

# Socio-Medical and Demographic Factors Associated with Perinatal Mortality in a Southern Benin Health Zone Hospital in 2020: A Case-Control Study

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**How to cite this paper:** Jerome, C.S., Salami, L., Cadete, V.A.G., Bedie, V., Glele-Ahanhanzo, Y., Makoutode, P.C. and Aguemon, B. (2023) Socio-Medical and Demographic Factors Associated with Perinatal Mortality in a Southern Benin Health Zone Hospital in 2020: A Case-Control Study. *Open Journal of Preventive Medicine*, 13, 227-238.

<https://doi.org/10.4236/ojpm.2023.138015>

**Received:** June 24, 2023

**Accepted:** August 28, 2023

**Published:** August 31, 2023

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## Abstract

**Background:** Perinatal mortality remains a major public health concern in developing countries such as Benin. To better steer response interventions, this study was carried out in southern Benin with the aim of identifying the demographic and socio-medical factors linked to perinatal mortality. **Methods:** The case-control study, held from January 1 to December 31, 2020, covered 154 targets, including 77 cases of neonates deceased within the perinatal period and 77 live-born control neonates selected on a one-for-one basis. Univariate analysis using the McNemar test and logistic regression were used to identify risk factors for perinatal mortality, at a 5% threshold of significance. **Results:** Sahoué/mina ethnicities, only associated socio-demographic characteristic, increased the risk of perinatal death by 2.47 times ( $p = 0.008$ ). Mother's age, education, occupation, marital status, and household size were not associated ( $p > 0.05$ ). Risk of death was increased 2.5 times when the mother was referred ( $p = 0.007$ ), 3.3 times when she came from a hard-to-reach locality ( $p < 0.001$ ), more than 6 times when she had less than three antenatal consultations prior to delivery or had an income of less than US\$ 61 ( $p < 0.001$ ). Antenatal consultation was the only feature strongly associated with perinatal death. **Conclusion:** Although attention must also be paid to referral and access to care, this study identifies antenatal consultation as the main target of any intervention to reduce perinatal mortality.

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## Keywords

Perinatal Mortality, Associated Factors, Antenatal Care, Benin

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### 1. Introduction

Maternal and newborn morbidity and mortality in the perinatal period, although often preventable, remain real scourges that cause suffering and even mourning in families around the world.

Worldwide, nearly 4.5 million perinatal deaths were recorded in 2015, including 2.1 million stillbirths and 2.4 million early neonatal deaths [1]. United Nations agencies, including UNICEF and WHO, estimate that every 16 seconds a mother loses her newborn at birth [2]. Birth and the first month of life continue to be times of high risk for the child. Two-thirds of neonatal deaths occur during the first week of life, and the risk of death is even greater during the first 24 hours of life [3].

In developing countries where many women give birth without the help of skilled staff, health risks are higher than in developed countries. Compared to women in high-income countries, women in sub-Saharan Africa are 10 times more likely to have their infants die in the first month of life [4]. These deaths would be related to a variety of factors, including the lack of appropriate health services, socio-demographic and health characteristics of women [2] [5] [6].

Like most countries in sub-Saharan Africa, Benin has low health indicators for pregnant women and children. Every year, the country records about 1200 maternal deaths and nearly 11,000 perinatal deaths for nearly 450,000 live births [7]. Perinatal mortality is estimated at 33 deaths per 1000 live births, with a geographical variation [8]. Despite various measures taken to address this high mortality rate, many women continue to arrive in emergency situations for various reasons and lose their newborns. This is the case at Comé's zone hospital where dozens of perinatal deaths are recorded each year [9].

It is to better orient the actions of response to this situation that the present research was initiated in order to study the demographic and socio-medical factors associated with perinatal mortality in southern Benin.

### 2. Methods

#### 2.1. Study Framework

The study was conducted at Comé Zone Hospital, which is the referral hospital for the Comé-Bopa-Grand-Popo-Houéyogbé health zone. It is a sanitary area located in the county of Mono, south-west of Benin. The area hospital has twelve departments or units of care, including a department of gynecology and obstetrics, a department of pediatrics that hosts this study.

#### 2.2. Study Design

This was a retrospective case-control study, covering the period from January 1

to December 31, 2020, to compare the birth group with stillborn or newborn deaths within 7 days (cases) and the birth group with new-born alive (controls).

**Study population:** The main targets were births registered at the maternity ward in the area. These include cases of stillbirths, that is, fetuses born after the 28<sup>th</sup> week of amenorrhea, without heartbeat or breathing, so as newborns dead within 7 days of life; and controls represented by live births from the 28<sup>th</sup> week of amenorrhea and were still alive.

Secondary targets were comprised of health workers involved in childbirth and/or prenatal and neonatal follow-up (obstetric gynecologists, midwives, pediatricians, and nurses) and mothers residing in the health zone and having given birth in the Comé zone hospital.

The criteria for inclusion of cases and controls were “having gave birth at Comé zone hospital during the study period” and “to be a mother residing in the CGBH health zone.”

The criteria for not including cases and controls were “any delivery record not containing exploitable information on perinatal death”, and “any delivery from the 28<sup>th</sup> week of amenorrhea occurring at home, received and registered at the zone hospital for incomplete delivery.”

Case-control matching was done on the variables age of mothers ( $\pm 5$  years), the occurrence of perinatal death ( $\pm 1$  month), the mother’s residence.

The sources of information were the medical records of the women who gave birth at the maternity ward of the zone hospital, antenatal consultation records, birth records, the ambulance logbook, the operating room report book and the neonatal medical records.

**Sampling:** For cases, the non-probabilistic method with the exhaustiveness technique was used. All cases of stillbirth or stillbirth and death within seven (7) days of birth at the Comé zone hospital that met the criteria were enumerated.

For controls, the probabilistic method was used, with a systematic random sampling technique for a proportion of one control for one case. Each control was drawn by step from the group of those meeting the criteria and matching variables.

The sample size was 154, including 77 cases eligible for the survey for the targeted period and 77 selected controls.

**Variables and data collection:** Several groups of variables were explored by this study. These included socio-demographic variables such as age, marital status, household size, ethnicity, mother’s profession, level of education and geographical accessibility, mother’s income; and socio-medical variables such as ANC visits, mode of hospital admission, fetal sex, fetal status at birth (stillbirth).

The data were collected by documentary analysis using a tabulation sheet, and by individual interviews with mothers and maternity health staff involved in deliveries and/or antenatal care.

**Data treatment and analysis:** After checking the completeness and accuracy of collected data entered into Kobocollect, analysis was carried out using Epi in-

fo 7 and IBM SPSS version 22 software. The mean with standard deviation was calculated for quantitative variables, while proportions were calculated for qualitative variables. Proportions were compared using McNemar's  $\chi^2$  or Fisher's exact test as appropriate. Multivariate analysis was also performed using a conditional logistic regression model. The significance threshold was p-value equal to 0.05. Results were presented in text or table format, as appropriate.

#### **Ethical and regulatory concerns**

The work was carried out in accordance with the provisions of Law No. 2010-40 of December 08, 2010, on the code of ethics and professional conduct for health research in the Republic of Benin. Authorization for data collection was obtained from the administrative authorities. Confidentiality, dignity, and integrity of participants were respected throughout the study. Data were collected and processed anonymously, and then used in aggregate for scientific purposes only.

### **3. Results**

#### **3.1. Characteristics of Case and Control Mothers**

The characteristics of the mothers surveyed are shown in **Table 1**. The mean age of mothers in cases was  $26.27 \pm 5.97$  years, with extremes ranging from 17 to 45 years, compared with  $25.49 \pm 5.04$  years in controls, with extremes ranging from 17 to 40 years. Most mothers, 87.0% of cases and 94.8% of controls, were aged 35 or under. Nearly two-thirds were housewives/shopkeepers.

Mothers were frequently referred (75.3% of case mothers, 54.5% of control mothers) and had made fewer than three antenatal visits (79.2% of case mothers; 36.4% of control mothers). Case mothers came from hard-to-reach areas (58.4%) and had a monthly income of less than US\$ 61 (87%), whereas control mothers came from easier-to-reach areas (70.1%) and often had a monthly income of less than US\$ 61 (51.9%).

Deliveries were attended by skilled providers, mainly gynecologists in the case group (63.3%) and midwives (41.5%) in the control group.

All case mothers (100%) were admitted to Comé hospital for clinical complications, compared with 27.3% of controls.

#### **3.2. Associated Factors with Perinatal Deaths**

##### **Univariate analysis**

Ethnicity was the only socio-demographic characteristic significantly associated with perinatal death ( $p = 0.008$ ). Mothers of Sahoué/Mina ethnicities were almost 2.5 times more likely to have a perinatal death (OR = 2.47; CI = [1.26 - 4.83];  $p = 0.008$ ) than mothers of other ethnicities (**Table 2**). No significant association was found between perinatal death and factors such as maternal age, level of education, household size, occupation, and marital status ( $p > 0.05\%$ ).

Mothers' characteristics for access to services were associated with perinatal

**Table 1.** Distribution of perinatal death cases and controls according to demographic and socio-medical characteristics of mothers at Comé zone hospital in 2020.

Variables	Cases n (%)	Controls n (%)	Total
Demographic characteristics of mothers			
Age of mothers (years)			
≤35	67 (87.0)	73 (94.8)	140
>35	10 (13.0)	04 (05.2)	14
Marital status			
Single	11 (14.3)	09 (11.7)	20
Married	66 (85.7)	68 (88.3)	134
Household size			
≤4	67 (87.0)	68 (88.3)	135
>4	10 (13.0)	09 (11.7)	19
Ethnicity			
Sahoué/Mina	56 (72.7)	40 (51.9)	96
Others	21 (27.3)	37 (48.1)	58
Occupation			
Student/Apprentice	06 (07.8)	11 (14.3)	17
Civil servant/Artisan	19 (24.7)	16 (20.8)	35
Housewife/Businesswoman	52 (67.5)	50 (64.9)	102
Education level			
Educated	55 (71.4)	65 (84.4)	120
No schooling	22 (28.6)	12 (15.6)	34
Socio-medical characteristics of mothers			
Mode of admission			
Referred	58 (75.3)	42 (54.5)	100
Not referred	19 (24.7)	35 (45.5)	54
Geographical accessibility			
Easy	32 (41.6)	54 (70.1)	86
Difficult	45 (58.4)	23 (29.9)	68
Number of ANC visits			
≥3	16 (20.8)	49 (63.6)	65
<3	61 (79.2)	28 (36.4)	89
Mothers' income			
≥61 US\$ (40,000 FCFA)*	10 (13.0)	37 (48.1)	47
<61 US\$ (40,000 FCFA)*	67 (87.0)	40 (51.9)	107

**Continued**

Type of attended staff for deliveries			
Obstetric gynecologist	49 (63.6)	29 (37.6)	78
Midwife	28 (36.4)	32 (41.6)	60
Other	0	16 (20.8)	16
Gender of newborn			
Female	32 (41.6)	36 (46.8)	68
Male	45 (58.4)	41 (53.2)	86
Stillborn's condition at birth			
Fresh	64 (83.1)		
Macerated	13 (16.9)		

\*This amount corresponds to the guaranteed interprofessional minimum salary in Benin Republic in 2020.

**Table 2.** Demographic and socio-medical characteristics of mothers associated with the occurrence of perinatal death at Comé zone hospital in 2020.

Variables	Cases	Controls	OR [95% CI]	p-value
Demographic characteristics of mothers				
Age of mothers (years)				0.093
<35	67	73	1	
≥35	10	4	2.73 [0.82 - 9.10]	
Marital status				0.632
Single	11	9	1.26 [0.49 - 3.24]	
Married	66	68	1	
Household size				0.806
≤4	67	68	1	
>4	10	09	1.13 [0.43 - 2.95]	
Ethnicity				0.008
Sahoué/Mina	56	40	2.47 [1.26 - 4.83]	
Others	21	37	1	
Occupation				0.413
Student/Apprentice	6	11	0.51 [0.18 - 1.45]	
Housewife/Businesswoman	52	50	1.12 [0.58 - 2.19]	
Civil servant/Artisan	19	16	1	
Education level				0.052
No schooling	22	12	2.17 [0.98 - 4.77]	
Educated	55	65	1	

**Continued**

Socio-medical characteristics of mothers				
Mode of admission				0.007
Referred	58	42	2.54 [1.28 - 5.05]	
Not referred	19	35	1	
Geographical accessibility				<0.001
Difficult	45	23	3.30 [1.70 - 6.43]	
Easy	32	54	1	
ANC Visits				<0.001
<3	61	28	6.67 [3.25 - 13.71]	
≥3	16	49	1	
Mother's income				<0.001
<61 US\$ (40,000 FCFA)*	67	40	6.20 [2.78 - 13.80]	
≥61 US\$ (40,000 FCFA)*	10	37	1	
Gender of newborn				0.516
Female	32	36	1	
Male	45	41	1.23 [0.65 - 2.33]	

\*This amount corresponds to the guaranteed interprofessional minimum salary in Benin Republic in 2020.

death. The risk of death was 2.5 times higher when the mother was referred (OR = 2.54; CI = [1.28 - 5.05];  $p = 0.007$ ); 3.3 times higher when she came from a difficult-to-access locality (OR = 3.30; CI = [1.70 - 6.43];  $p < 0.001$ ) and more than 6 times higher when she had completed fewer than three antenatal consultations before delivery (OR = 6.67; CI = [3.25 - 13.71];  $p < 0.001$ ) or had an income of less than US\$ 61 (OR = 6.20; CI = [2.78 - 13.80];  $p < 0.001$ ).

**Multivariate analysis**

This analysis was done with the variables of the factors associated with perinatal death with a  $p$ -value less than or equal to 20%.

The introduction of the variables into the multiple model with adjustment, using Wald's bottom-up method, led to the conclusion that only ANC visits was significantly associated with perinatal death (**Table 3**).

Fewer than three ANC visits during pregnancy increased the risk of losing a newborn before birth or within 7 days of life by a factor of 4 (OR = 4.00; CI = [1.51 - 10.60];  $p = 0.005$ ), compared with a woman having made at least three ANC visits.

**4. Discussion****4.1. Socio-Demographic Characteristics of Mothers**

Among the socio-demographic characteristics of mothers explored during the

**Table 3.** Results of the multivariate analysis of demographic and socio-medical characteristics of mothers associated with the occurrence of perinatal death at Comé zone hospital in 2020.

Variables	OR	95% CI	p-value
Age of mothers (years)	0.61	[0.10 - 03.52]	0.587
Ethnicity	2.06	[0.80 - 05.51]	0.139
Mode of admission	0.66	[0.22 - 01.92]	0.444
Education level	1.07	[0.34 - 03.51]	0.907
Mother's income	6.20	[2.78 - 13.80]	0.722
Geographical accessibility	0.51	[0.20 - 01.30]	0.156
<b>ANC Visits</b>	4.00	[1.51 - 10.60]	<b>0.005</b>

study, only ethnicity showed a statistically significant association with perinatal death ( $p = 0.008$ ). Mothers of Sahoué/Mina ethnicities were 2.5 times more likely to have a perinatal death (OR = 2.47; CI = [1.26 - 4.83]) than mothers of other ethnicities. No significant association was found between perinatal death and factors such as maternal age, level of education, household size, occupation, and marital status ( $p > 0.05$ ). For educational level, the risk of perinatal death, which was 2.17 times higher for mothers with no schooling than for those with schooling, was not significant ( $p = 0.052$ ). The same was true for mothers aged 35 and over, who showed a non-significant 2.73 times increase in risk compared with younger mothers ( $p = 0.093$ ).

The link between perinatal mortality and ethnicity is poorly documented. It has been noted in southern China that belonging to an ethnic minority decreased the risk of perinatal death [10].

Maternal age over 30 years has also been identified as a source of high risk of perinatal death, notably in northern Uganda (adjusted IRR = 2.5; CI = [1.1 - 5.8]), in the Oromia region of Ethiopia, (AOR = 7.59; CI = [1.91 - 30.10]), as well as in Abuja Nigeria hospitals (OR = 1.4; CI = [1.0 - 1.8]) [11] [12] [13].

Several authors have reported, in contrast to the results of the present study, that newborns born into small households of two or fewer people (AOR = 4.12; CI = [2.19 - 7.79]) had a higher risk of perinatal death than others [5] [14].

The association between low education and stillbirth (OR = 1.6; CI = [1.02 - 2.6]) and between maternal education and stillbirth ( $p = 0.01$ ) has also been reported in Brazil and Nigeria respectively [15] [16].

#### 4.2. Socio-Medical Characteristics of Mothers Accessing Services

The characteristics of mothers accessing services were all associated with perinatal death. Thus, the risk of death was 2.54 times higher when the mother was referred ( $p = 0.007$ ); 3.3 times higher when she came from a difficult-to-access locality ( $p < 0.001$ ) and more than 6 times higher when she had completed fewer than three antenatal consultations (OR = 6.67) before delivery or had an income



of less than US\$ 61 (OR = 6.20) ( $p < 0.001$ ).

Tangara reported a higher proportion, with 69% of cases evacuated [17]. This high proportion may be attributable to maternal pathologies during pregnancy, which necessitated the transfer of parturients to a specialized service.

The effect of antenatal care noted in this study is consistent with findings in other countries such as Ethiopia, notably where the risk of perinatal mortality is 2 to 5 times higher in women who have not had antenatal care [5] [18] [19]. The work of Dowswell *et al.* also revealed that a reduced number of antenatal visits (4 to 9) generated a 14% greater risk of perinatal mortality (OR = 1.14; CI = [1.00 - 1.31]) than antenatal visits [20].

The benefits of a high number of antenatal check-ups could lie, among other things, in the opportunity it offers the mother to avail herself of certain key care procedures that would reduce the risk of perinatal death, such as maternal anti-tetanus vaccination (OR = 0.43; CI = [0.24 - 0.77]) and partogram monitoring (POR = 0.22; CI = [0.06 - 0.76]) [18]. It could also contribute to the protection of the woman and her newborn by early detection and timely management of maternal pathologies during pregnancy that often lead to stillbirth, namely dystocia, retroplacental hematoma, arterial hypertension, acute fetal distress and preeclampsia. These results concur well with those obtained by several authors [21] [22].

Poor access to health facilities, such as residence far from them, increases the risk of perinatal mortality (AOR = 1.99; CI = [1.24 - 3.22]) [5], as does residence in rural areas, which increases the risk by 2 to 3 times [19] [23].

The amplifying effect on the risk of perinatal death of a low-income level, which in Benin is below the guaranteed minimum wage (SMIG) of US\$ 61, has also been noted in other countries. This is the case in Ethiopia, where perinatal mortality is 41% lower in households with a higher wealth index [23]. It is also the case in southern China, where an income of over 5000 was associated with a low risk of perinatal death [10].

### 4.3. Association Analysis Summary

According to the multivariate analysis, fewer than three antenatal care visits during pregnancy was the only factor among all those explored that consistently increased the risk of newborn death before birth or within 7 days of life by at least 4 times, compared with a woman who made at least three antenatal care visits ( $p = 0.005$ ).

This finding is consistent with that reported by a systematic review in sub-Saharan Africa, which reported 2.04 times (CI = [1.67 - 2.49]) higher risk of perinatal mortality in mothers who had no antenatal visits compared with those who had at least one ( $p < 0.0001$ ) [6].

### 4.4. Limits

The study was hospital-based. It provides only an indicative value of perinatal

mortality in the health zone, as it does not take into account perinatal deaths occurring in the community, which are not often recorded. Retrospective data collection does not guarantee data quality either.

## 5. Conclusions

Perinatal mortality remains relatively high in many countries, including Benin, and continues to plunge families into mourning.

Based on the findings of this study, perinatal death appears to be the result of several factors, the most decisive of which is the number of prenatal consultations carried out.

These results indicate that reducing perinatal mortality will inevitably require good prenatal care and monitoring. Nevertheless, it draws the attention of professionals and decision-makers to the need, on the one hand, to revisit the referral system, whose delay and/or quality of decision and execution often raise questions, and on the other hand, to reinforce geographical and financial accessibility to care for women, especially in rural areas.

## Acknowledgements

The authors would like to express their heartfelt thanks to the staff of the Comé zone hospital, the teams of the Mono county, the Faculty of Health Sciences of Cotonou and the Regional Institute of Public Health of Ouidah.

## Conflicts of Interest

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

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