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Prenatal care and pregnancy outcomes: A cross-sectional study in Luanda, Angola

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ABSTRACT

Objective: To describe prenatal care in Angolan women delivered at a large tertiary care unit, and to explore the association between prenatal care and selected perinatal outcomes. *Methods:* We conducted a cross-sectional study between December 2012 and February 2013, involving 995 women aged 13–46 years, delivered at Lucrécia Paím Maternity, Luanda. Trained interviewers collected information on timing, frequency, place, and satisfaction with prenatal care; sociodemographic and clinical characteristics; birth weight; and gestational age. Logistic regression models were fitted, and odds ratios with 95% confidence intervals (OR, 95%CI) estimated. *Results:* Quantitatively inadequate prenatal care (<4 visits) was more common in younger, less educated, poorer women, followed in public institutions, and those who felt more dissatisfied with care. More visits, both in primiparas and multiparas, were independently associated with more cesarean deliveries. After adjustment, having fewer than four visits was significantly associated with low birth weight (OR 2.00; 95% CI, 1.15–3.50) and preterm delivery (OR 2.74; 95% CI, 1.69–4.44 for 2–4 visits); similar associations were found regarding late entrance into care. *Conclusion:* Early entrance into prenatal care and the recommended number of visits are major determinants of mode of delivery and pregnancy outcomes, constituting targets to improve perinatal health.
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1. Introduction

Maternal and infant mortality are subtle general indicators of social and economic development. More broadly they reflect how women and children are valued and human rights respected at a country level. Although evident improvements occurred during the last decade, as a response to the Millennium Development Goals (MDGs), maternal and infant health are major challenges in African countries [1–4]. Globally, the maternal mortality ratio fell by nearly 44% over the past 25 years, to an estimated 216 maternal deaths per 100 000 live births in 2015, from 385 in 1990. The annual number of maternal deaths decreased by 43% from approximately 532 000 in 1990 to an estimated 303 000 in 2015. The approximate global lifetime risk of a maternal death fell considerably from 1 in 73 to 1 in 180. Low-resource regions accounted for approximately 99% of maternal deaths in 2015, with Sub-Saharan Africa alone accounting for roughly 66% [5]. The risk of a child dying before completing five years of age is still highest in the WHO African Region (81 per 1000 live births), and many countries in the Region still have rates above 100 deaths per 1000 live births. It is essential to end preventable child deaths and there is a critical role to expect from the continuity of care that prenatal visits and delivery in health institutions should promote [6].

The assessment of prenatal care uptake and quality are essential steps toward improving accessibility and birth outcomes [7,8]. The proportion of pregnant women initiating prenatal care during the first trimester of pregnancy is one of the standard clinical performance measures to assess the quality of maternal health care. One expects prenatal care to constitute an important moment of contact between the health workers and the women, ideally also the partners, and an opportunity for health education, including knowledge on how to prevent and detect pregnancy complications, and the development of a birth plan toward a safe delivery [9,10].

WHO recommends a minimum of four prenatal care visits [11,12] but in Angola only 47% of pregnant women reach that number, with a large variability between provinces [13,14]. A set of routine activities were adopted by the Ministry of Health of Angola to improve prenatal care uptake and content, including confirmation and monitoring of the progress of pregnancy, assessment of maternal and fetal well-being, detection of problems complicating pregnancy, tetanus immunization, anemia prevention, antimalarial intermittent preventive treatment, HIV counseling and testing, counseling on self-care at home, nutrition, and breastfeeding [13].

Prenatal care can be expected to influence the pregnancy outcome by changing attitudes toward mode of delivery or prevention of other

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birth-related complications. However, strong evidence is still lacking to guide the content and timing of prenatal care programs although there is a tendency to favor a model with reduced number of visits even if associated with some dissatisfaction by mothers [15].

In Angola maternal morbidity remains very high, demanding urgent improvement in the access and the performance of prenatal care [16]. WHO estimated for Angola in 2015 a maternal mortality ratio of 477, corresponding to 5400 maternal deaths, a 1 in 32 lifetime risk of maternal death, and 18.3% of deaths among women of reproductive age due to maternal causes [5]. Preterm birth and low birth weight are frequent outcomes in low-income countries and major determinants of early infant deaths. Although it is well recognized that prenatal care can influence such adverse pregnancy outcomes, it is important to understand how it is working in each particular context and the strength of the association or the effect, namely in relation to postnatal care [17,18].

The aim of the present study is to describe prenatal care in Angolan women delivered at a large tertiary care unit, and to explore the association between prenatal care and selected perinatal outcomes.

2. Materials and methods

A cross-sectional study was conducted in the largest public maternity of Angola, in Luanda. It is a national reference center for maternal health care, training of health professionals, and research. As a tertiary healthcare facility, the maternity receives the most complicated cases referred from facilities in lower levels of care. It performs cesarean and vaginal deliveries, provides intensive care to women and newborns, has specialized areas for eventful pregnancies and immediate puerperal complications, and has on-site laboratory support.

Recruitment of participants occurred from December 5, 2012, to February 22, 2013. During this period, 5442 deliveries were recorded, corresponding to 1686 cesarean deliveries and 3534 vaginal births. Women were invited to participate in the study after delivery and were interviewed during their hospital stay. Women who have had a vaginal delivery are usually discharged after 6 hours while women stay from 3–7 days after cesarean. Invitations occurred during daytime hours (from 8AM. to 5PM). To maximize the chances of recruitment and according to the resources available, women were visited on specific days of the week: Mondays, Wednesdays, and Fridays for vaginal deliveries, and Tuesdays and Thursdays for cesareans. Women were given insecticide impregnated bed nets after completing the questionnaire.

Women presenting severe conditions complicating delivery (such as eclampsia, complicated malaria, or postpartum hemorrhage), foreign nationality, residency in the Province of Luanda for less than 6 months, and twin pregnancy were not considered eligible to participate. The data were collected by face-to-face interviews using a structured questionnaire administered by six trained interviewers (three males and three females).

The questionnaire comprised 77 questions assessing demographic and socioeconomic characteristics, pathological and gynecological history, and history of present pregnancy, prenatal care, nutrition, and smoking and alcohol consumption. Information related to hospital admission, delivery, and the newborn was obtained from the clinical charts.

To measure the prevalence of inadequate prenatal care (defined as fewer than four visits) a sample size of 344 was estimated considering a 95% confidence level, a prevalence of inadequacy of 40%, and a 5% margin of error. However, a sample size of approximately 1000 was approached, using the same parameters and a power of 80%, to guarantee the required statistical power to assess the risk of adverse pregnancy outcomes, analyzing this cross-sectional survey as a case–control study. During the recruitment period, 1040 women were invited to participate. Of these, 40 refused, 5 had missing key information in their clinical files, leaving 995 participants for analysis. However, 11 women living with HIV infection were additionally excluded because of the particular relation between infection, prenatal care, and birth outcomes.

To characterize prenatal care we used four variables: the timing of the first prenatal care visit, the number of prenatal care visits, type of prenatal care provider (public hospital or healthcare center and private provider), and satisfaction with prenatal care (using a five-point scale, from 1 as very unsatisfied to 5 as very satisfied). The timing of the first visit was categorized as occurring in the first, second, or third trimester of pregnancy, and the frequency of prenatal care visits into fewer than four and four or more visits. Demographic and social characteristics considered in the present analysis included maternal age (categorized as ≤19, 20–24, 25–29, 30–34, and ≥35 years old), educational level (≤4, 5–8, 9–12, and >12 completed years of schooling), marital status (married or in cohabitation, single), place of residence (urban if living in Luanda, periurban if in other municipalities in the Province of Luanda), monthly family income (<100, 100–300, >300 US $, do not know/do not say). Pregnancy-related variables were: age at first sexual intercourse (<15, ≥15 years); number of previous pregnancies (0, 1, 2–4, ≥5); self-reported previous cesarean (no, yes); complications during previous pregnancy (categorized as no or yes if the woman had been diagnosed with any of the following: diabetes; hypertensive disorders, or urinary infection); maternal prepregnancy weight (≤50 kg, 51–60 kg, >60 kg); self-reported high risk pregnancy (no, yes); index pregnancy complications (no, yes); diagnosis of malaria in the index pregnancy (no, yes); and hospitalization during pregnancy (no, yes). Pregnancy-related outcomes considered were: cesarean delivery (no, yes); gestational age at birth (<37 weeks, ≥37 weeks, measured according to the date of the last menstrual period); fetal status (live birth, stillbirth); and birth weight (<2500 g, ≥2500 g).

The χ^2 test was used to compare the trimester of the first prenatal care visit and the number of prenatal care visits according to demographic, socioeconomic, lifestyle, reproductive health-related characteristics, pregnancy complications, and outcome variables: cesarean delivery; gestational age (<37 weeks, ≥37 weeks); fetal status (live birth, stillbirth); birth weight (<2500 g, ≥2500 g).

Logistic regression models were fitted to estimate the association of birth weight, gestational age at birth, or fetal status, as dependent variables, with timing of the first prenatal care visit and the number of prenatal care visits, adjusting for the potential confounders such as maternal age, previous pregnancy, maternal prepregnancy weight, and type of prenatal care provider, or to assess the association of care with cesarean delivery. Analysis of data was performed using SPSS version 21 (IMB, Armonk, NY, USA).

The project was approved by the Ethics Committee of the Faculty of Medicine of Agostinho Neto University, and written informed consent was obtained from all participants

3. Results

Table 1 presents the timing of the first prenatal care visit and the number of visits according to sociodemographic and pregnancy-related characteristics. Compared with pregnant women who had their first visit in the first trimester, those who started prenatal care in the second or third trimester, more often had fewer than two visits (31.4% vs 7.1% and 2.3%, respectively), were significantly less educated, and more frequently primiparous (33.3% vs 23.0%). Pregnant women who began prenatal care in the third trimester were more dissatisfied (8.6% vs 4.1%) compared with those who initiated care during the first trimester.

As also shown in Table 1, pregnant women who had fewer than the recommended four prenatal care visits were younger (24.2% vs 15.3% younger than 20 years of age), were less educated (21.7% vs 10.6% with less than 5 years of schooling), and reported more often living with less than US $100 per month (11.0% vs 5.5%). Pregnant women followed in private clinics reported more often the recommended number of prenatal care visits (14.6% vs 5.0%). Women with fewer than four prenatal care visits were proportionally more dissatisfied (8.9% vs 4.3%).

Table 1
Characteristics of participants according to trimester of first prenatal care visit and number of visits during pregnancy.

	First prenatal visit			Frequency of prenatal care visits		
	1st trimester	2nd/3rd trimester		<4	4 or more	
	n = 498 No. (%)	n = 453 No. (%)	*P* value[a]	n = 344 No. (%)	n = 589 No. (%)	*P* value[a]
Maternal age, y						
≤19	94 (51.9)	87 (48.1)	0.047	83 (48.0)	90 (52.0)	0.017
20–24	136 (59.9)	91 (40.1)		75 (33.5)	149 (66.5)	
25–29	126 (53.5)	107 (46.5)		80 (35.6)	145 (64.4)	
30–34	88 (46.3)	102 (53.7)		62 (32.5)	129 (67.5)	
≥35	57 (46.7)	65 (53.3)		43 (36.1)	76 (63.9)	
Maternal education, y						
≤4	59 (40.7)	86 (59.3)	<0.001	74 (54.4)	62 (45.6)	<0.001
5–8	150 (44.1)	190 (55.9)		155 (46.7)	177 (53.3)	
9–12	218 (59.9)	146 (40.1)		97 (27.0)	262 (73.0)	
>12	69 (71.9)	27 (28.1)		15 (15.0)	85 (85.0)	
Marital status						
Married/cohabitation	378 (51.7)	353 (48.3)	0.508	251 (35.2)	463 (64.8)	0.060
Single	120 (54.5)	100 (45.5)		93 (42.5)	126 (57.5)	
Place of residence						
Urban	258 (53.2)	227 (46.8)	0.678	181 (37.4)	303 (62.6)	0.883
Periurban	237 (51.6)	222 (48.4)		163 (36.7)	281 (63.3)	
Monthly family income, US $						
<100	40 (50.6)	39 (49.4)	0.644	37 (53.6)	32 (46.4)	<0.001
100–300	128 (52.9)	114 (47.1)		87 (37.2)	147 (62.8)	
>300	152 (55.1)	124 (44.9)		70 (24.9)	211 (75.1)	
Do not know/do not say	164 (50.0)	164 (50.0)		141 (43.3)	185 (56.7)	
Age at first sexual intercourse, y						
<15	49 (52.1)	45 (47.9)	0.993	42 (45.2)	51 (54.8)	0.067
≥15	419(52.8)	375 (47.2)		272 (34.9)	507 (65.1)	
Number of previous pregnancies						
0	166 (61.5)	104 (38.5)	<0.001	93 (35.0)	173 (65.0)	0.018
1	109 (58.6)	77 (41.4)		53 (29.1)	129 (70.9)	
2–4	170 (47.4)	189 (52.6)		137 (39.0)	214 (61.0)	
≥5	53 (39.0)	83 (61.0)		61 (45.5)	73 (54.5)	
Previous cesarean[b]						
No	243 (48.4)	259 (51.6)	0.830	182 (37.4)	304 (62.6)	0.944
Yes	89 (49.7)	90 (50.3)		69 (38.1)	112 (61.9)	
Complications during previous pregnancy[b,c]						
No	231 (48.3)	247 (51.7)	0.797	186 (39.1)	290 (60.9)	0.260
Yes	101 (49.8)	102 (50.2)		65 (34.0)	126 (66.0)	
Maternal prepregnancy weight, kg						
≤50	115 (56.1)	90 (43.9)	0.200	72 (35.8)	129 (64.2)	0.278
51–60	116 (57.4)	86 (42.6)		70 (34.3)	134 (65.7)	
>60	120 (49.6)	122 (50.4)		71 (29.1)	173 (70.9)	
High risk pregnancy						
No	395 (53.2)	347 (46.8)	0.351	274 (37.8)	451 (62.2)	0.313
Yes	103 (49.3)	106 (50.7)		70 (33.7)	138 (66.3)	
Complications during index pregnancy						
No	125 (48.8)	131 (51.2)	0.210	100 (39.8)	151 (60.2)	0.287
Yes	373 (53.7)	322 (46.3)		244 (35.8)	438 (64.2)	
Malaria diagnosis (index pregnancy)						
No	397 (50.8)	385 (49.2)	0.042	285 (37.3)	479 (62.7)	0.620
Yes	101 (59.8)	68 (40.2)		59 (34.9)	110 (65.1)	
Hospitalization during pregnancy						
No	463 (52.4)	420 (47.6)	0.978	320 (37.0)	544 (63.0)	0.807
Yes	35 (51.5)	33 (48.5)		24 (34.8)	45 (65.2)	
Type of prenatal care provider						
Public hospital	104 (54.7)	86 (45.3)	0.106	66 (37.1)	112 (62.9)	<0.001
Primary health center	328 (50.5)	321 (49.5)		259 (40.2)	385 (59.8)	
Private	63 (61.2)	40 (38.8)		17 (16.7)	85 (83.3)	
Satisfaction with prenatal care						
1 (very unsatisfied)	5 (41.7)	7 (58.3)	0.131	8 (80.0)	2 (20.0)	0.002
2	15 (34.1)	29 (65.9)		22 (48.9)	23 (51.1)	
3	48 (56.5)	37 (43.5)		31 (38.3)	50 (61.7)	
4	203 (52.1)	187 (47.9)		149 (39.6)	227 (60.4)	
5 (very satisfied)	214 (53.2)	188 (46.8)		128 (31.8)	274 (68.2)	
Cesarean delivery						
No	280 (52.3)	255 (47.7)	0.984	216 (40.2)	321 (59.8)	0.016
Yes	218 (52.4)	198 (47.6)		128 (32.3)	268 (67.7)	
Gestational age at birth, wk[d]						
<37	71 (48.0)	77 (52.0)	0.043	69 (49.3)	71 (50.7)	<0.001
≥37	267 (57.9)	194 (42.1)		121 (26.0)	344 (74.0)	
Fetal status						
Live birth	456 (52.5)	412 (47.5)	0.825	310 (36.3)	544 (63.7)	0.287
Stillbirth	42 (50.6)	41 (49.4)		34 (43.0)	45 (57.0)	
Birth weight, g[d]						

Table 1 (*continued*)

	First prenatal visit			Frequency of prenatal care visits		
	1st trimester	2nd/3rd trimester		<4	4 or more	
	n = 498 No. (%)	n = 453 No. (%)	*P* value[a]	n = 344 No. (%)	n = 589 No. (%)	*P* value[a]
<2500	50 (48.1)	54 (51.9)	0.438	53 (54.1)	45 (45.9)	<0.001
≥2500	393 (52.7)	353 (47.3)		251 (34.0)	487 (66.0)	

[a] χ^2 test.
[b] Only including multiparous women.
[c] Diseases during last pregnancy included: diabetes, hypertension, urinary infection, hemorrhage, and others.
[d] Only live births considered

There were no significant differences in the frequency of stillbirths according to number of visits but compared with those having 4four or more prenatal care visits women with fewer than four delivered significantly more often a low birth weight child (17.4% vs 8.5% with <2500 g) or a preterm birth (36.3% vs 17.1% with gestational age <37 weeks). In addition, the frequency of cesarean delivery was significantly higher among women with more than four visits (45.5% vs 37.2%). As presented in Table 2, the association with number of visits remained significant both in primiparas and multiparas after adjusting for other factors significantly associated with a cesarean delivery, such as education, place of residence, income, or having had a previous cesarean.

Table 2
Participants characteristics, prenatal care use, and mode of delivery.

	Mode of delivery (vaginal vs cesarean)			
	Primiparous OR (95% CI)	Adjusted[b] OR (95% CI)	Multiparous OR (95% CI)	Adjusted[b] OR (95% CI)
Maternal age, y				
≤19	1[a]	1	1	1
20–24	1.48 (0.87–2.51)	1.88 (0.96–3.69)	0.96 (0.47–1.94)	0.99 (0.48–2.07)
25–29	1.14 (0.52–2.50)	1.35 (0.55–3.33)	0.99 (0.50–1.97)	1.00 (0.49–2.05)
≥30	2.21 (0.67–7.30)	3.43 (0.88–13.29)	1.17 (0.60–2.28)	1.05 (0.52–2.11)
Maternal education, y				
≤4	1	1	1	1
5–8	0.40 (0.15–1.10)	0.47 (0.17–1.32)	0.49 (0.32–0.75)	0.51 (0.33–0.79)
9–12	0.43 (0.16–1.15)	0.58 (0.21–1.62)	0.31 (0.20–0.49)	0.35 (0.22–0.55)
>12	0.42 (0.13–1.36)	0.58 (0.17–1.95)	0.41 (0.23–0.74)	0.45 (0.24–0.82)
Marital status				
Married/cohabitation	1.57 (0.97–2.53)	1.59 (0.97–2.62)	1.38 (0.81–2.34)	1.07 (0.61–1.86)
Single	1	1	1	1
Place of residence				
Urban	1	1	1	1
Periurban	2.04 (1.26–3.30)	1.99 (1.21–3.28)	2.07 (1.53–2.80)	1.80 (1.32–2.46)
Monthly family income, US $				
<100	2.26 (0.73–6.94)	2.56 (0.80–8.15)	2.31 (1.33–4.02)	1.75 (0.96–3.16)
100–300	1.97 (0.90–4.33)	1.80 (0.78–4.13)	1.44 (0.98–2.11)	1.23 (0.82–1.85)
>300	1	1	1	1
Do not know/do not say	0.99 (0.51–1.92)	0.91 (0.45–1.83)	1.02 (0.69–1.50)	0.87 (0.58–1.31)
Complications during index pregnancy[c]				
No	1	1	1	1
Yes	0.98 (0.59, 1.63)	0.98 (0.58, 1.65)	1.25 (0.88, 1.76)	1.33 (0.93, 1.91)
Complications during the previous pregnancy[c]				
No			1	1
Yes			1.55 (1.13–215)	1.45 (1.03–2.03)
Previous cesarean				
No			1	1
Yes			6.07 (4.18–8.80)	6.57 (4.40–9.73)
Satisfaction with prenatal care				
1–2 (unsatisfied)	1	1	1	1
3–5 (satisfied)	1.21 (0.60–2.43)	1.25 (0.61–2.57)	1.06 (0.70–1.60)	1.03 (0.67–1.59)
Type of prenatal care provider				
Public hospital	1	1	1	1
Primary health center	0.88 (0.49–1.59)	0.91 (0.49–1.69)	0.93 (0.64–1.36)	0.87 (0.58–1.29)
Private	0.89 (0.37–2.15)	1.03 (0.40–2.63)	0.92 (0.52–1.62)	1.16 (0.63–2.13)
Frequency of prenatal care visits				
<4	0.49 (0.29–0.83)	0.45 (0.25–0.79)	0.81 (0.59–1.11)	0.68 (0.48–0.97)
≥4	1	1	1	1
First prenatal visit				
1st trimester	1	1	1	1
2nd/3rd trimester	1.02 (0.62–1.67)	1.00 (0.59–1.69)	0.98 (0.73–1.33)	0.90 (0.65–1.24)

[a] 1 = Reference class.
[b] Adjusted for maternal education, place of residence, and complications during index pregnancy.
[c] Diseases during pregnancy included: diabetes, hypertension, urinary infection, hemorrhage.

Table 3 presents the results of the logistic regression models fitted for fetal status, birth weight, and gestational age at birth. After adjusting for potential relevant confounders, lower number of prenatal care visits was significantly associated with low birth weight (OR 2.00; 95% CI, 1.15–3.50) and preterm delivery (OR 2.74; 95% CI, 1.69–4.44 for 2–4 visits). Also, compared with women entering earlier (first trimester) those that had the first visit later had a lower risk of low birth weight (OR 1.62; 95% CI, 0.94–2.81) and preterm delivery (OR 1.58; 95% CI, 1.01–2.48). No significant effect of prenatal care timing and quantity was found regarding the delivery of a stillbirth.

4. Discussion

This study used a sample of Angolan women delivered at the largest public maternity in Luanda, Angola, to describe prenatal care uptake and to evaluate its relation to commonly monitored pregnancy outcomes. It presents a description of the timing, the frequency, and the satisfaction with available prenatal care among women delivered in the largest maternity of Luanda. In this setting, we also assessed the association between prenatal care and mode of delivery and adverse perinatal outcomes, namely low birth weight and gestational age at birth. Overall, the study showed that only half of women entered care during the first trimester of pregnancy, 37% had fewer than four visits, but most women declared to feel satisfied with the provided care. Furthermore, in these Angolan women, insufficient prenatal care was associated with low birth weight and preterm delivery, independently of several potential confounders. The quantity of prenatal care significantly influenced the prevalence of cesarean delivery, which was high in the institution (31%) and in the study sample when compared with the overall experience in Africa, where it increased from 2.4% in 1990 to 7.4% in 2014. No national data were available for Angola [19].

The proportion of women reporting a first visit only during the third trimester of pregnancy was 4%, but only 6% reported one visit during pregnancy. These figures emphasize that women delivered in urban centers at large hospitals represent a special population group with a higher access to health care.

This study is unique in Angola representing a large effort to gather much needed information on prenatal care when considering the country and the information available for the Sub-Saharan African region. The project placed a central importance in training and administering face-to-face interviews and carefully consulting the clinical charts of these pregnant women. The expectation was to provide evidence based on reliable data describing the population of a geographical area where information is not easily available, but where perinatal investigation is more urgent than in any other places in the world. However, we were unable to overcome different challenges regarding data quality. As the tables reflect, missing data was a reality and the quality of data for some individuals (e.g. impossible gestational ages, weights, number of visits) was unacceptable, increasing the missing data. An interesting example, relating to birth weight and the decisions regarding nutritional advice during visits, is maternal weight. In our study this variable presented much missing data, which could be affecting our estimates and could not be adequately handled in the data analysis: when comparing women for whom information was available with those for whom it was not, they tended to be older, more educated, and more often used prenatal care (data available on request).

This needs to be considered as a weakness when evaluating our findings. In addition, thinking about external validity, we need to acknowledge an obvious selection bias since the hospital maternity is not the typical place to deliver in Angola. Most women give birth at home with the help of traditional birth attendants or experienced women in the community. Thus, our sample does not represent the experience of Angolan women in general, but only those who have a hospital birth. This also means that a large proportion of women, particularly those in a socioeconomically disadvantaged situation, are underrepresented. Still, the present findings help to assess perinatal health in the country.

Being young and presenting a typically disadvantaged socioeconomic profile (less educated women, with low income) was associated with less frequent (<4 visits) and late prenatal care uptake (second and third trimester of pregnancy). Several maternal sociodemographic factors are known to influence the timing of starting prenatal care [20]. In Nepal, a study revealed that the majority of pregnant women do not visit any prenatal care facility during the first trimester of their pregnancies [21] and similar to our findings, the start of prenatal care was associated with the mother's education and parity. The association between late uptake of prenatal care with a lower level of education was also found in Brazil [22].

Also in line with our results, previous studies show that the number of prenatal care visits is influenced by education and income. A Nepalese study showed that pregnant women with a higher educational level and higher income were, respectively, seven times and three times more likely to have four or more prenatal care visits when compared with those without education and with the lowest income [23].

Our results add to the body of literature urging women's empowerment in Africa. Women must know and be able to make the best decisions about their health and their babies' health [24].

In a study conducted in Tanzania, 71% of pregnant women started their first prenatal care at five months of pregnancy and the reasons behind the late onset were a late diagnosis of pregnancy, lack of partner support, and economic and cultural barriers [25]. Although we did not explore specific cultural barriers, we believe similar factors were operating and help to explain unmeasured variation, taking into account the shared regional context. In our study, a late start of the first prenatal care visit (second and third trimesters) was associated with having previous pregnancies. Many studies report that a previous experience of uncomplicated pregnancy leads women to postpone prenatal care initiation in subsequent pregnancies as they perceive that there is no reason for early prenatal care [23]; however, low satisfaction with previous care is an alternative explanation. In our study the proportion of unsatisfied women was relatively low. It may represent a response influenced by social desirability, but we also excluded the small percentage of women with serious complications and fetal deaths, which can explain the high proportion of satisfaction with care. Nonetheless, it seems clear

Table 3
Association of prenatal care characteristics and pregnancy outcomes.

	Low birth weight OR (95% CI)		Preterm newborn OR (95% CI)		Stillbirth OR (95% CI)	
	Crude	Adjusted[b]	Crude	Adjusted[b]	Crude	Adjusted[b]
First prenatal visit						
1st trimester	1[a]	1	1	1	1	1
2nd/3rd trimester	1.20 (0.80–1.81)	1.62 (0.94–2.81)	1.49 (1.03–2.16)	1.58 (1.01–2.48)	1.08 (0.69–1.69)	0.68 (0.36–1.28)
Frequency of prenatal care visits						
<4	2.28 (1.49–3.50)	2.00 (1.15–3.50)	2.76 (1.87–4.08)	2.74 (1.69–4.44)	1.33 (0.83–2.11)	1.16 (0.61–2.20)
≥4	1	1	1	1	1	1

[a] 1 = Reference class.
[b] Adjusted for maternal age, previous pregnancies, maternal prepregnancy weight, and place of prenatal visits using logistic regression. Missing data considered as a category stratum.

that previous experience is not promoting a more rapid contact with health services in this relatively wealthy sample of women.

Malaria and anemia are among the leading causes of illness in Angolan pregnant women. Although specified in prenatal protocols, supplementation with folic acid or iron with antimalarial chemoprophylaxis is not always included and the detection and tracking of hypertensive disorders and sexually transmitted infections are unavailable. We found a higher frequency of malaria diagnosis in women with early entrance into prenatal care (20% vs 15%), but no association with quantity of care. Also, these indicators had no significant association with hospital admissions during the index pregnancy. These can be considered indirect evidence for necessary improvements in quality of care. We would expect that a previously complicated pregnancy would result in earlier entrance and more frequent care, and consequently more adverse events diagnosed during the index pregnancy, as a cause and a consequence of planned closer vigilance.

Women with the recommended number of visits presented a significantly higher prevalence of cesarean deliveries. Although not enough information was available regarding the possibility of classifying the cases according to the 10-Group Classification System for cesarean delivery [26], the frequency was more than double the 15% usually presented as desirable, and revealed a rate of surgical deliveries too high for the frequency of recorded complications, which needs to be addressed by health policy decision makers. Adopting the 10-Group Classification System—as proposed in April 2015 by WHO for assessing, monitoring, and comparing cesarean delivery rates within and between healthcare facilities—seems a suitable next step.

Low birth weight remains the main cause of mortality and morbidity in infants, and a special problem in the care of pregnant women in low-resource countries. Low birth weight and premature delivery have also been previously associated with less frequent prenatal care in low-resource countries and in Africa [17,18,24]. In our study, this association was independent of several confounders (maternal age, maternal education, family income, place of prenatal care), strengthening the need for actions that specifically improve the uptake of prenatal care according to recommendations [27].

Unfortunately it was not possible to estimate an indicator of adequacy of care taking into consideration the number of visits, the time of first visit, and the duration of pregnancy, once the quality of information on gestational age precluded it. The benefits of early initiation of prenatal care for both mother and baby are well known [21,23]. WHO recommends starting prenatal care up to the fourth month of pregnancy [11]. In Angola, despite governmental efforts to improve prenatal care, maternal and perinatal mortality are still a major concern. This study also showed that women with four or more consultations shared with women reporting less frequent care a large number of similar exposures, which emphasizes the need for additional qualitative and quantitative research.

In conclusion, this study provides contextualized evidence on Angolan pregnant women regarding the factors associated with the use of prenatal care and how it influences the mode of delivery and fetal characteristics at birth. We believe it constitutes relevant information for health professionals and public health planners both at a national and a regional level.

Contributions

TN participated in the study design and supervision of data collection, drafted the manuscript, and participated in analysis and interpretation of data. SF and DC participated in analysis and interpretation of data, and reviewed the manuscript for important intellectual content. PC participated in the study design and reviewed the manuscript for important intellectual content. HB conceived the study and participated in its design, the analysis and interpretation of data, and reviewed the manuscript for important intellectual content.

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Conflict of interest

The authors have no conflicts of interest.

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