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ORIGINAL ARTICLE

Mortality Pattern Among Neonates Admitted in A Tertiary Care Hospital in Bangladesh

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Abstract

Background*: Neonatal mortality remains a significant public health challenge, particularly in low- and middle-income countries like Bangladesh.*

Objective: *This study aimed to analyze the patterns, predictors, and causes of neonatal mortality in a tertiary care hospital to inform targeted interventions.*

Methods*: A retrospective cohort study was conducted at the Bangladesh Shishu Hospital & Institute, analyzing data from neonates admitted between August 1, 2022, and January 31, 2023. Key variables such as demographic details, time of death, duration of hospital stay, mode of delivery, and cause of death were examined using descriptive statistics.*

Results*: Of the 1,418 neonates admitted during the study period, 91 (6.42%) experienced mortality. A slightly higher proportion of deaths occurred among male neonates (52.75%) compared to females (47.25%). The highest incidence of mortality was observed during nighttime hours (42.86%), and nearly half of the deaths (48.35%) occurred within the first 24 hours of admission. More than half of the neonates who died were delivered via cesarean section (53.85%), and the majority were born in hospitals (75.82%). The leading causes of death were preterm low birth weight and its complications (28.57%), neonatal sepsis (26.37%), and birth asphyxia (24.18%).*

Conclusion*: The study identified preterm low birth weight, sepsis, and birth asphyxia as the primary causes of neonatal mortality, with a high rate of early mortality and a higher prevalence of nighttime deaths. These findings suggest the need for improved perinatal care, better infection control, and enhanced monitoring, especially during critical periods.*

Keywords*: Neonatal Mortality, Preterm Birth, Low Birth Weight, Neonatal Sepsis, Birth Asphyxia, Cesarean Delivery, Early Neonatal Death.*

Introduction

Neonatal mortality, defined as the death of a newborn within the first 28 days of life, remains a critical global health issue and accounts for a significant proportion of child mortality worldwide. Although global child mortality rates have declined over the past few decades, the proportion of neonatal deaths within this age group has increased, now representing approximately 47% of all under-five deaths. Each year, about 2.4 million neonatal deaths occur globally, with the majority concentrated in low- and middle-income countries (LMICs), particularly

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in South Asia and sub-Saharan Africa. Reducing neonatal mortality is a critical aspect of achieving Sustainable Development Goal 3 (SDG 3), which aims to end preventable deaths of newborns and children under five by 2030, targeting a neonatal mortality rate of no more than 12 deaths per 1,000 live births globally.[1,2] Neonatal mortality is disproportionately high in LMICs compared to high-income countries (HICs), where improved healthcare infrastructure, availability of specialized neonatal care, and robust public health systems have contributed to lower mortality rates. Recent data indicate that neonatal mortality rates are 20-50 times higher in some LMICs compared to HICs, emphasizing the urgent need for targeted interventions in these regions. For example, preterm birth, low birth weight, and birth complications are managed more effectively in settings with advanced neonatal intensive care units (NICUs) and adequate healthcare resources.[3] In contrast, many LMICs, including Bangladesh, face challenges such as limited access to quality maternal and neonatal care, socio-economic disparities, and infrastructural inadequacies that hinder significant progress in reducing neonatal mortality.[4] Bangladesh has made remarkable strides in reducing child mortality over the last few decades; however, neonatal mortality continues to be a major public health concern. Despite a decline in the overall child mortality rate, the neonatal mortality rate in Bangladesh remains at 22 per 1,000 live births, which is still higher than the target set by SDG 3.[5] Regional disparities and socio-economic inequities further complicate the landscape of neonatal care in the country, with rural and underprivileged areas reporting higher neonatal mortality rates than urban centers. Improvements in healthcare access, maternal health services, and early neonatal interventions have contributed to some progress, but several challenges persist, including high rates of preterm births, limited access to emergency obstetric care, and socio-cultural barriers that impede the use of healthcare services.[6] Tertiary care hospitals play a pivotal role in managing high-risk neonates, especially those born prematurely or with congenital abnormalities and other complications. Such facilities are equipped to handle complex cases that require intensive care, and the presence of specialized NICUs significantly enhances the chances of survival for preterm and low birth weight infants. Studies have shown that neonatal outcomes improve substantially when high-risk deliveries occur in tertiary care hospitals as opposed to lower-level facilities, due to the availability of skilled healthcare professionals, advanced medical equipment, and critical care support.[7,8] In Bangladesh, where the healthcare system is under-resourced, tertiary care hospitals often serve as referral centers for complicated cases from across the country. Analyzing the factors that contribute to neonatal survival within these settings can provide valuable insights for improving neonatal care and policy development.[9] Previous research has identified several predictors of neonatal mortality, underscoring the multifactorial nature of this issue. Key predictors include birth weight, gestational age, maternal health, socio-economic factors, and quality of healthcare services. Low birth weight and prematurity are among the strongest predictors of neonatal mortality globally. Infants born with low birth weight, defined as less than 2,500 grams, are at a significantly higher risk of complications such as infections, respiratory distress, and developmental delays, which can lead to higher mortality rates.[10] Studies have shown that neonates born at less than 32 weeks gestation have particularly high mortality risks, often due to complications like respiratory distress syndrome and sepsis.[11] Additionally, maternal health conditions such as pre-eclampsia, diabetes, and infections during pregnancy have been associated with adverse neonatal outcomes.[12] Socio-economic factors, including maternal education level, household income, and access to prenatal care, also play a critical role. For instance, neonates born to mothers with limited antenatal care or lower socio-economic status have been found to have higher mortality rates, highlighting the importance of targeted interventions that address these disparities.[13,14] The situation is no different in Bangladesh, where studies have highlighted the significant role of maternal health, socio-economic factors, and healthcare access in determining neonatal outcomes. A study conducted in Chittagong, Bangladesh, identified maternal malnutrition, inadequate antenatal care, and low socio-economic status as key contributors to low birth weight, which is a critical risk factor for neonatal mortality.[15] Furthermore, research from Sylhet, a rural region in Bangladesh, reported that factors such as maternal

age, parity, and the presence of complications during pregnancy, including preterm labor and infections, significantly increased the risk of neonatal mortality.[16] In rural and peri-urban settings, lack of timely access to skilled birth attendants and emergency obstetric services has been linked to higher mortality rates, reinforcing the need for strengthened healthcare systems that can effectively manage high-risk pregnancies.[17] Despite these challenges, progress is being made, and there are promising strategies that can help reduce neonatal mortality in Bangladesh and similar LMIC settings. The implementation of community-based healthcare programs, improved access to antenatal care, and education for mothers about neonatal health are some of the initiatives that have shown success in various regions.[18] However, there is still a need for further research to understand context-specific factors that affect neonatal mortality in tertiary care hospitals. This study aims to identify the predictors of neonatal mortality in a neonatal unit of a tertiary care hospital in Bangladesh. By analyzing existing data, the study will provide insights that can inform targeted interventions, improve neonatal care practices, and ultimately reduce neonatal mortality rates in similar settings.

Materials and Methods

This retrospective cohort study was conducted in the Department of Neonatology at Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh from August 1, 2022 to January 31, 2023. The study aimed to describe the characteristics of neonates who experienced mortality during their hospital stay. Neonates were included those admitted within the first 28 days of life who died during their hospital stay. Exclusion criteria included neonates discharged on risk bond, those with congenital anomalies incompatible with life, and those whose records were incomplete. Data were collected retrospectively from medical records, focusing on key demographic and clinical variables such as birth weight, gestational age, maternal health conditions, and common complications like sepsis or respiratory distress. Only descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the characteristics of the neonates who died. This analysis provided insights into common patterns and potential risk factors. The study used de-identified data, ensuring confidentiality.

Results

The study observed a total of 1,418 neonates admitted to the neonatal unit between August 1, 2022, and January 31, 2023. Out of these, 91 neonates (6.42%) experienced mortality, while 1,327 neonates (93.58%) were discharged alive. This indicates a mortality rate of 6.42% among the admitted neonates during the study period (Fig.-1).

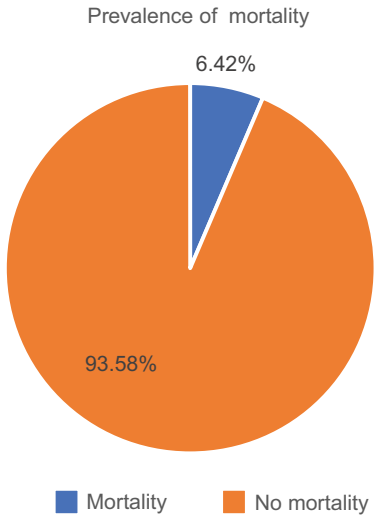

Fig.-1 *Incidence of death in the study*

Of the 91 neonates who experienced mortality during the study period, 48 (52.75%) were male, and 43 (47.25%) were female (Table I).

Table I
Gender Distribution among the cases (n=91)

Gender	Frequency	Percentage
Male	48	52.75
Female	43	47.25

Among the 91 neonates who died during the study period, the distribution of time of death showed that the highest number of deaths occurred at night, with 39 cases (42.86%). This was followed by 30 deaths (32.97%) in the evening and the lowest number of deaths occurred in the morning, with 22 cases (24.18%) (Fig.-2).

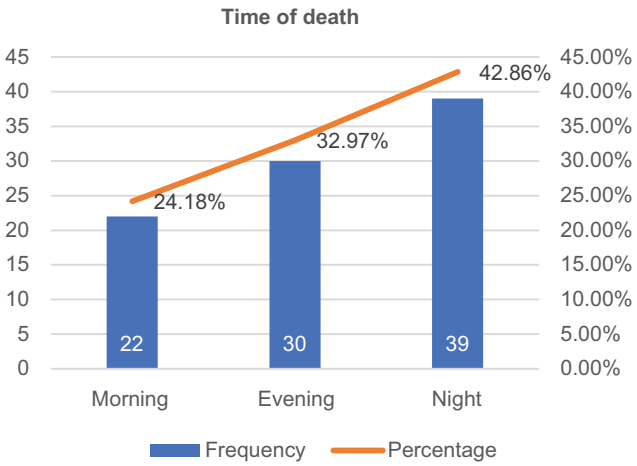

Fig.-2 *Distribution* of time of death among the participants (n=91)

The duration of hospital stay among the 91 neonates who experienced mortality showed that nearly half (48.35%) of the deaths occurred within the first 24 hours of admission. A smaller proportion, 15.39%, died between 24 to 72 hours, while 36.26% of the neonates died after more than 72 hours of hospital stay (Table II).

Table II
Distribution of hospital stay among the participants (n=91)

Hospital Stay	Frequency	Percentage
<24 hours	44	48.35
24-72 hours	14	15.39
>72 hours	33	36.26

Among the 91 neonates who died during the study period, 49 (53.85%) were born via cesarean section, while 42 (46.15%) were delivered through normal vaginal delivery (Table III).

Table III
Distribution of mode of delivery among the participants (n=91)

Mode of Delivery	Frequency	Percentage
Normal Vaginal Delivery	42	46.15
Cesarean Section	49	53.85

Out of the 91 neonates who experienced mortality, 69 (75.82%) were born in a hospital setting, while 22 (24.18%) were delivered at home (Fig.-3).

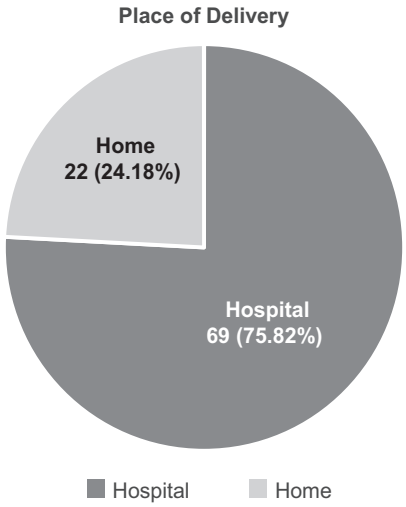

Fig.-3 *Distribution of place of delivery among the participants (n=91)*

The distribution of causes of death among the 91 neonates showed that the most common cause was preterm low birth weight and its complications, accounting for 26 cases (28.57%). Neonatal sepsis was the second most frequent cause, responsible for 24 deaths (26.37%), followed closely by birth asphyxia, which caused 22 deaths (24.18%). Congenital malformations contributed to 9 deaths (9.89%), while other causes accounted for 10 cases (10.99%) (Table IV).

Table IV
Disease pattern of death cases (n=91)

Cause of Death	Frequency	Percentage
Preterm low birth weight and its complications	26	28.57
Birth asphyxia	22	24.18
Neonatal sepsis	24	26.37
Congenital malformations	9	9.89
Others	10	10.99

Discussion

The present study analyzed the predictors and causes of neonatal mortality among neonates admitted to the neonatal unit of a tertiary care hospital in Bangladesh. Over the study period, a total of 91

neonatal deaths were recorded, resulting in a mortality rate of 6.42%. This rate is comparable to findings in other settings where neonatal mortality rates in tertiary care hospitals range widely depending on local health infrastructure, clinical protocols, and regional health challenges. For instance, a study conducted in Ethiopian hospitals reported a neonatal mortality rate of 12.5%, highlighting variations across regions but underscoring similar risk factors related to preterm birth and low birth weight (LBW) as key contributors to mortality.[19] The analysis of sex distribution revealed a slightly higher mortality among male neonates (52.75%) compared to females (47.25%). This finding is consistent with other studies that have observed a "male disadvantage" in neonatal survival, suggesting that biological factors, such as slower lung maturation in male fetuses, might contribute to higher risks of complications like respiratory distress and sepsis.[20,21] Vu et al. (2017) noted similar patterns in their systematic review, supporting the assertion that male neonates, especially those born prematurely, are more vulnerable to adverse outcomes.[20] The timing of neonatal deaths in this study showed a higher incidence during nighttime hours (42.86%), followed by the evening (32.97%) and morning (24.18%). This trend could be attributed to reduced staffing and potentially lower levels of supervision and clinical intervention during night shifts. Comparable findings were noted by Shokouhi et al. (2015), who reported increased neonatal deaths during night shifts, suggesting that resource allocation and the quality of care might fluctuate across different times of the day.[22] These insights call for improvements in staffing and round-the-clock monitoring to address the discrepancies in care during off-peak hours. Nearly half of the neonates (48.35%) who died did so within the first 24 hours of admission, indicating a critical period where early intervention could play a significant role in improving outcomes. This pattern of early mortality aligns with findings from Hadgu et al. (2020) in Ethiopia, where most neonatal deaths occurred within the first few days of life, reflecting the vulnerability of neonates, particularly those who are preterm or have low birth weight.[19] The high rate of early mortality in the current study suggests that timely and effective care upon admission could be crucial in reducing neonatal deaths, especially among high-risk groups. Regarding the mode of delivery, the study found that 53.85% of neonatal deaths occurred in neonates delivered via cesarean section (CS), while 46.15% were delivered through normal vaginal delivery. Although CS is often performed to manage complicated pregnancies, the findings indicate a slightly higher mortality rate among cesarean-born neonates, which could be related to the underlying maternal or fetal conditions necessitating the surgical intervention. Studies such as those by Rabiu et al. (2011) have documented that neonates born via cesarean, especially those delivered during the second stage of labor, may face higher risks due to complications that arise from prolonged or difficult labor.[23] However, cesarean delivery remains a crucial intervention for preventing adverse outcomes, particularly when performed appropriately. The study also showed that a majority of neonatal deaths (75.82%) involved neonates delivered in hospital settings, with 24.18% being home deliveries. Although hospital births generally provide a safer environment for delivery due to the availability of skilled healthcare professionals and resources, the high proportion of hospital-born neonatal deaths suggests that the neonates admitted to the neonatal unit were likely those with high-risk conditions requiring intensive care. A study by van der Kooy et al. (2017) found that hospital births had higher rates of interventions, reflecting the complexity and acuity of cases managed in hospital settings, which might explain the observed mortality patterns.[24] Additionally, this observation underlines the importance of strengthening perinatal care and postnatal follow-up, especially for neonates admitted with complications. The leading cause of neonatal mortality in the present study was preterm low birth weight and its complications (28.57%), followed by neonatal sepsis (26.37%) and birth asphyxia (24.18%). These findings are consistent with global and regional trends. Studies from both developing and developed countries consistently report preterm birth and low birth weight as the primary drivers of neonatal mortality, given the increased susceptibility of these neonates to conditions such as respiratory distress, hypothermia, and sepsis.[25] In Ethiopia, Kebede et al. (2021) similarly identified preterm complications and sepsis as the top causes of neonatal death, highlighting that preterm neonates are particularly vulnerable to infections and complications of immaturity.[26] Sepsis was the second most common cause of death, accounting for 26.37% of cases. The

high prevalence of neonatal sepsis points to the need for stringent infection control practices, especially in neonatal units where preterm and low birth weight infants are at high risk. Similar patterns were observed in studies by Hentges et al. (2014), emphasized the impact of sepsis on neonatal mortality and its long-term neurodevelopmental effects on survivors, further stressing the importance of effective infection prevention and control measures in neonatal care settings.[27] Birth asphyxia contributed to 24.18% of the deaths, reflecting a significant burden. Ellis et al. (2000) reported that birth asphyxia remains a critical cause of perinatal mortality in low-income countries, often due to a lack of skilled birth attendants and delays in accessing emergency obstetric care.[28] The findings emphasize the need for improved intrapartum care and timely intervention to prevent birth-related complications. Similarly, congenital malformations accounted for 9.89% of deaths in this study, comparable to other studies that have identified congenital anomalies as a less frequent but significant cause of neonatal mortality, particularly in cases involving cardiac and neural tube defects.[29] In conclusion, the findings of this study align with global and regional data on the key predictors and causes of neonatal mortality. Preterm low birth weight, sepsis, and birth asphyxia were the predominant contributors to mortality, highlighting critical areas for intervention. Improved maternal healthcare, timely access to skilled delivery services, and enhanced neonatal intensive care, particularly during the first 24 hours of life, could play a vital role in reducing neonatal mortality rates. The findings call for targeted interventions, including better infection control, improved perinatal care, and enhanced monitoring, especially during high-risk periods such as nighttime shifts.

Conclusion

This study provides valuable insights into the patterns of neonatal mortality in a tertiary care hospital in Bangladesh. The study identified preterm low birth weight, sepsis, and birth asphyxia as the primary causes of neonatal mortality, with a high rate of early mortality, higher prevalence of nighttime deaths and death within the first 24 hours of admission. Addressing these issues through better perinatal care, improved infection control, and round-the-clock skilled healthcare can play a crucial role in reducing neonatal mortality rates. Further research is recommended to explore context-specific strategies that can enhance neonatal care and outcomes in similar settings.

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