

# Risk Factors for Neonatal Mortality at the Institute of Nutrition and Child Health of the Donka/Guinea-Conakry National Hospital

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## Abstract

**Introduction:** The birth of a baby is a moment of joy and celebration. However, the neonatal period is a very delicate phase of life. Neonatal mortality rates remain high in low-income countries. In Guinea, after 20 years, this rate has fallen from 34.2% in 1998 to 32% in 2018. **Objective:** To identify the main risk factors for neonatal mortality. **Methods:** This was an observational, analytical case-control study, lasting 6 months from January 1 to June 30, 2019, conducted at the Institut de Nutrition et de la Santé de l'Enfant (INSE) at Donka National Hospital. **Results:** We collected 242 cases and 242 controls, *i.e.* a total of 484 records. 748 patients were registered, with 32.35% deaths. 82.86% of deaths occurred in the early neonatal period. Statistical analysis revealed the main risk factors: prematurity (RQ 7.39 95% CI 3.27 - 16.61  $p = 0.0000003$ ), hypothermia (RQ 2.29 95% CI 1.51 - 3.46  $p = 0.0001$ ), acute fetal distress (RQ 2.13 95% CI 1.33 - 3.43  $p = 0.0016$ ), low birth weight (QR 1.91 95% CI 1.12 - 3.24  $p = 0.016$ ), home birth (QR 3.26 95% CI 1.25 - 8.46  $p = 0.015$ ). **Conclusion:** Neonatal mortality is a health problem in the INSE neonatology department. To reduce the mortality rate in this referral facility, it is essential to equip it and provide ongoing training for staff.

## Keywords

Neonatal Mortality, INSE, Guinea-Conakry

## 1. Introduction

The birth of a baby is a moment of joy and celebration. However, the moment of

birth can be a risky event for the newborn. Neonatal mortality, a significant public health problem, remains a major concern as it persists at a high level despite the strategies and interventions implemented worldwide [1] [2]. Neonatal mortality rates remain high, with an average of over 45% in low-income countries compared to 4% in developed countries [3]. More than 80% of newborn deaths are attributed to prematurity, complications during labor and delivery, and infections such as sepsis, meningitis, and pneumonia. Other similar factors, especially complications during labor, are associated with a significant portion of neonatal deaths [4]. However, nearly 70% of these deaths could be prevented through simple and cost-effective interventions before and during pregnancy, during childbirth, and even during the postpartum period [5].

In Guinea, the neonatal mortality rate was 34.2% [6]. Overall, the risk of death for a Guinean child between birth and their fifth birthday is 111‰, with the neonatal component at 32‰, representing 48% of infant deaths (EDS 2018). These data clearly indicate a minimal decrease in the neonatal mortality rate in our country. The Institute of Nutrition and Child Health (INSE) is the reference center for newborn care in our country, and the mortality rate was 18.6% in 2011 [7]. However, no data on risk factors for neonatal mortality is currently available, hence the purpose of our study was to identify these risk factors.

## 2. Patients and Method

This was an observational, analytical case-control study with a duration of 6 months, from January 1st to June 30th, 2019, conducted at the Institute of Nutrition and Child Health (INSE) of the National Hospital of Donka.

It included all hospitalized newborns who were discharged alive or died during the study period. In this study, we defined the following:

- Cases: All medical records of newborns who died in the department during the study period;
- Controls: All medical records of newborns who were discharged alive during the study period.

The collected and analyzed parameters included sociodemographic characteristics of the parents, pregnancy data, delivery data, mode of admission, progress, age at the time of death, and clinical data.

The data was entered into Epidata V3.1 software and then exported to SPSS V21 for data cleaning and statistical analysis. Qualitative variables were expressed as frequencies and proportions, while quantitative variables were presented as means accompanied by their standard deviation. The odds ratio was calculated, along with its confidence interval, to assess the degree of association and the significance of the association between the dependent variable and the independent variables. The chi-square test and Fisher's exact test were used to compare proportions. A statistically significant difference was set at a  $p$ -value  $< 0.05$ . In the multivariate analysis, only variables with  $p \leq 0.20$  in the univariate analysis were used. The significance threshold was set at  $p < 0.05$ .

### 3. Ethical Considerations

This study obtained verbal consent from the parents of the patients, ensuring anonymity and without any coercion.

### 4. Results

During the study period, we collected 242 cases and 242 controls, totaling 484 records. Among the 748 patients registered, there were 242 deaths (32.35%) (Figure 1). The majority of deaths occurred during the early neonatal period, with 16.94% occurring before 24 hours and 65.32% occurring between 1 - 6 days, totaling 82.86% with a mean age of death of 4.07 days (Figure 2). Among the means of transportation, the car was the most commonly used method at 60.74% (Table 1). Three hundred and ninety-two (392) patients were referred to our service, accounting for 80.99% (Table 2). The average age of the mothers was 24.91 years. The age group of 20 - 24 years was the most represented with 72 cases (29.75%), followed by the age group of 25 - 29 years with 65 cases (26.86%). From the age of 35, there were 24 deaths, including 15 cases (6.20%) in the age group of 35 - 39 years and 9 cases (3.72%) in the age group of 40 years and above.

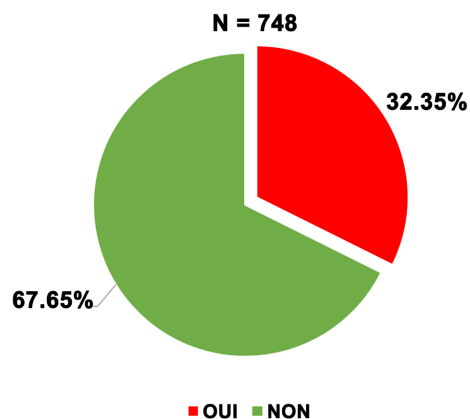


Figure 1. Neonatal mortality rate at INSE from January to June 2019.

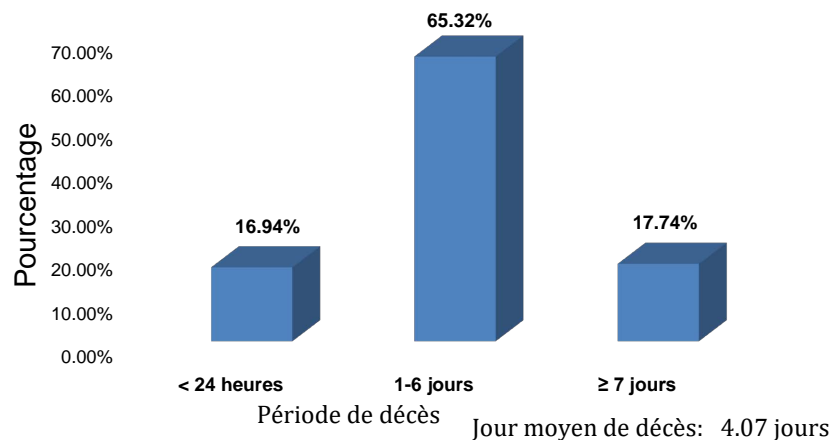


Figure 2. Distribution of the neonatal mortality rate according to the period of occurrence of death.

**Table 1.** Distribution of patients according to the means of transport used to arrive at INSE.

Means of transport	Number	Pourcentage	p value
Ambulance	8	1.65	0.40
Moto	13	2.69	
Car	294	60.74	
Missing	169	34.92	
Total	484	100.00	

**Table 2.** Distribution according to type of admission of newborns.

Admission Type	Number	Pourcentage (%)	p value
Referred	392	80.99	0.39
Spontaneous	88	18.18	
Missing	4	0.83	
Total	484	100	

The liberal profession was the most represented among the mothers' professions, with 111 cases (45.86%). The majority of prenatal care visits (CPN) were less than four (4) times, with 171 cases (70.66%). One hundred and ninety (190) deliveries (78.51%) were conducted vaginally, while 52 cases (21.48%) were done via cesarean section, and one hundred and ninety-one (191) deliveries (78.92%) were eutocic. Two hundred and twenty-two (222) deliveries (91.73%) took place in healthcare facilities, while there were 20 cases (8.26%) of home births (**Table 3**).

One hundred and forty-one (141) patients were male (58.26%) compared to 101 female patients (41.74%) with a ratio of 1.4. During the early neonatal period, 218 patients were registered (90.08%), and 86 deliveries occurred before the 37th week of gestation (35.53%) (**Table 4**). The main risk factors for neonatal mortality were as follows: prematurity (OR 7.39, 95% CI 3.27 - 16.61,  $p = 0.0000003$ ), hypothermia (OR 2.29, 95% CI 1.51 - 3.46,  $p = 0.0001$ ) (**Table 5**), acute fetal distress (OR 2.13, 95% CI 1.33 - 3.43,  $p = 0.0016$ ), low birth weight (OR 1.91, 95% CI 1.12 - 3.24,  $p = 0.016$ ), and home birth (OR 3.26, 95% CI 1.25 - 8.46,  $p = 0.015$ ) (**Table 6**).

## 5. Discussion

We conducted an observational study of the case-control type at INSE (Institut National de la Santé et de la Recherche Médicale) over a period of 6 months from January 1st to June 30th, 2019. Our objective was to identify risk factors associated with neonatal mortality at INSE. We collected 242 cases and 242 controls, making a total of 484 records. The main difficulties encountered were as follows: poor completion of records with a significant number of missing data for certain variables, absence of complementary examinations to confirm certain

**Table 3.** Distribution of maternal characteristics of pregnancy and childbirth.

Variables	Cases	Controls	OR 95% IC	p value
<b>Age of mother (N = 484)</b>				
<18	21	14		
18 - 19	33	35		
20 - 24	72	63		
25 - 29	65	68	NA	<b>0.24</b>
30 - 34	27	39		
35 - 39	15	20		
>40	9	3		
Average: 24.91 years $\pm$ 6.14 Extremes 15 - 48 years				
<b>Occupation</b>				
Student	23	16		
Student (feminine)	15	17		
Civil servant	3	4	NA	<b>0.57</b>
Self-employed	111	125		
Homemaker	88	76		
<b>CPN</b>				
0	2	1		
1 - 3	169	151	NA	<b>0.13</b>
>4	71	90		
Average = 2.96 $\pm$ 1.28 Extremes 0 - 10 CPN				
<b>Type of Birth Structure</b>				
Residence	20	7	3.02	<b>0.016</b>
Sanitary	222	235	1.25 - 7.92	
<b>Delivery route</b>				
Low	190	179	1.14	<b>0.29</b>
High	52	63	0.91 - 1.425	
<b>Mode of delivery (484)</b>				
Dystocic	51	65	0.73	<b>0.17</b>
Eutocic	191	177	0.48 - 1.11	

**Table 4.** Distribution of newborns according to neonatal characteristics.

Variables	Cases (n = 242)	Controls (n = 242)	Crude OR at 95%	p-Value
	Number	Number		
<b>Sex</b>				
Male	141	147	0.90	0.6400
Female	101	95	[0.61 - 1.30]	

**Continued****Age at admission (days)**

<7	218	211	1.34	0.39
≥7	24	31	[0.76 - 2.35]	

Average: 2.49 ± 5.40 with Extremes of 0 - 27 days

**Weight (g)**

FPN	125	92	1.74	0.03
≥2500	117	150	[1.21 - 2.50]	

Average: 2457.56g ± 852.54 with Extremes of 630 - 5750g

**Gestational Age (SA)**

Premature	86	56	1.83	0.04
Term	156	186	1.23 - 2.73	

Average: 37.07 ± 3.80 Extremes 25 - 44 weeks

**PC (Cm)**

Average: 32 cm ± 3.43 Extremes 21 - 52 cm

**Size (Cm)**

Average: 48 cm ± 5.31 Extremes 30 - 60 cm

**Table 5.** Distribution of risk factors for neonatal mortality.

Variables	Cases	Witnesses	OR 95% IC	p-Value
	Number	Number		
<b>Prematurity</b>				
<32	53	10	7.39	<b>0.0000003</b>
32 - 36	33	46	3.27 - 16.61	
<b>Hypothermia</b>				
Yes	86	47	2.29	<b>0.0001</b>
No	156	195	1.51 - 3.46	
<b>Hyperthermia</b>				
Yes	72	92	0.69	<b>0.68</b>
No	170	150	0.47 - 1.01	
<b>Malformation</b>				
Yes	14	12	1.17	<b>0.84</b>
No	228	230	0.53 - 2.260	
<b>Obstetric trauma</b>				
Yes	11	9	1.23	<b>0.82</b>
No	231	233	0.50 - 3.03	
<b>SFA</b>				
Yes	130	105	1.51	<b>0.029</b>
No	112	137	1.06 - 2.17	

**Continued**

RCUI				
Yes	29	37	0.75	<b>0.35</b>
No	213	205	0.45 - 1.27	
INN				
Yes	227	237	0.319	<b>0.037</b>
No	15	5	0.11 - 0.89	
Number of diagnoses				
1 - 2	86	113	0.63	<b>0.016</b>
>3	156	129	0.44 - 0.91	
SMK				
Yes	2	21	0.09	<b>0.000045</b>
No	240	221	0.02 - 0.38	

**Table 6.** Risk factors for neonatal mortality in multivariate analysis.

Variable	OR adjusted	IC 95%		p value
		ICI	ICS	
Prematurity	1.9356	0.9957	3.7628	0.0515
Less than 4 ANC (Antenatal Care)	1.1271	0.7354	1.7276	0.5829
Very preterm birth	7.387	3.2853	16.6094	<u>0.0000</u>
SFA	2.1385	1.3329	3.4309	<u>0.0016</u>
Less than 3 diagnoses	0.9997	0.6317	1.582	0.9988
FPN	1.9118	1.126	3.2461	<u>0.0164</u>
Hypothermia	1.616	0.9904	2.637	0.0547
Home birth	3.2642	1.2585	8.4663	<u>0.0150</u>
Neonatal infection	0.35	0.1041	1.1763	0.0896

diagnostic hypotheses, scarcity of similar studies in Guinea, and impossibility to confirm certain data with the parents.

The neonatal mortality rate during our study was 32.35%. A study conducted in the same department in 1998 found a rate of 34.2%. With the support of a team from Médecins Sans Frontières (Doctors Without Borders), who stayed in the department in 2011 and improved the technical platform for newborn care, this mortality rate had decreased to almost half of that in 1998 (18.5%). After their departure, our study shows that this rate has significantly increased. This highlights the weakness of the technical platform in this department, which is considered the reference structure for the care of newborns in our country. This should prompt the government, through the Ministry of Health and its partners, to invest more to sustain the joy of the day of birth for parents. In the literature,

some authors have reported that in Nigeria, Pakistan, and Ethiopia, the mortality rates were respectively 32.1%, 47.3%, and 62.5% [8] [9] [10].

In the United States (California), this rate was 0.35% [11], and in the Thames region, England, it was 0.38% [12]. This supports the findings of the World Health Organization (WHO) that neonatal mortality rates are higher in developing countries [13]. This could be explained by poverty and lack of knowledge in these countries, limiting access to antenatal care. The majority of deaths (82.86%) occurred during the neonatal period, which is consistent with the findings of some authors [14] [15] [16].

All these authors agree on the critical nature of this period; indeed, it represents not only a transition period between intrauterine and extrauterine life but also a period during which the newborn is more susceptible to be directly affected by maternal pathologies and complications related to pregnancy and childbirth. In our study, 60.74% of newborns were transported by car, compared to 1.65% by ambulance, but this difference was not significant. The most represented age group of mothers was 20 - 24 years old (29.75%), and overall, 93.29% of mothers were under 35 years old, but the observed difference between these age groups was not significantly associated with neonatal mortality. This maternal age-related mortality rate varies from one study to another. Garba M *et al.* reported that 70% of mothers were under 35 years old [17].

Noria H *et al.* found that 53.26% of the cases of parturients were over 35 years old [18]. Similarly, in France, it has been reported that neonatal mortality was high among women under 20 years old and those over 35 years old [19]. The most represented occupation of mothers was self-employment (46.25%), and 36.67% of them were housewives. The occupational categories of mothers did not have an influence on neonatal mortality. Our result differs from that of Niger in 2013, which found that 68.9% were housewives and newborns of these mothers had 3.43 times higher risk of dying compared to others [17]. The majority of mothers, 66.94% (including 0.82% with no antenatal care and 66.12% with 1 - 3 antenatal care visits), did not have at least 4 antenatal care visits as recommended by the WHO during pregnancy. This difference did not determine neonatal mortality in our study. However, authors report that the risk of neonatal mortality remains very high with insufficient antenatal care visits [17]. We found in this study that the risk of newborn mortality for home births was 3.02 (95% CI 1.25 - 7.92). This finding was also observed in Niger [17].

Contrary to the majority of studies that consider cesarean section as a protective factor against neonatal death [17] [20], it was performed in 21.48% of deliveries, and we did not find a significant difference between vaginal delivery and cesarean section, as in the study by Kedy KD *et al.* [21]. Male sex was predominant in our study (58.26%), but the difference between the two sexes was not statistically significant. This male predominance has also been reported by other authors [17] [18]. Unlike our study, some studies [10] [22] [23] have shown that male sex is a risk factor for neonatal mortality. We found that 51.65% of deceased newborns had a low birth weight, with a risk of death after bivariate analy-



sis of 1.91 (95% CI 1.12 - 3.24). It is generally believed that birth weight is one of the best indicators of a newborn's chance of survival. In the literature, there is a strong correlation between neonatal mortality and low birth weight [24].

Premature newborns in our study had a 1.83 times higher risk of death compared to those born at term, but this difference became nonsignificant after logistic regression. According to data from six developing countries, prematurity is the leading cause of early neonatal death [25]. Acute fetal distress had a risk of neonatal mortality of 2.13 (95% CI 1.33 - 3.43,  $p = 0.0016$ ). It was also associated with neonatal mortality in Algeria with a risk of 3.4 ( $p < 0.001$ ) [18]. Hypothermia (OR 0.69,  $p = 0.68$ ), congenital malformations (OR 1.17,  $p = 0.84$ ), and neonatal infections (OR 0.35,  $p = 0.08$ ) were not associated with neonatal mortality in our study. Our results differed from those of some studies. Congenital malformations have been cited by some authors as a cause of neonatal mortality [26]. Neonatal infections were associated with neonatal mortality in certain studies [17] [21].

## 6. Conclusion

Neonatal mortality is a health problem in the neonatology department of INSE. The early neonatal period accounted for the majority of deaths. Home births, low birth weight, extreme prematurity, and acute fetal distress were the main risk factors for neonatal mortality in this study. Reducing the mortality rate in this referral facility requires proper equipment and continuous training of staff. We believe that this work will be a determining factor in improving the care of newborns.

## Conflicts of Interest

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

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