

Modelling determinants of antenatal care services utilization in Nigeria

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ABSTRACT

Sensitization to antenatal care (ANC) services utilization has increased as a result of the increase in the number of maternal deaths in Nigeria. Hence, this study examined the determinants of ANC services utilization among women (15 – 49 years old) in Nigeria. Data from the Nigeria Demographic and Health Surveys (NDHS) for 2013 was used in this study. The responses to ANC checkups for the mother of most recent child was used to measure whether the respondent utilizes the ANC services. The Chi-squared test of independence was used to test the significant association between the response variable and each of the selected factors that are associated with the response. Also, a generalized logistic regression analysis was used to measure the effects of the selected factors that are associated with the use ANC services. The findings indicated that all the selected factors except husband's working status influenced the use of ANC services (P -values < 0.05). However, health enlightenment programmes that will sensitize and encourage women living in the rural area, women with no education, women with no occupation and women with low income from all part of Nigeria on the need to utilize ANC services should be employed on media outlets.

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Introduction

Antenatal care is an important factor in the survival of both the expectant mothers and their unborn children. According to the World Health Organization (Organization, 2019), the majority of the world's maternal deaths (99%) occur in developing countries such as Nigeria. There is high risk of maternal death and morbidity arising during and after pregnancy (Organization, 2005). The key cause of these health problems is inability to visit hospital for ANC checkup and a lack of ANC facility utilization (Kawungezi *et al.*, 2015).

Different studies have confirmed that a lack of ANC is a risk factor for maternal death such as Kwast (Kwast, 1989), Bhatia (Bhatia, 1993), Bhattia and Cleland (Bhatia & Cleland, 1995). Several factors have been associated with decrease in maternal death. For instance, educating women on the importance of utilizing ANC is crucial to decreasing maternal mortality (Ali & Adam, 2011; Efendi, Chen, Kurniati, & Berliana, 2017; Nuraini & Parker, 2005). Women of reproductive age (15-49) are to be educated to identify and act on some symptoms that can likely results to serious health complications during or after

pregnancy. It is also observed that utilizing ANC services provides significant improvements to maternal and neonatal outcomes (Rai, Singh, & Singh, 2012; Ram & Singh, 2006).

This study is intended to identify determinants of ANC service utilization among selected socio-demographical and maternal factors among women of reproductive age in Nigeria. The impacts of the identified risk factors of ANC utilization shall also be examined.

Findings from this study will assist policy makers, government agencies and international health organizations by providing information regarding the impact of various health intervention programs targeted at reducing maternal mortality rate (MMR) in Nigeria through adequate utilization of ANC services.

Material and Methods

Setting

The study makes use of data extracted from NDHS conducted in 2013. Nigeria is the most populous African country and seventh most populous country in the world with an estimated population of over 170 million (National Population Commission - NPC/Nigeria & ICF International, 2014). The country is divided into geopolitical zones namely, South-West (SW), South-East (SE), South-South (SS), North-West (NW), North-East (NE) and North-Central (NC). Each of the geopolitical zones is divided into states coming to a total of 36, with the Federal Capital Territory in Abuja (NPF and ICF 2014). According to previous reports, 61% of women of reproductive age received ANC in 2013 as compared to 58% in 2008 (National Population Commission - NPC/Nigeria & ICF International, 2014). This reflects a slight improvement in the use of ANC service. Similarly, it was observed from the reports that 46% of women who are under 20 years old did not attend the ANC in 2013 while 50% of women in this age group did not receive ANC 2008. Also, from the same report, 47% of women (15 – 49 years) who lived in rural areas did not receive ANC compare to 11% of women in urban area (National Population Commission - NPC/Nigeria & ICF International, 2014).

The 2013 NDHS was carried out by National Population Commission (NPC) in collaboration and support from United States Agency for International Development in Nigeria (USAID/Nigeria), United Nations Children's Fund (UNICEF) and Inner City Fund (ICF) among others to specifically collect adequate and up to date information on levels of fertility, marriages, use of family planning methods etc. The target groups in this study were women of reproductive age that were randomly selected in different households across Nigeria (National Population Commission - NPC/Nigeria & ICF International, 2014).

Data

The data used in this study is based on National population survey that was conducted through a multistage stratified design by the National Population Commission (NPC) through the Nigeria Demographic and Health Surveys (NDHS) for 2013. The survey included information on women of reproductive age. The data contains information on some fertility and mortality variables and also information regarding the use of ANC services. Details of the survey and more information about the data have been previously reported by NPC and ICF (National Population Commission - NPC/Nigeria & ICF International, 2014).

The Children's Recode dataset for the NDHS 2013 used in this study and can be obtained at https://dhsprogram.com/data/dataset/Nigeria_Standard-DHS_2013.cfm?flag=0. The electronic data is available from the DHS Program under its terms of use. Before downloading the data, users must register as a DHS user for reasons laid out on the DHS program website and dataset access is only granted for legitimate research purposes.

The data contained socio-demographic and maternal related responses from 8,658 mothers of reproductive age with at least one child. However, complete information on the selected factors (predictor variables) considered in this study are available for only 5,217 respondents while the remaining respondents with incomplete information i.e. missing observations on the same factors considered were excluded from the analysis. Hence, all analyses were based on 5,217 female respondents.

Response variable

The response variable also known as the dependent variable used in this study was based on the question on whether or not the respondent utilizes the ANC services. The response to the question was based on the following binary categorical scale: 1 if "Yes" (i.e. if the respondent utilized the ANC service facilities) and 0 if "No" (i.e. if the respondent does not utilized the ANC service facilities). This can be summarized below. That is,

$$Y_i = \begin{cases} 1 & : \text{if the respondent utilizes the ANC service facilities (Yes)} \\ 0 & : \text{if the respondent does not utilizes the ANC service facilities (No)} \end{cases} \quad (1)$$

Similar studies have used the same coding for the response variable (Adebayo, 2004; Babatunde Yahya & Adebayo, 2013).

Predictor variables

Information on other predictor (independent) variables as used in this study was also available. These include mother's (respondent's) current age which was grouped into seven classes, 15 – 19, 20 – 24, 25 – 29, 30 – 34, 35 – 39, 40 – 44 and 45 – 49 mother's level of education (No education, Primary, Secondary, and Higher), place of residence (urban or rural) of the respondent, wealth index (recoded as low income, middle income and high income) of the household where the respondent lived; religion affiliation (Catholic, other Christians, Islam and traditionalist) of the mother; exposure to mass media (yes or no), if the mother wanted the last child i.e. if the last child was planned or not (recoded as yes or no); mother's working status (recoded as working or not working); husband's working status (recoded as working or not working); husband's level of education (no education, primary, secondary and higher); geopolitical zones of the respondents (North West, North Central, North East, South East, South West and South South).

Ethics

The 2013 NDHS data used in this study was obtained via the Demographic and Health Surveys (DHS) under the fund from USAID. The survey was carried out by the NPC and investigation relied upon mysterious collection of information without any hints of recognizable fact on any of the respondents, therefore, no further ethical endorsement was necessary.

Statistical analysis

Descriptive statistics was used to determine the distribution of the respondent's sociodemographic and maternal factors with respect to ANC utilization. Similarly, as equally used in other studies such as Dubois and Girard 2003 (Dubois & Girard, 2003), Yahya and Adebayo 2013 (Babatunde Yahya & Adebayo, 2013), the employed statistical techniques assume that the responses as to the use of ANC obtained from individuals are independent of one another. Hence, Pearson Chi-squared (χ^2) test of association was used to determine if there was any association between the risk factors and responses regarding ANC utilization by respondents. A generalized logistic regression (GLR) approach was used to determine the relationships between ANC service utilization and its determinants among mothers.

Generally, the Logistic regression model,

$$f(y_i) = \ln \frac{P(y_i)}{1 - P(y_i)} \quad (2)$$

where

$$P(y_i = 1|X_1, X_2, \dots, X_k) = \frac{1}{1 + e^{-(\beta_0 + \sum_{i=1}^k \beta_i X_i)}} \quad (3)$$

determines the type of association that exist between a binary response variable and some independent variable(s) by converting the response variable to probability scores taking on values between zero and one. In this study, there are eleven variables and each has been labelled as follows;

X_1 - respondent's religion affiliation; X_2 - respondent's place of residence; X_3 - respondent's geopolitical zone; X_4 - respondent's husband educational level; X_5 - respondent's response to whether the last child was planned; X_6 - respondent's exposure to mass media; X_7 - respondent's age; X_8 - wealth index of the respondent's family; X_9 - husband of the respondent's working status; X_{10} - working status of the respondent; X_{11} - respondent's educational level.

The Omnibus test of model coefficients and Hosmer and Lemeshow statistic were employed to determine whether the explained variance in a set of data is significantly greater than the unexplained variance as described in an earlier study (Fagbamigbe & Idemudia, 2017) and goodness of fit of the model respectively. The analyses were performed using IBM SPSS 20.0.

Results

The average age of the mothers included in this study was 27.79 years with a standard deviation of 6.16. The minimum and maximum ages of mothers considered are 15 years and 49 years respectively. As noted in previous studies, place of residence, maternal education level and mother's age all play vital roles in determining women health and early child development (Awi & Alikor, 2006; Awogbenja & Dehinde, 2008; Babatunde Yahya & Adebayo, 2013). As shown in Table 1, more than 65% of the mothers lived in rural communities and more than a third (35.1%) of these mothers did not utilize ANC. More than 45% of illiterate women from the sample did not use ANC while about 30% of adolescent mothers (15 – 24 years) did not access ANC facilities.

Almost 56.4% of the mothers in this study lived in a household with no media exposure and 40.1% of this number did not use ANC service. Similarly, more than 70% of mothers with an occupation in this study utilized ANC services, as against 64.8% full-time house wives (mothers without occupation). Similarly, out of 99.5% of mothers whose husbands were employed, 73.4% of them used ANC services while 77.8% of mothers whose husbands were unemployed used ANC service. Additionally, 48.9% of mothers whose husbands are illiterate did not use ANC services and, conversely 93.7% of women married to husband who had obtained higher education visited ANC services.

With respect to religious affiliation, among 33.8% of mothers with Islamic affiliation did not utilize ANC services. ANC services were utilized by 88.0% of Catholic mothers and 85.8% of mothers of other Christian denomination. Traditionalist mothers had the lowest level of ANC service utilization (59.1%).

Looking at the data by geopolitical zone, North West geopolitical zone had the highest percentage (40.3%) of mothers who did not use ANC services. The South East has the highest use of ANC services (95.2%), followed by the South West with 92.5%. Of mothers from the North Central zone, 87.4% were utilizing ANC services while only 66.7% of mothers were in the North East.

Among mothers who answered that they wanted (or planned) the last child, 72.5% of them visited ANC services while 12.1% of women who did not want their last child do not visit the ANC service.

Finally, among the wealth index of respondents involved in this study, 54.5% of women with low income utilize ANC services, 83.6% of women with middle income and 93.0% of women with high income utilize the ANC services respectively..

Chi-squared test of association

With exception of working status of the husband, all previously mentioned factors are significantly associated with ANC utilization (P-values are provided in Table 1).

Logistic regression

The result of the logit model that shows and measures the functional effect of the different levels of all the previously mentioned factors with respect to the use of ANC services is presented in Table 2. The result shows that each of the levels of Religion, Husband's working status and every unit increase in mother's age are not statistically significant at 5% level from the reference categories with respect to the use of ANC service. Also, the South East geopolitical zone has no significant difference in the use of ANC service with respect to the North central region.

The result in Table 2 contains the estimated Odds Ratio (OR), standard error (s.e) of the estimated regression model parameters (β), P – values of the estimates and 95% confidence interval of the estimated OR. The table also reports the percentage change in OR for a unit change in the level of each of the identified factors. The percentage change measures the increase (+) or decrease (–) in the risk of utilizing ANC service due to the influence of the level of the respective risk factor. The result of the Omnibus test of model coefficients (P value < 0.001) and Hosmer and Lemeshow's goodness-of-fit test (P value > 0.05) indicates the fitted model is adequate.

Table1: Frequency distribution of determinants of antenatal care facility Utilization in Nigeria

Determinants (Factors)	Factors' Levels	Antenatal Care visit		Total 5217 (100%)	P value
		Yes (1) 3830 (73.4%)	No (0) 1387 (26.6 %)		
Religion	Catholic	307 (88.0%)	42 (12.0%)	349 (6.7%)	< 0.001
	Other Christians	1327 (85.8%)	219 (14.2%)	1546 (29.6%)	
	Islam	2170 (66.2%)	1108 (33.8%)	3278 (62.8%)	
	Traditionalist	26 (59.1%)	18 (40.9%)	44 (0.8%)	
Place of residence	Rural	2313 (64.9%)	1251 (35.1%)	3564 (68.3%)	< 0.001
	Urban	1517 (91.8%)	136 (8.2%)	1653 (31.7%)	
Geopolitical Zones	North Central	730 (87.4%)	105 (12.6%)	835 (16.0%)	< 0.001
	North East	720 (66.7%)	359 (33.3%)	1079 (20.7%)	
	North West	1076 (59.7%)	726 (40.3%)	1802 (34.5%)	
	South East	299 (95.2%)	15 (4.8%)	314 (6.0%)	
	South South	426 (75.9%)	135 (24.1%)	561 (10.8%)	
	South West	579 (92.5%)	47 (7.5%)	626 (12.0%)	
Husband's Education	No Education	964 (51.1%)	923 (48.9%)	1887 (36.2%)	< 0.001
	Primary	809 (78.6%)	220 (21.4%)	1029 (19.7%)	
	Secondary	1383 (87.4%)	199 (12.6%)	1582 (30.3%)	
	Higher	674 (93.7%)	45 (6.3%)	719 (13.8%)	
Wanted the last child?	Yes	3548 (72.5%)	1348 (27.5%)	4896 (93.8%)	< 0.001
	No	282 (87.9%)	39 (12.1%)	321 (6.2%)	
Mass media exposure: (TV)	Yes	2068 (90.9%)	206 (9.1%)	2274 (43.6%)	< 0.001
	No	1762 (59.9%)	1181 (40.1%)	2943 (56.4%)	
Mother's Age	15-19	234 (62.2%)	142 (37.8%)	376 (7.2%)	< 0.001
	20-24	845 (72.0%)	329 (28.0%)	1174 (22.5%)	
	25-29	1217 (74.3%)	421 (25.7%)	1638 (31.4%)	
	30-34	855 (76.6%)	261 (23.4%)	1116 (21.4%)	
	35-39	515 (74.9%)	173 (25.1%)	688 (13.2%)	
	40-44	150 (74.3%)	52 (25.7%)	202 (3.9%)	
	45-49	14 (60.9%)	9 (39.1%)	23 (0.4%)	
Wealth index	Low Income	1318 (54.5%)	1102 (45.5%)	2420 (46.4%)	< 0.001
	Middle Income	793 (83.6%)	155 (16.4%)	948 (18.2%)	
	High Income	1719 (93.0%)	130 (7.0%)	1849 (35.4%)	
Husband's working status	Working	3809 (73.4%)	1381 (26.6%)	5190 (99.5%)	0.607*
	Not working	21 (77.8%)	6 (22.2%)	27 (0.5%)	
Mother's working status	Working	2776 (77.3%)	815 (22.7%)	3591 (68.8%)	<0.001
	Not working	1054 (64.8%)	572 (35.2%)	1626 (31.2%)	
Mother's Education	No Education	1386 (55.9%)	1094 (44.1%)	2480 (47.5%)	<0.001
	Primary	849 (82.5%)	180 (17.5%)	1029 (19.7%)	
	Secondary	1288 (92.5%)	105 (7.5%)	1393 (26.7%)	
	Higher	307 (97.5%)	8 (2.5%)	315 (6.0%)	

* indicates that the Chi-square test of independence is not significant at 5% level of significance.

Table 2: Result of logistic regression model of antenatal care service utilization on some selected socio-demographic and maternal factors.

Risk Factor	Risk Factor Levels	s.e. (β)	P value	OR (e^{β})	95% CI for OR		% Change in OR
					Lower	Upper	
Geopolitical Zones	North-Central (ref)						
	North-East	0.145	0.027	0.726	0.546	0.964	-27.4
	North-West	0.139	< 0.001	0.554	0.421	0.727	-44.6
	South-East	0.315	0.911*	0.966	0.521	1.790	-3.4
	South-South	0.189	< 0.001	0.132	0.091	0.192	-86.8
	South-West	0.215	0.013	0.586	0.385	0.893	-41.4
Husband's Education	No Education (ref)						
	Primary	0.106	< 0.001	1.927	1.566	2.372	+92.7
	Secondary	0.120	< 0.001	2.005	1.585	2.536	+100.5
	Higher	0.193	< 0.001	2.303	1.576	3.363	+130.3
Religion	Traditionist (ref)						
	Catholic	0.397	0.950*	1.049	0.482	2.284	+4.9
	Other Christian	0.367	0.631*	1.193	0.582	2.446	+19.3
Mother's Age	Islam	0.350	0.396*	1.346	0.678	2.674	+34.6
	Age	0.006	0.350*	1.006	0.994	1.017	+0.6
Place of Residence	Rural (ref)						
	Urban	0.121	< 0.001	1.613	1.272	2.045	+61.3
Wealth Index	Low Income (ref)						
	Middle Income	0.122	< 0.001	2.300	1.812	2.920	+130.0
	High Income	0.185	< 0.001	2.721	1.895	3.907	+172.1
Husband's working status	Not working (ref)						
	Working	0.566	0.073*	2.759	0.910	8.365	+175.9
Mother's working status	Not working (ref)						
	Working	0.079	0.001	1.314	1.126	1.534	+31.4
Mass media exposure (TV)	No (ref)						
	Yes	0.128	0.001	1.508	1.174	1.937	+50.8
Wanted last child?	No (ref)						
	Yes	0.195	0.028	0.651	0.444	0.954	-34.9
Mother's Education	No Education (ref)						
	Primary	0.119	< 0.001	2.030	1.607	2.565	+103.0
	Secondary	0.162	< 0.001	3.727	2.715	5.117	+272.7
	Higher	0.405	< 0.001	6.789	3.072	15.004	+578.9
	Constant	0.717	0.167	0.371			
	Nagelkerke R^2				0.348		

* indicates that the results is not significant at 5% level

Discussion

From the distribution of the ANC service utilization, of the 5,217 women of reproductive ages involve in this study as presented in Table 1, it is observed that more than two-third (73.4%) of the mothers in this study used ANC services. The implication of this is that about one-third of the mothers who do not utilize

ANC services are at high risk of maternal mortality. This is similar to a previous report that found over a third of pregnant women did not attend ANC services during pregnancy (Fagbamigbe & Idemudia, 2015). The mothers using ANC services will have improved maternal health, reduced chance of suffering from anemia, reduced chance of pregnancy induced hypertension, reduced chance of preterm labour, reduced chance of low birth weight and other risks associated with pregnancy when not utilizing ANC services as also reported in literature (Abbas, Rabeea, Abdel Hafiz, & Ahmed, 2017).

The result of the Chi-squared test in Table 1 shows that the use of ANC services by mothers is associated with each of the factors considered except the working status of the respondent's husband. This result is also supported by previous similar studies such as Efendi *et al.* (2017) and Yahya and Adebayo (2013). Similarly, the logistic regression result in table 2 also supports that working status of the respondent's husband does not affect mother's decisions ($P > 0.05$) on utilizing ANC services.

The geopolitical zone that the mothers resided had negative association with the use of ANC service when compared with the reference category. In more specific terms, mothers from North-East geopolitical zone have about 27.4% (OR = 0.726, $P = 0.027$), mothers from North-West have 44.6% (OR = 0.554, $P < 0.001$), mothers from South-South have about 86.8% (OR = 0.132, $P < 0.001$) and mothers from South-West have about 41.4% (OR = 0.586, $P = 0.013$) reduced chances of visiting the ANC service compare to mothers from the North-Central region of Nigeria. Only mothers from the South-East region has the same pattern of ANC usage with the North-Central and therefore it was not found to be significantly different ($P = 0.911$). Similar result was obtained in Yahya and Adebayo (Babatunde Yahya & Adebayo, 2013).

Mother's educational level and that of their husbands are positively associated with the use of ANC service in Nigeria. Mothers with primary, secondary or higher education has about 103%, 272.7% or 578% respectively increased chance of utilizing ANC services compared to mother with no education. Similarly, mothers whose husbands have obtained primary, secondary or higher education have a 92.7%, 100.5% or 130.3% respectively increased chance of using the ANC service compared to mothers with illiterate husbands (no education). This is also supported by previous finding from the literature Titaley *et al.* 2010 and Efendi *et al.* 2017.

Place of residence is positively associated with the use of ANC service in this study. The results in Table 2 show that mothers that lived in the urban areas are 61.3% more likely to use ANC services. This is consistency with existing results from the literature (Efendi *et al.*, 2017) and (Babatunde Yahya & Adebayo, 2013).

Furthermore, the result of wealth index indicates a significant association with ANC utilization which is also supported by the literature (Efendi *et al.*, 2017). Mothers who lived in a household with high income have a 172.1% increased chance of visiting ANC services than those living in a low-income household. Similarly, mothers in a middle-income household have a 130% increased chance of using the ANC service than living in a low-income household (Matijasevich *et al.*, 2012).

In term of working status of the mother, there is a positive significant relationship between those that are working and the use of ANC service. Those that are working have about 31.4% increase chance of using ANC services compared to those that are not working. This result is also supported by previous research (Ibor *et al.*, 2011).

Mass media exposure of mothers was also found to have a positive significant association with the use of ANC services as also reported in literature (Efendi *et al.* 2016). Mothers who are exposed to mass media in terms of watching television have a 50.8% increase chance of using ANC services compared to those that have no exposure to mass media.

Finally, the result of the question if the respondent wanted their last child was found to have negative significant with the use of ANC services. Mothers who responded “Yes” to wanting the last child had a 34.9% reduced chance of utilizing ANC services compared to mothers who responded “No”.

Conclusion

The results obtained in this study indicate an improvement in ANC service utilization from 65.1% earlier reported by Fagbamigbe and Idemudia (Fagbamigbe & Idemudia, 2017) using a data from the 2012 National HIV/AIDS and Reproductive Health and Serological Survey (NARHS Plus) to 73.4% reported in this study. However, the results suggest that any programme or policy that will be created to further improve ANC service utilization should be targeted at women living in rural areas, women with no education, women with no occupation and women with low income from all parts of Nigeria. The results also suggest that ANC health programs should be advertised using mass media to increase sensitization.

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