



## Research article

## How effective is antenatal care in preparing mothers for newborn care? An exploratory survey of lactating women in a rural Nigerian district

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## ABSTRACT

**Background:** Neonatal death rates are high in sub-Saharan Africa and the majority of these deaths are preventable. Antenatal care (ANC) is a good channel for the reduction of neonatal deaths. This study aimed to assess newborn care practices among lactating women in Nigeria and determine their relationship with ANC attendance.

**Methodology:** This was a cross-sectional survey involving 241 lactating mothers selected using the cluster sampling method. A structured interviewer-administered questionnaire was employed to obtain data. The Chi-square test was used to assess the associations between categorical variables. Logistic regression was used to determine the predictors of umbilical cord care, thermal care, and neonatal vaccination status. Good cord care was defined as having minimum of three appropriate practices concerning the use of clean instruments to tie the cord, use of clean instruments to cut the cord, and application of chlorhexidine, 70% alcohol, saltwater, or nothing on the cord). Results were presented as odds ratios (ORs).  $P < 0.05$  was taken as statistically significant.

**Results:** The mean age of participants was  $29.0 \pm 5.5$  years. Most participants reported that sterile instruments were used to cut their baby's umbilical cords; that their babies were dried immediately after placenta delivery and that their babies were fully vaccinated (91.0%, 90.5%, and 85.1% respectively). ANC visits (aOR = 8.0,  $p = 0.02$ ) and place of delivery (aOR = 10.6,  $p = 0.01$ ) were significantly associated with good umbilical cord care practices. However, none of the participants' sociodemographic characteristics were significantly associated with newborn thermal care and vaccination status.

**Conclusion:** The prevailing antenatal care services are ineffective in preparing mothers for newborn care. Place and frequency of ANC have positive associations with umbilical cord care. There is a need to implement quality ANC that will enhance maternal and neonatal outcomes and implement innovative interventions to enhance ANC attendance. The WHO positive pregnancy experience model should be implemented.

## 1. Introduction

The progress towards reducing infant and child morbidity and mortality has accelerated but remains insufficient to achieve the targets of the Sustainable Development Goals (SDG). In particular, progress towards ending preventable deaths among under-fives by the year 2030 is slow. Neonatal deaths presently account for a greater proportion of global child deaths than in 1990, with about 47% of all under-five mortalities occurring during the neonatal period [1]. Specifically, SDG 3 aims to reduce neonatal mortality to 12 deaths per thousand live

births or less by 2030 [2]. While the Americas, West Pacific, and Europe have achieved rates below 7.5 per thousand live births, neonatal mortality remains significantly above 20 deaths per thousand live births in the other parts of the world. Africa is the worst hit, with a regional neonatal mortality rate of 27.2 per 1000 live births [1]. Although the current MMR and lifetime risk of maternal death in Nigeria are high, they represent a significant improvement from previous values warranting the country to be classified as "making progress" [3]. The neonatal mortality rate has, however, not changed significantly. Since 2015, there has been a decrease of only 2.2%, which is grossly

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inadequate if Nigeria were to achieve the SDG 3 goal of 12 or fewer deaths per thousand live births [1].

High-income countries (HIC) have emphasized neonates as a major focus in reducing child morbidity and mortality. However, in lower-income countries (LIC), neonatal mortality rate (NMR) trends and causes have attracted relatively little attention and in international public health policies and programs, neonatal death still does not receive attention commensurate with its burden [4]. Almost all (99%) neonatal deaths occur in low-income and middle-income countries, yet most epidemiological and other research focuses on the 1% of deaths in rich countries. The highest rates of neonatal deaths are in sub-Saharan Africa [5]. The majority of the causes of neonatal deaths are preventable [5, 6]. Specifically, the prevention of neonatal deaths relates to umbilical cord (subsequently referred to as cord) care, temperature control, and early initiation of breastfeeding [6]. Also, access to skilled birth attendants and emergency obstetric care are thought to prevent early neonatal deaths [7]. In addition, BCG vaccination and initiation of the polio vaccination within the first four weeks after birth can enhance childhood survival [8].

Antenatal care (ANC) is a good channel for newborn interventions and the reduction of neonatal deaths [9, 10]. Previously, the World Health Organization (WHO) recommended the implementation of a focused ANC (FANC) platform that consisted of a minimum of four ANC visits and a well-defined set of activities proven to be beneficial for neonatal health [11]. Pregnant women are educated and empowered to ensure that they require fewer visits (four visits- at four, six, eight, and nine months) if no complications are anticipated [11, 12, 13]. Upon identifying the inherent challenges in this approach, the WHO in November 2016 introduced a new set of guidelines on ANC for positive pregnancy experiences, which required more frequent (at least eight) contacts for pregnant women with health providers. The guideline projected that compared to the FANC, eight or more ANC visits could reduce perinatal mortality by as much as 8 per 1000 live births [14].

There are two important elements of quality ANC delivery to inform and prepare women to care correctly for their newborns [9]. To address the first element, the WHO guideline makes four recommendations, namely oral iron and folic acid supplementation, tetanus toxoid vaccination, early ultrasonography, and screening for alcohol and substance use [14]. The second is health education and counseling to create a bridge between medical conditions and social issues concerning ANC. Such issues include the promotion of healthy lifestyles, birth plans, preparation for unexpected events, and parenting especially cord and thermal care and immunization for the newborn [15]. The WHO guidelines also recommend the teaching of healthy eating and physical activity habits [14].

Studies conducted in Asia have shown that information on newborn care practices offered to pregnant women and their families during ANC visits resulted in improved care practices namely complete cord care, complete thermal care, and initiation of breastfeeding within 1 h of birth [6, 16], whereas such improvement in newborn care was not observed in Uganda [9]. Focused antenatal care (FANC) became the recommended type of antenatal care in Nigeria following the publication of the WHO trial on antenatal care which reported that more frequent visits of the traditional antenatal care approach did not necessarily improve pregnancy outcomes [17]. This ensures that the limited resources of developing countries like Nigeria can be redirected to give better quality antenatal care services across the recommended four visits [18, 19]. Similar to Tanzania [20], in Nigeria as of 2018, 73.9% of all pregnant women received ANC at least once, 43.3% received skilled care during childbirth and 41.9% received postnatal care within two days after childbirth from a skilled birth attendant [21]. The others were attended to by either Traditional Birth Attendants, Faith-Based Organizations, or had home deliveries. These proportions vary by state, with the northern states having lower proportions of skilled care than the southern states [21]. However, in what seems like a policy summersault, since 2016, many health care facilities in the country have not adopted the new WHO guideline that recommends more frequent antenatal visits. The need,

therefore, arises to evaluate the effect of non-implementation of the guideline, especially, because of the likely increased challenge on hitherto scarce resources.

In Nigeria, little is known about the relationship between newborn care practices and attending ANC consultations. This study specifically assessed newborn care practices with regards to thermal care, cord care, and newborn vaccination status among lactating women in Nigeria and determined their relationship with adherence to ANC attendance.

## 2. Methods

### 2.1. Study design and setting

A cross-sectional survey of lactating women with babies aged less than five months in the Ikenne Local Government Area (LGA) was carried out between October and December 2020. We chose the age limits to ensure comparability with similar studies [9, 22]. Ikenne LGA is one of the 20 LGAs in Ogun State, Nigeria. It comprises ten administrative wards. An administrative ward in Nigeria is a geographical area occupied by about 10,000–20,000 inhabitants. The wards were used as the sampling unit for this study. The estimated population of the LGA in 2018 was 149,825 with 42.1% being females. The population is predominantly rural. There are 18 government-owned primary health facilities, one General Hospital, and a privately-run Tertiary Health facility in the LGA. All the health facilities offer ANC as part of the Primary Health Care System which forms the fulcrum of health service delivery in Nigeria.

### 2.2. Sample size and data collection procedures

The sample size was determined using the standard formula for estimating sample size in cluster surveys [23]. The prevalence of complete thermal care practices was estimated to be 5.1%; based on a similar study conducted in Bangladesh [24]. The study was based on a design effect of 3 and a sample error of 5.0%. This yielded a minimum sample size of 225. It was adjusted by 10.0% for non-response yielding a sample size of 250. The thermal care outcome was preferred because it generated the highest required sample size of the three primary outcomes. So, our sample size is adequate to provide valid results for the three primary outcomes.

Our study required a total of 250 participants. Five of the wards were randomly selected using computer-generated random numbers from a list of the 10 wards. All eligible and consenting women attending postnatal clinics at health facilities within the selected wards participated in the study. Fifty women were selected consecutively per ward at the postnatal clinics of the selected ward health facilities during the study. Structured interviews were held with the women. The study collected data that included socio-demographic characteristics, previous obstetric history, and specifically for the last pregnancy, immediate newborn care practices, and immediate postnatal care-seeking practices in the case of neonatal illness. Three primary outcome variables were considered namely; cord care, thermal care, and newborn vaccination status. The data collection instrument was adopted from a similar study conducted in two districts in Uganda [8]. It was adjusted to suit the local context by a team of three Reproductive Health specialists. The questionnaire was pre-tested in the neighboring Sagamu LGA among 60 women in two communities. The Cronbach's alpha values for the scales, which were 0.86 (cord care), 0.89 (thermal care), and 0.84 (newborn vaccination status), are acceptable.

### 2.3. Data analysis

Each questionnaire was checked for completeness and accuracy before double entry into the Microsoft Excel software. The data were analyzed using the IBM SPSS Statistics version 22. Appropriate descriptive statistics were used to present the socio-demographic characteristics, certain reproductive health indicators, and selected newborn care practices. The primary exposure variable is the number of ANC visits during

the women's last viable pregnancy. It was coded as sufficient ANC visit = 1 (defined as having made four ANC visits or more, based on the earlier WHO FANC recommendation) and insufficient ANC visit = 0 (defined as none to 3 antenatal visits). Three Composite variables were generated from primary responses to constitute the primary outcome variables of interest. The Outcome variables are; good cord care (comprised of the use of clean instruments to tie the cord, use of clean instruments to cut the cord, and application of chlorhexidine, 70% alcohol, saltwater, or nothing on the cord), good thermal care (comprised of drying of the newborn before the placenta or immediately after the placenta was delivered, wrapping of the baby immediately the placenta was delivered and delayed bathing of the baby till 24 h or later, after delivery), and good newborn vaccination (defined as a newborn baby who has received both tuberculosis and the first dose of Polio vaccine, which is routinely administered at birth). For purposes of our analysis, we considered good cord care, if any three of the five possible responses were correct; good thermal care, if any three of the four responses are correct; and good newborn vaccination, if any one of the four possible outcomes were correct. The exposure variables are age (grouped as young 15–24 years or adults 25 years and above), parity (having the first baby or having two or more babies), and marital status (living with a spouse or living alone), source of income (regular or irregular source of income), level of education completed (attained no formal education, or completed at least primary level), and place of delivery (in a health facility or delivered outside of health facility).

The bivariate analysis was conducted using the chi-square test. ANC attendance was the primary exposure of interest, and was included in the models as a categorical variable with three levels Independent variables with corresponding p-values less than 0.1 were fitted into an exploratory logistic regression model. Post-estimation assessment using the Hosmer-Lemeshow chi-square was also conducted.

#### 2.4. Ethical consideration

We obtained written informed consent from the women before enrollment and upheld the highest level of confidentiality. The Babcock University Human Research Ethics Committee (BUHREC/106/15) approved the conduct of this study after reviewing the protocol. We also obtained permission from the Medical Officer of Health, the heads of facilities, community leaders, and the spouses of the women before the study was carried out.

### 3. Results

Two hundred and forty-one women (response rate = 96.4%) were interviewed in five primary health care facilities. The health facility implements the traditional model of antenatal care with scheduled antenatal care visits every four weeks until the 28th week of gestation, then every two weeks until the 36th week, and then weekly until delivery. However, this model was modified by encouraging women to visit as often as possible irrespective of the risk level associated with the index pregnancy.

#### 3.1. Sociodemographic characteristics

Table 1 presents the results of the sociodemographic characterization of the study participants. Forty-seven (19.5%) of the interviewees were aged between fifteen and twenty-four years old. The others were aged twenty-five to forty-one years old. The mean age and parity were  $29.0 \pm 5.5$  years and  $2.3 \pm 1.4$  babies, respectively. Two hundred and five (85.1%) of the participants had three or fewer parous experiences. As of the period of data collection, most of the women were married (97.5%) and had regular sources of income (87.6%). Also, most (91.3%) of the participants had completed at least a secondary school education.

More than one-third (34.9%) of the women attended eight or more antenatal care visits. Some women had as many as twenty antenatal visits, while the mean antenatal attendance was  $6.6 \pm 4.2$ . Forty-three

**Table 1.** Sociodemographic characteristics of the study participants.

Variable	n (%)
<b>Age group in years</b>	
15–24 (young)	47 (19.5)
≥25 (adult)	194 (80.5)
mean age	$29. \pm 5.5$
<b>Parity</b>	
One	74 (30.7)
Two	85 (35.3)
Three	46 (19.1)
Four	18 (7.5)
Five	10 (4.1)
Six or more	8 (3.3)
mean parity	$2.3 \pm 1.4$
<b>Level of education</b>	
None	4 (1.7)
Primary	17 (7.0)
Secondary	132 (54.8)
Tertiary	88 (36.5)
<b>Marital status</b>	
Married	235 (97.5)
Single/widowed	6 (2.5)
<b>Source of income</b>	
Regular	211 (87.6)
Non-regular	30 (12.4)
<b>Report of at least one child death or stillbirth</b>	
No	220 (91.3)
Yes	21 (8.7)
<b>Time of death of babies</b>	
Stillbirths	10 (40.0)
0–7 days after birth	4 (16.0)
7–28 days after birth	1 (4.0)
More than 28 days after birth	10 (40.0)
<b>Where the baby's death occurred</b>	
Health facility	13 (52.0)
Traditional Birth Attendant	3 (12.0)
Home	9 (36.0)
<b>Number of ANC visits</b>	
0	11 (4.6)
1–3	26 (10.8)
4–5	89 (36.9)
6–7	31 (12.9)
8 or more	84 (34.8)
mean number of ANC visits	$6.6 \pm 4.2$
<b>Place of delivery</b>	
Outside of health facility	43 (17.8)
Health facility	198 (82.2)

± Standard deviation.

(17.8%) of the women delivered outside health facilities; either at home or with traditional birth attendants, where skill birth attendance could not be ascertained.

There were twenty-five child deaths or still births reported by twenty-one (8.7%) women. One woman reported the three child deaths/stillbirths. Most of the deaths were either stillbirths (40.0%) or post-neonatal mortalities (40.0%). Thirteen (52.0%) of the deaths occurred within health facilities, while the others were outside of hospitals.

#### 3.2. Neonatal care practices

Table 2 shows the findings concerning neonatal care practices among the study participants. Two hundred and twenty-three of the women

reported that sterile instruments were used to cut their baby's umbilical cords. Also, two hundred and seventeen (90.0%) of the participants reported the use of cord clamp for tying their babies' umbilical cords after cutting. For cleaning, while 204 (85.0%) used spirit or alcohol, eighteen (7.5%) applied nothing or saltwater. The remaining eighteen (7.5%) women used other substances like baby powder, soot, animal waste, or herbal medications. On the whole, only seven women (2.9%) were adjudged to have reported poor cord care.

Most (90.5%) of the participants reported the practice of drying their babies before or immediately after placenta delivery, while 51.9% had the babies wrapped after placenta delivery. However, only 42.3% of the women reported delaying the babies' first bath till after 24 h. Overall, 63.1% of the participants were adjudged to have reported poor thermal care practices.

Twenty-eight (11.6%) and thirty-six (14.1%) of the women reported that their babies did not receive the BCG and first Oral Polio Vaccines,

**Table 2.** Neonatal care practices.

Variable n (%)	n (%)
<b>Cord care</b>	
<b>The material used for tying the umbilical cord</b>	
Cord clamp	217 (90.0)
Clean thread	21 (8.7)
Unclean household cloth	3 (1.3)
<b>The instrument used for cutting the umbilical cord</b>	
Sterile instrument	223 (92.5)
New razor blade	15 (6.2)
Old razorblade/household instruments	3 (1.3)
<b>Application of substance on umbilical cord</b>	
Spirit or alcohol	204 (85.0)
Saltwater/Nothing	18 (7.5)
Others	18 (7.5)
<b>Overall Cord Care</b>	
Poor cord care	7 (2.9)
Good cord care	234 (97.1)
<b>Thermal care</b>	
<b>Warmth for the new-born/drying of the baby</b>	
Before the placenta is delivered	125 (51.9)
After the placenta is delivered	93 (38.6)
After the delivery is complete	22 (9.1)
Baby not dried just wrapped	1 (0.4)
<b>Warmth for the new-born/wrapping of the baby</b>	
Before the placenta is delivered	112 (46.5)
After the placenta is delivered	125 (51.9)
Long after the delivery has been concluded	4 (1.6)
<b>Warmth for the new-born/Timing of first bathing</b>	
Immediately after delivery of the baby	42 (17.4)
Within 6 h of delivery	37 (15.4)
7–23 h after delivery	60 (24.9)
Second day or later	102 (42.3)
<b>Overall thermal care</b>	
poor thermal care	152 (63.1)
good thermal care	89 (36.9)
<b>Newborn vaccination status</b>	
<b>Immunization</b>	
Received BCG	213 (88.4)
Did not receive BCG	28 (11.6)
Received Polio	207 (85.9)
Did not receive Polio	34 (14.1)
<b>Overall immunization status</b>	
Incomplete newborn vaccination	36 (14.9)
Complete newborn vaccination	205 (85.1)

respectively. On the whole, 205 (85.1%) of the participants were adjudged to have reported complete newborn vaccination practices, while the remaining 36 (14.9%) had incomplete newborn vaccination practices.

### 3.3. Relationship between ANC visits and neonatal cord care practices

Table 3 shows the result of the exploratory logistic regression analysis assessing the association between participant characteristics and cord care. The overall model was statistically significant when compared to the null model, ( $\chi^2(3) = 20.94, p < 0.001$ ), and explained 36.0% of the variation of cord care (Nagelkerke  $R^2$ ), and correctly predicted 97.1% of cases. The model also demonstrated a good fit to the underlying data (Hosmer-Lemeshow  $\chi^2(3) = 2.39, p = 0.50$ ). Sufficient ANC visits (aOR = 8.0,  $p = 0.02$ ) and place of delivery (aOR = 10.6,  $p = 0.01$ ) were significant, but age (aOR = 4.8,  $p = 0.08$ ) was not. However, the model may be unstable given the few [7] of participants with poor outcome and the corresponding wide confidence intervals.

### 3.4. Relationship between ANC visits and neonatal thermal care practices

Table 4 shows the result of the exploratory logistic regression analysis assessing the association between participant characteristics and thermal care. The result of the binary analysis showed that none of the considered factors was associated with neonatal thermal care practices. Since there were not statistically significant associations at  $p \leq 0.1$ , a regression analysis was deemed unnecessary.

### 3.5. Relationship between ANC visits and neonatal immunization practices

Table 5 shows the result of the exploratory logistic regression analysis assessing the association between participant characteristics and neonatal immunization practices. The result of the binary analysis showed that none of the considered factors was associated with neonatal immunization practices. Since there were not statistically significant associations at  $p \leq 0.1$ , a regression analysis was deemed unnecessary. Also, the number of participants with incomplete vaccination is small, and as such, the model might have been relatively unstable.

## 4. Discussion

Contrary to the prevailing country policy, the health facilities in our study district still practice the traditional ANC delivery model even though the WHO has since reviewed its recommendation concerning ANC delivery on two occasions. In 2002, the WHO proposed the focused antenatal model in recognition of the failings of the traditional model. The traditional ANC model focused on the quantity not the quality of care, with women being expected to have multiple ANC visits irrespective of the risk level of the pregnancy, and the care itself was concerned with pregnancy-related issues alone. Women with normal pregnancies are expected to have a minimum of four visits to have adequate exposure to ANC services, including education to promote neonatal care and immunization. On the other hand, the Focused ANC model was the result of a 2001 multi-country randomized controlled trial and systematic review and was based on risk stratification. The WHO found that FANC had similar pregnancy outcomes and was more cost-effective compared with the traditional model. The model was hinged on early detection of complications, individualized care, and evidence-based ANC practice [18, 25, 26]. Nigeria adopted the Focused ANC model of care. In 2016, when it was apparent that the FANC was not achieving the desired goals, the WHO launched "positive pregnancy experience" approach, which required more frequent (eight or more) ANC visits with a projection of reducing perinatal deaths by 8 in every 1000 live births [14]. The continued practice of the traditional ANC model in our study site despite the policy changes of about twenty (FANC) and five (positive pregnancy experiences) years, is a classic

**Table 3.** Cord care and demographic characteristics.

Variable	poor cord care n (%)	good cord care n (%)	UOR [95% CI]	p-value	aOR [95% CI]	p-value
<b>Sufficient ANC**</b>						
No (0–3 visits)	5 (13.5)	32 (88.5)				
Yes (>= 4 visits)	2 (1.0)	202 (99.0)	15.8 [2.9–84.82]	0.001	8.0 [1.4–47.1]	0.02*
<b>Age**</b>						
15–24	4 (8.5)	43 (91.5)				
25–41	3 (1.5)	191 (98.5)	5.92 [1.3–27.4]	0.02	4.8 [0.8–26.8]	0.08
<b>Marital status</b>						
Married	7 (3.0)	228 (97.0)				
Single/widowed	0 (0.0)	6 (100.0)	49597911 [0.000]	1.00		
<b>Education</b>						
Non or primary	1 (4.8)	20 (95.2)				
Secondary plus	6 (2.7)	214 (97.3)	1.8 [0.2–15.6]	0.60		
<b>Parity**</b>						
Primiparous	4 (5.4)	70 (94.6)				
Multiparous	3 (1.8)	164 (98.2)	3.1 [0.7–14.3]	0.14		
<b>Place of delivery**</b>						
Outside health facility	5 (11.6)	38 (88.4)				
Health facility	2 (1.0)	196 (99.0)	12.9 [2.4–68.9]	0.003	10.6 [1.7–65.0]	0.01*
<b>Source of income</b>						
Regular	1 (3.3)	29 (96.7)				
Non-regular	6 (2.8)	205 (97.2)	1.2 [0.1–10.1]	0.88		

\*\*For initial inclusion in multivariable model; \*p-is less than 0.05; UOR = unadjusted odds ratio; aOR = adjusted odds ratio; (95% CI) Confidence Interval at 95%.

**Table 4.** Thermal care and demographic characteristics.

Variable	poor thermal care n (%)	good thermal care n (%)	UOR [95% CI]	p-value
<b>Sufficient ANC**</b>				
No (0–3 visits)	24 (64.9)	13 (35.1)		
Yes (>= 4 visits)	128 (62.7)	76 (37.3)	1.1 [0.5–2.3]	0.81
<b>Age**</b>				
15–24	25 (53.2)	22 (46.8)		
25–41	127 (65.5)	67 (34.5)	0.6 [0.3–1.1]	0.12
<b>Marital status</b>				
Married	147 (62.6)	88 (37.4)		
Single/widowed	5 (83.3)	1 (16.7)	0.3 [0.0–2.9]	0.32
<b>Education**</b>				
Non or primary	16 (76.2)	5 (23.8)		
Secondary plus	136 (61.8)	84 (38.2)	2.0 [0.7–5.56]	0.20
<b>Parity</b>				
Primiparous	44 (59.5)	30 (40.5)		
Multiparous	108 (64.7)	59 (35.3)	0.8 [0.5–1.4]	0.44
<b>Place of delivery**</b>				
Outside health facility	31 (72.1)	12 (27.9)		
Health facility	121 (61.1)	77 (38.9)	1.6 [0.8–3.4]	0.18
<b>Source of income**</b>				
Regular	19 (63.3)	11 (36.7)		
Non-regular	133 (63.0)	78 (37.0)	1.0 [0.5–2.2]	0.98

\*\*For initial inclusion in multivariable model; \*p-is less than 0.05; UOR = unadjusted odds ratio; (95% CI) Confidence Interval at 95%.

**Table 5.** Newborn vaccination and demographic characteristics.

Variable	Incomplete vaccination n (%)	Complete vaccination n (%)	UOR [95% CI]	p-value
<b>Sufficient ANC**</b>				
No (0–3 visits)	8 [21.6]	29 [78.4]		
Yes (>= 4 visits)	28 [13.7]	176 [86.3]	1.7 [0.7–4.2]	0.22
<b>Age**</b>				
15–24	6 [12.8]	41 [87.2]		
25–41	30 [15.5]	164 [84.5]	0.8 [0.3–2.1]	0.64
<b>Marital status</b>				
Married	36 [15.3]	199 [84.7]		
Single/widowed	0 [0.0]	6 [100.0]	0.9 [0.8–0.9]	0.60
<b>Education**</b>				
Non or primary	3 [14.3]	18 [85.7]		
Secondary plus	33 [15.0]	187 [85.0]	0.9 [0.3–3.4]	0.93
<b>Parity</b>				
Primiparous	8 [10.8]	66 [89.2]		
Multiparous	28 [16.8]	139 [83.2]	0.6 [0.3–1.4]	0.23
<b>Place of delivery**</b>				
Outside health facility	9 [20.9]	34 [79.1]		
Health facility	27 [13.6]	171 [86.4]	1.7 [0.7–3.9]	0.22
<b>Source of income**</b>				
Regular	7 (23.3)	23 (76.7)		
Non-regular	29 (13.7)	182 (86.3)	1.9 [0.8–4.9]	0.17

\*\*For initial inclusion in multivariable model; \*p-is less than 0.05; UOR = unadjusted odds ratio; (95% CI) Confidence Interval at 95%.

example of the policy-implementation disconnect that characterizes the health system in Nigeria and many other low and middle-income countries. The disconnect between policy and implementation is recognized as a major barrier to national development in Nigeria [27, 28, 29] and relevant stakeholders require intentionality in political commitment, role definition, coordination, and commitment to bridge this gap. Nigeria may need to adopt the current positive pregnancy experience approach in practice, since the mortality and perinatal mortality rates remain high, indicating that the traditional model is not achieving desired results.

Some (4.6%) of the women in our study did not attend ANC at all during the index pregnancy, while 74.6% had four or more visits. Compared to national rates, more participants attended ANC (67.0%) and had four or more visits (57.0%), while the rates were similar to those reported in the southwest, Nigeria [21]. The provision of ANC services by skilled professionals helps to ensure that pregnancy is properly monitored and results in a reduction in their risk of morbidity and mortality, and protects the mother and baby before, during, and after delivery. The mean ANC visits of 6.6 fall short of the eight currently recommended by the WHO, and is much lower than the 16 or higher that is expected in the traditional ANC model. Suboptimal ANC attendance may predispose to poor neonatal outcomes because of inadequate infection screening, treatment, and prevention services [30]. Universal ANC attendance, at least eight times, is desirable but attaining this requires commitment and a clear plan to generate necessary evidence and all the transformation of the data to effective and sustainable interventions to improve access and uptake of antenatal care services. Suboptimal ANC attendance may predispose to poor neonatal outcomes [31].

The proportion of women who had their delivery at health facilities (82.2%) was higher than the national average of 39.0% but comparable with the southwest region (76.3%) as obtained from the National Demographic and Health Survey [21]. Access to quality medical services in a hygienic environment has implications for reduced infections, pregnancy and delivery complications, and maternal and perinatal morbidity and mortality [32, 33]. Developing countries frequently report low rates of health facility delivery due to easy access to alternatives, the emergency nature of labor, and the fear of hospitals [34]. The implication is that access to skilled birth attendants is limited and a significant challenge to the attainment of the Sustainable Development Goals, therefore, exists. There is still a need for a coordinated drive towards universal skilled birth attendants for women in Nigeria and other developing countries. It is critical to generate high-quality evidence on the correlates of health facility delivery within the context of the SDG to support decision-making and design targeted interventions for enhancing facility delivery and improving the health outcomes of the mother and her baby.

Beyond the quantity, the quality of antenatal care is important, especially in settings of low resources, drug and equipment shortages, and poor-quality human resources. Our study used the report of neonatal care practices as a proxy for the quality of antenatal care. Our data suggest the presence of poor newborn care practices for thermal and vaccination status but optimal practices for cord care, although some poor cord care practices persist in the study population.

The prevalence of good cord care practices in our study is high compared to findings from Uganda and Bangladesh [9, 24]. This difference is likely due to inherent differences within the different population groups. The practice of using an unclean cloth to tie the cord, the use of old razors to cut the cord, and the use of animal dung to clean the cord were still in existence although not common. Unhygienic cord care practices including the use of potentially infectious material to clean the cord often away from the eyes of health professionals are widely reported in developing countries [9]. These practices are particularly difficult to eliminate and it may be more feasible to propose the use of more hygienic alternatives [35, 36, 37]. Women who attended at least four ANC visits and those who delivered in health facilities were more likely to practice good cord care. This finding is similar to what was found in Bangladesh [24] but a Ugandan study did not find an association between facility delivery and good cord care practices [9]. Other researchers found

secondary school education or more and regular income to be predictive of good care [9, 38], but this was not the case in the current study. Our study also revealed that older and multiparous women are more likely to have good cord care practices. This finding is similar to what was found in Eastern Nigeria, where demographic factors like parity, education, and occupation were related to cord care practices [39]. It is likely that education and experience resulting from the indicated factors put the women in a better position to care for their neonates umbilical cords.

The prevalence of good thermal care (36.9%) in our study is low but was higher than what was found among Ugandan (10.0%) and Bangladeshi (5.1%) mothers [9, 24]. However, this is consistent with findings concerning cord care in which our study demonstrates a higher prevalence of good practice. Neonatal care practices may be improving over time since these other studies were older having been conducted about a decade earlier. Many mothers in our study still delay drying and wrapping of newborns beyond the recommendation, while they do not delay bathing the babies till after 24 h. These malpractices are common in developing countries contrary to recommendations [22, 40]. These practices are even often propagated by health workers [41]. Poor thermal care may lead to hypothermia, which is a significant factor for morbidity and mortality in early neonatal life. Behavior change interventions for neonatal thermal care must be evidence-based and target both health workers and mothers. While we did not find ANC attendance or any of the other factors to be significantly associated with thermal care practices, Ugandan women who deliver in a health facility were more likely to practice good cord care but ANC attendance was not a predictor [9].

The neonatal vaccination status in our study was much better than the thermal practices but comparable with findings from other studies [9]. Neonatal vaccination is quite accessible to babies, especially those with facility deliveries because health workers make them available [42]. Besides, mothers and babies can have the services before discharge post-delivery so that there is no need to return to the facility. A significant proportion of our study population had facility delivery. Other factors that have been associated with good neonatal vaccination practices include a secondary or higher level of education, and primiparity [43, 44, 45].

#### 4.1. Implications for policy and practice

ANC as it is presently being practiced in the index population has not translated to appropriate newborn care practices. We expected that women with four or more ANC visits would report better neonatal care practices, but this was not the case except for cord care, which was very good in both groups. This raises critical questions about the delivery of ANC and challenges the insistence on the traditional model of ANC delivery. The quantity of ANC may be adequate but the quality is not effective in achieving the desired results. Besides the uptake of these services need to be near-universal if the SDGs will be achieved. These gaps and more are provided for in the WHO Recommendations on Antenatal Care for a Positive Pregnancy Experience [14]. Nigeria and similar developing countries must find innovative ways to implement person-centered care while prioritizing the health of women and their families. Implementing an essential core package of routine ANC will help bridge the current gaps in quality. Integrated care that includes clinical ANC health promotion that targets the misconceptions and other prevalent conditions will enrich the experiences of the women and enhance maternal and neonatal outcomes. The need for health systems interventions for improving the utilization and quality of ANC is more pressing now than ever. Nigeria should engender the commitment to bridge the policy-implementation gap if the SDG 3 of reducing neonatal mortality to 12 deaths per thousand live births or less by 2030 is to be attained [2].

#### 4.2. Limitations of the study

The cross-sectional nature of this study does not allow for precise causal inferences as far as factors that are associated with cord care,

thermal care, and neonatal vaccination are concerned (Outcome variables). Besides, delivery care was assessed through recall by lactating mothers of how such roles were carried out by health workers. There could, therefore, have been under or over-reporting distorting the findings of this study. The COVID-19 pandemic and the attending lockdowns and sundry challenges may have mitigated and could have contributed to the suboptimal ANC attendance seen in our study. Also, the inadequacy of the poor outcomes, particularly concerning cord care, implies instability of the regression models and possible residual model. At best, our findings in this respect are exploratory. The readers should, therefore, interpret the findings of the current study on the background of these limitations. Larger studies are needed. Furthermore, including qualitative interviews of mothers and/or health workers may have provided more detailed and helpful information to address the objectives of this study.

## 5. Conclusion

The prevailing antenatal care services are ineffective in preparing mothers for newborn care. Place and frequency of ANC have positive associations with umbilical cord care. There is a need to implement quality ANC that will enhance maternal and neonatal outcomes and implement innovative interventions to enhance ANC attendance. The WHO positive pregnancy experience model should be implemented.

## Declarations

### Author contribution statement

Adebola Omotosho: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Kolawole Sodeinde; Olufunmilola Abolurin; Adesola Adekoya: Performed the experiments; Wrote the paper.

Olumide Abiodun: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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### Data availability statement

Data will be made available on request.

### Declaration of interest's statement

The authors declare no conflict of interest.

### Additional information

No additional information is available for this paper.

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