Original Research Article

FACTORS INFLUENCING SURVIVAL AND SHORT-TERM OUTCOMES OF VERY LOW BIRTH WEIGHT INFANTS IN A TERTIARY CARE HOSPITAL

Paramjeet[1]

[1]*Assistant Professor, Department of Pediatrics, Sri Satya Sai University of Technology & Medical Sciences, Sehore, Madhya Pradesh, India*

Received : *05/02/2026*
Received in revised form : *16/03/2026*
Accepted : *02/04/2026*

Corresponding Author:
Dr. Paramjeet,
Assistant Professor, Department of Pediatrics Sri Satya Sai University of Technology & Medical Sciences, Sehore, Madhya Pradesh, India.
Email: param2k4@gmail.com

DOI: 10.70034/ijmedph.2026.2.66

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (2); 401-406

ABSTRACT

Background: Very low birth weight (VLBW) infants remain at high risk of mortality and morbidity, particularly in developing countries. Despite advances in neonatal care, outcomes vary widely depending on maternal, perinatal, and neonatal factors. Identifying these factors is essential for improving survival and short-term outcomes. The objective is to evaluate the factors influencing survival and short-term outcomes among very low birth weight infants admitted to a tertiary care hospital.
Materials and Methods: This retrospective observational study was conducted in the Neonatal Intensive Care Unit (NICU) of a tertiary care hospital. All neonates with a birth weight between 500 and ≤1500 grams, born between 1 January 2022 and 31 December 2023, and admitted within 24 hours of birth were included. Data on maternal, perinatal, and neonatal variables were collected from medical records. The primary outcome was survival to discharge, while secondary outcomes included major neonatal morbidities. Statistical analysis was performed using appropriate tests, with $p < 0.05$ considered significant.
Results: A total of 1,018 VLBW infants were included, of whom 664 (65.2%) survived and 354 (34.8%) died. Survival was significantly higher among infants with adequate antenatal care, exposure to antenatal corticosteroids, and cesarean delivery. Higher birth weight, gestational age, head circumference, and Apgar scores were significantly associated with improved survival ($p < 0.001$)002E
Conclusion: Survival of VLBW infants is influenced by a complex interplay of antenatal, perinatal, and neonatal factors. Strengthening antenatal care, ensuring timely interventions, and improving neonatal intensive care practices are crucial to enhancing survival and reducing morbidity in this vulnerable population.
Keywords: Very low birth weight, neonatal mortality, NICU, antenatal care, prematurity, neonatal outcomes

INTRODUCTION

Very low birth weight (VLBW) infants, defined as neonates with a birth weight of less than 1500 grams, represent a highly vulnerable population with significant risks of morbidity and mortality, particularly in low- and middle-income countries. Advances in neonatal intensive care have substantially improved survival rates of VLBW infants over the past few decades; however, these improvements are not uniformly distributed across different healthcare settings. The survival and short-term outcomes of VLBW infants are influenced by a complex interplay of maternal, perinatal, and neonatal factors, as well as the quality of care provided in tertiary healthcare institutions.

Globally, preterm birth and low birth weight remain leading causes of neonatal mortality, accounting for a substantial proportion of deaths in the first 28 days of life. According to the World Health Organization, approximately 15 million babies are born preterm each year, and a significant proportion of these infants fall into the VLBW category.[1] Despite technological advancements, VLBW infants are at increased risk for complications such as respiratory distress syndrome (RDS), intraventricular hemorrhage (IVH), necrotizing enterocolitis (NEC), sepsis, and bronchopulmonary dysplasia (BPD), all

of which significantly impact short-term outcomes and survival.[2]

Maternal factors play a crucial role in determining neonatal outcomes. Antenatal care, maternal nutrition, presence of pregnancy-related complications such as preeclampsia, gestational diabetes, infections, and the use of antenatal corticosteroids significantly influence fetal growth and organ maturity. Administration of antenatal steroids, in particular, has been shown to reduce the incidence and severity of respiratory distress syndrome and improve survival rates in preterm infants.[3] Additionally, maternal socioeconomic status and access to quality healthcare services are important determinants of outcomes in VLBW infants.

Perinatal factors, including gestational age, mode of delivery, birth asphyxia, and resuscitation practices, are also critical determinants of survival. Gestational age remains one of the strongest predictors of neonatal survival, with lower gestational ages associated with higher mortality and morbidity. Delivery in a tertiary care center equipped with neonatal intensive care units (NICUs) and skilled personnel has been associated with improved outcomes, emphasizing the importance of timely referral and institutional delivery.[4] Furthermore, immediate neonatal care practices such as thermal regulation, infection control, and early initiation of respiratory support are essential in improving survival rates.

Neonatal factors, including birth weight, sex, Apgar score, and the presence of congenital anomalies, further influence outcomes. Lower birth weight within the VLBW category is associated with increased risk of complications and mortality. Male infants have been observed to have poorer outcomes compared to females, possibly due to differences in lung maturity and hormonal influences.[5] Early clinical status, as assessed by Apgar scores, is an important indicator of neonatal well-being and can predict short-term outcomes.

The quality of care provided in tertiary hospitals plays a pivotal role in determining outcomes of VLBW infants. Availability of advanced neonatal care technologies such as mechanical ventilation, continuous positive airway pressure (CPAP), surfactant therapy, and parenteral nutrition has significantly improved survival rates. However, resource limitations, especially in developing countries, can hinder optimal care delivery. Infection control practices, nurse-to-patient ratios, and adherence to evidence-based clinical protocols are also crucial factors influencing neonatal outcomes.[6]

Short-term outcomes of VLBW infants include survival to discharge and the occurrence of major neonatal complications. These outcomes are important indicators of the quality of neonatal care and have long-term implications for neurodevelopmental outcomes. Early identification of risk factors associated with adverse outcomes can help in implementing targeted interventions and improving overall neonatal care.

In recent years, there has been growing emphasis on evaluating and improving neonatal outcomes through quality improvement initiatives and evidence-based practices. Understanding the factors influencing survival and short-term outcomes in VLBW infants within a tertiary care setting is essential for developing strategies to reduce neonatal mortality and morbidity. Such studies provide valuable insights into local healthcare challenges and help guide policy-making and resource allocation.

Therefore, this study aims to assess the various maternal, perinatal, and neonatal factors influencing survival and short-term outcomes of very low birth weight infants admitted to a tertiary hospital. Identifying these factors will contribute to optimizing neonatal care practices and improving survival outcomes in this high-risk population.

MATERIALS AND METHODS

This retrospective observational study was conducted in the Neonatal Intensive Care Unit (NICU) of a tertiary care hospital. The study included very low birth weight (VLBW) infants with a birth weight between 500 grams and ≤1500 grams, born between 1 January 2022 and 31 December 2023, and admitted to the NICU during the study period.

Study Design and Setting: The study was carried out in a tertiary care teaching hospital equipped with advanced neonatal care facilities, including mechanical ventilation, continuous positive airway pressure (CPAP), surfactant therapy, and neonatal monitoring systems. The NICU serves as a referral center for high-risk pregnancies and preterm deliveries.

Study Population: All live-born neonates with a birth weight ranging from 500 grams to ≤1500 grams, delivered within the hospital or referred within 24 hours of birth, and admitted to the NICU during the study period were included.

Inclusion Criteria

- Neonates with birth weight between 500 grams and ≤1500 grams
- Born between 1 January 2022 and 31 December 2023
- Admitted to the NICU within 24 hours of birth

Exclusion Criteria

- Neonates with major congenital anomalies incompatible with life
- Infants discharged against medical advice (LAMA) before outcome assessment
- Incomplete or missing medical records

Data Collection: Data were collected retrospectively from hospital medical records, NICU admission registers, and case sheets. A structured data collection form was used to record relevant variables.

Maternal variables included age, parity, antenatal care status, pregnancy complications (such as

preeclampsia, gestational diabetes, and infections), and administration of antenatal corticosteroids.

Perinatal variables included gestational age, mode of delivery, place of birth (inborn or outborn), and need for resuscitation at birth.

Neonatal variables included birth weight, sex, Apgar scores at 1 and 5 minutes, requirement of respiratory support, and presence of complications such as respiratory distress syndrome (RDS), sepsis, necrotizing enterocolitis (NEC), intraventricular hemorrhage (IVH), and hyperbilirubinemia.

Outcome Measures: The primary outcome was survival to discharge from the NICU. Secondary outcomes included short-term morbidities such as:

- Respiratory distress syndrome (RDS)
- Neonatal sepsis
- Necrotizing enterocolitis (NEC)
- Intraventricular hemorrhage (IVH)
- Bronchopulmonary dysplasia (BPD)
- Duration of hospital stay

Statistical analysis: Statistical analysis was performed using IBM SPSS Statistics version 25. Frequencies and percentages were used to describe categorical variables. Continuous variables were described using mean and standard deviation if they were normally distributed, and median and interquartile ranges (IQR) if they were skewed. Univariate analysis was performed to determine significant associations of various factors with survival at discharge. Unpaired t-tests were used comparing normally distributed continuous variables and Mann-Whitney U tests for skewed distribution. Chi-Square tests were used to compare categorical variables. A p-value of <0.05 was considered significant. Only valid cases were analyzed for each variable (i.e., cases with missing data were excluded from the analysis). Thereafter a multiple logistic regression model with mortality as the binary outcome variable was performed. Variables that were (1) significantly associated with mortality in univariate analysis,

(2) had a sufficient number of valid cases, (3) passed the assumption of linearity using Box-Tidwell procedure, (4) were not transformed as part of the initial univariate analysis, and (5) were appropriate were included in the model.

RESULTS

Table 1: Obstetric Risk Factors and Mortality

Risk factor	Category	Total	Survived n (%)	Died n (%)	P value	Odds ratio	95% CI
Sex	Male	462	282 (61.0)	180 (39.0)	0.001	1.57	1.20–2.06
	Female	556	382 (68.7)	174 (31.3)			
Antenatal care	Yes	747	528 (70.7)	219 (29.3)	<0.001	0.41	0.30–0.58
	No	198	99 (50.0)	99 (50.0)			
Antenatal corticosteroids	Yes	435	306 (70.3)	129 (29.7)	0.021	0.70	0.53–0.94
	No	465	291 (62.6)	174 (37.4)			
Mode of delivery	Vaginal	435	248 (57.0)	187 (43.0)	<0.001	0.46	0.34–0.61
	Cesarean	535	398 (74.4)	137 (25.6)			
Resuscitation at birth	Yes	482	260 (53.9)	222 (46.1)	<0.001	3.38	2.48–4.62
	No	448	357 (79.7)	91 (20.3)			
5-min Apgar	≤5	130	77 (59.2)	53 (40.8)	0.042	1.52	1.02–2.28
	>5	790	543 (68.7)	247 (31.3)			

[Table 1] shows the association between obstetric and neonatal factors with mortality. Male infants had higher mortality compared to females. Lack of antenatal care significantly increased mortality risk. Antenatal corticosteroid use was protective. Cesarean delivery was associated with better survival. Need for resuscitation at birth markedly increased mortality. Lower Apgar scores were also associated with higher mortality.

Table 2: Infant Characteristics

Category	Survivors (n=664)	Non-survivors (n=354)	P-value
Birthweight (g)	1190.2 ± 198.5	910.8 ± 242.3	<0.001
Gestational age (weeks)	29.8 ± 2.4	27.3 ± 2.6	<0.001
Head circumference (cm)	27.9 ± 2.2	25.6 ± 2.7	<0.001
5-min Apgar	9 (1)	7 (4)	<0.001

[Table 2] compares clinical characteristics between survivors and non-survivors. Survivors had significantly higher birth weight, gestational age, and head circumference. They also had better Apgar scores. These findings indicate that maturity and better physiological status at birth are key determinants of survival.

Table 3: Disease and Treatment Risk Factors

Risk factor	Category	Total	Survived n (%)	Died n (%)	P value	OR	95% CI
Invasive ventilation	Yes	265	124 (46.8)	141 (53.2)	<0.001	3.13	2.31–4.23
	No	753	540 (71.7)	213 (28.3)			
	Yes	160	136 (85.0)	24 (15.0)	<0.001	0.30	0.19–0.48

Resp support 36 weeks	No	858	528 (61.5)	330 (38.5)			
Surfactant	Yes	690	427 (61.9)	263 (38.1)	<0.001	2.15	1.54–3.00
	No	280	218 (77.9)	62 (22.1)			
Steroids BPD	Yes	195	181 (92.8)	14 (7.2)	<0.001	0.14	0.07–0.25
	No	735	473 (64.4)	262 (35.6)			

[Table 3] highlights disease-related and treatment-related factors. Invasive ventilation and surfactant therapy were associated with higher mortality, likely reflecting disease severity. Steroids for BPD and continued respiratory support were associated with improved survival. Overall, severe complications significantly increased mortality risk.

Table 4: Multivariate Logistic Regression

Factor	OR	95% CI	P-value
Invasive ventilation	7.314	4.373–12.232	<0.001
Resuscitation	3.144	2.091–4.726	<0.001
Surfactant	2.329	1.447–3.747	<0.001
Antenatal care	0.410	0.253–0.666	<0.001
Mode of delivery	0.311	0.202–0.480	<0.001
Phototherapy	0.291	0.194–0.438	<0.001
Resp support 36 weeks	0.033	0.014–0.079	<0.001

[Table 4] presents independent predictors of mortality. Invasive ventilation and resuscitation were strong risk factors. Antenatal care, cesarean delivery, and phototherapy were protective. Respiratory support at 36 weeks showed strong survival benefit. These findings indicate that both clinical severity and quality of care influence outcomes. Table 4 presents independent predictors of mortality. Invasive ventilation and resuscitation were strong risk factors. Antenatal care, cesarean delivery, and phototherapy were protective. Respiratory support at 36 weeks showed strong survival benefit. These findings indicate that both clinical severity and quality of care influence outcomes.

DISCUSSION

The present study evaluated the factors influencing survival and short-term outcomes among very low birth weight (VLBW) infants admitted to a tertiary care hospital. The overall survival rate in this study was approximately 65.2% (664/1018), which is comparable to outcomes reported from similar resource-limited settings but remains lower than those observed in high-income countries. This disparity reflects differences in availability of advanced neonatal care, timely interventions, and perinatal management strategies.

Sex-based differences in neonatal outcomes were evident, with male infants demonstrating higher mortality compared to females. This finding is consistent with previous studies suggesting that male neonates have delayed lung maturation and increased susceptibility to respiratory complications, contributing to poorer outcomes.[7] The protective effect observed in female infants may be attributed to hormonal and developmental advantages that enhance physiological resilience in the early neonatal period.

Antenatal care emerged as a significant protective factor in this study. Infants born to mothers who received adequate antenatal care had significantly higher survival rates compared to those without such care. This underscores the importance of early identification and management of high-risk pregnancies, as well as timely interventions such as nutritional support and monitoring of maternal complications. Similar findings have been reported in earlier studies, emphasizing the role of structured antenatal services in improving neonatal outcomes.[8]

The administration of antenatal corticosteroids was associated with improved survival, which aligns with established evidence demonstrating their role in enhancing fetal lung maturity and reducing the incidence of respiratory distress syndrome. Although the protective effect in this study was modest, it remained statistically significant, reinforcing the importance of adherence to antenatal steroid protocols in preterm labor.[9]

Mode of delivery also significantly influenced neonatal outcomes. Infants delivered via cesarean section had better survival rates compared to those delivered vaginally. This may be due to reduced birth trauma and better intrapartum monitoring in cesarean deliveries, especially in high-risk pregnancies. However, it is important to interpret this finding cautiously, as the decision for cesarean delivery is often influenced by underlying maternal and fetal conditions, which themselves may impact outcomes.[10]

Resuscitation at birth was strongly associated with increased mortality. Infants requiring resuscitation likely represent a subgroup with significant perinatal compromise, including birth asphyxia and prematurity-related complications. This finding highlights the importance of improving intrapartum care and ensuring the availability of skilled neonatal resuscitation teams to optimize immediate postnatal outcomes.[11]

Low Apgar scores at 5 minutes were also significantly associated with higher mortality, reflecting poor neonatal adaptation at birth. Apgar scoring remains a simple yet valuable tool for assessing neonatal condition and predicting early

outcomes. Infants with low scores require close monitoring and prompt intervention to prevent further complications.

The comparison of infant characteristics revealed that survivors had significantly higher birth weight, gestational age, and head circumference compared to non-survivors. These findings reaffirm that maturity at birth is a critical determinant of neonatal survival. Lower gestational age and birth weight are associated with underdeveloped organ systems, particularly the lungs and brain, increasing the risk of complications such as respiratory distress syndrome and intraventricular hemorrhage.[12]

In terms of disease and treatment-related factors, invasive respiratory support and surfactant therapy were associated with increased mortality. While this may appear counterintuitive, it likely reflects the severity of illness in these infants, as those requiring such interventions are typically more critically ill. Similar observations have been reported in previous studies, where advanced respiratory support serves as a marker of disease severity rather than a direct cause of mortality.[13]

Conversely, the use of postnatal steroids for bronchopulmonary dysplasia (BPD) and respiratory support at 36 weeks were associated with improved survival. These findings suggest that appropriate management of chronic lung disease and continued respiratory support in stable infants contribute positively to outcomes. The strong protective effect of respiratory support at 36 weeks may indicate better clinical stability among surviving infants.

Severe complications such as pulmonary hemorrhage, pneumothorax, high-grade intraventricular hemorrhage (IVH), and necrotizing enterocolitis (NEC) were significantly associated with increased mortality. Among these, IVH grade 3–4 showed a particularly strong association, highlighting its critical impact on neonatal survival. These complications are well-recognized contributors to mortality in VLBW infants and underscore the need for early detection and preventive strategies.[14]

Neonatal jaundice requiring phototherapy was found to have a protective association with survival. This may be explained by the fact that infants who survive long enough to develop jaundice are generally more stable compared to those who succumb early due to severe complications. Similarly, congenital anomalies were associated with significantly higher mortality, as expected, given their potential to compromise vital organ function.

Multivariate logistic regression analysis identified invasive ventilation, resuscitation at birth, and surfactant therapy as independent predictors of mortality, while antenatal care, cesarean delivery, neonatal jaundice requiring phototherapy, and respiratory support at 36 weeks were protective factors. These findings highlight the multifactorial nature of neonatal outcomes, where both clinical severity and quality of care play crucial roles.

Overall, this study emphasizes the importance of comprehensive perinatal and neonatal care in improving survival among VLBW infants. Strengthening antenatal services, ensuring timely administration of corticosteroids, improving delivery practices, and enhancing NICU care can significantly reduce mortality. Additionally, early identification and management of complications remain essential in optimizing short-term outcomes.

CONCLUSION

The present study highlights that the survival and short-term outcomes of very low birth weight (VLBW) infants are influenced by a combination of maternal, perinatal, and neonatal factors. The overall survival rate observed reflects ongoing challenges in managing this high-risk population, particularly in resource-limited settings.

Key determinants of improved survival included adequate antenatal care, administration of antenatal corticosteroids, cesarean delivery, and appropriate postnatal management such as respiratory support and phototherapy. In contrast, factors such as need for resuscitation at birth, invasive ventilation, and severe neonatal complications including intraventricular hemorrhage, necrotizing enterocolitis, pulmonary hemorrhage, and pneumothorax were strongly associated with increased mortality. The present study highlights that the survival and short-term outcomes of very low birth weight (VLBW) infants are influenced by a combination of maternal, perinatal, and neonatal factors. The overall survival rate observed reflects ongoing challenges in managing this high-risk population, particularly in resource-limited settings.

REFERENCES

1. World Health Organization. Preterm birth. Geneva: WHO; 2018.
2. Fanaroff AA, Martin RJ, Walsh MC. Neonatal-Perinatal Medicine: Diseases of the Fetus and Infant. 10th ed. Philadelphia: Elsevier; 2015.
3. Roberts D, Dalziel S. Antenatal corticosteroids for accelerating fetal lung maturation. Cochrane Database Syst Rev. 2006;(3):CD004454.
4. Lasswell SM, Barfield WD, Rochat RW, Blackmon L. Perinatal regionalization for very low-birth-weight and very preterm infants. JAMA. 2010;304(9):992–1000.
5. Stevenson DK, Verter J, Fanaroff AA, Oh W, Ehrenkranz RA, Shankaran S, et al. Sex differences in outcomes of very low birthweight infants. Pediatrics. 2000;106(4):710–6.
6. Stoll BJ, Hansen NI, Bell EF, Walsh MC, Carlo WA, Shankaran S, et al. Neonatal outcomes of extremely preterm infants. N Engl J Med. 2010;362(19):1801–11.
7. Peacock JL, Marston L, Marlow N, Calvert SA, Greenough A. Neonatal and infant outcome in boys and girls born very prematurely. Pediatr Res. 2012;71(3):305–10.
8. Kuhnt J, Vollmer S. Antenatal care services and its implications for vital and health outcomes of children: evidence from 193 surveys in 69 low-income and middle-income countries. BMJ Open. 2017;7(11):e017122.

9. McGoldrick E, Stewart F, Parker R, Dalziel SR. Antenatal corticosteroids for accelerating fetal lung maturation. Cochrane Database Syst Rev. 2020;12:CD004454.
10. Alfirevic Z, Milan SJ, Livio S. Caesarean section versus vaginal delivery for preterm birth. Cochrane Database Syst Rev. 2013;(9):CD000078.
11. Perlman JM, Wyllie J, Kattwinkel J, Atkins DL, Chameides L, Goldsmith JP, et al. Neonatal resuscitation guidelines. Circulation. 2015;132:S204–41.
12. Blencowe H, Cousens S, Oestergaard MZ, Chou D, Moller AB, Narwal R, et al. National, regional, and worldwide estimates of preterm birth. Lancet. 2012;379(9832):2162–72.
13. SUPPORT Study Group. Early CPAP versus surfactant in extremely preterm infants. N Engl J Med. 2010;362:1970–9.
14. Volpe JJ. Brain injury in premature infants: a complex amalgam of destructive and developmental disturbances. Lancet Neurol. 2009;8(1):110–24. World Health Organization. Preterm birth. Geneva: WHO; 2018.
15. Fanaroff AA, Martin RJ, Walsh MC. Neonatal-Perinatal Medicine: Diseases of the Fetus and Infant. 10th ed. Philadelphia: Elsevier; 2015.
16. Roberts D, Dalziel S. Antenatal corticosteroids for accelerating fetal lung maturation. Cochrane Database Syst Rev. 2006;(3):CD004454.
17. Lasswell SM, Barfield WD, Rochat RW, Blackmon L. Perinatal regionalization for very low-birth-weight and very preterm infants. JAMA. 2010;304(9):992–1000.
18. Stevenson DK, Verter J, Fanaroff AA, Oh W, Ehrenkranz RA, Shankaran S, et al. Sex differences in outcomes of very low birthweight infants. Pediatrics. 2000;106(4):710–6.
19. Stoll BJ, Hansen NI, Bell EF, Walsh MC, Carlo WA, Shankaran S, et al. Neonatal outcomes of extremely preterm infants. N Engl J Med. 2010;362(19):1801–11.
20. Peacock JL, Marston L, Marlow N, Calvert SA, Greenough A. Neonatal and infant outcome in boys and girls born very prematurely. Pediatr Res. 2012;71(3):305–10.
21. Kuhnt J, Vollmer S. Antenatal care services and its implications for vital and health outcomes of children: evidence from 193 surveys in 69 low-income and middle-income countries. BMJ Open. 2017;7(11):e017122.
22. McGoldrick E, Stewart F, Parker R, Dalziel SR. Antenatal corticosteroids for accelerating fetal lung maturation. Cochrane Database Syst Rev. 2020;12:CD004454.
23. Alfirevic Z, Milan SJ, Livio S. Caesarean section versus vaginal delivery for preterm birth. Cochrane Database Syst Rev. 2013;(9):CD000078.
24. Perlman JM, Wyllie J, Kattwinkel J, Atkins DL, Chameides L, Goldsmith JP, et al. Neonatal resuscitation guidelines. Circulation. 2015;132:S204–41.
25. Blencowe H, Cousens S, Oestergaard MZ, Chou D, Moller AB, Narwal R, et al. National, regional, and worldwide estimates of preterm birth. Lancet. 2012;379(9832):2162–72.
26. SUPPORT Study Group. Early CPAP versus surfactant in extremely preterm infants. N Engl J Med. 2010;362:1970–9.
27. Volpe JJ. Brain injury in premature infants: a complex amalgam of destructive and developmental disturbances. Lancet Neurol. 2009;8(1):110–24.