

# Epidemiological and Clinical Profile of Newborns Admitted to the Neonatal Intensive Care Unit of the Mother and Child Health Unit, Cocody University Hospital

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## Abstract

**Introduction:** Neonatal mortality remains a major public health concern, accounting for nearly half of all deaths among children under five. In sub-Saharan Africa, neonatal mortality rates remain high, ranging between 30 and 37 per 1000 live births. In Côte d'Ivoire, the rate is estimated at 32‰, but data on newborns hospitalized in neonatal intensive care units (NICUs) are still limited. **Objective:** To describe the epidemiological and clinical characteristics of newborns admitted to the neonatal intensive care unit (NICU) at Cocody University Hospital and to identify the main factors associated with neonatal death. **Methods:** This descriptive and analytical study was conducted from January to May 2025 in the Department of Gynecology, Obstetrics and Pediatrics (Mother and Child Health Unit) of the University Hospital of Cocody, Abidjan. All newborns admitted to the Neonatal Intensive Care Unit (NICU) during the study period were included. Data were entered and analyzed using SPSS version 25.0. **Results:** A total of 160 newborns were included. Male infants predominated (59.4%), and 65% were preterm. The main reasons for admission were respiratory distress (37.5%), prematurity (32.5%), and neonatal sepsis (13.7%). The most frequent conditions were early-onset bacterial neonatal infection (93.8%) and hyaline membrane disease (51.9%). The overall neonatal mortality rate was 39.4%. Factors significantly associated with death included an Apgar score < 7 at the 5th minute ( $p = 0.042$ ), Sarnat stage III ( $p = 0.010$ ), Silverman score  $\geq 5$  ( $p = 0.031$ ), and birth weight < 1500 g ( $p = 0.002$ ).

**Conclusion:** Neonatal mortality at Cocody University Hospital remains high, mainly due to complications of prematurity, respiratory distress, and infections. Strengthening intrapartum care, management of preterm infants, and neonatal monitoring is essential to reduce neonatal lethality.

### Keywords

Newborn, Neonatal Intensive Care, Mortality, Cote d'Ivoire

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## 1. Introduction

Neonatal mortality remains a major public health challenge, accounting for nearly 47% of all deaths among children under five worldwide [1]. Each year, approximately 2.3 million newborns die before reaching their first month of life, with one third dying on the day of birth and nearly three quarters within the first week [2]. Most of these deaths are preventable, being primarily related to prematurity and low birth weight, intrapartum asphyxia, and severe infections such as sepsis [3]-[5]. In sub-Saharan Africa, one in twenty-seven newborns dies before one month of age, corresponding to a neonatal mortality rate far above the global average [1] [2]. In some countries of the region, rates remain between 30 and 37 deaths per 1000 live births [3]. Despite progress in reducing under-five mortality over the past two decades, the decline in neonatal mortality has been much slower [4]. In Côte d'Ivoire, the neonatal mortality rate was estimated at 32 per 1000 live births in 2021 [6]. The main reported causes are prematurity (42%), neonatal asphyxia (25%), lower respiratory tract infections (8%), congenital malformations (7%), and sepsis (6%) [6]. However, data specifically describing the epidemiological and clinical profile of newborns admitted to neonatal intensive care units (NICUs) remain scarce. The objective of this study was to describe the epidemiological and clinical characteristics of newborns admitted to the NICU of Cocody University Hospital in Abidjan, and to identify the main causes of death and associated risk factors.

## 2. Methods

This descriptive and analytical study was conducted from January to May 2025 in the Department of Gynecology, Obstetrics and Pediatrics of the University Hospital of Cocody, Abidjan. The center is exclusively dedicated to maternal and child health and includes a Neonatal Intensive Care Unit (NICU) equipped with 16 incubators, two resuscitation tables, a blood gas analyzer, non-invasive ventilation devices (NIV), and multiparameter monitors. It was a descriptive, analytical, cross-sectional study carried out over a five-month period, from January 1 to May 31, 2025. The study population consisted of all newborns aged 0 - 28 days admitted to the NICU during the study period. All live newborns admitted to the PGOP NICU were included, while those who arrived deceased were excluded. Maternal

variables included: age, marital status, level of education, occupation, number of antenatal care (ANC) visits, associated maternal conditions, and mode of delivery. Neonatal variables included: sex, birth weight, gestational age (according to WHO classification: preterm < 37 weeks, term 37 - 41 weeks, post-term  $\geq$  42 weeks [7]), Apgar score at 1 and 5 minutes, reason for admission, final diagnosis, complications, and outcome (survived or deceased).

#### Operational Definitions

- Neonatal asphyxia: Apgar score <7 at the 5th minute.
- Neonatal infection: clinical suspicion associated with at least one biological sign (elevated CRP, leukocytosis or leukopenia) or confirmed by culture.
- Low birth weight (LBW): <2500 g.
- Macrosomia:  $\geq$ 4000 g.
- Presumed Neonatal Bacterial Infection (PNBI):

PNBI was diagnosed in newborns presenting with at least two clinical signs suggestive of infection (such as fever, hypothermia, respiratory distress, poor feeding, lethargy, or seizures) associated with at least one abnormal biological marker—including C-reactive protein (CRP)  $\geq$ 10 mg/L, leukocytosis  $>$  25,000/mm<sup>3</sup>, leukopenia  $<$  5000/mm<sup>3</sup>, or a positive blood culture when available. This operational definition was based on the protocol used at Cocody University Hospital.

#### Data Collection and Statistical Analysis

Data were collected using a standardized questionnaire developed for this study and completed from medical records, admission registers, and neonatal follow-up charts. Data were entered and analyzed using SPSS software (version 25.0). Quantitative variables were expressed as means  $\pm$  standard deviation or as medians with interquartile ranges, depending on their distribution. Qualitative variables were expressed as frequencies and percentages. The analysis of factors associated with neonatal mortality was carried out using a univariate approach. Associations between qualitative variables were tested using the Chi-square test or Fisher's exact test where appropriate, and those between quantitative variables using Student's t-test. A p-value  $<$  0.05 was considered statistically significant. Multivariate analysis was not performed due to the limited sample size and the presence of collinearity between certain variables (e.g., gestational age, birth weight, and respiratory distress), which could have biased the regression model.

#### Ethical Considerations and Informed Consent

The study was conducted in accordance with the principles of the Declaration of Helsinki (2013 revision). Authorization to carry out the research was obtained from the administrative authorities of the Department of Gynecology, Obstetrics and Pediatrics of Cocody University Hospital. The study involved no invasive procedures and posed no risk to participants. Confidentiality and anonymity of all data were strictly maintained throughout the research process. Verbal informed consent was obtained from each mother or legal guardian after providing a clear explanation of the study's purpose and procedures. Participation was voluntary, and respondents were free to decline or withdraw at any time without affecting

their care or that of their newborn.

### 3. Results

The study included 160 mothers of hospitalized newborns. The mean maternal age was  $29.4 \pm 6.7$  years, ranging from 17 to 45 years. The most represented age group was 30 - 40 years (43.1%), followed by 20 - 30 years (40.6%). Regarding occupation, most mothers were engaged in the informal sector (43.1%), while 26.1% were unemployed and 17.5% were students; only 13.1% worked in the formal sector. From an obstetric standpoint, pauciparous women represented more than half of the participants (53.1%), compared to 30.6% primiparous and 16.3% multiparous. Most mothers (85%) attended fewer than six antenatal visits, and over half (52.5%) had an incomplete antenatal assessment. These findings indicate a young maternal profile, predominantly active in the informal sector, with suboptimal prenatal follow-up.

**Table 1** summarizes the maternal characteristics.

**Table 1.** Maternal characteristics.

Variables	Categories	Frequency (n)	Percentage (%)
Age (years)	<20	17	10.6
	20 - 30	65	40.6
	30 - 40	69	43.1
	40 - 50	9	5.6
Occupation	Student	28	17.5
	Unemployed	42	26.1
	Formal sector	21	13.1
	Informal sector	69	43.1
Parity	Primiparous	49	30.6
	Pauciparous	85	53.1
	Multiparous	26	16.3
Number of antenatal care (ANC) visits	<6	136	85.0
	$\geq 6$	24	15.0
Antenatal assessment	Complete	84	47.5
	Incomplete	76	52.5

#### 3.1. Neonatal Characteristics

Among the 160 newborns included, the majority were born within the same maternity unit (inborn, 83.8%), while 16.3% were referred from other health facilities (outborn). The main reasons for admission were respiratory distress (37.5%), prematurity (32.5%), neonatal sepsis (13.7%), and perinatal asphyxia (7.5%). Cases of status epilepticus (5%) and congenital malformations (3.8%) were also reported. Male infants slightly predominated, accounting for 59.4% compared to

40.6% females. Regarding gestational age, preterm newborns represented two-thirds of cases (65%), while 33.1% were term infants and 1.9% were extremely preterm (<28 weeks). Birth weight ranged from 850 g to 4600 g. Newborns with normal birth weight (2500 - 3999 g) represented 31.3%, whereas very low birth weight (<1500 g) accounted for 37.5% of the population. Macrosomia infants were rare (2.5%). From a trophic standpoint, most newborns were eutrophic (78.1%), followed by hypotrophic (18.1%) and macrosomia (3.8%). The Apgar score at the 5th minute was below 6 in 56.9% of newborns, indicating a significant proportion of perinatal asphyxia. Respiratory distress was moderate in nearly half of the cases (49.4%) and severe in 38.8%. Neurologically, 60% of newborns had a normal condition. Hypoxic-ischemic encephalopathy of Sarnat stage II and III was observed in 19.4% and 10% of cases respectively, while 6.9% showed neurological disorders related to prematurity. **Table 2** summarizes the neonatal characteristics.

**Table 2.** Neonatal characteristics.

Variables	Categories	Number (n)	Percentage (%)
Origin	Inborn	134	83.8
	Outborn	26	16.3
Reason for admission	Respiratory distress	60	37.5
	Prematurity	52	32.5
	Neonatal sepsis	22	13.7
	Low Apgar score	12	7.5
	Status epilepticus	8	5.0
	Congenital malformation	6	3.8
Sex	Male	95	59.4
	Female	65	40.6
Gestational age (weeks)	< 28	3	1.9
	28–36	104	65.0
	37–42	53	33.1
Birth weight (g)	≥ 4000	4	2.5
	2500 - 3999	50	31.3
	2001 - 2499	22	13.8
	1501 - 2000	24	15.0
	1000 - 1500	45	28.1
	< 1000	15	9.4
Trophic status	Eutrophic	125	78.1
	Hypotrophic	29	18.1
	Macrosomic	6	3.8
Apgar score at 5th minute	< 6	91	56.9
	> 6	67	41.9
Respiratory distress	Mild	19	11.9
	Moderate	79	49.4
	Severe	62	38.8

**Continued**

	Normal	96	60.0
Neurological status	Neurological disorders in preterm infants	11	6.9
	Sarnat I	6	3.8
	Sarnat II	31	19.4
	Sarnat III	16	10.0

### 3.2. Pathologies Encountered, Complications, and Outcomes of Newborns

The most frequently encountered pathologies among hospitalized newborns were presumed neonatal bacterial infections (PNBI), observed in 93.8% of the infants, followed by hyaline membrane disease (HMD) (51.9%) and perinatal asphyxia (32.5%). Metabolic disorders and sepsis each accounted for 18.8%, while anemia was noted in 18.1% of cases. Neonatal jaundice (NHND) was recorded in 12.5% of the infants, congenital malformations in 5.6%, and congenital or neonatal encephalopathies (CNE) in 1.9%. The main complications observed were nosocomial infection (30.6%), neonatal hemorrhagic disease (NHND) (16.3%), disseminated intravascular coagulation (DIC) (15%), and status epilepticus (13.1%). Other severe complications included multiorgan failure (6.9%), neonatal encephalopathy (5%), and septic shock (1.9%). Regarding the outcomes of newborns, more than half (54.4%) were transferred to other specialized departments, mainly pediatric surgery, while 39.4% of infants died during hospitalization. Discharges with improvement were rare (2.5%), as were surgical transfers (1.25%) and discharges against medical advice (2.5%). **Table 3** summarizes the pathologies encountered, complications, and outcomes of the newborns.

**Table 3.** Pathologies encountered, complications, and outcomes of newborns.

Variables	Categories	Number (n)	Percentage (%)
Pathologies encountered	PNBI (Presumed Neonatal Bacterial Infection)	150	93.75
	HMD (Hyaline Membrane Disease)	83	51.88
	Perinatal asphyxia	52	32.50
	Metabolic disorders	30	18.75
	Sepsis	30	18.75
	Anemia	29	18.13
	NHND (Neonatal Hemorrhagic Disease)	20	12.50
	Congenital malformations	9	5.63
	CNE (Congenital or Neonatal Encephalopathy)	3	1.88

**Continued**

Complications	Nosocomial infection	49	30.63
	NHND	26	16.25
	DIC (Disseminated Intravascular Coagulation)	24	15.00
	Status epilepticus	21	13.13
	Multiorgan failure	11	6.88
	CNE	8	5.00
	Septic shock	3	1.88
Outcomes of newborns	Transfer	87	54.38
	Death	63	39.38
	Discharge	4	2.50
	Surgical transfer	2	1.25
	Discharge against medical advice (DAMA)	4	2.50

**3.3. Factors Associated with Neonatal Death**

No statistically significant association was found between the mode of delivery and neonatal death, although the risk of death among infants born by vaginal delivery was 1.6 times higher than that observed after cesarean section. Similarly, there was no significant association between the sex of the newborn and mortality. However, a statistically significant association was observed for an Apgar score below 7 at the 5th minute. The risk of death was 1.9 times higher among newborns with a score < 7 compared to those with a score  $\geq 7$ . Regarding gestational age, no significant association was found, although the risk of death was 1.6 times higher among post-term infants. A significant association was identified between neurological status at admission and mortality, with the risk of death being approximately 2.5 times higher among newborns with Sarnat stage III compared to others. A significant relationship was also found between respiratory distress and death. Newborns with a Silverman score between 3 and 4 had a 1.4 times higher risk of death, while those with a score  $\geq 5$  had a 1.6 times higher risk. Finally, a significant association was observed between birth weight and mortality. Newborns weighing less than 1000 g had a 2.5 times higher risk of death, and those weighing between 1500 and 2000 g had a 2.1 times higher risk. **Table 4** summarizes the Factors Associated with Neonatal Death

**Table 4.** Factors associated with neonatal death.

Variables	Categories	Transfer n (%)	Death n (%)	OR (95% CI)	P-value
Mode of delivery	Vaginal delivery	46 (47.4)	39 (62.0)	1.685 (0.886 - 3.206)	0.111
	Cesarean section	51 (52.6)	24 (38.0)		

**Continued**

					0.845
Sex	Male	57 (60.0)	38 (40.0)	0.938 (0.491 - 1.790)	
	Female	40 (61.5)	25 (38.5)	—	
Apgar score (5th minute)	≥7	62 (64.0)	30 (47.6)	—	0.042
	<7	35 (36.0)	33 (52.4)	1.949 (1.022 - 3.714)	
Gestational age	Preterm	64 (66.0)	41 (65.0)	1.041 (0.534 - 2.027)	0.649
	Term	31 (32.0)	21 (33.4)	0.938 (0.478 - 1.846)	
	Post-term	2 (2.0)	1 (1.6)	1.305 (0.116 - 14.70)	
Neurological disorders	Sarnat I	7 (7.2)	1 (1.6)	0.613 (0.095 - 3.937)	0.010
	Sarnat II	21 (21.7)	12 (19.0)	1.174 (0.531 - 2.595)	
	Sarnat III	4 (4.1)	12 (19.0)	2.572 (1.892 - 3.497)	
Silverman score	1 - 2	13 (13.4)	2 (3.2)	0.317 (0.086 - 1.168)	0.031
	3 - 4	21 (21.6)	21 (33.3)	1.406 (0.953 - 2.070)	
	≥5	59 (60.0)	40 (63.5)	1.634 (1.142 - 2.338)	
Birth weight (g)	≤1000	2 (2.0)	14 (22.2)	2.571 (1.918 - 3.448)	0.002
	1001 - 1500	29 (30.0)	15 (23.8)	1.365 (0.661 - 2.817)	
	1501 - 2000	18 (18.5)	6 (9.5)	2.165 (0.809 - 5.795)	
	2001 - 2499	14 (14.5)	8 (12.7)	1.160 (0.456 - 2.948)	
	2500 - 3999	32 (33.0)	20 (31.7)	1.058 (0.537 - 2.086)	
	≥4000	2 (2.0)	0 (0.0)	1.663 (1.465 - 1.888)	

## 4. Discussion

### 4.1. Sociodemographic Profile of Mothers

In this study, most mothers were between 20 and 40 years old, with a predominance of women working in the informal sector. This profile reflects the demographic structure of Côte d'Ivoire, where women of childbearing age are generally young and economically active within the informal economy [8]. These findings are consistent with other African studies showing that socioeconomic vulnerability, low education level, and limited access to antenatal care are major determinants of neonatal risk [9]-[11]. In our population, 85% of mothers had attended fewer than six antenatal consultations, which is below the World Health Organization's recommendation of at least eight visits to ensure optimal maternal and fetal surveillance [12] [13].

## 4.2. Clinical Profile of Newborns

Most newborns admitted to the neonatal intensive care unit (NICU) were inborn (83.8%), reflecting both an effective perinatal referral system and a high burden of local neonatal morbidity. The main causes of admission were respiratory distress (37.5%), prematurity (32.5%), and neonatal sepsis (13.7%). These findings are similar to those reported by Haile and Tewele in Ethiopia [14] and Seid *et al.* in Jimma [15], who documented respiratory distress and sepsis rates of 17.7% each. These conditions remain the leading causes of neonatal hospitalization in African NICUs, underscoring the heavy contribution of prematurity and perinatal infections to neonatal morbidity [3] [16]. Premature infants represented nearly two-thirds of admissions, confirming their high vulnerability to respiratory and metabolic complications [17] [18]. Very low birth weight infants (<1500 g) accounted for 37.5% of cases, consistent with findings from Sourerya *et al.* in Cameroon [18].

## 4.3. Neonatal Pathologies and Complications

The most frequent pathologies observed were presumed neonatal bacterial infection (93.8%), hyaline membrane disease (51.9%), and perinatal asphyxia (32.5%). These results are in line with those of Al-Nafeesah *et al.* in Saudi Arabia [19] and Thomas *et al.* in Ethiopia [20]. The high rate of neonatal infections in our cohort may be attributed to inadequate hygiene practices, prematurity, and the lack of standardized infection prevention protocols, as also reported by Garba *et al.* in Niger [21]. Severe respiratory distress, affecting 38.8% of newborns, was comparable to data from Faye *et al.* in Dakar (47.7%) [22] and can be explained by the high proportion of premature infants and surfactant deficiency [23] [24]. Neurological disorders were present in 40% of infants, higher than the 18% reported by Sheth [25], likely due to delayed transfer and perinatal asphyxia.

## 4.4. Neonatal Mortality and Associated Factors

The neonatal mortality rate observed in this study (39.4%) remains high but comparable to findings from other African studies [26]-[28]. The main factors significantly associated with mortality were respiratory distress, low birth weight, neurological impairment, and an Apgar score < 7 at the fifth minute, all previously identified as key predictors of neonatal death in African settings [27] [29] [30]. This elevated mortality rate reflects both the severity of admitted cases and the limitations in human and technical resources in neonatal intensive care units.

### Study Limitations

This study has some limitations. First, its cross-sectional and single-center design limits the generalizability of the findings to other neonatal care settings. Second, some clinical and laboratory data were retrospectively extracted from medical records, which may have led to missing or incomplete information. Third, microbiological confirmation of infection was not systematically performed for all cases,

possibly resulting in an overestimation of presumed bacterial infections. Finally, only univariate analyses were conducted, as the limited sample size and collinearity between variables such as gestational age, birth weight, and respiratory distress prevented reliable multivariate modeling. Despite these limitations, this study provides valuable insight into neonatal morbidity and mortality patterns in a tertiary hospital in Côte d'Ivoire and highlights priorities for improving newborn care.

## 5. Conclusion

This study highlights a young maternal population, predominantly active in the informal sector, with insufficient antenatal follow-up. These characteristics point to persistent challenges in obstetric care and prenatal prevention in Côte d'Ivoire, directly impacting neonatal health outcomes. Among newborns, admissions were dominated by prematurity, respiratory and neurological distress, and infections, emphasizing the burden of perinatal conditions on neonatal morbidity and mortality. Despite progress, neonatal mortality remains high, underlining the urgent need to improve antenatal care, prevent perinatal infections, and ensure the availability of surfactant. Continuous neonatal staff training, standardized care protocols, and nosocomial infection prevention should be prioritized to improve survival outcomes among hospitalized newborns.

## Conflicts of Interest

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

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