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Factors Associated with Maternal and Perinatal Complications of Preeclampsia at the Central Hospital of Yaoundé: A Cross-Sectional Analytical Study

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Abstract

Introduction: Pre-eclampsia (PE) is a public health problem especially in developing countries due to its incidence and severity. It is responsible for high maternal and perinatal morbidity and mortality. Accordingly, the objective of this work was to study the factors associated with the occurrence of maternal and perinatal complications of preeclampsia. **Method:** This was an analytical cross-sectional study with prospective and retrospective data collection including all patients, pregnant or postpartum, admitted for preeclampsia to the maternity ward of the Yaoundé Central Hospital. It took place over a period of seven (07) months. The data collected was analyzed using CS Pro 7.4, SPSS 20.0 and Microsoft Office Excel 2010 software. We compared the group with complications to the group without complications. We calculated the odds ratio to look for associations between variables and their 95% confidence intervals. The threshold for statistical significance was set at $p < 0.05$. **Results:** We recruited 214 cases of preeclampsia in our series. There were maternal complications in 44.4% of cases, dominated by eclampsia (31.8%). We recorded 07 maternal deaths, representing a maternal lethality of 3.3%. We had at least one perinatal complication in 105 cases (49.1%). The predominant perinatal complication was prematurity. We recorded 32 cases of intrauterine fetal demise and 13 cases of early neonatal death, giving

a perinatal lethality of 21%. After logistic regression, the factors associated with maternal complications were residing in a rural area (OR = 2.217 [1.054 - 3.09]; p < 0.036); a nurse-aid as prenatal consultation provider (PNC) (OR = 5.059 [2.175 - 36.162]; p < 0.001) and a number of PNCs < 4 (OR = 1.154 [2.330 - 4.029]). **Conclusion:** Complications of preeclampsia are very common in our setting. Several identified factors are associated with the occurrence of these complications. We suggest building the capacity of providers of PNC and sensitization of women on the use of PNC services.

1. Introduction

According to the American College of Obstetricians and Gynecologists (ACOG), pre-eclampsia (PE) is defined by the appearance of an increase in blood pressure figures (≥140/90 mm Hg) observed from the 20th week of amenorrhea after 02 measurements at least 4 hours apart and, 24-hour proteinuria of ≥300 mg. This definition may also include single or multiple organ involvement, even in the absence of proteinuria. It is believed to be the consequence of abnormal placentation around the 12th week of pregnancy under the influence of multiple factors [1].

Pre-eclampsia (PE) is a major cause of maternal morbidity and mortality worldwide. Its incidence varies with ethnic, geographical and socioeconomic differences of the populations studied. It complicates 2% to 8% of pregnancies in the world [2] [3]. PE represents a real public health problem because of its consequences on both the fetus and the mother. Nearly 12% to 25% of intrauterine growth restriction (IUGR) and 15% to 20% of premature births are attributable to PE [4].

A real medico-obstetric emergency, PE remains one of the biggest causes of admission to intensive care unit during pregnancy in America. It is responsible for nearly 20% of maternal deaths and 15% of preterm births in the United States [5]. According to Steven W, the American economist, in 2012, the United States may have spent 2.18 billion dollars for the management of complications of PE until the 12th month after childbirth [6]. Abalos *et al.* found an incidence of 1.5% in Brazil, a figure that varied according to whether the patients were in rural or urban areas [7].

In France, PE is considered the second leading cause of obstetrical maternal deaths after postpartum hemorrhage. Its incidence is 1% to 3% in nulliparas and 0.5% to 1.5% in multiparas, and complications occur in 10% of cases [8]. In England, its incidence varies from 0.72% to 3.25% [9], with high perinatal mortality. Indeed, according to Action on Pre-eclampsia (APEC), approximately 1000 newborn babies die each year from complications of PE. In Switzerland, the incidence of PE, found by Purde *et al.* was 10% and the most common maternal

complications were eclampsia and HELLP syndrome (hemolysis, elevated liver enzymes, and low platelet) [10].

In Africa, PE affects approximately 10% of pregnancies [11]. Kichou *et al.* found that PE had an incidence of 7.8% in the Tizi-Ouzou region of Algeria: the rates of prematurity, IUGR and fetal death were 58.2%, 49.7% and 6.7% respectively and maternal complications occurred in 10% of PE cases [12]. In Abidjan PE affects approximately 5.4% of pregnancies with a maternal lethality of 22.6%. The complications encountered were eclampsia (94.3%), HELLP syndrome (40.5%), acute renal failure (13.2%), stroke (7.5%) and acute pulmonary edema (APE) (2.8%) [13].

In Cameroon, the complications of eclampsia identified at the Douala General Hospital in 158 patients were acute renal failure (13.2%), HELLP syndrome (12.6%), placental abruption (3.8%) and acute pulmonary edema (3.8%) with maternal and perinatal lethality of 4.43% and 21.5%, respectively [14]. The identification of factors associated with the occurrence of complications of preeclampsia could make it possible to develop strategies to reduce the morbidity and mortality associated with this condition.

2. Objectives

2.1. General Objective

Identify the factors associated with materno-fetal complications of PE at the major maternity of the central hospital of Yaoundé.

2.2. Specific Objectives

1) List the maternal and perinatal complications occurring in pre-eclamptic patients.

2) Describe comparatively the sociodemographic and obstetrical characteristics of cases of preeclampsia: with or without complications.

3) Identify the factors associated with the occurrence of these complications.

3. Materials and Methods

We carried out an analytical cross-sectional study with prospective and retrospective data collection. The study took place at the major Maternity of the central hospital of Yaoundé (CHY), a category 2 hospital in the Cameroon health pyramid. The Gynecology-Obstetrics unit of the CHY offers maternal and neonatal health care, including monitoring of pregnancies, and management of obstetrical emergencies, including preeclampsia.

The study was conducted from November 1, 2019 through May 31, 2020. However, it covered the period from January 1, 2019 to April 30, 2020. The study population consisted of pregnant or postpartum women admitted to the maternity ward of the Central Hospital. We included all patients in whom the diagnosis of PE had been made and who agreed to participate in our study. Patients with incomplete medical records were excluded. The sampling was con-

secutive and exhaustive. Our minimum sample size (139) was determined using the Cochrane formula:

$$n = t^2 \times p \times (1 - p)/m^2$$

n: Minimum sample size;

t: Level of confidence (1.96 at 95%);

p: Estimated proportion of the population with the prevalence of severe forms of PE which will be estimated here at 10%;

m: Error Margin (generally set at 5%);

AN: $(1.96)^2 \times 0.10 \times (1 - 0.10)/0.05^2 =$ **138.29 participants**.

Data was collected using a pre-tested technical sheet for the study, after obtaining authorizations. For the prospective component, after having identified the patients using the various registers (emergency admission, delivery room and hospitalizations), we approached them in order to introduce ourselves and explain to them the purpose of our work. After obtaining their informed consent, we proceeded to collect the data on the technical sheet designed for this purpose. For unconscious patients, informed consent was given by the head of the family and information was obtained by hetero-anamnesis. This anamnesis was supplemented by the elements of the medical file and the patient's prenatal visit card. The patients were reviewed regularly until their discharge. For the retrospective part, we used hospitalization registers (period from January 1, 2019 to November 30, 2019) to identify patients who met our inclusion criteria. The numbers of the files allowed us to find the medical files of the patients in the archives and the telephone contacts appearing there made it possible to have the missing information.

The variables studied are maternal and fetal. The maternal variables are:

1) Sociodemographic variables: age, ethnicity, profession, level of education, place of residence.

2) Obstetrical variables:

- Parity: a patient is considered nulliparous when she has never given birth. The primipara is that patient who has given birth once. The paucipara is the one who has had to give birth 2 to 3 times. While the multiparous is the patient who had already had to give birth 4 times and the grand multiparous, the one who has given birth >5 times.

- Data on PNC: number of prenatal contacts, qualification of provider, weight and blood pressure figures at the beginning of pregnancy, and drugs received during pregnancy.

The fetal variables are:

1) During pregnancy: we considered as intrauterine growth retardation the birth weight of a newborn < 10th percentile for gestational age and sex, according to the reference curve for Cameroon. Intrauterine fetal death diagnosed by obstetric ultrasound or absence of fetal heart sounds (BDCF) during physical examination.

2) During childbirth: Acute fetal distress was diagnosed when an abnormal fetal heart rate (FHR) and/or the presence of meconium amniotic fluid was ob-

served using a fetal Doppler.

3) Postpartum: Birth weight, sex, Apgar score, transfer to neonatology, death.

The data collected was entered using a mask designed in CS Pro version 7.4 software and the analysis was done with SPSS software (Statistical Package for Social Sciences) version 23.0. and Microsoft Excel 2010. The error threshold α was set as statistically significant at 5% for each variable studied. A univariate analysis first allowed us to study the association between the variables and the complications of the disease using the odds ratio expressed with its 95% confidence interval. The study of the association between the variables was done, by a multivariate analysis to eliminate confounding factors. The illustrations of the results were designed using Microsoft Office Excel 2010 software. They were expressed in the form of figures and tables. Statistical tools used for comparing qualitative variables were the Chi-square tests and Fisher's exact test. On the ethical side, we obtained an ethical clearance from the Institutional Ethics Committee of the Faculty of Medicine and Biomedical Sciences. In addition, we ensured the anonymity of the completed technical sheets.

4. Results

We recruited 214 cases of pre-eclampsia into our study (Figure 1).

4.1. Maternal and Perinatal Complications Observed

4.1.1. Maternal Complications

We identified 95 cases that presented at least one maternal complication. The proportion of cases with maternal complications was 44.4%. The dominant complication was eclampsia (31.8%). We recorded 07 maternal deaths, giving a maternal lethality of 3.3% (Table 1).

4.1.2. Perinatal Complications

Of the 214 participants, 105 had at least one perinatal complication, giving a proportion of 49.1%. These complications were dominated by prematurity. The perinatal lethality rate was 21% (Table 2).

Table 1. Distribution of maternal complications related to PE.

Maternal complications	Number (N = 214) n	Proportion (%)
Eclampsia	68	31.8
HELLP syndrome	18	8.4
Placental abruption	12	5.6
Acute pulmonary edema	10	4.7
Acute renal failure	7	3.3
Disseminated intravascular coagulation	6	2.8
Ocular pathologies	5	2.3
Hemorrhagic cerebrovascular accident	3	1.4
Maternal death	7	3.3

Table 2. Distribution of perinatal complications of PE.

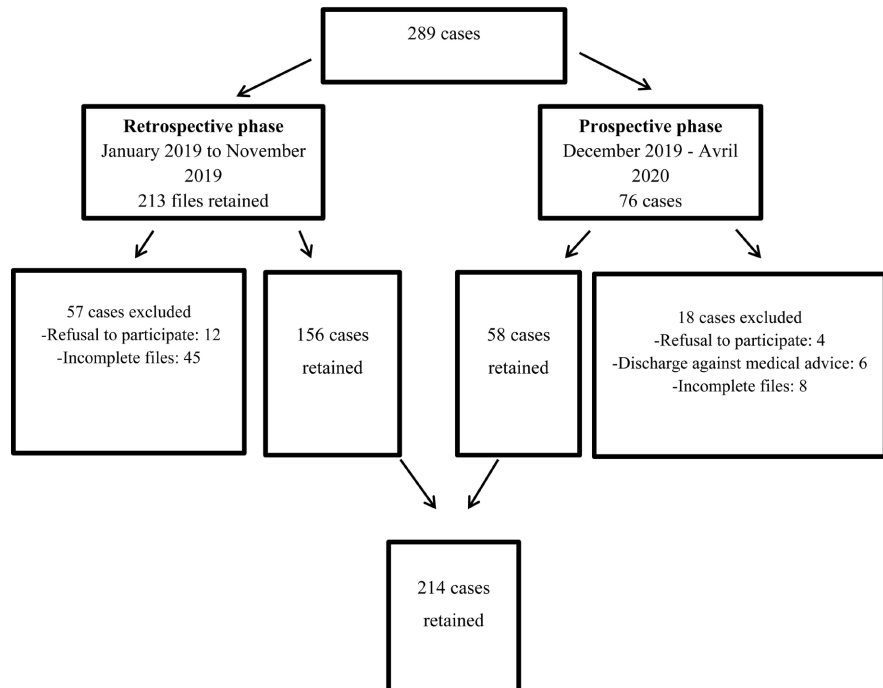| Perinatal complications	Number (N = 214) n	Proportion (%)
Prematurity	75	35.00
Intra-uterine growth restriction	45	21.00
Intra-uterine fetal death	32	15.00
Acute fetal distress	16	7.47
Early neonatal death	13	6.07

Figure 1. Diagram of the recruitment of participants.

4.2. Sociodemographic and Reproductive Characteristics

4.2.1. Sociodemographic Characteristics of Participants

The age group of 20 to 25 years and the lack of formal education were statistically associated with the occurrence of complications of preeclampsia. Residing in an urban environment and university level of education were the protective factors (Table 3).

4.2.2. Reproductive Characteristics

Primiparity was associated significantly with complications of preeclampsia (Table 4).

4.3. Prenatal Consultations

The factors associated with maternal complications were PNC at integrated health center and medicalized health center (OR = 2.43; p < 0.007); number of prenatal contacts < 4 (OR = 2.578; p = 0.001); nurse-aid as PNC provider (OR =

10.5; p < 0.01) (Table 5).

4.4. Factors Associated with Complications of Preeclampsia

After logistic regression, the factors associated with maternal complications are: place of residence in a rural area (OR = 2.217 [1.054 - 3.09]; p < 0.036); a nurse-aid as PNC provider (OR = 5.059 [2.175 - 36.162]; p < 0.001) and a number of prenatal contacts < 4 (OR = 1.154 [2.330 - 4.029]) (Table 6).

Table 3. Distribution of participants with respect to sociodemographic characteristics.

Variables	Categories	Maternal complications		OR (95% CI)	P-value
		Yes	No		
Age group	<20	15 (46.9)	17 (53.1)	1.125 (0.530-2.390)	0.759
	[20 - 25 [	28 (60.9)	18 (39.1)	2.345 (1.203 - 4.573)	0.011
	[25 - 30 [	20 (39.2)	31 (60.8)	0.757 (0.399 - 1.437)	0.394
	[30 - 35 [	15 (31.9)	32 (68.1)	0.510 (0.257 - 1.011)	0.051
	[35 - 40 [	14 (43.8)	18 (56.3)	0.970 (0.455 - 2.068)	0.937
	>40	3 (50.0)	3 (50.0)	1.261 (0.249 - 6.394)	1
Place of residence	Urban	48 (38.4)	77 (61.6)	0.557 (0.321 - 0.966)	0.037
	Rural	47 (52.8)	42 (47.2)		
Marital status	Single	66 (44)	84 (56)	1.456 (0.457 - 2.954)	0.315
	Married	28 (44.4)	35 (55.6)	0.621 (0.245 - 9.125)	0.845
	Widow	1 (100)	0 (0.0)	/	1
Occupation	Homemaker	28 (52.8)	25 (47.2)	1.571 (0.842 - 2.932)	0.154
	Student	33 (51.6)	31 (48.4)	1.511 (0.839 - 2.721)	0.168
	Formal sector	12 (25.5)	35 (74.5)	0.347 (0.168 - 0.715)	0.003
	Informal sector	22 (44.0)	28 (56.0)	0.979 (0.518 - 1.853)	0.949
Formal education	None	9 (81.8)	2 (18.2)	6.122 (1.290 - 29.054)	0.013
	Primary	19 (51.4)	18 (48.6)	1.403 (0.690 - 2.853)	0.349
	Secondary	51 (46.4)	59 (53.6)	1.179 (0.687 - 2.023)	0.551
	Superior	16 (28.6)	40 (71.4)	0.400 (0.207 - 0.773)	0.006

Table 4. Distribution of cases of PE according to parity.

Parity	Maternal complications		OR (95% CI)	P-value
	Yes	No		
Primipara	60 (51.3)	57 (48.7)	1.863 (1.071 - 3.245)	0.003
Paucipara	20 (32.7)	41 (67.3)	0.993 (0.27 - 1.004)	0.281
Multipara	13 (46.4)	15 (53.6)	1.190 (0.489 - 2.543)	0.068
Grand multipara	2 (25.0)	6 (75.0)	0.405 (0.080 - 2.054)	0.305

Table 5. Distribution of cases of PE according to PNC.

Variables	Categories	Maternal complications		OR (95% CI)	P-value
		Yes	No		
PNC	**Yes**	**85 (41.7)**	**119 (58.3)**	**/**	**<0.001**
	No	10 (100)	0 (0.0)		
Place of PNC	Private health center (lay or confessional)	39 (48.8)	41 (51.2)	1.613 (0.912 - 2.852)	0.099
	IHC or MHC	**28 (58.3)**	**20 (41.7)**	**2.432 (1.257 - 4.704)**	**0.007**
	District hospital	9 (34.6)	17 (65.4)	0.711 (0.300 - 1.680)	0.435
	Reference hospital	**9 (18.0)**	**41 (82.0)**	**0.225 (0.102 - 0.495)**	**<0.001**
PNC provider	**Nurse-aid**	**7 (87.5)**	**1 (12.5)**	**10.590 (1.278 - 87.760)**	**0.010**
	Nurse/midwife	**43 (60.6)**	**28 (39.4)**	**3.327 (1.826 - 6.064)**	**<0.001**
	General practitioner	8 (30.8)	18 (69.2)	0.583 (0.241 - 1.411)	0.228
	Gynecologist-obstetrician	**27 (27.3)**	**72 (72.7)**	**0.304 (0.169 - 0.546)**	**<0.001**
Disease in pregnancy	Yes	21 (35.6)	38 (64.4)	0.605 (0.326 - 1.124)	0.110
	No	74 (47.7)	81 (52.3)		
Number of PNC contacts	**<4**	**52 (57.8)**	**38 (42.2)**	**2.578 (1.475 - 4.505)**	**0.001**
	≥4	43 (34.7)	81 (65.3)		
Baseline blood pressure	<median	39 (41.5)	55 (58.5)	1.195 (0.665 - 2.147)	0.550
	≥median	35 (37.2)	59 (62.8)		
Pre-gestational weight	<86	37 (49.3)	38 (50.7)	1.515 (0.818 - 2.806)	0.186
	≥86	36 (39.1)	56 (60.9)		
Prevention of PE	**Yes**	**26 (32.5)**	**54 (67.5)**	**0.454 (0.255 - 0.808)**	**0.007**
	No	69 (51.5)	65 (48.5)		

PNC: Prenatal care. IHC: Integrated health center. MHC: Medicalized health center. PE: Preeclampsia. OR: Odds ratio. CI: Confidence interval.

Table 6. Factors associated with complications of preeclampsia multivariate analysis.

Variable	Adjusted odds ratio	P-value
Age (20 - 25 years)	1.514 (0.421 - 5.442)	0.525
Place of residence (Rural)	**2.217 (1.054 - 3.09)**	**0.036**
Occupation (formal sector)	1.128 (0.500 - 4.242)	0.641
Formal education (none)	2.091 (0.154 - 28.433)	0.580
Place of PNC (IHC or MHC)	2.309 (0.840 - 6.030)	0.070
Provider of PNC (Nurse-aid)	**5.059 (2.175 - 36.162)**	**0.001**
Number of PNC contacts < 4	**1.154 (2.330 - 4.029)**	**0.023**

5. Discussion

5.1. Complications of Preeclampsia

5.1.1. Maternal Complications

In our series, maternal complications of PE occurred in 44.4% of patients; these

were eclampsia (31.8%), HELLP syndrome (8.4%) and placental abruption (5.6%). This result is similar to that of Ze Minkande *et al.* in 2018 and Tshabu-Aguemon in 2017. In their series, Ze Minkande found a maternal complication in 51% of patients and the three most common complications were eclampsia (39%), HELLP syndrome (14%) and acute kidney injury (12%) [15]. According to the work of Tshabu-Aguemon where 142 patients (43.6%) presented complications, morbidity was dominated by eclampsia (36.8%), placental abruption (7.4%) and puerperal infection (1.84%) [16].

The maternal lethality in our series was 3.3%. This figure is closed to that of Ze Minkande where the maternal lethality was 3.5% [15]. In their series, the authors Kichou *et al.* and Tshabu-Aguemon *et al.* found maternal lethality of 2% and 2.4% respectively [12] [15]. In our series, some patients admitted for mild PE from the outset, developed complications during hospitalization. Because our neonatal services are suboptimal in performance, there could be a tendency to be too conservative. Furthermore, there are noticeable delays in referral from feeder health facilities and the time from indication to achievement of procedures, like cesarean section, is sometimes too long due to financial and related administrative bottlenecks. Worthy of note is that, since this is a referral facility, we tend to receive cases that are more complicated. This selection bias predisposes such referral health facilities to graver management outcome figures.

5.1.2. Perinatal Complications

The occurrence of perinatal complications of PE in our study was 49.1%. These complications were dominated by prematurity (35%), intrauterine growth restriction (IUGR) (21%) and intra-uterine fetal death (IUFD) (15%). These figures are similar to those found in the literature where the rates of perinatal complications range from 46.5% to 49.7% [17] [18]. Indeed, in their work, Tshabu-Aguemon *et al.* found fetal complications in 49.7% of cases. These complications were: prematurity (44.1%), acute fetal distress (31.28%), IUFD (13.5%) and IUGR (6.13%) [16]. That prematurity was the most frequent complication is expected, given that the management of pre-eclampsia is an emergency and the mainstay of treatment is delivery of the placenta and fetus.

The perinatal case fatality of 21% is similar to that found by Nguefack *et al.* in 2015 (21.5%) in a similar setting [19]. However, it is higher than figures found by Benjelloun *et al.* (16.65%) [20]; Tshabu-Aguemon *et al.* (18.4%) [16]; Diallo *et al.* (11.52%) [17] and Aabidha *et al.* (15%) [21]. These differences could also suggest delays in management in our setting.

5.2. Sociodemographic and Reproductive Characteristics

5.2.1. Sociodemographic Characteristics

- Maternal age

The mean age in our series was 28 ± 7 years, figures similar to those of the series of Ze Minkande *et al.* in 2018 whose average age was 28.41 ± 7.01 years [15]. This figure is higher than those found by Tshabu-Aguemon *et al.* in Benin and

Diallo *et al.* in 2019 in Guinea Conakry whose average age was 26.4 ± 6.3 years and 26.05 ± 2.9 years respectively [16] [17]. The age group of 25 - 30 years was the most affected with a frequency of 23.8%. Fouedjio *et al.* in three maternity wards in Yaoundé, found a frequency of 30% in this group [22]. This age group falls within the peak reproductive activity period of a woman's life and, therefore, corroborates the hypothesis that the age group from 20 to 35 years is a risk factor for pre-eclampsia [23].

- **Occupation**

The most represented professions were students (29.9%) and homemakers. This is in line with data from the literature which show that the risk of PE is higher in homemakers or women with a low level of education [17] [22] [24]. A study done in Germany in 2011 found an association of PE with socioeconomic status. In fact, PE occurred more in pregnant women who were jobless or had low-income jobs than in women who had high-income jobs [25].

- **Marital status**

Single or cohabiting women were the most affected with 70% of cases, which matches the results reported by Fouedjio *et al.* with a proportion of 73.3% [22]. However, these figures are much lower than those found by Diallo *et al.* in Guinea Conakry and Tshabu-Aguemon in Benin; 97.7% and 98.2% respectively [16] [17].

5.2.2. Reproductive Characteristics

Primiparas and nulliparas predominated in our series (54.7%) followed by pauciparas (28.5%). Other authors have also noted a clear predominance of nulliparous and primiparous women, for example, Tchaou *et al.* in Benin (55.8%) [26], Liu *et al.* in Taiwan (48.3%) [27] and Sibai *et al.* in the United States (75%) [28]. This high occurrence could be explained by conflict between the immune system of the mother and the genes of the father during the first gestations.

Although PE is a disease of primiparous women, the literature affirms that multiparous patients with a history of PE or other complications of PE represent a population at high risk of developing another episode of the disease, especially in its severe forms [reference]. This is why a history of PE is considered a significant risk factor in many studies with a recurrence rate that varies from 20 to 55% depending on the publication [29]. In our series, we found that 13.6% of patients had a history of PE.

5.3. Prenatal Follow-up

For a good follow-up of pregnancy, the WHO recommendation in 2019 was at least 04 PNC contacts for each pregnancy. Only 50% of our patients had to do 4 PNCs. This result is, however, slightly higher than earlier figures reported by Fouedjio *et al.* and Tchaou *et al.* (47.3% and 47.6% respectively) [22] [26]. The differences could indicate slight improvement over time in PNC use, but the overall low use, at least in part, may be accounted for by the earlier termination of these pregnancies.

5.4. Factors Associated with Complications of Preeclampsia

After multivariate analysis, the factors associated with maternal complications were: primiparity (OR = 2.217 [1.054 - 3.09]; p < 0.036), nurse-aid as qualification of PNC provider (OR = 5.059 [2.175 - 36.162]; p < 0.001) and a number of PNCs < 4 (OR = 1.154 [2.330 - 4.029]). These factors had been highlighted by Benjelloun *et al.* in Morocco [20] and by Diallo *et al.* in Guinea Conakry [17]. Indeed, these authors found that maternal complications were statistically more frequent in primiparous women and in pregnant women who had had little or no prenatal consultation. According to Fouedjio *et al.* [22], having a pregnancy monitored by nurse-aid increases the risk of eclampsia by a factor of 9.29. This could be explained by their low level of expertise in the timely detection of complications of pregnancy.

Other associated factors found by Fouedjio *et al.* include a family history of hypertension in the mother (OR = 4.8; [1.21 - 19.35]; p < 0.026), age less than 20 years (OR = 2.46; [1.026 - 5.902]; p < 0.044) [22]. These were not significant in our study [22].

6. Conclusion

At the end of our study, complications of preeclampsia are frequent. Women under age 30 and primiparous women were the most exposed. The factors associated with maternal complications were, after multivariate analysis, primiparity, nurse-aid as provider of PNC and a number of PNCs < 4. We suggest improvement of quality of staff, and their training, for PNC units, as well as sensitization of women on importance of PNC.

Conflicts of Interest

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

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