

Original article

Maternal Risk Factors and Neonatal Outcomes of Preterm Birth in Benghazi, Libya

Malak Alamrouni¹, Marleen Alamrouni¹, Mohsen Najeeb²¹Faculty of Medical and Health Science, Libyan International Medical University, Benghazi, Libya.²Faculty of Medicine, University of Benghazi, LibyaEmail: marleenalamrouni495@gmail.com**Keywords:**

Preterm Birth, Maternal Risk Factors, Neonatal Outcomes, Neonatal Complications, Benghazi Children's Hospital, Libya.

ABSTRACT

Preterm birth is one of the leading causes of neonatal morbidity and mortality worldwide and remains a major public health challenge. Identifying maternal risk factors and evaluating neonatal outcomes are essential for improving pregnancy care and neonatal survival in Libya. This study aimed to identify the maternal risk factors associated with preterm birth and evaluate neonatal outcomes among preterm infants admitted at Benghazi Children's Hospital, Libya. A retrospective cross-sectional study was conducted using medical records of 100 preterm neonates and their mothers admitted to Benghazi Children's Hospital between 2023 and 2025. Data on maternal characteristics, pregnancy-related risk factors, neonatal complications, and clinical outcomes were collected and analyzed using descriptive and inferential statistical methods. The mean maternal age was 33.25 ± 5.12 years, while the mean gestational age and birth weight were 34.05 ± 1.48 weeks and 2.00 ± 0.50 kg, respectively. Maternal infection was the most frequently identified risk factor (34%), followed by multiple gestation (20%) and antepartum hemorrhage (9%). Respiratory distress syndrome was the most common neonatal complication (60%), followed by neonatal jaundice (33%), sepsis (7%), and anemia (5%). A strong positive correlation was observed between gestational age and birth weight ($r = 0.749$, $p < 0.001$). The neonatal survival rate was 92%, while the mortality rate was 2%. Associations between individual maternal risk factors and neonatal complications were generally weak and did not reach statistical significance. Maternal infection and multiple gestations were the predominant risk factors associated with preterm birth in Benghazi. Although respiratory distress syndrome remained the predominant neonatal complication, the overall survival rate was high. These findings highlight the importance of strengthening antenatal infection screening, providing specialized care for multiple pregnancies, and continuing to improve neonatal intensive care services to reduce the incidence of preterm birth in Libya.

Introduction

Preterm birth (PTB), defined as any birth occurring before 37 completed weeks of gestation, constitutes a major public health burden globally and is a leading cause of infant morbidity and mortality worldwide [1]. Prematurity is the foremost cause of death in children under five years old [2]. Addressing this immense burden is critical to achieving the Sustainable Development Goal (SDG) dedicated to reducing neonatal mortality rates, especially given that neonatal deaths account for 45% of all under-five mortality globally [2]. Survivors face significant consequences, including respiratory distress syndrome, developmental delays, and long-term cognitive or physical impairments [3].

Understanding regional differences in Libya is essential for developing targeted strategies to reduce the burden of preterm birth and improve neonatal outcomes. These variations reflect the complex interplay of maternal health, environmental conditions, and healthcare access within the country [4,5,6,7]. The risk landscape associated with PTB is intricate and significantly shaped by social and environmental factors, including stress and exposure to pollutants [1, 4]. Additionally, local factors such as maternal age, socioeconomic status, and healthcare access further contribute to the risk [4]. General risk factors contributing to preterm delivery include having a previous preterm infant, multiple births, maternal infection, and maternal psychological or social stress [4, 5].

Preterm birth remains a significant health concern in Libya, with varying incidence rates reported across different regions [5,6,7]. Regional data highlight that infections, maternal age, and obstetric history play critical roles in influencing preterm birth rates [4, 5, 7]. Studies indicate that the incidence of preterm birth ranges from approximately 2.8% in cities like Sirt [5] to higher rates influenced by diverse risk factors in other areas [6, 7]. Due to the significant regional variations in preterm birth risk factors and outcomes across Libya, existing data from other cities may not adequately inform clinical management in Benghazi. Therefore, localized data specific to Benghazi are urgently needed to develop targeted interventions and effective preventive strategies.

This study aims to investigate the maternal risk factors associated with preterm birth and evaluate the neonatal outcomes in Benghazi, Libya, through a retrospective analysis of hospital records. The objectives are to determine the incidence rate of preterm births, characterize common maternal pathological conditions and risk factors, evaluate neonatal complications and short-term outcomes, analyze correlations between maternal pathology and neonatal health, and formulate recommendations for updating clinical guidelines and prevention programs based on localized evidence.

Methodology

This observational, retrospective cross-sectional study involved the analysis of hospital records from Benghazi Children's Hospital over a defined period (2023–2025). The target population included preterm neonates (born before 37 completed weeks of gestation) and their mothers. Inclusion criteria comprised all neonates delivered preterm and managed within the nurseries of the specified hospital during the study period. Exclusion criteria included term deliveries, deliveries outside the specified hospital, and cases lacking required documentation or consent.

Data were collected using a pre-designed structured questionnaire/data abstraction tool, retrieving information from medical records on:

Maternal Characteristics: Age, parity, history of abortion or prior neonatal death, antenatal visits, and previous C-sections.

Antepartum/Intrapartum Risk Factors: Presence of infections (e.g., UTI), maternal chronic diseases (e.g., hypertension, diabetes), antepartum hemorrhage, PROM (premature rupture of membranes), and mode of delivery (C/S vs. vaginal).

Neonatal Pathological Outcomes: Gestational age, birth weight, APGAR scores at 1 minute, and complications like sepsis, respiratory distress syndrome, and intraventricular hemorrhage.

Treatment and Final Outcome: Use of specific antibiotics (e.g., Ampicillin + Gentamicin, Claforan + Amikacin), respiratory supportive measures (e.g., CPAP, mechanical ventilator), hospital stay duration, and survival outcome (Died, Alive/Discharged, Transferred).

The collected data were analyzed using Python with libraries such as Pandas, NumPy, SciPy, and Statsmodels, performing functions equivalent to SPSS. Descriptive statistics (frequencies, percentages, mean, standard deviation) were used to summarize the data. Pearson correlation coefficients were calculated to determine linear relationships between continuous variables. Data visualization was performed using Matplotlib and Seaborn.

Ethical approval was sought from the relevant ethics committee prior to data collection. Confidentiality and anonymity of patient data were strictly maintained during data collection and analysis.

Results

Study Population Characteristics

The study encompassed 100 preterm birth cases managed at Benghazi Children's Hospital between 2023 and 2025.

Table 1: Descriptive Statistics of Maternal and Neonatal Characteristics (n=100)

Characteristic	Mean (SD)	Range
Maternal Age (years)	33.25 (5.12)	28 - 40
Gestational Age (weeks)	34.05 (1.48)	31 - 36
Birth Weight (kg)	2.00 (0.50)	0.40 - 3.16
Hospital Stay (days)	5.04 (4.55)	1 - 21

The demographic and clinical characteristics of the maternal and neonatal populations are summarized in Table 1. The mean maternal age was 33.25 years (SD = 5.12), with a range of 28 to 40 years. The average gestational age at birth was 34.05 weeks (SD = 1.48), falling within the late preterm category (34-36 weeks), and the mean birth weight was 2.00 kg (SD = 0.50). The average hospital stay for neonates was 5.04 days (SD = 4.55).

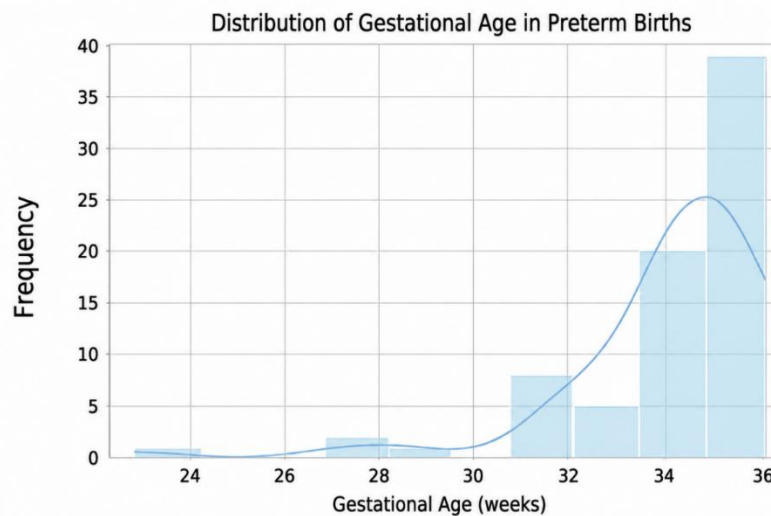


Figure 1. The gestational age distribution, showing a concentration of births in the 34–35-week range.

Maternal Risk Factors

Analysis of maternal characteristics revealed several common risk factors associated with preterm delivery in the study cohort (Table 2). Maternal infection, predominantly urinary tract infections (UTIs), was the most frequently identified risk factor, present in 34% of cases. Multiple gestations (twins or triplets) accounted for 20% of the cases. Antepartum hemorrhage was observed in 9% of mothers, while hypertension and diabetes mellitus were less common, at 5% and 1%, respectively.

Table 2: Prevalence of Maternal Risk Factors (n=100)

Maternal Risk Factor	Frequency (n)	Percentage (%)
Maternal Infection	34	34.0
Multiple Gestation	20	20.0
Antepartum Hemorrhage	9	9.0
Hypertension	5	5.0
Diabetes Mellitus	1	1.0

Neonatal Outcomes and Complications

Short-term neonatal outcomes and complications are detailed in Table 3. Respiratory Distress Syndrome (RDS) was the most prevalent complication, affecting 60% of preterm neonates. Neonatal jaundice was observed in 33% of cases, followed by neonatal sepsis (7%) and anemia (5%).

Table 3: Prevalence of Neonatal Complications (n=100)

Neonatal Complication	Frequency (n)	Percentage (%)
Respiratory Distress Syndrome (RDS)	60	60.0
Neonatal Jaundice	33	33.0
Neonatal Sepsis	7	7.0
Anemia	5	5.0

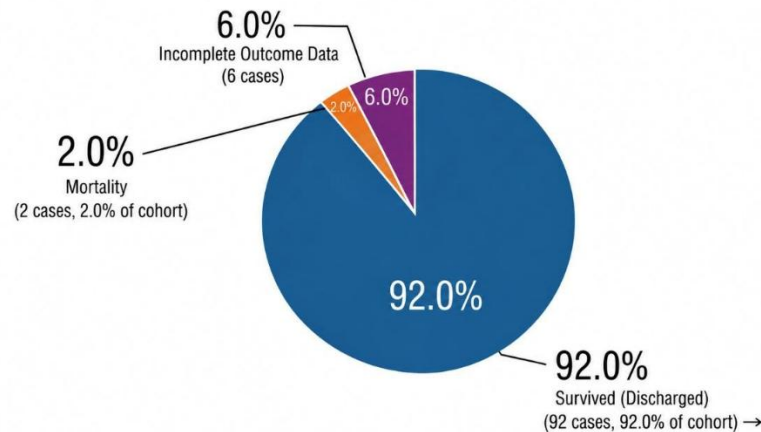


Figure 2. The survival outcomes. The overall short-term survival rate for preterm neonates in this cohort was 92.0% (92 out of 100 cases were discharged alive and stable). A mortality rate of 2.0% was recorded, with 6 cases having incomplete outcome data.

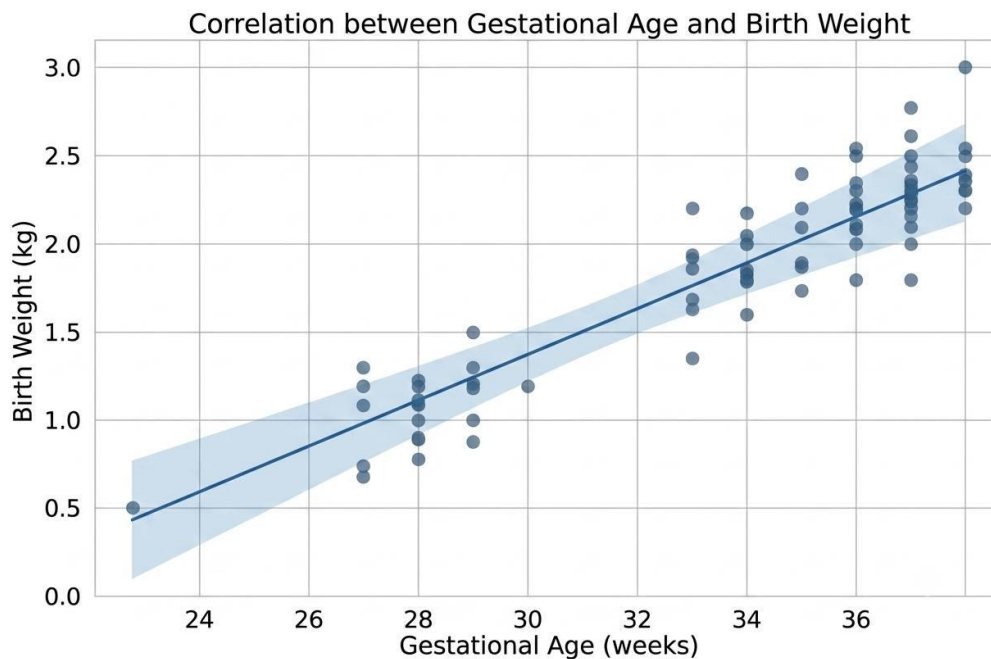


Figure 3. The strong positive correlation identified between gestational age and birth weight ($r = 0.749$, $p < 0.001$), indicating that neonates born at later gestational ages tend to have higher birth weights.

Pathological Correlations

Further analysis explored the correlations between specific maternal risk factors and neonatal complications (Table 4). A correlation heatmap (Figure 6) provides a visual summary of these relationships.

Table 4: Correlation Matrix (Pearson r) between Maternal Risk Factors and Neonatal Outcomes

	RDS	Jaundice	Anemia	Sepsis	Survival
Maternal Infection	0.07	-0.05	0.01	0.07	-0.03
Multiple Gestation	0.13	0.02	0.08	0.04	-0.06
Diabetes	0.04	0.01	0.00	0.00	-0.01
Hypertension	0.03	0.00	0.00	0.00	-0.01
Antepartum Hemorrhage	0.09	0.03	0.00	0.00	-0.02

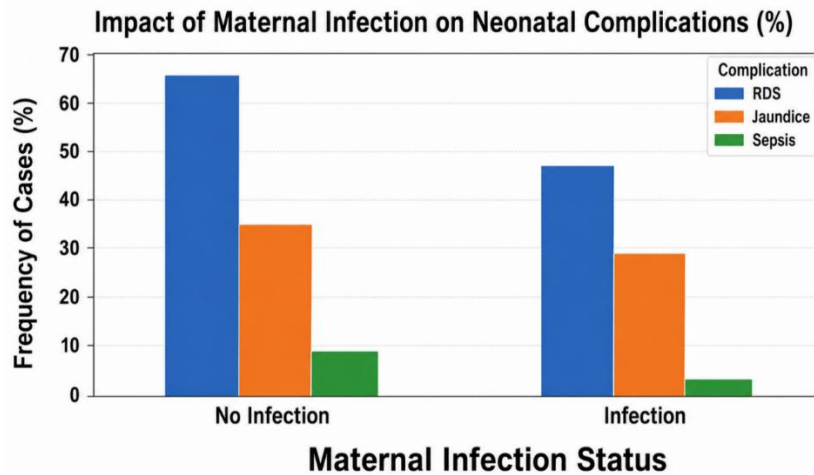


Figure 4: To further investigate the impact of maternal infection, a grouped bar chart compared the prevalence of RDS, jaundice, and sepsis in neonates born to mothers with and without documented infections. While the percentages varied, no statistically significant differences were observed for these specific complications based solely on the presence of maternal infection in this cohort.

Discussion

This study provides crucial localized evidence on maternal risk factors and neonatal outcomes associated with preterm birth at Benghazi Children's Hospital, a region previously lacking specific data. The findings contribute to a better understanding of preterm birth epidemiology in Benghazi and offer insights for updating clinical guidelines and prevention programs. Our cohort of 100 preterm birth cases, with a mean gestational age of 34.05 weeks and a mean birth weight of 2.00 kg, aligns with the global understanding that preterm birth is a significant contributor to neonatal morbidity and mortality [1, 2]. The predominance of late preterm births (34-36 weeks) in our sample is consistent with trends observed in many settings, where this subgroup constitutes the largest proportion of preterm deliveries [3].

Maternal infection emerged as the most prevalent risk factor in our study, affecting 34% of mothers. This finding resonates strongly with the literature, which consistently identifies maternal infections, particularly UTIs, as a major contributor to preterm labor [4, 5]. A study conducted in Misurata reported that antepartum infections were a significant risk factor, accounting for about 40% of preterm birth cases [4]. Our findings for Benghazi are thus comparable to other Libyan regions and international data, underscoring the critical need for effective prenatal screening and management of infections. Multiple gestations were the second most common risk factor, present in 20% of our cases. This is a well-established risk factor for preterm birth globally [5]. The high prevalence in our cohort emphasizes the need for specialized antenatal care for mothers with multiple pregnancies in Benghazi. Other factors such as antepartum hemorrhage (9%), hypertension (5%), and diabetes mellitus (1%) were less frequent in our cohort. While these are recognized risk factors in the broader literature [4, 5], their lower prevalence in our specific sample might reflect local demographic characteristics, referral patterns, or the specific population captured by a retrospective study at a children's hospital.

Respiratory Distress Syndrome (RDS) was the most common neonatal complication, affecting 60% of preterm infants. This high incidence is a consistent finding in preterm populations worldwide, as immature lungs are a hallmark of prematurity [3, 7]. The proposal also noted that survivors of preterm birth face significant consequences, including RDS [7]. Our data reinforce the necessity of robust respiratory support services, including surfactant therapy and mechanical ventilation, as highlighted in the proposal's discussion of local care protocols [5].

Neonatal jaundice (33%) and sepsis (7%) were also observed. The prevalence of jaundice is expected in preterm infants due to hepatic immaturity. The 7% incidence of neonatal sepsis, while concerning, is lower than some reported rates, potentially reflecting effective prophylactic antibiotic use or early intervention strategies within Benghazi Children's Hospital. This aligns with the proposal's emphasis on evaluating specific treatments like antibiotic combinations [5]. Our study reported an encouraging short-term survival rate of 92.0%. This figure is higher than the 80.2% survival rate (19.8% mortality) documented in Sirt [5], suggesting potentially effective neonatal care practices at Benghazi Children's Hospital, or differences in the severity of cases managed. The proposal noted that regional variability in outcomes is profound across Libya [4, 5, 6, 7], and our data provide a positive benchmark for Benghazi.

The strong positive correlation between gestational age and birth weight ($r = 0.749$, $p < 0.001$) is a fundamental principle of neonatal physiology and is universally observed [1]. This finding underscores the importance of prolonging gestation whenever safely possible to improve neonatal size and maturity.

Interestingly, our correlation analysis between specific maternal risk factors and neonatal complications yielded weak or non-significant linear relationships. For instance, maternal infection showed only a weak positive correlation with neonatal sepsis ($r = 0.07$). This contrasts with the general understanding that maternal infections can directly lead to neonatal sepsis [4]. The lack of a strong direct correlation in our data might be attributed to several factors:

Intervention Effect: Aggressive antenatal and postnatal management, including early antibiotic administration for suspected maternal infections, could be mitigating the direct impact on neonatal sepsis. The proposal specifically mentioned evaluating how treatments like antibiotic combinations correlate with neonatal survival [5].

Confounding Variables: The complex interplay of various factors, including the quality of immediate postnatal care, specific clinical interventions, and the overall health status of the neonate, might obscure direct linear correlations in a retrospective dataset.

Sample Size/Statistical Power: While 100 cases provide valuable localized data, detecting subtle correlations for less frequent events might require a larger sample size or more advanced multivariate analyses.

Limitations

This study is subject to several limitations inherent to its retrospective, single-center design. Data were extracted from existing medical records, which may have led to incomplete documentation for some variables (e.g., 6 cases with incomplete outcome data). The sample size, while sufficient for descriptive analysis, might limit the statistical power to detect weaker correlations or conduct extensive multivariate regression analyses as suggested in the proposal's methodology [5]. Furthermore, the study focused on short-term outcomes, and long-term developmental impacts were not assessed.

Conclusion

Our findings from Benghazi Children's Hospital highlight maternal infection and multiple gestations as key local risk factors for preterm birth. While neonatal complications like RDS are prevalent, the observed high survival rate is encouraging. The weak direct correlations between specific maternal risk factors and neonatal complications suggest that effective clinical interventions are likely playing a crucial role in mitigating adverse outcomes. This localized evidence is vital for developing targeted strategies to improve maternal and neonatal health in Benghazi.

Recommendations

Based on the localized evidence from Benghazi Children's Hospital:

1. Infection Screening: Strengthen prenatal screening and early treatment for Urinary Tract Infections (UTIs) and other maternal infections to reduce the incidence of preterm labor.
2. Respiratory Support: Given the 60% incidence of RDS, ensure continuous availability of surfactant therapy and advanced respiratory support (CPAP/Ventilators).
3. Multiple Gestation Management: Develop specialized protocols for multiple gestations, as they represent 20% of preterm cases.
4. Weight-Gestational Age Monitoring: Use the strong correlation between GA and weight to prioritize "buying time" in threatened preterm labor through tocolytics and steroids.
5. Further Research: Conduct larger, prospective studies to explore the long-term outcomes of preterm infants and to further investigate the impact of specific interventions on maternal-neonatal health in Benghazi.

Authors Contributions

Malak Alamrouni contributed to study conception, data collection, critical revision, and approved the final manuscript.

Marleen Alamrouni contributed to study design, data collection, data analysis, manuscript writing, and manuscript drafting.

Mohsen Najeib contributed to data analysis using SPSS, interpretation of the results, and critical revision of the manuscript.

Acknowledgements

We would like to thank Supervisor Dr. Warda Musbah for her support throughout this research. We also appreciate the Benghazi Children's Hospital for their cooperation and for providing us with the data needed to complete this study

Conflict of Interest:

The authors declare that they have no conflict of interest.



Funding:

This research received no specific grant or financial support from any funding agency in the public, commercial, or not-for-profit sectors.

References

1. Monga A, Dobbs SP. Gynaecology by Ten Teachers, 19th Edition. CRC Press; 2011.
2. Santhanam I. Illustrated textbook of pediatrics. Delhi: Jaypee Brothers, Medical Publishers Pvt. Ltd; 2018.
3. Noura Elawam. Birth Asphyxia Prevalence and Related Factors in Live Births at University Hospital, Tripoli, Libya. AlQalam Journal of Medical and Applied Sciences. 2024 Nov 3;1146–52.
4. Elzaroug ZA, Eldug II, Ismail ME, Abdelmalek MA, Hanaish IS, Mustafa AB, et al. Risk factors of preterm babies: Regarding gestational age, maternal medical history, delivery mode and influences. World Journal of Biology Pharmacy and Health Sciences [Internet]. 2022 [cited 2024 Feb 23];9(2):028–32.
5. Alamari S. Incidence, Risk Factor, Outcome among Preterm Delivery in Nursery of Ibsina Teaching Hospital. Libyan Medical Journal. 2024 Nov 7:215-20.
6. Incidence and Risk Factors of Preterm Birth among Women in Tripoli Hospitals, Libya. Libyan Medical Journal. 2025 Jan 20;41–7.
7. Neonatal and Perinatal Mortality Rates in Neonatal Intensive Care Unit of Misurata Teaching Hospital – Libya/2013 Journal of Hematology & Thromboembolic Diseases [Internet]. 2017 [cited 2025 Oct 20].