

Original article:

Prematurity: A Major Cause of Early Neonatal Mortality in Ad-din Medical College Hospital

Nasim Jahan¹, Md Abdul Mannan², Shirin Akter³, Farhana Afroz⁴, Tashmin Farhana⁵, Mahmuda Nasrin⁶, Zenifer Islam⁷, Nandita Nazma⁸

Abstract:

Objective: Early neonatal mortality within the first 24 hours contributes substantially to overall neonatal mortality rates. Reliable cause-specific mortality data are limited; thus the estimated proportion of prematurity-related deaths nationally remains questionable. The objective was to determine the presumed causes of neonatal death within the first 24 hours in Ad-din Medical College Hospital. **Methods:** This is a retrospective study initiated in January of 2016 to December 2016, conducted in the delivery room and adjacent neonatal area at Ad-din Medical College Hospital. Research assistants were trained to observe and record events related to labor, neonatal resuscitation, and 24-hour postnatal course. Perinatal asphyxia (PNA) was defined as failure to initiate spontaneous respirations and/or 5-minute Apgar score <7, prematurity as gestational age <37 weeks, and low birth weight (LBW) as birth weight (BW) < 2500gm. Data were analyzed with using the SPSS version (Chi-Square test). **Results:** Over 1 year, 14316 neonates were born and evaluated. Of these, 1867 were admitted to the neonatal area. Twenty seven neonates died secondary to Prematurity (55.56%), PNA (37.03%) and Meconium aspiration syndrome (7.41%). **Conclusions:** Most cases of early neonatal mortality were related to Prematurity and its related complications and Perinatal asphyxia are additional important considerations. Reducing Perinatal mortality requires a multifaceted approach with attention to issues related to potential complications of Prematurity and its related complications and PNA.

Keywords: Prematurity; Perinatal asphyxia (PNA); Meconium aspiration syndrome (MAS); Early neonatal mortality.

Bangladesh Journal of Medical Science Vol. 18 No. 03 July'19. Page : 593-597
DOI: <https://doi.org/10.3329/bjms.v18i3.41634>

Introduction:

The interval from birth to 28 days of age is the neonatal period which represents the time of the greatest risk to the infant. Approximately 65% of all deaths that occur in the first year of life happen during this 4-weeks period. Neonatal mortality in Bangladesh is 18.4 per 1000 live birth. Prematurity contributes majority of these death. Each year an estimated 15 million babies are born preterm (before 37 completed weeks of gestation). Complications of preterm birth responsible for approximately 1 million death of children each year.¹ More than 80% of preterm births occur between 32-37 weeks of gestation and majority

of these babies can survive with essential newborn care. Many survivors face a lifetime of disability, including learning disabilities and visual and hearing problems. Prematurity is the leading cause of death in children under the age of 5 years globally. Almost all countries rate of preterm births are increasing. More than 75% of these deaths could be prevented with current, cost-effective interventions without intensive care. Among 184 countries the rate of preterm birth ranges from 5% to 18% of babies born. Approximately 12% of babies are born too early in the lower-income countries, in comparison to 9% in higher-income countries. In Bangladesh rate of

1. Dr Nasim Jahan, consultant Pediatrics and Neonatology, Asgar Ali hospital, Dhaka, Bangladesh
2. Dr Md Abdul Mannan, Prof. of Neonatology, Department of Neonatology, Ad-din Medical College Hospital (AMCH), Dhaka, Bangladesh
3. Dr. Shirin Akter, Specialist, Asgar Ali Hospital, Dhaka
4. Dr. Farhana Afroz, Specialist, Asgar Ali Hospital
5. Dr. Tashmin Farhana, Specialist, Asgar Ali Hospital,
6. Dr. Mahmuda Nasrin, Clinical staff, Asgar Ali Hospital
7. Dr. Zenifer Islam, Clinical staff, Asgar Ali Hospital
8. Dr. Nandita Nazma, Associate professor, Department of pediatrics, International Medical College & Hospital, Tongi, Dhaka

Correspondence to: Dr. Nasim Jahan, Consultant, Dept of Pediatrics and Neonatology, Asgar Ali Hospital, Dhaka, Bangladesh, Cell no: 01757078207, E-mail: njahan.jesy@gmail.com

premature delivery is 14%². The highest numbers of estimated preterm births occurred in 10 countries which includes India, China, Nigeria, Pakistan, Indonesia, United States, Bangladesh (rank-7), the Philippines, Democratic Republic of the Congo and Brazil. These 10 countries account for 60% of all preterm births worldwide. So preterm birth is truly a global problem². Poorer families are at higher risk for premature delivery. The survival chances of the 15 million babies born prematurely every year vary dramatically depending on where they are born. More than 90% of extremely preterm neonates (≤ 28 weeks GA) born in low-income countries die within the first few days of life in comparison to less than 10% of extremely preterm neonates die in high-income settings. South Asia and sub-Saharan Africa account for half the world's births. Preterm Birth complications are responsible for more than 80% of the world's 1 million deaths. Approximately 50% of these babies are born at home. Even for those born in a health clinic or hospital, essential newborn care is often lacking³.

Children face the highest risk of dying in neonatal period, at a global neonatal mortality rate 19 deaths per 1,000 live births and in Bangladesh 20 per 1000 live births⁴. Among the SDG regions, neonatal mortality rate was highest in sub Saharan Africa and Southern Asia, which is reported 28 deaths per 1,000 live births. A child in sub-Saharan Africa or in Southern Asia is nine times more likely to die in the first month in comparison to a child in a high-income country. Neonatal mortality rates ranged from 46 per 1,000 live births in Pakistan to 1 per 1000 live births in Iceland and Japan. Globally 2.6 million children died in the first month of life-approximately 7,000 newborn deaths every day. More than 75% deaths occurs during the first week of life, about 1 million newborns dying on the first 24 hours and close to 1 million dying within the next six days. Two regions account for almost 80 per cent of the newborn deaths, Southern Asia accounted for 39 per cent of deaths and sub-Saharan Africa accounted for 38 per cent. At the country level, 50% of all neonatal deaths are concentrated in five countries, namely, India (24 per cent), Pakistan (10 percent), Nigeria (9 percent), the Democratic Republic of the Congo (4 percent) and Ethiopia (3 percent). A third of all newborn deaths occurred in India and Pakistan alone⁴. The main causes of newborn deaths are preterm birth related complications (35%), intrapartum related events (24%), and serious infections like sepsis or meningitis and pneumonia (21%). These causes responsible for

nearly 80% of deaths in this age group and almost all of these deaths occur in developing countries⁴. In Bangladesh approximately 3,100,000 babies were born each year or around 8,600 every day⁵ and neonatal death is still high, accounting for 50% of all under-five deaths and more than two-thirds of infant deaths⁴. An estimated 62,000 newborns die every year in Bangladesh and 50% of them die on 1st day of life⁴. The main causes of neonatal deaths are prematurity (29.7 percent), birth asphyxia and trauma (22.9 percent) and sepsis (19.9 percent)⁶. Children who die within the first 28 days of birth suffer from conditions and diseases associated with lack of quality care at birth or skilled care and treatment immediately after birth. Prematurity is a global serious clinical problem followed by perinatal asphyxia and around 5-10% of all newborns need resuscitation at birth. Preterm birth complications remains a main killer of children under age 5 (18%) followed by pneumonia (16%) and perinatal asphyxia (12%), others are diarrhoea (8%), neonatal sepsis (7%) & malaria (5%).⁴ Most under-5 deaths are caused by diseases that are readily preventable or treatable with proven, cost-effective interventions. Ad- din Medical College Hospital located in central Dhaka, which is densely populated area. It has an immediate catchment of $\wedge 500,000$ people and serves as a referral hospital for $\wedge 2$ million people. The hospital provides comprehensive emergency obstetric and basic emergency newborn care including intensive care. The neonatal unit consists of well equipped 55 beds which provides upto level-III care. Midwives with the help of doctor largely conduct deliveries. After birth, infants who require more than routine care are triaged to an adjacent neonatal area and are intermittently cared by family members and the labor staff. Most infants are discharged rapidly; however, a subset dies for different reasons. Evidence-based estimation of neonatal as well as child mortality is a cornerstone for tracking progress towards child survival goals and identifying priority areas to accelerate progress towards eliminating preventable causes of child deaths. Reliable estimates are crucial for planning national and global health strategies, policies and interventions on child health and well-being. Our objective for this study was to identify the presumed causes of death within the first 24 hours of birth in this referral hospital.

Methods:

This is a retrospective study initiated in January of 2016 to December 2016 at Ad-din Medical College Hospital: an urban referral hospital in central Dhaka.

Research assistants (observers) were continuously present in the labor ward to observe the routine practice of health care providers in the delivery room as well as postnatally in an adjacent neonatal area through the initial 24 postnatal hours. The observers worked in 2 shifts over 24 hours. Four observers cover each shift; 1 was always located in the labor ward or in the theater, and 3 in the adjacent neonatal area. The findings are recorded on a data collection form immediately after the delivery. The following definitions were used. Gestational age (GA) was based on self report of the last menstrual period and distance from symphysis pubis to the fundus. Normal term GA is routinely defined as ≥ 37 weeks. Thus prematurity was defined as a GA < 37 weeks and low birth weight (LBW) as birth weight (BW) < 2500 gm. PNA was defined as a failure to initiate spontaneous respirations and/or 5-minute Apgar score < 7 : the most commonly used indicator to identify PNA in resource limited settings. If a premature neonate also had a history of suspected intrapartum related hypoxia (abnormal fetal heart rate [FHR], labor complication, no respiratory efforts, and/or 5-minute Apgar score $< 7/10$), the primary cause of death was categorized as PNA. Normal was defined as survival > 24 hours without any detected difficulties. Analyses were performed using the SPSS version (Chi-Square test).

Ethical clearance:

This study design have been approved by the Ethics Committee of Ad-din Medical College Hospital, Dhaka, Bangladesh.

Results:

Over 1 year, 14,316 neonates were born and evaluated. Of these, 1867 (13.04%) were admitted to the neonatal area and twenty seven (0.19%) were early neonatal deaths. The (n=27) neonates died

secondary to prematurity (n=15; 55.56), PNA (n=10; 37.03%) and meconium aspiration syndrome (n=2; 7.41).

Neonatal characteristics, related to neonatal outcome are presented in Table 1. Neonates who died were of lesser BW and GA as compared with normal neonates (P $< .0001$). The proportion of boy and premature neonates were higher among infants who died than among normal neonates (P $< .0001$).

The characteristics of neonates who died by presumed etiology are presented in Table 2. As anticipated, neonates who died secondary to PNA were of greater BW and GA as compared with infants who died of prematurity (P $< .0001$). In 2 premature infant, the primary cause of death was considered to be PNA. The proportion of boy and premature neonates were higher among infants who died than among PNA neonates (P $< .0001$).

Table 1. Neonatal Characteristics Related to Normal or Dead Neonates at 24 Hours

| Characteristics | Normal (n = 14,289) | Dead (n = 27) | P |
|-----------------|---------------------|----------------|-----------|
| BW, g | 2563 \pm 475 | 1715 \pm 765 | $< .0001$ |
| GA, wk | 36.6 \pm 1.6 | 31.7 \pm 4.4 | $< .0001$ |
| Boy | 7573 (53) | 17 (63) | $< .0001$ |
| Premature | 3668 (25.67) | 15 (55.56) | $< .0001$ |
| | | | |

Values given are n (%). P: deaths versus survival > 24 h. Normal = survival > 24 h without any detected difficulties.

Table 2. Neonatal Characteristics Related to Dead Neonates (Within 24 Hours) by Etiology.

| Characteristics | Prematurity (n=15) | PNA (n=10) | P | Meconium aspiration syndrome (n=2) |
|-----------------|--------------------|----------------|-----------|------------------------------------|
| BW, g | 1621 \pm 247 | 3013 \pm 536 | $< .0001$ | 2477 \pm 104 |
| GA, wk | 29.8 \pm 2.1 | 35.4 \pm 1.2 | $< .0001$ | 35.5 \pm 1.9 |
| Boy | 10 (66.67) | 05 (50) | $< .0001$ | 02 (100) |
| Premature | 15 (100) | 02 (20) | $< .0001$ | 01(50) |
| | | | | |

Values given are n (%). P: Prematurity versus PNA outcome.

Discussion:

These data provide retrospective observational informations on causes of early neonatal deaths in an urban hospital in a moderate resource setting. The

reports indicate that prematurity is the predominant cause accounting for 55.56 of deaths, among the other causes PNA noted in 37.03% cases and meconium aspiration syndrome 7.41 are additional cause. The

assignment of prematurity as a proximate cause of death in this report included a complicated obstetric history with preterm labor, failure of neonates to initiate spontaneous respirations or severe respiratory distress coupled with the requirement for basic resuscitative actions including positive pressure ventilation with bag and mask and eventually ventilator support, and the absence of overt signs of infection. The findings showed 55% early mortality rate attributed to prematurity and 37% secondary to PNA are near consistent with the global estimates of preterm-related neonatal mortality of 35% and PNA related mortality of 24% within 1 month⁴. In Bangladesh, the causes of neonatal mortality because of preterm related mortality of 30% followed by PNA related mortality of 23% and sepsis 20% within 1st month of life⁶. However this observation is not consistent with the findings of Edmond KM et al.⁷, Chowdhury HR⁸, and Hege LE⁹, where the major cause of early neonatal death was PNA (53-60%) and second common cause of early neonatal death was prematurity (15-18%). We speculate that this discrepancy is in part due to under reporting of early neonatal deaths, misclassification of asphyxiated infants as stillbirths (the non breathing non resuscitated infant), and an unreliable “high” 5-minute Apgar score.

A basic tenet of the Helping Babies Breathe program^{10,11} is that initiation of positive pressure ventilation (PPV) by bag and mask within the Golden first minute after delivery in non breathing infants has the great potential to reduce early neonatal deaths and “fresh stillbirths” (the non breathing non resuscitated infant) dramatically. This is a critically important concept because it makes the assumption that more than 90% non breathing infants are in primary apnea and will respond to the early initiation of PPV. The times to initiation of PPV as well as the duration of PPV were significantly longer among infants who died compared with infants with normal outcome. Specifically, the risk for death increased 16% for every 30 seconds’ delay in initiating PPV

up to 6 minutes and 6% for every minute of applied PPV¹². In this report, infants with a diagnosis of PNA-related deaths were significantly more likely to receive PPV when corrected for BW and GA. Many of these infants presented with obstetrical complications and FHR abnormalities. Analysis of the same population (and reported separately) reveals that FHR abnormalities intermittently detected with the fetoscope identifies fetal compromise, and the risk for early neonatal deaths and fresh stillbirths¹³. Thus, fetal heart rate (FHR) monitoring and anticipation of the potential need for PPV before delivery should become an important teaching point of the Helping Babies Breathe program¹⁰. The data also indicate that a multifaceted approach beyond PPV is necessary to achieve the greatest impact of reducing early neonatal mortality.

Conclusions:

Those premature neonates who did not require much resuscitation in the delivery room suggesting that other potential factors may have contributed to death including temperature instability, hypoglycemia, and unrecognized or unanticipated infection. In the hospital setting, it is raise the need for simple neonatal protocols to observe and manage the “seemingly stable” premature or LBW neonates.

Conflict of interest: The authors declared no conflict of interest

Authors’ contributions:

Data gathering and idea owner of this study: Dr. Nasim Jahan, Dr. Md. Abdul Mannan, dr. Shirin Akter

Study design: Dr. Nasim Jahan, Dr. Abdul Mannan, Dr. Mahmuda Nasrin,

Data gathering: Dr. Tashmin Farhana, Dr. Farhana Afroze

Writing and submitting manuscript: Dr. Nasim Jahan, Dr. Abdul Mannan, Dr. Shirin akter

Editing and approval of final draft: all authors participated in editing and approval of final draft.

References:

1. Liu L, Oza S, Hogan D, Chu Y, Perin J, Zhu J, et al. Global, regional, and national causes of under-5 mortality in 2000-15: an updated systematic analysis with implications for the Sustainable Development Goals. *Lancet*. 2016;**388**(10063):3027-35.
 2. Blencowe H, Cousens S, Oestergaard M, Chou D, Moller AB, Narwal R, Adler A, Garcia CV, Rohde S, Say L, Lawn JE. National, regional and worldwide estimates of preterm birth. *Lancet*, 2012; **9**; **379**(9832):2162-72.
 3. March of Dimes, PMNCH, Save the Children, WHO. Born Too Soon: The Global Action Report on Preterm Birth. Eds CP Howson, MV Kinney, JE Lawn. World Health Organization. Geneva, 2012.
 4. UNICEF: Levels and Trends in Child Mortality Report.2017; 1-25.
 5. United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision.
 6. WHO-MCEE estimates for child causes of death, 2000-2015. (http://www.who.int/healthinfo/global_burden_disease/estimates_child_cod_2015/)
 7. Edmond KM, Quigley MA, Zandoh C, et al. Aetiology of stillbirths and neonatal deaths in rural Ghana: implications for health programming in developing countries. *Paediatr Perinat Epidemiol*. 2008;**22**(5):430– 437
 8. Chowdhury HR, Thompson S, Ali M, Alam N, Yunus M, Streatfield PK. Causes of neonatal deaths in a rural sub district of Bangladesh: implications for intervention. *J Health Popul Nutr*. 2010;**28**(4):375–382
 9. Hege L E, Estomih M, Erling S and Jeffrey P. Birth Asphyxia: A Major Cause of Early Neonatal Mortality in a Tanzanian Rural Hospital. *Pediatrics* April 16, 2012; DOI: 10.1542/peds.2011-3134.
 10. The American Academy of Pediatrics. Helping babies breathe. Available at: www.helpingbabiesbreathe.org/. Accessed January 31, 2012.
 11. Singhal N, Lockyer J, Fidler H, et al. Helping Babies Breathe: global neonatal resuscitation program development and formative educational evaluation. *Resuscitation*. 2012;**83**(1): 90–96.
 12. Ersdal HL, Mduma E, Svensen E, Perlman JM. Early initiation of basic resuscitation interventions including face mask ventilation may reduce birth asphyxia related mortality in low-income countries. [published online ahead of print December 23, 2011]. *Resuscitation*. 2012 doi:10.1016/j.resuscitation. 2011.12.011.
 13. Ersdal HL, Mduma E, Svensen E, Sundby J, Perlman JM. Obstetrical factors that increase the risk for fetal heart rate abnormalities, bag mask ventilation, 5 min Apgar score ,7, deaths and fresh stillbirths in a low-resourced hospital. In: Abstract *Pediatric Academic Societies (PAS) Annual Meeting 2011*; May 1–4, 2011; Denver, CO
-