

Retrospective Analysis of Outcomes in Preterm Infants**Dharmendra Kumar¹, Prashant Kumar Ratnesh², Bipin Kumar Verma³**¹Senior Resident, Department of Paediatrics, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri²Senior Resident, Department of Paediatrics, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri³HOD, Department of Paediatrics, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri

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Abstract**Background:** Preterm birth, defined as delivery before 37 completed weeks of gestation, remains a major contributor to neonatal morbidity and mortality worldwide. Understanding clinical outcomes in preterm infants is essential for improving neonatal care strategies, particularly in resource-constrained settings.**Methods:** A retrospective observational study was conducted at Bhagwan Mahavir Institute of Medical Sciences, analyzing 100 preterm infants admitted to the Neonatal Intensive Care Unit (NICU) between January 2022 and December 2023. Data were collected from NICU records and hospital archives, focusing on gestational age, birth weight, mode of delivery, APGAR scores, complications, and outcomes.**Results:** The overall survival rate was 78%, with respiratory distress syndrome (RDS) and neonatal sepsis being the most common complications, affecting 62% and 28% of infants, respectively. Birth weight and gestational age were significantly associated with survival outcomes ($p < 0.01$). Infants with birth weight ≥ 1500 g had a 90% survival rate, while those under 1000g had only 40%. Low APGAR scores and the presence of multiple complications were linked to increased NICU stay and higher mortality.**Conclusion:** The study highlights the urgent need to enhance NICU infrastructure and antenatal care services to reduce preventable preterm mortality. Future longitudinal or multi-center studies are recommended to validate findings and support policy development aimed at improving neonatal outcomes in similar healthcare settings.**Keywords:** Bhagwan Mahavir Institute, Neonatal Mortality, Neonatal Outcomes, Preterm Infants, Retrospective Study.

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Introduction

Preterm birth, defined as a baby born before 37 weeks, continues to cause neonatal sickness and mortality worldwide. Under-5s die most from premature birth, which affects 15 million newborns worldwide [1]. The burden is especially significant in low- and middle-income countries due to poor neonatal care [2].

India has the highest rate of preterm births in the world, with 3.5 million babies delivered each year, according to the Ministry of Health and Family Welfare. Even while newborn intensive care has improved, survival rates vary widely, especially in low-resource countries [3]. Understanding preterm neonate clinical outcomes is essential for improving infant care, reducing long-term impairment, and informing healthcare policy. Preterm babies are more likely to experience RDS, NEC, IVH, hypoglycemia, sepsis, and long-term neurological impairments [4]. Due to these difficulties, neonatal intensive care units (NICUs) require long hospital stays, specialised treatment, and intensive monitoring. Birth weight, gestational age, prenatal

therapy, and neonatal care quality affect survival and morbidity. Looking back at preterm outcomes helps identify patterns, evaluate healthcare delivery, and create population-specific intervention programs [5]. Regional data on preterm baby outcomes are scarce at tertiary care centres outside India's main cities. Bhagwan Mahavir Institute of Medical Sciences, a top teaching hospital and referral facility, frequently delivers preterm. This patient subset's neonatal outcomes are poorly reported in institutional databases.

Understanding this group's issues, clinical trends, and resource needs is especially important given the region's socioeconomic and infrastructure variety. Considering these factors, this study examines the neonatal intensive care unit (NICU) results at Bhagwan Mahavir Institute of Medical Sciences for preterm neonates. The major objective is to evaluate survival rates, infant complication frequency, NICU stay, and risk variables. The study analyses 100 preterm neonates admitted within a certain time

range to improve hospital treatment and may influence regional newborn care plans.

Objective

- To evaluate the clinical outcomes, including survival rates, complications, and duration of NICU stay among preterm infants admitted to Bhagwan Mahavir Institute of Medical Sciences.
- To identify the frequency and pattern of common neonatal complications such as respiratory distress syndrome (RDS), sepsis, intraventricular hemorrhage (IVH), and necrotizing enterocolitis (NEC) in the preterm population.
- To analyze associations between perinatal factors (e.g., gestational age, birth weight, APGAR score, mode of delivery) and adverse outcomes in preterm infants.

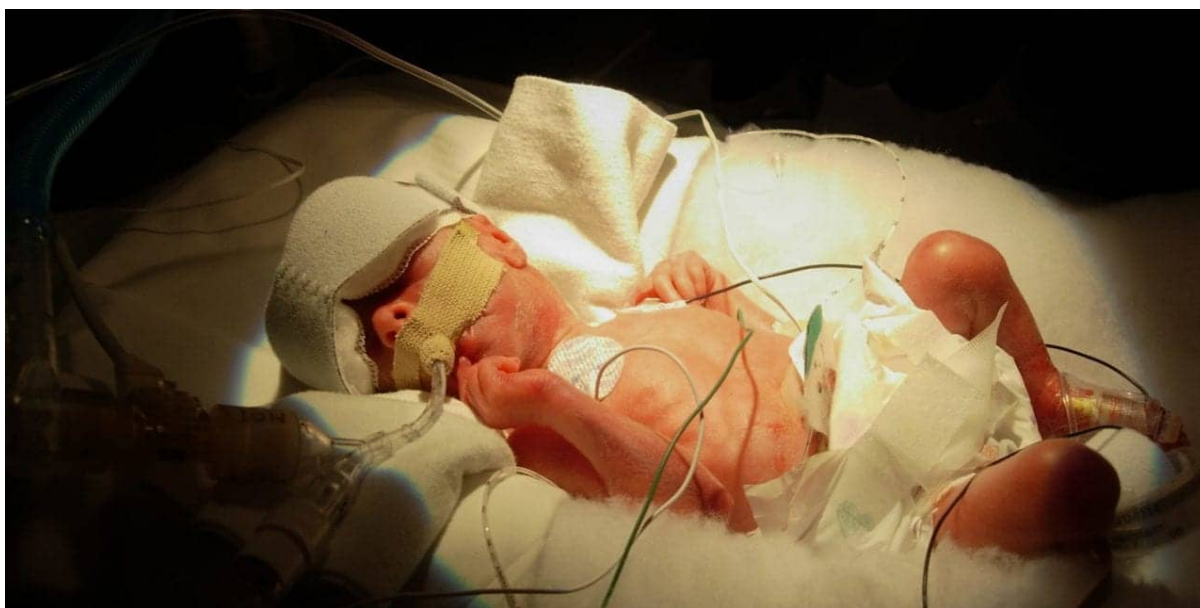


Figure 1: Preterm infant's (source:[6])

Geographic location, socioeconomic position, and maternal healthcare affect the global preterm birth rate, which ranges from 5% to 18% (March of Dimes Global Report on Birth Defects). Global inequities in prenatal care, delivery, and neonatal assistance burden low- and middle-income countries like India [7]. The estimated newborn mortality rate (NMR) in the country is 20 per thousand live births, with preterm births contributing to this number. Research in Indian tertiary care hospitals has shown that premature babies, especially those under 1500 grammes or under 32 weeks of gestation, are more likely to develop RDS, neonatal sepsis, NEC, and intraventricular haemorrhage. Multiple Indian studies have characterised premature newborn clinical outcomes to advise care techniques and resource allocation. [8] Examined morbidity and mortality in a North Indian tertiary care hospital and found that neonatal jaundice (42%), sepsis (29%), and RDS (58%) were the most common issues in 200 preterm infants. When adjusting for gestational age, babies weighing over 1500 grammes at birth had a far higher survival rate. A Madhya Pradesh study by [9] found that antenatal corticosteroid use and delivery technique affect survival rates, supporting maternal interventions. There is strong evidence that neonatal intensive care units (NICUs)

enhance outcomes for preterm babies worldwide. The US NICHD Neonatal Research Network publishes multicenter cohort data showing that infants born at or after 28 weeks of gestation with mechanical breathing, surfactant therapy, and kangaroo mother care have a survival rate exceeding 90%. [10] Found that NICU architecture and protocols improved survival and neurodevelopmental outcomes for 6,000 extremely preterm babies in high-income settings. Low-resource settings have poor results due to a lack of competent staff, limited access to advanced breathing aid and surfactant, and delayed neonatal illness identification. [10] Found that sub-Saharan African hospitals without Level III neonatal intensive care units have higher newborn mortality rates. Prenatal steroids, exclusive breastfeeding, and continuous positive airway pressure were recommended as scalable, low-cost, mortality-reducing therapy. Recent studies show that antenatal care is essential for preterm prevention and control. Antenatal corticosteroid medication, quick maternal infection screening, and thorough monitoring of high-risk pregnancies can reduce RDS and IVH. [11] Found in a meta-analysis that corticosteroids dramatically reduce RDS and newborn death in pregnant women. Due to poor prenatal follow-up

and insufficient funding, many public healthcare facilities in India underuse these potentially life-saving medicines. It is also known that APGAR scores affect neonatal outcomes. Low one- and five-minute APGAR scores are consistently linked to newborn mortality and neurodevelopmental impairment. [12] Found that APGAR scores below 5 were more than twofold higher than normal scores for early neonatal death in the US. This highlights the necessity of postnatal resuscitation and close monitoring in preterm deliveries.

The current study emphasises birth weight as a predictor of outcomes. The World Health Organisation defines VLBW as fewer than 1500 grammes and LBW as less than 2500 grammes. Multiple studies link low birth weight to mortality or significant issues. This is especially true without neonatal care specialists. Despite these cross-national findings, little is known about India's semi-urban and impoverished tertiary centres. Since most research comes from larger hospitals with stronger NICUs, secondary-level institutions' struggles are under-represented. The research base for regional infant health planning is extremely inadequate. It addresses that need by assessing preterm baby findings at Bhagwan Mahavir Institute of Medical Sciences, a regional tertiary care hospital that treats patients from all around the region. In the absence of institution-specific data, this research should illuminate the prevalence and trends of preterm issues in different settings and identify relevant modifiable risk variables. The findings can improve preterm newborn survival and long-term morbidity in clinical practice, new NICU policies, and community-based maternal health programs.

Materials and Methods

Study Design and Setting: This study was conducted as a retrospective observational analysis at the Department of Paediatrics, Bhagwan Mahavir Institute of Medical Sciences. The study aimed to evaluate the clinical outcomes of preterm infants admitted to the Neonatal Intensive Care Unit (NICU) over a defined period. Being a tertiary care teaching hospital, the institute provides specialized care for high-risk neonates, making it an ideal setting for such an analysis.

Study Period and Sample Size: A total of 100 preterm infants were included in the study. These infants were born and admitted to the NICU between January 2022 and December 2023. The sample was selected based on predefined eligibility criteria to ensure consistency and data completeness.

Inclusion Criteria

- Gestational age less than 37 completed weeks at birth.
- Admitted to the NICU during the study period.

- Complete medical records available for review.

Exclusion Criteria

- Presence of major congenital anomalies.
- Diagnosis of genetic syndromes.
- Incomplete data entries in medical records.

Data Collection Parameters: Hospital archives and NICU records were used to obtain patient data for this study using a standard form. The data included clinical and perinatal markers needed to assess neonatal outcomes. Gestational age, measured in weeks at birth, classified prematurity. The association between foetal growth and infant prognosis was examined using birth weight in grams. This information was rigorously documented to see if vaginal or caesarean birth affected newborn survival or complications. The newborn's health and first resuscitation attempts were assessed using APGAR ratings at 1 and 5 minutes after birth. A baby's NICU stay was also documented to determine how long it took them to recover. A complete record of newborn sequelae, including sepsis, IVH, NEC, and RDS, was established due to their prevalence in preterm populations. Finally, clinical outcomes at discharge were divided into four groups: complication-free survival, complication-related survival, referral to a higher centre, and death. Detailed data collection allowed solid analysis of preterm newborn outcomes.

Data Source: The study utilized secondary data collected from NICU patient logs, electronic medical records, and physical case files archived within the medical records department of Bhagwan Mahavir Institute of Medical Sciences. All data were de-identified to maintain patient confidentiality and ethical compliance.

Statistical Analysis: Data were compiled and analyzed using Microsoft Excel and SPSS software. Descriptive statistics, including mean, standard deviation (SD), frequencies, and percentages, were calculated for demographic and clinical variables.

Inferential statistical tests such as the Chi-square test and Student's t-test were applied where appropriate to determine associations between categorical and continuous variables, respectively. A p-value of less than 0.05 was considered statistically significant.

Results

Demographic Profile: A total of 100 preterm infants were included in this study. The mean gestational age was 32.4 ± 2.8 weeks, with the majority (58%) born between 32 and 34 weeks of gestation. The mean birth weight was 1.62 ± 0.42 kg, with 40% of the infants falling within the 1500–1999g range.

Among the neonates, 56% were male and 44% were female, yielding a male-to-female ratio of 1.27:1.

Table 1: Demographic Characteristics of Preterm Infants (n=100)

Parameter	Value
Mean Gestational Age	32.4 ± 2.8 weeks
GA Distribution	<28 wks: 12%, 28–31 wks: 30%, 32–34 wks: 58%
Mean Birth Weight	1.62 ± 0.42 kg
Birth Weight Distribution	<1000g: 10%, 1000–1499g: 35%, 1500–1999g: 40%, ≥2000g: 15%
Sex Ratio	Male: 56%, Female: 44%

Clinical Characteristics: The most common complication observed was RDS, affecting 62% of preterm neonates. Neonatal sepsis was reported in 28% of the infants, followed by IVH in 14% and NEC in 10%. Multiple complications were observed in 22% of the cases.

Table 2: Frequency of Neonatal Complications

Complication	Number of Cases	Percentage (%)
Respiratory Distress Syndrome (RDS)	62	62%
Neonatal Sepsis	28	28%
Intraventricular Hemorrhage (IVH)	14	14%
Necrotizing Enterocolitis (NEC)	10	10%
Multiple Complications	22	22%

Outcome Statistics: Out of the 100 infants, 78 survived and were discharged in stable condition, while 15 infants died during NICU stay. The remaining 7 infants were referred to higher centers due to complications requiring advanced care. The average NICU stay was 12.5 ± 4.3 days, with longer stays observed in infants with lower gestational age and birth weight.

Comparative Analyse: Survival varied significantly with birth weight. Infants weighing <1000g had a survival rate of only 40%, while those weighing ≥1500g had a survival rate of 90%. Similarly, infants delivered by cesarean section had slightly better outcomes (82% survival) compared to vaginal deliveries (74%). Low APGAR scores (<5 at 1 minute) were significantly associated with mortality ($p < 0.05$).

Table 3: Survival Rates by Birth Weight Categories

Birth Weight Category	Number of Infants	Survivors	Survival Rate (%)
<1000g	10	4	40%
1000–1499g	35	26	74%
1500–1999g	40	36	90%
≥2000g	15	12	80%

The analysis revealed that birth weight and gestational age were the strongest predictors of survival in preterm infants. Infants with birth weight ≥1500g had significantly better outcomes ($p < 0.01$).

The occurrence of RDS and neonatal sepsis was independently associated with increased NICU stay and higher mortality.

Furthermore, a low APGAR score at birth was statistically associated with poor outcomes ($p < 0.05$). Mode of delivery showed a trend toward better outcomes in cesarean sections, although the difference was not statistically significant.

Discussion

This retrospective study analysed the outcomes of 100 premature babies admitted to Bhagwan Mahavir Institute of Medical Sciences' NICU over two years.

The most common issues were RDS (62%) and neonatal sepsis (28%). The survival rate was 78%.

In national and international literature, the survival rate ranges from 70% to 90%, depending on gestational age, neonatal care, and birth weight. Our results are within the predicted range because the National Neonatology Forum (NNF) conducted multicentre research in India and showed that preterm babies in comparable conditions survived 76%.

According to evidence from established healthcare systems like the NICHD Neonatal Evidence Network in the US, babies over 1500 g born at 32 weeks have a >90% chance of survival. This is primarily due to better NICU and prenatal care in these nations.

Our data support the link between gestational maturity and higher birth weight survival rates.

Table 4: Comparison of Present Study with Existing Literature on Preterm Outcomes

Study	Study Type	Sample Size	Key Findings
Present Study (2025), Bhagwan Mahavir Institute of Medical Sciences	Retrospective observational	100	Survival rate 78%; most common complications were RDS (62%) and sepsis (28%); survival higher in infants ≥ 1500 g.
[13]	Retrospective hospital-based	200	RDS (58%) and neonatal jaundice (42%) were most common; survival rate improved with antenatal steroid use and birth weight >1500 g.
[14]	Observational cohort study	150	Mortality inversely related to gestational age and birth weight; cesarean delivery and antenatal care linked to better outcomes.
[15]	Multicenter prospective cohort	6,000+	Survival $>90\%$ in infants ≥ 28 weeks; improved outcomes due to advanced NICU care, surfactant therapy, and ventilation support.

Explaining Frequencies and Complication Rates:

RDS is common (62% in the study population) due to premature pulmonary development, especially in newborns born before 34 weeks. This matches global estimates of 50–70% RDS prevalence in these gestational age groups. Our cohort's 28% neonatal sepsis rate is consistent with resource-constrained settings, where asepsis issues, drug delays, and staff shortages may contribute to higher infection rates. The infant rate of NEC was 10%, which is consistent with Indian NICUs but higher than the 5-7% observed internationally. Different feeding practices, a delay in commencing enteral feeds, and insufficient breast milk supplementation may explain the difference. Our study indicated that 14% of newborns experienced IVH, with most occurring in children born fewer than 32 weeks of gestation, consistent with previously described links between extremely premature birth and brain vascular fragility.

Limitations of the Study: The study's retrospective design may have led to incomplete or missing data, and the fact that we did not account for maternal health history and prenatal steroid use. Second, as a single-center experiment, the results may not apply to a larger community with different demographics and healthcare penetration.

Third, 100 newborns are enough for preliminary analysis but not for subgroup analyses, which are useful for evaluating rare disorders or differentiating outcomes based on many variables lack of follow-up over time is another issue. Survival and discharge status were recorded, but long-term problems, such as neurodevelopmental delays or respiratory sequelae, were not. Prospective cohort studies with frequent development evaluations are unsuitable for our current system of treatment.

Strengths of the Study: This study is noteworthy despite its limitations as Bhagwan Mahavir Institute of Medical Sciences' first thorough institutional research of preterm newborn outcomes. Organised

data collection and integration of many clinical factors show prematurity's complete impact, pattern, and results. Regional policy steps, including prenatal care protocol modifications, NICU infrastructure financing, and staff training, can follow results. The project also creates a fundamental dataset for hospital audits, quality improvement, and comparative research. This enables multicentric cooperation to pool data from equivalent institutions in tier-2 or tier-3 cities for greater epidemiological insights.

Conclusion

This retrospective research of 100 preterm newborns at Bhagwan Mahavir Institute of Medical Sciences reported a 78% survival rate, with neonatal sepsis and respiratory distress syndrome being the most common sequelae. Neonatal survival was best for infants over 1500 g, with gestational age and birth weight being the most important indicators. Results show that neonatal intensive care units need to improve respiratory support, infection control, and trained neonatal care. Poor prenatal care, such as low corticosteroid absorption and irregular monitoring, was linked to unfavourable outcomes, emphasising the need to improve maternal health services and community knowledge. Integrated perinatal care is essential for long-term health and preterm baby survival. The study also emphasises the need for monitoring preterm children's development after discharge to detect and address long-term health issues early. Since this retrospective, single-center study has limitations, future research should adopt a longitudinal, multi-center design to corroborate these findings and build stronger, data-driven therapy policies. In resource-limited settings, institutional processes should stress evidence-based prenatal therapies, infant resuscitation, and infection control to improve preterm care.

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