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Examining Factors Influencing Antenatal Care Visits in Nigeria

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Abstract

The number of maternal deaths worldwide linked to pregnancy and childbirth is high in Nigeria. Meanwhile, attending the recommended number of antenatal care (ANC) appointments may help reduce maternal morbidity and death. This research sought to examine the factors influencing ANC visits in Nigeria. This study employed secondary data extracted from the Nigeria Demographic and Health Survey 2018. A total sample of 21,427 women was included. Data analysis was carried out using the Zero-Inflated Negative Binomial Regression. The level of significance was $p < 0.05$. Among the participants, 5,337 (24.9%) did not attend any ANC visits. As the number of visits increases, there is a gradual decrease in frequency, with 4 visits being the most common (12.7%). Findings revealed that place of residence, maternal education, insurance coverage, marital status, partner's education, region, and age of the mother consistently impacted additional ANC visits. While the place of residence, maternal education, insurance coverage, partner's education, region, and age of the mother impacted zero ANC visits. Policymakers should

focus on rural areas and those with lower education levels to improve ANC visits. Furthermore, specific attention should be given to pregnant women over 18 years of age to ensure they receive adequate ANC.

Keywords: Antenatal care visits; Zero-Inflated Negative Binomial Regression; Nigeria; Maternal health; Factors

INTRODUCTION

Antenatal care (ANC), also referred to as prenatal care, is an essential medical service experienced practitioners provide to pregnant women to support them during their pregnancy (Hinton, *et al.,* 2024). Interestingly, ANC is still a prominent measure to improve maternal health outcomes. It is provided by trained birth attendants to guarantee women's and children's health (Rahman, Yamaji, Nagamatsu & Ota, 2022). Additionally, ANC is essential in encouraging critical health behaviours and practices, like advocating for breastfeeding and emphasizing the importance of early postnatal care (Giles, *et al.,* 2020). Utilizing ANC services is important in reducing the alarming rates of maternal mortality (Effiong & Adhowhoarie, 2023). Antenatal care is an essential part of any healthcare plan to reduce the risk of stillbirths, premature labour, and pregnancy-related problems (Wastnedge, et al., 2021). Hence, women must receive adequate and timely ANC services to ensure a positive pregnancy experience.

However, the issue being investigated stems from the World Health Organization's (WHO) vision of a world in which "every pregnant woman and newborn receives quality care throughout the pregnancy, childbirth, and the postnatal period."(Heinonen, 2021). Still, Nigeria has some of the highest rates of maternal mortality worldwide, and efforts to lower these deaths have been sluggish because of the ongoing disregard for several contributory variables (Ope, 2020). The number of maternal deaths worldwide linked to pregnancy and childbirth has risen to 303,000 in recent years, with 99% of these tragedies occurring in underdeveloped countries (Adulo, Hassen & Chernet, 2022). This is despite the many benefits and strategies associated with ANC. Nigeria, in particular, is among these developing nations dealing with the highest rates of maternal mortality and morbidity.

Maternal mortality ratio (MMR) of 512 deaths per 100,000 live births was reported by the Nigeria Demographic and Health Survey (NDHS) 2018 (Olamijulo, Olorunfemi & Okunola, 2022). In the same year, according to the World Health Organization (WHO),

approximately 830 women per day died from pregnancy-related and childbirth-related avoidable, with 99% of these deaths occurring in underdeveloped countries like Nigeria (Oladipo & Akinware, 2023). According to WHO's latest report, Nigeria was responsible for 12% of all maternal, neonatal deaths, and stillbirths, with 540 women and children per thousand meeting a tragic fate in 2020 (WHO, 2024). The report also states that Nigeria has the second-highest rate of maternal, neonatal, and child fatalities globally, after India.

Meanwhile, attending the recommended number of antenatal care appointments may help to reduce maternal morbidity and death by identifying pregnancy-related issues and increasing the prevalence of facility-based deliveries (Aziz, et al., 2020). As such, it is imperative to explore the factors influencing antenatal care visits by reproductive-age women in Nigeria and, in the long run, develop more effective solutions to confront the daunting challenge of maternal mortality in Nigeria.

Numerous studies have highlighted that the frequency of antenatal care visits is influenced by various sociodemographic factors, including age, wealth status, geographical location, educational level, husband's occupation, marital status, and socioeconomic status (Tessema, et al., 2021). However, only a few considered Nigeria as a whole. Therefore, this study aims to examine the factors influencing antenatal care visits among reproductive-age women in Nigeria and propose effective solutions to address the maternal mortality challenge facing the country.

METHODS

Source of data

This research employed secondary data extracted from the NDHS 2018 since all the necessary information in the explanatory variables required for the research could only be extracted from the 2018 NDHS data. At the time of this study, the most recent survey was from 2018, covering the years 2013 to 2018. It was completed with the help of various foreign partners. The study's population includes 21,427 reproductive age mothers from the NDHS 2018. The information on individuals who participated in the survey was extracted for use in this study. The outcome variable for this study was the number of antenatal care visits, while the independent variables include: place of residence, maternal education, covered by health insurance, marital status, partner's education, religion and age groups.

Ethical considerations

The study relied on NDHS data that had been made publicly available. The organizations (NDHS) that ordered, paid for , or handled the surveys were responsible for their ethical practices. ICF International and an institutional review board in each country have both approved all DHS surveys, ensuring that the protocols adhere to those established by the US Department of Health and Human Services for the protection of human subjects. Prior permission is not needed for the data to be used by a third partner.

Method of data analysis

In this study, the models that were adopted are Poisson Regression, Negative Binomial Regression, Zero-Inflated Binomial Regression, and Zero-Inflated Negative Binomial (ZINB) Regression. $p < 0.05$ was considered to be statistically significant. The details of these methods can be found in our earlier research work (Bamigbala & Ojetunde, 2023).

RESULTS

Table 1 shows the socio-demographic characteristics of the respondents. Out of all the 21,427 antenatal care visit data collected, the data reveals that most respondents reside in urban areas (72.3%) compared to rural areas (27.7%). A substantial portion of respondents have no education (54.3%), which is the largest category. This is followed by those with primary education (21.3%). On health insurance coverage, the majority of respondents (97.8%) are not covered by health insurance. Regarding marital status, the data shows a percentage of married participants (94.3%), followed by single (4.3%) and separated (1.5%). Partner education levels vary, with a significant portion having no education (40.8%) or secondary education (28.4%). The majority of respondents identify as Muslim (62.6%), followed by Christian (36.9%), and a small percentage belong to other religions (.4%). The data indicates that the vast majority of participants are 18 years of age and older (91.6%), while a smaller percentage are less than 18 years old (8.4%).

Table 1: Demographic characteristics of the respondents

Factors	Categories	Frequency	Percentage
Place of Residence	Rural	5933	27.7
	Urban	15494	72.3
	Total	**21427**	**100.0**
Maternal Education	No Education	11631	54.3
	Primary Education	4565	21.3
	Secondary	3988	18.6
	Education	1243	5.8
	Tertiary Education	**21427**	**100.0**
	Total		
Covered by Health Insurance	No	20965	97.8
	Yes	462	2.2
	Total	**21427**	**100.0**
Marital Status	Married	20201	94.3
	Separated	315	1.5
	Single	911	4.3
	Total	**21427**	**100.0**
Partner Education	No Education	8738	40.8
	Primary Education	3503	16.3
	Secondary	6090	28.4
	Education	3096	14.4
	Tertiary Education	**21427**	**100.0**
	Total		
Religions	Christian	7915	36.9
	Muslim	13420	62.6
	Others	92	.4
	Total	**21427**	**100.0**
Age Groups	18 years and Above	19621	91.6
	Less than 18years	1806	8.4
	Total	**21427**	**100.0**

Factors associated with ANC visit using Chi-Square test

Table 2 displays results from Chi-Square tests assessing factors influencing Antenatal Care (ANC) visits. The data reveals significant associations between ANC visits and several variables. The Chi-Square tests confirm significant relationships between place of residence, maternal education, wealth index, marital status, partner education, religious affiliation, and age groups with ANC visits, providing valuable insights for targeted

interventions to improve ANC attendance. However, health insurance coverage does not show a significant association with ANC visits.

Table 2: Assessing Associations between demographic characteristics of the respondents with ANC Visits Using Chi-Square Test

Factors	χ^2-Value	p-value	Remark
Place of residence	194.397	0.0000	Significant
Maternal education	130.431	0.0000	Significant
Covered by health insurance	15.482	0.115	Not Significant
Marital status	61.973	0.0000	Significant
Partner education	129.655	0.0000	Significant
Religions	249.640	0.0000	Significant
Age groups	5945.889	0.0000	Significant

Numbers of ANC visits

Table 3 shows the distribution of Antenatal Care (ANC) visits among participants, presenting the mean and variance of ANC visits. The average number of ANC visits per participant is 4.62, with a variance of 18.706. This indicates the presence of overdispersion in the data on ANC visits, as the variance exceeds the mean. Among the participants, the majority (24.9%) did not attend any ANC visits. As the number of visits increases, there is a gradual decrease in frequency, with 4 visits being the most common. The range of ANC visits spans from 0 to 20, illustrating diverse attendance patterns within the group. This comprehensive view of ANC visit distribution sheds light on the varied engagement levels among participants and emphasizes the need for tailored interventions to improve ANC utilization across the spectrum of attendees.

Table 3: Numbers of ANC visits

Factors	Categories	Frequency	Percentage
ANC Visits			
	0	5337	24.9
	1	583	2.7
	2	968	4.5
	3	2241	10.5
	4	2716	12.7
	5	2344	10.9
	6	2090	9.8
	7	1055	4.9
	8	1079	5.0
	9	439	2.0
	10	806	3.8
	11	160	.7
	12	472	2.2
	13	80	.4
	14	113	.5
	15	231	1.1
	16	166	.8
	17	56	.3
	18	115	.5
	19	33	.2
	20	343	1.6
	Total	**21427**	**100.0**
	Mean 4.62		
	Variance 18.70		

Models comparison using AIC and BIC

In Table 4, the models were compared using two commonly used criteria for model selection: the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). Lower values of AIC and BIC indicate better model fit relative to the other models being compared. The Zero Inflated Negative Binomial Regression had the lowest AIC

(**101400.2**) and BIC (**101663.3**) among all the models, indicating it provides the best fit to the data.

Table 4: Models Comparison Using AIC and BIC

Models	AIC	BIC
Poisson (P) regression	135577.0	135705.1
Negative Binomial (NB) regression	108934.0	109069.1
Zero Inflated Poisson (ZIP) regression	108061.7	108316.9
Zero Inflated Negative Binomial (ZINB) regression	**101400.2***	**101663.3***

**** Best fit Model.***

Factors influencing additional ANC visits

In Table 5, examining the impact of place of residence on ANC visits, the negative coefficient suggests that rural residents are less motivated to have additional ANC visits compared to urban residents when all other factors are constant. Regarding maternal education, the estimate is -0.04932 for those with primary education, which is statistically significant due to a p-value lower than 0.05. The odds ratio is close to 1, indicating minimal effect.

For those covered by insurance, the estimate is 0.20932, indicating a significant association with higher odds of additional ANC visits. In terms of marital status, being separated shows an estimate of 0.16454, significant and indicating higher odds of about 18% additional ANC visits compared to being married. Conversely, being single has an estimate of -0.05257 and is also statistically significant. The negative coefficient suggests that single mothers are less motivated to have ANC visits compared to married women.

Regarding partner education, primary education has an estimate of 0.04504, which is significant, indicating about a 4.6% increase in the odds of additional ANC visits. Secondary education, with an estimate of 0.05075, is also significant, showing a slightly stronger effect than primary education. Tertiary education, with an estimate of 0.07786, is significant, suggesting the highest increase in odds of additional ANC visits among the education categories. Examining religion, Muslim women have higher odds of additional ANC visits with an estimate of 0.17321. Conversely, women of other religions show a

negative estimate of -0.22643, which is significant, indicating lower odds of additional ANC visits compared to Christian women.

Lastly, considering the maternal age group, those below 18 years show an estimate of 1.16960, highly significant. This suggests that those below 18 years of age have much higher odds of additional ANC visits than those above 18 years.

Table 5: Count Model Coefficients (Negbin with Log Link)

Variables	Estimate	Standard Error	Z-value	P-value	Odd Ratio
Intercept	1.70656	0.03100	55.042	0.000000	5.509974
Place of Residence					
Urban (Ref)					1.000000
Rural	-0.09581	0.01392	-6.833	0.000000*	0.908636
Maternal Education					
No Education (Ref)					1.000000
Primary Education	-0.04932	0.01402	-3.519	0.000400*	0.951876
Secondary Education	-0.01382	0.01624	-0.851	0.394500	0.986275
Tertiary Education	-0.02766	0.02631	-1.051	0.293175	0.972719
Covered by Insurance					
No (Ref)					1.000000
Yes	0.20932	0.03536	5.919	0.000000*	1.232839
Marital Status					
Married (Ref)					1.000000
Separated	0.16454	0.04410	3.731	0.030189*	1.178850
Single	-0.05257	0.02425	-2.168	0.003183*	0.948787
Partner Education					
No Education (Ref)					1.000000
Primary Education	0.04504	0.01527	2.949	0.003183*	1.046069
Secondary Education	0.05075	0.01447	3.508	0.000452*	1.052059
Tertiary Education	0.07786	0.01833	4.248	0.000000*	1.080971
Region					
Christian (Ref)					1.000000
Muslim	0.17321	0.01203	14.397	0.000000*	1.189115
Others	-0.22643	0.08208	-2.759	0.005804*	0.797375
Age Group					
Above 18 years (Ref)					1.000000
Less than 18years	1.16960	0.06842	17.093	0.000000*	3.220704
Log(theta)	1.60619	0.02252	71.335	0.000000*	4.983786

* Statistically significant at p <0.05

Factors influencing zero ANC visits

The Zero Part Analysis in Table 6, represents the portion of the ZINB model specifically designed to analyze the occurrence of zero counts independently from positive counts. Concerning place of residence, the analysis reveals an estimate of 0.49287. The Odds ratio (1.637007) indicates that rural residents constitute about 63.7% odds of not attending ANC visits.

Examining maternal education, secondary education shows a negative estimate of -0.45718, which is significant, and the odds ratio of 0.633066 shows that mothers with secondary education decreased the log-odds of not attending any ANC visits compared to mothers with no education. Similarly, tertiary education has a significant negative estimate (-0.49224), indicating 38.9% odds of decreasing Zero ANC visits compared to women with no education.

For insurance coverage, the analysis shows an estimate of -0.24810, which is significant, and the odds ratio of 0.780281 implies that having insurance reduces the log-odds of not attending ANC visits by approximately 22% compared to individuals without insurance. However, partner education also demonstrates significant impacts, with primary education (vs. No Education) showing an estimate of -0.51733, secondary education at -0.55645, and tertiary education at -0.32696. These results indicate decreasing odds of not attending ANC visits with tertiary education having the highest odds of about 27.9% impact in reducing the log-likelihood of not attending ANC visits compared to partners with no education.

Analyzing religion, the estimate for Muslim (vs. Christian) individuals is -0.49377, significant, suggesting higher odds of approximately 39% of reducing the likelihood of not attending ANC visits. Lastly, examining the maternal age group, individuals below 18 years (vs. above 18 years) have a highly significant estimate of -5.12853, indicating significantly higher odds of reducing the likelihood of attending zero ANC visits.

Table 6: Zero-Inflation Model Coefficients (Binomial with Logit Link)

Variables	Estimate	Standard Error	Z-value	P-value	Odd Ratio
Intercept	-0.31312	0.11329	-2.764	0.005710	0.731162
Place of Residence					
Urban (Ref)					1.000000
Rural	0.49287	0.04987	9.882	0.000000*	1.637007
Maternal Education					
No Education (Ref)					1.000000
Primary Education	0.02950	0.05689	0.519	0.604090	1.029939
Secondary Education	-0.45718	0.07291	-6.271	0.000000*	0.633066
Tertiary Education	-0.49224	0.11417	-4.311	0.000000*	0.611255
Covered by Insurance					
No (Ref)					1.000000
Yes	-0.24810	0.12594	-1.970	0.048844*	0.780281
Marital Status					
Married (Ref)					1.000000
Separated	-0.37497	0.19853	-1.889	0.058930	0.687303
Single	-0.13804	0.09100	-1.517	0.129290	0.871063
Partner Education					
No Education (Ref)					1.000000
Primary Education	-0.51733	0.06521	-7.934	0.000000*	0.596110
Secondary Education	-0.55645	0.06052	-9.195	0.000000*	0.573240
Tertiary Education	-0.32696	0.07594	-4.306	0.000000*	0.721112
Religion					
Christian (Ref)					1.000000
Muslim	-0.49377	0.04922	-10.031	0.000000*	0.610321
Others	0.01477	0.28930	0.051	0.959290	1.014879
Age Group					
Above 18 years (Ref)					1.000000
Less than 18years	-5.12853	0.14036	-36.538	0.000000*	0.005925

* Statistically significant at $p < 0.05$

DISCUSSION

The findings from the analysis of factors influencing additional ANC visits and zero ANC visits reveal several significant associations. Firstly, rural residents are less likely to have additional ANC visits, with odds of 9.1% lower visits than urban residents. Maternal education (primary education) shows minimal impact on additional visits. Insurance coverage is associated with 23.28% higher odds of additional visits, and being separated

increases the odds; meanwhile, being single lowers the odds. Partner education (primary, secondary, and tertiary), especially tertiary education, significantly increases the odds. Muslim women have higher odds of additional visits compared to Christians, while other religions show lower odds. While those below 18 years had significantly higher odds of additional visits

For zero ANC visits, rural residents have 63.7% higher odds of not attending any ANC visits, while secondary and tertiary education reduces the odds of zero visits. Partner education, including primary, secondary, and tertiary education reduces these odds. Insurance coverage reduces the odds by about 14%. Muslims had a 38.8% likelihood of reducing zero ANC visits, while maternal age below 18 years significantly lowers the odds of zero visits.

In line with our findings, prior research on factors influencing 4 or more ANC contacts shows that women living in rural areas had a reduction in additional ANC contacts than their urban counterparts (Basha, 2019; Adewuyi, et al., 2018). These may result from disparities in how easily accessible health services are distributed between rural and urban areas (Basha, 2019; Adewuyi, et al., 2018; Goli, et al., 2018). When facilities are present, they may be unavailable due to bad road infrastructure, ineffective transportation, or extremely long distances (Adewuyi, et al., 2018). Furthermore, rural areas lack enough funding, making it difficult to attract and retain health staff (Fagbamigbe & Idemudia, 2015). Also, women in rural locations may have a worse socioeconomic level than their urban counterparts, making ANC service utilization less likely (Okedo-Alex, et al., 2019).

We also found a positive association between education and additional ANC contacts. According to studies, higher levels of education correlate with a higher prevalence and greater odds of additional ANC contacts (Hijazi et al., 2018; Islam & Masud, 2018; Tiruaynet & Muchie, 2019). It should be highlighted that education improves people's behaviour and health knowledge (Bamigbala, Ojetunde & Ibrahim, 2002; Bamigbala, Ojetunde & Okorie, 2002; Okoro, Bamigbala, et al., 2022). Maternal education corresponds with the use of basic maternal healthcare (Bamigbala, Ojetunde & Tanko, 2024) including ANC, whereas a lack of formal education is associated with underutilization or non-usage of ANC (Adewuyi, 2018). Maternal education can increase healthcare literacy, making them more aware of risk indications and potentially able to identify pregnancy difficulties. Furthermore, it can improve women's socioeconomic status and position, decision-making

power (Dimbuene, et al., 2018), and confidence in taking health-related measures (Tekelab et al., 2019; Mekonnen, Dune & Perz, 2019). Pregnant women with a greater degree of education, as well as their spouses with a higher level of education, may make better collaborative decisions about obtaining health care throughout pregnancy (Bolarinwa, et al., 2021).

In tandem with the result of this study, a few other studies discovered that younger women attended ANC clinics more frequently than older ones. This could be attributed to their relative lack of childbearing experience (low parity), as they may be newlyweds or teens, and hence more inclined to seek ANC early than their older counterparts due to pregnancy ignorance/limited awareness. Early studies have linked low parity to early ANC booking and an increase in the frequency of ANC contacts (Akowuah, et al., 2018; Mwase, et al., 2018; Yaya, et al., 2018).

Also, in line with the result of this study, other studies have found that women without health insurance had lower rates of early commencement and at least four ANC visits (Okedo-Alex, et al., 2019). Women face unique health demands during pregnancy and childbirth, necessitating the use of ANC services. However, due to poor income and financial dependency, women are generally less willing to pay for insurance than males (Adebayo, et al., 2015). To reduce maternal morbidity and mortality, ANC and other maternal health care should be provided for free or at a reduced charge.

CONCLUSION

Based on the findings of this study, policymakers should focus on rural areas to improve ANC attendance, and those with lower education levels. Also, educating partners, especially those with no education, could also improve ANC attendance. Furthermore, specific attention should be given to pregnant women over 18 years to ensure they receive adequate ANC, which in turn will decrease the mortality rate in Nigeria.

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