

Morbidity and mortality patterns of preterm low birth weight neonates admitted to Edward Francis Small Teaching Hospital in Banjul, The Gambia

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Abstract

Background

Preterm low birth weight (LBW) neonates are highly vulnerable to morbidity and mortality, particularly in resource-limited settings. Despite this burden, there is limited evidence on their clinical outcomes in The Gambia.

Methods

A retrospective study was conducted among preterm LBW neonates admitted to the neonatal intensive care unit (NICU) at Edward Francis Small Teaching Hospital (EFSTH), Banjul. Data were extracted from medical records and analyzed using SPSS version 20. Multivariate logistic regression analysis was performed to identify independent predictors of mortality, with statistical significance set at $p < 0.05$.

Results

The overall mortality rate was **40.1%**. The most common morbidities were respiratory distress syndrome (55.7%), hypoglycemia (54.9%), hypothermia (45.1%), neonatal jaundice (43.9%), birth asphyxia (29.9%), neonatal infections (27.0%), feeding difficulties (21.9%), and chronic lung disease (15.6%) .

Multivariate analysis identified **neonatal jaundice** and **pregnancy-induced hypertension (PIH)** as independent predictors of mortality.

Discussion

The high mortality rate observed highlights the significant burden of preterm LBW neonatal deaths in this setting. The predominance of conditions such as respiratory distress syndrome, metabolic disturbances, and neonatal jaundice reflects the vulnerability of this population. The strong association between neonatal jaundice and mortality may be due to increased susceptibility to severe hyperbilirubinemia in preterm infants. Similarly, maternal PIH contributes to adverse neonatal outcomes through its association with prematurity and intrauterine growth restriction.

Conclusion

Mortality among preterm LBW neonates remains high and constitutes a major public health concern. Strengthening antenatal care services, early identification and management of pregnancy-induced hypertension, and prompt diagnosis and treatment of neonatal jaundice are essential to improve neonatal survival. Further prospective studies are recommended

Background

Preterm low birth weight (LBW) remains a major global public health challenge and a leading cause of neonatal morbidity and mortality. There is a paucity of information on the morbidity and mortality patterns of preterm LBW neonates admitted to Edward Francis Small Teaching Hospital (EFSTH) in

Banjul, The Gambia. Despite the high burden of neonatal mortality in the region and the introduction of modern techniques in the neonatal intensive care unit (NICU) at EFSTH, preterm LBW neonates remain at high risk of developing multiple complications. A previous study in The Gambia identified preterm birth as a leading cause of neonatal morbidity and mortality (1).

The neonatal period, defined as the first 28 days of life, is the most vulnerable period for child survival, with the majority of deaths occurring from preventable causes (2). Globally, approximately 30 million newborns are at risk of preterm birth and low birth weight, with those born too soon or too small facing the greatest risk of death and long-term disability (3). In 2017 alone, about 2.5 million neonatal deaths occurred worldwide, accounting for nearly half of all under-five mortality (3, 4). It is estimated that more than 75% of these deaths could be prevented through simple, cost-effective interventions without the need for complex technological care (4).

Sub-Saharan Africa bears a disproportionate burden of neonatal mortality due to limited access to quality antenatal, intrapartum, and neonatal care services. In many low- and middle-income countries (LMICs), including The Gambia, a significant proportion of births are not adequately monitored, and many newborns are not even weighed at birth, posing a major challenge for accurate assessment and intervention (13). Additionally, early neonatal deaths are often not separately reported in national and global estimates, further obscuring the true burden (12).

Preterm neonates are particularly vulnerable due to physiological immaturity affecting multiple organ systems. They are predisposed to complications such as respiratory distress syndrome (RDS), hypothermia, hypoglycemia, neonatal infections including sepsis, jaundice, necrotizing enterocolitis (NEC), and birth asphyxia, all of which significantly contribute to morbidity and mortality. The risk and severity of these complications vary depending on gestational age and birth weight categories (7, 8). Preterm neonates are classified as extremely preterm (< 28 weeks), very preterm (28–32 weeks), moderate preterm (32–33⁶ weeks), and late preterm (34–36⁶ weeks) (7). Similarly, LBW is categorized into extremely low birth weight (ELBW), very low birth weight (VLBW), and low birth weight (LBW) based on birth weight thresholds (8).

Studies have shown that preterm LBW neonates often require prolonged hospital stays and are at increased risk of adverse neurodevelopmental outcomes, including cerebral palsy, visual impairment, delayed social development, and long-term neurological deficits (4). Although advances in neonatal care, including improved NICU technologies, have increased survival rates in high-income settings, they have also led to a rise in long-term disabilities among survivors (5). In contrast, many NICUs in low-resource settings lack essential equipment such as mechanical ventilators, continuous positive airway pressure (CPAP) machines, infusion pumps, and parenteral nutrition, which are critical for improving neonatal survival (7).

Neonatal infections, particularly sepsis, remain a major contributor to mortality among preterm LBW neonates and are associated with long-term complications such as impaired neuromotor development (6). Preventive strategies such as kangaroo mother care (KMC)—defined as continuous skin-to-skin

contact combined with exclusive breastfeeding—have been shown to significantly improve neonatal outcomes and promote bonding and parental well-being (9, 10).

Globally, the prevalence of prematurity was estimated at 10.6% in 2014, with regional variations, and slightly declined to 10.2% in 2019 (11). In many Asian and African countries, preterm LBW remains the leading risk factor for neonatal mortality (4). Extremely preterm and ELBW neonates carry the highest risk of death and complications (4). Evidence from Bangladesh, for example, showed that 12.4% of neonatal admissions were due to preterm LBW, accounting for 6.5% of deaths (4).

The Sustainable Development Goals (SDG 3, target 3.2) aim to reduce neonatal mortality to less than 12 per 1,000 live births by 2030 (1). Achieving this target requires strengthening health systems, improving early diagnosis and management of neonatal complications, and implementing cost-effective interventions such as infection prevention, thermal care, and improved clinical monitoring (14).

At EFSTH, the oldest public hospital and the main referral and teaching hospital in The Gambia, preterm LBW neonates constitute a significant proportion of NICU admissions. However, there is limited local evidence describing the patterns of morbidity and mortality and associated risk factors in this population.

Therefore, this study aimed to assess the morbidity and mortality patterns of preterm low birth weight neonates admitted to EFSTH and to identify factors associated with mortality. The findings are expected to inform clinical practice, guide policy, and support the development of targeted interventions to reduce neonatal morbidity and mortality in The Gambia.

Methods

Study Design and Population

A hospital-based retrospective descriptive cross-sectional study was conducted in the Neonatal Intensive Care Unit (NICU) of EFSTH.

The study population included all preterm low birth weight neonates (gestational age <37 weeks and birth weight $\leq$ 2500 g) admitted to the NICU during the study period. Data were obtained from the NICU records department.

A total of 257 neonatal case folders were reviewed using a convenience sampling technique, including all available and eligible records within the study period.

Inclusion and Exclusion Criteria

Inclusion criteria:

- Preterm neonates (<37 weeks gestation) with birth weight $\leq$ 2500 g
- Neonates admitted to the NICU at EFSTH during the study period

- Referred preterm LBW neonates from other health facilities
- Neonates with complete and accessible medical records

Exclusion criteria:

- Stillbirths
- Term low birth weight neonates
- Preterm neonates with birth weight >2500 g
- Incomplete or missing medical records

Variables and Definitions

Outcome variable:

- Neonatal outcome, categorized as alive (discharged) or death during NICU admission

Independent variables included:

1. Sociodemographic characteristics:
Neonatal age (hours/days), sex, maternal age, residence, education level, socioeconomic status, marital status, occupation, and referral facility.
2. Maternal and obstetric factors:
Chronic illnesses (e.g., diabetes mellitus, hypertension, HIV/AIDS) and pregnancy-related complications including pregnancy-induced hypertension (PIH), antepartum hemorrhage (APH), premature rupture of membranes (PROM), and TORCH infections.
3. Neonatal characteristics:
Place and mode of delivery, Apgar scores (1st and 5th minute), gestational age, birth weight, and antenatal care attendance.
4. Neonatal morbidities:
Including respiratory distress syndrome (RDS), neonatal jaundice, hypoglycemia, hypothermia, birth asphyxia, infections (sepsis, meningitis), feeding difficulties, chronic lung disease (CLD), necrotizing enterocolitis (NEC), intraventricular hemorrhage (IVH), retinopathy of prematurity (ROP), congenital anomalies, and failure to thrive (FTT).

Operational definitions:

- Morbidity: Any clinical diagnosis recorded in the neonatal medical records
- Mortality: Death occurring during NICU admission prior to discharge
- Pattern: Frequency and distribution of morbidity and mortality outcomes

Data Collection Procedures

Data were extracted retrospectively from neonatal case folders, referral forms, clinicians' notes, and nursing records using a structured checklist developed from relevant literature.

The checklist captured:

- Sociodemographic information
- Maternal and obstetric factors
- Neonatal characteristics
- Morbidity and clinical outcomes

No direct patient contact was involved. Access to records was granted upon presentation of ethical approval.

Data Analysis

Data were checked for completeness and consistency, coded, and entered into Microsoft Excel, then exported to SPSS version 20 for analysis.

- Descriptive statistics were used to summarize variables (frequencies, percentages, means)
- Bivariate analysis was conducted to identify associations between independent variables and mortality
- Variables with $p < 0.05$ were included in multivariate logistic regression to identify independent predictors of mortality
- Statistical significance was set at $p < 0.05$ with 95% confidence intervals

Quality Control

Data quality was ensured through:

- Use of a standardized data extraction tool
- Independent review and supervision by two academic supervisors
- Cross-checking and validation of entered data before final analysis

Results

A total of 257 preterm LBW neonates case folders was reviewed for this study, out of which was an incomplete 15 case folders for only preterm neonates plus 5 case folders for only LBW neonates, and so 20 (7.8%) case folders were excluded. The remaining 237 preterm LBW neonates were included in the data analysis of this study making a response rate of 92.2%.

Neonatal and maternal sociodemographic characteristics

Out of the 237 sampled neonates, (n = 120; 50.6%) were female and (n = 117; 49.4%) were male. So, about 1.2% difference between both sex of the neonate, and the slight majority were female. The neonates admitted within 1–24 hours of age were (82.3%), and the mothers of 99 (41.8%) of the neonates belonged to the age category of 24–35 years. Most of the mothers reside in the urban area (76.4%), about 230 (97.0%) were married, majority had no formal education (73.0%), mainly multipara (54.4%) mothers and from a low socio-economic status (85.7%). Many participants (89.1%) had duration of hospital stay < 3 weeks. Most of the referral were from EFSTH (48.9%), followed by BDH (18.9%), however, about (28.4%) from EFSTH died, (51.1%) from BDH died, (63.6%) from KGH died, (100%) from BMCH died, (38.5%) from EDH died, (46.4%) from OTHERS died, and (33.3%) from FMHC died (Table 1)

Table 1

Neonatal and maternal sociodemographic characteristics of preterm LBW neonates admitted to EFSTH, Banjul, The Gambia (n = 237)

Characteristics	Category	Total, n (%) n = 237	Alive, n (%) n = 142	Death, n (%) n = 95	p value
Sex of the neonate	Female	120 (50.6)	72 (60)	48 (40)	0.900
	Male	117 (49.4)	70 (59.8)	47 (40.2)	
Neonatal age at admission	1–24 hours	195 (82.3)	117 (60)	78 (40)	
	1–7 day	26 (10.9)	17 (65.4)	9 (34.6)	
	> 7 day	16 (6.8)	8 (50)	8 (50)	
Maternal age (years)	0 / no record	38 (16.0)	22 (57.9)	16 (42.1)	
	15–23	70 (29.5)	43 (61.4)	27 (38.6)	
	24–35	99 (41.8)	60 (60.6)	39 (39.4)	
	36–48	30 (12.7)	18 (60)	12 (40)	
Residence	Rural	56 (23.6)	29 (51.8)	27 (48.2)	
	Urban	181 (76.4)	113 (62)	68 (38)	
Marital status	Single	7 (3.0)	6 (85.7)	1 (14.3)	
	Married	230 (97.0)	136 (59)	94 (41)	
Socioeconomic status	Low	203 (85.7)	122 (60)	81 (40)	
	Moderate	32 (13.5)	19 (59.4)	13 (40.6)	
	High	2 (0.8)	1 (50)	1 (50)	
Formal educational level	Educated	64 (27.0)	44 (68.8)	20 (31.2)	
	Not educated	173 (73.0)	98 (56.6)	75 (43.4)	
Occupation of mom	Housewife	163 (68.8)	94 (57.7)	69 (42.3)	0.156
	Teacher	9 (3.8)	9 (100)	0 (0)	
	Business	23 (9.7)	11 (47.8)	12 (52.2)	
	Farmer	14 (5.9)	7 (50)	7 (50)	
	Student	9 (3.8)	6 (66.7)	3 (33.3)	
	Unemployed	1 (0.4)	1 (100)	0 (0)	

Characteristics	Category	Total, n (%) n = 237	Alive, n (%) n = 142	Death, n (%) n = 95	p value
	Others	18 (7.6)	14 (77.8)	4 (22.2)	
Parity	Primipara	72 (30.4)	45 (62.5)	27 (37.5)	
	Multipara	129 (54.4)	79 (61.2)	50 (38.8)	
	Grand multipara	36 (15.2)	18 (50)	18 (50)	
Referral	EFSTH	116 (48.9)	83 (71.6)	33 (28.4)	0.107
	KGH	22 (9.3)	8 (36.4)	14 (63.6)	
	BDH	45 (18.9)	22 (48.9)	23 (51.1)	
	FMHC	9 (3.8)	6 (66.7)	3 (33.3)	
	EDH	13 (5.5)	8 (61.5)	5 (38.5)	
	BMCH	4 (1.7)	0 (0)	4 (100)	
	Others	28 (11.8)	15 (53.6)	13 (46.4)	
Duration of hospital stay	< 3 weeks	211 (89.1)	120 (57)	91 (43)	0.002
	3–4 weeks	15 (6.3)	14 (93.3)	1 (6.7)	0.024
	1–2 months	10 (4.2)	7 (70)	3 (30)	0.418
	> 2 months	1 (0.4)	1 (100)	0 (0)	0.900

Table 2

Maternal medical conditions and obstetric complications of preterm LBW neonates admitted to EFSTH, Banjul, The Gambia (n = 237)

Characteristics	Category	Total, n (%) n = 237	Alive, n (%) n = 142	Death, n (%) n = 95	p-value
Medical: HIV&AIDS	Yes	8 (3.4)	4 (50)	4 (50)	
	No	229 (96.6)	138 (60)	91 (40)	
DM	Yes	2 (0.8)	1 (50)	1 (50)	
	No	235 (99.2)	141 (60)	94 (40)	
Mental illness	Yes	1 (0.4)	1 (100)	0 (0)	
	No	236 (99.6)	141 (60)	95 (40)	
Others; chronic HTN	Yes	17 (7.2)	9 (52.9)	8 (47.1)	
	No	220 (92.8)	133 (60)	87 (40)	
Obstetric: gestation	Yes	3 (1.3)	1 (33.3)	2 (66.7)	
-al DM	No	234 (98.7)	141 (60)	93 (40)	
APH	Yes	25 (10.5)	14 (56)	11 (44)	0.673
	No	212 (89.5)	128 (60)	84 (40)	
PIH	Yes	67 (28.3)	47 (70.1)	20 (29.9)	0.045
	No	170 (71.7)	95 (55.9)	75 (44.1)	
Polyhydramnios /	Yes	9 (3.8)	5 (55.6)	4 (44.4)	
Oligohydramnios	No	228 (96.2)	137 (60)	91 (40)	
PROM	Yes	86 (36.3)	54 (62.8)	32 (37.2)	0.496
	No	151 (63.7)	88 (52.3)	63 (41.7)	
Others; TORCH, anemia, malaria	Yes	47 (19.8)	25 (53.2)	22 (46.8)	0.295
	No	190 (80.2)	117 (62)	73 (38)	

Maternal and obstetric related characteristics

The majority (n = 86; 36.3%) of preterm LBW neonates were born to mothers who had a PROM, and (n = 67;28.3%) were born to mothers who had a diagnosis of PIH (Table 2).

Neonatal characteristics

The vast majority (n = 231;97.5%) of preterm LBW neonates were born in health facilities. The majority (n = 161;67.9%) of these were born via SVD, spontaneous vaginal delivery, and mostly (n = 199;84.0%) singleton delivery. 130 (54.9%) preterm LBW neonates had a 1 min Apgar score of > 7. 192 (81.0%) preterm LBW neonates had a 5 min Apgar score of > 7. The majority (n = 95;40.1%) were late preterm neonates, and (n = 128;54.0%) were LBW neonates. Most (n = 122;51.5%) of the antenatal visits were 4–6 visits (Table 3)

Table 3

Neonatal characteristics of preterm LBW neonates admitted to EFSTH, Banjul, The Gambia (n = 237)

Characteristics	Category	Total, n (%) n = 237	Alive, n (%) n = 142	Death, n (%) n = 95	P value
Place of delivery	Health/Facility	231 (97.5)	138 (60)	93 (40)	
	Home	6 (2.5)	4 (66.7)	2 (33.3)	
Mode of delivery	CS	76 (32.1)	51 (67.1)	25 (32.9)	
	SVD	161 (67.9)	91 (56.5)	70 (43.5)	
Type of delivery	Singleton	199 (84.0)	116 (58.3)	83 (41.7)	
	Multiple	38 (16.0)	26 (68.4)	12 (31.6)	
Apgar score 1st minute	< 7	107 (45.1)	50 (46.7)	57 (53.3)	0.001
	≥ 7	130 (54.9)	92 (70.8)	38 (29.2)	0.001
Apgar score 5th minute	< 7	45 (19.0)	17 (37.8)	28 (62.2)	0.001
	≥ 7	192 (81.0)	125 (65.1)	67 (34.9)	0.001
EGA (weeks)	< 28 (extreme)	34 (14.3)	6 (17.6)	28 (82.4)	0.001
	28–32 (very)	57 (24.1)	38 (66.7)	19 (33.3)	0.001
	32–33 (moderate)	51 (21.5)	39 (76.5)	12 (23.5)	0.001
	34–36 (late)	95 (40.1)	59 (62.1)	36 (37.9)	0.001
Birth weight (kg)	< 1 (ELBW)	25 (10.6)	0 (0)	25 (100)	
	≥ 1 - <1.5 (VLBW)	84 (35.4)	53 (63.1)	31 (36.9)	
	≥ 1.5 - <2.5 (LBW)	128 (54.0)	89 (69.5)	39 (30.5)	0.330
Antenatal visits	0	6 (2.5)	3 (50)	3 (50)	
	1–3	103 (43.5)	59 (57.3)	44 (42.7)	
	4–6	122 (51.5)	75 (61.5)	47 (38.5)	
	Do not know	6 (2.5)	5 (83.3)	1 (16.7)	0.239

*key. CS; Caesarean section. SVD; spontaneous vaginal delivery. EGA: Estimated gestational age.

Morbidity and mortality pattern of preterm low birth weight neonates**Morbidity distribution**

This study indicated that 132 (55.7%), 64 (27%), 130 (54.9%), 107 (45.1%), 37 (15.6%), 202 (14.8%), 104 (43.9%), 52 (21.9%), 71 (29.9%), 33 (13.9%), 82 (34.6%), 22 (9.3%), 21 (8.9%), 14 (5.9%), 21 (8.9%), and 16 (6.8%) preterm LBW neonates were diagnosed with RDS, neonatal infections, hypoglycemia, hypothermia, CLD, anemia, neonatal jaundice, feeding difficulty, birth asphyxia, congenital anomaly, risk for sepsis, FTT, ICH, PVL, AKI, and NEC, respectively. Most participants who had a diagnosis with RDS (53%), neonatal infections (50%), NEC (75%), hypoglycemia (47%), hypothermia (44.9%), CLD (81.1%), feeding difficulty (63.5%), AKI (90.5%), birth asphyxia (59.2%), ICH (95.2%), PVL (92.9%), and neonatal jaundice (26%) died (**TABLE 4**).

Table 4 Overall morbidity characteristics of preterm LBW neonates admitted to EFSTH, Banjul, The Gambia (n=237)

Characteristics	Category	Total, n (%) n=237	Alive, n (%) n=142	Death, n (%) n=95	p value
Respiratory distress syndrome	Yes	132 (55.7)	62 (47.0)	70 (53.0)	0.001
	No	105 (44.3)	80 (76.2)	25 (23.8)	
Neonatal infections; sepsis, meningitis	Yes	64 (27.0)	32 (50)	32 (50)	0.059
	No	173 (73.0)	110 (63.6)	63 (36.4)	
NEC	Yes	16 (6.8)	4 (25)	12 (75)	
	No	221 (93.2)	138 (62.4)	83 (37.6)	
Hypoglycemia	Yes	130 (54.9)	69 (53.0)	61 (47.0)	0.018
	No	107 (45.1)	73 (68.2)	34 (31.8)	
Hypothermia	Yes	107 (45.1)	59 (55.1)	48 (44.9)	0.174
	No	130 (54.9)	83 (63.8)	47 (36.2)	
Chronic lung disease	Yes	37 (15.6)	7 (18.9)	30 (81.1)	0.001
	No	200 (84.4)	135 (68)	65 (32)	
Anemia	Yes	35 (14.8)	23 (65.7)	12 (34.3)	
	No	202 (85.2)	119 (58.9)	83 (41.1)	
Neonatal jaundice	Yes	104 (43.9)	77 (74)	27 (26)	0.001
	No	133 (56.1)	65 (48.9)	68 (51.1)	
Feeding difficulty	Yes	52 (21.9)	19 (36.5)	33 (63.5)	0.001
	No	185 (78.1)	123 (66)	62 (34)	
Acute kidney injury	Yes	21 (8.9)	2 (9.5)	19 (90.5)	0.001
	No	216 (91.1)	140 (64.8)	76 (35.2)	
Birth asphyxia	Yes	71 (29.9)	29 (40.8)	42 (59.2)	0.001
	No	166 (70.1)	113 (68)	53 (32)	
Congenital anomaly	Yes	33 (13.9)	15 (45.5)	18 (54.5)	0.071
	No	204 (86.1)	127 (62.3)	77 (37.7)	
Intracranial hemorrhage	Yes	21 (8.9)	1 (4.8)	20 (95.2)	0.001
	No	216 (91.1)	141 (65.3)	75 (34.7)	
Periventricular	Yes	14 (5.9)	1 (7.1)	13 (92.9)	0.003

leukomalacia	No	223 (94.1)	141 (63.2)	82 (36.8)
Risk for sepsis	Yes	82 (34.6)	42 (51.2)	40 (48.8)
	No	155 (65.4)	100 (64.5)	55 (35.5)
Others; FTT, ROP	Yes	22 (9.3)	13 (59)	9 (41)
	No	215 (90.7)	129 (60)	86 (40)

Table 5 Morbidity distribution of Preterm LBW neonates admitted to EFSTH, Banjul, The Gambia (n=237)

Characteristics	Category	RDS	NI	HGM	HTM	CLD	FD	BA	NJ	AKI
Sex of the neonate	Female	47.5	29.2	52.5	51.7	12.5	17.5	25.8	39.2	8.3
	Male	64.1	24.8	57.3	38.5	18.8	26.5	34.2	48.7	9.4
Duration of hospital stay	<3 weeks	54.5	26.1	54.0	46.0	15.2	21.3	30.3	39.8	9.5
	3-4 weeks	66.7	40.0	40.0	26.7	26.7	13.3	33.3	86.7	6.7
	>1-2 months	60.0	30.0	90.0	60.0	10.0	50.0	10.0	60.0	0
	>2 months	100	0	100	0	0	0	100	100	0
Maternal formal education	Educated	48.4	28.1	64.1	40.6	15.6	21.9	23.4	56.2	7.8
	Not educated	58.4	26.6	51.4	46.8	15.6	22.0	32.4	39.3	9.2
Marital status	Single	42.9	42.9	42.9	42.9	14.3	14.3	14.3	42.9	0
	Married	56.1	26.5	55.2	45.2	15.7	22.2	30.4	43.9	9.1
Parity	Primipara	48.6	30.6	56.9	37.5	15.3	13.9	27.8	48.6	8.3
	Multipara	58.9	23.3	53.5	48.8	15.5	26.4	34.1	46.5	8.5
	Grand multipara	58.3	33.3	55.6	47.2	16.7	22.2	19.4	25.0	11.1
Socioeconomic Status	Low	57.1	26.1	52.2	45.3	16.3	22.7	30.5	43.8	9.9
	Moderate	46.9	34.4	71.9	46.9	12.5	18.8	25.5	46.9	3.1
	High	50.0	0	50.0	0	0	0	50.0	0	0
Maternal chronic HTN	Yes	41.2	17.6	47.1	41.2	11.8	11.8	11.8	23.5	11.8
	No	56.8	27.7	55.5	45.5	15.9	22.7	31.4	45.5	8.6
Mode of delivery	C/S	60.5	19.7	60.5	53.9	17.1	17.1	42.1	40.8	6.6
	SVD	53.4	30.4	52.2	41.0	14.9	24.2	24.2	45.3	9.9
APH	Yes	80.0	16.0	68.0	48.0	20.0	20.0	52.0	40.0	8.0
	No	52.8	28.3	53.3	44.8	15.1	22.2	72.2	44.3	9.0
PIH	Yes	52.2	17.9	61.2	50.7	14.9	19.4	26.9	44.8	7.5
	No	57.1	30.6	52.4	42.9	15.9	22.9	31.2	43.5	9.4
PROM	Yes	57.0	32.6	53.5	48.8	16.3	26.7	25.6	46.5	8.1
	No	55.0	23.8	55.6	43.0	15.2	19.2	32.5	42.4	9.3

Apgar score	<7	80.4	26.2	61.7	46.7	25.2	21.5	48.6	43.0	12.1
1st minute	≥7	35.4	27.7	49.2	43.8	7.7	22.3	14.6	44.6	6.2
Apgar score	<7	97.8	26.7	64.4	55.6	35.6	26.7	62.2	33.3	17.8
5th minute	≥7	45.8	27.1	52.6	42.7	10.9	20.8	22.4	46.4	6.8

*key. NI; neonatal infections. HGM; hypoglycemia. HTM; hypothermia. NJ; neonatal jaundice. BA; birth asphyxia. CA; congenital anomaly. FD; feeding difficulty.

Morbidity distribution with maternal and neonatal characteristics

In this study, RDS was observed in 64.1%, 100%, 60.5%, 80.0%, 80.4% and 97.8% of the male neonates, neonates with >2 months duration of hospital-stay, neonates born via caesarian section, neonates born to mothers with APH, neonates with <7 Apgar score in 1st minute, and neonates with <7 Apgar score in 5th minute, respectively (**TABLE 5**).

Table 6 Multivariate logistic regression of independent predictors of preterm LBW neonatal mortality at EFSTH, Banjul, The Gambia (n=237)

Predictor Variable	Category	AOR	95% CI	p value
Apgars score at 5 th minute	>7 (normal)	1.00(Ref)		
	<7(low)	2.04	0.24 - 1.00	0.051
Pregnancy-induced hypertension	No	1.00(Ref)		
	Yes	2.36	1.15 - 5.03	0.022*
Neonatal jaundice	No	1.00(Ref)		
	Yes	4.81	2.41 - 10.16	<0.001*

key. AOR; Adjusted odds ratio. CI: Confidence Interval, Ref= Reference category. Bold values with asterisk() denote statistically significant factors (p <0.05).

Predictors of Preterm Low-Birth-Weight Neonatal Mortality

A multivariate logistic regression model was utilized to determine the independent clinical predictors of neonatal mortality among the cohort of preterm, low-birth-weight (LBW) infants (n = 237). After adjusting for potential confounding factors, maternal pregnancy-induced hypertension (PIH) and neonatal jaundice emerged as statistically significant independent predictors of mortality. Neonates who developed neonatal jaundice experienced the highest risk of mortality, with nearly a fivefold increase in odds compared to those without jaundice (AOR = 4.81, 95% CI: 2.41 - 10.16, p < 0.001). Maternal pregnancy-

induced hypertension was also strongly associated with a poor prognosis; infants born to mothers with PIH had more than double the odds of neonatal death compared to those born to normotensive mothers (AOR = 2.36, 95% CI: 1.15 - 5.03, $p = 0.022$). Conversely, a low Apgar score at the 5th minute (score less than 7) demonstrated a downward trend toward increased mortality, but this association did not reach statistical significance within the multivariate framework (AOR = 2.04, 95% CI: 0.24 - 1.00, $p = 0.051$) (TABLE 6).

Discussion

This retrospective study was conducted to determine the morbidity and mortality patterns of preterm low birth weight (LBW) neonates and to identify factors associated with mortality at Edward Francis Small Teaching Hospital (EFSTH). The overall mortality rate observed in this study was 40.1%, indicating a substantial burden and highlighting persistent challenges in neonatal care within this setting.

The mortality rate reported in this study is higher than findings from studies conducted in Ethiopia (37.8%) (4) and Iran (28.7%) (15). This variation may be explained by differences in study settings and inclusion criteria. The Ethiopian study was conducted across two referral NICUs, thereby distributing high-risk neonates across facilities, whereas EFSTH serves as the main national referral center, concentrating more critically ill neonates. Additionally, the Iranian study excluded neonates with severe congenital malformations, while the present study included such cases, potentially increasing the observed mortality.

In contrast, the mortality rate in this study is lower than that reported in a rural prospective study conducted in Telangana, India (88.8%) (16). This discrepancy may be attributed to differences in study design and population characteristics. Prospective studies in rural settings often capture more severe and unmanaged cases, whereas retrospective studies may underestimate mortality due to missing or incomplete data.

The most common morbidities identified in this study were respiratory distress syndrome (RDS) (55.7%), hypoglycemia (54.9%), hypothermia (45.1%), neonatal jaundice (43.9%), birth asphyxia (29.9%), neonatal infections (27.0%), feeding difficulties (21.9%), and chronic lung disease (CLD) (15.6%). These findings are consistent with studies conducted in India (16, 17, 19), Nepal (18), and Australia (20), which similarly identified these conditions as leading causes of NICU admissions among preterm LBW neonates.

Neonatal jaundice was found to be an independent predictor of mortality, with affected neonates having nearly fivefold increased odds of death (AOR 4.81; 95% CI 2.41–10.16; $p < 0.001$). This finding is consistent with a study conducted in Pakistan (21). The increased risk may be attributed to the vulnerability of preterm LBW neonates to severe hyperbilirubinemia due to immature hepatic function and increased red blood cell breakdown. Clinically significant jaundice requiring treatment occurs in approximately 50–80% of preterm neonates (22).

Maternal pregnancy-induced hypertension (PIH) was also significantly associated with neonatal mortality, with more than double the odds of death (AOR 2.36; 95% CI 1.15–5.03; $p = 0.022$). This finding

aligns with studies conducted in Australia (20). PIH, including preeclampsia and eclampsia, contributes to adverse pregnancy outcomes such as placental insufficiency, intrauterine growth restriction, and preterm delivery, all of which increase neonatal mortality risk (23).

Although a low 5-minute Apgar score (< 7) showed a trend toward increased mortality, this association did not reach statistical significance in multivariate analysis (AOR 2.04; $p = 0.051$). This finding is comparable to studies conducted in Uganda (24), Bangladesh (25), and China (26), where low Apgar scores were associated with adverse outcomes but were not always independently predictive after adjustment.

Prematurity and low birth weight increase susceptibility to infections due to immature immune function. Additionally, prolonged oxygen therapy predisposes neonates to chronic lung disease (CLD), contributing to both morbidity and mortality, as reported in studies from China (26) and South Korea (27). Neonatal sepsis further contributes to CLD development through mechanisms involving inflammation, oxidative stress, and lung injury (28).

Interestingly, neonatal infections were not independently associated with mortality in this study. This may reflect the availability of broad-spectrum antibiotic therapy, basic laboratory investigations, and timely diagnosis at EFSTH, enabling early and effective management of infections. Furthermore, the implementation of kangaroo mother care (KMC)—which promotes thermal regulation, breastfeeding, and infection prevention—may contribute to improved neonatal outcomes (10).

Conclusion

This study demonstrates that the mortality rate of preterm LBW neonates remains high (40.1%), representing a significant public health concern in The Gambia. The most common morbidities identified were RDS, hypoglycemia, hypothermia, neonatal jaundice, birth asphyxia, neonatal infections, feeding difficulties, and CLD.

Importantly, neonatal jaundice and pregnancy-induced hypertension (PIH) were identified as independent predictors of mortality. These findings highlight the need for targeted interventions focusing on early detection and management of these conditions to improve neonatal survival.

Limitations

This study has several limitations. First, the retrospective design may have resulted in incomplete or missing data, potentially affecting the accuracy of findings. Second, the study was conducted at a single tertiary referral hospital, which may limit the generalizability of results to other settings. Third, the inclusion of neonates with severe congenital anomalies may have contributed to an overestimation of mortality rates.

Recommendations

To reduce morbidity and mortality among preterm LBW neonates in The Gambia, the following recommendations are proposed:

- Strengthen antenatal care services, particularly early detection and management of pregnancy-induced hypertension (PIH) through routine blood pressure monitoring and urinalysis.
- Improve referral systems and maternal care at regional hospitals such as Bundung Maternal and Child Health Hospital (BMCH), Bansang Hospital (BDH), and Kanifing General Hospital (KGH).
- Implement routine screening and early management of neonatal jaundice, including serum bilirubin monitoring and timely phototherapy.
- Enhance capacity of NICUs by improving availability of essential equipment such as CPAP machines, incubators, and monitoring devices.
- Promote and scale up kangaroo mother care (KMC) as a cost-effective intervention to improve neonatal survival.
- Strengthen infection prevention and control measures and ensure timely antibiotic therapy.
- Educate mothers and families on the importance of regular antenatal visits and early recognition of neonatal danger signs.
- Conduct prospective, multicenter studies to further investigate risk factors and improve generalizability of findings.

Abbreviations

- **AIDS** – Acquired Immunodeficiency Syndrome
- **AKI** – Acute Kidney Injury
- **AOR** – Adjusted Odds Ratio
- **APH** – Antepartum Hemorrhage
- **BDH** – Brikama District Hospital
- **BMCH** – Bundung Maternity and Child Health Hospital
- **CI** – Confidence Interval
- **CIOMS** – Council for International Organizations of Medical Sciences
- **CLD** – Chronic Lung Disease
- **DM** – Diabetes Mellitus
- **EDH** – Essau District Hospital
- **EGA** – Estimated Gestational Age
- **EFSTH** – Edward Francis Small Teaching Hospital
- **FMHC** – Fajikunda Major Health Centre
- **FTT** – Failure to Thrive
- **HIV** – Human Immunodeficiency Virus

- **HTN** – Hypertension
- **IVH** – Intraventricular Hemorrhage
- **KGH** – Kanifing General Hospital
- **LBW** – Low Birth Weight
- **NEC** – Necrotizing Enterocolitis
- **NICU** – Neonatal Intensive Care Unit
- **PIH** – Pregnancy-Induced Hypertension
- **PROM** – Premature Rupture of Membranes
- **PVL** – Periventricular Leukomalacia
- **ROP** – Retinopathy of Prematurity
- **RDS** – Respiratory Distress Syndrome
- **SPSS** – Statistical Package for the Social Sciences
- **TORCH** – Toxoplasmosis, Other Infections, Rubella, Cytomegalovirus, Herpes Simplex Virus

Declarations

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Ethical Considerations

Ethical approval was obtained from the Research Ethics Committee of EFSTH (Approval No: EFSTH_REC_2024084).

The study adhered to the Declaration of Helsinki and CIOMS International Ethical Guidelines for Health Research Involving Humans.

Patient confidentiality was strictly maintained:

- No identifiers were recorded
- Data were used solely for research purposes

The requirement for informed consent was waived due to the retrospective nature of the study and absence of direct patient interaction

Clinical Trial Registration

Not applicable.

Disclosure statement

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Availability of Data and Materials

All data generated or analyzed during this study are included in this published article. Additional details are available from the corresponding author on reasonable request

Author contribution

1. Mariama Gassama; conceptualisation, data collection, data analysis, and writing the original manuscript.
2. Sana M. Ceesay; conceptualisation, data visualization, review and draft manuscript preparations.
3. Sang Mendy; Data Visualisation and Analysis
4. Muhammed Manka; Data Analysis and Visualization.
5. Lamin Makalo; co-supervisor, advice on study methodology, data visualization, manuscript preparation.
6. Adoulwahab Sallah; co-supervisor, advice on research project selection, advice on situation of preterm low birthweight neonates in NICU, and review of original manuscript.
7. Augusta Eneh; supervision and manuscript preparation

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