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Epidemiological Aspects and Factors Associated with Early Neonatal Death From 2018 to 2020 in the Maternity of the Savè-Ouessè Health Zone, Benin, West Africa

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ABSTRACT

Background: Most of the new-born deaths occur in developing countries where care access is poor. This study aimed to investigate the epidemiological aspects and factors associated with early neonatal death in maternity.
Subjects and Method: A case-control study was conducted from 2018 to 2020 in the Savè-Ouessè (SaO) health zone in the Collines department in Benin. Two groups of new-borns aged 0-7 days were recruited, 176 cases and 176 controls. The dependent variable was early neonatal death. The main independent variables studied were related socio-demographic characteristics, medical and gynaeco-obstetric history, pregnancy-related illnesses, service use and quality of health care, and neonatal parameters. Data collection was carried out from October to December 2021 from delivery records at the maternity unit level. An additional questionnaire was addressed to corresponding mothers. Logistic regression model was used to identify factors that explain early neonatal death occurrence.
Results: No Fertility desire (OR= 3.22; CI95%= 1.13 to 9.16; p =0.029); No Observance of ANC rhythms (OR= 5.14; CI95%= 1.63 to 16.15; p= 0.005); Supervised intake of SP (OR= 6.33; CI95%= 1.33 to 29.99; p<0.001); No Existence of active fetal movements (OR= 7.01; CI95%= 2.67 to 18.41; p<0.001); and Amniotic fluid colour/ Haematic (OR= 4.09; CI95%= 2.07 to 9.63; p<0.001) increased early neonatal death in SaO health zone from 2018 to 2020 in SaO health zone, Benin**Conclusion:** Even if early neonatal mortality appears to be low in the SaO health zone, its reduction requires to strengthen family planning, to improve the observance of intermittent preventive treatment and to monitor obstetric labour.
Keywords: perinatal death, early neonatal, death, associated factors, Benin.

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BACKGROUND

Neonatal mortality is the number of deaths in the first 28 days of life divided by the number of live births in the same period. It is early when it occurs within the first seven days of life and very early when it occurs within the first 24 hours. Every day, some 800 women and 6,700 new-borns die in the period around childbirth (Organisation Mondiale de la Santé, 2021). The majority

of neonatal deaths (75%) occurs during the first week of life, and of these, 25-45% occurs in the first 24 hours after delivery (Hogan et al., 2010). Most of these newborns deaths occurs in developing countries where access to care is poor (Organisation Mondiale de la Santé, 2020, World Health Organization, 2021). This mortality is related to the health conditions of the mother, the course of pregnancy and delivery, which are still major problems in most developing countries (Segbedji, 2022).

In Benin, the neonatal mortality rate was estimated at 30‰ in 2018. For the Collines department this rate was 37‰ in the same year (INSAE-Bénin, 2021). In the health zone of SaO, no survey data is available on neonatal mortality let alone on its early neonatal component. It is to address this deficiency that we initiated this work on early neonatal death to determine its rate, causes and associated factors.

SUBJECTS AND METHOD

1. Study Design

The study was conducted in the maternity of the Savè-Ouessè (SaO) health zone. It forms the Collines health department with the health zones of Dassa-Glazoué and the health zone of Savalou-Bantè. The SaO health zone covers an area of 4,922 km² and in 2020 had a population of 278,842 inhabitants, e.g. a density of 59.9 inhabitants per km². In 2020, the SaO health distrcit had an hospital, 18 full health centres, 16 isolated maternity units. In 2020, the staffing ratio of 0.18 doctors per 10,000 inhabitants, 0.6 nurses per 5,000 inhabitants and 1.65 midwives per 5,000 women of childbearing age was estimated. After the restructuring of Emergency Obstetric and Neonatal Care (EmONC) network in 2018, only the maternity units of Kilibo, Ouessè and the Savè hospital were retained for EmONC network programme. The hospital of SaO health zone did not have a neonatal unit and newborns requiring specific care were referred to the regional hospitals of Parakou city in the north or Abomey city in the south.

A case-control study was conducted. A 36-month period data from 1 January 2018 to 31 December 2020 was collected. Data collection was carried out from October to December 2021 from delivery records at the maternity unit level.

2. Population and Sample

All delivery records registered in the maternity units of the health zone from 2018 to 2020 were included. A case was defined as any new-born, aged 0-7 days, delivered alive and died in the maternity during the study period. A control was defined as any new-born delivered and discharged alive during the same study period. Any neonate older than 7 days or with an incomplete record was excluded from the study.

An exhaustive census of all cases meeting the inclusion criteria was done. Thus 176 cases of early neonatal death were identified for 176 controls identified after a systematic random selection from the 24,655 live births. Controls were recruited at a ratio of one control to one case. The minimum sample size was calculated using the following formula: $n=2p \times (1-p) \times (Z\alpha + Z2\beta)^2/(p1-p0)^2$ (Lwanga , 1991) where n is the number of cases, p0=15% is the proportion of controls exposed to early neonatal death, p1=28% is the proportion of cases exposed to early neonatal death, p=21.5% with $p=(p1+p0)/2$; $Z\alpha=1.96$ with $\alpha=5\%$, $Z2\beta=0.84$ with $\beta=20\%$. With these assumptions the required sample size is 156 cases for 156 controls. An exhaustive census of all cases meeting the inclusion criteria was done. Thus 176 cases of early neonatal death were identified for 176 controls identified after a systematic random selection from the 24,655 live births. Controls were rec-

ruited at a ratio of one control to one case.

3. Study Variables

The dependent variable was early neonatal death. The main independent variables studied were related to socio-demographic characteristics, medical and gynaeco-obstetric history, pregnancy-related illnesses, service use and quality of health care, and neonatal parameters.

4. Operational Definition of Variables

Mother age group (years) divided to: 15-19 (1); 20-24 (2); 25-34 (3); and 35-45 (4).

Mother education level divided to: Secondary at least (1); Primary (2); and Illiterate (3).

Mother marital status divided to: Married / Union (1) and Single (2).

Mother occupation divided to: Employee or civil servant (1); Housewives (2); Retailer or shopkeeper (3); and Craftswoman Student/ apprentice (4).

Place of residence divided to: Under 2 Km (1); Between 2 et 5 Km (2); and More than 5 Km (3).

Parity divided to: Nulliparous (1); 1 – 3 delivery (2); and ≥ 4 delivery (3).

Early neonatal death; Fertility desire; History of stillbirth or perinatal death; Previous Caesarean section; History of preterm premature rupture of membranes; History of high blood pressure; Other health history; Pre-eclampsia/ Eclampsia; Obstetric Haemorrhages; Preterm premature rupture of membranes; Dystocia; Malaria; High blood pressure; Traumatic injury; Other medical issues; Attending four ANC at least; Observance of ANC rhythms; Knowledge of danger signs; Delivery by qualified health worker; Use of partogramm; Existence of active fetal movements divided to: Yes (0); and No (1).

Supervised intake of SP divided to: More than two doses (1); One or two doses (2); and Any dose (3).

Tetanus vaccine divided to: ≥ 2 doses (0); 0 - 1 dose (1).

Time to seek care (hour) divided to: <1 (1); 1 – 2 (2); >2 (3).

Quality of last ANC and Quality of delivery follow-up divided to: Good (0); Poor (1).

Gestational age (week) divided to: 28 – 32 (1); 33 – 37 (2); 38 – 41 (3); >41 (4).

Number of fetuses divided to: Single (1); and Twin (0).

Fetal presentation divided to: Cephalic (1); Seat (2); and Transverse (3).

Amniotic fluid colour divided to: Clear (1); Tinged or meconium (2); Cloudy or foul (4); and Haematic (5).

Fetal weight (g) divided to: < 1500 (1); 1500 – 2500 (2); and > 2500 g (3).

Mode of delivery divided to: Eutocic (1); Caesarean section (2); and Directed (3).

Sex of fetus divided to: Male (1); Female (2).

5. Study Instruments

Data was collected from delivery records at the maternity unit level. An additional questionnaire was addressed to corresponding mothers. The data was collected by midwives and nurses. The tools were pretested in the maternity of the commune of Glazoué in September 2021. This helped to improve their completeness and understanding by the interviewers. Validation of the completed collection tools was carried out by the college of doctors (surgeon and general practitioner) of the Savè zone hospital trained in EmONC programme. The causes of death were attributed by the doctors and the midwives in charge.

6. Data analysis

Data were analysed by using SPSS-Win version 23.0 software. Quantitative variables were presented as proportions.

Bivariate and multivariate logistic regression model was performed to identify factors associated with early neonatal death. The strength of the association was measured by the Odds ratios and its confidence interval. The 5% significance level is

the maximum threshold retained for accepting a variable as a predictor in the logistic regression model.

7. Research Ethics

The data collected from delivery records at the maternity unit level processed in strict confidence. Mothers' participation in the study was voluntary and their free and informed consent obtained. Permission was obtained from the administrative authorities of the SaO health zone before data collection.

RESULTS

1. Early neonatal mortality rate

From January 2018 to the end of December 2020, a total of 25031 deliveries and 176 early neonatal deaths were recorded. The early neonatal mortality rate was 7.03‰. All neonatal deaths (100%) of the cases were recorded within the first 24 hours in the maternities during the study period.

2. Trends in early neonatal death rates from 2018 to 2020

The trend in early neonatal death rate was 9.49‰ in 2018 and 5.14‰ in 2020 with an average of 7.03‰ for the period (Figure1).

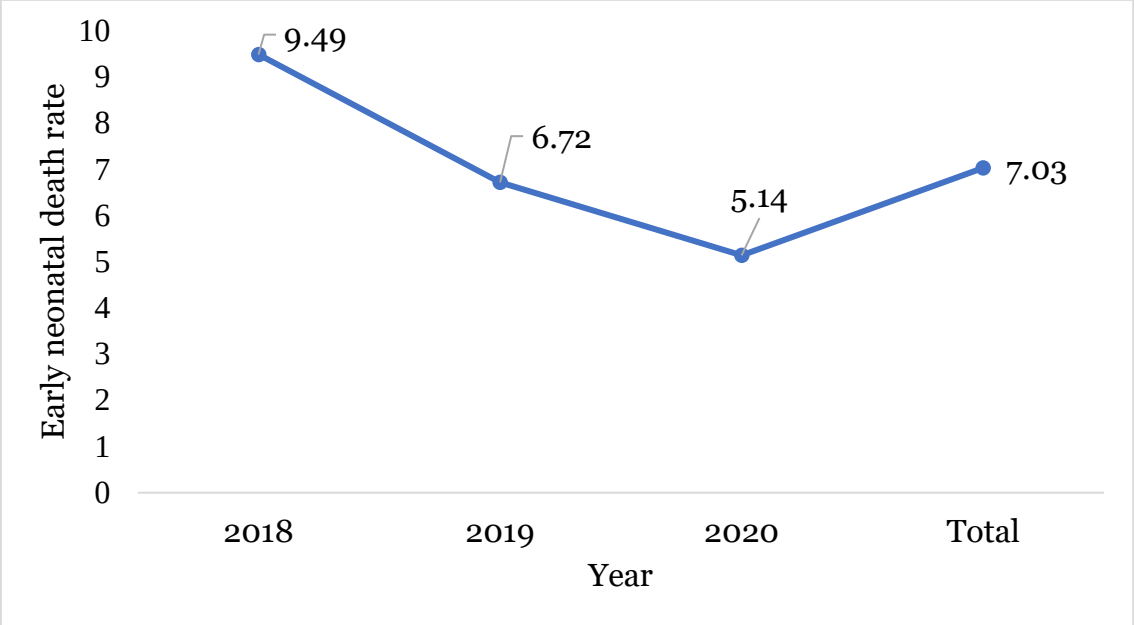

Figure 1. Trends of the early neonatal death rate from 2018 to 2020, SaO health distrcit, Benin

3. Causes of new-born deaths

The causes of early neonatal deaths in the maternity of the SaO health zone during the study period were dominated by asphyxia (69.89%), infections (15.91%) and prematurity (14.20%) (Figure 2).

4. Factors linked to early neonatal deaths

Socio-demographic factors of mothers

In univariate analysis, the lack of education and mothers living more than 5 km from the health centre were significantly associated with early neonatal death. In contrast, there was no significant association with either the mother's age or occupation (Table 2).

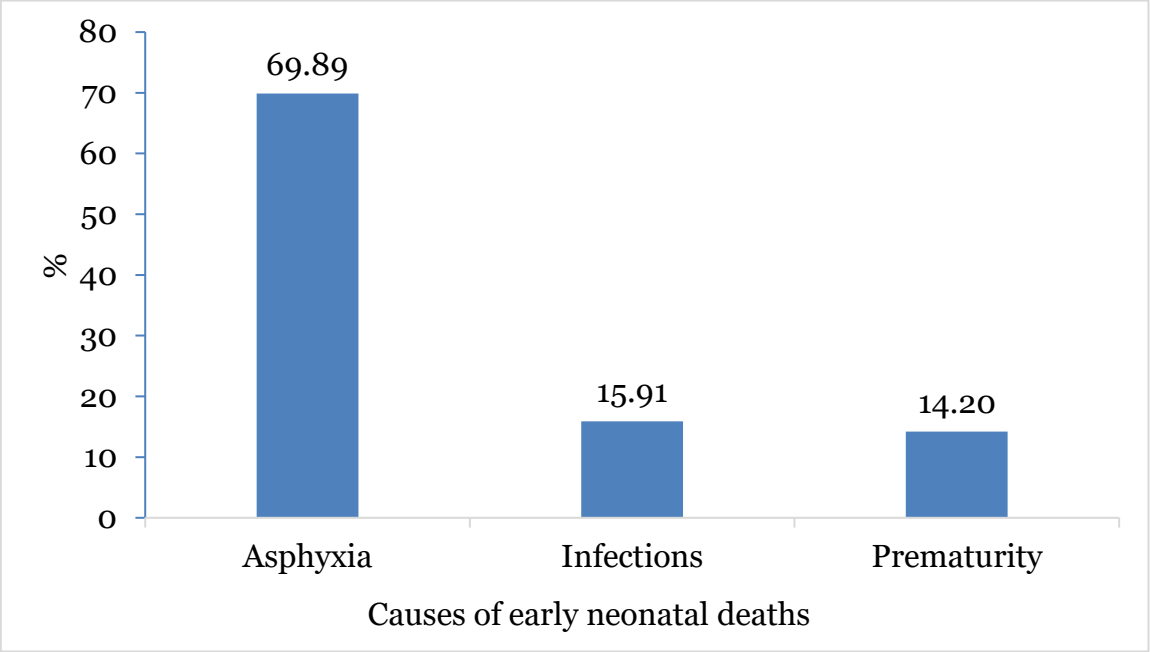

Figure 2. Causes of early neonatal deaths from 2018 to 2020, SaO health zone, Benin

Table 2. Association between mother's socio-demographic characteristics and early neonatal death from 2018 to 2020, a case-control study, univariate analysis, SaO health zone, Benin.

Variables	Case(n=176) n (%)	Control (n=176) n (%)	OR (95% CI)	p
Age group (year)				
15-19	14 (7.95)	16 (9.09)	1.05 (0.47 – 2.36)	0.891
20-24	55 (31.25)	51 (28.98)	0.84 (0.51 – 1.39)	0.514
25-34	80 (45.45)	88 (50.00)	1	
35-45	27 (15.34)	21 (11.93)	0.70 (0.36 – 1.36)	0.705
Education level				
Secondary at least	12 (6.82)	33 (18.75)	1	
Primary	11 (6.25)	11 (6.25)	0.36 (0.51 – 1.05)	0.063
Illiterate	153 (86.93)	132 (75.00)	1.30 (1.12 – 1.61)	**0.001**
Marital status				
Married / Union	171 (97.16)	171 (97.16)	1	
Single	5 (2.84)	5 (2.84)	0.92 (0.22 – 3.75)	0.910
Occupation				
Employee or civil servant	5 (2.84)	6 (3.41)	1	
Housewive	68 (38.63)	45 (25.57)	0.43 (0.11 – 1.61)	0.212
Retailer or shopkeeper	56 (31.82)	62 (35.23)	0.73 (0.19 – 2.75)	0.651
Craftswoman	40 (22.73)	52 (29.55)	0.82 (0.21 – 3.13)	0.783
Student/ apprentice	7 (3.98)	11 (6.25)	1.04 (0.21 – 5.09)	0.954
Place of residence				
Under 2 Km	17 (9.66)	40 (22.66)	1	
Between 2 et 5 Km	21 (11.93)	44 (25.00)	0.92 (0.42 – 2.05)	0.928
More than 5 Km	138 (78.41)	92 (52.27)	3.81 (2.10 – 8.00)	**<0.001**

Maternal obstetric and gynaecological history

At univariate analysis, multiparity, lack of desire for motherhood and history of caesarean section, hypertension and other medical history (sickle cell disease, diabetes and HIV) were significantly more frequent in the cases. Morbid events such as pre-eclampsia/ eclampsia, haemorrhage and malaria were also significantly higher among cases than control (Tables 3 and 3).

Table 3. Association between maternal obstetric and gynaecological history and early neonatal death from 2018 to 2020, a case-control study, univariate analysis, SaO health zone, Benin.

Variables	Case(n=176) n (%)	Control (n=176) n (%)	OR (CI 95%)	p
Parity				
Nulliparous	38 (21.59)	35 (19.89)	1	
1 - 3	88 (50.00)	103 (58.52)	1.35 (0.72 – 2.52)	0.347
≥ 4	50 (34.30)	37 (21.02)	1.87 (1.11 – 3.14)	**0.018**
Fertility desire				
Yes	117 (66.48)	140 (79.55)	1	
No	59 (33.52)	36 (20.45)	1.96 (1.21 – 3.17)	**0.006**
History of stillbirth or perinatal death				
Yes	42 (23.86)	29 (16.48)	1.60 (0.91 – 2.81)	0.098
No	134 (76.14)	147 (83.52)	1	
Previous Caesarean section				
Yes	39 (22.16)	23 (13.07)	2.52 (1.28 – 3.96)	**0.035**
No	137 (77.84)	153 (86.93)	1	
History of preterm premature rupture of membranes				
Yes	10 (5.68)	5 (2.84)	1.01 (0 99 – 1.04)	0.089
No	166 (94.32)	171 (97.16)	1	
History of high blood pressure				
Yes	11 (6.25)	9 (5.11)	1.13 (1.01 – 1.18)	**0.036**
No	165 (93.75)	167 (94.89)	1	
Other health history*				
Yes	8 (4.55)	5 (2.84)	2.31 (1.70 – 7.67)	**0.015**
No	164 (93.18)	167 (94.89)		

* Other health history: diabetes, sickle cell disease and HIV

Quality of care received by mothers

No attendance to the four antenatal consultations (ANC) and no observance of ANC rhythms; absence or inadequacy of intermittent preventive treatment with Sulfadoxine-Pyrimethamine (IPT-SP); under vaccination against tetanus and lack of awareness of danger and severity signs by the mothers were associated with early neonatal death. The early neonatal death increased when the partogramm was not traced, when the last ANC and the follow-up of the labour were of poor quality (Table 4).

Neonatal parameters

New-born weight, sex and mode of delivery were not linked to early neonatal death. In

contrast, average prematurity, breech presentation and abnormal amniotic fluid colour were significantly related to early neonatal death. The presence of active fetal movements at entry was found to be a protective factor for early neonatal death (Table 5).

Multivariate Analysis

In multivariate analysis, lack of desire for motherhood; no observance of ANC rhythms; lack of or insufficient IPT-SP intake; lack of the new-born active movement, meconium, cloudy and hematopoietic amniotic fluid were significantly associated with neonatal death (Table 6).

Table 3. Association between maternal, obstetric, and gynaecological issue and early neonatal death from 2018 to 2020, a case-control study, univariate analysis, SaO health zone, Benin

Variables	Case (n=176) n (%)	Control (n=176) n (%)	OR (CI 95%)	p
Pre-eclampsia/ Eclampsia				
Yes	32 (18.18)	12 (6.82)	2.33 (1.07 – 3.37)	**<0.001**
No	144 (81.82)	164 (93.18)	1	
Obstetric Haemorrhages				
Yes	41 (23.3)	9 (5.11)	5.63 (2.64 – 12.01)	**<0.001**
No	135 (76.7)	167 (94.89)	1	
Preterm premature rupture of membranes				
Yes	5 (2.84)	6 (3.41)	0.82 (0.246– 2.75)	0.751
No	171 (97.16)	170 (96.59)	1	
Dystocia				
Yes	26 (14.8)	17 (9.7)	0.61 (0.32 – 1.18)	1.143
No	150 (85.2)	159 (90.3)	1	
Malaria				
Yes	24 (13.64)	12 (6.82)	2.14 (1.03- 4.43)	**0.036**
No	152 (86.36)	164 (93.18)	1	
High blood pressure				
Yes	37 (21.02)	25 (14.2)	1.62 (0.35 – 2.08)	0.093
No	139 (78.98)	151 (85.8)	1	
Traumatic injury				
Yes	38 (21.59)	26 (14.77)	0.62 (0.36 – 1.09)	0.090
No	138 (78.41)	150 (85.23)	1	
Other medical issues*				
Yes	8 (4.55)	17 (9.66)	0.71 (0 33 – 1.53)	0.709
No	168 (95.45)	159 (90.34)	1	

*Other medical issues: anaemia, urinary tract infections, and HIV

Table 4. Association between service use and quality of health care and early neonatal death from 2018 to 2020, a case-control study, univariate analysis, SaO health zone, Benin

Variables	Case (n=176) n (%)	Control (n=176) n (%)	OR (CI 95%)	p
Attending four ANC at least				
Yes	38 (21.59)	56 (31.82)	1	
No	138 (78.41)	120 (68.18)	1.69 (1.05 – 2.73)	**0.030**
Observance of ANC rhythms				
Yes	25 (14.2)	45 (25.57)	1	
No	151 (85.8)	127 (72.16)	2.35 (1.34 – 4.10)	**0.021**
Supervised intake of SP*				
More than two doses	31 (17.62)	58 (32.95)	1	
One or two doses	69 (39.20)	93 (52.84)	4.09 (2.367 – 7.09)	**<0.001**
Any dose	76 (43.18)	25 (14.20)	5.68 (3.03 – 10.65)	**<0.001**
Tetanus vaccine				
≥ 2 doses	81 (46.02)	134 (76.14)	1	
0 - 1 dose	95 (53.98)	42 (23.86)	3.74 (2.37 – 5.90)	**<0.001**
Knowledge of danger signs				
Yes	140 (79.55)	114 (64.77)	1	
No	36 (20.45)	62 (35.23)	2.11 (1.31 – 3.41)	**0.002**
Time to seek care (hour)				
<1	123 (69.89)	107 (60.8)	1	
1 - 2	16 (9.09)	28 (15.91)	0.78 (0.46 – 1.31)	0.357
>2	37 (21.02)	41 (23.3)	1.57 (0.74 – 3.37)	0.237
Delivery by qualified health worker				
Yes	167 (94.89)	164 (93.18)	1	
No	9 (5.11)	12 (6.82)	1.62 (1.05 – 5.08)	**0.045**
Use of partogramm				
Yes	92 (52.27)	152 (86.36)	1	
No	84 (47.73)	34 (19.32)	4.14 (2.51 – 6.84)	**<0.001**
Quality of last ANC				
Good	28 (15.91)	85 (48.3)	1	
Poor	148 (84.09)	91 (51.7)	4.93 (2.99 – 8.14)	**<0.001**
Quality of delivery follow-up				
Good	65 (36.93)	95 (53.98)	1	
Poor	111 (63.07)	81 (46.02)	2.00 (1.30 – 3.06)	**0.001**

SP= Sulfadoxine Pyrimethamine

Table 5. Association between neonatal parameters and early neonatal death from 2018 to 2020, a case-control study, univariate analysis, SaO health zone, Benin

Variables	Case (n=176) n (%)	Control n=176) n (%)	OR (CI 95%)	p
Existence of active fetal movements				
Yes	61 (34.7)	154 (87.5)	0.06 (0.03 – 0.11)	**<0.001**
No	115 (65.3)	19 (10.8)	1	
Gestational age (week)				
28 - 32	30 (17)	6 (3.4)	2.05 (1.01 – 3.25)	**<0.001**
33 - 37	48 (27.3)	49 (27.8)	0.88 (0.53 – 1.43)	0.607
38 - 41	90 (51.1)	109 (61.9)	1	
> 41	6 (3.4)	10 (5.7)	1.37 (0.482 – 3.93)	0.551
Number of gestations				
Single	168 (95.5)	165 (93.8)	1	
Twin	8 (4.5)	11 (6.3)	1.45 -0.54 – 3.91)	0.456
Fetal presentation				
Cephalic	154 (87.5)	143 (81.3)	1	
Seat	17 (9.7)	11 (6.3)	4.15 (3.21 – 8.14)	**<0.001**
Transverse	5 (2.8)	22 (12.5)	0.67 (0.36 – 1.46)	0.173
Amniotic fluid colour				
Clear	13 (7.4)	135 (76.7)	1	
Tinged or meconium	110 (62.5)	26 (14.8)	7.38 (4.32 – 15. 52)	**<0.001**
Cloudy or foul	17 (9.7)	9 (5.1)	8.50 (1.11 – 6.49)	**<0.001**
Haematic	36 (20.5)	6 (3.4)	10.58 (1.14 – 17.79)	**<0.001**
Fetal weight (g)				
< 1500	36 (20.5)	5 (2.8)	0.84 (0.21 – 1.64)	0.546
1500 - 2500	60 (34.1)	27 (15.3)	0.96 (0.59 – 1.58)	0.896
> 2500 g	80 (45.5)	144 (81.8)	1	
Mode of delivery				
Eutocic	121 (68.8)	126 (71.6)	1	
Caesarean section	27 (15.3)	32 (18.2)	1.13 (0.64 – 2.01)	0.656
Directed	28 (15.9)	18 (10.2)	0.61 (0.32 – 1.17)	0.141
Sex of fetus				
Male	93 (52.8)	94 (53.4)	1	
Female	83 (47.2)	82 (46.6)	0.96 (0.63 – 1.48)	0.886

DISCUSSION

The objective of the study was to determine the rate, causes and factors associated with early neonatal death in SaO health zone in Benin from 2018 to 2020.

1. Early neonatal death rate

The early neonatal death rate reported in the study was 7.03‰. This rate is relatively low compared to the estimated early neonatal mortality rate of 34.12‰ in Butembo in 2018 (Saasita, 2019), 11.9‰ in Antananarivo in 2015 (Rafamatanantsoa, 2018) and 24.49‰ in Ouagadougou in 2017 (Zoungrana-Yameogo, 2021). It is also lower than the 12‰ found in 2010 in Lubumbashi in DRC (Ntambue, 2013) and the 24.52‰ obtained in Benin in 2018 by the Demographic and Health Survey (INSAE-Bénin, 2021). However, the current work had exclusively considered neonatal deaths occurring in

peripheral maternity units and almost all early neonatal deaths (100%) occurred within the first 24 hours. Rigorous monitoring and proper application of EmONC functions by the actors during this critical period are essential for the reduction of this indicator. This proportion is higher than the 88.7% and 64.6% respectively found by Segbedji et al., at the Kara universal hospital in Togo in 2020 (Segbedji, 2022) and Ntambué et al., in Lubumbashi in DRC in 2010 (Ntambue, 2013).

The early neonatal death rate has decreased from 9.49‰ in 2018 to 5.14‰ in 2020. This trend could be explained, by the training of providers in some health facilities on EmONC functions, by the organisation and follow-up of the recommendations of the neonatal death audits but especially by the implementation of major reforms in the health system from 2018 marked by the closure of maternity units without qualified personnel and the reorganisation of some health centres.

Table 6. Factors significantly associated with early neonatal death in SaO health zone from 2018 to 2020, a case-control study, multivariate analysis, SaO health zone, Benin

Variables	Adjusted OR (CI 95%)	p
Fertility desire		
Yes	1	**0.029**
No	3.22 (1.13 - 9.16)	
Observance of ANC rhythms		
Yes	1	**0.005**
No	5.14 (1.63 - 16.15)	
Supervised intake of SP*		
More than two doses	1	
One or two doses	1.97 (1.02 - 6.40)	**<0.001**
Any dose	6.33 (1.33 - 29.99)	**<0.001**
Existence of active fetal movements		
Yes	1	**<0.001**
No	7.01 (2.67 - 18.41)	
Amniotic fluid colour		
Clear	1	
Tinged or meconium	1.17 (1.05 - 2.74)	**<0.001**
Cloudy or foul	2.65 (1.55 - 7.24)	**<0.001**
Haematic	4.09 (2.07 - 9.63)	**<0.001**

*SP= Sulfadoxine Pyriméthamine

2. Causes of neonatal deaths

According to the WHO, the three main direct causes of neonatal mortality in Africa were in increasing order, prematurity, neonatal infection and neonatal asphyxia (Sidi-Yakhlef, 2019). The causes of early neonatal deaths in the SaO health zone in Benin was dominated by asphyxia (69.89%), infections (15.91%) and prematurity (14.20%) This discordance compared to WHO data can be explained by the profile of neonatal death included into the study. All the neonatal death included occurred within the first 24 hours. Pathophysiologically, younger newborns are more likely to die of asphyxia compared to older. For Segbedji et al, in 2020 in Togo, similar to SaO health zone findings, the predominant causes of early neonatal death were, in increasing order, perinatal asphyxia (30.8%), prematurity (22.8%) and

respiratory distress (20.8%) (Segbedji, 2022). Good management of these causes through the rigorous application of EmONC in maternity units would reduce early neonatal deaths in maternity units in the Sao-Saharan zone. Neonatal infections are a reminder of the need to reinforce the observance of hygiene and asepsis rules in SaO health zone maternity units and to better diagnose and treat the maternal infections that cause them (Zoungrana-Yameogo, 2021). The absence of neonatal units in rural areas limits the care of sick new-borns in general and premature newborn especially. Training and supervision of maternity staff on Helping Babies Breath (HBB) and scaling up kangaroo care can induce a positive impact on early neonatal mortality.

3. Factors associated with early neonatal death

Lack of fertility desire increased 3.22 times early neonatal death compare to fertility desire. The desire for motherhood could motivate pregnant women to seek care, to observe ANC rhythms, to keep appointments, to follow advice on nutrition and malaria prevention; and to monitor for danger signs and severity.

Furthermore, no observance of ANC rhythms increased the risk of early neonatal death by 5.14 times among cases. These results are similar to those found in others studies in Kara, Togo (Segbedji, 2022), and Antananarivo, Madagascar (Rafamatanantsoa, 2018). Pregnancy monitoring reduced the risk of neonatal death by 30% according to a 2015 study in Nigeria (Akinyemi, 2015). In the current context of low demand for ANC services by women in Benin, great efforts should be made to sensitise them to use ANC especially in the last trimester of pregnancy when the risk of preterm delivery is high.

To combat malaria and its effects during pregnancy, the WHO recommended in 2004 in regions with a moderate to high level of Plasmodium falciparum endemicity the use of insecticide-treated nets, the administration of ITP-SP to pregnant women and adequate and rapid management of malaria in pregnant women (Desai, 2007). In the present study, lack of or inadequate use of ITP-SP in pregnant women increased the risk of early neonatal death. This finding is consistent with observations from a study in Kamina, DRC, in 2017, where the risk of early neonatal death was increased by 1.69 (p= 0.001), (Deddy, 2021). A supervised dose of SP taken by a pregnant woman suppresses or eliminates any existing asymptomatic infection of the placenta and provides up to six weeks of post-treatment prophylaxis (World Health Organization, 2004, White, 2005). Two doses of ITP-SP would provide more than 12 weeks of post-treatment prophylaxis and would be effective in reducing low birth weight and the risk of moderate to severe anaemia in pregnant women (Kayentao, 2013), which are often associated with early neonatal mortality. Awareness-raising sessions should be reinforced for pregnant women to increase the use of preventive treatment for ITP-SP.

The absence of active fetal movement increases the risk of early neonatal death by 7.01 times. The lack of fetal active movements is one of the dangers and severity signs to be followed in pregnant women. Abnormal amniotic fluid colour is a risk factor of neonatal death. These results are similar those found at Felege Hiwot Hospital in northwest Ethiopia in 2018 (Addisu, 2018). Abnormal colour (stained or meconium, cloudy) of the amniotic fluid reflects fetal suffering and is responsible for perinatal asphyxia but especially for inhalation of meconium amniotic fluid, the management of which remains problematic in a context of insufficient qualified human resources.

The study was limited to the peripheral maternity hospitals of the SaO health zone without taking into account early neonatal deaths recorded in private facilities and at home constituted a risk of underestimating of the rate of early neonatal death. This explains the fact that only cases of neonatal death within 24 hours were recorded. The exhaustive inclusion of cases that died within 24 hours does not allow for the identification of all causes of death that may occur within the seven-day period. The zone hospital did not have a neonatal unit and newborns requiring specific care were referred to the regional hospitals of Parakou city in the north or Abomey city in the south. The early neonatal mortality rate was 7.03‰ in the SaO health zone from 2018 to 2020. This rate appears low as the study was exclusively interested in data from public peripheral maternity hospitals and new-born died in the hospitals. A community-based study would provide a more accurate rate of early neonatal death. Strengthening of family planning, improvement of compliance with IPT-SP and monitoring of labour and delivery, well-equipped neonatology services with the required personnel could reduce early neonatal mortality rate.

AUTHOR CONTRIBUTION

Toudonou Serge, Damien Barikissou Georgia, and AGUEMON Badirou conceived and designed the study, performed analysis, interpretation of data and critically reviewed the manuscript. Toudonou Serge collected the data.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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