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Unattended Pregnancies in Ngaoundéré, Cameroon: Maternal and Neonatal Outcomes

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Abstract

Introduction: Unattended pregnancies are associated with significant maternal, perinatal morbidity and mortality. The prevalence remains high in Cameroon, particularly in the Adamawa region. The aim of this study was to study the factors associated with the occurrence of maternal and/or perinatal complications in unattended pregnancies in the city of Ngaoundéré. **Methods and Materials:** We conducted a case-control study, with prospective data collection of women admitted between January 1st and April 30th, 2025, into four hospitals. **Results:** A total of 363 deliveries were included, 121 cases matched to 242 controls. In univariate analysis, the clinical and biological factors associated with increased risk of complications were: maternal age < 20 years and ≥ 40 years; spinster status; being referred; grand multiparous women; absence of iron intake during pregnancy; maternal malaria and placental malaria. In multivariate analysis using logistic regression, factors associated with maternal complications were: age between 15 and 20 years; spinster status; absence of iron supplementation; and maternal and placental malaria. Concerning perinatal complications, the independent factors identified were: maternal HIV infection; low blood pressure on admission; maternal malaria and placental malaria. Maternal death rate was 1.65%, and perinatal mortality rate was 10.74%. **Conclusion:** Maternal and perinatal mortality rates were high in unattended pregnancies. Factors associated with the occurrence of adverse outcomes were age between 15 and 20 years, spinster status, absence of iron supplementation, grand multiparous women, and malaria.

Keywords

Unattended Pregnancies, Complications, Associated Factors, Ngaoundéré

1. Introduction

Each year, approximately 4.5 million women and newborns die during pregnancy, childbirth, or the first few weeks after birth, corresponding to one death every seven seconds [1]. The causes are largely detectable and treatable if antenatal care is provided [1]. Antenatal care is one of the main components of the fight against maternal and neonatal mortality [1]. It has been demonstrated that a lack of antenatal care leads to both maternal and fetal consequences. In developed countries, 1% to 3% of women give birth without having received antenatal care, compared to 37% in sub-Saharan Africa [2]. In Cameroon, 12.8% women give birth without antenatal care. The Adamawa region has the highest figures with 29.4% unattended pregnancies [3].

Thus, a previous study found that women with unattended pregnancies experienced more complications, such as eclampsia, postpartum hemorrhage, and uterine rupture, than attended pregnancies [4]. Factors associated with the occurrence of maternal and perinatal complications in pregnancies without prenatal care include: age over 35, high parity, early maternal age, low level of education, and marital status [2] [4]-[6].

We undertook this study to identify the factors associated with the occurrence of maternal and/or perinatal complications in pregnancies without antenatal care in the city of Ngaoundéré.

2. Materials and Methods

We conducted a prospective case-control study with data collection in four hospitals in the city of Ngaoundéré: the Ngaoundéré Regional Hospital, the Sabongari Health Center, the Boumdjeré Health Center, and the Lamidat Private Health Center. The period of study was between January 1st, 2025, and April 30th, 2025. The target population consisted of all pregnant women who gave birth in the aforementioned facilities during the study period beyond 28 weeks of gestation. Women referred after delivery in the health facilities were included, too. We excluded multiple gestations and major fetal malformations.

We defined the following:

- Unattended pregnancy: pregnancy during which no antenatal consultation was done.
- Cases: women with unattended pregnancy who experienced maternal and/or perinatal complications.
- Controls: women with unattended pregnancy who did not experience any maternal or perinatal complications.

We matched one case with two controls based on the healthcare facility. The matching approach was done based on the presumed term of delivery. The minimum sample size was calculated using Schesselman's formula at 85 participants. Sampling was consecutive. After drafting the research protocol and obtaining ethical clearance from the Ethics Committee of the Faculty of Medicine and Biomedical Sciences at the University of Yaoundé 1, we proceeded with data collection. Informed consent was signed by the women who gave birth and agreed to participate in our study. The data collected from the women were reported on pre-established and pre-tested forms. After delivery, we performed the following:

- Capillary hemoglobin assay: using a photometric method with a hemoglobinometer, a microdrop of capillary blood was collected by finger prick and then placed in a specific microcuvette. The device measured the hemoglobin concentration photometrically, with an instant display of the result in g/dL.
- Peripheral maternal venous blood sampling using a sterile syringe, immediately after delivery.
- Placental blood, cord blood, and placental tissue sampling: Placental blood was collected by direct puncture of the large vessels located on the fetal surface of the placenta within 30 minutes of delivery. Cord blood was collected by puncture of an umbilical vein at the level of the proximal cord segment. A fragment of the maternal surface of the placenta was removed using a sterile scalpel, then swabbed and stored in a container.
- Next, a parasitological examination was performed using thick blood film and thin blood film smears on the four slides (peripheral blood, placental blood, umbilical cord blood, and placental tissue). The thick blood film, which concentrates the blood cells, allowed malaria parasite detection. The thin blood film, spread in a thin layer and fixed with methanol, allowed identification of the parasite species. Every slide was stained with 10% Giemsa and examined under x100 microscope magnification.
- Anemia was referred to as a hemoglobin concentration lower than 10 g/dl.
- Maternal parasitemia was defined as the presence of the malaria parasite in the maternal peripheral sample. Placental parasitemia was defined as the presence of malaria parasites in placental or umbilical specimens.

Data were cross-checked, entered, recoded as needed, and analyzed using R Studio software version 2024.12.1-563. The search for associated factors was performed using univariate analysis followed by multivariate analysis using binary logistic regression. We used a 95% confidence interval for odds ratios. A p-value < 0.05 was considered statistically significant.

3. Results

We retained 121 cases and 242 controls.

Figure 1 illustrates the distribution of maternal complications observed in the case group. The main complications were: anemia with 106 cases (87.6%), emergency cesarean section with 41 (33.9%), high blood pressure during pregnancy with 24 (20%), and postpartum hemorrhage with 19 (15.7%).

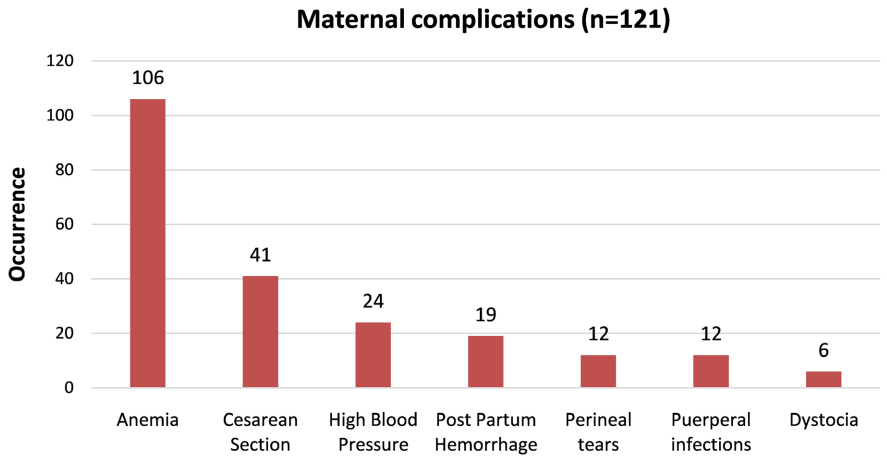

Figure 1. Occurrence of maternal complications in the case group.

As shown in **Figure 2**, the main perinatal complications reported in the case group were: neonatal sepsis in 23 (21.9%), neonatal asphyxia in 20 (19%), preterm birth in 17 (16.2%), small for gestational age in 14 (13.3%), and intra-uterine growth retardation in 13 (12.3%).

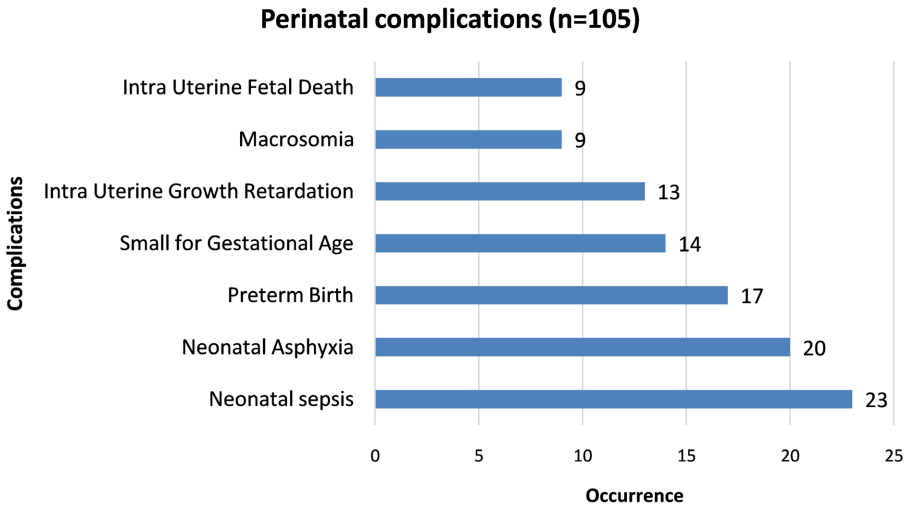

Figure 2. Occurrence of perinatal complications in the case group.

Regarding the sociodemographic factors reported in **Table 1**, the mean age was 28.1 years ± 7.9 years (range 16 - 44 years) and 28.4 years ± 7 years (range 15 - 44 years) in the cases and control groups, respectively. Women under 20 years (OR = 1.77; p = 0.03) and above 40 years (OR = 2.3; p = 0.03) had twice the risk of maternal and/or perinatal complications. Having no formal education increased the risk of complications by 1.42 (p = 0.03). Furthermore, we found no association between the woman's occupation and the occurrence of complications. Single women had three times the risk of maternal and/or perinatal complications (OR = 3.31; p = 0.01), while women in cohabiting relationships had a lower risk (OR = 0.3; p = 0.01).

Similarly, women whose husbands are students were more at risk of experiencing a complication (OR = 1.24; p = 0.01). On the other hand, those who had a trader as husband were not prone to complications (OR = 0.64; p = 0.02).

Table 1. Sociodemographic characteristics.

Variables	Cases (N = 121) n (%)	Controls (N = 242) n (%)	OR (IC 95%)	p-Value
Age				
[15 - 19]	22 (18.18)	27 (11.15)	1.77 [1.01 - 3.31]	**0.03**
[20 - 29]	38 (31.4)	99 (40.9)	0.66 [0.41 - 1.04]	0.07
[30 - 39]	48 (39.7)	104 (43)	0.8 [0.55 - 1.36]	0.5
≥40	13 (10.7)	12 (5)	2.30 [1.01 - 5.22]	**0.04**
Level of Education				
No Education	38 (31.4)	59 (24.38)	1.42 [0.87 - 2.30]	**0.05**
Primary	19 (15.7)	44 (18.18)	0.8 [0.46 - 1.51]	0.5
Secondary	44 (36.36)	89 (36.78)	0.98 [0.62 - 1.5]	0.9
Higher	20 (16.53)	50 (20.66)	0.76 [0.42 - 1.34]	0.3
Occupation				
Student	22 (18.18)	40 (16.53)	4.12 [0.56 - 29.94]	0.16
Household	56 (46.28)	112 (46.28)	1.31 [0.35 - 4.93]	0.68
Informal Sector	32 (26.44)	72 (29.75)	0.6 [0.14 - 2.99]	0.58
Private Sector	5 (4.13)	8 (3.31)	1.16 [0.32 - 3.94]	0.81
Civil Servant	6 (4.96)	10 (4.13)	0.9 [0.99 - 8.93]	0.95
Marital Status				
Single	33 (27.27)	58 (23.97)	3.31 [1.32 - 8.44]	**0.01**
Cohabitation	6 (4.95)	35 (14.46)	0.29 [0.11 - 0.68]	**0.01**
Married	82 (67.76)	149 (61.57)	0.97 [0.58 - 1.62]	0.9
Occupation of Husband				
Trader	45 (37)	70 (29)	0.64 [0.44 - 0.93]	**0.02**
Student	12 (9.9)	15 (6.2)	1.24 [1.08 - 2.90]	**0.01**
Informal Sector	49 (40)	144 (60)	0.53 [0.32 - 0.87]	**0.01**
Private Sector	7 (5.8)	6 (2.5)	1.81 [0.57 - 5.97]	0.31
Civil Servant	8 (6.6)	7 (2.9)	1.78 [0.60 - 5.40]	0.3
Residence				
Rural Area	38 (31)	79 (33)	1.00 (Ref)	-
Urban Area	83 (69)	163 (67)	0.5 [0.18 - 1.49]	0.22

Regarding obstetric characteristics, shown on Table 2, factors associated with increased risk of complications were: multiparity (OR = 1.98; p = 0.03), gestational age between 28 and 37 weeks (OR = 4.89; p = 0.02), gestational age between 37 and 40 weeks (OR = 1.68; p = 0.02) and being referred (OR = 4.99; p < 0.001). Neither the mode of admission nor the place of delivery was associated with the occurrence of complications.

Table 2. Obstetrical characteristics.

Variables	Cases (N = 121) n (%)	Controls (N = 242) n (%)	OR (IC 95%)	p-Value
Parity				
Nulliparous	30 (24.8)	50 (20.7)	3.3 [0.5 - 21.34]	0.19
Primiparous	44 (36.4)	87 (36)	1.19 [0.66 - 2.12]	0.5
Pauciparous	21 (17.4)	19 (7.9)	0.5 [0.25 - 1.17]	0.11
Multiparous	26 (21.5)	86 (35.5)	1.98 [1.06 - 3.73]	**0.03**
Gestationnel Age				
[28 - 37 weeks[	49 (40.49)	70 (28.92)	4.89 [1.24 - 19.26]	**0.02**
[37 - 40 weeks]	64 (52.89)	145 (59.91)	1.68 [1.07 - 2.63]	**0.02**
>40 weeks	8 (6.61)	27 (11.15)	0.69 [0.26 - 1.79]	0.4
Abortion/Miscarriage				
No	55 (45.5)	87 (36)	1.00 (Ref)	
Yes	66 (54.5)	155 (64)	0.67 [0.39 - 1.17]	0.16
Mode of Admission				
Referred	45 (37.19)	38 (15.70)	4.99 [2.4 - 10.34]	**<0.001**
Not Referred	76 (62.80)	204 (84.29)	0.59 [0.37 - 0.93]	0.02
Pregnancy				
Desired	65 (53.71)	122 (50.41)	1.14 [0.73 - 1.76]	0.5
Not Desired	56 (46.28)	120 (49.58)	0.87 [0.56 - 1.35]	0.5
Membranes on Admission				
Normal	68 (56.19)	100 (41.32)	0.62 [0.38 - 1.01]	0.05
Ruptured	53 (43.80)	142 (58.67)	0.83 [0.31 - 1.80]	0.04
Place of Delivery				
Home	26 (21.5)	38 (15.7)	1.46 [0.84 - 2.5]	0.17
Hospital	94 (77.7)	204 (84.3)	0.68 [0.39 - 1.18]	0.16

As shown in Table 3, medical factors associated with increased risk of complications included: high blood pressure (OR = 8.8; p = 0.01), HIV infection (OR = 2.31; p = 0.03), past history of cesarean section (OR = 2.18; p = 0.003), obesity (OR 2.94; p = 0.009) and absence of iron supplementation during the pregnancy (OR 0.45; p = 0.006).

Table 3. Past history records.

Variables	Cases (N = 121) n (%)	Controls (N = 242) n (%)	OR (IC 95%)	p-Value
High Blood Pressure				
No	115 (95.04)	240 (99.1)	0.16 [0.32 - 0.80]	**0.02**
Yes	6 (4.95)	2 (0.9)	8.8 [1.5 - 49.72]	**0.01**
HIV Status				
Negative	109 (90.08)	231 (95.45)	0.41 [0.18 - 1.01]	**0.05**
Positive	12 (9.9)	11 (4.5)	2.31 [1.02 - 6.97]	**0.03**
Cesarean Section				
No	86 (71.07)	204 (84.29)	1.07 [0.33 - 3.44]	0.9
Yes	35 (28.92)	38 (15.70)	2.18 [1.29 - 3.68]	**0.003**
Alcohol				
No	112 (36.5)	195 (63.5)	0.33 [0.15 - 0.70]	**0.04**
Yes	9 (316.1)	47 (83.9)	3.78 [1.6 - 8.6]	**0.002**
Tobacco				
No	117 (97%)	242 (100%)	-	**0.06**
Yes	4 (3.3%)	0 (0%)	-	**0.9**
Obesity				
No	114 (94.2%)	205 (84.7%)	0.34 [0.2 - 0.92]	0.06
Yes	7 (5.8%)	37 (15.3%)	2.94 [1.27 - 6.81]	**0.009**
Iron Supplementation				
No	20 (16.52)	73 (30.16)	2.28 [1.29 - 4.01]	**0.004**
Yes	101 (83.5)	169 (69.83)	0.45 [0.26 - 0.79]	0.006

Table 4. Factors associated with maternal complications on multivariate analysis.

Variables		Occurrence	Percentage (%)	OR [CI 95%]	p-Value
Age	[15 - 20 years]	22	18.18	3.34 [1.71 - 3.49]	0.01
Marital Status	Single	6	4.95	4.42 [1.15 - 16.94]	0.03
Obesity	Yes	7	5.8	0.16 [0.03 - 0.83]	0.029
Iron Supplementation	No	20	21.5	2.74 [1.25 - 3.7]	0.006
Maternal Parasitemia	Yes	53	17	3.35 [1.1 - 10.6]	0.03
Placental Parasitemia	Yes	14	11.6	13.6 [4 - 46.55]	0.001

On multivariate analysis, five independent factors were found to be associated with the occurrence of maternal complications. There were including age group [15 - 29 years] (OR = 3.3; p = 0.01); being single (OR = 4.4; p = 0.03); lack of iron

supplementation (OR = 2.7, p = 0.006); maternal parasitemia (OR = 3.35, p = 0.003) and placental parasitemia (OR = 13.6, p < 0.001) (Table 4).

Furthermore, we noted two maternal deaths, representing a frequency of 1.65%.

Regarding the factors associated with perinatal complications on multivariate analysis, as shown on Table 5, the following were identified: being multiparous (OR = 1.98; p = 0.03); HIV infection (OR = 3.64; p = 0.03); Low blood pressure on admission (OR = 4.22; p = 0.041); maternal parasitemia (OR = 3.88; p < 0.001) and placental parasitemia (OR = 34.21; p < 0.001).

We report 13 perinatal deaths, representing a frequency of 10.74%.

Table 5. Factors associated with perinatal complications on multivariate analysis.

Variables		Occurrence	Percentage (%)	OR [CI 95%]	p-Value
Parity	Primiparous	44	36.4	0.35 [0.13 - 0.94)	0.03
	Multiparous	26	21.5	1.98 [1.06 - 3.73]	0.03
Obesity	Yes	7	5.8	0.26 [0.07 - 1.03]	0.05
Desire	No	16	13.2	0.42 [0.23 - 0.79]	0.008
HIV Status	Positive	23	19.1	3.63 [1.13 - 11.6]	0.03
Low Blood Pressure on Admission		4	3.3	4.22 [1.06 - 16.76]	0.041
Maternal Parasitemia	Yes	56	46.2	3.88 [2.07 - 7.15]	0.001
Placental Parasitemia	Yes	56	46.2	34.21 [6.4 - 180.5]	0.001

4. Discussion

1) Sociodemographic Factors

In our study, the 15 - 20 age group was associated with the occurrence of maternal complications. One hypothesis is the physiological immaturity of the reproductive system. Indeed, Fouelifack *et al.* showed that adolescent girls have a high risk of soft tissue tears and prematurity [7]. The same observation was made by Mahavarkar *et al.* [8]. Furthermore, other authors have found that advanced age (>35 years) also increases the risk of maternal complications. Foumsou *et al.*, in their study, emphasized that above 35 years, in addition to cultural perceptions and reduced reliance on healthcare, women tend to underestimate the specific risks associated with each pregnancy and delivery [4]. In our sample, 33% of the women who gave birth were single, suggesting a context of poverty. This explains the lack of follow-up, implying the failure to detect risk factors for complications. This effect was documented by Cavazos-Rehg *et al.*, who noted that complications were more likely to be observed in pregnant women under 18 years and above 35 years [9].

We found no association between education level, occupation, and the occurrence of complications. This is inconsistent with data from the literature. However, we observed that nearly half of the women involved were unemployed and

had no formal education. These results are consistent with those reported by Leki *et al.*, who attributed the increased occurrence of complications in women with low levels of education to the second delay in the "three delays" model, often linked to a lack of information, financial resources, or the ability to make informed decisions [10]. However, according to Vidal *et al.*, women with a high level of education are more exposed to complications [11]. This was explained by professional stress, which can contribute to the development of complications such as gestational hypertension and pre-eclampsia. Another hypothesis is the false sense of security leading to non-compliance with preventive measures or delays in seeking care [12]. Thus, the absence association in our study could be explained by the simultaneous presence of these two contrasting profiles in our sample.

Single women had a higher risk of maternal complications compared to those living with a partner. This result was also found by Prakesh *et al.* [13].

No association between residence and the occurrence of complications was established in our study, contradicting data from the literature, which present rural areas as a risk factor for complications. Indeed, in our sample, one-third of the participants lived in rural areas, which may have mitigated the role of rurality.

2) Obstetric and Clinical Factors

We observed that primiparity reduced the risk of complications, as did multiparity. This result, although statistically significant, contradicts several publications that have found extreme parities, particularly primiparous and grand multiparous women, to be at risk of complications. Furthermore, Traoré *et al.* found that grand multiparous women had an increased risk of complications, including postpartum hemorrhage, cesarean section, and neonatal macrosomia [14]. These results were explained by uterine fatigue related to multiple pregnancies, short interpregnancy interval, and low levels of education [14]. This trend is also reported by Foumsou *et al.*, who observed that high parity accounted for 33% of unattended pregnancies [4]. However, our results could be explained by cultural specificities inherent to our area. Indeed, Pierre Fournier, in his analysis, emphasizes that in contexts with strong traditional and cultural influences, the presence of traditional birth attendants constitutes indirect protection against complications [15].

The benefit of antenatal care is to improve maternal and fetal outcomes, thereby reducing maternal and fetal morbidity and mortality. The number of antenatal care visits is linked with the onset of complications. Obossou *et al.* found that having carried out between five and seven antenatal consultations was associated with better maternal and fetal outcomes [16].

In our series, the absence of iron supplementation was associated with the occurrence of maternal complications. Peña-Rosas *et al.*, as well as Balarajan *et al.*, demonstrated that iron supplementation reduces the risk of severe anemia and its consequences, particularly postpartum hemorrhage [17] [18].

Malaria was found to be associated with maternal and perinatal complications. Several studies have described the deleterious effects of placental malaria on trans-

placental exchange and villous inflammation, leading to anemia, neonatal infections, and premature births [19] [20]. Pregnancy-associated malaria includes malaria in pregnancy, placental malaria, and congenital malaria [21]. Pregnancy-associated malaria, due to placental hypoxia, may lead to several maternal, fetal, newborn, and child health outcomes [21] [22]. In our study, we had to study both maternal parasitemia and placental parasitemia; no correlation was checked between these two variables.

3) Maternal and Perinatal Outcomes

In our study, we found a maternal mortality rate of 1.65%; the main etiology was postpartum hemorrhage. This rate is approximately 13 times lower than that reported by Ngo Dingom *et al.* in Cameroon, where postpartum hemorrhage accounted for 21.13% of maternal deaths [23]. Regarding perinatal complications, we found 10.8% perinatal mortality rate. This rate is comparable to that found in Cameroon by Ngono Akam *et al.*, who reported a perinatal mortality rate of 8.2% [24]. Poor monitoring can lead to the failure to detect certain pregnancy problems, inadequate preparation for childbirth, or delays in the management of a distressed fetus. These factors highlight the importance of good monitoring and confirm the relevance of the three-delay model of Thaddeus and Maine [25] for explaining both maternal and neonatal mortality.

5. Conclusion

Maternal and perinatal mortality rates were high among unattended pregnancies. Factors significantly associated with the occurrence of complications included: young age (between 15 and 20 years), single marital status, multiparity, lack of iron supplementation, and maternal or placental malaria parasitemia. Specific counseling and behavioral change should be addressed to this group of pregnant women.

Authors' Contributions

Inna Gambo Haoua wrote the first draft. Nyada Serge Robert, Ngando Laure, Ebong Ebontane Cliford, Nsahlaï Christiane, Tompeen Isidore, Batoum Mboua Véronique, and Mpono Emenguele Pascale were co-investigators. Mve Koh Valère was the supervisor of the study. All authors reviewed the final manuscript.

Conflicts of Interest

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

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