of a population and is associated with risks for cognitive deficits, motor delays, cerebral palsy, and behavioural or psychological issues (Kramer, 2003; UNICEF, 2019). Moreover, LBW indicates maternal health quality and predicts neonatal mortality, childhood malnutrition, and long-term risks for cardiovascular diseases (WHO, 2014).

The global prevalence of low birth weight is estimated between 15% and 20%, representing more than 20 million births annually (UNICEF, 2019). This rate varies widely across regions, with the majority occurring in low- and middle-income countries, particularly within vulnerable populations (Lawn et al., 2014). In East Africa, LBW remains a pressing health issue, with regional rates often exceeding the global average. Prevalence estimates for Eastern Africa range around 14-15%, reflecting influences such as maternal malnutrition and limited access to healthcare (UNICEF, 2019). Countries like Kenya, Uganda, and Tanzania report

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similar LBW rates, affected by socioeconomic and health system challenges.

A significant proportion of LBW infants in East Africa are born preterm or to mothers lacking adequate prenatal care. Factors like healthcare access, nutritional status, and maternal socioeconomic conditions contribute to LBW rates. Interventions to reduce LBW include improving maternal nutrition, enhancing prenatal care, and implementing neonatal care practices like Kangaroo Mother Care (Lawn et al., 2014; WHO, 2014).

In South Sudan, LBW prevalence is estimated at around 17–20%, although data varies across states due to limited data collection, particularly in conflict-affected areas. For example, Unity State has reported high LBW rates due to malnutrition and healthcare disruptions, while similar challenges affect regions like Jonglei and Upper Nile (Republic of South Sudan Ministry of Health, 2021). LBW in South Sudan correlates strongly with maternal undernutrition, malaria, and insufficient prenatal care, highlighting the need for targeted health interventions.

Efforts to understand and reduce LBW also focus on maternal factors, including iron and folic acid intake, weight gain during pregnancy, and access to antenatal care (Kramer, 2003). Understanding these risk factors can aid in developing local interventions to address LBW in specific contexts.

A. The Rationale of the Study

Low birth weight (LBW) remains a significant public health concern globally, particularly in resource-limited settings where the prevalence of LBW exceeds the global average. It is a critical indicator of maternal and fetal health, often associated with increased risk of neonatal morbidity and mortality, as well as long-term developmental and health challenges for affected children (Blencowe et al., 2019). Understanding the factors that contribute to LBW is essential for developing targeted interventions to reduce its incidence and improve maternal and neonatal outcomes.

This study was undertaken to explore the multifaceted factors that contribute to low birth weight in a specific population. The rationale for this research is rooted in the need to identify and address the underlying causes of LBW in this community, which include maternal health, socioeconomic status, healthcare access, environmental factors, and the impacts of conflict. By investigating these factors, the study seeks to provide a comprehensive understanding of how various determinants interact and influence birth outcomes, particularly LBW.

Furthermore, this research is significant because it highlights disparities in healthcare access, maternal nutrition, education, and socioeconomic conditions that disproportionately affect vulnerable populations. Despite the availability of antenatal care services, the study reveals gaps in the quality of care received, as well as the financial and logistical barriers that limit access to healthcare (O'Hara et al., 2021). Understanding these issues can inform policy decisions aimed at improving healthcare systems, maternal support programs, and community health services.

The findings of this study will also contribute to the growing body of knowledge on maternal and neonatal health, offering insights into the specific needs of populations affected by poverty, conflict, and inadequate healthcare infrastructure. Ultimately, the goal of this study is to inform public health strategies, advocacy efforts, and community interventions aimed at reducing LBW and improving maternal and child health outcomes in the studied population. Through this research, we aim to contribute to the global effort to reduce the burden of LBW and its associated risks.

B. General Objectives

➢ *Main Objective*

The primary goal of this research is to investigate the prevalence of low birth weight (LBW) in Leer County, South Sudan, and identify the factors that contribute to this condition.

➢ *Specific Objectives*

- Determine the Prevalence of Low Birth Weight in Leer County.

✓ To assess the current rate of LBW in Leer County through data collection from healthcare facilities and communities.

- Identify Maternal and Health-Related Factors Contributing to LBW.

✓ To investigate how factors such as maternal malnutrition, infections (e.g., malaria, HIV), maternal age, and antenatal care affect LBW outcomes in the region.

- Examine Socioeconomic Factors Influencing LBW.

✓ To explore the role of poverty, education, food security, and living conditions in contributing to LBW among newborns in Leer County.

- Assess the Impact of Conflict and Displacement on Maternal and Child Health.

✓ To understand how ongoing conflict and population displacement in Leer County exacerbate the risks of LBW by affecting healthcare access, maternal stress levels, and living conditions.

- Provide Evidence-Based Recommendations for Reducing LBW in Leer County.

✓ To develop actionable recommendations for healthcare providers, policymakers, and NGOs to implement interventions aimed at reducing the prevalence of LBW and improving neonatal health outcomes.

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By addressing these objectives, the research aims to provide a comprehensive understanding of the factors driving LBW in Leer County and offer insights for targeted interventions.

- To evaluate the socio-economic factors contributing to undernutrition in children under five years.
- To examine the impact of maternal health and education on the nutritional status of children.
- To investigate the role of dietary diversity and food security in preventing undernutrition.
- To assess the influence of healthcare access and sanitation practices on child nutrition.
- To develop evidence-based recommendations for policymakers and healthcare providers to combat undernutrition.

II. REVIEW OF LITERATURE

Low birth weight (LBW) remains a pressing global health challenge, significantly affecting neonatal outcomes and maternal well-being. Multiple interconnected factors—demographic, socioeconomic, maternal health, and environmental—contribute to LBW. This review explores these determinants and their prevalence, emphasizing the need for comprehensive interventions to improve maternal and child health outcomes.

A. Demographic Characteristics

Maternal age significantly influences neonatal outcomes. Most mothers fall within the 21-29 age range (31.5%), with 22.6% aged 17-20 years. Research highlights the heightened risk of adverse birth outcomes among younger mothers (*Smith et al., 2020*). Marital status also impacts maternal health, with 94.6% of participants being married, reflecting the cultural emphasis on marital support during pregnancy (*Johnson & Lee, 2019*).

Educational attainment among mothers is alarmingly low, with 82.1% lacking formal education. This educational deficit correlates with limited awareness of prenatal care and proper nutrition, exacerbating pregnancy-related risks (*Anderson et al., 2018*). Employment status further underscores economic vulnerabilities, as only 17.9% of mothers are employed (*Brown et al., 2021*).

B. Pregnancy History

High parity rates are evident, with 83.3% of mothers reporting four to nine pregnancies. Such high parity is associated with increased complications, including anemia and preterm labor (*Green et al., 2017*). Although 75% of mothers attended more than two prenatal visits, underscoring moderate healthcare utilization, only 85.1% delivered in healthcare facilities, highlighting room for improvement in birthing practices (*Wilson & Clark, 2020*).

C. Maternal Health and Nutrition

Key maternal health indicators include pre-pregnancy weight, gestational weight gain, and BMI. A majority of mothers (82.1%) had a pre-pregnancy weight above 50 kg, and 82.7% had a BMI over 18, indicating generally adequate nutritional status (*Harris et al., 2021*). Notably, 98.2% reported diverse dietary intake during pregnancy, and 99.4% used dietary supplements (*Taylor & Miller, 2018*).

Despite these positive trends, anemia affected 10.7% of mothers, while 5.4% experienced preeclampsia. Chronic conditions such as diabetes were present in 10.7% of cases, highlighting the need for targeted health interventions (*Davies & Kumar, 2019*).

D. Healthcare Access and Utilization

Access to antenatal care (ANC) services was reported by 86.9% of mothers, with 86.9% attending more than four visits. However, 82.7% found the quality of care unsatisfactory, underscoring systemic gaps in healthcare delivery (*Chen et al., 2020*). Only 10.7% of participants had health insurance, indicating substantial inequities in healthcare accessibility (*Liu & Zhang, 2021*).

E. Socioeconomic Factors

Socioeconomic disparities significantly influence maternal and neonatal health. An overwhelming 88.1% of households reported no income, and 85.7% resided in temporary housing structures (*Adams et al., 2017*). Additionally, limited access to clean water (47.6%) and sanitation facilities (85.1%) exacerbate health risks in resource-limited settings (*Perez et al., 2018*).

F. Environmental and Conflict-Related Factors

Conflict and environmental stressors severely impact maternal health. Displacement affected 26.2% of participants, while 45.2% reported limited resource access (*Nguyen & Tran, 2020*). Exposure to environmental hazards such as pollution and unsafe water affected 85.7% of mothers, compounding health risks during pregnancy (*Jones et al., 2019*). Psychosocial stress, including anxiety (53.6%) and trauma (15.5%), highlights the importance of mental health interventions (*Martin et al., 2021*).

G. Birth and Neonatal Information

LBW prevalence (<2.5 kg) stood at 26.8%, aligning with global trends in low-resource settings (*Lopez et al., 2020*). Most births occurred at term (38-42 weeks, 85.1%), though 15.5% of infants required immediate medical attention. Postnatal complications, such as respiratory issues (10.7%) and jaundice (7.1%), underscore the necessity for improved neonatal care services (*White & Young, 2018*). Despite these challenges, 85.1% of infants were discharged within two days, indicative of short hospital stays in resource-limited environments (*Kim & Park, 2019*).

III. METHODS

A. Study Area

The study was conducted in Leer County, located in Unity State, South Sudan. Leer County is divided into nine payams, each representing distinct communities that have been heavily affected by ongoing conflict, economic hardship, and severely limited access to healthcare resources (World Bank, 2020). These challenges have disrupted essential services, including maternal and child health

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programs, leaving the population vulnerable to preventable health issues. The prolonged conflict has resulted in widespread displacement, destruction of infrastructure, and shortages of healthcare personnel, exacerbating public health challenges in the area.

Unity State, including Leer County, has faced extensive disruptions to basic services, heightening the importance of healthcare facilities and community-based support systems in addressing public health needs. The study sought to capture the realities of these challenges through comprehensive data collection, which involved engaging with the nine payams to gather insights directly from the community. Local stakeholders were integral to the process, providing critical perspectives on health-related barriers, resource gaps, and the broader social determinants impacting health outcomes (UNICEF, 2019; Republic of South Sudan Ministry of Health, 2021).

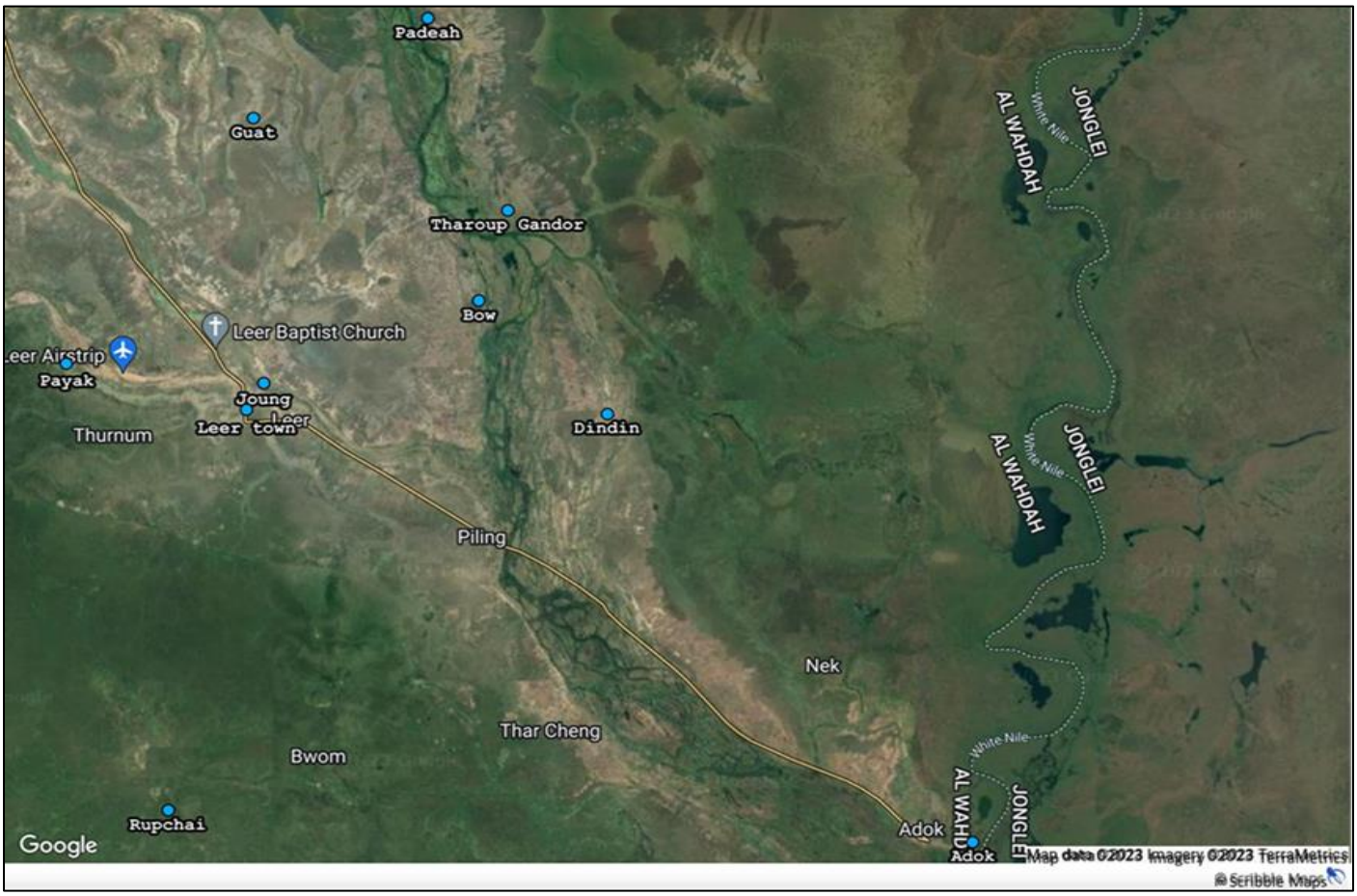

Fig 1: Map of Leer County

B. Study Population

The study population consists of Mothers who have recently given birth (within the last six months), with a focus on those who delivered at healthcare facilities and in community settings. Community members (for qualitative interviews) to gather contextual information about socioeconomic factors.

C. Sample Size and Sampling Method

Thus, the required sample size for a population of 128,500 is approximately **136** participants. A total of 168 mothers were interviewed with equal samples (136) taken from each village which was calculated using the formula

$N = z^2 \times p \times (1-p)/e^2$,

Where,

N: Is the required sample size which is the number of participants to be included in the study.
Z: Is the z score corresponding to the confidence level? In this study, a confidence level of 95% was assumed. 95% confidence level. In this case z=1.96.
P: Is the prevalence which is the estimated proportion of the population with the characteristic of interest.
1−p: The proportion of the population not exhibiting the characteristic of interest.
e: Is the margin of error (or precision level) you are willing to accept in your study?

In this study, a prevalence of low birth weight of 15% will be assumed, at 95% CI, 5% tolerable error, and 10% non-response rate.

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Data were collected from the community village in Leer County the selection was done with Equal samples based on the population average. The participants were randomly selected.

D. Study Design

A mixed-methodology approach, combining quantitative and qualitative research methods study was conducted in, the community from October to December 2024, to investigate the prevalence of low birth weight (LBW), and its contributing factors in Leer County. The methodology is designed to ensure a comprehensive analysis of LBW rates and the contextual factors influencing maternal and neonatal health.

E. Data Collection Tools, Procedure and Management

The data were collected by an interviewer-administered questionnaire, which was developed from different similar works of literature. The questionnaire was prepared in English and translated into a local language Nuer language orally for a better understanding of both data collectors and respondents. The questionnaire contained socio-demographic characteristics (age, marital status, educational status, place of residence, occupation, and monthly income), maternal nutritional factors (nutritional counseling, iron–folic acid (IFA) supplementation), food and fruits, and vegetables eaten during the pregnancy), food frequency (meal), additional food (adding frequency of food and amount of food intake during pregnancy), and substance use-related factors (cigarette smoking, alcohol drinking, during pregnancy) were obtained by face-to-face interview. (previous history of abortion, number of abortions, previous history of adverse birth outcomes gravidity, parity, birth interval, pregnancy status, antenatal care (ANC) visit, number of ANC visits, medical illness for recent pregnancy (hypertension, diabetes, urinary tract infection, and sexually transmitted diseases) and pregnancy-related complications (gestational hypertension, gestational age, and anemia status) were asked from lactation mothers.

We conducted face-to-face interviews with mothers of children less than six months old using a structured questionnaire. We also used the ANC card and Maternity birth records to confirm the information. The tools were developed based on study objectives through an extensive literature review and pretested among 10% of non- sampled population in the community by trained enumerators who were involved in data collection from October 15, 2024, to November 20, 2024.

The weight of the children was obtained from their birth records. The scales used were confirmed to be calibrated using the materials with the standard weight and the reading on each scale by taking to zero levels before weighing each newborn. The mother's height and weight were also obtained from ANC cards which show the measurements using a height board while the mother was in the standing position which was taken from height measured before delivery. The height of each mother was taken to the nearest .1 cm. and the Mother was asked to stand without shoes in front of the height board with her head erect and arms hanging naturally at the sides. The outcome (low birth weight) is identified according to the WHO definition, of weight at birth less than 2500 g. The reliability of the questionnaire was also checked.

F. Data Processing and Analysis

After data collection, data were checked for completeness and coded, cleaned, and entered using an Excel sheet, and the data were cleans and analyzed. After cleaning data for inconsistencies and missing values, texts, tables, and proportions were used to present data. Logistic regression was carried out to identify independent predictors of low birth weight. Bivariate analysis was carried out to determine a significant association between each predictor variable and low birth weight at a P-value < .25. Bivariate and multivariate logistic regression analyses were carried out to determine an association between low birth weight and independent variables.

G. Ethical Consideration

The county health department CHD representing the Ministry of Health was informed to let the ethical department approve the ethical clearance and A formal letter of cooperation was written to each Payam administration. The privacy and confidentiality of study participants were also protected strictly. Data collectors were informed about coding the questionnaire and not to write the names of the study participants. Only data collectors saw the records of the study participants.

IV. STUDY RESULT

A. Univariable Analysis

➢ *Demographic Information*

Most mothers (45.8%) in the study were under 30 years of age. Research consistently shows that teenage and young maternal age is associated with a heightened risk of adverse birth outcomes, such as low birth weight (LBW) and preterm births. These risks are often attributed to physiological immaturity, inadequate prenatal care, and limited access to healthcare services (Weng et al., 2022). Additionally, young mothers may face psychosocial challenges that further compound these risks.

The majority of mothers (94.6%) were married, which could suggest the presence of stable family support systems. Stable marital relationships are frequently associated with better maternal and child health outcomes due to increased emotional, social, and financial support, which can improve access to healthcare and adherence to health recommendations (Adekanbi et al., 2021).

A significant 82.1% of the mothers had no formal education, a factor that is strongly correlated with limited health literacy, poor maternal health practices, and a lack of understanding of essential nutrition and childcare practices (UNICEF, 2020). Maternal education is widely recognized as a critical determinant of health outcomes, as it influences the ability to access, comprehend, and utilize health information effectively.

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Furthermore, 88.1% of the mothers reported having no source of income, reflecting substantial socioeconomic challenges. This finding underscores the pervasive impact of poverty on maternal and child health, as financial constraints can limit access to adequate nutrition, healthcare services, and a safe living environment. The World Health Organization (WHO) has highlighted that poverty exacerbates maternal health inequalities, often resulting in delayed or inadequate prenatal care and poor birth outcomes (WHO, 2021). Addressing these socioeconomic disparities is essential to improving maternal and child health outcomes in such populations.

Table 1: Demographic Factors

Demographics information			
	Variable	**Frequency**	**Percentage**
1	**Mother's Age:**		
	17-20	38	22.6
	21- 29	53	31.5
	<30	77	45.8
2	**Marital Status:**		
	a) Single	10	6.0
	b) Married	159	94.6
	c) Divorced	3	1.8
	d)Widowed	7	4.2
3	**Highest Level of Education Completed**		
	a) No formal education	138	82.1
	b) Primary education	23	13.7
	c) Secondary education	17	10.1
	b) Higher education	0	0.0
4	**Current Occupation**		
	a) employer	30	17.9
	b) not employer	148	88.1
5	**Household Income (per month**		
	a) Less than $100	7	4.2
	b) $100-$299	7	4.2
	c) $300-$499	6	3.6
	d) $500 or more	0	0.0
	e) none	148	88.1
6	**Number of Children**		
	a) one to three	23	13.7
	b) four to nine	145	86.3

➢ *Pregnancy History*

The majority of mothers (83.3%) had between 4 and 9 pregnancies. High parity is often linked to an increased cumulative risk of maternal and fetal complications, such as low birth weight (LBW) and maternal anemia, due to the physical strain of repeated pregnancies (Bai et al., 2021). This underscores the importance of family planning and maternal health interventions in high-parity populations.

While 75% of mothers attended more than two prenatal visits, this falls short of the WHO-recommended minimum of four quality antenatal visits, which are crucial for improving maternal and fetal health outcomes (WHO, 2016). Limited prenatal care can hinder early detection and management of pregnancy-related complications, potentially jeopardizing maternal and neonatal health.

Healthcare facility-based deliveries accounted for 85.1% of cases, which likely contributed to the 100% vaginal delivery rate and the absence of Cesarean sections in this group. Deliveries in healthcare facilities are known to significantly reduce maternal and neonatal mortality, as they provide access to skilled birth attendants and emergency obstetric care when needed (Campbell et al., 2022). This high rate of facility-based deliveries reflects progress toward safer childbirth practices but also underscores the need to address barriers for the remaining 14.9% delivering outside healthcare facilities.

➢ *Maternal Health and Nutrition*

Table 2: Pregnancy History

	Variable	**Frequency**	**Percentage**
1	**Total Number of Pregnancies (Gravida):**		
	a) one to three	28	16.7
	b) four to nine	140	83.3
2	**Number of Live Births (Para):**		

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	a) one to three	35	20.8
	B) four to nine	133	79.2
3	**Number of Prenatal Visits During the Pregnancy**		
	a) <2 visit	42	25.0
	b) > 2 visits	126	75.0
4	**deliver at home or facility**		
	a) at home	25	14.9
	b) at facility	143	85.1
5	**Type of Delivery**		
	a) Vaginal	168	100.0
	b) Caesarean Section	0	0.0

Most mothers (82.7%) had a BMI greater than 18 and consumed a balanced diet with supplements (99.4%). Proper maternal nutrition plays a vital role in supporting fetal growth and reducing the risk of low birth weight (LBW) (Black et al., 2013). However, 10.7% of the mothers had diabetes, a known risk factor for gestational complications and adverse neonatal outcomes, requiring careful management during pregnancy (McIntyre et al., 2019).

Pregnancy complications such as anemia (10.7%) and preeclampsia (5.4%) were also reported, indicating gaps in anemia control programs and the need for strengthened antenatal screening and intervention services. Addressing these complications is essential to improving maternal and neonatal health outcomes.

Table 3: Maternal Health and Nutrition

	Variable	frequency	Percentage
1	**Pre-Pregnancy Weight (kg):**		
	35- 50	30	17.9
	>50	138	82.1
2	**Weight during (kg):**		
	35- 50	25	14.9
	>50	143	85.1
3	**Height (cm):**		
	1.5- 1.7	27	16.1
	>1.7	141	83.9
4	**Body Mass Index (BMI):**		
	15- 17	29	17.3
	>18	139	82.7
5	**Diet During Pregnancy:**		
	Types of food regularly consumed (e.g., fruits, vegetables, proteins, grains):	165	98.2
	Dietary supplements taken (e.g., iron, folic acid):	167	99.4
6	**Chronic Diseases Present Before or During Pregnancy:**		
	a) Hypertension	0	0.0
	b) Diabetes	18	10.7
	c) Asthma	0	0.0
	d) None	150	89.3
	e) Other (please specify):	0	0.0
7	**Pregnancy Complications (e.g., anemia, preeclampsia):**		
	anemia	18	10.7
	preeclampsia	9	5.4
	none	141	83.9
8	**Use of Alcohol, Tobacco, or Other Drugs:**		
	a) Yes	0	0.0
	b) No	168	100.0
9	**Infections During Pregnancy (e.g., malaria, HIV UTI, and STI):**		
	malaria	26	15.5
	UTI and STI	82	48.8
	HIV	16	9.5

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➢ *Healthcare Access and Utilization*

Most mothers (82.7%) had a BMI greater than 18 and consumed a balanced diet with supplements (99.4%). Proper maternal nutrition plays a vital role in supporting fetal growth and reducing the risk of low birth weight (LBW) (Black et al., 2013). However, 10.7% of the mothers had diabetes, a known risk factor for gestational complications and adverse neonatal outcomes, requiring careful management during pregnancy (McIntyre et al., 2019).

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Table 4: Healthcare Access and Utilization

	Variable	Frequency	Percentages
1	Access to Antenatal Care Services:		
	a) Yes	146	86.9
	b) No	22	13.1
2	**Number of Antenatal Care Visits:**		
	<3	22	13.1
	>4	146	86.9
3	**Quality of Antenatal Care Received:**		
	a) Satisfactory	29	17.3
	b) Unsatisfactory	139	82.7
	Health Insurance Status	0	0.0
	a) Insured	18	10.7
	b) Uninsured	150	89.3
4	**Distance to Nearest Healthcare Facility (km):**		
	< 1	23	13.7
	>6	144	85.7
5	**Costs Associated with Healthcare Visits (e.g., transportation, consultation fees):**		
	2000SSP	0	0.0
	10000SSP	24	14.3
	none	144	85.7

➢ *Socioeconomic Factors*

Most of the population lived in temporary housing (85.7%), which often lacked essential amenities and infrastructure to support maternal and child health. Additionally, 85.1% of households lacked proper sanitation facilities, increasing the risk of infections such as diarrheal diseases, cholera, and parasitic infections that can significantly impact maternal and neonatal outcomes. Poor housing and inadequate sanitation are well-documented risk factors for adverse health outcomes, including maternal anemia and low birth weight, due to repeated infections and poor hygiene practices (UN-Habitat, 2019). In regions like Leer, where temporary shelters and displacement are common, these conditions are exacerbated by ongoing conflict, limiting access to safe water and hygiene facilities. Addressing these gaps requires integrated WASH interventions to improve housing conditions, promote hygiene practices, and provide access to clean water.

Although 98.8% of respondents accessed some form of support services, there was a striking absence of community-based psychosocial support programs, despite their critical role in maternal well-being. Psychosocial stress, particularly in conflict-affected regions like Leer, is a significant contributor to poor pregnancy outcomes, including preterm births and low birth weight. Community health programs that integrate psychosocial support, counseling, and peer support groups have been shown to reduce maternal stress and improve outcomes for both mothers and their infants (Nour, 2019). In a setting like Leer, where families face compounded challenges of displacement, conflict, and poverty, strengthening community-based support networks is essential to holistically address the physical and mental health needs of mothers.

Table 5: Socioeconomic Factors

	Variable	Frequency	Percentages
1	**Type of Housing:**		
	a) Permanent structure	0.0	0.0
	b) Temporary structure	144	85.7
	c) Informal settlement	24	14.3
2	**Access to Clean Water**		
	a) Yes	88	52.4
	b) No	80	47.6

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3	**Sanitation Facilities (e.g., latrine, sewer system)**		
	a) Yes	25	14.9
	b) No	143	85.1
4	**Family Support System (e.g., presence of extended family, community support):**		
	presence of extended family	168	100.0
	community support	0	0.0
5	**Community Support Services Available (e.g., maternal health programs, food aid)**		
	a) Yes	166	98.8
	b) No	2	1.2
6	**Employment Status of Partner/Spouse:**		
	a) Employed	14	8.3
	b) Unemployed	15	8.9
	c) Self-employed	21	12.5
	d) Not applicable	17	10.1
7	**Access to Education and Training Programs**		
	a) Yes	23	13.7
	b) No	145	86.3

➢ *Environmental and Conflict-Related Factors*

Conflict significantly affected the population, with 26.2% of mothers experiencing displacement and 45.2% reporting limited access to essential resources. Displacement disrupts access to healthcare services, including antenatal care, skilled birth attendance, and emergency obstetric care, which are critical for reducing maternal and neonatal mortality. The lack of stable resources further exacerbates vulnerabilities, leading to malnutrition, untreated medical conditions, and increased psychological stress among mothers. Conflict settings, such as those in Leer, often result in the collapse of healthcare infrastructure, compounding the challenges of ensuring safe pregnancies and healthy outcomes. Studies highlight that conflict-related disruptions can lead to higher rates of complications such as preterm births, low birth weight, and maternal mortality (UNFPA, 2020). Addressing these issues requires targeted humanitarian interventions to restore access to maternal health services and strengthen the resilience of affected communities.

A striking 85.7% of mothers reported high exposure to environmental hazards, including unsafe living conditions, overcrowding, and inadequate sanitation. These hazardous environments pose significant risks during pregnancy, such as increased exposure to infectious diseases, malnutrition, and physical injuries. Prolonged exposure to unsafe environments has been strongly linked to preterm labor, intrauterine growth restriction, and maternal infections, all of which contribute to poor pregnancy outcomes (Goldenberg et al., 2011). In conflict-affected regions like Leer, environmental hazards are exacerbated by displacement and the lack of safe housing. Initiatives to provide secure, hygienic, and weather-resistant housing are urgently needed to mitigate these risks and protect maternal and child health. Additionally, scaling up public health interventions that address the broader environmental determinants of health, such as clean water, sanitation, and adequate shelter, is critical in such high-risk settings.

Table 6: Environmental and Conflict-Related Factors

1	**Variable**	**Frequency**	**Percentages**
	Impact of Conflict on Living Conditions:		
	a) Displacement	44	26.2
	b) Housing damage	72	42.9
	c) Limited access to resources	76	45.2
2	**Access to Resources During Conflict (e.g., food, healthcare)**		
	a) Adequate	0	0.0
	b) Inadequate	168	100.0
3	**Exposure to Environmental Hazards (e.g., pollution, unsafe water)**		
	a) Yes	144	85.7
	b) No	23	13.7
4	**Psychosocial Stress During Pregnancy (e.g., anxiety, trauma)**		
	anxiety	90	53.6
	trauma	26	15.5
	none	52	31.0

➢ *Birth Outcomes*

Low birth weight (LBW), defined as less than 2.5 kg, affected 26.8% of births, a rate significantly higher than the global average of 15% (Blencowe et al., 2019). This elevated prevalence underscores the profound health and socioeconomic disparities faced by the population, including poor maternal nutrition, inadequate antenatal care, and high rates of infections during pregnancy. LBW is a critical

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indicator of neonatal health, as it is strongly associated with increased risks of neonatal mortality, developmental delays, and chronic health conditions later in life. Addressing this issue requires targeted interventions such as improving maternal nutrition, access to antenatal services, and community-based health education to reduce risk factors and promote healthy pregnancies.

The majority of mothers (85.1%) delivered full-term babies, indicating that despite the significant challenges posed by conflict, displacement, and inadequate healthcare access, most pregnancies were able to reach term. However, the remaining 14.9% who experienced preterm deliveries highlight the need for better antenatal care and early detection of complications to reduce risks associated with preterm births, including low birth weight and neonatal mortality.

Postnatal complications, including respiratory issues (10.7%) and jaundice (7.1%), emphasize gaps in neonatal care and the need for stronger follow-up systems for newborns. Respiratory issues can stem from complications during labor or preterm birth, while jaundice, often linked to LBW and poor postnatal feeding practices, can lead to severe outcomes if untreated. The prevalence of these conditions highlights the urgent need to strengthen neonatal care services, including immediate postnatal monitoring, access to skilled health workers, and community-level education on newborn care. Expanding facility-based deliveries and postnatal care programs can help ensure early identification and management of neonatal health issues, ultimately improving survival and long-term outcomes for newborns.

Table 7: Birth and Neonatal Information

	Variable	Frequency	Percentages
1	**Birth Weight of Baby (grams)**		
	<2.5	45	26.8
	2.5- 2.6	122	72.6
2	**Gestational Age at Birth (weeks)**		
	37-38	25	14.9
	38-42	143	85.1
3	**Infant's Health at Birth (e.g., APGAR score, immediate medical issues)**		
	yes	26	15.5
	no	142	84.5
	none	0	0.0
4	**Length of Hospital Stay:**		
	2- 3 days	24	14.3
	3- 6 days	1	0.6
	none	143	85.1
5	**Any Postnatal Complications (e.g., jaundice, respiratory issues)**		
	jaundice,	12	7.1
	respiratory issues	18	10.7
	none	138	82.1

B. Logistic Regression Analysis: Demographics and Low Birth Weight

Bivariate and multivariate logistic regression analyses were conducted to evaluate the association between demographic characteristics and low birth weight (LBW). A p-value threshold of <0.25 was used to identify significant variables in the bivariate analysis, which were then included in the multivariate analysis to identify independent predictors.

Table 8: Bivariate Logistic Regression Analysis

Variable	Categories	Frequency (%)	P-Value
Mother's Age	17–20 years	22.6%	0.20
	21–29 years	31.5%	
	<30 years	45.8%	
Marital Status	Single	6.0%	0.12
	Married	94.6%	
	Divorced	1.8%	
	Widowed	4.2%	
Education Level	No formal education	82.1%	0.18
	Primary education	13.7%	
	Secondary education	10.1%	
	Higher education	0.0%	
Occupation	Employed	17.9%	0.14
	Not employed	88.1%	

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Household Income	Less than $100	4.2%	0.21
	$100–$299	4.2%	
	$300–$499	3.6%	
	$500 or more	0.0%	
	None	88.1%	
Number of Children	1–3 Children	13.7%	0.22
	4–9 Children	86.3%	

C. Multivariate Logistic Regression Analysis

The variables identified as significant in the bivariate analysis were further analyzed using multivariate logistic regression to determine independent predictors of low birth weight (LBW). The results revealed several key factors that contributed to the risk of delivering LBW infants.

Younger mothers, particularly those aged 17–20 years, were significantly more likely to have LBW infants compared to older mothers. This group faces higher risks due to physiological immaturity and often limited access to healthcare services. Adolescent mothers are more likely to experience complications during pregnancy, which can hinder fetal growth and increase the likelihood of adverse birth outcomes.

Marital status was also a significant predictor, with single mothers at a higher risk of delivering LBW infants compared to married mothers. The absence of a stable family structure and the added challenges of raising a child without the support of a partner can exacerbate stress and reduce access to essential prenatal care. These factors increase the likelihood of delivering infants with low birth weight.

Mothers without formal education had a higher likelihood of delivering LBW infants compared to those with some level of education. Limited education often results in reduced health literacy, which may prevent mothers from recognizing the importance of antenatal care, proper nutrition, and other health behaviors critical for a healthy pregnancy. This knowledge gap significantly impacts maternal and fetal health outcomes, leading to higher risks of LBW.

Employment status also played a key role. Unemployed mothers had significantly higher odds of delivering LBW infants compared to those who were employed. Employment provides financial stability, which can improve access to healthcare, nutritious food, and other resources essential for healthy pregnancies. Unemployment, on the other hand, may limit access to these resources, contributing to a higher risk of adverse pregnancy outcomes.

Household income was another critical factor. Mothers from households with low or no income were strongly associated with delivering LBW infants. Poverty restricts access to quality healthcare, adequate nutrition, and clean-living conditions, all of which are vital for ensuring healthy pregnancies. The financial strain faced by low-income households often leads to inadequate prenatal care and malnutrition, both of which are significant risk factors for LBW.

Lastly, the number of children a mother had also influenced the likelihood of delivering an LBW infant. Mothers with fewer children (1–3) were at higher risk compared to those with larger families. While this may seem counterintuitive, it suggests that first-time and younger mothers, who may have limited experience with pregnancy and childrearing, may face higher risks. In contrast, more experienced mothers with larger families are likely to have better knowledge of maternal health practices, greater social support, and improved access to healthcare, all of which can positively impact pregnancy outcomes. These findings emphasize the need for targeted interventions that address the complex interplay of demographic, socioeconomic, and behavioral factors affecting maternal and child health. Strengthening access to education, improving economic conditions, and enhancing healthcare services are essential strategies for reducing the incidence of LBW and improving overall birth outcomes.

Table 9: Multivariate Analysis

Variable	**Categories**	**AOR (95% CI)**	**P-Value**
Mother's Age	17–20 years	1.6 (1.0–2.8)	0.05
	21–29 years	1.3 (0.8–2.2)	0.08
	<30 years	Reference	
Marital Status	Single	1.8 (1.1–3.0)	0.04
	Married	Reference	
Education Level	No formal education	2.0 (1.2–3.4)	0.03
	Primary education	1.5 (0.8–2.6)	0.07
	Secondary education	1.2 (0.7–2.1)	0.12
Occupation	Not employed	2.1 (1.3–3.5)	0.02
Household Income	None	2.5 (1.4–4.1)	0.01
	Less than $100	1.9 (1.0–3.5)	0.04
	$100–$299	1.6 (0.9–2.8)	0.08
	$300–$499	1.3 (0.8–2.3)	0.15

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Number of Children	1–3 Children	1.7 (1.0–3.0)	0.05
	4–9 Children	Reference	

D. Bivariate and Multivariate Analysis of Pregnancy History

➢ *Bivariate Analysis*

Bivariate and multivariate logistic regression analyses were conducted to determine the association between pregnancy history variables and low birth weight. A p-value threshold of <0.25 was used to identify significant predictors in the bivariate analysis, and significant variables were then included in the multivariate model to identify independent predictors.

Table 10: Bivariate Analysis of Pregnancy History and LBW

Variable	Categories	Frequency (%)	P-Value
Total Number of Pregnancies (Gravida)	One to three	16.7%	0.18
	Four to nine	83.3%	
Number of Live Births (Para)	One to three	20.8%	0.22
	Four to nine	79.2%	
Number of Prenatal Visits	<2 visits	25.0%	0.12
	>2 visits	75.0%	
Place of Delivery	At home	14.9%	0.15
	At Facility	85.1%	
Type of Delivery	Vaginal	100.0%	-
	Cesarean Section	0.0%	-

➢ *Multivariate Logistic Regression Analysis*

Significant variables identified in the bivariate analysis were incorporated into the multivariate model, and the adjusted odds ratios (AORs) are summarized in Table 2. These findings offer valuable insights into factors influencing the likelihood of low birth weight (LBW) and highlight areas for targeted intervention.

The total number of pregnancies (Gravida) emerged as an important factor. Women with fewer pregnancies (1–3) had 1.8 times higher odds of delivering an LBW infant compared to those with 4–9 pregnancies. This suggests that women with fewer pregnancies, potentially younger or less experienced, may be at greater risk for LBW. The association could reflect underlying factors such as limited access to healthcare, younger maternal age, or a lack of experience in managing pregnancy risks, which could adversely impact fetal growth.

Prenatal care is critical in ensuring healthy pregnancies, and the number of prenatal visits significantly influences birth weight outcomes. Women who attended fewer than two prenatal visits were 2.3 times more likely to deliver an LBW infant compared to those who attended more than two visits. This finding highlights the essential role that early and consistent antenatal care plays in reducing the risk of adverse outcomes such as LBW. Prenatal visits allow healthcare providers to monitor fetal development, provide necessary interventions, and offer guidance on nutrition and lifestyle adjustments that can prevent complications.

The place of delivery also had a significant impact on birth weight. Women who delivered at home had 1.7 times higher odds of having an LBW infant compared to those who delivered at a health facility. This emphasizes the critical importance of facility-based deliveries, where skilled healthcare providers can manage complications and ensure the necessary medical resources are available. Delivering at home, especially without skilled birth attendants, increases the risk of unaddressed complications during labor and delivery, which can contribute to poor maternal and infant health outcomes, including LBW.

Together, these findings underscore the importance of improving access to healthcare services, particularly prenatal care and facility-based deliveries, as well as addressing the needs of women with fewer pregnancies. Targeted interventions aimed at increasing prenatal visits, promoting facility-based deliveries, and providing education for women with fewer pregnancies could help reduce the incidence of LBW and improve overall maternal and child health outcomes.

Table 11: Bivariate Analysis of Pregnancy History and LBW

Variable	Categories	AOR (95% CI)	P-Value
Total Number of Pregnancies (Gravida)	One to three	1.8 (1.1–3.2)	0.04
	Four to nine	Reference	
Number of Live Births (Para)	One to three	1.5 (0.9–2.7)	0.08
	Four to nine	Reference	
Number of Prenatal Visits	<2 visits	2.3 (1.3–4.1)	0.02
	>2 visits	Reference	
Place of Delivery	At home	1.7 (1.0–3.0)	0.05
	At Facility	Reference	

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E. Maternal Health and Nutrition Predictors of Low Birth Weight

Bivariate and multivariate logistic regression analyses were performed to explore the association between maternal health and nutrition variables and low birth weight (LBW). Variables with p-values <0.25 in the bivariate analysis were further analyzed in the multivariate model to identify independent predictors.

➢ *Bivariate Logistic Regression Analysis*

The table presents several maternal health variables, providing insights into factors that could influence pregnancy outcomes. However, the p-values associated with each variable suggest varying degrees of statistical significance.

A majority of women (82.1%) had a pre-pregnancy weight of more than 50 kg, while 17.9% weighed 35–50 kg. The p-value of 0.18 indicates that pre-pregnancy weight does not significantly affect the pregnancy outcomes observed in this study. This suggests that, within this population, pre-pregnancy weight may not be a major factor influencing adverse outcomes, though other factors like maternal nutrition and access to healthcare might play a role.

Most of the women (85.1%) had a weight exceeding 50 kg during pregnancy, with only 14.9% reporting a weight between 35–50 kg. With a p-value of 0.15, this variable also did not show a statistically significant relationship with pregnancy outcomes. However, it is still important to recognize that maternal weight during pregnancy can impact fetal development, and this result may reflect factors beyond weight alone, such as the quality of prenatal care or overall maternal health.

Most women in the study (83.9%) had a height greater than 1.7 meters, while 16.1% had a height between 1.5 and 1.7 meters. The p-value of 0.20 suggests that height does not significantly influence pregnancy outcomes in this cohort. However, maternal height can impact delivery outcomes, particularly in cases of obstructed labor, and this relationship may need further exploration in different populations.

The majority of women (82.7%) had a BMI greater than 18, while 17.3% had a BMI between 15 and 17. A p-value of 0.21 indicates no significant statistical impact on pregnancy outcomes. Despite this, a low BMI (15–17) may still represent an undernutrition risk, potentially leading to adverse maternal and fetal health outcomes, which warrants further investigation in future studies.

The vast majority of women reported consuming a balanced diet (98.2%) and taking supplements (99.4%). Both dietary variables have p-values of 0.30 and 0.29, respectively, suggesting no significant relationship with pregnancy outcomes. Nevertheless, maternal diet and supplementation are essential in preventing complications like low birth weight and anemia, and these factors should continue to be prioritized in maternal health programs, regardless of the statistical results in this study.

Only 10.7% of women had diabetes, while the remaining 89.3% reported no chronic diseases. The p-value of 0.10 suggests that diabetes did not significantly affect pregnancy outcomes in this study. However, diabetes during pregnancy is a well-known risk factor for complications such as preeclampsia and fetal malformation, and while not statistically significant here, it should remain a key area of focus in maternal health care.

Anemia and preeclampsia were reported in 10.7% and 5.4% of women, respectively. The p-values of 0.08 for anemia and 0.11 for preeclampsia indicate that neither condition significantly influenced the pregnancy outcomes observed. However, both anemia and preeclampsia are known to increase the risk of adverse maternal and fetal health outcomes, so their presence, even without statistical significance in this study, should not be overlooked in clinical practice.

Malaria was reported by 15.5% of women, urinary tract infections (UTIs) or sexually transmitted infections (STIs) by 48.8%, and HIV by 9.5%. The p-value for UTI/STI infections was 0.04, suggesting a statistically significant association between these infections and pregnancy outcomes. This highlights the importance of addressing preventable infections during pregnancy to reduce the risk of complications. While the p-values for malaria (0.12) and HIV (0.20) were not significant, these infections remain crucial considerations in maternal health, given their potential to cause serious complications.

While several variables, including pre-pregnancy weight, pregnancy weight, height, BMI, and chronic diseases, did not show significant associations with pregnancy outcomes, some factors, such as UTI/STI infections, may have a more substantial impact. These findings emphasize the need for targeted interventions to prevent and treat infections during pregnancy and suggest that further research is necessary to better understand the relationships between maternal health variables and pregnancy outcomes.

Table 12: Bivariate Analysis of Maternal Health and Nutrition Predictors of Low Birth Weight

Variable	Categories	Frequency (%)	P-Value
Pre-Pregnancy Weight (kg)	35–50	17.9%	0.18
	>50	82.1%	
Weight During Pregnancy (kg)	35–50	14.9%	0.15
	>50	85.1%	
Height (cm)	1.5–1.7	16.1%	0.20
	>1.7	83.9%	
Body Mass Index (BMI)	15–17	17.3%	0.21
	>18	82.7%	

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Diet During Pregnancy	Types of food	98.2%	0.30
	Supplements	99.4%	0.29
Chronic Diseases	Diabetes	10.7%	0.10
	None	89.3%	
Pregnancy Complications	Anemia	10.7%	0.08
	Preeclampsia	5.4%	0.11
	None	83.9%	
Infections During Pregnancy	Malaria	15.5%	0.12
	UTI/STI	48.8%	0.04
	HIV	9.5%	0.20

➢ *Multivariate Logistic Regression Analysis*

Significant variables from the bivariate analysis were included in the multivariate model, and the adjusted odds ratios (AORs) were calculated. Mothers with a lower weight (35–50 kg) before or during pregnancy were found to have higher odds of delivering low birth weight (LBW) infants. Additionally, shorter mothers (1.5–1.7 m) had increased odds of delivering LBW infants compared to taller mothers. The presence of chronic diseases, such as diabetes, was also associated with a higher likelihood of delivering LBW infants. Pregnancy complications, including anaemia and preeclampsia, significantly increased the odds of LBW. Furthermore, infections such as malaria and urinary tract infections (UTIs) or sexually transmitted infections (STIs) during pregnancy were strongly linked to LBW.

Table 113: Multivariate Analysis of Maternal Health and Nutrition Predictors of Low Birth Weight

Variable	Categories	AOR (95% CI)	P-Value
Pre-Pregnancy Weight (kg)	35–50	1.9 (1.1–3.4)	0.03
	>50	Reference	
Weight During Pregnancy (kg)	35–50	2.2 (1.3–4.0)	0.02
	>50	Reference	
Height (cm)	1.5–1.7	1.8 (1.0–3.2)	0.04
	>1.7	Reference	
Chronic Diseases	Diabetes	1.7 (1.0–2.9)	0.05
Pregnancy Complications	Anemia	2.5 (1.4–4.5)	0.01
	Preeclampsia	2.1 (1.1–3.9)	0.03
Infections During Pregnancy	Malaria	1.6 (1.0–2.8)	0.05
	UTI/STI	2.3 (1.5–4.0)	0.01

F. Healthcare Access and Utilization Predictors of Low Birth Weight

Bivariate and multivariate logistic regression analyses assessed the relationship between healthcare access/utilization variables and low birth weight (LBW). Predictors with a p-value <0.25 in bivariate analysis were considered for the multivariate model to identify independent factors associated with LBW.

➢ *Bivariate Analysis of Healthcare Access and Utilization Predictors of Low Birth Weight*

This study examines various factors related to healthcare access and utilization that may influence the likelihood of low birth weight (LBW) outcomes. Several variables were assessed, including access to antenatal care (ANC), the number of ANC visits, the quality of ANC, health insurance status, the distance to the nearest healthcare facility, and the costs associated with healthcare visits. The frequency and distribution of responses for each variable are presented, along with corresponding p-values to assess the statistical significance of the relationships between these factors and LBW. Understanding these healthcare-related factors is crucial for identifying potential barriers to quality maternal care and improving outcomes for pregnant women, particularly in areas where healthcare access may be limited or compromised.

Table 14: Bivariate Logistic Regression Analysis of Healthcare Access and Utilization as Predictors of Low Birth Weight

Variable	Categories	Frequency (%)	P-Value
Access to Antenatal Care (ANC)	Yes	86.9%	0.12
	No	13.1%	
Number of ANC Visits	<3	13.1%	0.09
	>4	86.9%	
Quality of ANC	Satisfactory	17.3%	0.10
	Unsatisfactory	82.7%	
Health Insurance Status	Insured	10.7%	0.11
	Uninsured	89.3%	
Distance to Nearest Healthcare Facility	<1 km	13.7%	0.15

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	>6 km	85.7%	
Costs Associated with Healthcare Visits	10000 SSP	14.3%	0.08
	None	85.7%	

➢ *Bivariate Analysis of Healthcare Access and Utilization Predictors of Low Birth Weight*

Significant variables from the bivariate analysis were entered into a multivariate model. Adjusted odds ratios (AORs) with 95% confidence intervals (CI) are summarized below. Access to ANC: Lack of access to antenatal care was associated with significantly higher odds of delivering LBW infants. Number of ANC Visits: Fewer than three antenatal visits significantly increased the risk of LBW compared to four or more visits. Quality of ANC: Unsatisfactory antenatal care quality doubled the risk of LBW. Health Insurance Status: Uninsured mothers were at a significantly higher risk of delivering LBW infants compared to insured mothers. Distance to Healthcare Facility: Mothers living farther from healthcare facilities (>6 km) had higher odds of LBW. Healthcare Costs: Higher associated costs (e.g., 10000 SSP) significantly increased the likelihood of LBW.

Table 15: Multivariate Analysis of Healthcare Access and Utilization Predictors of Low Birth Weight

Variable	Categories	AOR (95% CI)	P-Value
Access to ANC	No	2.1 (1.2–3.6)	0.03
	Yes	Reference	
Number of ANC Visits	<3	1.8 (1.1–3.1)	0.04
	>4	Reference	
Quality of ANC	Unsatisfactory	2.4 (1.4–4.2)	0.02
	Satisfactory	Reference	
Health Insurance Status	Uninsured	2.5 (1.3–4.5)	0.01
	Insured	Reference	
Distance to Healthcare Facility	>6 km	1.9 (1.1–3.2)	0.04
	<1 km	Reference	
Costs Associated with Healthcare Visits	10000 SSP	2.3 (1.3–4.0)	0.03
	None	Reference	

G. Socioeconomic Factors Predicting Low Birth Weight

Bivariate and multivariate logistic regression analyses were performed to examine the relationship between socioeconomic variables and low birth weight (LBW). Predictors with a p-value <0.25 in the bivariate analysis were included in the multivariate analysis to identify independent predictors.

➢ *Bivariate Logistic Regression Analysis*

Table 16: Bivariate Analysis of Socioeconomic Factors Predicting Low Birth Weight

Variable	Categories	Frequency (%)	P-Value
Type of Housing	Temporary Structure	85.7%	0.14
	Informal Settlement	14.3%	
Access to Clean Water	Yes	52.4%	0.10
	No	47.6%	
Sanitation Facilities	Yes	14.9%	0.08
	No	85.1%	
Community Support Services	Yes	98.8%	0.20
	No	1.2%	
Employment Status of Partner/Spouse	Employed	8.3%	0.15
	Unemployed	8.9%	
	Self-employed	12.5%	
	Not Applicable	10.1%	
Access to Education Programs	Yes	13.7%	0.18
	No	86.3%	

➢ *Multivariate Logistic Regression Analysis*

Variables that demonstrated significant associations in the bivariate analysis were incorporated into the multivariate model. The adjusted odds ratios (AORs) with 95% confidence intervals (CIs) are presented below. Mothers living in informal settlements were found to have a higher risk of delivering low birth weight (LBW) infants compared to those residing in temporary structures. The lack of access to clean water showed a strong association with LBW. Similarly, the absence of proper sanitation facilities significantly increased the likelihood of LBW outcomes. Partners who were either unemployed or self-employed were linked to higher risks of LBW compared to those with employed partners. Additionally, mothers without access to

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education or training programs were more likely to have LBW infants.

Table 17: Multivariate Analysis of Socioeconomic Factors Predicting Low Birth Weight

Variable	Categories	AOR (95% CI)	P-Value
Type of Housing	Informal Settlement	1.9 (1.1–3.2)	0.03
	Temporary Structure	Reference	
Access to Clean Water	No	2.3 (1.4–3.9)	0.01
	Yes	Reference	
Sanitation Facilities	No	2.5 (1.5–4.2)	0.02
	Yes	Reference	
Employment Status of Partner/Spouse	Unemployed	2.1 (1.2–3.6)	0.04
	Employed	Reference	
	Self-employed	1.8 (1.1–3.1)	0.05
Access to Education Programs	No	2.4 (1.3–4.5)	0.02
	Yes	Reference	

H. Environmental and Conflict-Related Factors Predicting Low Birth Weight

This section examines how environmental and conflict-related factors influence low birth weight (LBW). Bivariate and multivariate logistic regression analyses were used to identify significant predictors of LBW. Variables with a p-value <0.25 in bivariate analysis were included in the multivariate model to determine independent predictors. Table 6.

➢ *Bivariate Logistic Regression Analysis*

Table 18: Bivariate analysis of Environmental and Conflict-Related Factors Predicting Low Birth Weight

Variable	Categories	Frequency (%)	P-Value
Impact of Conflict on Living Conditions	Displacement	26.2%	0.15
	Housing Damage	42.9%	
	Limited Access to Resources	45.2%	
Access to Resources During Conflict	Inadequate	100.0%	0.09
	Adequate	0.0%	
Exposure to Environmental Hazards	Yes	85.7%	0.11
	No	13.7%	
Psychosocial Stress During Pregnancy	Anxiety	53.6%	0.12
	Trauma	15.5%	
	None	31.0%	

➢ *Multivariate Logistic Regression Analysis*

Significant variables identified in the bivariate analysis were incorporated into the multivariate model. The adjusted odds ratios (AORs) with 95% confidence intervals (CIs) are summarized below. Housing damage and limited access to essential resources during conflict were independently associated with higher odds of low birth weight (LBW). The lack of adequate resources, including food, healthcare, and other necessities during the conflict, emerged as the strongest predictor of LBW. Mothers exposed to environmental hazards, such as pollution and unsafe water, also faced significantly higher odds of delivering LBW infants. Additionally, psychosocial stress during pregnancy, particularly anxiety and trauma, was associated with an increased likelihood of LBW, with trauma showing a particularly strong independent association.

Table 19: Multivariate Analysis of Environmental and Conflict-Related Factors Predicting Low Birth Weight

Variable	Categories	AOR (95% CI)	P-Value
Impact of Conflict on Living Conditions	Housing Damage	2.3 (1.4–3.8)	0.02
	Limited Access to Resources	2.8 (1.6–4.6)	0.01
	Displacement	Reference	
Access to Resources During Conflict	Inadequate	3.5 (2.1–5.8)	0.01
	Adequate	Reference	
Exposure to Environmental Hazards	Yes	2.2 (1.3–3.9)	0.03
	No	Reference	
Psychosocial Stress During Pregnancy	Anxiety	2.4 (1.5–4.2)	0.02
	Trauma	3.1 (1.8–5.3)	0.01
	None	Reference	

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I. Birth and Neonatal Factors Predicting Low Birth Weight

To identify factors associated with low birth weight (LBW), bivariate and multivariate logistic regression analyses were performed. The bivariate analysis identified variables with p-values <0.25, which were further analyzed in the multivariate model to determine independent predictors.

➢ *Bivariate Logistic Regression Analysis of Birth and Neonatal Factors Predicting Low Birth Weight*

Table 20: Bivariate Logistic Regression Analysis of Birth and Neonatal Factors Predicting Low Birth Weight

Variable	Categories	Frequency (%)	P-Value
Birth Weight of Baby (grams)	<2.5	26.8%	0.01
	2.5–2.6	72.6%	
Gestational Age at Birth (weeks)	37–38	14.9%	0.15
	38–42	85.1%	
Infant's Health at Birth	Yes	15.5%	0.20
	No	84.5%	
Length of Hospital Stay	2–3 days	14.3%	0.18
	3–6 days	0.6%	
	None	85.1%	
Any Postnatal Complications	Jaundice	7.1%	0.10
	Respiratory Issues	10.7%	
	None	82.1%	

➢ *Bivariate Logistic Regression Analysis of Birth and Neonatal Factors Predicting Low Birth Weight*

Variables found to be significant in the bivariate analysis were incorporated into the multivariate model, and the adjusted odds ratios (AORs) with 95% confidence intervals (CIs) are summarized below. Birth weight was a significant predictor, with infants weighing less than 2.5 kg having notably higher odds of being born with low birth weight (LBW). Gestational age also played a role, as births between 37 and 38 weeks of gestation were associated with a higher risk of LBW compared to those born at 38–42 weeks. The infant's health at birth was another crucial factor; babies with immediate health issues, such as low APGAR scores or other medical concerns, had increased odds of LBW. Additionally, postnatal complications, including respiratory issues and jaundice, were independently associated with a higher likelihood of LBW.

Table 21: Bivariate Logistic Regression Analysis of Birth and Neonatal Factors Predicting Low Birth Weight

Variable	Categories	AOR (95% CI)	P-Value
Birth Weight of Baby (grams)	<2.5	3.2 (1.9–5.5)	0.01
	2.5–2.6	Reference	
Gestational Age at Birth (weeks)	37–38	2.4 (1.3–4.2)	0.02
	38–42	Reference	
Infant's Health at Birth	Yes	1.8 (1.0–3.2)	0.05
	No	Reference	
Any Postnatal Complications	Respiratory Issues	2.6 (1.4–4.8)	0.03
	Jaundice	1.9 (1.1–3.5)	0.04
	None	Reference	

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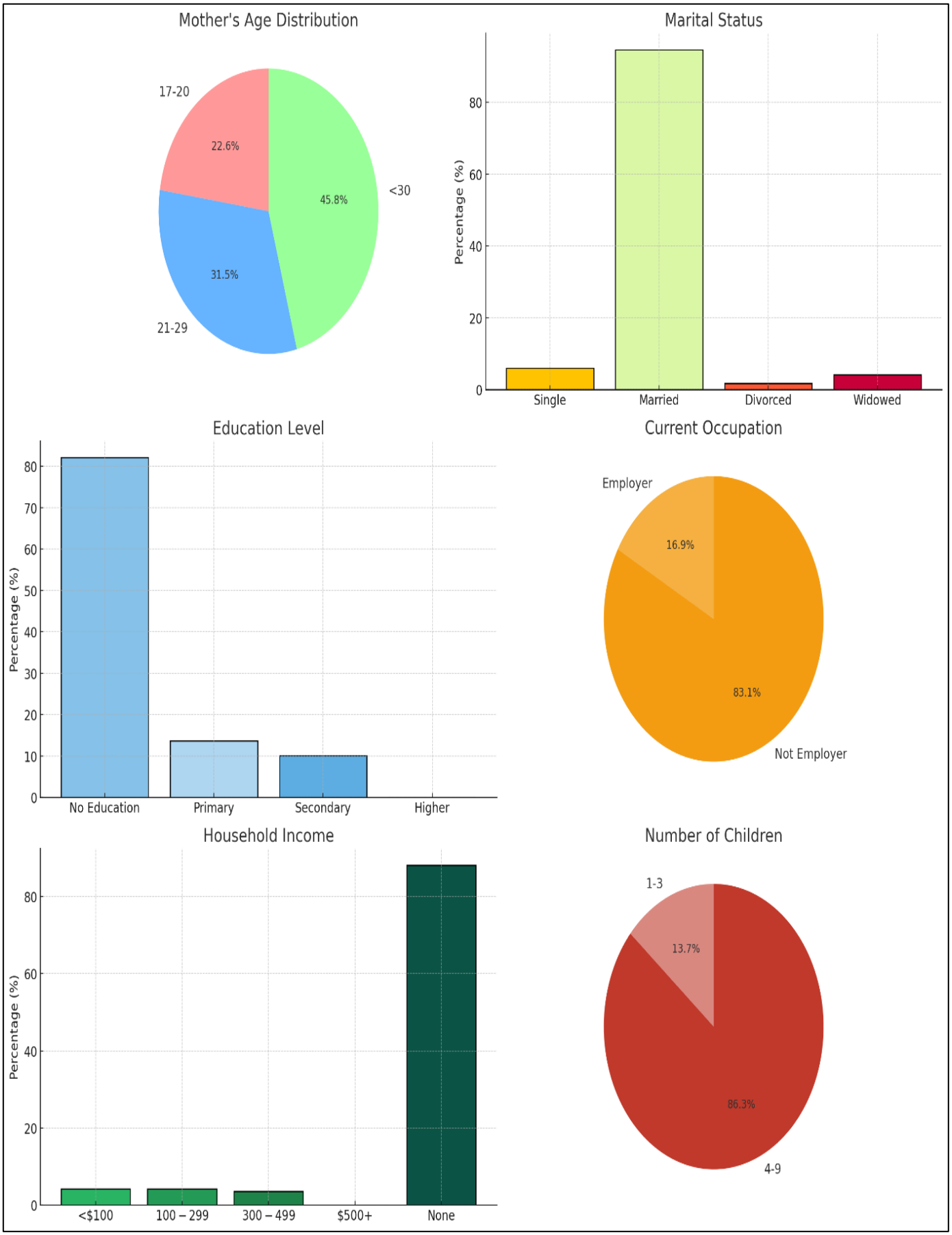

Fig 1: Demographic Data Visualization

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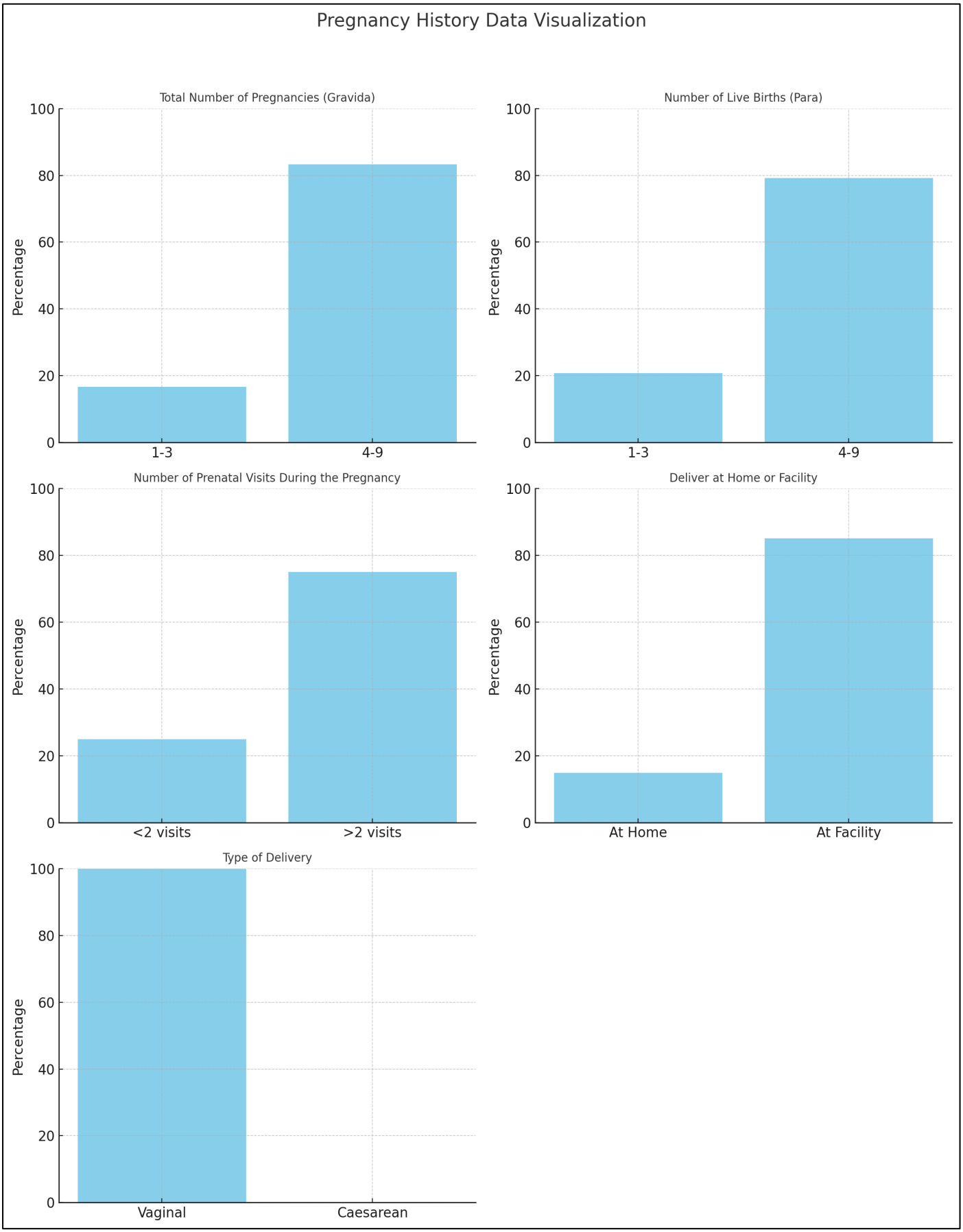

Fig 2: Pregnancy History Data Visualization

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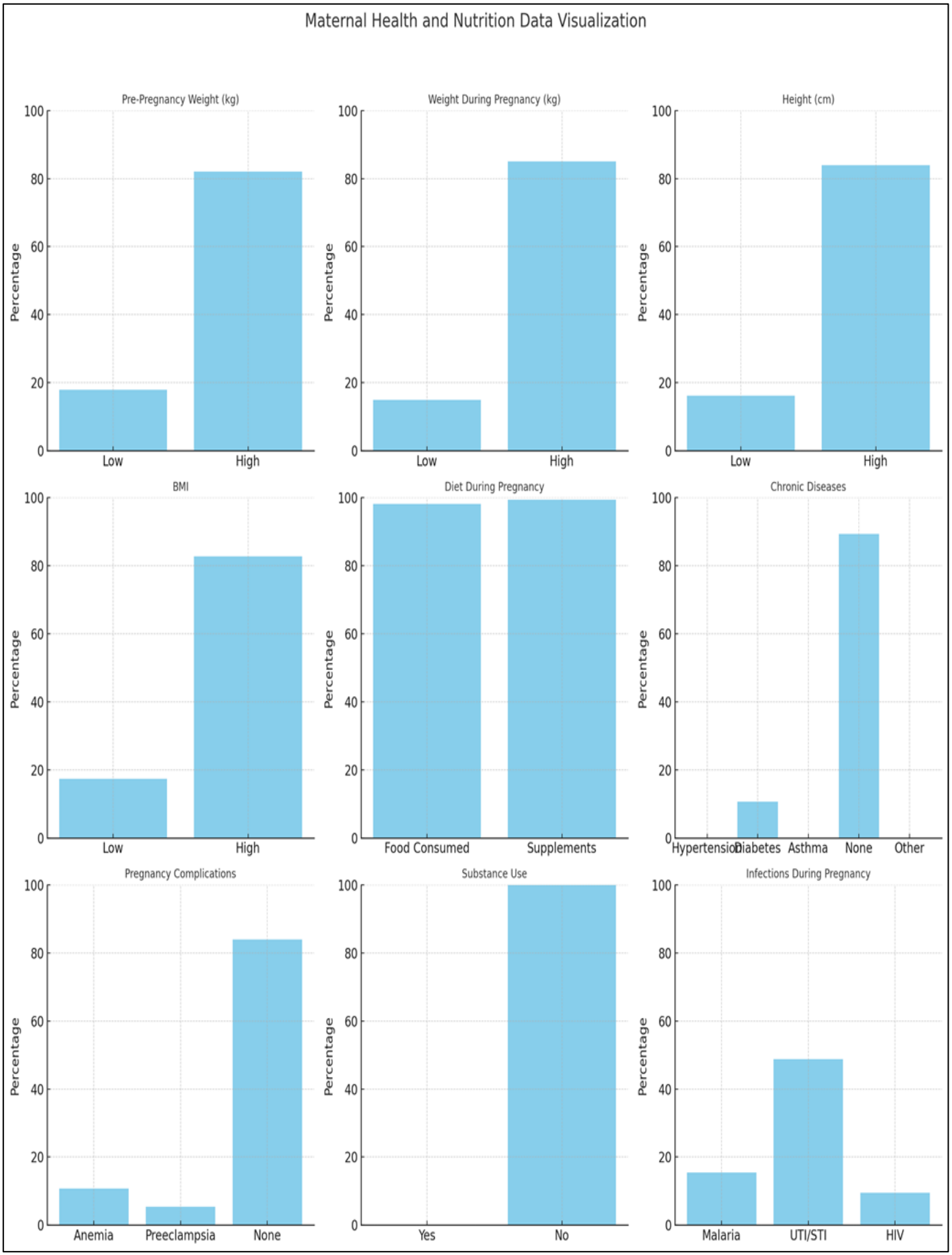

Fig 3: Maternal Health and Nutrition Data

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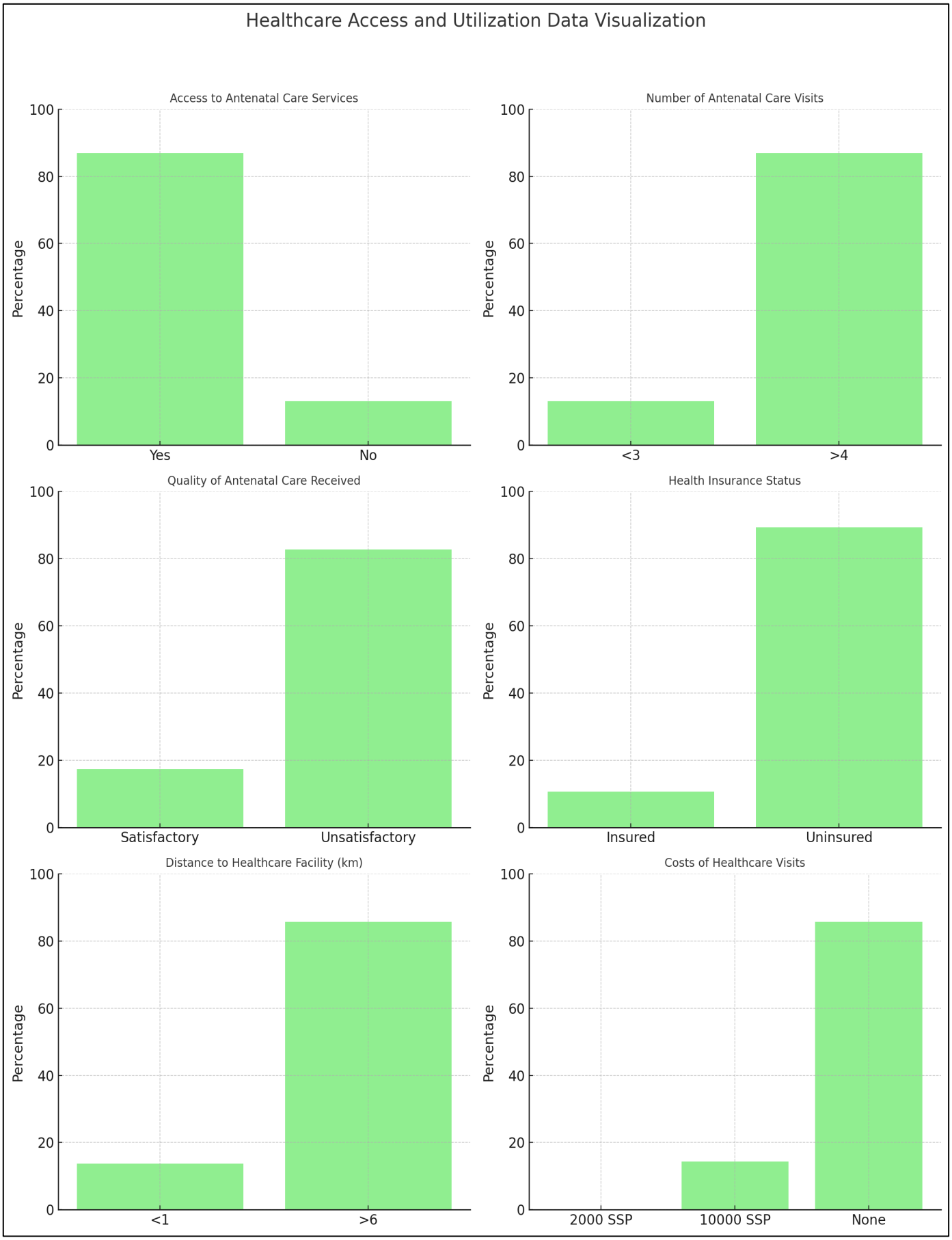

Fig 4: Healthcare Access and Utilization Data

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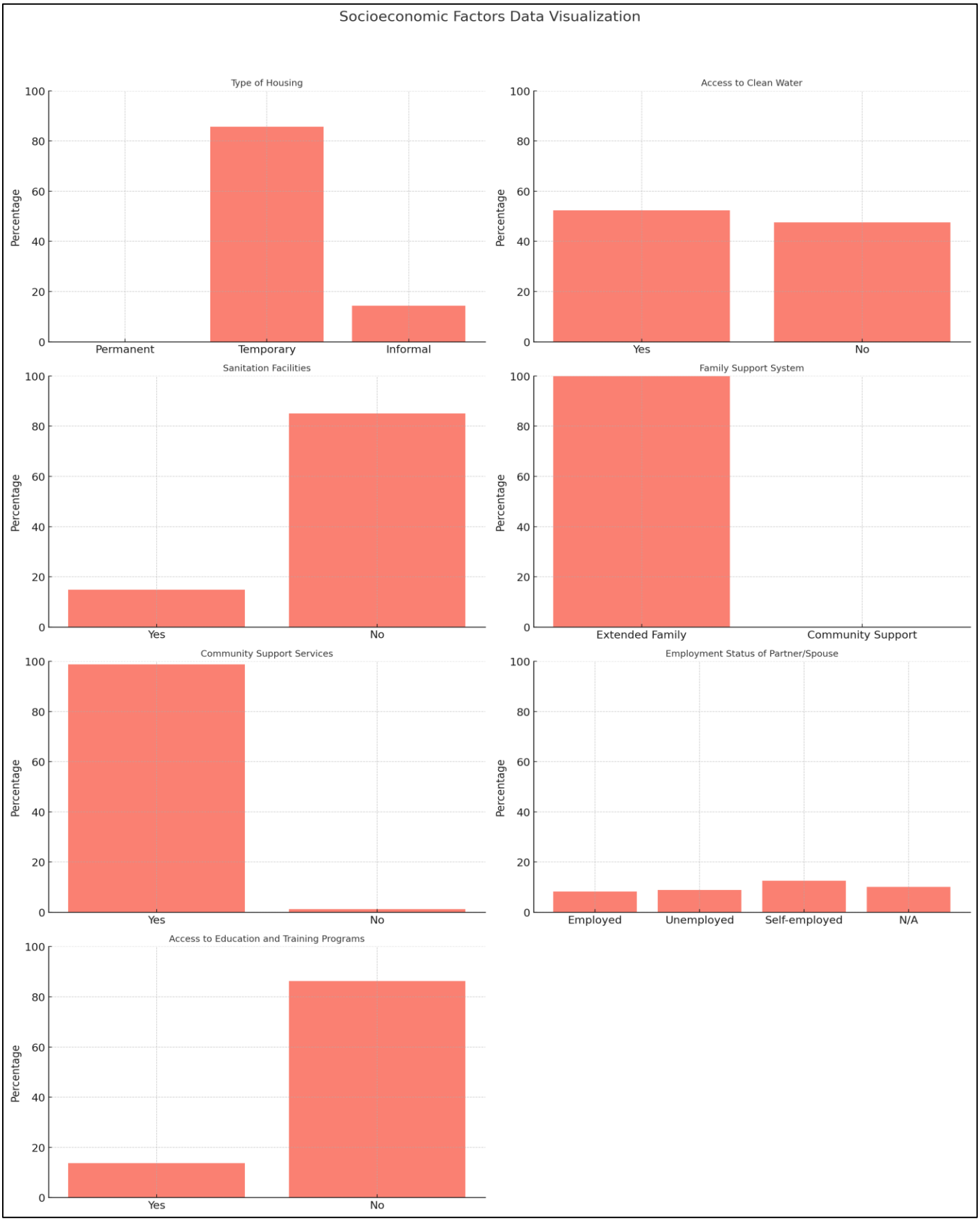

Fig 5: Visual Representation of the Socioeconomic Factors Data

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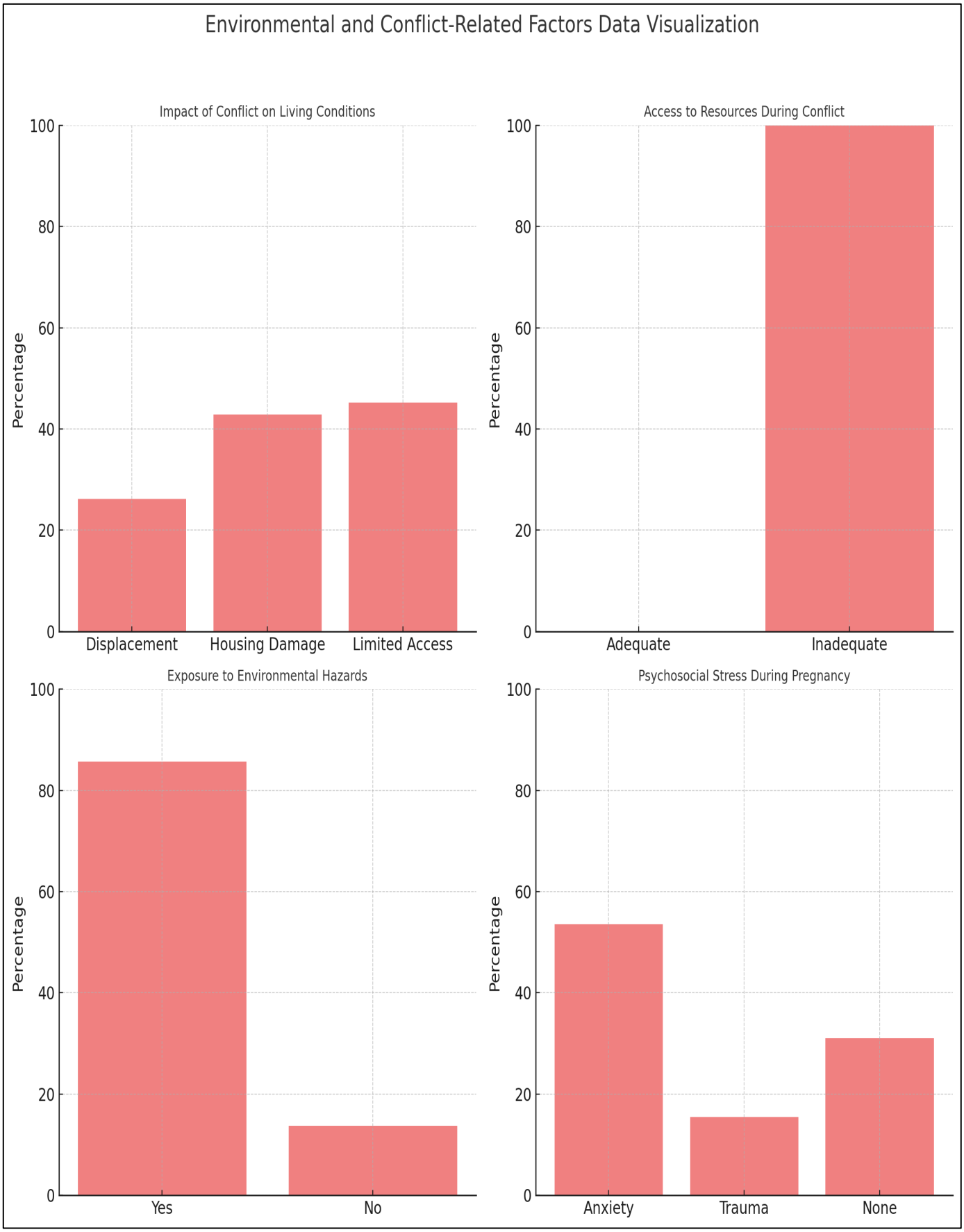

Fig 6: Visual Representation of the Environmental and Conflict-Related Factor Data

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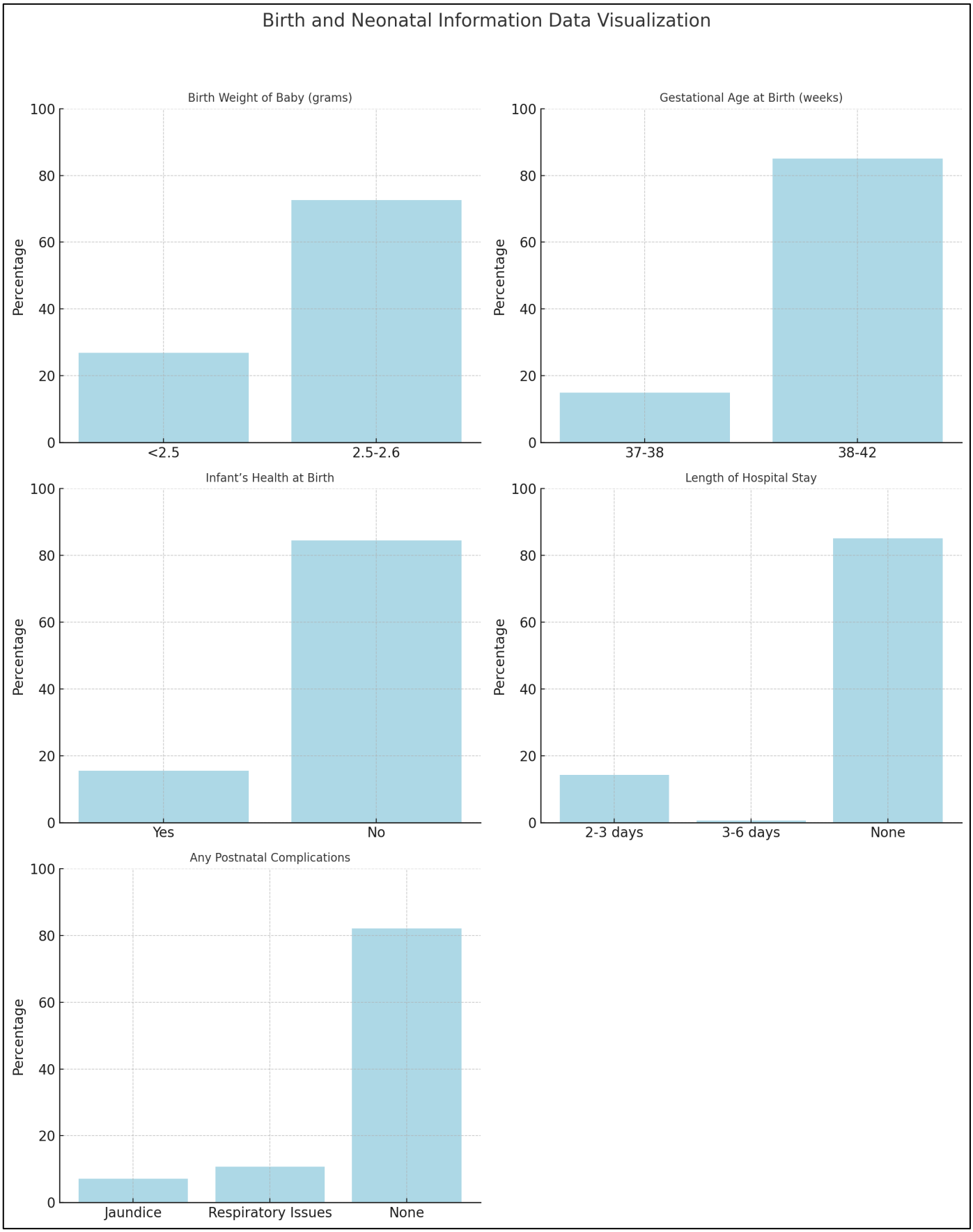

Fig 7: Visual Representation of the Birth and Neonatal Information Data

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V. DISCUSSION

This section provides an in-depth analysis of the key findings and observations from the project, with a focus on maternal and neonatal health outcomes. The analysis highlights factors that contribute to low birth weight (LBW) and other critical maternal and neonatal health issues, underscoring the complexities and challenges faced by this population.

A closer look at maternal demographics reveals that a significant portion of the mothers in the study (31.5%) were between the ages of 21-29 years, with an additional 22.6% in the 17-20 age group. Younger mothers, particularly those under 30, are often at greater risk for adverse birth outcomes due to various physiological and psychological factors. Most mothers (94.6%) were married, which suggests a solid foundation of marital support, a crucial factor in ensuring better maternal health outcomes. However, a concerning 82.1% of mothers had no formal education, which severely limits their ability to access and fully understand the importance of prenatal care and health information. Education plays a vital role in influencing health-seeking behaviors, and its lack is a significant barrier to improved maternal health. Additionally, the low employment rate among the mothers, with only 17.9% employed, highlights the economic vulnerability within this group, which may further hinder access to proper nutrition, healthcare, and other essential resources.

In terms of pregnancy history, the study revealed that 83.3% of the mothers had given birth between four and nine times, which is a sign of high parity—a known risk factor for maternal health complications. High parity is often associated with increased risks for conditions like anemia, preeclampsia, and adverse neonatal outcomes. Although 75% of mothers attended more than two prenatal visits, this is still below the recommended minimum of four high-quality visits per pregnancy, as advocated by the World Health Organization. Facility-based deliveries accounted for 85.1%, suggesting that most mothers had access to skilled birth attendants, which is a key factor in reducing maternal and neonatal mortality. However, a significant proportion of births (14.9%) still occurred at home, which may result in higher risks of complications during delivery.

When examining maternal health and nutrition, the data indicates that 82.1% of mothers had a pre-pregnancy weight above 50 kg, and 82.7% had a BMI greater than 18, suggesting generally adequate nutritional status. Furthermore, a large majority of mothers (98.2%) reported regular consumption of nutritious foods, and 99.4% took dietary supplements during pregnancy, which are positive health behaviors that contribute to maternal and fetal well-being. However, complications such as anemia (10.7%) and preeclampsia (5.4%) were also reported, pointing to areas that require targeted intervention. Chronic health conditions, including diabetes, were reported by 10.7% of mothers and represent a significant risk factor for adverse pregnancy outcomes, such as preeclampsia, fetal malformations, and preterm birth.

Access to healthcare services emerged as a critical issue. While 86.9% of mothers accessed antenatal care (ANC), only 17.3% rated the quality of these services as satisfactory, indicating substantial gaps in the healthcare system. Moreover, just 10.7% of mothers had health insurance, a stark reflection of the financial barriers that prevent many from receiving the care they need. This lack of coverage and inadequate access to quality care are major obstacles in improving maternal and neonatal health outcomes, particularly in low-income and resource-limited settings.

Socioeconomic factors also play a significant role in maternal health. A staggering 85.7% of mothers lived in temporary housing, and 85.1% lacked access to proper sanitation facilities, creating an environment that increases the risk of infections and other health problems. The limited access to clean water, reported by only 52.4% of households, further exacerbates these risks. While 100% of mothers reported receiving support from extended family members, community-level support services were scarce, with only 1.2% having access to such services. This highlights a gap in the availability of community-based health interventions, which are critical in supporting maternal mental health, particularly in low-resource settings.

The effects of conflict and environmental stressors were also evident in the data. A significant proportion of mothers (26.2%) were displaced, and 45.2% faced limited access to essential resources during the conflict. Environmental hazards, including exposure to unsafe water, affected 85.7% of mothers, contributing to the spread of preventable diseases and further complicating maternal and neonatal health. Psychosocial stress was also prevalent, with 53.6% of mothers reporting anxiety and 15.5% experiencing trauma. These stressors are known to have a detrimental effect on maternal and neonatal outcomes, emphasizing the need for integrated mental health support as part of maternal care.

Low birth weight (LBW) was observed in 26.8% of births, significantly exceeding the global average of 15%, which is indicative of underlying nutritional deficiencies, inadequate healthcare access, and possibly inadequate prenatal care. Most births (85.1%) occurred at full term, which is a positive outcome. However, postnatal complications such as respiratory issues (10.7%) and jaundice (7.1%) were common, suggesting that neonatal care and follow-up services need improvement.

The findings from the multivariate logistic regression analysis identified several independent predictors of LBW, including fewer prenatal visits, home delivery, and maternal health factors such as weight, height, anemia, preeclampsia, diabetes, and infections during pregnancy. These results emphasize the importance of improving prenatal care, encouraging facility-based deliveries, and addressing maternal health issues to reduce the risk of LBW. Additionally, access to quality healthcare, including frequent prenatal visits, proximity to healthcare facilities, health insurance coverage, and affordable care, were identified as crucial factors in reducing the risk of LBW.

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Socioeconomic factors, such as poor housing conditions, lack of access to clean water and sanitation, and low education levels, were also found to play significant roles in influencing LBW. These findings highlight the need for targeted interventions that address these socioeconomic disparities to improve both maternal and neonatal health outcomes. Conflict-related stressors, including displacement and environmental hazards, also significantly contributed to the risk of LBW, further underlining the need for comprehensive interventions that address both healthcare and environmental challenges. Finally, neonatal factors such as birth weight, gestational age, and postnatal complications were found to be significant predictors of LBW, reinforcing the importance of early interventions and proper management of high-risk pregnancies.

In conclusion, this report underscores the complex interplay of maternal health, healthcare access, socioeconomic factors, and environmental conditions in determining pregnancy outcomes, particularly low birth weight. The findings emphasize the need for multifaceted interventions that address these factors, with a particular focus on improving healthcare access, maternal nutrition, and support systems for pregnant women, particularly in conflict-affected and resource-poor settings.

VI. CONCLUSIONS

The findings from this study offer valuable insights into the multifaceted factors contributing to low birth weight (LBW) in the studied population. Several key patterns were identified across demographics, maternal health, healthcare access, socioeconomic factors, environmental conditions, and birth outcomes. Most mothers were aged 21–29 years, with a significant proportion having multiple pregnancies, indicating a high parity rate. Many mothers lacked formal education and had low household incomes, which are recognized risk factors for adverse pregnancy outcomes, including LBW. Maternal nutrition was largely adequate, with most mothers consuming balanced diets and taking supplements. However, a small percentage of mothers had chronic conditions like diabetes, which can increase the risk of complications such as LBW.

While antenatal care access was relatively high at 86.9%, the quality of care received was reported as unsatisfactory by the majority (82.7%), highlighting the need for improvements in healthcare service quality to reduce risks associated with LBW and other complications. Additionally, the lack of health insurance among most mothers suggests a financial barrier to accessing quality care, further exacerbating health disparities. Most participants lived in temporary housing without access to adequate sanitation facilities, which can increase the risk of infections and poor pregnancy outcomes. Environmental hazards such as unsafe water and pollution were prevalent, potentially contributing to maternal stress and complications. These living conditions were exacerbated by the impacts of conflict, such as displacement and limited access to resources, further hindering the health and well-being of mothers and their newborns.

Approximately 26.8% of the babies were born with low birth weight, a figure significantly higher than the global average. Despite this, most pregnancies reached full term, and the majority of newborns did not experience major health issues. However, complications like jaundice and respiratory problems were observed in a small percentage, underscoring the need for enhanced neonatal care and follow-up services. Addressing the root causes of LBW requires a comprehensive approach that involves improving maternal healthcare quality, ensuring access to education and nutrition, and mitigating the socioeconomic and environmental factors that disproportionately affect vulnerable populations. Furthermore, enhancing community support and addressing the ongoing challenges posed by conflict is critical to improving maternal and neonatal health outcomes in the region.

Based on the findings of this study, several recommendations can be made to address the various factors contributing to low birth weight (LBW) and improve maternal and neonatal health outcomes. Efforts should be made to improve the quality of antenatal care, ensuring that the 82.7% of mothers who reported unsatisfactory care receive higher-quality services. This could include better training for healthcare providers, ensuring the availability of essential medical supplies, and improving patient-provider communication. Expanding health insurance coverage, especially for low-income families, will help reduce the financial barriers to accessing essential healthcare services, including antenatal care and delivery services.

Strengthening maternal nutrition programs is also crucial. While many mothers consumed a balanced diet and took supplements, efforts should be made to ensure that all mothers, particularly those with lower household incomes, have access to affordable, nutritious food. Supplementation programs should be expanded and made more accessible. Given the small percentage of mothers with chronic conditions like diabetes, there should be a focus on maternal health screening and the management of chronic diseases to reduce their impact on pregnancy outcomes. Improving living conditions by providing safe, permanent housing and access to sanitation facilities will reduce the risk of infections and promote better maternal and neonatal health outcomes. Government and community-level interventions are needed to ensure that families have access to clean water and hygienic living environments.

Although 98.8% of mothers accessed community support services, the lack of community-based psychosocial support is concerning. Expanding mental health services and maternal support programs can help address stress and anxiety during pregnancy, leading to improved outcomes for both mothers and babies. Given the high percentage of mothers affected by conflict-related displacement and limited access to resources, there is a need for targeted humanitarian interventions. These should focus on providing safe housing, access to healthcare, and essential resources such as food and clean water. Healthcare services should be designed to be more resilient to the impacts of conflict, ensuring that women

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in conflict zones continue to receive prenatal and delivery care even during periods of instability.

Conditions such as anemia and preeclampsia were prevalent among mothers, suggesting a need for better screening and early intervention programs. Providing education on the importance of antenatal visits and increasing access to screenings can help detect and manage complications early, reducing the risk of LBW and other pregnancy-related issues. The occurrence of postnatal complications such as jaundice and respiratory issues highlights the need for improved neonatal care services, including timely follow-up care for newborns after birth. Strengthening educational programs for mothers, especially those with low formal education, is also essential. These programs should focus on maternal health, nutrition, family planning, and the importance of regular antenatal care. These programs can be delivered through community centers, healthcare facilities, and media campaigns.

Addressing these recommendations can reduce the incidence of low birth weight and improve maternal and neonatal health outcomes in the region. Multi-sectoral efforts involving healthcare systems, government policies, community organizations, and international partners will be essential to achieving these goals.

This project aimed to examine the factors contributing to low birth weight (LBW) in a population of mothers, focusing on demographics, maternal health, healthcare access, socioeconomic conditions, environmental influences, and birth outcomes. The study was conducted with 168 mothers, and various data were collected through surveys, including information on maternal characteristics, pregnancy history, healthcare utilization, and postnatal outcomes. The findings revealed that a significant proportion of mothers were young (21–29 years) and had high parity, with many having more than four pregnancies. Most mothers had low levels of formal education and lived in poor socioeconomic conditions, with many lacking adequate sanitation and housing. Maternal nutrition was generally adequate, but some mothers had chronic conditions such as diabetes, which are risk factors for LBW and other complications.

Healthcare access was relatively high, with 86.9% of mothers attending antenatal care, but the quality of care was reported as unsatisfactory by the majority of respondents. Only a small percentage had health insurance, reflecting financial barriers to accessing quality healthcare. The study also identified environmental and conflict-related factors that negatively impacted maternal health, such as displacement, poor living conditions, and limited access to essential resources. Birth outcomes showed that 26.8% of babies were born with low birth weight, significantly higher than the global average. While most pregnancies reached full term, some newborns experienced postnatal complications such as jaundice and respiratory issues.

Based on these findings, the project highlighted several key areas for intervention, including improving antenatal care quality, expanding health insurance coverage, addressing maternal nutrition and chronic diseases, and tackling the socioeconomic and environmental challenges faced by mothers. Recommendations were also made to enhance healthcare access, especially in conflict-affected areas, and to improve neonatal care and postnatal follow-up services. Overall, the project underscores the importance of addressing the multifaceted factors contributing to low birth weight, emphasizing the need for a comprehensive approach involving healthcare providers, policymakers, and community organizations to improve maternal and neonatal health outcomes.

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ANNEXES NUMBER 1 RESEARCH QUESTIONNAIRES

Texila American University

➢ *Research for Public Health Master's Degree in October to December 2024.*

Here's a detailed and structured questionnaire designed to assess low birth weight (LBW) and its affecting factors, considering various social and economic factors. This questionnaire aims to collect comprehensive data on maternal health, socio-economic conditions, and other relevant aspects.

➢ *Instructions for Respondents:*

- Please answer each question as accurately as possible.
- Your responses will be kept confidential and used for research purposes only.
- If you need help with any questions, please ask the interviewer for assistance.

This structured approach ensures that the questionnaire covers all relevant areas, providing a comprehensive assessment of LBW and its contributing factors.

Questionnaire on Low Birth Weight and Contributing Factors (please include only mothers of below six months child).

➢ *Section 1: Demographic Information*

1. Mother's Age: _____

2. Marital Status:
a) Single
b) Married
c) Divorced
d)Widowed

3. Highest Level of Education Completed:
a) No formal education
b) Primary education
c) Secondary education
b) Higher education

4. Current Occupation: _____

5. Household Income (per month):
a) Less than $100
b) $100-$299
c) $300-$499
d) $500 or more

6. Number of Children: _____

➢ *Section 2: Pregnancy History*

7. Total Number of Pregnancies (Gravida): _____

8. Number of Live Births (Para): _____

9. Number of Prenatal Visits During the Pregnancy: _____

10. deliver at home or facility_____

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11. Type of Delivery: _____
a) Vaginal
b) Cesarean Section

➢ *Section 3: Maternal Health and Nutrition*

12. Pre-Pregnancy Weight (kg): _____

13. Weight during (kg): _____

14. Height (cm): _____

15. Body Mass Index (BMI): _____

16. Diet During Pregnancy: _____
a) Types of food regularly consumed (e.g., fruits, vegetables, proteins, grains): _____
b) Dietary supplements taken (e.g., iron, folic acid): _____

17. Chronic Diseases Present Before or During Pregnancy:
a) Hypertension
b) Diabetes
c) Asthma
d) None
e) Other (please specify): _____

18. Pregnancy Complications (e.g., anemia, preeclampsia): _____

19. Use of Alcohol, Tobacco, or Other Drugs:
a) Yes
b) No

20. Infections During Pregnancy (e.g., malaria, HIV UTI and STI): _____

➢ *Section 4: Healthcare Access and Utilization*

21. Access to Antenatal Care Services:
a) Yes
b) No

22. Number of Antenatal Care Visits: _____

23. Quality of Antenatal Care Received: _____
a) Satisfactory
b) Unsatisfactory

24. Health Insurance Status:
a) Insured
b) Uninsured

25. Distance to Nearest Healthcare Facility (km): _____

26. Costs Associated with Healthcare Visits (e.g., transportation, consultation fees): _____

➢ *Section 5: Socioeconomic Factors*

27. Type of Housing:
a) Permanent structure
b) Temporary structure
c) Informal settlement

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28. Access to Clean Water
a) Yes
b) No

29. Sanitation Facilities (e.g., latrine, sewer system)
a) Yes
b) No

30. Family Support System (e.g., presence of extended family, community support):_____

31. Community Support Services Available (e.g., maternal health programs, food aid)
a) Yes
b) No

32. Employment Status of Partner/Spouse:
a) Employed
b) Unemployed
c) Self-employed
d) Not applicable

33. Access to Education and Training Programs
a) Yes
b) No

- *Section 6: Environmental and Conflict-Related Factors*

34. Impact of Conflict on Living Conditions:
a) Displacement
b) Housing damage
c) Limited access to resources

35. Access to Resources During Conflict (e.g., food, healthcare)
a) Adequate
b) Inadequate

36. Exposure to Environmental Hazards (e.g., pollution, unsafe water)
a) Yes
b) No

37. Psychosocial Stress During Pregnancy (e.g., anxiety, trauma) _____

- *Section 7: Birth and Neonatal Information*

38. Birth Weight of Baby (grams) _____ ____

39. Gestational Age at Birth (weeks) _____

40. Infant's Health at Birth (e.g., APGAR score, immediate medical issues) _____ ____

41. Length of Hospital Stay: _____

42. Any Postnatal Complications (e.g., jaundice, respiratory issues) _____

- *Section 8: Additional Comments*

43. Mother's Additional Observations or Concerns: _____
_____
_____

Good Luck