Scientific Research Publishing

Open Journal of Pediatrics, 2026, 16(3), 404-412
https://www.scirp.org/journal/ojped
ISSN Online: 2160-8776
ISSN Print: 2160-8741

Survival and Determinants of Mortality among Extremely Low Birth Weight Newborns in a Tertiary Hospital in Burkina Faso

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How to cite this paper: Ouattara, C.Z., Dembélé, A., Kaboré, R., Sawadogo, O., Ouattara, R., Ouédraogo, F., Kalmogho, A., Yonaba, C. and Kouéta, F. (2026) Survival and Determinants of Mortality among Extremely Low Birth Weight Newborns in a Tertiary Hospital in Burkina Faso. *Open Journal of Pediatrics*, **16**, 404-412.
https://doi.org/10.4236/ojped.2026.163040

Received: March 5, 2026
Accepted: March 27, 2026
Published: March 30, 2026

Abstract

Introduction: Neonatal mortality remains a major global public health challenge. Extremely low birth weight (ELBW) newborns (<1000 g) represent the most vulnerable group, particularly in low-resource settings. This study aimed to evaluate hospital survival and identify determinants of mortality among ELBW newborns hospitalized in a tertiary hospital in Burkina Faso. **Methods:** A retrospective analytical cohort study was conducted in the neonatal unit of Yalgado Ouédraogo University Hospital between October 2021 and September 2024. All newborns with a birth weight <1000 g and an exploitable medical record were included. Survival probabilities were estimated using the Kaplan-Meier method. Determinants of mortality were identified using multivariate logistic regression. **Results:** A total of 110 ELBW newborns were included. The mean birth weight was 810 g (range 500 - 990 g) and the mean gestational age was 29 weeks (22 - 34 weeks). Overall hospital mortality was 71%. Kaplan–Meier analysis showed survival probabilities of 72% at 24 hours, 48% at 7 days, and 29% at 28 days. The median survival time was 4 days. Independent factors associated with mortality were male sex (OR 3.92 [1.34 - 11.49]), respiratory distress (OR 3.39 [1.14 - 10.04]), while birth weight ≥900 g was associated with improved survival (OR 0.20 [0.05 - 0.87]). **Conclusion:** Survival among ELBW newborns remains extremely limited in this resource-constrained setting. Strengthening perinatal care, early respiratory support, and neonatal intensive care capacities is essential to improve outcomes.

Keywords

Extremely Low Birth Weight Infants, Neonatal Mortality, Prematurity, Survival Analysis, Low-Resource Setting, Burkina Faso

1. Introduction

Neonatal mortality remains a major global public health issue. In 2023, approximately 2.3 million newborns died during their first month of life, accounting for nearly half of all deaths among children under five [1]. Prematurity and low birth weight are the main causes of these deaths, particularly in countries with limited resources [2] [3]. Among low-birth-weight newborns, those with extremely low birth weight (<1000 g) represent the most vulnerable group. These newborns constitute a particularly high-risk group due to the immaturity of their respiratory, metabolic, and immune functions [3]-[6]. The prognosis for these children depends heavily on the quality of specialized perinatal and neonatal care, including antenatal corticosteroid therapy, neonatal resuscitation, respiratory support, and appropriate nutrition [7] [8]. In high-income countries, advances in perinatal medicine have led to dramatic improvements in the survival of extremely low birth weight newborns, with survival rates exceeding 80% in specialized centers [5] [6]. In contrast, in low-resource countries, mortality among newborns weighing less than 1000 g remains very high, which may exceed 70% to 90%, due to limitations of the technical care platform and healthcare organization [7]-[10].

Sub-Saharan Africa has the highest neonatal mortality rates in the world, estimated around 27 deaths per 1000 live births [1]. In this region, premature and low birth weight newborns contribute disproportionately to neonatal mortality [3]. The survival of extremely low birth weight newborns is a particular challenge, requiring intensive neonatal care that is often unavailable in resource-limited settings [11]-[13].

In Burkina Faso, neonatal mortality remains high despite progress made in maternal and child health [14]. Low birth weight newborns account for a significant proportion of neonatal admissions and hospital deaths. However, specific statistical data on extremely low birth weight infants (<1000 g) remain limited, particularly in tertiary hospitals where the most severe cases are referred.

In this context, the survival of extremely low birth weight newborns is a sensitive indicator of the quality of perinatal and neonatal care. Identifying the determinants of mortality in this particularly vulnerable group is essential for guiding strategies to improve care and contribute to reducing neonatal mortality.

The objective of this study was to evaluate hospital survival and identify the determinants of mortality among extremely low birth weight newborns (<1000 g) hospitalized in a tertiary hospital in Burkina Faso.

2. Methods

2.1. Study Design and Setting

We conducted a retrospective analytical cohort study in the neonatal unit of Yalgado Ouédraogo University Hospital, the main national tertiary referral center in Burkina Faso from October 1st, 2021 to September 30th, 2024.

2.2. Study Population

All newborns admitted to the neonatal unit during the study period with a birth weight <1000 g were eligible. They were either born in the maternity ward of the hospital (inborn) or referred from another health facilities (outborn).

2.3. Inclusion Criteria

- Birth weight <1000 g.
- Admission to the neonatal unit.
- Available and complete medical record.

2.4. Exclusion Criteria

- Missing key clinical data.
- Prior hospitalization elsewhere.

2.5. Variables Studied

The variables studied included maternal variables (age, number of pregnancies, prenatal consultations, residence, socioeconomic status) and neonatal variables (weight, gestational age, sex, respiratory distress, temperature). Gestational age was estimated using the last menstrual period, obstetric ultrasound when available, or Valery Farr score. Respiratory distress was defined as the presence of at least two of the following criteria: change in respiratory rate (tachypnea >60 breaths/min or bradypnoea (<30 breaths/min); signs of pulmonary retraction (nasal flaring, intercostal retraction, xiphoid retraction, expiratory grunting, poor thoracoabdominal synchronization); cyanosis; oxygen requirement.

Hypothermia was defined as axillary temperature <36.5˚C and fever has axillary temperature ≥37.5˚C according to WHO criteria.

The main outcome variable was hospital survival.

2.6. Statistical Analysis

Data were analyzed using STATA version 15. Missing data were assessed for each variable. Variables with more than 10% missing data were excluded from multivariable analysis. Cases with missing values for selected predictors were excluded using a complete-case analysis approach. Continuous variables were expressed as mean ± SD, and categorical variables as frequencies and percentages. Survival probability was estimated using the Kaplan-Meier method with birth as the starting time, death as the event, and discharge alive as censoring. Although time-to-event data were available, logistic regression was used to identify independent predictors of in-hospital mortality because the primary objective was to evaluate overall mortality during hospitalization rather than time-dependent hazards. A Cox proportional hazards model produced similar results (data not shown).

Factors associated with mortality were identified using multivariate logistic regression. Statistical significance was set at $p < 0.05$. Variables with $p < 0.20$ in univariate analysis and clinically relevant variables were included in the multivariable

logistic regression model. Collinearity between predictors was assessed using variance inflation factors.

3. Results

3.1. Hospitalization Rate

During the study period, 110 extremely low birth weight newborns were admitted among 1528 neonatal hospitalizations, representing 7.2% of all neonatal admissions.

3.2. Characteristics of Mothers and Newborns

• **Mothers' characteristics**

Most mothers were aged between 18 and 35 years (82.7%). Rural residence was reported in 67.3% of cases and 87.3% had a low socioeconomic status. More than half of mothers (57.3%) had attended only 2 - 3 antenatal care visits, and only 6.3% had ≥4 visits (Table 1).

Table 1. Distribution of newborns according to the sociodemographic and obstetric characteristics of their mothers.

Sociodemographic characteristics	Number	Percentage
Age (in years)		
Under 18	13	11.8
18 to 35	91	82.7
Over 35	06	05.5
Residence		
Urban	36	32.7
Rural	74	67.3
Socioeconomic status		
Low	96	87.3
Medium	14	12.7
Pregnancies Number		
1	55	50.0
2 to 5	52	47.3
Over 5	3	02.7
Prenatal care visit Number		
0 to 1	40	36.4
2 to 3	63	57.3
4 and above	7	06.3

3.3. Newborns Characteristics

The mean birth weight was 810 g (500 - 990 g) and mean gestational age was 29 weeks (22 - 34 weeks). Female newborns accounted for 61% of cases. The median time to admission was 4.4 hours, ranging from 30 minutes to 40 hours. Clinical conditions included respiratory distress: 68.2% and hypothermia: 45.5% (Table 2).

Table 2. Newborns characteristics (n = 110).

Variables	n	Percentage
Female sex	67	61
Birth weight (grammes)		
≥900	28	25.5
<900	82	74.5
Birthplace		
Inborn	29	26.4
Outborn	81	73.6
Admission deadline (hours)		
<6	72	66
6 - 12	19	17
>12	19	17
Respiratory distress	75	68.2
Hypothermia	50	45.5

3.4. Survival Analysis

Overall hospital mortality was 71% (78/110).

Kaplan–Meier analysis showed a rapid decline in survival during the first days of life with an estimated probability of 72% at 24 hours, 48% at 7 days, and 29% at 28 days. The median survival time was 4 days, indicating a very high rate of early neonatal mortality. More than 90% of deaths occurred during the first week of life (Figure 1).

3.5. Factors Associated with Death

Male sex (OR = 3.92) and respiratory distress (OR = 3.39) increase the risk of death, while weight ≥ 900 g (OR = 0.2) is a protecting factor for survival (Table 3).

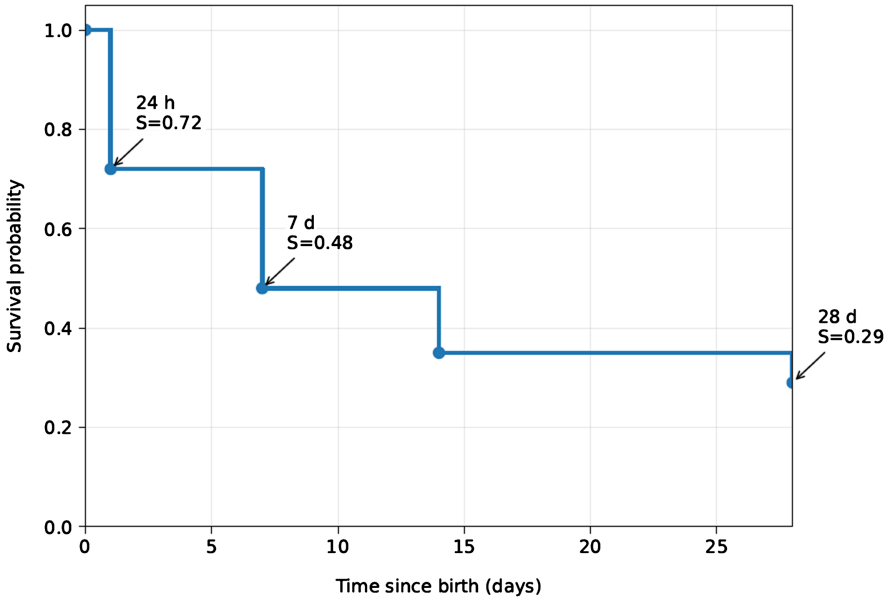

Figure 1. Kaplan-Meier survival curve of extremely low birth weight newborns (<1000 g).

Table 3. Factors associated with mortality.

Factor	OR	CI 95%	p
Male sex	3.92	1.34 - 11.49	0.013
Weight ≥ 900 g	0.20	0.05 - 0.87	0.032
Respiratory distress	3.39	1.14 - 10.04	0.028

4. Discussion

4.1. Study Limits

The retrospective and single-center nature of the study, as well as the lack of follow-up after discharge, are the main limitations of the study. Despite these limitations, it enabled the assessment of hospital survival and the identification of determinants of mortality among extremely low birth weight newborns hospitalized in a tertiary hospital in a resource-limited country.

4.2. Survival and Factors Associated with Mortality

This study highlights the extremely high mortality of ELBW newborns in a tertiary hospital in sub-Saharan Africa. All newborns in our cohort were extremely preterm. The mean gestational age was 29 weeks, indicating extreme prematurity. The observed mortality rate (71%) is consistent with previous African studies reporting mortality rates exceeding 60% - 80% among infants weighing less than 1000 g [8]-[12].

In contrast, survival rates in high-income countries exceed 80% due to advances in neonatal intensive care, including mechanical ventilation, surfactant therapy, and specialized nutritional support [5] [6].

The Kaplan–Meier survival analysis demonstrated that mortality occurred predominantly during the early neonatal period, with more than 90% of deaths occurring within the first week of life. This pattern has been widely reported in low-resource settings and reflects the vulnerability of ELBW newborns to respiratory distress, hypothermia, hypoglycemia sepsis, and feeding difficulties. Indeed, neonatal infections also contribute significantly to mortality among very low birth weight infants in resource-limited settings. Furthermore, nutritional management is another key determinant of survival among very low birth weight infants [7]-[10].

Respiratory distress emerged as a major determinant of mortality. This finding is consistent with previous studies indicating that respiratory distress syndrome remains one of the leading causes of death among extremely premature infants [10].

The absence of advanced respiratory support modalities such as CPAP and surfactant therapy likely contributed significantly to the high mortality observed in our setting. Evidence from Malawi and other African countries has shown that the introduction of low-cost CPAP systems can substantially improve survival among preterm infants [7]-[9] [11] [12] [15].

Birth weight was another strong determinant of survival. Infants weighing ≥900 g had significantly better outcomes than those with lower birth weight. This relationship between birth weight and neonatal survival has been consistently demonstrated in the literature [3] [6] [12] [13].

Male sex was associated with increased mortality, confirming the well-documented biological vulnerability of male newborns during the neonatal period [16].

Overall, these findings reflect the combined impact of limited neonatal intensive care resources, insufficient antenatal corticosteroid use, frequent postnatal transfers, and shortages of trained healthcare personnel. Strengthening the continuum of care from pregnancy to neonatal intensive care is therefore essential to improve survival outcomes in this population [17] [18].

5. Conclusion

Survival among extremely low birth weight newborns remains extremely limited in this resource-constrained tertiary hospital. Most deaths occur during the first week of life. Improving survival will require strengthening perinatal care, increasing access to antenatal corticosteroids, improving respiratory support capacities (CPAP and surfactant), and promoting early kangaroo mother care.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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