


# Clinical, Aetiological and Evolutionary Aspects of Respiratory Distress in Term Neonates: A Single-Centre Cross-Sectional Study

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## Abstract

**Introduction:** Respiratory distress is a frequent cause of morbidity and mortality in neonates. The aim of this study was to assess its frequency and describe its clinical and evolutionary characteristics in the neonatology department of the Gabriel Touré University Hospital in Bamako. **Methodology:** This was a prospective cross-sectional study conducted from 1 January 2021 to 30 June 2021. All term neonates aged 0 to 28 days hospitalised with signs of respiratory distress (tachypnoea, nasal flaring, expiratory whining, intercostal and subcostal indrawing, xiphoid funneling and cyanosis) were included. The sociodemographic and clinical variables of the newborns and their mothers were analysed using SPSS.20 software. **Results:** During the study period, 1272 newborns were admitted to hospital, including 705 born at term, of whom 188 were included in the study. The mothers' ages ranged from 14 to 45 years, with an average of 24 years. The pregnancy was not followed up in 15% of cases. Newborns were resuscitated at birth in 51% of cases. The main clinical signs observed were hypoxia, neurological disorders and fever. Perinatal asphyxia (55%), neonatal infections (34%) and congenital malformations (6%) were the main causes of respiratory distress. Mortality was estimated at 37%. **Conclusion:** Neonatal respiratory distress is a major cause of death. Most causes can be avoided if pregnancy and delivery are properly managed.

## Keywords

Respiratory Distress, Neonate, Asphyxia

## 1. Introduction

Respiratory distress is the inability to obtain and maintain normal breathing. Respiratory distress in neonates is a frequent reason for hospitalisation. It is the cause of considerable mortality in developing countries [1] [2]. According to World Health Organisation estimates, around 3% of the 120 million children born each year in developing countries present with respiratory distress requiring resuscitation, and around 900,000 of them die as a result. Around 15% of full-term newborns and 29% of premature babies admitted to a neonatal intensive care unit present with NRD [3].

It is clinically diagnosed by the combination of an abnormal respiratory rate, signs of respiratory distress and generalised or localised cyanosis. The causes of respiratory distress in newborns (NRD) are diverse and multi-systemic; its origin is not always pulmonary [2] [4]. There are many risk factors; the increasing number of full-term babies born by elective caesarean section has also increased the incidence. The most common causes in term newborns are transient neonatal tachypnoea, respiratory distress syndrome, pneumonia, meconium aspiration syndrome, persistent neonatal pulmonary hypertension and pneumothorax [4]. Early diagnosis of respiratory distress and appropriate treatment may be the only guarantee of a good prognosis [5] [6] [7].

In Mali, neonatal mortality is very high due to inadequate technical facilities, a lack of qualified staff and difficulties in organising care, all of which make management difficult [1] [4]. Despite these enormous challenges in terms of diagnosis and management, very few studies have been devoted to respiratory distress in term newborns. This study was initiated to assess the frequency of respiratory distress in term newborns in the neonatology department, to identify the clinical signs and main causes of respiratory distress in newborns, and to propose an innovative strategy to improve the quality of care.

## 2. Methodology

### 2.1. Type of Study and Study Period

This was a prospective cross-sectional study, conducted in the neonatology unit of the Gabriel Touré University Hospital Centre (CHU) in Bamako, which is a third referral hospital in Mali. The neonatology unit is located on the 1st floor of the paediatrics department, which includes a large reception hall and five hospitalisation wards divided as follows:

- Ward 1: reserved for stable full-term newborns
- Ward 2: reserved for unstable term newborns
- Ward 3: reserved for premature babies and stable hypotrophic babies
- Ward 4: reserved for unstable newborns and hypotrophs
- Ward 5: reserved for incubators

The department also includes a Kangaroo Unit (for monitoring premature and hypotrophic babies) and a sorting room for patient visits and monitoring. It is equipped with thirty beds, ten heating tables, ten incubators, an oxygen circuit

for respiratory assistance for newborns in distress and six phototherapy devices. There is no mechanical ventilation equipment or CPAP (Continuous Positive Airway Pressure). The neonatology department sees newborn babies up to 28 days old. Five doctors are usually present on working days. The paramedical team of 15 nurses is led by a senior nurse who works in coordination with the head of department. The staff take it in turns day and night to ensure continuous medical surveillance. Every morning, a staff meeting is held to review the situation of each child admitted to the department.

## 2.2. Study Period and Study Population

The study was conducted from 1 January 2021 to 30 June 2021. All term neonates (gestational age between 37 and 41 weeks of amenorrhoea) aged 0 to 28 days hospitalised in the neonatology department and presenting with clinical signs of respiratory distress were included. The clinical signs of respiratory distress were tachypnoea, nasal flaring, expiratory grunting, intercostal and subcostal tugging, xiphoid funneling and cyanosis.

Premature newborns (born before 37 weeks' gestation) and those from prolonged pregnancies (over 41 weeks' gestation) were not included.

## 2.3. Tools and Data Collection

Data were collected by interview and from medical records after authorisation from the newborns' parents or guardians. On admission, patients were examined by a doctor registered with the Diplôme d'études spécialisées (DES). Daily monitoring was performed. Vital signs and oxygen saturation were observed daily and recorded in the medical records. Data collected included the sociodemographic and obstetric characteristics of the mothers and the epidemiological and clinical characteristics of the newborns.

Data were entered and analysed using Microsoft Excel 2013 and SPSS 20.0. Qualitative variables were expressed as frequencies and percentages, and quantitative variables as means.

## 2.4. Ethical Considerations

Ethical authorisation was obtained from university and hospital authorities. The name or any other identifying information was not recorded on the survey form and all information extracted from the file was kept strictly confidential and secure. All efforts were made to preserve the confidentiality of the participants by storing the information in a filing cabinet and keeping it in a password-locked computer system.

## 2.5. Operational Definitions

**1) Neonatal respiratory distress** is defined by the presence of one or more of the following signs: an abnormal respiratory rate (tachypnoea > 60 breaths/min, bradypnoea < 30 breaths/min, respiratory pauses or apnoea) or signs of respira-

tory struggle (expiratory groans, fluttering of the wings of the nose, intercostal draught, xiphoid funnels or thoraco-abdominal tilt), with or without cyanosis.

- It is early if it occurs before 7 days of life.
- It is late if it occurs after 7 days of life.

**2) Perinatal asphyxia** has been defined by an Apgar score  $< 7$  at 5 minutes of life and the presence of neurological signs such as hypotonia, weakness of archaic reflexes, coma or convulsions [8] [9].

**3) Neonatal infection** refers to any newborn presenting with an infectious anamnesis (prolonged rupture of membranes, maternal fever at the time of delivery, maternal urogenital infections during the last month of pregnancy, etc.), clinical signs of infection, or one of the following: leukocytosis  $> 25,000/\text{mm}^3$ , leukopenia  $< 5000/\text{mm}^3$ , platelet count  $< 150,000/\text{mm}^3$ , CRP  $> 6 \text{ mg/l}$  [8] [9].

**4) Transient tachypnoea** in caesarean neonates was a transient respiratory distress triggered by delayed resorption of fetal lung fluid, which improved over the first 24 to 48 hours of life [8] [9].

### 3. Results

#### 3.1. Socio-Demographic and Obstetric Characteristics of the Mothers

During the study period, 1272 newborns were admitted to hospital, of whom 705 (55%) were born at term. One hundred and eighty-eight full-term babies presented with respiratory distress on admission (27%). The parents lived in urban areas in 77% of cases, and in unfavourable socio-economic conditions in 96% of cases (Table 1). The mothers' ages ranged from 14 to 45, with an average of 24. They were aged between 18 and 29 in 56% of cases. They had not attended school in 47% of cases. The mothers were multiparous in 37% of cases and primiparous in 33%. The pregnancy was not monitored in 15% of cases. Arterial hypertension was found in 8 mothers and sickle cell anaemia in 6. In this study, 81% of the mothers gave birth vaginally, with labour lasting more than 18 hours in 5% of cases. In 24% of cases, delivery took place in a university hospital, and the mothers of 16 children gave birth in a private clinic (Table 2).

#### 3.2. Clinical Characteristics and Outcome of Newborns (Table 3)

The newborns had a low birth weight in 28% of cases. Birth weight ranged from 1280 g to 4110 g with an average of 2608 g. The average age on admission was 4 days, ranging from 0 to 28 days. In 53% of cases, they were admitted on the first day of life (Table 3). The sex ratio was 1.7. The Apgar score was less than 7 at the 5th minute of life in 12% of cases. Newborns were reanimated at birth in 51% of cases. Hypoxia was observed in 67% of neonates. The Silverman score was greater than 5 in 14% of cases. The main clinical signs associated with respiratory distress were weakness of archaic reflexes (76%) and fever (48%). Convulsions were observed in a quarter of patients. C-reactive protein levels were elevated in 14% of cases.

**Table 1.** Socio-demographic characteristics of mothers.

Socio-demographic characteristics		Number (n = 188)	%
Maternal age (year)	14 - 17	21	11
	18 - 29	106	56
	30 - 45	61	33
Residence	Urban (district and regional capital)	144	77
	Rural	44	23
Socio-economic Level	Unfavourable	181	96
	favourable	7	4
Mothers' level of education	Not enrolled	89	47
	Primary	61	32
	Secondary	38	20

**Table 2.** Mothers' obstetrical history.

		Workforce	%
Parity	Multiparity ( $\geq 4$ births)	69	37
	Primiparity	62	33
	Pauparity (2 to 3)	57	30
Number of antenatal consultations (CPN)	Less than 4 NPCs	104	55
	4 CPN and more	57	30
	No NPC	27	15
route of delivery	Low track	153	81
	Caesarean section	35	19
Working hours	Working hours > 18 h	9	5
	Working hours < 18 h	154	82
	Not specified	25	13
Place of delivery	CSREF	73	39
	Gabriel Touré University Hospital	40	21
	CHU Point G	6	3
	CSCOM	40	21
	Medical practice	28	15
	Clinic	1	1

**Table 3.** Socio-demographic and clinical characteristics of newborns.

Socio-demographic and clinical characteristics of newborn babies		Workforce	%
Age (days) of newborns	<1	99	53
	1 - 6	52	28
	7 - 14	17	9

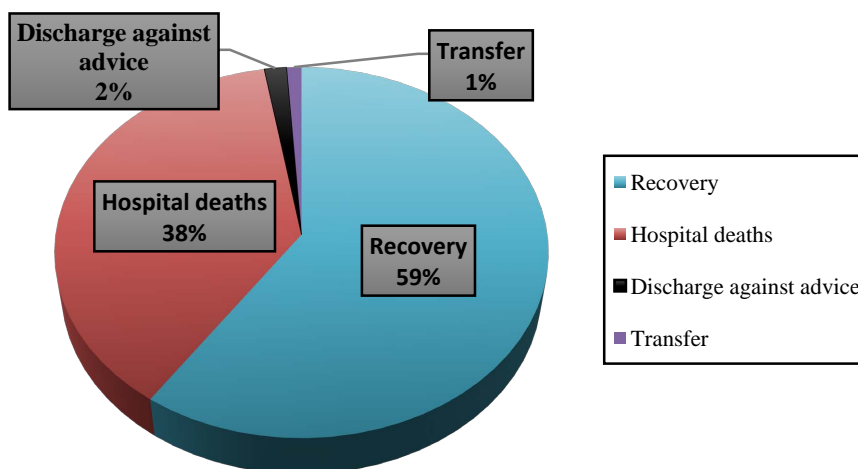
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	15 - 21	8	4
	22 - 28	12	6
Gender	Male	119	63
	Female	69	37
Apgar score at 5 <sup>ème</sup> minutes	<7	22	12
	≥7	157	83
	Not specified	9	5
Birth weight (g)	<2500	53	28
	2500 - 4000	130	69
	>4000	3	2
Signs of respiratory struggle	Intercostal traction (ICT)	187	99
	Battement des ailes du nez (BAN)	181	96
	Geignement	32	17
	Thoracoabdominal balancing (TAB)	6	3
	Xyphoid funnel	6	3
Etiologies of NRD	Perinatal asphyxia	103	55
	Neonatal infection	63	34
	Congenital malformations	13	6
	Transient tachycardia	6	3
	Haemorrhagic disease	2	1
	Meconium inhalation	1	1

Chest X-rays were performed in ten patients, half of whom showed pathological signs. Cardiac disease was detected in 7 patients. Perinatal asphyxia was the main cause of respiratory distress in this study (55%), followed by neonatal infection (34%) and congenital malformations (6%). Antibiotic treatment was prescribed for 182 patients (97%). Saline was administered to 89% of patients and 78% received oxygen therapy. In some cases, caffeine was administered (11%). The average hospital stay was 4 days, ranging from 1 to 24 days. The mortality rate was 37% (**Figure 1**). Three patients (2%) were discharged against medical advice, and two newborn babies were transferred to another hospital at the parents' request.

#### 4. Discussion

The aim of this prospective, single-centre, cross-sectional study was to investigate the clinical characteristics, aetiological factors and outcome of term neonates with respiratory distress. However, the study had limitations due to its single-centre design, small sample size and short study duration (6 months). Another limitation of this study was that it was difficult to assess the actual condition of the newborn at birth, as most of the patients were born in other hospitals or in



**Figure 1.** Distribution of newborns by outcome.

the absence of the paediatrician. The frequency of respiratory distress in newborns (27%) was very high in this study. These results are slightly lower than those obtained by Senegalese authors (34.8%) who conducted a study over a longer period (12 months) [9]. A similar unpublished study in the neonatal department of a university hospital in Morocco found an admission rate of 9.8% [10]. A previous study reported a higher prevalence (47.5%) in a university hospital in Cameroon [8]. These results confirm the need not to underestimate respiratory distress in term newborns, even if it is less frequent than in premature infants [11].

Mothers' level of education, multiparity and inadequate or non-existent antenatal care are generally associated with a risk of respiratory distress in the newborn [2] [3]. In this study, the majority of pregnant women were not followed up in accordance with World Health Organisation recommendations. The WHO now recommends eight antenatal visits, providing additional opportunities for early detection and management of complications related to pregnancy and childbirth [12].

Primiparity was fairly common and considered by some authors to be a risk factor for perinatal and obstetric complications [3] [4] [13]. Most parturients gave birth in peripheral facilities (private and public), which were generally poorly equipped and lacking in qualified staff. Most mothers (81%) gave birth vaginally. It is therefore necessary to improve referral/evacuation systems and to make caesarean sections genuinely free of charge. Ongoing training for staff (midwives and birth attendants), improvements in technical facilities at all levels and better conditions for transferring newborns must be integrated into strategies to prevent neonatal mortality [14] [15]. Priority should be given to identifying and transferring high-risk pregnant women to a centre capable of providing specialist care for mother and child [16]. According to the literature, hospitalisation during the first week of life, male gender and referral status are factors generally associated with neonatal mortality [17] [18]. A low Apgar score

(measured at five minutes of life) and hypoxia are associated with a long length of stay and high neonatal mortality [2] [19]. In most cases, bacteriological and radiological examinations were not carried out because the hospital was under-equipped or the parents were poor.

The main causes of respiratory distress found in our patients do not differ from studies carried out in Burkina Faso and Senegal [6] [9]. With a minimum of rigour, these causes can be prevented and treated. Several factors are involved in the occurrence of perinatal asphyxia. They may be maternal, obstetric or foetal in origin, or linked to the healthcare system and the environment in which childbirth takes place. Most cases of neonatal asphyxia can be prevented by good monitoring of the pregnancy and by improving the quality of perinatal care [20]. The training of all healthcare personnel and the provision of adequate equipment in maternity wards and neonatology departments will have a definite impact on reducing neonatal mortality.

## 5. Conclusion

Neonatal respiratory distress is a frequent cause of admission and mortality in the neonatology ward. Most of the risk factors and aetiologies are preventable. Perinatal asphyxia and neonatal infections are the main causes of respiratory distress in term neonates. Improving the quality of pregnancy monitoring, building staff capacity, providing neonatal resuscitation equipment and improving transfer conditions could improve the quality of antenatal care.

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## Conflicts of Interest

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

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