Association Between Compliance With the New WHO-Recommended Frequency and Timing of Antenatal Care Contacts and Receiving Quality Antenatal Care in Cameroon

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Abstract

The objective of this study was to determine whether adherence to the new WHO recommendations for the frequency and timing of antenatal care (ANC) contacts was associated with receiving quality prenatal care in Cameroon. The 2018 Cameroon Demographic and Health Survey yielded a weighted sample of 5,694 women aged 15 to 49 years for analysis. We found that 8.9% of women had at least eight ANC contacts, with 47.3% of those occurring during the first trimester. Overall, 28.3% (95% CI [26.4, 30.3]) of the women received all eight ANC interventions studied. Women who made at least eight ANC contacts prior to delivery had a higher chance of receiving the full set of interventions (AOR = 1.41; 95% CI [1.00, 1.99]). Even among women who started ANC in the second trimester, those who made at least eight contacts were more likely than those who made fewer contacts to receive the full set of interventions. Furthermore, women who had their first contact later in the second (AOR = 0.85; 95% CI [0.72, 0.99]) or third trimester (AOR = 0.33; 95% CI [0.19, 0.57]) were less likely to receive the full set of interventions. According to our findings, Cameroonian women who followed the new global recommendations for prenatal care were more likely to receive quality prenatal care before giving birth. To have a positive pregnancy experience, however, more women must begin ANC in the first trimester and have at least eight contacts with health care providers before delivery.

Keywords

antenatal care, maternal health, quality care, Cameroon

Introduction

Globally, the number of women who die from pregnancy and childbirth-related causes or complications has decreased, but remains high, especially in low- and middle-income countries (LMICs). An estimated 295,000 women died from pregnancy-related causes in 2017, and 2.4 million newborns die before their first 28 days of life each year, the majority of whom are born prematurely (United Nations Inter-agency Group for Child Mortality Estimation, 2017; World Health Organization [WHO], 2019a). At least 94% of the global maternal deaths occur in LMICs, with sub-Saharan Africa (SSA) and Southern Asia accounting for approximately 86% of the global number of maternal deaths; the burden is highest in SSA, with 196,000 deaths (WHO, 2021). The United Nations' Global Strategy for Women's, Children's, and Adolescent's Health (2016–2030) prioritizes maternal health, with an ambitious mortality reduction target of fewer than 70 deaths per 100,000 live births included in the Sustainable Development Goals (SDGs; Every Woman Every Child, 2015; WHO, 2019b).

Antenatal care (ANC) during pregnancy provides a variety of services that can help with the early prevention, detection, and treatment of risk factors. It is also frequently used to promote the use of skilled birth attendants as well as healthy behaviors such as breastfeeding, early postnatal care, and pregnancy spacing planning (Lincetto et al., 2013). Malaria, syphilis, tetanus, HIV/AIDS, and other undiagnosed infections during pregnancy, as well as high blood pressure, diabetes, and other pre-existing health conditions, frequently complicate pregnancy and endanger both mother and child. However, the majority of adverse maternal and perinatal outcomes can be avoided with high-quality ANC

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(Afulani, 2016; Arunda et al., 2017; Kuhnt & Vollmer, 2017; Tuladhar & Dhakal, 2011). The widely used global benchmark for ANC coverage was reporting at least four ANC visits. But studies have shown that pregnant women need more than four ANC visits to get all the care they need and lower their risk of dying during pregnancy (Benova et al., 2018; Carvajal-Aguirre et al., 2017; Kyei et al., 2012).

The WHO issued new comprehensive recommendations on routine ANC for positive pregnancy outcomes in November 2016, taking a human rights-based approach to addressing the complex nature of ANC practice, organization, and delivery within diverse health systems (WHO, 2016). The new guidelines recommend a minimum of eight ANC contacts, with the first occurring in the first trimester (up to 3 months of gestation). According to data from Africa, the prevalence of a minimum of eight contacts is generally low in most countries, ranging from 1% in Senegal, Zambia, and Uganda to 43% in Ghana (Ekholuenetale, 2021). The reporting of eight or more ANC contacts during pregnancy has been linked to factors such as the timing of the first ANC contact, maternal education, and wealth (Ahinkorah et al., 2021; Ekholuenetale, 2021; Ekholuenetale, Benebo, et al., 2020).

Cameroon is one of 16 SSA countries with a high maternal mortality rate. In 2017, the country had 529 maternal deaths per 100,000 live births (WHO, 2019a). A review of the literature identified no or inadequate ANC, hypertensive disorders of pregnancy, severe malaria, HIV/AIDS, pre-existing co-morbidities, ectopic pregnancy, placenta previa, anemia, pneumonia, heart disease, and delays in arrival at health facilities as drivers of maternal mortality in Cameroon, the majority of which can be detected and managed early in pregnancy (Wirsiy et al., 2019). However, with the previous benchmark of at least four ANC contacts, there was underutilization of ANC. Although pregnant women in Cameroon have nearly universal access to one skilled ANC contact, a significantly lower percentage have their first contact in the first trimester, and only about two-thirds have four or more contacts before delivery (National Institute of Statistics (Cameroon) & ICF, 2020). According to a recent study, 6.3% of married women in the country had eight or more ANC contacts, with 35.6% of contacts occurring during the first trimester (Ahinkorah et al., 2021).

Measuring health-care contacts with the health system without data on the care received is insufficient to reduce preventable deaths among women and newborns and achieve SDG-3 by 2030. Furthermore, emerging data show that even in LMICs with high levels of ANC coverage, quality is significantly lower and inequitable (Arsenault et al., 2018; Carvajal–Aguirre et al., 2017). Nevertheless, there is a dearth of literature on how compliance with the revised guidelines on ANC coverage relates to receiving quality care in Cameroon, a country with a high burden of maternal mortality where most of the existing studies have focused on the utilization of ANC, including the determinants of the timing and frequency of ANC contacts (Ahinkorah et al., 2021; Tolefac et al., 2017; Venyuy et al., 2020). We found a recent publication on the quality of care received during pregnancy by Ameyaw et al. (2021). They reported that women's empowerment indicators such as knowledge and attitude toward domestic violence were associated with receiving quality care during pregnancy in Cameroon. However, because the focus of their study was on how women's empowerment affects their ability to get good care during pregnancy, more research is needed to better understand the relationship between the frequency and timing of ANC contact under the revised WHO guidelines and the likelihood of getting basic ANC interventions during pregnancy.

This study examined the relationship between adhering to the new WHO antenatal care contact frequency and timing recommendations and receiving high-quality prenatal care during pregnancy using data from Cameroon's 2018 Demographic and Health Survey (DHS). The results will help policymakers and health care providers figure out what they can do and how well they follow the standard ANC model recommended by the WHO.

Methods

Data Source

In most countries, including Cameroon, the DHSs are the most comprehensive sources of population-level data on maternal and child health outcomes. However, these surveys have a significant shortcoming in that they cannot provide information on the type of prenatal care provided. Nonetheless, basic services such as weighing, urine analyses, blood pressure measurement, tetanus vaccination, and so on are frequently recorded during ANC. This data does not cover the entire range of services provided, but it can be used to determine whether women receive the bare minimum of services. As a result, information obtained through the DHS can provide, at a minimum, a basic indicator of care quality.

For this study, data were obtained from the 2018 Cameroon Demographic and Health Survey (CDHS), which was implemented by the National Institute of Statistics (NIS), in collaboration with the Ministry of Public Health. The 2018 CDHS is the fifth DHS in Cameroon since 1991. A nationally representative sample of 13,527 women aged 15 to 49 from all selected households and 6,978 men aged 15 to 64 from half of the selected households were interviewed, which represented a response rate of 98% for women and 98% for men. The sample design for the 2018 CDHS provides estimates at the national level, for urban and rural areas, and 12 study domains. The final report contains additional information about the study design, sampling strategy, and data collected in the 2018 CDHS (National Institute of Statistics (Cameroon) & ICF, 2020).

Sample

For this analysis, the children's recode file was used. We identified a total of 9,733 women aged 15 to 49 years with information covering a wide range of topics. In the dataset, 6,463 women had information on ANC, of which 822 (12.7%)

did not use ANC during their most recent pregnancy, and 68 did not know the number of ANC contacts they made during their most recent pregnancy. The women who did not use ANC during their most recent pregnancy and those who did not know the number of contacts they made before delivery were excluded in the analysis. Furthermore, women who did not know the gestational age of their pregnancy at their initial ANC contact ($n=6$) were also excluded. A total of 5,567 women (weighted $N=5,694$) who gave birth within the previous 5 years and had information on ANC use were studied.

Measures

Dependent Variable Measurement

Based on their availability in the dataset and in line with global recommendations, the study included eight ANC interventions as a proxy for ANC quality. We evaluated the following ANC services: blood pressure measurement, blood sample collection for analysis, tetanus toxoid vaccination, urine testing, intestinal parasite treatment, HIV counseling and testing, iron–folate supplementation, and sulfadoxine/pyrimethamine for malaria prevention. The survey asked women if they had received any of these services at ANC during their most recent pregnancy. If a woman reported receiving the service, she received a "1 point," otherwise she received a "0 point." A composite quality of maternal health care indicator (denoted total number of interventions received) was developed by counting the number of interventions mothers received from the set of interventions evaluated. For regression analysis, a dummy variable with a binary outcome was created, with "0" representing women who received fewer than eight interventions (i.e., 0–7) and "1" representing women who received the full set of interventions.

The Primary Independent Variables

The number of ANC contacts made prior to delivery and the timing of the first contact are the main independent variables. The information was gathered from women's self-reports of the number of ANC contacts they made prior to delivery during their most recent pregnancy, as well as the age of the pregnancy when the first ANC contact occurred. The number of contacts was classified as 1 to 3, 4 to 7, and 8 or more contacts based on the previous ANC model and the 2016 WHO recommendation. The timing of the first ANC contact was classified as first trimester: 0 to 3 months; second trimester: 4 to 6 months; and third trimester: >6 months.

Covariates

Women's demographic, obstetric, and economic characteristics such as age, highest level of education, parity, marital status, place of residence, region, and wealth quintile were included as confounding factors to examine the independent relationship between the number of ANC contacts and

receiving quality maternal health care. Existing literature linking these characteristics to the content of care received influenced their inclusion (Ameyaw et al., 2021; Jiwani et al., 2020).

Statistical Analysis

Descriptive statistics were used to describe the distribution of respondents by demographic and economic characteristics, the number of ANC contacts, the timing of the first ANC contact, and the coverage of interventions received by mothers. The association between each of the independent variables and the outcome variable was investigated using a design-based Chi-square test. To investigate the relationship between the number of ANC contacts, as well as the timing of the first contact, and the receipt of quality prenatal care, a series of binary logistic regression models were used. In model 1, we conducted a univariate analysis to determine the relationship between having at least eight contacts and the outcome. The analysis in model 2 was restricted to the timing of the first ANC contact. The final model (model 3) took into account the impact of other maternal, obstetric, demographic, and economic factors on the outcome. The "svy" commands were used to account for the cluster sampling design and sampling weights. The statistical significance level was set at p0.05. The findings are presented in the form of adjusted odds ratios (AOR) with confidence intervals. Stata/SE 13.0 was used for all analyses (StataCorp LP, College Station, TX, USA).

Ethical Considerations

The dataset used in this paper is publicly available on the DHS program website in de-identified form. As a result, no additional ethical approval from an Institutional Review Board (IRB) was required for the current study (IRB).

Results

Characteristics of Study Respondents

More than half of all study participants (66.4%; 95% CI [64.2, 68.5]) had four to seven ANC contacts, while only 8.9% (95% CI [7.8, 10.1]) had at least eight contacts before delivery. The majority of women (59.3%) were married, and 51.8% lived in urban areas. Approximately 47.0%, 49.0%, and 3.0% of the women made their first ANC contact in the first, second, and third trimesters, respectively. Table 1 shows the distribution of participants based on the other characteristics.

Coverage of Antenatal Care Interventions Among the Study Participants

The majority of ANC interventions had a high level of coverage. For example, more than 9 in 10 women reported that they had been weighed (97.8%) and that their blood pressure

(97.7%), urine (92.4%), and blood (97.1%) samples had been taken during ANC for the most recent pregnancy. However, of all the interventions offered to women during ANC, giving drugs to treat intestinal parasites had the lowest coverage (36.0%; Figure 1a). In addition, 0.2% received none of the interventions and one intervention during ANC, while 42.3% received seven interventions. Overall, 28.3% (95% CI [26.4, 30.3]) of the women received the full set of interventions investigated (Figure 1b).

Receipt of the Full Set of Antenatal Care Interventions by Antenatal Care Coverage Indicators and Key Demographic and Economic Factors

The distribution of antenatal care interventions by predictor variables is shown in Table 2. The study found significant differences in the receipt of all eight interventions depending on the number of ANC contacts made during pregnancy and the timing of the first contact. In comparison to their counterparts, a significant percentage of women who had at least eight ANC contacts during their pregnancy received all eight interventions, according to the data. Similarly, more women who had their first contact during the first trimester received the full set of ANC interventions than those who had their first ANC contact in the second or third trimester. Among the subsample of women who made at least eight contacts during the first trimester, a slightly higher percentage of those who made one to three and four to seven contacts received all interventions ($p = .387$). On the other hand, among women who made their first visit in the second trimester, a greater proportion of those who made at least eight contacts received all the interventions than the other groups. There were significant differences in the receipt of the full set of ANC interventions among women based on age, education, marital status, region, place of residence, and wealth quintile (Table 2).

Binary logistic regression analysis of the relationship between eight or more antenatal care contacts and the receipt of the full set of antenatal care interventions.

Bivariate analysis in Model 1 revealed that having made at least eight contacts during pregnancy was associated with increased odds of receiving all interventions investigated (OR = 2.16; 95% CI [1.58, 2.97]). In Model 2, the analysis showed that women who made their first contact in the second or third trimesters had reduced odds of receiving all the interventions (AOR = 0.65; 95% CI [0.56, 0.77] and AOR = 0.26; 95% CI [0.12, 0.34], respectively). We also discovered that women who had their first ANC contact in the second and third trimesters had a lower chance of receiving the full set of interventions. Women's obstetric, demographic, and economic characteristics were included as confounding factors in the full model (Model 3). According to the findings, having at least eight contacts increased the likelihood of receiving all ANC interventions by 41% (AOR = 1.41; 95%

Table 1. Descriptive Statistics of the Study Participants (Weighted $N = 5,694$).

Variables	Frequency	Percentage (%)
Number of ANC contacts		
1–3	1,409	24.7
4–7	3,780	66.4
≥8	505	8.9
Timing of the first ANC contact		
First trimester	2,692	47.3
Second trimester	2,810	49.4
Third trimester	192	3.4
Number of children ever born		
1–2	2,389	41.9
3–4	1,655	29.1
≥5	1,650	29.0
Age group		
15–24	1,797	31.5
25–34	2,736	48.1
35–49	1,161	20.4
Education		
No formal education	1,161	20.4
Primary	1,739	30.5
At least secondary	2,794	49.1
Marital status		
Never in a union	753	13.2
Married	3,377	59.3
Living with partner	1,147	20.1
Widowed	88	1.5
Divorced	61	1.0
Separated	268	4.7
Region		
Adamawa	217	3.8
Center (without Yaoundé)	633	11.1
Douala	612	10.7
East	376	6.6
Far-North	917	16.1
Littoral (without Douala)	214	3.8
North	700	12.3
North-West	403	7.1
West	662	11.6
South	295	5.2
South-West	101	1.8
Yaoundé	564	9.9
Place of residence		
Urban	2,949	51.8
Rural	2,745	48.2
Wealth quintile		
Poorest	920	16.2
Poorer	1,204	21.1
Middle	1,201	21.1
Richer	1,264	22.2
Richest	1,105	19.4

CI [1.00, 1.99]). The model fitness statistics showed that there was not enough statistical evidence ($p = .317$) to indicate a
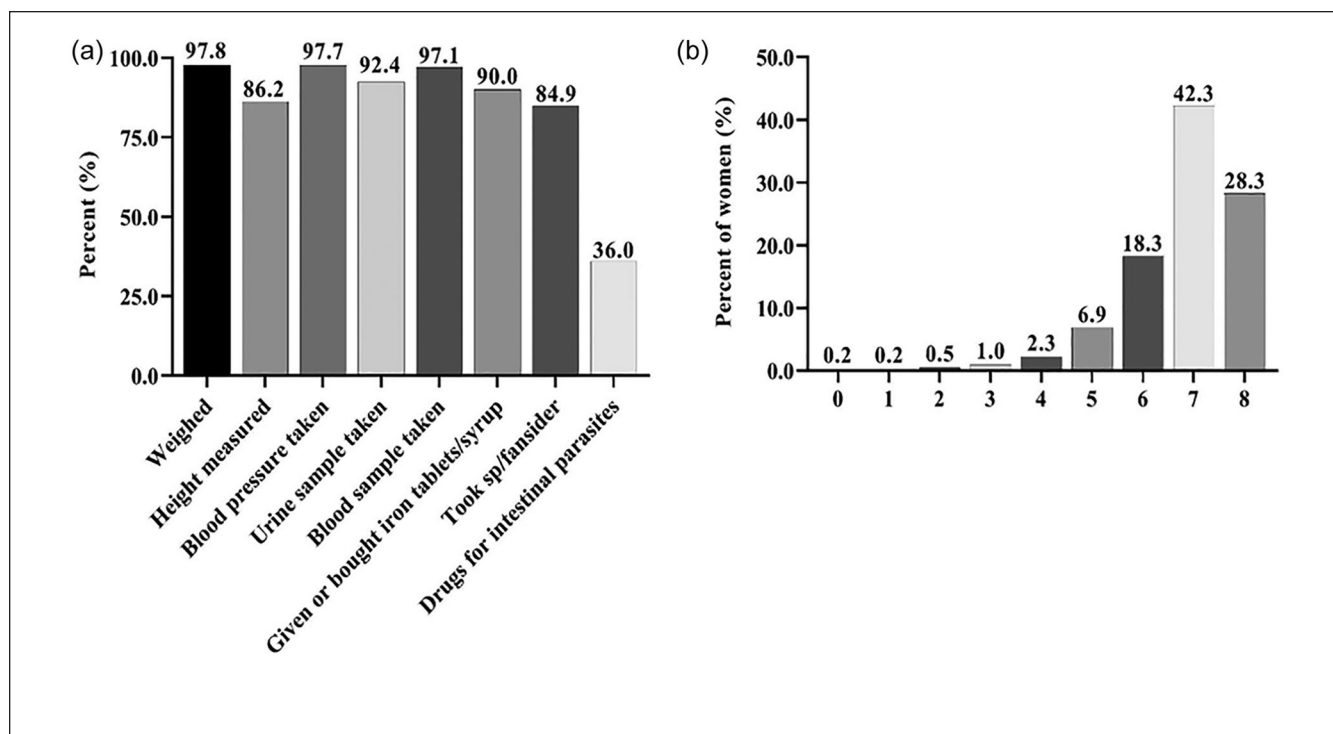
Figure 1. Coverage of antenatal care interventions among the study participants: (a) antenatal care interventions and (b) number of interventions received.

lack of fit in our model. Other factors linked to receiving the full set of interventions included the timing of the first ANC contact, marital status, region, the number of children born, and wealth quintile (Table 3).

Discussion

Prior to 2016, the widely used global indicator for measuring ANC coverage was at least four ANC visits, which was later found to be insufficient for pregnant women to receive all of the necessary ANC interventions and to reduce the risk of maternal mortality, particularly when the first contact is delayed (Benova et al., 2018; Carvajal-Aguirre et al., 2017; Kyei et al., 2012). The WHO issued new guidelines in 2016 regarding the number of ANC contacts required for a positive pregnancy experience, increasing the minimum of four visits to eight ANC contacts, with the first contact occurring in the first trimester and increased contacts occurring during the third trimester (WHO, 2016). Increased coverage of recommended contacts, however, should be accompanied by a greater emphasis on the quality of care received. This study examined the relationship between compliance with the new WHO guidelines on the frequency and timing of ANC contact and receiving quality prenatal care, as defined by a set of eight essential ANC interventions, using a nationally representative dataset.

According to the study, only about 9% and 47% of women, respectively, complied with the new WHO guidelines for ANC contact frequency and timing, with at least half

of pregnant women making their first contact in the second trimester and more than half making four to seven contacts before delivery. Similar patterns have been observed by other researchers in less resourced settings around the world, including but not limited to Ghana, Nigeria, and Myanmar (Ahinkorah et al., 2021; Ekholuenetale, Benebo, et al., 2020; Ekholuenetale, Nzoputam, et al., 2020; Mugo et al., 2020). In LMICs, at least half of pregnant women contact the health system on time, and one in every nine pregnant women contacts the health system at least eight times before giving birth (Jiwani et al., 2020). Noncompliance with the minimum of eight contacts is, indeed, a common occurrence in SSA and has been estimated to range from 99% in Zambia to 73% in Libya (Odusina et al., 2021). Although the profile of women in Cameroon who initiate ANC late and make fewer than eight contacts was not explored in this study, an earlier study reported that women in the study area who exhibited these patterns were adolescents, had no formal education, had three to four children, and were from the poorest socioeconomic group (Ahinkorah et al., 2021). Other factors contributing to the delay in ANC initiation in Cameroon include financial constraints and a long distance to health facilities (Tolefac et al., 2017). In general, our findings suggest that compliance with the new guidelines remains difficult in Cameroon, particularly given that health care is largely paid for out of pocket. According to a cost analysis carried out in one of Cameroon's districts, while pregnant women preferred the increase from four to eight contacts, they were unwilling to

Table 2. Chi-Square Test of the Receipt of the Full Set of Antenatal Care Interventions by Predictor Variables (Weighted $N = 5,694$ Unless Indicated).

Variable	The total number of interventions received		
	<8 (% of women)	All 8 (% of women)	p-Value
Antenatal care coverage indicators			
Number of ANC contacts			<.001
1–3	79.6	20.4	
4–7	69.7	30.3	
≥8	64.3	35.7	
Timing of first ANC contact			<.001
First trimester	66.6	33.4	
Second trimester	75.3	24.7	
Third trimester	90.8	9.2	
Number of ANC contacts among first-trimester registrants ($N = 2,691$)			.387
1–3	70.5	29.5	
4–7	66.7	33.3	
≥8	63.6	36.4	
Number of ANC contacts among second-trimester registrants ($N = 2,810$)			.005
1–3	79.8	20.2	
4–7	73.0	27.0	
≥8	65.8	34.2	
Women's characteristics			
Number of children ever born			.958
1–2	71.8	28.2	
3–4	71.8	28.2	
≥5	71.4	28.6	
Age group			.006
15–24	72.1	27.9	
25–34	73.1	26.9	
35–49	67.7	32.3	
Education			<.001
No formal education	84.8	15.2	
Primary	71.0	29.0	
At least secondary	66.7	33.3	
Marital status			.003
Never in a union	68.8	31.2	
Married	73.7	26.3	
Living with partner	70.3	29.7	
Widowed	64.9	35.1	
Divorced	73.3	26.7	
Separated	61.3	38.7	
Region			<.001
Adamawa	77.9	22.1	
Center (without Yaoundé)	68.7	31.3	
Douala	67.8	32.2	
East	61.1	38.9	
Far-North	78.1	21.9	
Littoral (without Douala)	78.9	21.1	
North	93.2	6.8	
North-West	64.0	36.0	
West	66.5	33.5	
South	51.0	49.0	

Table 2. (continued)

	The total number of interventions received		
Variable	<8 (% of women)	All 8 (% of women)	p-Value
South-West	61.6	38.4	
Yaoundé	68.3	31.7	
Place of residence			.001
Urban	68.4	31.6	
Rural	75.2	24.8	
Wealth quintile			<.001
Poorest	87.6	12.4	
Poorer	72.0	28.0	
Middle	70.1	29.9	
Richer	68.8	31.2	
Richest	63.2	36.8	

pay for the contacts (Ngequih Tumasang et al., 2021). Strategies such as user fee exemption and waivers for pregnant women have increased women's utilization of ANC services, including timely initiation and more contacts (Dennis et al., 2020; Manthalu et al., 2016). These strategies could be adapted in the study setting to increase ANC utilization.

In terms of the quality of care received, we discovered that almost all of the interventions studied had high population coverage, with the exception of deworming, which had very low coverage. Routine ANC deworming reduces the risk of adverse pregnancy outcomes such as neonatal mortality and low birth weight (Walia et al., 2021). However, only about a third of women in our study received drugs to prevent intestinal worms. This finding is consistent with Zambian reports (Kyei et al., 2012). More broadly, deworming coverage among pregnant women in soil-transmitted helminthiasis endemic areas is reportedly low, at 23% (Bangert et al., 2019). Low coverage has been attributed (in part) to a lack of country-specific guidance on the safety and efficacy of deworming, inadequate drug supply, and perceived fear of side effects, particularly teratogenicity, among women and health personnel (Insetta et al., 2014). Nonetheless, there is substantial evidence that deworming is safe for pregnant women once they have passed the first trimester (Gyorkos et al., 2006; Salam et al., 2021).

Overall, 28% of women received the full set of interventions, which is slightly higher than the 14% reported by Ameyaw et al. (2021) in the same setting when they examined the relationship between women's empowerment indicators and receiving quality care during pregnancy. The different interventions used to measure the quality of care, as well as a different study sample, could explain the observed differences. We recognize that assessing the quality of ANC content from DHS data is difficult because the existing questions in these datasets are limited and focus on the receipt of components reported by the mother rather than the overall quality of services received per se. Our results, therefore, suggest that less than a third of women in Cameroon receive a higher number of preventive screening components as part of ANC during pregnancy, undermining the goal of ANC, which is to detect and manage complications early during pregnancy. Qualitative studies may help us better understand the quality of care women receive as part of ANC, such as respectful, individualized, person-centered care.

According to our findings, the frequency and timing of the first ANC contact had an independent relationship with the quality of care received. On the one hand, women who made at least eight contacts during their prenatal period had a higher chance of receiving the full set of interventions. Women whose first contact was initiated in the second or third trimester, on the other hand, had a lower chance of receiving the full set of interventions, with a much lower chance noted among those whose first contact was in the third trimester. Previous studies identified that late initiation of ANC was associated with fewer than eight contacts, resulting in missed opportunities for ANC interventions (Ekholuenetale, Benebo, et al., 2020; Ekholuenetale, Nzoputam, et al., 2020). Our bivariate analyses revealed that even among women who initiated ANC in the second trimester, those who made at least eight contacts were more likely to receive the full set of interventions. However, it is unclear at what contacts in these women's schedules these interventions were received, given that the DHS only records if the service was received by the woman during ANC. The findings emphasize the importance of both timely ANC initiation and frequent contact by pregnant women before delivery to reap the majority of the benefits of ANC. Specifically, a minimum of eight ANC contacts appears to be the key driver of receiving a greater number of ANC components during pregnancy, lending support to the new guideline on the minimum contacts required by pregnant women for a positive pregnancy experience (WHO, 2016).

In line with previous research (Afulani, 2016; Agha & Tappis, 2016; Ameyaw et al., 2021; Carvajal–Aguirre et al., 2017; Mugo et al., 2020), we discovered that the number of children ever born, marital status, region, and wealth quintile

Table 3. Analysis of the Relationship Between Eight or More Antenatal Contacts and the Receipt of the Full Set of Antenatal Care Interventions (*N* = 5,694).

Variables	Model 1 OR [95% CI]	Model 2 AOR [95% CI]	Model 3 AOR [95% CI]
Number of ANC contacts			
1–3	1.00		1.00
4–7	1.69 [1.34, 2.12]***		1.27 [0.99, 1.64]
≥8	2.16 [1.58, 2.97]***		1.41 [1.00, 1.99]*
Timing of first ANC contact			
First trimester		1.00	1.00
Second trimester		0.65 [0.56, 0.77]***	0.85 [0.72, 0.99]*
Third trimester		0.20 [0.12, 0.34]***	0.33 [0.19, 0.57]***
Number of children ever born			
1–2			1.00
3–4			1.12 [0.94, 1.33]
≥5			1.38 [1.10, 1.73]**
Age group			
15–24			1.00
25–34			0.85 [0.72, 1.00]
35–49			0.97 [0.75, 1.26]
Education			
No formal education			1.00
Primary			1.35 [0.95, 1.92]
At least secondary			1.37 [0.98, 1.93]
Marital status			
Never in a union			1.00
Married			1.07 [0.84, 1.36]
Living with partner			1.00 [0.81, 1.25]
Widowed			1.52 [0.89, 2.57]
Divorced			1.23 [0.53, 2.83]
Separated			1.60 [1.13, 2.28]**
Region			
Adamawa			1.00
Center (without Yaoundé)			1.24 [0.78, 1.97]
Douala			1.05 [0.65, 1.68]
East			2.07 [1.29, 3.30]**
Far-North			1.25 [0.75, 2.09]
Littoral (without Douala)			0.71 [0.45, 1.13]
North			0.31 [0.18, 0.53]***
North-West			1.66 [1.03, 2.69]*
West			1.29 [0.82, 2.04]
South			2.66 [1.71, 4.15]***
South-West			1.56 [0.92, 2.55]
Yaoundé			1.08 [0.66, 1.75]
Place of residence			
Urban			1.00
Rural			1.07 [0.80, 1.42]
Wealth quintile			
Poorest			1.00
Poorer			1.76 [1.16, 2.65]**
Middle			1.95 [1.27, 3.01]**
Richer			2.08 [1.29, 3.35]**
Richest			2.62 [1.57, 4.38]***
Model fitness statistics			
Number of observations			5,567
Weighted population			5,694
F-adjusted test statistic = *F*(9,400)			1.164
Prob > *F*			.317

Note. AOR = adjusted odds ratio; OR = odds ratio.
*p < .05. **p < .01. ***p < .001.

were all related to the quality of care received. Wealth has been linked to timely ANC contact and a greater number of ANC contacts, both of which increase the likelihood of receiving a greater number of ANC components during pregnancy (Ahinkorah et al., 2021; Jiwani et al., 2020; Mugo et al., 2020). The association between higher parity and receiving the full set of interventions in this study may be difficult to explain, because a large body of literature suggests that women of high parity initiate ANC late and make fewer contacts, reducing their chances of receiving quality ANC (Ahinkorah et al., 2021; Bolarinwa et al., 2021; Ekholuenetale, 2021; Jiwani et al., 2020; Mugo et al., 2020). Indeed, women who have had five or more successful pregnancies are reluctant to attend ANC, and when they do, it is usually after the second trimester, claiming that they have experience coping with the common minor disorders of pregnancy (Mulondo, 2020). In contrast to our findings, other scholars reported that primiparous women were more likely than women with five or more children to receive a higher number of ANC components (Carvajal–Aguirre et al., 2017). Nonetheless, the findings of this study show that making at least eight contacts increases the chances of receiving the full set of interventions, even when the first contact is made in the second trimester. Because of their increased risk of obstetric complications, neonatal morbidity, and perinatal mortality, it is reasonable to assume that women with high parity ($\geqslant$5) were advised by healthcare professionals to make more frequent contact and were provided with preventive services (Asundep et al., 2014; Bai et al., 2002).

Policy Implications of Our Findings

Our research has policy implications. While there are clear benefits to increasing antenatal contacts, implementing the new guidelines in Cameroon will be much more difficult given the current findings of this study. There are, however, evidence-based strategies available, such as user fee exemptions and waivers, which can be used to increase women's chances of initiating ANC early in pregnancy and making more contacts. Our findings show that, with the shift from a minimum of four to eight ANC contacts, there is a need to identify women who initiate ANC late, as they are less likely to meet the new recommended threshold for a positive pregnancy experience.

Limitations

A limitation of this study is that we were only able to analyze the content of ANC based on only eight interventions reported to have been received at least once during ANC. We recognize that these are not all of the components of ANC, nor are they the most important, but they are the ones most frequently reported in DHS. Moreover, no information was available regarding the contacts through which these components were received, as well as the quality of the services received. The measures used, such as the number, timing,

and components received at ANC, were based on mothers' recollections of events during the prenatal period and may be prone to recall bias. Another limitation is that the DHS used a cross-sectional study design, which makes it impossible to draw causal inferences from the results. Finally, we excluded women who did not use ANC during their most recent pregnancy. As a result, the conclusions reached in this study are limited to Cameroonian women of the reproductive age who have used ANC at least once during pregnancy.

Conclusion

From this study, it has been shown that many Cameroonian women of reproductive age who attend at least one ANC visit before giving birth do not begin ANC early enough and do not attend it frequently enough to receive quality maternal health care before delivery. According to the findings, compliance with the 2016 WHO ANC guidelines for a positive pregnancy experience was significantly associated with receiving a higher number of ANC interventions before delivery. We also discovered that the number of children ever born, marital status, region, and wealth quintile were all related to the quality of care received during pregnancy. Strategies are needed in the study setting to promote timely initiation of ANC and a higher number of contacts (8+) among pregnant women for a positive pregnancy experience.

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References

Afulani, P. A. (2016). Determinants of stillbirths in Ghana: Does quality of antenatal care matter? *BMC Pregnancy and Childbirth*, *16*, 32. https://doi.org/10.1186/s12884-016-0925-9

Agha, S., & Tappis, H. (2016). The timing of antenatal care initiation and the content of care in Sindh, Pakistan. *BMC Pregnancy and Childbirth*, *16*(1), 190. https://doi.org/10.1186/s12884-016-0979-8

Ahinkorah, B. O., Seidu, A., Budu, E., Mohammed, A., Adu, C., Agbaglo, E., Ameyaw, E. K., & Yaya, S. (2021). Factors associated with the number and timing of antenatal care visits among married women in Cameroon: Evidence from the 2018 Cameroon Demographic and Health Survey. *Journal of Biosocial Science*, *54*(2), 322–332. https://doi.org/10.1017/S0021932021000079

Ameyaw, E. K., Dickson, K. S., Adde, K. S., & Ezezika, O. (2021). Do women empowerment indicators predict receipt of quality antenatal care in Cameroon? Evidence from a nationwide survey. *BMC Women's Health*, *21*(1), 343. https://doi.org/10.1186/s12905-021-01487-y

Arsenault, C., Jordan, K., Lee, D., Dinsa, G., Manzi, F., Marchant, T., & Kruk, M. E. (2018). Equity in antenatal care quality: An analysis of 91 national household surveys. *The Lancet Global Health*, *6*(11), e1186–e1195. https://doi.org/10.1016/S2214-109X(18)30389-9

Arunda, M., Emmelin, A., & Asamoah, B. O. (2017). Effectiveness of antenatal care services in reducing neonatal mortality in Kenya: Analysis of national survey data. *Global Health Action*, *10*(1), 1328796. https://doi.org/10.1080/16549716.2017.1328796

Asundep, N. N., Jolly, P. E., Carson, A., Turpin, C. A., Zhang, K., & Tameru, B. (2014). Antenatal care attendance, a surrogate for pregnancy outcome? The case of Kumasi, Ghana. *Maternal and Child Health Journal*, *18*(5), 1085–1094. https://doi.org/10.1007/s10995-013-1338-2

Bai, J., Wong, F. W. S., Bauman, A., & Mohsin, M. (2002). Parity and pregnancy outcomes. *American Journal of Obstetrics and Gynecology*, *186*(2), 274–278. https://doi.org/10.1067/mob.2002.119639

Bangert, M., Bancalari, P., Mupfasoni, D., Mikhailov, A., Gabrielli, A. F., & Montresor, A. (2019). Provision of deworming intervention to pregnant women by antenatal services in countries endemic for soil-transmitted helminthiasis. *PLOS Neglected Tropical Diseases*, *13*(5), e0007406. https://doi.org/10.1371/journal.pntd.0007406

Benova, L., Tunçalp, Ö., Moran, A. C., & Campbell, O. M. R. (2018). Not just a number: Examining coverage and content of antenatal care in low-income and middle-income countries. *BMJ Global Health*, *3*(2), e000779. https://doi.org/10.1136/bmjgh-2018-000779

Bolarinwa, O. A., Sakyi, B., Ahinkorah, B. O., Ajayi, K. V, Seidu, A., Hagan, J. E., & Tessema, Z. T. (2021). Spatial patterns and multilevel analysis of factors associated with antenatal care visits in Nigeria: Insight from the 2018 Nigeria Demographic Health Survey. *Healthcare*, *9*(10), 1389. https://doi.org/10.3390/healthcare9101389

Carvajal–Aguirre, L., Amouzou, A., Mehra, V., Ziqi, M., Zaka, N., & Newby, H. (2017). Gap between contact and content in maternal and newborn care: An analysis of data from 20 countries in sub–Saharan Africa. *Journal of Global Health*, *7*(2), 1–8. https://doi.org/10.7189/jogh.07.020501

Dennis, M. L., Benova, L., Goodman, C., Barasa, E., Abuya, T., & Campbell, O. M. R. (2020). Examining user fee reductions in public primary healthcare facilities in Kenya, 1997–2012:

Effects on the use and content of antenatal care. *International Journal for Equity in Health*, *19*(1), 35. https://doi.org/10.1186/s12939-020-1150-8

Ekholuenetale, M. (2021). Prevalence of eight or more antenatal care contacts: Findings from multi-country nationally representative data. *Global Pediatric Health*, *8*, 1–9. https://doi.org/10.1177/2333794X211045822

Ekholuenetale, M., Benebo, F. O., & Idebolo, A. F. (2020). Individual-, household-, and community-level factors associated with eight or more antenatal care contacts in Nigeria: Evidence from Demographic and Health Survey. *PLOS ONE*, *15*(9), e0239855. https://doi.org/10.1371/journal.pone.0239855

Ekholuenetale, M., Nzoputam, C. I., Barrow, A., & Onikan, A. (2020). Women's enlightenment and early antenatal care initiation are determining factors for the use of eight or more antenatal visits in Benin: Further analysis of the Demographic and Health Survey. *Journal of the Egyptian Public Health Association*, *95*(1), 13. https://doi.org/10.1186/s42506-020-00041-2

Every Woman Every Child. (2015). *The global strategy for women's, children's and adolescents' health (2016–2030)*. Author. http://www.everywomaneverychild.org/wp-content/uploads/2016/12/EWEC_Global_Strategy_EN_inside_LogoOK_web.pdf

Gyorkos, T. W., Larocque, R., Casapia, M., & Gotuzzo, E. (2006). Lack of risk of adverse birth outcomes after deworming in pregnant women. *Pediatric Infectious Disease Journal*, *25*(9), 791–794. https://doi.org/10.1097/01.inf.0000234068.25760.97

Insetta, E. R., Soriano, A. J., Totañes, F. I. G., Macatangay, B. J. C., & Belizario, V. Y. (2014). Fear of birth defects is a major barrier to soil-transmitted helminth treatment (STH) for pregnant women in the philippines. *PLoS ONE*, *9*(2), e85992. https://doi.org/10.1371/journal.pone.0085992

Jiwani, S. S., Amouzou-Aguirre, A., Carvajal, L., Chou, D., Keita, Y., Moran, A. C., Requejo, J., Yaya, S., Vaz, L. M., & Boerma, T. (2020). Timing and number of antenatal care contacts in low and middle-income countries: Analysis in the Countdown to 2030 priority countries. *Journal of Global Health*, *10*(1). https://doi.org/10.7189/jogh.10.010502

Kuhnt, J., & Vollmer, S. (2017). Antenatal care services and its implications for vital and health outcomes of children: Evidence from 193 surveys in 69 low-income and middle-income countries. *BMJ Open*, *7*(11), e017122. https://doi.org/10.1136/bmjopen-2017-017122

Kyei, N. N. A., Chansa, C., & Gabrysch, S. (2012). Quality of antenatal care in Zambia: A national assessment. *BMC Pregnancy and Childbirth*, *12*(1), 151. https://doi.org/10.1186/1471-2393-12-151

Lincetto, O., Mothebesoane-Anoh, S., Gomez, P., & Munjanja, S. (2013). Antenatal care: Opportunities for Africa's newborns. *International Journal of Scientific & Technology Research*, *2*(2), 51–62.

Manthalu, G., Yi, D., Farrar, S., & Nkhoma, D. (2016). The effect of user fee exemption on the utilization of maternal health care at mission health facilities in Malawi. *Health Policy and Planning*, *31*(9), 1184–1192. https://doi.org/10.1093/heapol/czw050

Mugo, N. S., Mya, K. S., & Raynes-Greenow, C. (2020). Country compliance with WHO-recommended antenatal care guidelines:

Equity analysis of the 2015–2016 Demography and Health Survey in Myanmar. *BMJ Global Health*, *5*(12), e002169. https://doi.org/10.1136/bmjgh-2019-002169

Mulondo, S. A. (2020). Factors associated with underutilisation of antenatal care services in Limpopo, South Africa. *British Journal of Midwifery*, *28*(11), 788–795. https://doi.org/10.12968/bjom.2020.28.11.788

National Institute of Statistics (Cameroon), & ICF. (2020). *2018 Cameroon demographic and health survey*. Author. https://dhsprogram.com/publications/publication-FR360-DHS-Final-Reports.cfm

Ngequih Tumasang, E., Mbu, R., & Mbacham, W. (2021). Cost benefit analysis of four and eight antenatal care visits in bamenda health district, cameroon. *International Journal of Health Economics and Policy*, *6*(3), 79. https://doi.org/10.11648/j.hep.20210603.11

Odusina, E. K., Ahinkorah, B. O., Ameyaw, E. K., Seidu, A.-A., Budu, E., Zegeye, B., & Yaya, S. (2021). Noncompliance with the WHO's recommended eight antenatal care visits among pregnant women in Sub-Saharan Africa: A multilevel analysis. *BioMed Research International*, *2021*, 1–11. https://doi.org/10.1155/2021/6696829

Salam, R. A., Das, J. K., & Bhutta, Z. A. (2021). Effect of mass deworming with antihelminthics for soil-transmitted helminths during pregnancy. *Cochrane Database of Systematic Reviews*, *2021*(5). https://doi.org/10.1002/14651858.CD005547.pub4

Tolefac, P. N., Halle-Ekane, G. E., Agbor, V. N., Sama, C. B., Ngwasiri, C., & Tebeu, P. M. (2017). Why do pregnant women present late for their first antenatal care consultation in Cameroon? *Maternal Health, Neonatology and Perinatology*, *3*(1), 29. https://doi.org/10.1186/s40748-017-0067-8

Tuladhar, H., & Dhakal, N. (2011). Impact of antenatal care on maternal and perinatal outcome: A study at Nepal medical college teaching hospital. *Nepal Journal of Obstetrics and Gynaecology*, *6*(2), 37–43.

United Nations Inter-agency Group for Child Mortality Estimation. (2017). *Levels & trends in child mortality: Report 2017, estimates developed by the UN inter-agency group for child mortality estimation*. United Nations Children's Fund. https://www.unicef.org/media/48871/file/Child_Mortality_Report_2017.pdf

Venyuy, M. A., Cumber, S. N., Nkfusai, C. N., Bede, F., Ijang, Y. P., Wepngong, E., Bama, S. N., Tsoka-Gwegweni, J. M., & Tebeu, P. M. (2020). Determinants to late antenatal clinic start among pregnant women: The case of Saint Elizabeth General Hospital, Shisong, Cameroon. *Pan African Medical Journal*, *35*, 1–9. https://doi.org/10.11604/pamj.2020.35.112.18712

Walia, B., Kmush, B. L., Lane, S. D., Endy, T., Montresor, A., & Larsen, D. A. (2021). Routine deworming during antenatal care decreases risk of neonatal mortality and low birthweight: A retrospective cohort of survey data. *PLOS Neglected Tropical Diseases*, *15*(4), e0009282. https://doi.org/10.1371/journal.pntd.0009282

Wirsiy, F. S., Ako-arrey, D. E., Njukeng, P. A., Manjong, F. T., Lukong, L. K., Lekedji, M. Y., Gamba, B., & Yeika, E. V. (2019). Maternal mortality in cameroon: A critical review of its determinants. *Journal of Gynaecology and Neonatal*, *2*(1), 106.

World Health Organization. (2016). *WHO recommendations on antenatal care for a positive pregnancy experience*. Author. https://apps.who.int/iris/bitstream/handle/10665/250796/97892415?sequence=1

World Health Organization. (2019a). *Trends in maternal mortality 2000 to 2017: Estimates by WHO, UNICEF, UNFPA and the United Nations Population Division*. Author.

World Health Organization. (2019b). *World health statistics 2019: Monitoring health for the SDGs, sustainable development goals*. Author.

World Health Organization. (2021). *World health statistics 2021: Monitoring health for the SDGs, sustainable development goals*. Author.