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Determinants of Adverse Maternal Outcomes among Advanced Age Pregnant Women in Douala (Cameroon)

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Abstract

Introduction: Advanced maternal age is an increasing obstetric risk factor, particularly in African contexts where demographic transition is accompanied by delayed motherhood. This study aimed to identify the determinants of adverse maternal outcomes among older pregnant women in Douala. **Methodology:** This was an observational longitudinal analytical study with prospective data collection, conducted at Laquintinie Hospital in Douala from January to August 2025. It included 234 women aged ≥35 years who gave birth from 28 weeks of gestation onward. Sociodemographic, obstetric, medical, and prenatal data were collected through patient interviews, prenatal care booklets, and the hospital's maternity obstetric records. Statistical analysis involved χ^2 tests and multivariate logistic regression to identify factors independently associated with adverse maternal outcomes. The significance level was set at $p < 0.05$. **Results:** The frequency of adverse maternal outcomes was 20.5%, including 9.8% postpartum hemorrhages, 4.7% preeclampsia/eclampsia, and 3.4% maternal deaths. The main factors independently associated with adverse outcomes were: • Age ≥ 40 years (OR = 2.31 (1.12 - 4.76); p = 0.023), • Low education level (OR = 2.10 (1.01 - 6.83); p = 0.047), • Unemployment (OR = 1.94 (1.01 - 3.74); p = 0.048), • Medical history (OR = 2.08 (1.01 - 4.31); p = 0.044) and previous cesarean section (OR = 2.12 (1.03 - 4.36); p = 0.039), • Pathology discovered during pregnancy, particularly gestational hypertension (OR = 2.87 (1.22 - 6.75); p = 0.015). Regular calcium supplementation was identified as a significant protective factor against adverse maternal outcomes (OR = 0.42 (0.20 - 0.90); p = 0.024). **Conclusion:** Adverse maternal outcomes remain

common among women of advanced maternal age in Douala, primarily linked to age ≥ 40 years, medical history, and precarious socio-economic conditions. These findings highlight the importance of integrating calcium supplementation into routine antenatal care. And targeted monitoring of at-risk women, is essential to reduce maternal morbidity and mortality in this group.

Keywords

Advanced Maternal Age, Maternal Complications, Cesarean Section, Pregnancy Pathologies, Calcium, Douala

1. Introduction

Over the decades, motherhood has shifted to increasingly advanced ages, reflecting profound social and economic changes influencing women's reproductive paths. Higher education levels, rising participation in the labor market, fertility control, and advancements in assisted reproductive technology have significantly reshaped the timeline of motherhood. In this context, an increasing number of pregnancies now occur in women aged 35 or older, an age traditionally considered a threshold for advanced maternal age [1]-[3]. While this shift reflects undeniable social progress, it comes with obstetrical challenges. Advanced-age pregnancies are associated with a constellation of maternal complications: hypertension, gestational diabetes, preeclampsia, postpartum hemorrhage, repeat cesarean, infection, or maternal near-miss events, all of which increase in frequency with age [4]-[7]. These complications are attributed to physiological fragility associated with aging, the growing burden of chronic comorbidities, and obstetric history such as cesarean section or secondary infertility [8] [9]. In low- and middle-income countries, these risks are exacerbated by limited obstetric resources, delays in accessing care, and gaps in perinatal monitoring [10] [11]. In Cameroon, the economic capital, Douala, hosts a young urban population yet faces a rapid reproductive transition, with a notable increase in advanced-age pregnancies observed in reference maternity hospitals. However, the maternal outcomes of these pregnancies and their determining factors remain poorly documented, with most studies focusing on perinatal or neonatal outcomes [12]-[14]. Understanding the determinants of maternal complications in this at-risk population is crucial for improving obstetric care and reducing preventable maternal morbidity. This study aimed to identify factors associated with adverse maternal outcomes among older pregnant women in Douala, to contribute to more anticipatory and well-adapted care for the realities of Cameroon's urban hospital settings.

2. Methods

This was a longitudinal observational study at Laquintinie Hospital in Douala with real-time data collection and follow-up of pregnant women aged 35 years and older, from their first antenatal visit until delivery and the immediate postpartum

period, conducted between January and August 2025 (8 months). This facility handles obstetric emergencies, monitors high-risk pregnancies, and manages reference deliveries.

2.1. Study Population

The study included all pregnant women aged 35 and older who delivered a viable fetus (≥28 weeks of gestation) or experienced intrauterine fetal death during the study period. Incomplete records, pregnancies terminated before 28 weeks, and women referred immediately postpartum were excluded. A total of 234 pregnant women of advanced maternal age were included in the analysis.

2.2. Operational Definitions

- Advanced maternal age: pregnancy occurring at ≥35 years.
- Adverse maternal outcome: occurrence of severe maternal complications (preeclampsia, hemorrhage, infection, uterine rupture, sepsis, transfusion, obstetric hysterectomy, or maternal death) during pregnancy, childbirth, or postpartum.
- Favorable outcome: delivery without major complications.
- Adequate prenatal care: at least one prenatal visit per month until delivery.
- Regular calcium supplementation: daily intake of ≥1 g/day for ≥1 month before delivery.

2.3. Variables Studied

Independent variables were grouped into three categories:

- Sociodemographic factors: age, marital status, education level, employment status.
- Medical and obstetric factors: parity, medical history' included any pre-existing condition prior to pregnancy (such as chronic hypertension, diabetes, sickle-cell disease, HIV infection, hepatitis B, or epilepsy), history of cesarean section, associated pathologies during pregnancy.
- Prenatal care-related factors: number of prenatal visits, iron and calcium supplementation, malaria prophylaxis (IPT), aspirin intake, diagnosis of gestational hypertension or other intercurrent pathology.

The dependent variable was maternal outcome (favorable/adverse).

2.4. Data Collection

Using a standardized data collection sheet, data were extracted from interviews with the pregnant women during prenatal visits, prenatal care booklets, delivery registers, maternity obstetric records, and postnatal surveillance sheets. Each record was reviewed by two independent investigators to minimize transcription bias.

2.5. Statistical Analysis

Data were analyzed using SPSS version 26.0. Quantitative variables were summa-

rized by mean ± standard deviation, and qualitative variables by frequencies and percentages. The association between independent variables and maternal outcomes was studied using the χ^2 test or Fisher's exact test, depending on the sample sizes. Odds ratios (OR) with their 95% confidence intervals (CI) were calculated in univariate analysis. Variables significant at $p < 0.20$ were entered into a multivariate logistic regression model to identify independent factors for adverse outcomes. The model's quality was verified using the Hosmer-Lemeshow test and the area under the ROC curve (AUC).

2.6. Ethical Considerations

The study received authorization from the management of Laquintinie Hospital. Data confidentiality was strictly maintained, and the information was anonymized before analysis. No direct interventions were conducted on the patients, as the study relied solely on clinical records.

3. Results

3.1. Association of Adverse Maternal Outcomes with Sociodemographic Characteristics of Participants

Maternal complications affected 20.5% of women overall, with a clear age gradient (16.4% at 35 - 39 years → 50% at ≥ 45 years). Maternal mortality reached 3.4%, concentrated among women aged ≥ 40, unemployed, or with a low level of education. Unemployed women and those with primary education had the highest rates of complications, 28.4% and 38.5% respectively, and mortality rates of 6% - 8%, reflecting the impact of socioeconomic determinants on maternal prognosis (Table 1, Figure 1).

Table 1. Obstetric outcomes and adverse outcomes based on sociodemographic profile of advanced maternal age pregnant women in douala (N = 234).

Variables	Maternal Complications n (%)	OR (IC 95%)	Maternal Death n (%)	OR (IC 95%)	p-value
Age					
35 - 39 (n = 159)	26 (16.4)	1.00 (ref.)	2 (1.3)	1.00 (ref.)	-
40 - 44 (n = 67)	18 (26.9)	1.85 (0.93 - 3.66)	4 (6.0)	4.93 (0.91 - 26.8)	**0.03***
≥45 (n = 8)	4 (50.0)	5.00 (1.23 - 20.3)	2 (25.0)	24.5 (3.1 - 192.8)	-
Marital Status					
Single (n = 143)	35 (24.5)	1.00 (ref.)	6 (4.2)	1.00 (ref.)	0.22
Married (n = 91)	13 (14.3)	0.52 (0.26 - 1.04)	2 (2.2)	0.51 (0.10 - 2.64)	-
Education Level					
Primary (n = 13)	5 (38.5)	2.78 (0.86 - 8.97)	1 (7.7)	2.38 (0.27 - 21.0)	**0.04***
Secondary (n = 163)	33 (20.2)	1.22 (0.60 - 2.47)	6 (3.7)	1.54 (0.29 - 8.10)	-
Higher Education (n = 58)	10 (17.2)	1.00 (ref.)	1 (1.7)	1.00 (ref.)	-

Continued

Profession					
Unemployed (n = 74)	21 (28.4)	2.22 (1.07 - 4.58)	5 (6.8)	3.25 (0.62 - 17.1)	**0.05***
Salaried ≤ Minimum Wage (n = 3)	1 (33.3)	2.86 (0.25 - 32.1)	0 (0.0)	—	-
Salaried ≥ Minimum Wage (n = 69)	10 (14.5)	1.00 (ref.)	1 (1.4)	1.00 (ref.)	-
Informal Sector (n = 88)	16 (18.2)	1.32 (0.58 - 3.02)	2 (2.3)	1.64 (0.16 - 16.9)	-

*χ^2 test or Fisher's exact test according to frequencies. Significant if $p < 0.05$.

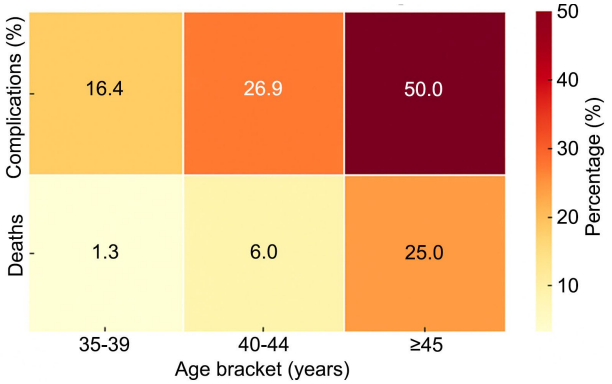

Figure 1. Gradient color heatmap of the evolution of maternal complications and deaths according to advanced maternal age.

3.2. Adverse Maternal Outcomes Based on Obstetric and Medical Histories of Participants

Maternal complications were significantly more frequent among pregnant women with a medical history (36.1% vs. 17.7%, p = 0.02). Similarly, a history of cesarean section significantly increased the risk of complications (33.9% vs. 15.7%, OR = 2.22 (1.13 - 4.36), p = 0.01). Maternal mortality, although rare (3.4%), mainly concerned grand multiparas and hypertensive patients. These associations confirm the aggravating role of medical and surgical histories in the prognosis of pregnancies at advanced age.

Figure 2 illustrates the odds ratios (OR) of the main obstetric and medical variables associated with adverse maternal outcomes in women of advanced maternal age in Douala. Several histories were observed to significantly increase the risk of complications:

- Overall medical histories increased the risk of adverse outcomes by approximately 2.3 times (OR = 2.32; 95% CI 1.05 - 5.14), confirming the impact of comorbidities on prognosis.
- Among these histories, hypertension emerged as the most determining factor, with an almost quadrupled risk (OR = 3.93; 95% CI 0.97 - 15.8).
- Women who were HIV-positive or had other medical histories (asthma, diabetes, sickle cell disease, etc.) also had an increased risk, although not statistically significant, reflecting the low power due to small sample sizes.
- A history of cesarean section was associated with a doubled risk (OR = 2.22;

95% CI 1.13 - 4.36), highlighting the importance of scar tissue in pregnancy complications at advanced age.

- Conversely, high parity (simple multiparity) did not appear as a major risk factor, while grand multiparity showed a trend toward a very high risk (OR = 2.75; 95% CI 0.17 - 44.6), probably amplified by the rarity of cases.

Overall, the figure reflects an increasing gradient of maternal risk in the presence of medical or surgical histories, particularly hypertension and prior cesarean section, two major determinants of the complications observed in this cohort of advanced-age pregnancies (Table 2, Figure 2):

Table 2. Adverse maternal outcomes based on obstetric and medical histories of advanced maternal age pregnant women in douala (N = 234).

Variables	Maternal Complications n (%)	OR (IC95%)	Maternal Death n (%)	OR (IC 95%)	p-value
Parity					
Nulliparous (n = 25)	7 (28.0)	1.00 (ref.)	1 (4.0)	1.00 (ref.)	-
Primiparous (n = 34)	5 (14.7)	0.46 (0.14 - 1.52)	0 (0.0)	-	
Multiparous (n = 173)	35 (20.2)	0.67 (0.27 - 1.67)	6 (3.5)	0.87 (0.09 - 8.08)	0.41
Grand multiparous (n = 2)	1 (50.0)	2.75 (0.17 - 44.6)	1 (50.0)	25.5 (1.8 - 354.7)	-
Medical History					
Yes (n = 36)	13 (36.1)	2.32 (1.05 - 5.14)	3 (8.3)	2.56 (0.62 - 10.5)	**0.02***
No (n = 198)	35 (17.7)	1.00 (ref.)	5 (2.5)	1.00 (ref.)	-
Type of Medical History					
Hypertension (n = 8)	4 (50.0)	3.93 (0.97 - 15.8)	1 (12.5)	5.48 (0.51 - 58.8)	0.07
HIV Positive (n = 16)	5 (31.3)	1.84 (0.59 - 5.77)	1 (6.3)	2.50 (0.27 - 23.4)	-
Other Histories (n = 12)**	4 (33.3)	1.92 (0.53 - 7.02)	0 (0.0)	-	-
History of Cesarean					
Yes (n = 62)	21 (33.9)	2.22 (1.13 - 4.36)	4 (6.5)	2.04 (0.52 - 7.97)	**0.01***
No (n = 172)	27 (15.7)	1.00 (ref.)	4 (2.3)	1.00 (ref.)	-

*χ^2 test or Fisher's exact test according to frequencies. Significant if $p < 0.05$. ** Others = asthma, diabetes, sickle cell disease, hepatitis B, obesity, epilepsy.

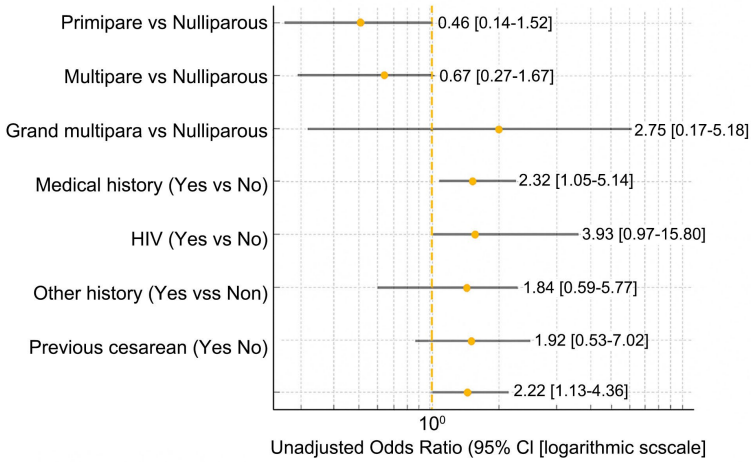

Figure 2. Forest plot illustrating the Odds Ratios of adverse maternal outcomes based on obstetric and medical histories.

3.3. Maternal Outcomes Based on Prenatal Care and Pathologies Discovered during Pregnancy (N = 234)

Adverse outcomes were significantly more frequent among women with insufficient prenatal care (<1 prenatal visit/month), absence of malaria prophylaxis (IPT), or lack of calcium supplementation ($p < 0.01$). The occurrence of a pathology during pregnancy tripled the risk of complications (OR = 3.32; 95% CI = 1.64 - 6.72), primarily dominated by gestational hypertension (OR = 3.47; $p = 0.002$). Conversely, regular intake of calcium and aspirin seemed protective against maternal complications (Table 3, Figure 3).

Table 3. Maternal outcomes based on prenatal care and pathologies discovered during pregnancy (N = 234).

Variables	Complications n (%)	OR (IC 95%)	Maternal Death n (%)	OR (IC 95%)	p-value
Prenatal Visit/Month					
Yes (n = 224)	43 (19.2)	1.00 (ref.)	7 (3.1)	1.00 (ref.)	-
No (n = 10)	5 (50.0)	4.25 (1.08 - 16.7)	1 (10.0)	3.44 (0.37 - 31.8)	**0.04***
Multiple Pregnancy					
Yes (n = 7)	3 (42.9)	3.10 (0.64 - 14.9)	1 (14.3)	5.19 (0.45 - 59.8)	0.09
No (n = 227)	45 (19.8)	1.00 (ref.)	7 (3.1)	1.00 (ref.)	-
Iron + Folic Acid Supplementation					
Yes (n = 225)	44 (19.6)	1.00 (ref.)	7 (3.1)	1.00 (ref.)	-
No (n = 9)	4 (44.4)	3.30 (0.80 - 13.5)	1 (11.1)	3.93 (0.42 - 36.4)	0.08
Malaria Prevention (IPT)					
Yes (n = 219)	40 (18.3)	1.00 (ref.)	6 (2.7)	1.00 (ref.)	-
No (n = 15)	8 (53.3)	5.12 (1.75 - 14.9)	2 (13.3)	5.62 (0.99 - 31.8)	**0.004***
Aspirin (Preeclampsia Prevention)					
Yes (n = 19)	2 (10.5)	0.47 (0.10 - 2.05)	0 (0.0)	-	0.32
No (n = 215)	46 (21.4)	1.00 (ref.)	8 (3.7)	1.00 (ref.)	-
Calcium					
Yes (n = 169)	26 (15.4)	0.39 (0.21 - 0.73)	3 (1.8)	0.26 (0.06 - 1.15)	**0.004***
No (n = 65)	22 (33.8)	1.00 (ref.)	5 (7.7)	1.00 (ref.)	-
Pathology Discovered During Pregnancy					
Yes (n = 48)	21 (43.8)	3.32 (1.64 - 6.72)	5 (10.4)	3.64 (0.98 - 13.6)	**0.001***
No (n = 186)	27 (14.5)	1.00 (ref.)	3 (1.6)	1.00 (ref.)	-
Type of Pathology					
Gestational Hypertension (n = 34)	15 (44.1)	3.47 (1.53 - 7.89)	3 (8.8)	3.03 (0.67 - 13.7)	**0.002***
Malaria (n = 7)	2 (28.6)	1.61 (0.30 - 8.70)	0 (0.0)	-	-
Hepatitis B (n = 4)	1 (25.0)	1.38 (0.14 - 13.6)	0 (0.0)	-	-
Gestational Diabetes (n = 2)	1 (50.0)	3.00 (0.18 - 50.6)	0 (0.0)	-	-

*Significant if $p < 0.05$.

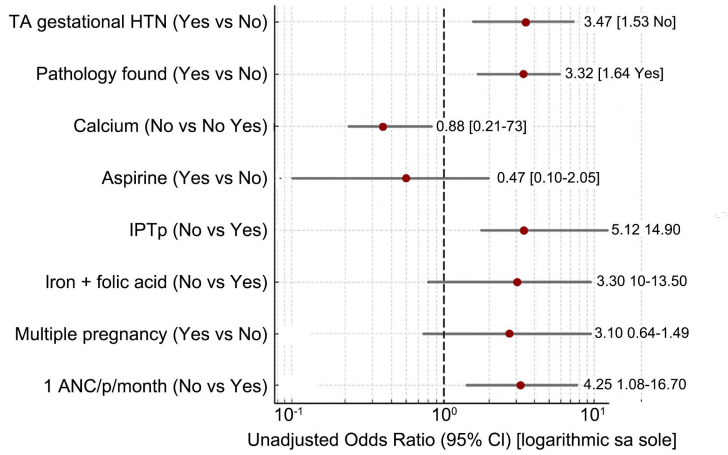

Figure 3. Forest plot of the odds ratios of maternal outcomes based on prenatal care and pathologies during pregnancy.

3.4. Determinants of Adverse Maternal Outcomes (Logistic Regression)

After adjusting for the significant variables in univariate analysis, the factors independently associated with adverse maternal outcomes were (**Table 4**):

- Age ≥ 40 years (OR = 2.31 (1.12 - 4.76); p = 0.023).
- Low level of education (OR = 2.10 (1.01 - 6.83); p = 0.047).
- Unemployment (OR = 1.94 (1.01 - 3.74); p = 0.048).
- Medical history (OR = 2.08 (1.01 - 4.31); p = 0.044) and history of cesarean section (OR = 2.12 (1.03 - 4.36); p = 0.039).
- The occurrence of a gestational pathology, specifically hypertension (OR = 2.87 (1.22 - 6.75); p = 0.015).

Conversely, regular intake of calcium had a protective effect (OR = 0.42 (0.20 - 0.90); p = 0.024).

The final model showed good calibration and satisfactory discrimination (AUC = 0.82).

Table 4. Independent factors associated with adverse maternal outcomes among advanced maternal age pregnant women in douala (Multivariate Logistic Regression, N = 234).

Variables	OR (IC 95%)	p-value
Maternal Age ≥ 40 Years	2.31 (1.12 - 4.76)	0.023*
Primary Level Education	2.10 (1.01 - 6.83)	0.047*
Unemployed	1.94 (1.01 - 3.74)	0.048*
Medical History	2.08 (1.01 - 4.31)	0.044*
History of Cesarean Section	2.12 (1.03 - 4.36)	0.039*
Pathology Discovered During Pregnancy	3.04 (1.41 - 6.58)	0.004*
Gestational Hypertension	2.87 (1.22 - 6.75)	0.015*
Regular Calcium Supplementation	0.42 (0.20 - 0.90)	0.024*

Hosmer–Lemeshow Test: $\chi^2 = 6.18$; p = 0.63 (good calibration), Area under the ROC Curve = 0.82 (good model discrimination), *Significant if $p < 0.05$.

4. Discussion

This study conducted in Douala among 234 pregnant women of advanced maternal age highlighted a significant frequency of adverse maternal outcomes, affecting approximately one in five women (20.5%). The most common complications were postpartum hemorrhage (9.8%), preeclampsia-eclampsia (4.7%), and postpartum cardiomyopathy (0.4%). The maternal death rate (3.4%) remains high despite an urban and hospital setting. Multivariate analysis identified several independent factors associated with adverse outcomes:

- Age ≥ 40 years (OR = 2.31; 95% CI 1.12 - 4.76).
- Low education (OR = 2.10).
- Unemployment (OR = 1.94).
- History of medical conditions (OR = 2.08) and cesarean section (OR = 2.12).
- the occurrence of a pathology during pregnancy, particularly gestational hypertension (OR = 2.87). Conversely, regular calcium supplementation had a protective effect (OR = 0.42; p = 0.024).

These results confirm the complexity of the obstetric profile of older women and the multiplicity of determinants of maternal risk.

4.1. Comparison with the Literature

The observed complication rates are consistent with those reported in other African contexts. In Rwanda, Benimana *et al.* (2020) found severe maternal morbidity in 19.8% of women ≥ 35 years old, compared to 12.1% in younger women [11]. In Ethiopia, Abate *et al.* (2021) reported an increased risk of preeclampsia and postpartum hemorrhage beyond the age of 40 [12]. The association between advanced maternal age and adverse outcomes is explained by reduced cardiovascular and uterine adaptive capacity, the increased frequency of chronic pathologies, and decreased myometrial contractility. Several meta-analyses confirm a doubling of the risk of preeclampsia, hemorrhage, and cesarean section from the age of 40 [3] [15]. Medical history and previous cesarean section act through distinct mechanisms: the former reflects an underlying pathological condition, whereas the latter indicates prior obstetric morbidity and an increased likelihood of surgical complications in subsequent pregnancies.

A history of cesarean section also doubles the risk of maternal complications due to scar tissue and intraoperative complications (adhesions, uterine rupture, hemorrhage). Similar results were observed in Cameroon by Njamen *et al.* (2021) [16] and in the WHO multicenter study (Laopaiboon *et al.* 2014) [6]. Medical history (hypertension, HIV, diabetes) was associated with a two-fold increased risk in our study. This finding is consistent with that of Bukar *et al.* in Nigeria [17] and Ganchimeg *et al.* (2014) [10], showing that pre-existing comorbidities worsen obstetric prognosis in older women.

On the socioeconomic level, unemployed or low-educated women presented more complications, probably due to late access to care, lower adherence to prenatal care and a lack of health knowledge. These social determinants have also been identified in Ghana [18] and Senegal [19] as indirect factors of maternal

mortality. Finally, pregnancy-related pathology, particularly hypertension, emerged as the most powerful determinant in the model. This link is well documented in the literature: pregnancy-related hypertension is responsible for approximately 20% of maternal deaths in sub-Saharan Africa [20] [21].

4.2. Pathophysiological Interpretation and Local Context

These associations reflect the clinical reality of Douala maternity wards, where older women combine several vulnerabilities: medical history, previous cesarean sections, and sometimes incomplete prenatal monitoring. Decreased uterine compliance and metabolic reserves, endothelial damage, and an increased inflammatory response explain the frequency of hypertensive and hemorrhagic disorders in this age group [7]. The socioeconomic context also plays an aggravating role: some women delay their first ANC or discontinue supplementation due to lack of means, which increases avoidable morbidity. The protective effect of calcium observed here corroborates the WHO (2011) recommendations [22], which recommend daily supplementation of 1.5 - 2 g/day to reduce the risk of preeclampsia by 50% in populations with low dietary intake. In the Cameroonian context, this measure should be systematically integrated into antenatal care protocols, particularly for women over 35 years.

4.3. Strengths and Limitations of the Study

The main strength of this study lies in the combination of a rigorous analytical approach and a representative sample of older pregnant women. Logistic regression made it possible to identify independent determinants while controlling for confounding factors. Although prospective, the study may have been subject to information bias related to patient self-reporting of medical history. Some potentially important variables, such as BMI or reference time, were not available. Finally, the limited size of certain subgroups (≥45 years, grand multiparous women) reduces the statistical power of certain associations.

4.4. Practical Implications and Outlook

These results call for strengthening maternal risk stratification from the first ANC visit, by identifying women aged ≥40 years or with a history of medical or surgical complications. Routine calcium supplementation, blood pressure control, and prevention of hypertensive complications should be integrated into local protocols. In the medium term, the implementation of a predictive obstetric risk score in older women could help direct patients to the appropriate levels of care. Finally, prospective multicenter studies would validate these results and explore the interactions between social, biological, and obstetric factors in the occurrence of adverse outcomes.

5. Conclusion

Adverse maternal outcomes remain frequent among advanced-age pregnant

women. Prevention relies on rigorous antenatal monitoring, management of comorbidities, and systematic calcium supplementation.

Author Contributions

All authors contributed to the development of this work.

Conflicts of Interest

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

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