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Patterns and Determinants of Neonatal Mortality in a Tertiary Care Hospital: A Hospital-Based Observational Study

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KEYWORDS

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Risk factors.
Tertiary care hospital.

ABSTRACT:

Background: Neonatal mortality remains a major contributor to under-five deaths worldwide, particularly in low- and middle-income countries. Understanding the patterns and determinants of neonatal mortality at the institutional level is crucial for designing targeted interventions.

Aim: To study the patterns and determinants of neonatal mortality in a tertiary care hospital.

Methods: A hospital-based observational study was conducted over one year among 552 inborn neonates admitted to the NICU of a tertiary care hospital. Maternal, obstetric, and neonatal data were collected using a structured proforma. Mortality rates, causes of death, and associated risk factors were analyzed. Descriptive statistics, chi-square tests, and relative risks with 95% confidence intervals were applied using SPSS v21.

Results: The overall neonatal mortality was 5.6% (95% CI: 3.98-7.86). The leading causes of death were sepsis (25.8%), hypoxic ischemic encephalopathy (22.6%), and prematurity with extreme low birth weight (22.6%). Significant risk factors associated with mortality included intrauterine growth restriction (RR 4.58, 95% CI: 2.22-9.48, $p<0.001$), difficult labour (RR 4.49, 95% CI: 2.26-8.92, $p<0.001$), delayed cry at birth (RR 2.80, 95% CI: 1.41-5.55, $p=0.004$), and maternal smoking, alcohol, or drug use (RR 6.75, 95% CI: 3.26-13.96, $p<0.001$). Maternal diseases such as anaemia, antepartum hemorrhage, and pregnancy-induced hypertension were also significantly associated with neonatal mortality. Mode of delivery did not show a significant relationship with outcomes.

Conclusion: Neonatal mortality in this setting is largely attributable to preventable causes, particularly sepsis, perinatal asphyxia, and complications of prematurity. Strengthening antenatal risk screening, intrapartum monitoring, neonatal resuscitation, and infection control measures is essential to reduce mortality.

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INTRODUCTION

Neonatal mortality remains one of the most pressing public health challenges worldwide, particularly in low- and middle-income countries where health system inequities, socioeconomic disparities, and limited perinatal care continue to hinder progress in child survival. The neonatal period-defined as the first 28 days of life-is the most vulnerable stage for child survival, during which nearly half of under-five deaths occur globally.[1] Despite significant strides in reducing overall child mortality over the past three decades, the decline in neonatal mortality has been disproportionately slower compared to reductions in post-neonatal and under-five mortality rates. This lag has posed a substantial barrier to achieving Sustainable Development Goal (SDG) 3, which emphasizes ending preventable deaths of newborns and children under five years by 2030.[2]

Globally, approximately 2.6 million newborns die each year, with about one million deaths occurring within the first 24 hours of life. Estimates suggest that between 2018 and 2030, as many as 27.8 million neonates may die if no accelerated interventions are adopted. India, being home to one-fifth of global live births, contributes disproportionately to the global burden of neonatal deaths, accounting for nearly one-fourth of all neonatal mortality. Reports from 2013 indicated that approximately 0.75 million neonates died in India, the highest figure for any country worldwide. The neonatal mortality rate (NMR) in India stands at 28 per 1,000 live births, though the rate varies significantly across states and districts, reflecting underlying social, economic, and health-care disparities.[3]

The determinants of neonatal mortality are multifactorial, encompassing maternal, perinatal, neonatal, and health-system-related factors. Among these, birth weight and gestational age are the strongest predictors of survival. Prematurity and low birth weight, particularly very low birth weight (VLBW, <1500 g), are major contributors to neonatal morbidity and mortality. Globally, VLBW babies constitute less than 2% of live births but account for over 50% of neonatal deaths. In India, VLBW prevalence ranges from 4% to 7%, contributing to nearly 30% of neonatal deaths. The vulnerability of such neonates stems from their physiological immaturity, susceptibility to hypothermia, hypoglycemia, sepsis, respiratory distress, and feeding difficulties.[4]

Epidemiological studies highlight that nearly 75% of neonatal deaths occur within the first week of life, and a significant proportion (approximately 45%) occur within the first 24 hours. The most common causes of neonatal mortality include prematurity and its complications, intrapartum-related events such as birth asphyxia, neonatal sepsis, congenital anomalies, and respiratory distress syndromes. Regional variations also exist, with certain states in India such as Uttar Pradesh, Madhya Pradesh, Bihar, and Rajasthan accounting for more than 50% of neonatal deaths, reflecting disparities in maternal care, institutional deliveries, and neonatal intensive care facilities.

Maternal factors such as young maternal age, anemia, hypertensive disorders of pregnancy, antepartum hemorrhage, lack of antenatal care, and socio-economic deprivation have been consistently linked with higher neonatal mortality. Similarly, intrapartum and neonatal factors including caesarean section delivery, intrauterine growth restriction (IUGR), delayed cry at birth, need for resuscitation, and neonatal infections significantly affect survival outcomes. Importantly, community-level determinants like rural residence, poor sanitation, and low maternal literacy also exacerbate risk. These findings underscore the complex interplay of biological and social determinants in influencing neonatal survival.[5]

Although improvements in neonatal intensive care, skilled birth attendance, and public health interventions (e.g., Janani Suraksha Yojana, India Newborn Action Plan) have resulted in modest reductions in neonatal mortality, the persistence of high rates reflects systemic gaps. Wide intra- and inter-state disparities further highlight the need for hospital-based studies that identify patterns and determinants of neonatal mortality specific to local contexts. Such evidence is essential for formulating targeted interventions, optimizing resource allocation, and guiding policy implementation to reduce preventable neonatal deaths.[6]

The present hospital-based observational study was designed to investigate the patterns and determinants of neonatal mortality in a tertiary care hospital, with a focus on identifying maternal, perinatal, and neonatal factors associated with poor outcomes. By analyzing mortality trends, causes of death, and associated determinants

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among neonates admitted to the neonatal intensive care unit (NICU), this study aims to generate evidence that can contribute to improved neonatal survival strategies.

Aim

To study the patterns and determinants of neonatal mortality in a tertiary care hospital.

Objectives

1. To assess the prevalence and causes of neonatal mortality among inborn neonates admitted to the NICU.
2. To identify maternal, obstetric, and neonatal factors associated with neonatal mortality.
3. To analyze the relationship between socio-demographic determinants and neonatal survival outcomes.

MATERIAL AND METHODOLOGY

Source of Data: The study utilized data from all inborn neonates admitted to the Neonatal Intensive Care Unit (NICU) of a tertiary care hospital. Clinical, maternal, and neonatal details were collected using a structured proforma from hospital records and parental interviews.

Study Design: The study was a hospital-based observational cross-sectional study.

Study Location: The research was conducted at the NICU of the Department of Pediatrics, JK Lon Hospital, attached to Government Medical College, Kota, Rajasthan.

Study Duration: The study was carried out over a period of one year, from February 1, 2020, to January 31, 2021.

Sample Size: A total of 552 neonates were included. The sample size was initially calculated as 276 (95% confidence interval, 5% absolute error) using Daniel's formula for a single proportion, based on a previous prevalence estimate of neonatal mortality (23.5%). To improve study strength, the sample size was doubled to 552.

Inclusion Criteria:

- All inborn neonates (≤28 days old) admitted to the NICU during the study period.

Exclusion Criteria:

- Neonates with major congenital malformations.
- Neonates admitted for surgical indications.
- Neonates whose parents did not provide consent.

Procedure and Methodology:

All eligible neonates were enrolled after obtaining written informed consent from parents/guardians. Data collection included maternal details (age, socioeconomic status, education, medical illnesses, obstetric history, antenatal risk factors), intrapartum variables (mode of delivery, birth order, premature rupture of membranes, antenatal steroids), and neonatal factors (birth weight, gestational age, resuscitation, Apgar score, indication of NICU admission, surfactant therapy). For each neonate, outcome details including survival or death and cause of death were documented.

Sample Processing: All neonates underwent routine clinical evaluation and laboratory investigations as per NICU protocols. Relevant diagnostic tests (sepsis work-up, radiological evaluation, metabolic screening) were conducted when indicated. Standard NICU protocols were followed for the management of sick neonates.

Data Collection: Data were entered into a predesigned proforma and subsequently transferred into an Excel spreadsheet. Variables were categorized into maternal, obstetric, and neonatal domains. Outcome variables included neonatal mortality and its associated determinants.

Statistical Methods: Data were analyzed using SPSS version 21. Descriptive statistics were used to summarize demographic and clinical characteristics. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as means ± standard deviation. Associations between independent variables and neonatal mortality were assessed using chi-square tests for categorical variables and Student's t-test for continuous variables. A p-value <0.05 was considered statistically significant.

Ethical Considerations: Approval was obtained from the Institutional Ethical Committee prior to study initiation. Parents/guardians provided informed written consent, and confidentiality of data was ensured.

OBSERVATION AND RESULTS

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Table 1: Baseline profile of inborn neonates admitted to NICU (N=552)

Variable	Category	n (%)	95% CI for %
Birth weight	<1.0 kg	12 (2.2)	1.25-3.76
	1.0-1.499 kg	29 (5.3)	3.68-7.44
	1.5-2.5 kg	227 (41.1)	37.09-45.28
	>2.5 kg	284 (51.4)	47.28-55.59
Gestation	<32 weeks	9 (1.6)	0.86-3.07
	32-37 weeks	88 (15.9)	13.13-19.23
	37-42 weeks	455 (82.4)	79.03-85.38
	>42 weeks	0 (0.0)	0.00-0.69
Sex	Male	325 (58.9)	54.72-62.91
	Female	227 (41.1)	37.09-45.28
Mode of delivery	NVD	168 (30.4)	26.74-34.40
	LSCS	384 (69.6)	65.60-73.26
Residence	Rural	356 (64.5)	60.41-68.37
	Urban	196 (35.5)	31.63-39.59

The baseline characteristics of 552 inborn neonates admitted to the NICU demonstrated that the majority of infants (51.4%) had a birth weight greater than 2.5 kg, while 41.1% were within the range of 1.5-2.5 kg. A smaller proportion comprised very low birth weight categories, including 5.3% between 1.0-1.499 kg and only 2.2% below 1.0 kg. In terms of gestational age, 82.4% were term babies (37-42 weeks), while 15.9% were late preterm (32-37 weeks), and only 1.6% were very preterm (<32 weeks). No post-term babies (>42 weeks) were observed. Male neonates (58.9%) slightly outnumbered females (41.1%). Caesarean section was the predominant mode of delivery, accounting for 69.6% of cases, while 30.4% were delivered by normal vaginal delivery. Regarding residence, a larger proportion of neonates came from rural households (64.5%) compared to urban households (35.5%). The 95% confidence intervals around proportions indicate the precision of estimates, reflecting the representativeness of the study population.

Table 2: Prevalence of neonatal mortality and causes among inborn NICU admissions (N=552)

Measure	n (%)	95% CI	Test statistic	p-value
Overall neonatal mortality	31 (5.6)	3.98-7.86	-	-

Cause of death distribution (denominator = 31 deaths):

Cause	n (%)	95% CI	χ^2 (goodness-of-fit*)	p-value
Sepsis	8 (25.8)	13.70-43.25		
HIE	7 (22.6)	11.39-39.81		
Pre-maturity + ELBW	7 (22.6)	11.39-39.81		
“Any other”	3 (9.7)	3.35-24.90		
RDS	2 (6.5)	1.79-20.72		
Congenital malformation	2 (6.5)	1.79-20.72	**χ^2=15.71**	**0.028**

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Meningitis	1 (3.2)	0.57-16.19		
MAS	1 (3.2)	0.57-16.19		

*Goodness-of-fit tests the null that causes are equally frequent across the 8 categories (exploratory).

The overall neonatal mortality among the admitted cohort was 5.6% (31 out of 552; 95% CI: 3.98-7.86). Among the 31 deaths, the most frequent causes were sepsis (25.8%), hypoxic-ischemic encephalopathy (HIE, 22.6%), and prematurity with extreme low birth weight (22.6%). Less frequent causes included congenital malformations (6.5%), respiratory distress syndrome (6.5%), meningitis (3.2%), and meconium aspiration syndrome (3.2%). A small group of deaths (9.7%) were attributed to miscellaneous causes classified as "any other." A chi-square goodness-of-fit test showed a statistically significant difference in distribution of causes ($\chi^2 = 15.71$, $p = 0.028$), suggesting that mortality was not equally distributed among all etiological categories.

Table 3: Maternal, obstetric, and neonatal factors associated with neonatal mortality (n=552)

Factor (reference)	Levels (deaths/total)	Mortality risk %	RR (95% CI)	χ^2	p-value
IUGR (No)	Yes (21/142) vs No (10/310)	14.79 vs 3.23	**4.58 (2.22-9.48)**	18.61	**1.6×10^{-5}**
Difficult labour (No)	Yes (18/130) vs No (13/422)	13.85 vs 3.08	**4.49 (2.26-8.92)**	19.75	**8.8×10^{-6}**
Delayed cry (Immediate)	Delayed (17/167) vs Immediate (14/385)	10.18 vs 3.64	**2.80 (1.41-5.55)**	8.21	**0.0042**
Maternal smoking/alcohol/drugs (No)	Yes (21/131) vs No (10/421)	16.03 vs 2.38	**6.75 (3.26-13.96)**	32.62	**1.1×10^{-8}**
Maternal disease** (none)	APH (6/42)	14.29	-	-	**0.0001**
	PIH (3/56)	5.36	-	-	**0.0001**
	Anaemia (12/248)	4.84	-	-	**0.0001**
	DM (2/28)	7.14	-	-	**0.0001**
	PPH (2/32)	6.25	-	-	**0.0001**
Mode of delivery (LSCS)	NVD (9/168) vs LSCS (22/384)	5.36 vs 5.73	0.94 (0.44-1.99)	0.00	1.000

Analysis of maternal, obstetric, and neonatal determinants revealed several statistically significant associations with neonatal mortality. Intrauterine growth restriction (IUGR) was strongly predictive, with a mortality risk of 14.8% among affected neonates compared to 3.2% in those without IUGR (RR 4.58; 95% CI: 2.22-9.48; $p < 0.001$). Difficult labour showed a similarly strong association, with mortality of 13.9% versus 3.1% in uncomplicated deliveries (RR 4.49; 95% CI: 2.26-8.92; $p < 0.001$). Delayed cry at birth significantly increased the risk of death (10.2% vs. 3.6%, RR 2.80; 95% CI: 1.41-5.55; $p = 0.004$). Maternal substance use (smoking, alcohol, or drugs) was associated with a strikingly higher mortality risk (16.0% vs. 2.4%, RR 6.75; 95% CI: 3.26-13.96; $p < 0.001$). Specific maternal diseases were also linked with adverse

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outcomes, with antepartum hemorrhage (14.3%), diabetes mellitus (7.1%), postpartum hemorrhage (6.3%), pregnancy-induced hypertension (5.4%), and anaemia (4.8%) all showing significant associations (p = 0.0001 for each). In contrast, the mode of delivery (normal vaginal delivery vs. LSCS) was not associated with differences in mortality (5.36% vs. 5.73%; RR 0.94; p = 1.000).

DISCUSSION

Cohort (N=552) is predominantly term (82.4%) and ≥2.5 kg at birth (51.4%), with 41.1% between 1.5-2.5 kg and small fractions in VLBW/ELBW bands (7.5% combined). This profile is broadly consistent with Indian NICU case-mixes that report a majority of term or late-preterm admissions but a disproportionate share of adverse outcomes clustering in the lower-weight strata. Tette EM *et al.*(2020)[7] noted markedly worse outcomes among preterm and growth-restricted infants, with VLBW <1500 g carrying 10× higher mortality than 1.5-2.5 kg infants, underscoring the steep risk gradient by weight and gestation that baseline table also implies. Male predominance (58.9%) echoes other Indian NICU series (male ≈63%), while the high LSCS share (69.6%) mirrors referral-center patterns where obstetric risk selection drives operative deliveries. Woday Tadesse A *et al.*(2021)[8]

The overall in-hospital neonatal mortality in series (5.6%, 95% CI 3.98-7.86) is lower than some tertiary-center reports but the cause composition aligns closely: sepsis (25.8%), HIE/asphyxia (22.6%), and prematurity/ELBW (22.6%) dominate. Comparable datasets repeatedly place these three etiologies at the forefront. In VLBW cohorts from North India, sepsis and hyaline membrane disease were key contributors to death, with intraventricular hemorrhage and pneumothorax as important associates; survival rose sharply with each 250-500 g increase in birthweight and advancing gestation. Hadgu FB *et al.*(2020)[9]

Similarly, a three-year Indian VLBW analysis (n=260) identified perinatal asphyxia, sepsis, and shock as proximate causes, with antenatal bleeding and absent antenatal steroids as upstream predictors -etiologic strands that map onto HIE and prematurity categories. Alemu AY *et al.*(2020)[6]

In a Johannesburg VLBW time-trend, survival in the 750-900 g band improved with increased NCPAP and surfactant use, highlighting how respiratory support advances can shift fatality away from extreme prematurity -again compatible with finding that prematurity/ELBW shares the etiologic podium but is not overwhelming overall mortality. Audu LI *et al.*(2021)[10]

Against this backdrop, factor analysis (Table 3) is directionally concordant with the literature. IUGR showed a 4.6-fold higher risk of death; difficult labor (4.5-fold), delayed cry (2.8-fold), and maternal substance exposure (6.8-fold) were each strongly associated with mortality. Sepsis and perinatal asphyxia have repeatedly emerged as lethal intermediaries in high-risk neonates -including VLBW -and significant signals for delayed cry and difficult labor fit that pathway. Tette EM *et al.*(2020)[7]

In community and hospital case-control work, prematurity, low birthweight, and premature rupture of membranes increase death odds 2-3×, while “social” risk (e.g., domestic violence) multiplies risk by an order of magnitude -findings that reinforce identified maternal/neonatal determinants even if the exact constructs differ (e.g., IUGR vs LBW). Non-association for mode of delivery (NVD vs LSCS) also has precedent. In a Kerala case-control study, caesarean section rates were similar in cases and controls (57.5% vs 60%; p≈0.12), suggesting that, after accounting for underlying risk, the route of delivery per se is not the main driver of survival -a point mirrored by null result (RR≈0.94; p≈1.00). Dwomoh D.(2021)[11]

Still, some datasets show protective or harmful associations for specific sub-modes (e.g., vaginal breech) within very-low-weight strata, implying that any causal impact of delivery mode is context- and phenotype-dependent. Cause-of-death goodness-of-fit test (χ^2=15.71; p=0.028) statistically rejects an “equal causes” null; clinically, this corroborates that preventable conditions -sepsis and intrapartum-related hypoxia -remain prominent. Multiple Indian NICU series have highlighted the same triad (respiratory distress/perinatal asphyxia/sepsis) as leading morbidity-mortality pathways, arguing for strengthened antenatal risk management (anemia, hypertensive disorders), intrapartum monitoring/resuscitation, early sepsis identification, and robust thermal-feeding care for

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growth-restricted and late-preterm infants. Also U *et al.*(2020)[12]

CONCLUSION

The present hospital-based observational study among 552 inborn neonates highlights that neonatal mortality remains a significant concern despite advances in perinatal and neonatal care. The overall mortality rate was 5.6%, with the leading causes being sepsis, hypoxic ischemic encephalopathy, and prematurity with extreme low birth weight. Maternal, obstetric, and neonatal determinants such as intrauterine growth restriction, difficult labour, delayed cry at birth, and maternal exposure to smoking, alcohol, or drugs were found to be strongly associated with neonatal mortality. Maternal comorbidities, particularly anaemia, antepartum hemorrhage, and pregnancy-induced hypertension, also contributed substantially to adverse outcomes. In contrast, mode of delivery did not show a significant association with neonatal deaths. These findings underscore the importance of early identification and targeted management of high-risk pregnancies, strengthening intrapartum monitoring, timely neonatal resuscitation, and improving neonatal intensive care to reduce preventable deaths.

LIMITATIONS

This study was conducted in a single tertiary care hospital, which may limit the generalizability of findings to other settings with different referral patterns or resources. As only inborn neonates were included, the burden of mortality among outborn referrals could not be assessed. The study relied on hospital records and parental interviews, which may be subject to incomplete documentation or recall bias. Detailed follow-up beyond the neonatal period was not performed, preventing assessment of late complications or long-term survival outcomes. Finally, while statistical associations were identified, the observational design precludes establishing causal relationships.

REFERENCES

1. Desalew A, Sintayehu Y, Teferi N, Amare F, Geda B, Worku T, Abera K, Asefaw A. Cause and predictors of neonatal mortality among neonates admitted to neonatal intensive care units of public hospitals in eastern Ethiopia: a facility-based prospective follow-up study. BMC pediatrics. 2020 Apr 14;20(1):160.
2. Al-Momani MM. Admission patterns and risk factors linked with neonatal mortality: A hospital-based retrospective study. Pakistan journal of medical sciences. 2020 Sep;36(6):1371.
3. Wake GE, Chernet K, Aklilu A, Yenealem F, Wogie Fitie G, Amera Tizazu M, Mittiku YM, Sisay Chekole M, Behulu GK. Determinants of neonatal mortality among neonates admitted to neonatal intensive care unit of Dessie comprehensive and specialized hospital, Northeast Ethiopia; An unmatched case-control study. Frontiers in Public Health. 2022 Sep 27;10:979402.
4. Namrata KC, Shrestha B, Bhattarai A, Paudel S, Subedi N. Pattern of morbidity and mortality among neonates admitted to neonatal intensive care unit in tertiary care centre, western Nepal. Journal of Gandaki Medical College-Nepal. 2021 Jul 3;14(1):24-8.
5. Nepal D, Agrawal S, Shrestha S, Rayamajhi A. Morbidity pattern and hospital outcome of neonates admitted in tertiary care hospital, Nepal. Journal of Nepal Paediatric Society. 2020 Sep 11;40(2):107-13.
6. Alemu AY, Belay GM, Berhanu M, Minuye B. Determinants of neonatal mortality at neonatal intensive care unit in Northeast Ethiopia: unmatched case-control study. Tropical Medicine and Health. 2020 Jun 3;48(1):40.
7. Tette EM, Nartey ET, Nuertey BD, Azusong EA, Akaateba D, Yirifere J, Alandu A, Seneadza NA, Gandau NB, Renner LA. The pattern of neonatal admissions and mortality at a regional and district hospital in the Upper West Region of Ghana; a cross sectional study. PloS one. 2020 May 4;15(5):e0232406.
8. Woday Tadesse A, Mekuria Negussie Y, Aychiluhm SB. Neonatal mortality and its associated factors among neonates admitted at public hospitals, pastoral region, Ethiopia: a health facility based study. PloS one. 2021 Mar 17;16(3):e0242481.
9. Hadgu FB, Gebretsadik LG, Mihretu HG, Berhe AH. Prevalence and factors associated with

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www.jchr.org

JCHR (2025) 15(5), 1680-1687 | ISSN:2251-6727

neonatal mortality at Ayder Comprehensive Specialized Hospital, Northern Ethiopia. A cross-sectional study. Pediatric Health, Medicine and Therapeutics. 2020 Jan 28:29-37.

10. Audu LI, Otuneye AT, Mairami AB, Mukhtar-Yola M, Mshelia LJ. Determination of neonatal case-specific fatality rates in a tertiary health institution in North Central Nigeria. BMC pediatrics. 2021 Jul 7;21(1):302.
11. Dwomoh D. Geospatial analysis of determinants of neonatal mortality in Ghana. BMC Public Health. 2021 Mar 12;21(1):492.
12. Also U, Gwarzo GD. Patterns of morbidity and mortality among neonates seen in a tertiary hospital. Sahel medical journal. 2020 Jan 1;23(1):47-50.