

## Risk Factors for Neonatal Mortality at St Camille Hospital in Ouagadougou, Burkina Faso

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### Abstract

**Background:** Neonatal mortality remains a public health concern in developing countries such as Burkina Faso. Improving the survival rate of newborns requires a good knowledge of the current situation. This study aimed at determining the risk factors for neonatal mortality in the Neonatology Department of Saint Camille Hospital of Ouagadougou (HOSCO - *Hôpital Saint Camille de Ouagadougou*).

**Materials and Methods:** This was a retrospective, descriptive and analytical study that included all newborns hospitalized in the neonatology department, at St Camille Hospital, in Burkina Faso from January 1 to December 31, 2017. Total of 710 records of hospitalized newborns in 2017 were analyzed. Among them our study focused on cases of death.

**Results:** The neonatology department registered 246 deaths out of 710 hospitalizations, representing a mortality rate of 34.6%, of whom 194 (78.8%) were preterm infants and 52 (11.2%) were term newborns. Among the deceased newborns, 88% had a low birth weight and the sex ratio was 0.8. November was the most fatal period (12.6%). Prematurity and respiratory distress were the main reasons for referral. Prematurity (76.4%), asphyxia (51.2%) and neonatal infection (27.2%) were the top 3 diagnoses at admission. The leading cause of death was respiratory distress (89.8%). All the newborns have been hospitalized within 24 hours of life and the average time to death in the unit was 3 days and 54% of deaths occurred within 72 hours of hospitalization.

**Conclusion:** Mortality rate is higher among preterm infants while it is relatively low among full-term newborns in our facility. Prematurity, asphyxia and neonatal infection remain the main risk factors associated with neonatal mortality.

**Key Words:** Asphyxia, Burkina Faso, Neonatal infection, Prematurity, Respiratory distress.

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## 1- INTRODUCTION

The day of birth and the first days of life of the newborn are the higher risk period of mortality for mothers and children (1). Despite significant progress over the past two decades in reducing child mortality, major challenges remain in developing countries such as Burkina Faso (2-4). In 2015 the Electromagnetic compatibility INSD referred 23.2‰ rate of neonatal mortality in the country (5). According to global estimates, neonatal mortality declined by 41 per cent from 2000 to 2017 (6). Among the 5.4 million children who died before the age of 5 in 2017, 46.3% of deaths occurred in the first month of life (6). Neonatal infections and complications related to prematurity remain the leading causes of neonatal mortality worldwide, with two thirds of deaths occurring in Sub-Saharan Africa and South Asia (2, 7, 8). Despite the subsidy from the Burkina government for emergency obstetric and neonatal care (EmONC) in all health facilities since 2006 and the free care policy for children under five to achieve the Millennium Development Goals (MDGs4), efforts are still needed to significantly reduce neonatal mortality in Burkina Faso (3). A good knowledge of the main causes of neonatal mortality is essential to develop an effective care strategy with the aim of reducing this mortality in our facility.

## 2- MATERIALS AND METHODS

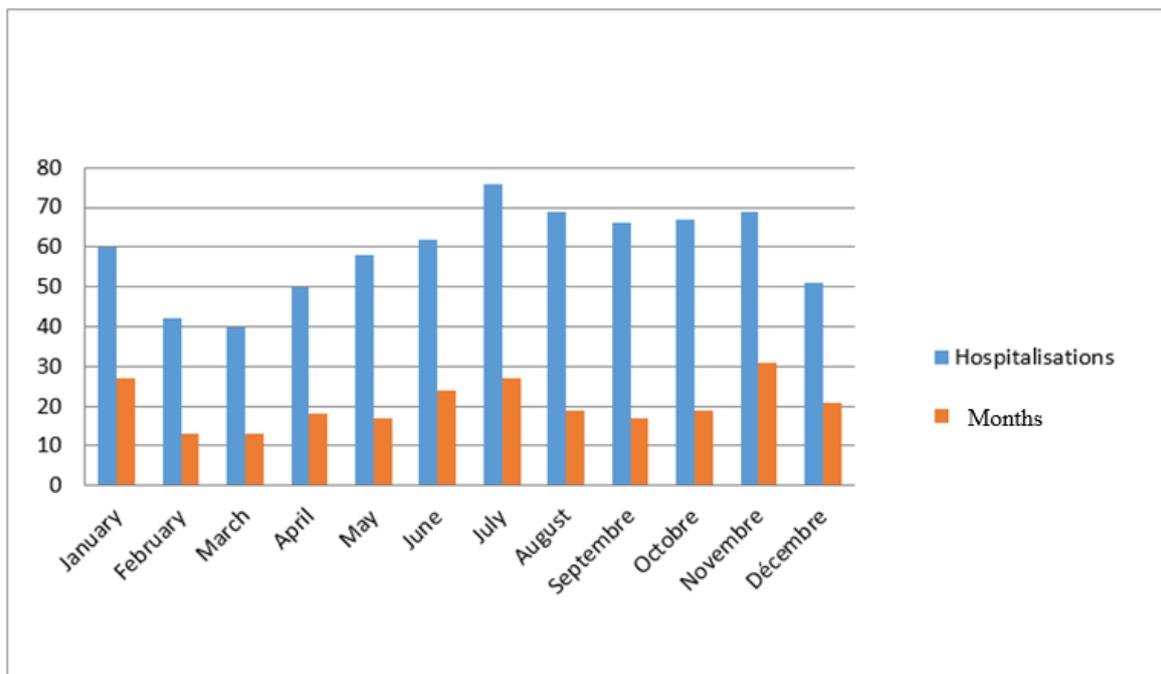
This was a descriptive and retrospective study of the risk factors for inpatient neonatal mortality in the neonatal department of Saint Camille Hospital in Ouagadougou (HOSCO) from January 1 to December 31, 2017. The inclusion criteria were newborns of both sexes hospitalized

and deceased in HOSCO neonatal department and whose names were on the hospital registry and with a workable clinical record. The study variables included: socio-demographic characteristics (gender, date of birth, place of birth, gestational age, referral); maternal and perinatal history (pathology during pregnancy, mode of delivery, weight at birth, birth status, APGAR score (appearance (coloration); Pulse (heart rate); Grimace (responsiveness to stimuli); Activity (muscle tone); Breathing (breathing effort); and hospitalization data (date and time of admission, constants, diagnosis, cause of death and time to death). The data were processed and analyzed using SPSS software version 17.0, Microsoft EXCEL 2010 software. Chi-square or Fisher tests were used to compare proportions. The difference was statistically significant for  $p < 0.05$ .

## 3-RESULTS

### 3-1. Neonatal characteristics

Of the 710 newborns hospitalized from the 1<sup>st</sup> to the 31<sup>st</sup> of December 2017, 246 (34.6%) cases of death were recorded and included in this study. Among them 194 (78.8%) were preterm and 52 (11.2%) were term newborns. Gestational age was specified for 98% (241/246) of deceased newborns. The mean gestational age was 33 weeks of amenorrhea (WA) with extremes of 27 WA and 42 WA; 78.8% (190/241) of newborns had a gestational age below 37 WA. About 46% (113/246) of the deaths were male, with a sex ratio of 0.8. November was the period with the highest number of deaths, 12.6% (31/246) of cases. **Figure.1** shows the distribution of the number of deaths by month.

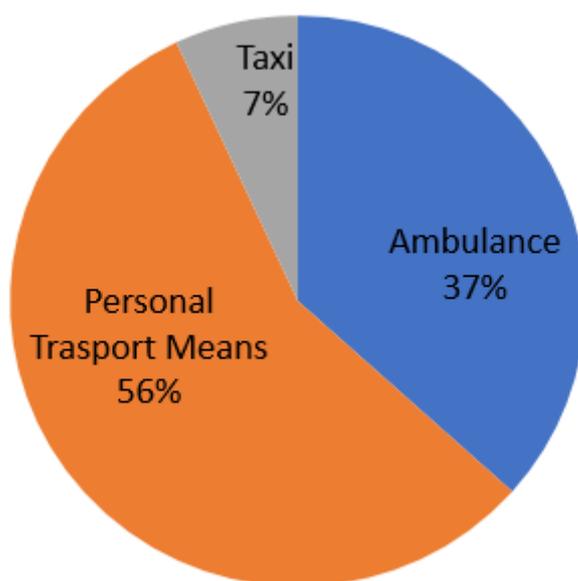


**Fig1:** Distribution of deaths by hospitalization and period.

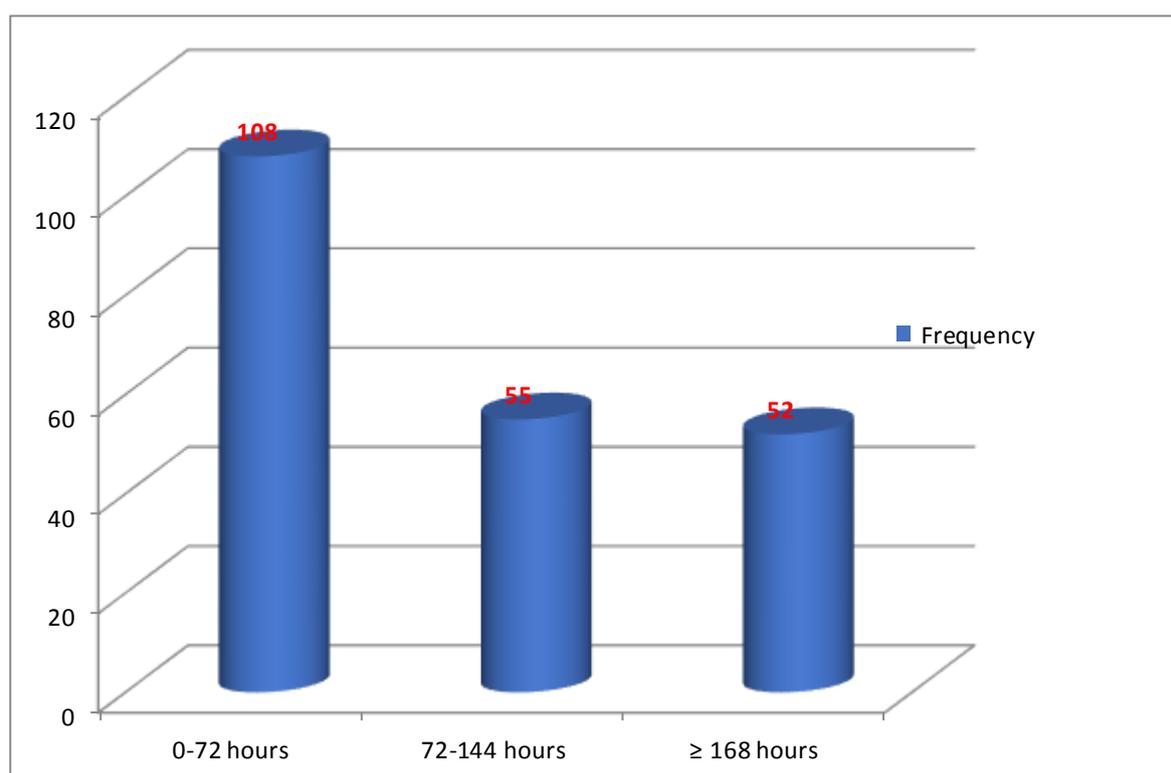
**3-2. Mode of Admission**

Of the 246 cases, the mode of admission was specified for 245 cases, and the majority of the newborns were referred: 243 (99.1%). Of the 205 newborns born outside HOSCO, 74 (37%) arrived by ambulance (**Figure.2**). The postnatal age

at admission was reported for 87.4% (215/246) of newborns, of whom 50.2% (108/215) had been admitted before 3 days of life, as shown in **Figure.3**. The average of admission period was 8.7 hours with extremes ranging from 20 minutes to 10 days.



**Fig.2:** Distribution of the 246 deceased newborns by mode of transport.



**Fig.3:** Distribution of deceased newborns by admission time.

### 3-3. Clinical Data

**Table.1** summarizes the main referral/transfer reasons; several reasons were reported for the same newborn. Prematurity was the main reason for referral (79.0%) with odds ratios ranging from 9.6 (prematurity vs. respiratory distress; 95% CI [6.3 - 14.5]) to 227.0 (prematurity vs. apparent death status/fever; 95% CI [80.6 - 639.3]) compared to other referral reasons. The pregnancy history is specified in 230 newborns, of which 86 (37.4%) cases of pathologies were recorded.

**Table.2** provides a breakdown of the pathologies recorded in mothers during pregnancy. Multiple pregnancy was the most common pathology encountered (51.1% of cases;  $p < 0.05$ ) in the current study population. It is worth noting that 4.1% (10/246) of the deceased newborns were born at home; 88.2% (217/246) had a low birth weight ( $< 2.500$  g) as shown in **Figure.4**. The Apgar score was recorded

for 74.7% (184/246) of newborns: at 1 minute, the mean score was  $6.4 \pm 1.6$ ; at 5 minutes, the mean score was  $7.4 \pm 1.7$ ; at 10 minutes, the mean score was  $7.9 \pm 1.7$  with extremes ranging from 2 to 9. Of the 244 newborns for whom the birth route was specified, 11.9% (29/244) were born by cesarean section. The appearance of the amniotic fluid was specified for 65.8% (162/246) of cases. Among them, amniotic fluid was clear in 24.1% (39/162), tinted in 71.0% (115/162) and meconium in 4.9% (8/162).

The average birth weight was  $1,170 \pm 31.1$  g with extremes ranging from 650 g to 4,030 g. Among deceased newborns, 86.9% (214/246) had low birth weight with 70.7% (174/246) having a weight of less than 1,500 g. The mean temperature was  $33^\circ\text{C}$  with extremes ranging from  $32^\circ\text{C}$  to  $38.5^\circ\text{C}$ . The majority (95.1%, 234/246) of deceased newborns were hypothermic with a temperature below  $36.5^\circ\text{C}$ , 1.2% (3/246) had a temperature above  $37.5^\circ\text{C}$ . Heart rate was recorded for

231 deceased newborns. The average frequency was 45 beats per minute with extremes ranging from 23 to 177 beats per minute. Respiratory rate was recorded for 233 newborns with an average of 52 cycles per minute and extremes ranging from 0 to 97 cycles per minute while oxygen saturation was measured in 191 newborns with an average of 75% and extremes ranging from 30 to 100%. Blood glucose levels were measured in 70.7% (174/246) of newborns. The average blood glucose level was 65.5 mg/dl with extremes

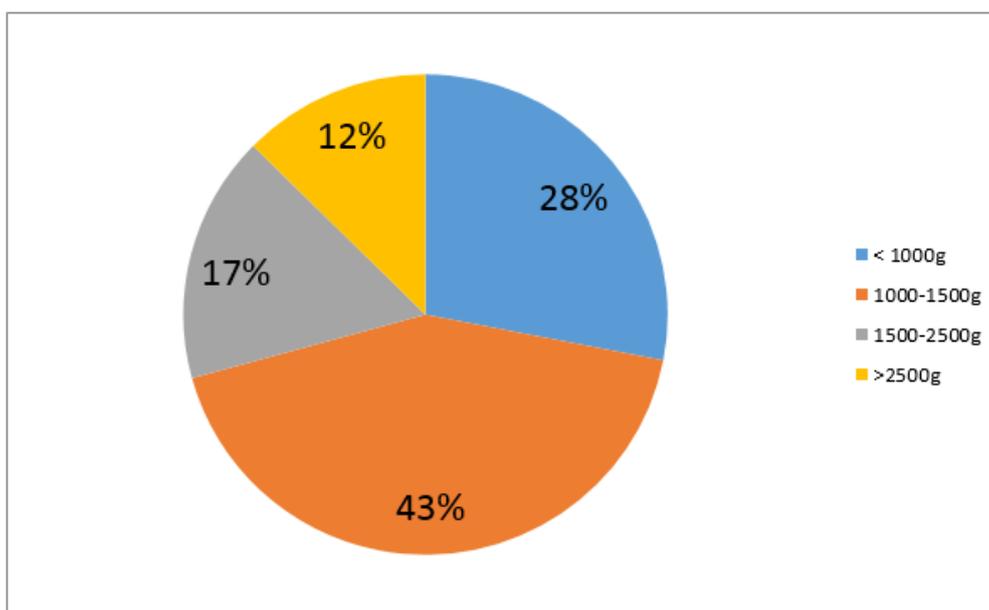
ranging from 0 to 224 mg/dl and 22.4% (39/174) of newborns had blood glucose levels below 25 mg/dl.

**Table.3** summarizes the diagnosis d. Several diagnoses could be retained for the same newborn. The 3 main diagnosis included prematurity (76.4%), asphyxia (51.2%), and neonatal infection (27.2%). However, prematurity was significantly higher than asphyxia ( $p < 0.001$ ; OR: 3.08 [2.10 - 4.54]) and neonatal infection ( $p < 0.001$ ; OR: 8.66 [5.76 - 13.01]).

**Table-1:** Distribution of cases by reason for referral.

Reasons	Numbers (n = 244)	Percentage	P-value	Odds Ratio	95% Confidence Interval
Prematurity <sup>#</sup>	193	79.0 %	-	-	-
Respiratory distress	69	28.7 %	< 0.001	9.6	[6.3 – 14.5]
Asphyxia	19	07.7 %	< 0.001	44.8	[25.6 – 78.5]
Low birth weight	19	07.7 %	< 0.001	44.8	[25.6 – 78.5]
Convulsions	06	02.4 %	< 0.001	150.1	[63.1 – 357.2]
State of apparent death	04	01.6 %	< 0.001	227.0	[80.6 – 639.3]
Fever	04	01.6 %	< 0.001	227.0	[80.6 – 639.3]
Other*	24	9.8 %	< 0.001	34.7	[20.6 – 58.5]

Other\*: congestion, resuscitation, abandonment, hypotonia, jaundice, pallor, blunt reflexes, hypothermia, crying, amniotic fluid inhalation, edema, tinted amniotic fluid, skin necrosis. #Prematurity was compared with the other reference reasons.



**Fig.4:** Distribution of deceased newborns by birth weight.

**Table-2:** Distribution of newborns by disease during pregnancy.

Pathologies	Numbers (n = 86)	Percentage	P-value	Odds Ratio	95% Confidence Interval
Multiple pregnancy <sup>#</sup>	44	51.1 %	-		
Pathology of the annexes	10	11.6 %	0.006	3.35	[1.47 – 7.66]
Pre-eclampsia/eclampsia	09	10.4 %	0.002	3.84	[1.64 – 8.98]
Premature rupture of membranes (> 72 hrs)	07	8.1 %	0.0002	5.53	[2.22 – 13.78]
Malaria	04	4.6%	< 0.001	10.48	[3.45 – 31.83]
Other *	12	13.9%	0.016	2.79	[1.27 – 6.14]

Other\*: gestational diabetes, STI, nephrotic syndrome, intrauterine growth retardation, metrorrhagia, hepatitis B, anemia, threat of preterm delivery, fetal suffering. #Multiple pregnancy was compared with the other conditions during pregnancy.

**Table-3:** Distribution of death cases by diagnosis.

Diagnosis	Numbers (n = 246)	Percentage	P-value	Odds Ratio	95% Confidence interval
Prematurity <sup>#</sup>	188	76.4%	-	-	-
Asphyxia	126	51.2%	< 0.001	3.08	[2.10 – 4.54]
Neonatal infection	67	27.2%	< 0.001	8.66	[5.76 – 13.01]
Hypotrophy	19	07.7%	< 0.001	38.73	[22.3 – 67.3]
Birth defects	09	03.6%	< 0.001	85.34	[41.2 – 176.7]
Congenital heart disease	08	03.2%	< 0.001	96.43	[44.9 – 206.9]
Other*	06	02.4%	< 0.001	129.65	[54.8 – 307.0]

Other \*: jaundice, post maturity. #Prematurity was compared with the selected diagnosis.

### 3-4. Treatment

In this study, 129 deceased newborns (52.4%) received neonatal resuscitation procedures ranging from unclogging to external cardiac massage. Of the 241 cases where the concept of drug treatment administration before referral was specified, 34 newborns (14.1%) had received either a vitamin K1 injection or oxygen therapy with a flow rate between 0.5 liter/min to 5 liters/min depending on the need and/or a peripheral venous route with antibiotics administration.

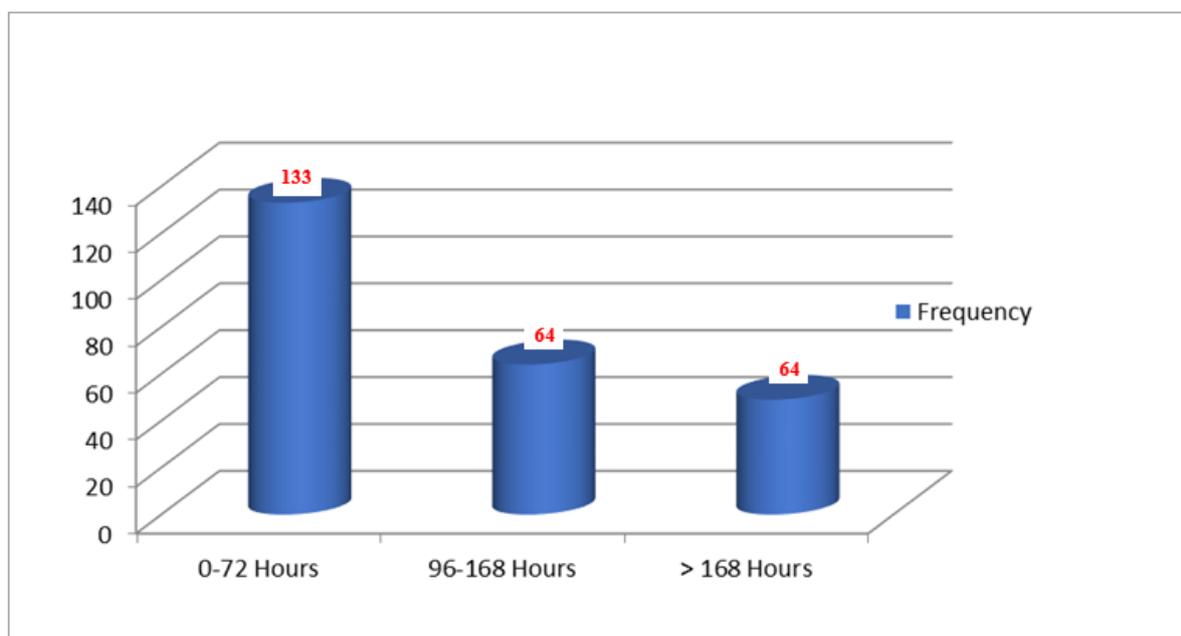
### 3-5. Etiologies of deaths

Several causes of death have sometimes been reported in the same newborn. The leading cause of death was respiratory distress reported in 221 cases (89.8%) and a risk 63 to 232 times higher than the other causes of death in this study. **Table.4** presents the etiologies of death in newborns. In this study 54.1% (133/246) of newborns died within 72 hours of admission. The average time to death was 3 days with extremes ranging from a few hours to 34 days.

**Table-4:** Distribution of newborn death cases by cause of death

Causes of death	Numbers	Percentage	P-value	Odds Ratio	95% Confidence Interval
Respiratory distress <sup>#</sup>	221	89.8%	-	-	-
Hemorrhage	30	12.1%	< 0.001	63.6	[36.2 – 111.7]
Intestinal obstruction	16	06.5%	< 0.001	127.1	[66.1 – 244.4]
Anemia	11	04.4%	< 0.001	188.8	[90.8 – 392.9]
Other*	09	03.6%	< 0.001	232.8	[106.3 – 509.7]

Other\*: hydro-electrolytic disorders, hypoglycemia. #Respiratory distress was compared with the cause of death.



**Fig.5:** Distribution of newborns by time of life to death (all newborns were hospitalized within the first day of life).

#### 4- DISCUSSION

This study shows a mortality rate of 36.4% (246/710) among newborns hospitalized in the neonatology department during the study period. The number of newborns hospitalized (710 over 12 months) in our study is higher than the average number of hospitalizations (567) reported in 2015 by Ouedraogo et al. (3) in Burkina Faso with a significantly lower average mortality rate (11.0%) compared with this study. The increase in hospitalizations over the years could be explained by the improvement in the conditions for accessing health services with the free care policy covering some maternal and neonatal diseases. An earlier study reported that bacterial infection was the main reason for hospitalization of newborns at the Charles de Gaulle University Hospital Pediatric Center in Ouagadougou, Burkina Faso (8). The Apgar score was recorded in 74.7% of newborns and home delivery was likely the cause of this score missing in the remaining 25.3% of newborns. The lack of improvement of the mean score at 5 and 10 minutes (between  $6.4 \pm 1.6$  and  $7.9 \pm 1.7$ )

with extremes between 2 and 9 is a risk factor for morbidity and mortality, as pointed out by Ouedraogo/Yugbaré et al. (9). The high infant mortality rate observed in this study is reportedly linked to several risk factors. Indeed, our findings revealed that 63.0% of deceased newborns were transported by personal or public transportation means (taxis). Kouéta et al. (10) reported in 2011 in Burkina Faso, a 2.8 higher risk of death when personal transport means (motorcycle, car) or public transport (taxi) were used compared to ambulance. We can deduce that distance and transport conditions are a factor influencing neonatal mortality. Medical transport with specialists is therefore necessary to improve newborn survival (11, 12). The mean temperature of the deceased newborns in this study was 33 °C, and 95.1% were hypothermic at admission. Promoting pre-clinical kangaroo-technique for pregnant women, midwives and peripheral birth facilities could help restore the temperature of low birth weight babies and increase their chance of survival. The average oxygen saturation was 75.0%, and 22.4% of the deceased newborns were hypoglycemic.

These results could be explained by poor transfer conditions (lack of preconditioning, non-medical transfer). Prematurity and asphyxia are the two main diagnoses mentioned in the deceased newborns in our study with a percentage of 76.4% and 51.2%, respectively. These findings may result from the difficulty in managing prematurity in our developing country context and also from the inadequacy of newborn care in maternity units where 95.9% of deceased newborns were born. Indeed, several previous studies have reported complications related to prematurity as a significant risk factor in neonatal mortality (2, 7, 13, 14). The main risk factor for death was respiratory distress (89.8%) which is both a complication of prematurity (main diagnosis), and hypothermia.

In our study, the majority of deaths occurred within the first 72 hours (54.0%). Our findings are consistent with the data of the WHO which estimates the annual number of newborn deaths at 2.7 million and stillbirths at 2.6 million (1). Improving the survival rate of newborns requires a diagnosis of the situation and continuous training of health care workers on both newborn care and transfer as well the management of neonatal conditions.

## 5- CONCLUSION

Mortality rate was higher among preterm infants, especially in November when it is cold. Prematurity, asphyxia and neonatal infection remain the main risk factors associated with neonatal mortality. Improved monitoring of pregnancies, labor, and delivery and transport conditions would contribute to a significant reduction in neonatal mortality in Burkina Faso.

**6- CONFLICT OF INTEREST:** None.

## 7- ACKNOWLEDGEMENTS

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