



# Pattern of Neonatal Admissions and Care Outcomes in Special Care Newborn Unit of Cox's Bazar District Hospital, Bangladesh

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. Author OO conceived the documentation, analyzed the data and drafted and finalized the manuscript. Authors LP and RUR collected the data. All authors read and approved the final manuscript.*

## **Article Information**

DOI: 10.9734/AJPR/2022/v10i4204

## **Open Peer Review History:**

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/93397>

**Original Research Article**

**Received: 13/09/2022**

**Accepted: 18/11/2022**

**Published: 23/11/2022**

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## ABSTRACT

**Background:** Neonatal morbidity and mortality contribute significantly to under-five morbidity and mortality. A substantial reduction in neonatal mortality is therefore necessary to achieve the Sustainable Development Goals targets.

**Aims:** Assessed the pattern of neonatal admission and care outcomes.

**Place and Duration of Study:** Special Care Newborn Unit of Cox's Bazar District hospital, Bangladesh conducted in September 2022.

**Methodology:** Hospital-based retrospective study. Data extracted from the admission register and the records of 3982 newborns admitted between August 2021 and July 2022. Bivariate analysis using the Chi-square test, was performed to determine factors associated with neonatal mortality and p value was set at significant level of 5%.

**Results:** 3982 neonates were admitted, 2426 (61%) were male and 1556 (39%) were female with 1071 (27%) from the hospital and 2911 (73%) from outside the hospital. Birth asphyxia was the commonest morbidity, 49% followed by Low Birth Weight/prematurity (18%) and neonatal sepsis 17%. 3,225 (81.4%) of the neonates admitted survived while 538 (13.5%) died and 203 (5.1%) were discharged against medical advice. There was significant association between birth weight, morbidity pattern and mortality ( $p < 0.05$ ) with most deaths associated with prematurity/LBW. There was significant association between neonatal mortality and the place of delivery, death among outborn was 16% compared with 7% among inborn ( $p < 0.05$ ) but no significant association between neonatal mortality and gender.

**Conclusion:** There was a high burden of neonatal care at the hospital and majority of causes of neonatal morbidity and mortality were preventable. There is need for holistic approach to pregnancy, delivery and newborn care to reduce neonatal morbidity and mortality in the district.

*Keywords: Special care newborn unit; pattern; neonatal; admission; outcome.*

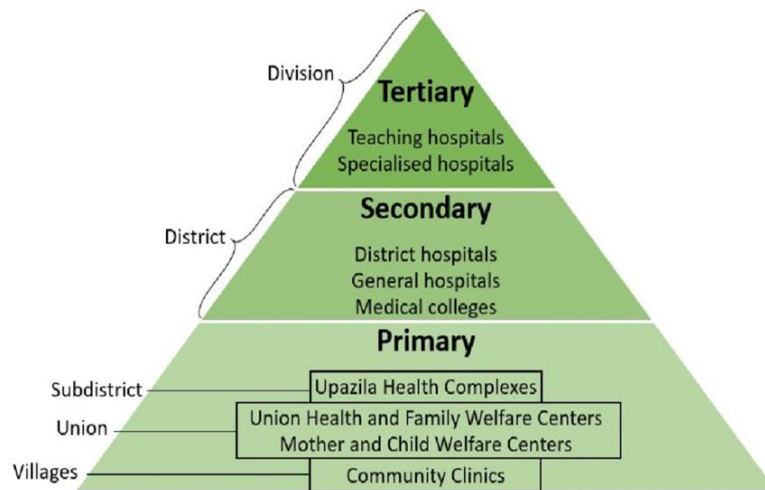
## 1. INTRODUCTION

Globally, 2.4 million children die after birth each year and 36% of these children are from the developing countries [1]. Neonatal mortality contributes to the overall under-five death rates, accounting for 40% of the under-five mortality rate worldwide [1]. Bangladesh reported reduction in infant mortality from 52 per 1000 live birth in 2007 to 38 per 1000 live birth in 2017, however the decline in neonatal mortality is relatively slow from 37 to 30 per 1,000 live births in the same period [2]. Neonatal deaths account for an increasing share of the deaths of children under age five, rising from about 40% in the early 1990s to 61% currently [2]. The commonest causes of neonatal deaths in Bangladesh were birth asphyxia 25%, prematurity 33%, sepsis 9%, congenital abnormality 10% and others 13% [2].

Considering this high burden, the Government of Bangladesh (GoB) has emphasized newborn health and committed to achieving the Sustainable Development Goals (SDG) target by reducing newborn mortality to 12 per thousand live births or below by 2030 [3]. In response to

the Global Every Newborn Action Plan (GENAP), the GoB also developed the Bangladesh Every Newborn Action Plan (BENAP) with specific strategies for averting newborn mortality and morbidity [3,4]. The plan included strengthening facility based newborn care services through establishing Special Care Newborn Unit (SCANU) in the district hospitals and Newborn Stabilization Unit (NSU) in the Upazila Health Complexes (UHCs) [5,6]. In addition, the government has identified newborn signal functions that are categorized by health facilities to assist in appropriately planning and adequately monitoring of the progress and performance of health facilities in providing newborn care [3].

Bangladesh has a well-structured health system with three tiers of primary health care – Upazila Health Complexes (UHC) at the sub-district level, Union Health and Family Welfare Centres (UHFWC) at the Union (collection of few villages) level, and Community Clinics (CC) at the village level. These are backed by the District Hospitals providing secondary level care and the tertiary hospitals of various kind in large urban centers. (Fig. 1) [7,8].



**Fig. 1. Health care system in Bangladesh**

This study assessed the pattern of neonatal admission and care outcomes at Cox’s Bazar District Hospital Special Care Newborn Unit (SCANU). The findings of this study will be used for evidence based newborn health programming for better newborn outcome in the district.

## 2. MATERIALS AND METHODS

### 2.1 Design

This was hospital-based retrospective survey which involved review of neonatal admission register and the records of 3982 newborns admitted between August 2021 and July 2022.

### 2.2 Study Population and Setting

This study was done at Special Care Newborn Unit of Cox’s Bazar District hospital, Bangladesh. It is a 65-bed unit and the only referral facility in Cox’s Bazar district for the host communities and the Rohingya refugees (Forcibly Displaced Myanmar Nationals) (FDMN) and supported by UNICEF. The facility has trained manpower and necessary equipment to provide all essential and emergency cares for sick newborns including Kangaroo Mother care unit.

The study was conducted in September 2022.

### 2.3 Data Collection and Statistical Analysis

The data were extracted using a form designed to capture relevant information from the unit’s admission register and case notes of the neonates. The data collected included records

of admission such as date of admission, age, weight of the child, status at birth, gestational age, mode and place of delivery, diagnosis on admission, treatments given and outcomes. The extracted data were entered into a Microsoft Excel spreadsheet and analysed using SPSS version 21. Univariate analysis was done by generating frequencies and proportions and variables presented in graph and tables. Bivariate analysis using the Chi-square test, was performed to determine factors associated with neonatal mortality and p value was set at significant level of 5%.

## 3. RESULTS

### 3.1 Characteristics of Neonates on Admission

Table 1 shows that among the 3,982 neonates admitted into the SCANU, 2426 (61%) were male and 1556 (39%) were female with 1071 (27%) from the Cox’s Bazar district hospital and 2911(73%) from outside the hospital. The breakdown of the outborn admission shows that 1194(41%) were from home delivery, 485(17%) from other government health facilities and 1232(42%) from private and Non-Governmental Organization health facilities in the host communities and refugee camps.. The mean length of stay was  $4.64 \pm 1.3$  days and mean bed occupancy rate of  $78.8 \pm 12.5\%$ .

### 3.2 Pattern of Neonatal Morbidity and Mortality at Admission

Fig. 2 shows the distribution of the neonatal morbidity on admission with 1953 (49%) of the

total 3982 admissions were Birth Asphyxia, 679(17%) were neonatal sepsis, 390(10%) were Low birth weight (>1.5-2.5 kg) and 299 (8%) were very low birth weight (<1.5 kg).

birth having highest case fatality of 22%, [LBW(<1.5kg ,case fatality of 38%: LBW(1.5-2.5kg, case fatality of 8.2%] followed birth Asphyxia,16% and Sepsis 8.7%.

Fig. 3 shows that 3,225 (81.4%) of the neonates admitted survived while 538 (13.5%) died and 203(5.1%) were discharged against medical advice.

### 3.3 Kangaroo Mother Care Follow up Visit

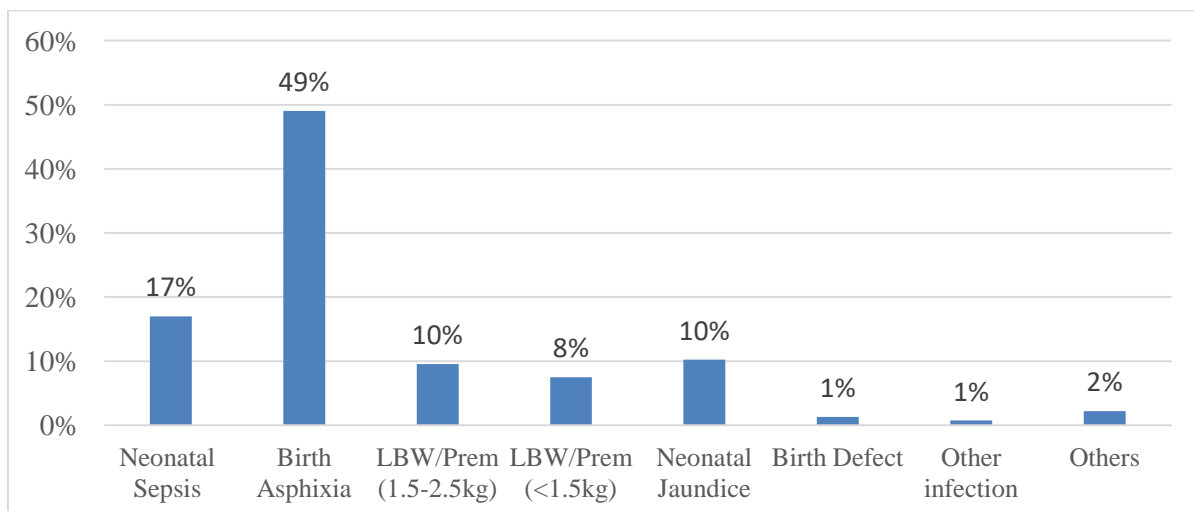
Fig. 5 shows the follow up visits by low birth weight/premature babies who were managed using Kangaroo mother care in the KMC section of the SCANU. It shows that 225 babies were managed and discharged using the national protocol while 42 other babies absconded and didn't fulfil the discharge criteria. Among the 225 neonates discharged and expected to return for the four follow up visit, 151(67%) came for the 1<sup>st</sup> visit and 22(10%) came from the 2<sup>nd</sup> visit and none of them came for the remaining 3<sup>rd</sup> and 4<sup>th</sup> visits.

Fig. 4 shows the causes of death among the neonates admitted into the unit. The commonest cause of death was due to Birth Asphyxia with 312(58%) of the total 538 deaths, while 113(21%) was due to Low birth weight(<1.5kg) and 59(11%) due to neonatal sepsis.

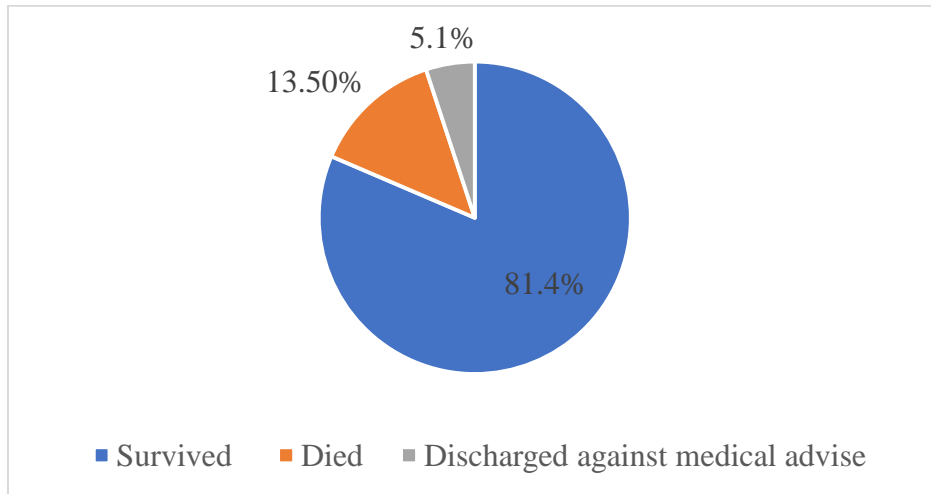
Table 2 shows the case fatality rate of the common cause of neonatal mortality with Low

**Table 1. Basic characteristics of Neonates admitted (Aug 2021- July 2022)**

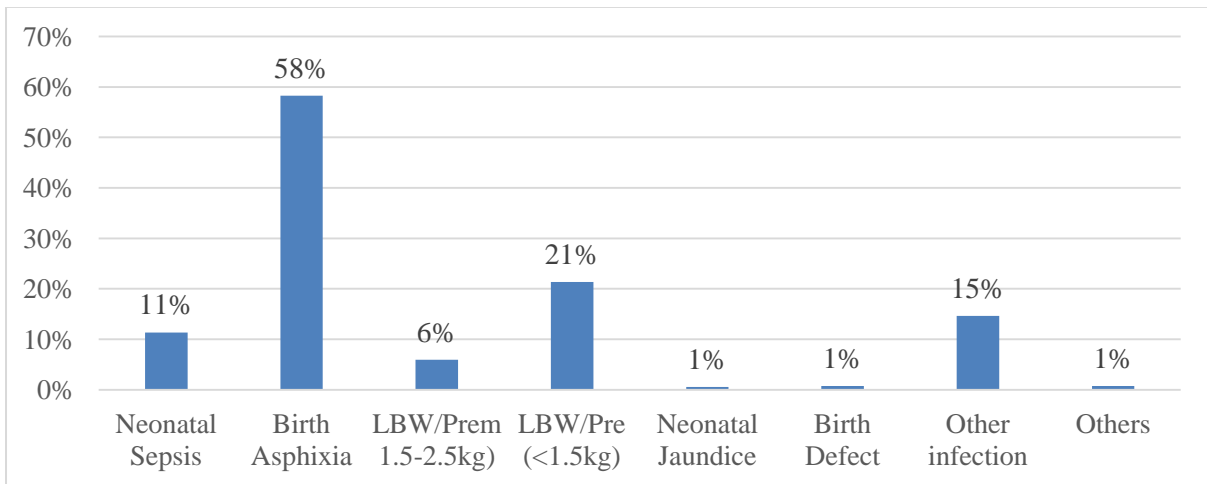
Variables	Number (n=3982)
<b>Gender</b>	
Male	2426(61%)
Female	1556(39%)
<b>Source of Admission</b>	
Inborn	1071(27%)
Out born	
Home	1194(41%)
Government health facilities	485(17%)
Private and NGO health facilities	1232(42%)
<b>Length of Stay (Days) (mean)</b>	4.64± 1.3
<b>Bed Occupancy Rate (%) (mean)</b>	78.8% ±12.5%



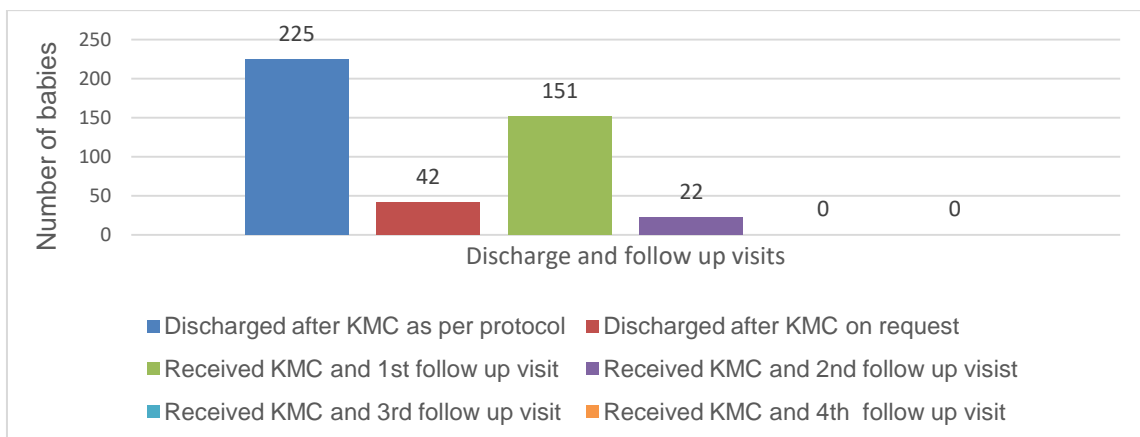
**Fig. 2. Pattern of neonatal admission at the SCANU (Aug 2021-July 2022) (n=3982)**



**Fig. 3. Outcome of newborn admission (n=3982)**



**Fig. 4. Causes of Death at the SCANU (Aug 2021-July 2022) n=538**



**Fig. 5. KMC discharge and follow up visits**

### 3.4 Factors Associated with Neonatal Outcome

Table 3 shows the review of the records of each newborn who died from the SCANU. Among the 538 neonates that died between August 2021-July 2022, 394( 73%) were normal vaginal delivery and 275(51%) were from primipara mothers. A total of 246(46%) of them died between 1<sup>st</sup> and 3<sup>rd</sup> day on admission while 102(19%) of them died within 24 hours of admission.

### 3.5 Factors Associated with Neonatal Death

Table 4 shows that a significant association exists between birth weight of the neonates and neonatal mortality ( $p < 0.05$ ). Newborns who weighed less than 1.5kg died most while there was better survival with increasing weight beyond 1.5kg with 38% of death among newborn less than 1.5 kgs and 8% among neonate 1.5-2.5kg.

Likewise, a significant association exist between clinical indications for admission and neonate's mortality ( $p < 0.05$ ) with most deaths associated with prematurity/LBW (21%) followed by Birth Asphyxia (16%) and Sepsis (9%) and 3.3% from

other causes. The analysis shows there was significant association between neonatal mortality and the place of delivery. Neonatal mortality among outborn (home and other health facility) was 16% [13% among those delivered at home and 18% among those delivered in other health facilities including private or NGO health facilities] compared with 7% among those delivered at the Cox Bazar district hospital (inborn). There was no significant association between neonatal death and gender even though the mortality among the male neonates was 14% compared to 12.6% among female neonates ( $p > 0.05$ ).

## 4. DISCUSSION

The study highlighted the pattern of neonatal admission and care outcomes among neonates admitted in the Special Care Newborn Unit. There was higher number of male neonates compared to female admitted. This is similar to findings from other studies which indicated that male neonates are more vulnerable during the neonatal period [9-14]. Many reasons have been attributed to this which included the biological vulnerability of males to infections [15,16] or discrimination against female off springs due to cultural and social factors which contribute to male babies getting more attention by parents than females [11,12].

**Table 2. Case fatality rates of the common causes of neonatal morbidity and mortality**

Clinical indications for admission	Survived	Died	Case fatality rate (%)
Birth Asphyxia	1641	312	16%
LBW (<1.5kg)	186	113	38%
LBW (1.5-2.5kg)	358	32	8.2%
Sepsis	620	59	8.7%
Others	661	22	3.3%

**Table 3. Some characteristics of neonatal death (August 2021-July 2022)**

Mode of delivery	Number (%) n=538
Normal vaginal delivery (NVD)	394(73)
Caesarean session (CS)	144(27)
<b>Parity</b>	
Primipara	275 (51)
Multipara	241(45)
Grandmultipara	22(4)
<b>Duration of stay (days)</b>	
<1	102 (19)
1 to 3	246(46)
4 to 7	119 (22)
>7	71(13)

**Table 4. Association between some variables and neonatal care outcomes (August 2021 - July 2022)**

Variables	Died	Survived	Total	Chi square (p value)
<b>Birth weight</b>				
<1.5kg	113	186	299	167.26( 0.000)*
1.5-2.5kg	32	358	390	
>2.5kg	393	2900	3293	
<b>Pattern of disease</b>				
Birth Asphyxia	312	1641	1953	115.7 (0.000)*
LBW/prematurity	145	544	689	
Sepsis	59	620	679	
Others (Neonatal Jaundice, congenital abnormalities, birth trauma/injury etc)	22	639	661	
<b>Place of delivery</b>				
Inborn( home and other health facilities)	462	2450	2912	51.53(0.000)*
Cox Bazar District hospital	76	995	1071	
<b>Gender</b>				
Male	342	2084	2426	1.8275(0.176)
Female	196	1360	1556	

A study by Becklake and Kauffmann reported that the lungs of female neonates are at lower risk than those of male neonates for developing both transient tachypnoea of the newborn and respiratory distress syndrome. They are also more responsive to hormone accelerators of surfactant production, presumably because of their more mature lung phospholipid profiles [15]. Also, a study by Libert et al., established a genetic influence in neonatal infection, revealing that in response to various immune challenges, females show better survival than males and the X-chromosome linked diseases are predominant in males than females [16]. However, a study in Karachi reported more female neonates on admission than male [17].

#### 4.1 Causes of Admission

Birth asphyxia was the commonest neonatal morbidity followed by low birthweight/prematurity and sepsis in the study. This is similar to findings from other studies in Pakistan, Nigeria, India and Tanzania which reported birth asphyxia as the most common cause of hospital admissions though the proportion attributable to it varies from each study [18-22]. Our study found 49% of admission was due to birth asphyxia compared to 24%, 32%,31%,16% and 27% in other studies in Pakistan, Nigeria, Indian and Tanzania respectively [18-22]. However, in most of the studies on neonatal admission in NICU (neonatal

intensive care unit), the commonest morbidity was prematurity/low birth weight [10,13,23-25], while sepsis was also reported as the commonest morbidity in few other studies [26-28]. This variation in causes of admission from studies to studies is likely a reflection of the health systems in terms of the quality of maternal and newborn care services at the lower-level health systems that affect the patient management and cases that are finally referred, the referral systems and other socio-economic factors.

#### 4.2 Mortality Rate and Causes of Mortality

In the study, the mortality rate among the neonates admitted was 13.5%, this is similar to 13.6% mortality rate reported in a study in India [29], but lower than finding from studies in India, Pakistan, Bangladesh, Ghana, and Ethiopia which reported mortality rates of 17.14% , 17.15%, 14.9%, 16% and 20.5% respectively [13,26,30,31,32]. The rate is however more than was reported in studies in Shri lanka, previous study in Bangladesh, Northern Nigeria and Pakistan which reported neonatal mortality rate of 8%, 9.43%,4.32%, and 8% respectively [9,10,33,34]. Mortality rate of any neonatal intensive care unit depends on many factors other than the clinical conditions of the baby on admission such as the infrastructure, manpower and quality of care at the facilities. This could be

responsible for the variations in the mortality rate reported in the studies.

Birth Asphyxia was the commonest cause of death, 58% of deaths, followed by low birth weight/prematurity and other infections. This is similar to findings in Pakistan, India, which also reported birth asphyxia as the major cause of mortality and contributed 46% and 30% of the total mortality respectively [35,36]. Most studies however reported prematurity/low birth weight as the commonest cause of death and accounted for between 35%–70% of neonatal deaths among admitted neonates [25,26,37-39]. A previous study in Bangladesh however reported neonatal infection as the predominant cause of death (29%) among the admitted neonates [40].

### 4.3 Time of Death

In the study, majority of the deaths (46%) occurred between 1 and 3 days of admission and 19% occurred within first 24 hours of admission. This is unlike most studies in Nigeria and Pakistan that reported that between 88.5%, 46%, and 52% of death occurred occurs within the first 24 hours respectively [14,25,35]. The first 24 hours are regarded as the most dangerous of a child's life that carry the highest risk of death [41]. A study in Nigeria reported neonatal mortality was significantly higher in the first 24 hours of admission among neonates with low birth weight/prematurity [25]. This may be the reason for the difference in the time of death on admission in our study where the commonest cause of admission is birth asphyxia unlike the other studies where prematurity/LBW was the commonest cause of admission [10,13,23-25].

### 4.4 Association Factors and Neonatal Outcome

There was significant association between the clinical indications and neonatal mortality with more death associated with prematurity/LBW (21%), Birth Asphyxia (16%) and Sepsis (9%). This is similar to other studies which reported significant association between pattern of diseases and neonatal mortality where most deaths were associated with prematurity LBW (27.4%), Respiratory distress (20.6%) and Birth asphyxia (17.3%) [25,42,43]. However, other studies found birth asphyxia as a predictor of neonatal mortalities [44,45].

There was significant association between birth weight and neonatal mortality. This shows that

the newborns who weighed less than 1.5kg died most, while there was better survival with increasing weight. This is similar to findings from studies in Nigeria, Ghana, Kenya, Indonesia and Pakistan which observed that birth weight of the neonates were associated with the care outcomes and confirmed birth weight was a significant predictor of neonatal outcome [25,42,43,46,47]. Survival and discharge rates increase as the birth weight increases. There was no significant association between gender and neonatal care outcome even though more death were recorded among the male than female neonates. This is similar to a finding in Nigeria, Mauritania and Pakistan which also reported no significant association between gender and neonatal outcome even though the mortality was higher among the male neonates [33,45,47].

The study found significant association between neonatal care outcome and the place of delivery. Newborn deaths among those delivered outside the hospital, out born (home and other health facility) was 16% compared with 7% for the hospital (inborn). This is similar to finding from studies in Pakistan and India that found significant association between out born neonates and mortality [47,48]. However, a study in Kenya found no significant association between newborn delivered out born (home and in order health facilities) compared to the inborn even though the out born newborn had increased tendency of dying [43].

### 4.5 Kangaroo Mother Care Follow up Visits

In the study, among the 225 LBW/premature babies managed and discharged in the KMC unit and expected to return for the four follow up visits based on the treatment protocol, only 151(67%) came for the 1<sup>st</sup> visit and 22(10%) came from the 2<sup>nd</sup> visit and none of them came for the remaining 3<sup>rd</sup> and 4<sup>th</sup> visits. This is similar to finding in a previous study in Bangladesh where only 39% of the newborn discharge from KMC had at least one post follow up visit [49]. However other studies have reported better follow up visits [50,51]. A study in Bangladesh reported 64% of newborn completed up to 3<sup>rd</sup> follow up visit while a study in Malawi reported that 88% of mothers and babies followed up at health facilities within 30 days, though the rate varied by sites [50,51]. Distance was cited as main reasons for not completing follow-up visit



and completion of follow-up visits was higher at facilities closer to home (lower level) [51]. A study in Ghana reported low dropout rate of less than 20% compared to what was expected over the four weeks of follow up and use of phone calls to follow up and remind mothers following discharge from hospital was reported as the strategy used to improve on the visits [52]. The low follow up visit in our study could have been attributed to distance, the study site is the only district referral newborn care facility which receive patients from other parts of the district some of which are very far. However, better follow up mechanism has to be considered to reduce the follow up dropout rate.

## 5. CONCLUSION

The study highlighted relatively high number of neonatal cases that are managed at this hospital and majority of causes of neonatal morbidity and mortality were preventable. Holistic approach to pregnancy, delivery and newborn care at all levels of the health system is essential to reduce neonatal morbidity and mortality in the district. All efforts should be made by the government and partners to ensure effective and quality maternal and newborn care services with strong community health system. Implementation of key newborn interventions including the newly defined newborn signal functions in Bangladesh is essential to reduce newborn deaths within the continuum of care at all levels of the health system in the district.

## 6. LIMITATION OF THE STUDY

The study was a retrospective hospital-based study and relied on the available data from the study site and so the finding cannot be used to generalize the pattern of newborn admission and mortality in the district. The analysis done in the study was limited to the information available in the hospital record and patients case notes. Despite this, our study is the first to be conducted in the study site and our findings provided relevant and useful information that can be used to improve newborn care services in the hospital and also in the whole district. Further studies are required to document the maternal risk factors and health system factors associated with newborn morbidity and mortality in the health facility.

## CONSENT

It's not applicable.

## ETHICAL APPROVAL

The approval to use the data was granted by the hospital management and all personal identifiers were not included in the data collected to ensure confidentiality.

## ACKNOWLEDGEMENTS

The authors would like to thank all the staff of the Special Care Newborn Unit of Cox's Bazar District hospital for their support during the study.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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