

Morbidity and Mortality of Newborns in a Context of Limited Resources in Tombouctou, Mali

Kassogué Djibril¹, Cissouma Assétou², Kassogué Abdoulaye^{3*}, Boré Boubacar¹, Sogoba Robert¹, Diallo Zoumana¹, Maiga Talfi¹, Dolo Akoro¹, Sogoba Seydou⁴, Touré Lahaou¹, Maiga Mariam⁵, Samaké Alou⁵, Mariko Souleymane¹, Ongoiba Oumar¹, Sanogo Oumar¹, Traoré Bassirima¹

¹Paediatrics Department, Timbuktu Hospital, Timbuktu, Mali

²Paediatrics Department, Sikasso Hospital, Sikasso, Mali

³Paediatrics Department, Nianankoro Fomba Hospital, Ségou, Mali

⁴Department of Obstetrics and Gynaecology, CHU du Point G, Bamako, Mali

⁵Department of Paediatrics, Commune VI District Hospital, Bamako, Mali

Email: *kassogueabdoulaye6@gmail.com, kassogedji@yahoo.fr, cis_astou@yahoo.fr, borboubacar@gmail.com, sogobar@yahoo.fr, diallozoumana1367@gmail.com, talfimaiga23@gmail.com, doloakoro@gmail.com, seydotsogoba@yahoo.fr, lahaou@hotmail.com, m_mariam07@yahoo.fr, alousamake2008@gmail.com, souleymanemariko@yahoo.fr, babaongoiba@gmail.com, osanogo49@yahoo.fr, t.bassirima@yahoo.fr

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Abstract

Introduction: Worldwide, 2.3 million children died in the first 20 days after birth in 2022, according to the WHO. In Mali, according to the sixth Demographic and Health Survey, the neonatal mortality rate was estimated at 33% live births in 2018. The Timbuktu region had the highest neonatal mortality rate in the country with 44%. The objective of this work was to study the causes of neonatal morbidity and mortality and related factors in the paediatrics department of Timbuktu hospital. **Materials and method:** This was a descriptive, cross-sectional study conducted from 1 January to 31 December 2023 in the neonatology unit of the paediatrics department of Timbuktu hospital, including all newborns admitted to hospital. **Results:** Our study took place over 12 months, during which 618 admissions were made to the paediatric ward, including 244 newborns, *i.e.* 39.48%. The majority of newborns (86.5%) were admitted in the first week of life. The mean age was 3 days, with a sex ratio of 1.1 for males. Weight under 2500 g was 54.1% for an average weight of 2372 g. The main mode of admission was transfer from the hospital maternity unit (62%). The main reasons for admission were acute foetal distress (27.9%) and prematurity (26.2%). The average age of the mothers was 24, with extremes of 15 and 49. The mothers were housewives (87.3%), uneducated and primiparous (59% and 36.5% respectively); only 40.2% had made more than 3 antenatal

care visits. Newborns born by vaginal delivery accounted for 80.7% and those born by caesarean section for 19.3%. The risk of infection was present in 52.5% of cases. The three leading causes of hospitalisation were birth asphyxia (40.2%), neonatal infection (32.4%) and prematurity (25%). The mortality rate was 21.7%. The main causes of death were prematurity (39.6%), birth asphyxia (32.1%) and neonatal infection (24.5%). **Conclusion:** Neonatal morbidity and mortality remain a concern in Timbuktu. Despite the unfavourable security situation, morbidity and mortality indicators are close to those in some hospitals in Mali. The correct application of Essential Newborn Care and antenatal care remains a major challenge for the hospital and the Timbuktu region.

Keywords

Morbidity, Mortality, Newborns, Timbuktu

1. Introduction

Worldwide, 2.3 million children died in the first 20 days after birth in 2022. The 6500 or so newborns who die every day account for 47% of all deaths of children under the age of five. Most of these deaths are the result of the mother's poor health and nutritional status, combined with inadequate care before, during and after childbirth [1].

The neonatal period (from birth to 28 days of life) is marked by the fragility of the various homeostasis regulation systems [2]. The neonatal mortality rate in sub-Saharan Africa was the highest in the world in 2022, at 27 deaths per 1000 live births. The three main causes are asphyxia (40%), low birth weight and prematurity (25%) and infections (20%) [1].

In Mali, according to the sixth Demographic and Health Survey (E.D.S.M VI), the neonatal mortality rate estimated at 34% live births in 2012 in Mali fell to 33% live births in 2018. The Timbuktu region has the highest neonatal mortality rate in the country at 44%, ahead of the Sikasso (42%) and Segou (41%) regions. Other perinatal indicators are also among the highest in Mali: perinatal mortality of 57% followed by Sikasso (45%) and Segou (42%) [3].

Projects to improve newborn survival must have a solid foundation of essential newborn care and be consistent with targets for antenatal and postnatal care, skilled health personnel and emergency obstetric and neonatal care [1]. All the components of this strategy are affected by the security crisis in Mali, particularly in the northern regions, including Timbuktu. The paediatric ward at Timbuktu hospital is the only referral facility for newborn babies in the Timbuktu and Taoudeni regions. Despite these difficulties, the scarcity of studies on the subject in Timbuktu and questions about the actual situation of care for newborns, particularly sick newborns, compared with other regions of the country, prompted the initiation of this work, the aim of which is to study the causes of neonatal

morbidity and mortality and to determine the factors associated with them in the paediatric department of Timbuktu hospital.

2. Methodology

We conducted a descriptive and analytical cross-sectional study with prospective data collection from 1 January to 31 December 2023 (*i.e.* 12 months) in the functional neonatology unit of Timbuktu Hospital. All sick neonates hospitalised in the unit during the study period were included. Newborns seen in consultation but not hospitalised as well as newborn babies whose records were incomplete and therefore difficult to use were not included in the study. Sampling was exhaustive, and the parameters studied were the newborn's vitals, signs and symptoms; the parents' socio-demographic characteristics; obstetric history, pregnancy follow-up, and the place and type of the mother's delivery. All newborns meeting the inclusion criteria were systematically collected. Patient files were selected on the basis of their completeness and usability. Data were collected on an individual form. Our study is purely scientific and will enable us to evaluate the management of sick newborns. The results of this study will be made available to all those involved in newborn health and survival. Word processing and tables were created using Word and Excel 2013. Data analysis was performed using SPSS version (12.0). We used the chi2 test with a significant p threshold of less than 0.05. This study was carried out on the basis of informed consent from the parents and full support from the hospital administration. The results obtained were not used for any other purpose. They will be used to improve medical practice.

3. Results

Our study took place from 1 January to 31 December 2023, during which time 618 admissions were made to the paediatrics department, including 244 newborns in the functional neonatology unit, a frequency of 39.48%; with a peak in August (**Figure 1**).

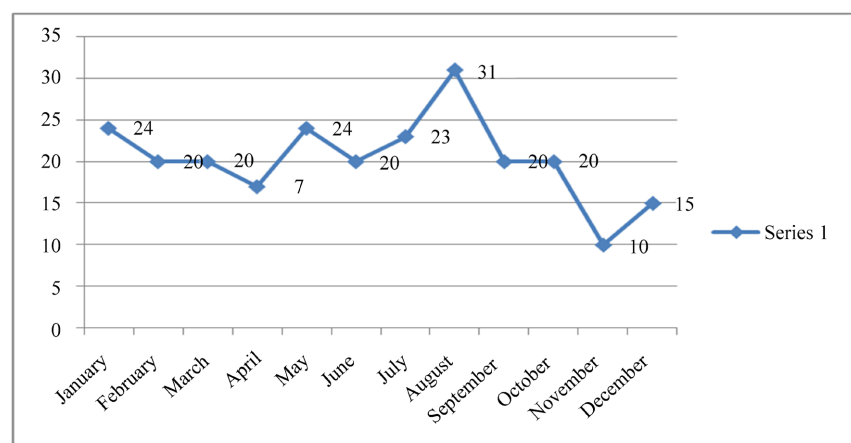


Figure 1. Breakdown of newborns by month of admission to Timbuktu hospital in 2023.

The majority of newborns (211 or 86.5%) were admitted in the first week of life.

The average age of the newborns was 3 days, with a sex ratio of 1.1 for males. Admission weights of less than 2500 g accounted for 54.1%, with an average weight of 2372 g. The mode of admission was hospital maternity transfer (62%), referred by parents (34.4%) and referral from another health facility (3.6%). 98% of our patients came from Timbuktu and the surrounding area.

Mothers aged 20 - 29 accounted for 50%. The average age was 24, with extremes of 15 and 49. In 87.3% of cases they were housewives; 59% had not attended school. Primiparous mothers accounted for 36.5%, followed by multiparous mothers (32.8%). Mothers who had undergone validated antenatal care (more than 3 sessions) accounted for 40.2%.

Newborns born by vaginal delivery accounted for 80.7% and those born by caesarean section 19.3%. Home births accounted for 7.4%. The risk of infection was present in 52.5% of cases (**Table 1**).

Table 1. Sociology-demographic characteristics of mothers in Timbuktu hospital in 2023.

Age of mother	Number	Percentage
≤19 years	67	27.5
20 - 29 years	122	50.0
30 - 39 years	47	19.3
≥40 years	8	3.3
Mother Instruction	Number	Percentage
No schooling	144	59
Koranic	52	21.3
Primary	26	10.7
Secondary	10	4.1
Higher	12	4.9
Mother's occupation	Number	Percentage
Housewife	213	87.3
Shopkeeper	3	1.2
Pupil/student	20	6.3
Civil servant	8	3.2
Parity	Number	Percentage
Primiparous	89	36.5
Paucipare	35	14.3
Multiparous	80	32.8
Large multiparous	40	16.4

The main reasons for admission were acute foetal distress (27.9%), prematurity (26.2%), fever (7%) and refusal to suckle (6.6%). The dominant clinical signs in newborns were hypothermia (61.1%), respiratory distress (63.5%), pallor (11.4%), sucking problems (76.6%) and absence/poor responsiveness (50.8%) (**Table 2**).

Table 2. Clinical characteristics of newborns on admission to Timbuktu Hospital in 2023.

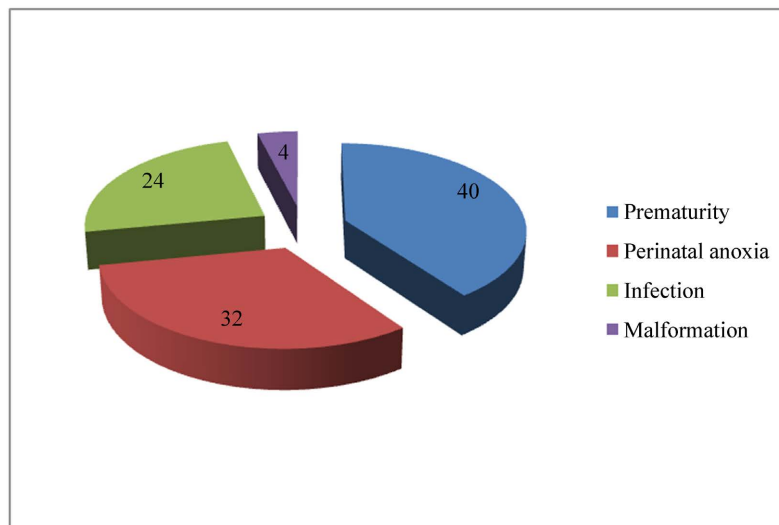
Reasons for admission	Number	Percentage
Acute foetal distress	68	27.9
Bloating	5	2
Diarrhoea	7	2.9
Prematurity	64	26.2
Refusal to suckle	16	6.6
Dyspnoea	12	4.9
Fever	17	7
Malformation	4	1.6
Vomiting	3	1.2
Jaundice	6	2.5
2 or more signs	42	17.2
Temperature	Number	Percentage
<35°C	35	14.3
35°C - 36°C	124	50.8
37°C - 37.5°C	31	12.7
>37.5°C	54	22.1
Respiratory distress	Number	Percentage
None	89	36.5
Mild	83	34.0
Severe	72	29.5
Pallor	Number	Percentage
Absent	216	88.5
Mild	25	10.2
Severe	3	1.2
Suction	Number	Percentage
Absent	91	37.3
Ineffective	96	39.3
Effective	57	23.4
Reactive	Number	Percentage
Does not move after stimulation	28	11.5
Moves after stimulation	96	39.3
Spontaneous movements	120	49.2
Total	244	100

The top three causes of hospitalisation were perinatal anoxia (40.2%), neonatal infection (32.4%) and prematurity (25%). One case of neonatal tetanus was diagnosed. The infant was fed mainly parenterally on admission, with infusion of 10% serum glucose + electrolytes (92.2%), and the average length of hospital stay was 3.83 days (**Table 3**).

Table 3. Morbidity and management of newborns at Timbuktu Hospital in 2023.

Diagnosis	Number	Percentage	
Perinatal anoxia	98	40.2	
Neonatal infection	78	32	
Prematurity	61	25	
Hypotrophy	2	0.8	
Malformation	4	1.6	
Neonatal tetanus	1	0.4	
Treatment received	Number	Percentage	
Received (medical)	242	99.2	
Not received	parental refusal	1	0.4
	death before treatment	1	0.4
Molecules (antibiotic therapy)	Number	Percentage	
Dual antibiotic therapy	238	97.5	
Tri-antibiotic therapy	4	1.6	
No	2	0.8	
Food on admission	Number	Percentage	
SG10 + electrolytes	225	92.2	
Direct feeding	14	5.7	
Feeding	4	1.2	
None (death before treatment and refusal)	2	0.8	
Total	244	100	

The main causes of death were prematurity (39.6%), birth asphyxia (32.1%) and neonatal infection (24.5%) (**Figure 2**). The vast majority of deaths (90%) occurred during the first 3 days of hospitalization. The mortality rate was 21% (**Figure 3**).

**Figure 2.** Outcome of newborn care at Timbuktu Hospital in 2023.

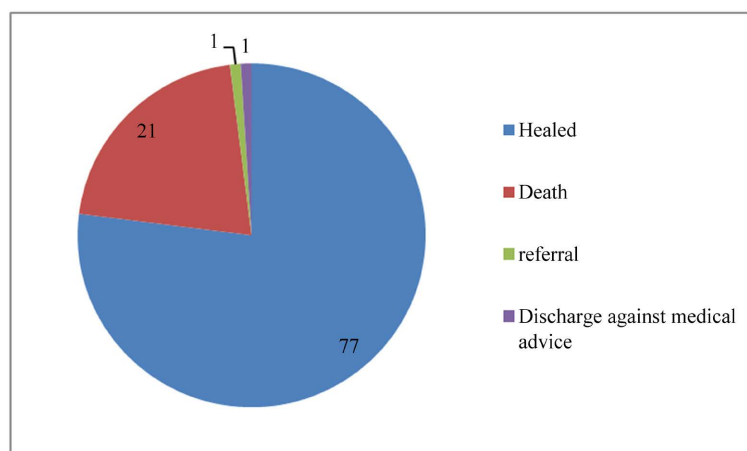


Figure 3. Causes of newborn mortality in Timbuktu hospital in 2023.

4. Comments and Discussion

4.1. Socio-Demographic Characteristics

4.1.1. Parents' Characteristics

In our study, mothers aged between 20 and 29 years were the most represented (50%). The average age was 24.09 years, with extremes of 15 and 49 years. The majority of mothers (59%) did not attend school. Primiparous mothers were in the majority (36.5%), followed by multiparous mothers (32.8%). Most of the mothers (87.3%) were housewives and more than half of the fathers (59%) were farmers. The majority of mothers (80.3%) and more than half of fathers (67.6%) did not attend school. These characteristics reflect the literacy rates in the Timbuktu region (among the lowest in the country) according to EDSM VI of 2018 [3]: 19% for women and 30% illiteracy for men.

4.1.2. Characteristics of Newborn Babies

The majority of newborns (211 or 86.5%) were admitted in the first week of life. This can be explained by the fact that the majority of our patients were referred to us directly by the hospital maternity unit (62%), generally following the detection of a problem in the immediate postpartum period. This predominance of admissions in the first week of life has been described by Sylla M. *et al.* in Bamako [4], and by Doucoure I. and Kassogue A. in Ségou [5] [6]. The average age of newborns was 3 days, with a sex ratio of 1.1 for males. This male predominance has been observed in several other studies [4] [6]-[9]. Weight on admission of less than 2500 g accounted for 54.1%, with an average weight of 2372 g. This result is in line with that of the EDSM VI, according to which the percentage of low birth weight births is higher when the mother has no education than when she has secondary education or more. 98% of our patients came from Timbuktu and the surrounding area.

4.2. Clinical Data

4.2.1. Morbidity

The main reasons for admission were acute foetal distress (27.9%) and prematurity (26.2%) followed by fever (7%) and refusal to suckle (6.6%). Most newborns

showed signs of danger: hypothermia (61.1%), respiratory distress (63.5%), paleness (11.4%), sucking problems (76.6%) and absence/poor responsiveness (50.8%). All these situations require specific and urgent treatment by qualified staff.

The top three causes of hospitalisation were perinatal anoxia (40.2%), neonatal infection (32.4%) and prematurity (25%). The average length of hospital stay was 3.83 days. These major causes of hospitalisation have been found in several studies in Bamako, Sikasso and Ségou [4] [6] [10]-[15]. They constitute major problems during the neonatal period because of their frequency, severity and possible consequences on the child's neuropsychological development. In our study, 59.8% of women had performed less than three ANC. This low ANC rate (poor pregnancy monitoring) reflects the number of women who did not receive appropriate preventive care (medication, VAT), which explains the occurrence of a case of neonatal tetanus. According to the 2018 EDSM VI, in the Timbuktu region, prenatal care by a qualified provider was 31%, compared with a national average of 67%; iron supplementation coverage during pregnancy was 66%, compared with a national average of 75%; prevention of neonatal tetanus by vaccination of the mother was 32%, compared with 50% for the country as a whole; and postnatal care coverage of the newborn was 28%, compared with 61% in the Koulikoro region [3]. In our study, congenital malformations were observed in 1.6% of cases, lower than the rate of 3.4% reported by Kassogue. A in Ségou [6]. In a worldwide study of the frequency of congenital malformations, involving 20 million births, 0.83% of malformations were reported on the basis of birth certificates, 1.26% on the basis of hospital records and 4.50% on the basis of complete paediatric examinations [15]. In the United States, the incidence of congenital malformations is 8.76%, while in Germany it is 2.20% [16]. could this low rate in our study be explained by underestimation, as the investigations are less specialised?

4.2.2. Management

Danger signs should be identified as early as possible in health facilities or at the child's home, and the child should be referred to the appropriate service for further diagnosis and care [1]. In our study, all patients received medical treatment; one parent refused without any reason related to the cost of care. The referral rate to another healthcare facility was 3.6%. Referrals have been difficult (if not impossible) since 2012, with the exacerbation of insecurity (even ambulances have been taken away) having wiped out the region's structured referral/evacuation system. The functionality of the evacuation referral system could significantly increase morbidity and mortality rates, as many children would not have access to healthcare in time. Insecurity makes it difficult to obtain supplies of essential medicines, which in turn complicates the conditions under which patients are treated. Most of the food used on admission was parenteral, with infusion of 10% glucose serum + 92.2% electrolytes. Paediatric/neonatal care is provided by local partners to ensure the availability of medicines and consumables, which largely explains the low rate of refusal of care. Antibiotic therapy was the most commonly used specific treatment, with bi-antibiotic therapy used in 97.5% of cases and tri-antibiotic

therapy in 1.6%. The risk of infection at birth was 52.5%. At the end of the treatment, the average length of stay in hospital was 3.83 days; the recovery rate was 77%, mortality 21%, discharge against medical advice 1% and referral to another facility 1%. Referral concerned cases of congenital malformations.

4.2.3. Mortality

During our study, the mortality rate was 21%, lower than those reported by Kassogue A (25.1%) in Ségou in 2017 [6], Diakité I. (33.9%) [8] in Sikasso and by Sylla M. *et al.* (31.9%) at the CHU Gabriel Touré in Bamako. These results have the same significance as regards the importance of neonatal mortality in our country. The main causes of death were prematurity (39.6%), perinatal anoxia (32.1%) and neonatal infection (24.5%). In Ségou, according to Kassogue A, perinatal anoxia (43.6%) is the leading cause of death, followed by prematurity (25.3%) and neonatal infection (23.4%). These results corroborate those of the WHO, which states that the vast majority of neonatal deaths in Africa are due to 3 main causes: asphyxia (40%), low birth weight and prematurity (25%) and infections (20%) [2]. These pathologies have been identified as the main causes of death in other African studies, notably in Bangui and Cotonou [17] [18]. We recorded one case of neonatal tetanus that died during hospitalisation. Sylla M. *et al.*, Kasse D *et al.* in Bamako and Doucoure I. and Kassogue A. in Ségou reported a fatality of neonatal tetanus in their study [4]-[6] [19]. These results show that tetanus remains a dreaded disease in the neonatal period; its appearance being linked to the absence of vaccination of women during pregnancy and also to the lack of hygiene during intra- and post-natal care.

The majority of deaths occurred during the first three days of hospitalisation (90%), similar to the situation in Ségou [6] (89.92% of cases). The high rate of deaths in the early neonatal period has been reported by other studies, Sylla M. *et al.* [5] and Doucoure I. in Ségou [4].

5. Conclusion

Neonatal morbidity and mortality remain a cause for concern in Timbuktu. This study shows that, despite the unfavourable security situation, the efforts made in the neonatology unit have resulted in morbidity and mortality indicators close to those of certain hospitals in Mali, which have been little or unaffected by the crisis. The correct application of Essential Newborn Care and antenatal care remains a major challenge for the hospital and the Timbuktu region.

6. Limitations of the Study

Our descriptive study is an evaluation of newborn care in hospitals. The results are not representative of the population of the Timbuktu region or of Mali as a whole. It needs to be supplemented by other analytical studies on the knowledge and attitudes of mothers and families about care that improves newborn survival.

Conflicts of Interest

The authors declare that there are no conflicts of interest in this work.

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