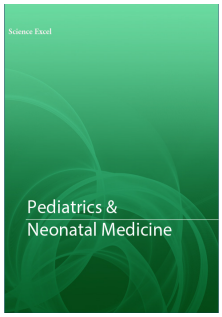
Pediatrics and Neonatal Medicine

Original Article



Determinants of Neonatal Morbidity And Mortality In The Suburbs of Dakar in Senegal

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Abstract

Introduction: Neonatal morbidity and mortality is a major public health problem in developing countries such as Senegal. The objective of our study was to study the determinants of neonatal morbidity and mortality in a hospital located in the suburbs of Dakar in Senegal.

Materials and methods: We conducted a retrospective, descriptive and analytical study over the period from 1 January to 31 December 2019 (1 year).

Results: Of the 1198 children hospitalized in the ward, all 500 were newborns.
(incidence=41.7%). The sex ratio was 1.29. The most common maternal pathologies were hypertension, preeclampsia and diabetes. The notion of urogenital infection was reported in 21% of cases MPR was greater than 12 hours in 60% of cases. More than a quarter (27%) of newborns had not screamed at birth and 74% were resuscitated. Almost half of newborns (43%) were preterm infants. Hypotrophs accounted for 48% (n=202). Diagnoses on admission were dominated by infections neonatal, inhalation of amniotic fluid, hyaline membrane disease and perinatal asphyxia. The mortality rate was 19% (n=95). The most frequently found causes of death were related to prematurity (48.4%), respiratory distress (82%) and nosocomial infections (20%).

Conclusion: Despite initiatives undertaken at the national level, statistics remain
alarming and call for more efforts to be made to achieve the Sustainable Development Goals (SDGs) by 2030.

Introduction

Neonatal morbidity and mortality is a major public health problem in developing countries such as Senegal. According to the Global Fund's epidemiological report for UNICEF, five point two (5.2) million children under the age of five have died worldwide. Of these deaths, 2.4 million (47%) occurred in the first month of life which represents about 6700 newborn deaths every day. More than two-thirds of neonatal deaths occur within the first week of life, and approximately one million newborns die within the first 24 hours [1]. These frightening figures for neonatal mortality are marked by a disparity according to different regions of the globe. The majority of these deaths occur in sub-Saharan Africa, on average, high-income countries have a neonatal mortality rate of three per 1000, compared to 27 per 1000 in low-income countries. Of the 10 countries with the highest neonatal mortality rates, eight are in sub-Saharan Africa and two in South Asia [2]. Significant efforts would be needed to save the lives of 16 million newborns by 2030.

In Senegal, according to the 2018 Continuous Demographic and Health Survey (DHSc) report, trends in child mortality over the past twenty years show a decline overall, however, there has been a slowdown in this trend since 2014 [3]. Indeed, from 1997 to 2018, the neonatal mortality ratio fell from 37 per thousand to 23 per thousand, a decrease of 38% [4]. A first study conducted at the National Hospital Center (NHC) in Pikine, in 2012, reported a neonatal mortality rate of 33% [5]. Another study carried out at the neonatology department at the NHC Abass Ndao in Dakar located in downtown Dakar found a rate of 22.4% [6]. The problems associated with this neonatal morbidity and mortality are multifactorial, involving environmental, socio-economic, gynecological, obstetrical and medical factors, which interact with each other and can influence pregnancy, childbirth and the fate of the newborn. The objectives of our study were to evaluate neonatal morbidity and mortality and to study its determinants in a hospital located in the suburbs of Dakar.

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Materials and methods

Scope of the study

Our study took place in the pediatric department of the NHC of Pikine. The service has three neonatal units, two of which (located in maternity and paediatrics) welcoming newborns from the delivery room (inborns) and one unit (housed in paediatrics) admitting newborns suffering from various pathologies coming directly from home or referred by other health facilities. These three neonatal units have a total capacity of 27 places, including 17 cradles and 10 incubators.

The staff is composed of two university hospital paediatricians, including a head of department, two hospital paediatric practitioners, twenty-six nurses including a major; seven nursing assistants; eighteen nursing assistants; an assistant

administrative and a medical secretary. Each year, this service welcomes students enrolled in the Diploma of Special Studies in Pediatrics and those in the 5th and 7th year of medicine as part of their practical internship.

Medical and paramedical teams, operating according to a system of on-call and on-call duty and daily permanence. The technical platform includes: monitoring monitors, phototherapy devices including a tunnel, electric syringe pumps, vacuum cleaners, oxygen extractors, homemade CPAP devices. Conventional biology examinations (blood count, Rhesus Blood Group, azotemia, serum creatinine, blood ionogram, blood glucose), can be performed urgently at the hospital laboratory and are available 24 hours a day. On the other hand, other examinations such as C reactive protein are regularly out of reagents. Blood gases are not available. Radiological investigations, although mostly available, are performed late in unstable newborns because mobile radio is not available in all neonatal units. However, ultrasound and computed tomography are available on duty.

Type of study

We conducted a retrospective, descriptive and analytical study over the period from 1 January to 31 December 2019 (1 year).

Study population

All infants aged 0-28 days hospitalized in the neonatal ward during the period were included in our study.

We excluded: any newborn who died on arrival and any file whose data was insufficient and/or unusable.

Data collection and analysis

Data were collected from hospital records and recorded on data collection cards prepared for this purpose.

We studied the following parameters: Sociodemographic and epidemiological: age at admission, socio-economic level of parents, parents' occupation, address and provenance, date of hospitalization.

Maternal history and anamnestic data: maternal age, gestation, parity, the notion of inbreeding, family defects, maternal medical, surgical and obstetric history; pregnancy and childbirth data: the number of antenatal consultations (CPN), the number of obstetric ultrasounds performed, maternal pathologies during pregnancy, the duration of labour, data on delivery (place, term, route, presentation, duration of rupture of membranes (RPM), data on birth: adaptation to extrauterine life (cry at birth, APGAR score at M1 and M5), the notion of resuscitation, trophicity, maturity; clinical data: mode of admission, reasons for admission, reference conditions, state on arrival; therapeutic data: the means of care; evolving data: favourable or unfavourable outcome; the occurrence of complications, mortality rate, age at death, cause of death.

These data were entered on SPHINX (version V5) and analyzed using SPSS (Statistical Package for Social Sciences) version 23.

The results are presented as means and standard deviations for quantitative parameters and as percentages for qualitative parameters. The materiality threshold was retained for a p-value < 0.05. (Chi Two Test).

Results

Epidemiological and socio-demographic data

During the study period on one thousand one hundred and ninety-eight (1198) children hospitalized in the ward; The 500 were newborns (an incidence of 41.7%). There was a male predominance (n=218) with a sex ratio of 1.29 (Figure 1).

The majority of newborns (93%) were admitted during the first week of life with an average delay of 1.6 days and extremes ranging from 0 to 27 days.

They came from the suburbs in most cases 86% (n=369).

Newborns were inborns in 68% of cases (n=340) (Figure 2).

Half (n=246 or 49%) of mothers were in the 26-35 age group with extremes ranging from 15 to 48 (figure 3). They were illiterate in more than half (56.52 per cent) of the cases and housewives in 58.4 per cent of cases.

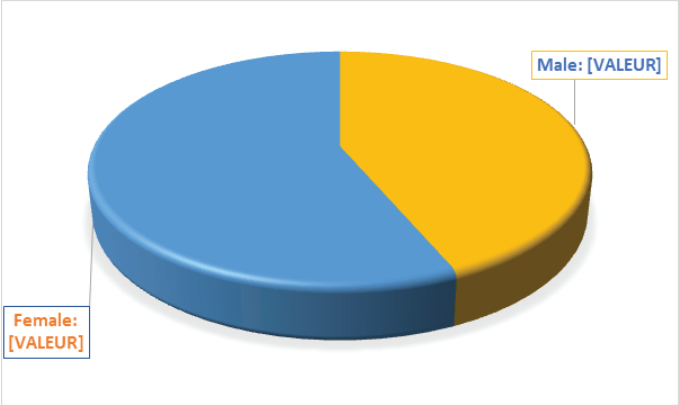

Figure 1: *Distribution of newborns by sex*

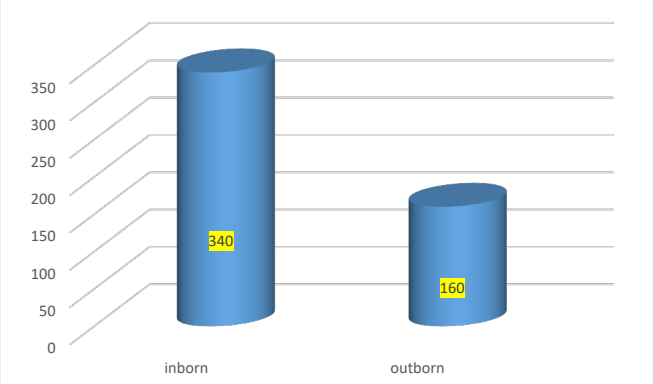

Figure 2: *Distribution of newborns by mode of admission*

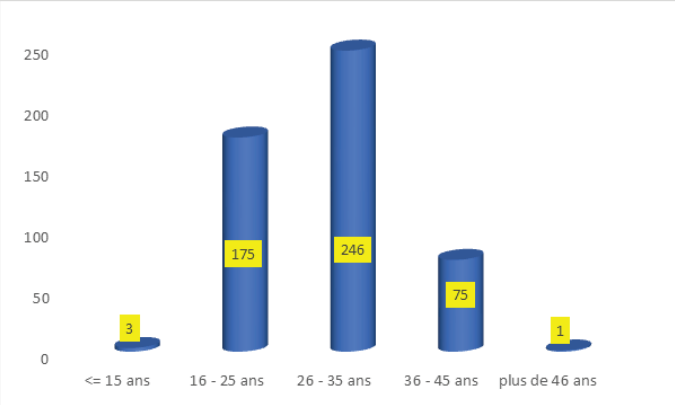

Figure 3: *Maternal age distribution at admission*

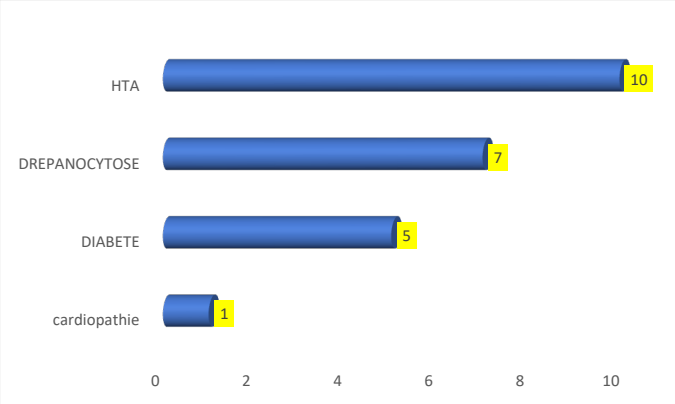

Figure 4: *Distribution of chronic maternal pathologies*

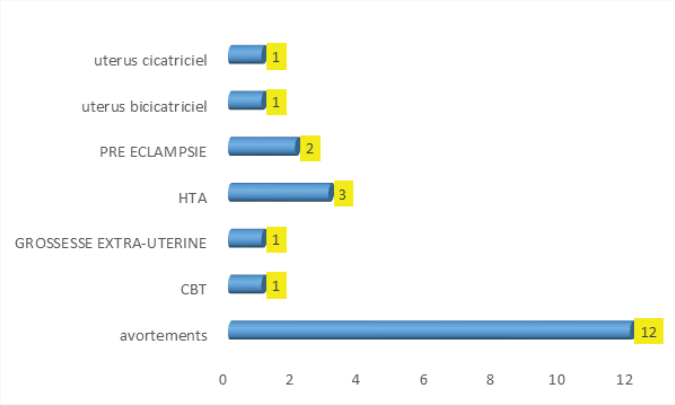

Figure 5: *Distribution of mothers by obstetric history*

The average age of fathers was 31.5 years with extremes of 29 to 60 years

They belonged to the working class in 36% (n=180) of cases. The socio-economic level was considered low in 79% of cases.

A notion of parental consanguinity was found in 4% (n=20) of cases and it was second degree in 80% (n=16/20) of cases.

Maternal history and pregnancy follow-up

Primigeste (n=184) and primiparous (181) were in the majority with 37 and 36.5% respectively. The vast majority of women (n=313) had no history of abortion, however 51 women (14.2%) had had at least 2 abortions.

Mothers had a history of preterm birth in 21% of cases.

The history of chronic maternal pathologies was found in 5% of cases (n = 23) of which the most found were arterial hypertension (hypertension), sickle cell anemia and diabetes with a clear prevalence of hypertension (43.4%) (figure 4).

Obstetric history was found in only 9% (n=21) of women (figure 5)

Regarding pregnancy follow-up, only half of the mothers (49%, n=241) had been able to benefit from 4 NPCs and 26 mothers (5%) had performed only one NPC during pregnancy. The majority of women (n=350, 80%) had received at least 3 doses of sulfadoxine-pyrimethamine (SP). Almost half of the women (47%, n=219) had received two doses of tetanus vaccine (VAT) and in 7% of cases (n=35), mothers had received no dose of VAT at all. Toxoplasma serology was negative in most mothers (87%). Rubella serology was undone in 88% (n=440) of cases and positive in only 2% of cases (n=10). Only 3% (n=15) of cases were serology of cytomegalovirus (CMV) negative. Syphilitic serology was negative in 68% of cases (n=340). The Hbs antigen test was positive in 3% (n=15) and not performed in 42% of cases. Retroviral serology was positive in only 1% of cases (n=5).

Eighty-one percent of mothers 81% (n=403) of mothers had received an ultrasound and in only 36% of mothers (n=135) was it performed early. Two hundred and eight mothers had a pathology during pregnancy, the most common of which were hypertension, pre-eclampsia, retroplacental hematoma and diabetes (table I).

Maternal pathologies	Staff	Percentage (%)
Pre-eclampsia	78	38,5
HTA	29	14,5
HRP	15	7
Scarred uterus	15	7
Diabetes	13	6,5
Chorioamnionitis	9	4,5
oligohydramnios	9	4,5
fibroma	8	3
hydramnios	8	3
Placenta previae	6	2,5
Cord procidence	4	2
Anaemia	4	2
Asthma	2	1
Pneumonia	2	1
HIV infection	2	1
Hand procidence	1	0,5
Mechanical dystocia	1	0,5
Dynamic dystocia	1	0,5
Breast tumour	1	0,5
Total	208	100

Table 1. Maternal pathologies during pregnancy

Threat of preterm birth was reported in 17% (n=77) of cases

Only 1% (n=4) of mothers received magnesium sulphate.

Mothers had urogenital infection in the third trimester in 21% (n=92/441) of cases and only almost a quarter (n=23/92) were able to benefit from oral or local antibiotic treatment.

Childbirth data

The average working time was 7.6 hours with extremes ranging from 1 to 48 hours. Thirty-nine percent (39%) of mothers (n=115) had premature rupture of membranes and the duration was greater than 12 h in 60% (n=69) of cases. Antibiotic prophylaxis was initiated in 18% of mothers (n=51).

Amniotic fluid was tinted in 37% (n=91) of cases and meconium in 7% (n=7) of cases. The mode of presentation was cephalic in 87% (n=184/221) of cases and breech in 13% (n=27/221) of cases. 59% of deliveries (n=295/500) were vaginal delivery. Just over one-quarter of newborns (n=135/500) did not spontaneously cry out at birth and 26% (n=129/500) were stimulated, aspirated and/or ventilated at birth. The average APGAR score at M5 was 7 with extremes ranging from 4 to 10.

Neonatal data

More than half of the newborns (53%, n=265) were born at term, however 43% (n=215) had prematurity and 4% (n=20) had post-maturity.

According to the classification of prematurity, extreme prematurity was more represented at 45% (n=84) (Figure 6).

Almost half of the neonates (48%, n=240) had intrauterine growth restriction. Essential newborn care was informed and performed in 91% (n=455) of cases at birth. Feeding was mixed in 80% of cases (n=400) and exclusive breastfeeding in 16% (n=80) of cases.

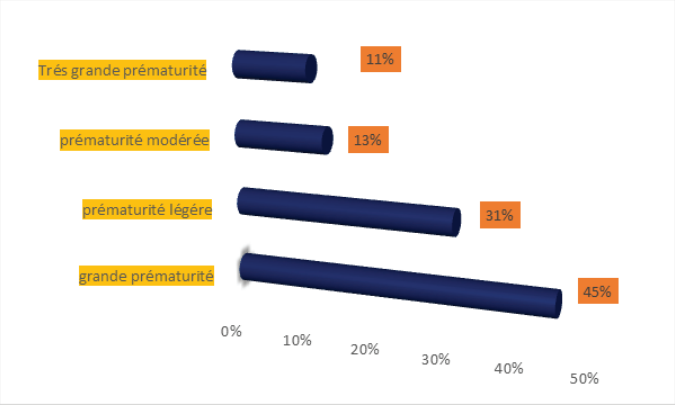

***Figure 6**: Distribution of newborns by preterm birth*

Clinical data

Ninety-three (93) newborns were transferred from other facilities. The reasons for transfer were dominated by acute respiratory distress (38.7%, n=36), prematurity 16.12% (n=15) and no cry 14% (n=13) (Table II).

Transfer was non-medical in 36% of cases (n=33).

Clinical signs at admission were entangled and dominated by respiratory distress (66%, n=332), thermoregulatory disorders (47%, n=240) and neurological distress (27%, n=136) (table 3).

***Table 2:** Distribution of Newborns by Reasons for Transfer*

Reasons for transfer	Staff	Percentage (%)
Respiratory distress	36	38,7
Prematurity	15	16,12
No screams	13	14
Fever	9	9,6
Jaundice	6	6,45
Digestive disorders	5	5,37
Neonatal infection	5	4,27
Umbilical bleeding	1	1,07
Total	93	100

***Table 3:** Distribution of neonates by clinical signs noted at admission*

Clinical signs	Staff	Percentage (%)
Respiratory problems	332	66
Thermoregulation disorders	240	47
Neurological disorders	144	28,6
Non-cholestatic jaundice	40	8
Obstetric trauma	35	7
Saturation disorders	33	7
Metabolic disorders	20	4,1
Digestive disorders	15	3
Polymalformative syndrome	15	3,1
Hematological disorders	12	2,5
Hemodynamic disorders	13	2 ,6
Water and electrolyte disorders	9	1,8
Nutritional disorders	8	1,6
Skin disorders	4	0,8

The main diagnoses at admission were maternal-fetal infection (74%, n=371), amniotic fluid inhalation (40%, n=201), hyaline membrane disease (22%, n=40) and perinatal asphyxia (20%, n=111) (figure 7).

Therapeutic datas

The main ventilatory support was bubble CPAP in 62% of cases.

Antibiotic therapy was initiated in 70% of cases with an average duration of 8.5 days and extremes of 2 and 60 days for some severe and profound infections. Phototherapy was initiated in 20% of cases.

Scalable data

The average length of hospital stay is 9.57 days with extremes of 1 and 62 days. The evolution was favorable in 60.8% of cases, however we deplored a mortality rate of 19% (n=95) and complications in 18.4% (n=92) of cases. The most common complications were nosocomial infection (31.5%, n=29), ulcerative-necrotizing entroecolitis (UNEC) (24%, n=22) and neonatal sepsis (9.5%, n=9) (figure 8).

Most deaths (67%, n=64/95) occurred within the first week of life (figure 9).

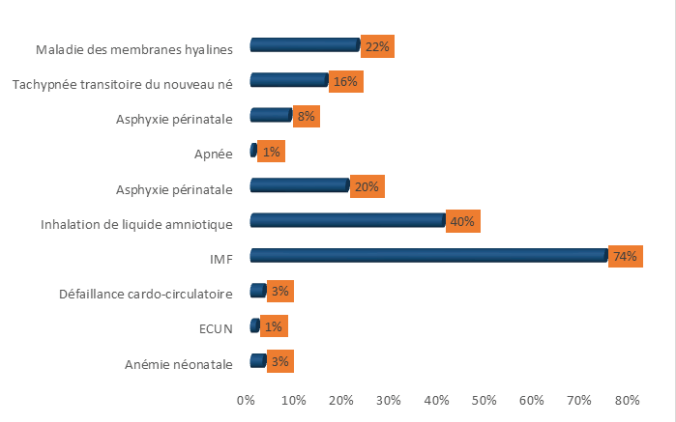

Figure 7: *Distribution of newborns by diagnosis*

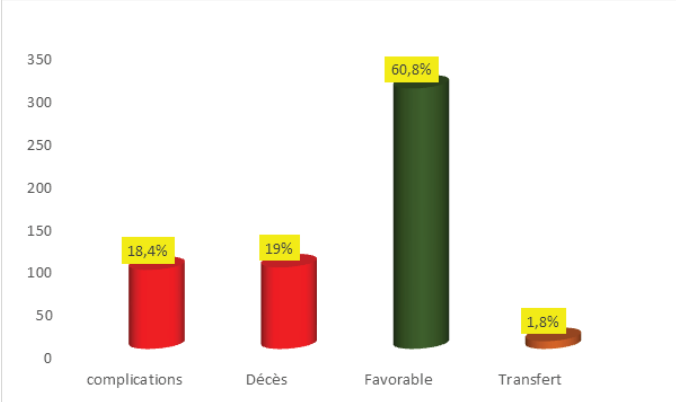

Figure 8: *Distribution of newborns by evolutionary modalities*

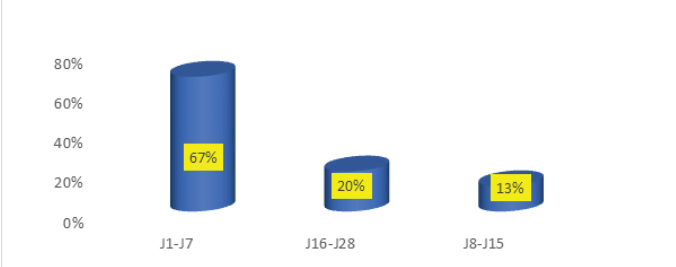

Figure 9: *Distribution of newborns by age of death*

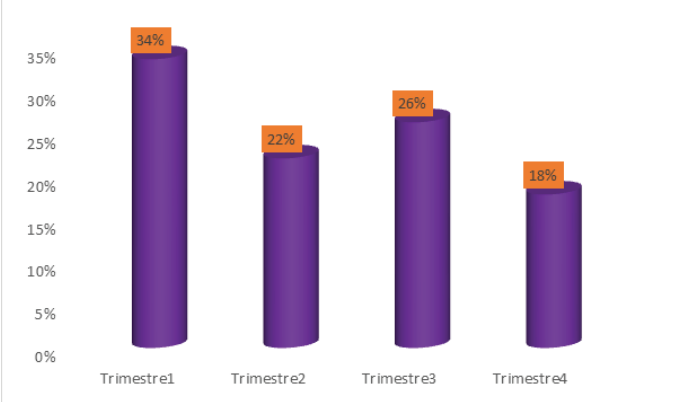

Figure 10: *Distribution of newborns by pattern of deaths over trimesters*

According to the distribution of deaths during the quarters, the first and third trimesters were the most morbid with 34% (n=32) and 26% (n=17), respectively (figure 10).

The determinants that appeared to be related to morbidity and mortality were: prematurity (p=0.000), hypothermia (p=0.040), respiratory distress (p=0.000), perinatal asphyxia (p=0.000), nosocomial infection (p=0.000), neonatal anemia (p=0.000) and cardiorespiratory arrest (p=0.039).

Discussion

Epidemiological and socio-demographic data

Our high prevalence shows not only that the NHC of Pikine is one of the main reference hospitals in the suburbs of Dakar where outborn newborns from other health facilities are referred; But it is also endowed with a maternity so directly admitting newborns inborn. We have regained a male predominance. The male sex is more vulnerable to the morbid phenomena of life. This finding has already been reported in the literature [5,6]. The average age of mothers was 28 with extremes ranging from 15 to 48. This observation reflects our socio-cultural realities in Africa with early marriages and motherhood. This average young age of mothers has been reported by other African studies [4-6].

Maternal history and pregnancy follow-up

In our study, primigestes and primiparous were more represented, as evidenced by other studies conducted respectively in Morocco [7] and Burkina Faso [8]. Regarding pregnancy follow-up, only half of the mothers had been able to benefit from 4 NPCs and 5% had performed only one NPC during pregnancy. Indeed, WHO recommends that every pregnant woman make at least four antenatal visits and perform the first in the first trimester of pregnancy. The DHSc 2018 report shows that the proportion of pregnant women who had at least four antenatal visits was 59%. This proportion varies according to the place of residence. It is higher in urban areas (71 per cent) than in rural areas (50 per cent). In addition, about two-thirds (64%) of women had their first antenatal visit in the first trimester. In urban areas, this percentage is 78% compared to 55% in rural areas [9,10].

Only 36% (n=135) of mothers had an early ultrasound. This low rate of early ultrasound performance reflects the low level of education of mothers in our study and in Africa in general and also calls into question the quality of antenatal visits.

The most common maternal pathologies were hypertension, preeclampsia, HRP and diabetes; which constitute a morbid condition for both the mother and the newborn. All these maternal vascular pathologies are recognized as a risk factor for prematurity because it provides hypoxia and chronic stress in the fetus with a vital prognosis in the absence of extraction of the fetus before term [11]. High blood pressure is frequently reported by authors [12,13]. As for maternal urogenital infections, they were reported in 21% of cases in our study. This explains the frequency of neonatal infections, which is one of the leading causes of neonatal mortality in developing countries. Urogenital infection is also strongly correlated with a risk of premature birth even if its prevalence is often underestimated because in the majority of cases, it is often asymptomatic or poorly documented due to the lack of systematic screening for the carriage of strepto B during pregnancy in Africa.

Childbirth data

Premature rupture of the membranes (PRM) was found in 39% of cases and was greater than 12 hours in 60% of cases. As with uro-genital infections, PRM over 12 is also a major infectious risk factor. Only 18% of mothers had received antibiotic prophylaxis. In cases of maternal infectious risk, maternal antibiotic prophylaxis initiated before entering labour reduces the risk of maternal-fetal infection. Amniotic fluid (AF) was tinted in more than one-third of cases. The tinted nature of AF is strongly predictive of fetal distress and risk of LA inhalation and perinatal asphyxia [14].

Regarding the delivery route, more than half of the mothers had given birth vaginally. This route remains the most common in the absence of any obstetric complications that may indicate a caesarean section. Proportions very close to ours have been reported by other authors [15, 16]. However, in Burkina Faso, a much higher rate of caesarean section was found [10].

Just over a quarter of newborns did not cry spontaneously at birth and a quarter were stimulated, aspirated and/or ventilated at birth. This once again calls into question the use of the partogram (to detect danger thresholds) and the monitoring of women in the labour room in our maternity wards. The average APGAR score at M5 was 7 with extremes ranging from 4 to 10. This observation reflects the frequency of perinatal asphyxia, which remains the secund cause of morbidity and mortality after low birth weight in developing countries.Thus, almost half of the newborns were premature babies. Indeed, prematurity remains a real public health problem in Africa and remains one of the main reasons for hospitalization in neonatology. This same trend was also found in other studies [17-19].

Clinical data

The mean age of newborns at admission was 1.6 days with extremes ranging from 0 to 27 days. This demonstrates the importance of the proximity of pediatric and gynaecology services such as the NHC of Pikine obstetrics whose rule is to systematically evaluate all newborns. This initial examination after birth makes it possible to detect and sensitize mothers on the danger signs before their discharge from the maternity ward, which will allow early consultation. Other African studies reported the same trend [8,20].

The transfer was unmedical in more than half of the cases. These deplorable transfer conditions, often by taxi, are organized by poorly educated parents who do not respect any hygiene and safety standards, often exposing newborns to hypothermia, hypoglycemia and the risk of infection.

Thus, hypothermia was present in 32.4% of newborns. Poor transfer conditions (with a lack of transfer incubators) [21], thermoregulation disorders especially in low birth weights; expose newborns to hypothermia that can quickly engage their prognosis [12]. Hypoglycaemia also affected 3.4% of newborns. It represents a major neonatal emergency that can lead to severe neurological damage and quickly lead to death if management is delayed.

Diagnosis at admission was dominated by neonatal infections, AF inhalation, MMH and APN. These diseases represent the main causes of morbidity and mortality in Africa due to the frequency of maternal infections and low birth weight.

Scalable data

We found a very high mortality rate as in most African studies [22-24]. These deaths occurred mainly during the first week of life. This finding is consistent with Lawn's theory that two thirds of neonatal deaths occur in the first week of life. These results corroborate Lawn JE et al's finding that neonatal mortality follows the "two-thirds rule": two-thirds of newborn deaths occur during the first month of life; of these deaths, more than two-thirds occur during the first week; of these, two-thirds occur during the first 24 hours after birth [9]. Hence the importance of the first postnatal visit, which must be systematic before discharge from the maternity hospital in order to detect signs of danger and to encourage care as soon as possible in order to avoid complications. A first study carried out at the CHN of Pikine found a higher death rate of 81.8% during the first week of life [5]. As for the distribution of deaths according to trimester, the number of deaths was higher during the first and third trimesters in our study.

This was consistent with a significantly higher rate of delivery in the first trimester and thus a similarly increasing neonatal morbidity. The third trimester corresponds to the period of the year when part of the staff goes on holiday with a higher demand in workload compared to supply. The most frequent causes of death were prematurity, respiratory distress, nosocomial infections, hypothermia and intrauterine growth retardation. Infection is most often linked to the often deleterious conditions of practice with a failure to respect the rules of transfer and asepsis. Several authors have reported these causes of death in Africa [5,9].

In our study, prematurity was strongly associated with mortality (p=0.000).

In fact, it is one of the most frequent causes of neonatal mortality due to the lack of technical support (incubators, CPAP, exogenous surfactant) in developing countries, which is necessary for the adequate management of these particularly vulnerable newborns. The occurrence of complications, especially in very premature babies, leads to high neonatal mortality [12].

Similarly, there was a strong correlation between trophicity and mortality (p=0.0005).

Hypothermia was also significantly associated with mortality (p=0.040)

Indeed, there was a very high percentage of very premature babies and premature babies are particularly vulnerable to hypothermia because of their immature thermoregulation and major vital functions. This is compounded by the lack of incubators for their adequate management.

Respiratory distress was closely associated with mortality (p=0000):

This respiratory distress is often due to maternal-fetal infection (MFI) with pulmonary localisation, hyaline membrane disease (HMD) or perinatal asphyxia (PNA). The hypoxaemia it causes is an important predictor of mortality in these newborns, especially if they are preterm.

The management of very premature infants with MMH is problematic in developing countries due to the unavailability of exogenous surfactant and the use of artificial ventilation is not always possible in most referral hospitals.

In other studies, respiratory distress was also statistically related to the occurrence of death [15-17].

The same is true for APN (p=0000), which is more often complicated by severe anoxic-ischaemic encephalopathy and multivisceral failure with a risk of death and complications in

most cases [23].

Nosocomial infections are also responsible for a high morbidity and mortality in neonatal units due to a lack of rigorous asepsis, often linked to a heavy workload and a lack of qualified personnel.

Conclusion and recommendations

Our results show that neonatal morbidity and mortality is a major public health problem in developing countries like Senegal. Despite the initiatives undertaken at the national level, the statistics remain alarming and call for greater efforts to achieve the overall Sustainable Development Goals (SDGs) by 2030.

Thus, we make the following recommendations:

- To the authorities of the Ministry of Health: it is necessary to raise the standard of living of the population and the literacy rate of mothers, to improve health coverage according to the demographic growth of the population with quality services accessible to all sections of the population; to strengthen health structures such as the NHC of Pikine with sufficient material and human resources in order to optimise the care of newborns; to organise training campaigns for health personnel on the basic techniques of neonatal resuscitation

- For the population: pregnant women should be made aware of the need for education and information sessions to ensure better monitoring of their pregnancies and to give birth in hospital as soon as possible.

- For medical and paramedical staff, it is imperative to encourage them to ensure quality prenatal consultations through continuous medical training that will enable them to identify high-risk pregnancies and to respect the rules of referral and counter-referral of the mother-child couple, to carry out good monitoring of women in the delivery room by correctly filling in the partogram; to respect asepsis norms and protocols to reduce the risk of infection in the delivery rooms and neonatology units; to prevent the risk of maternal-foetal infection by systematic and adapted antibiotic therapy in the event of any maternal infectious risk before the onset of labour; to systematically introduce maternal antenatal corticosteroid therapy in the event of any threat of premature delivery; to integrate the principle of anticipation in the resuscitation of the newborn in order to prevent APN; and finally, to improve multidisciplinary collaboration between gynaecologists and paediatricians neonatologists for a better management of the mother-child couple.

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