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# Determinants of Antenatal Care Services Utilisation in Nigeria

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**Abstract**

This study reports on recent evidence on determinants of antenatal visits in Nigeria using data from Demographic and Health Surveys for 2003 and 2008. Using count data models, the results show that women education beyond primary education level increases significantly the likelihood that a pregnant woman would complete at least four antenatal visits before delivery. The results also show that household wealth status has significant positive effect on the number of visits before delivery. There are significant differences in the number of antenatal visits determined by geopolitical zones and the place of antenatal also determines significantly the number of visits. These findings suggest that there is room for policy to control the attitude of women to care utilisation during pregnancy by influencing their education level and income.

**Keywords:** Antenatal care, women, Negative binomial, Nigeria

## 1. Introduction

One of the Millennium Development Goals (MDGs) targets is to reduce by three quarters, between 1990 and 2015, the maternal mortality ratio in all countries. Maternal mortality is the most important indicator of maternal health and well-being in any country. As a result, it has been central to government health sector policies aimed at improving the overall health of the Nigerian population especially that of the women. The World Health Organization (WHO, 2004) has defined maternal mortality as "the death of a woman while

 

pregnant or within 42 days of a termination of a pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental and incidental causes." Available evidence indicates that Nigeria has some of the worst statistics relating to maternal mortality in the developing world. Worldwide, an estimated half a million women die each year from complications of pregnancy and childbirth. Of this, 55,000 maternal deaths occur in Nigeria alone (Nigerian Health Review (NHR), 2006; NPC, 2001). Thus, although Nigeria accounts for only 2% of the world's population, it accounts for 10% of the global estimates of maternal deaths. The reduction of maternal mortality represents a major challenge to Nigeria. Mid-way to the target date for achieving the MDG, the maternal mortality rate was expected to be 440 per 100,000 live births. The reality however shows that in the rural areas, it was 828 deaths per 100,000 live births, and 531 deaths per 100,000 live births in urban areas. Disparity was wide on zonal basis. When this is compared to a target of less than 75 live births per 100,000 by 2015, this clearly shows that the country is off the track. Maternal mortality is the highest in Africa with 1,100 mothers dying per 100,000 live births (WHO, 2006).

Nigerian Health Review (2006), reports that one of the major causes of maternal deaths is inadequate motherhood services such as antennal care. Approximately two-thirds of all Nigerian women and three-quarters of rural Nigerian women deliver outside of health facilities and without medically-skilled attendants present. Data from the Nigerian Demographic and Health Surveys 2003 indicate that among pregnant Nigerian women, only about 64% receive antenatal care from a qualified health care provider. There are wide regional variations, with only about 28% of women in the Northwest Zone and 54% in the Northeast Zone receiving antenatal care from trained health providers (NHR, 2006). The rest either do not receive antenatal care at all or receive care from untrained traditional birth attendants, herbalists, or religious diviners.

There are studies in Nigeria that have related maternal health to care utilisation and other risk factors. For example, Ibeh (2008) studied maternal mortality index in Nigeria in relation to care utilisation using Anambra state as case study and attributes high maternal mortality to poor socioeconomic development, weak health care system, low socioeconomic status of women, and socio-cultural barriers to care utilisation. He found that about 99.7 percent of women in the locality studied attended antenatal clinics with 92.3 percent of them making 4 or more visits before delivery. Okonofual, et.al (1992) studied risk factors that affect maternal mortality in Ile-Ife in Nigeria using 35 cases of maternal death that occurred during the period 1st October 1989 to 30 April 1991. The results showed that maternal deaths involved women who were younger and of poorer socioeconomic status. The results also showed lack of prenatal care among all women in the sample.

Aniebube and Aniebube (2010) studied the attitude of pregnant women to a new antenatal care model with four antenatal visits (focused antenatal care) using a cross-sectional survey data and multiple logistic regression analysis in Enugu, Nigeria. Only 20.3% of the parturient desired a change to the new model. The

 

most common reasons for desiring the change were convenience (65.1%) and cost considerations (24.1%). Awusi, et al (2009) investigated antenatal care (ANC) services utilization in Emevor village**,** Isoko South L.G.A of Delta State using a cross-sectional survey data as well as means, percentages and the student's t test/ chi-square (where applicable) statistical methods. The findings reveal that of the 200 women studied, 113 (57%) utilized antenatal care services during pregnancy while 87 (43%) did not. According to them, the 43% non- utilization rate was very high when compared to the less than 5% reported for industrialized countries. Chuku (2008) examines the role of antenatal care on small size at birth based on the 2003 Nigeria Demographic and Health Survey data with multi-stage cluster sampling procedure. The study finds that antenatal care as measured by tetanus toxoid injections and women who were provided guidance on where to go for pregnancy complications (a proxy for antenatal care) are associated with lower odds of giving birth to small-sized babies suggesting that the content of antenatal care is important in judging its quality and effect. Adesegun and Babalola (2009) used 2005 National HIV/AIDS and Reproductive Health Survey data and multilevel modeling to examine the determinants of maternal services utilization in Nigeria, with a focus on individual, household, community and state-level factors. The result indicate that only about three-fifths (60.3%) of the respondents used antenatal services at least once during their most recent pregnancy. So far studies have failed to estimate the magnitude of impact of household socioeconomic and other characteristics including the place of antenatal on the likelihood of attending antenatal. Our study is therefore different from these existing studies in Nigeria in the sense that we estimated a count data model of antenatal visits using two demographic and health and surveys data and ascertained the magnitude of impact of various factors on the number of antenatal visits.

## 2. Model Specification and Data

Since an antenatal visit is the outcome of interest which is a nonnegative integer or a count denoted by $y, \text{such that } y \in No = \{0,1,2,...\}$, following Cameron and Travedi (2009) the starting point in our modeling process is the Poisson Model. The objective is to analyse y in a regression setting, given a vector of K covariates X. The Univariate Poisson Distribution, denoted by Poisson (y\μ), for the number of occcurences of the event y over a fixed exposure period has the probability mass function

$$\Pr(Y = y) = \frac{e^{-\mu}\mu^{y}}{y!}, \qquad y = 0,1,2,... \qquad \text{.....2.1}$$

where E(Y)=μ and Var(Y)=μ. This is called the equidispersion property of the Poisson distribution.
According to Cameron and Travedi(2009), the equidispersion property is commonly violated in applied work, because overdispersion is common. As a result the conditional variance exceeds the conditional mean.

 

The presence of unobserved heterogeneity is the most common way to account for such additional dispersion. Cameron and Travedi argues that unobserved heterogeneity, which generates additional variability in y, can be generated by introducing multiplicative randomness where μ is replaced by μv, where v is random variable. Hence, y follows the distribution- Poisson (y\μv). if v is such that E(v)=1 and Var(v)= $\sigma^2$ , v preserves the mean and increases the dispersion such that E(y)=μ and Var(y)=μ(1+μ $\sigma^2$ )>E(y)=μ.

In a special case where v is approximately Gamma (1,α), where α is the variance parameter of the gamma distribution, the marginal distribution of y is a Poisson-gamma mixture called the negative binomial distribution denoted by NB(μ,α) whose probability mass function is given by

$$\Pr(Y = y \mid \mu, v) = \frac{\Gamma(\alpha^{-1} + y)}{\Gamma(\alpha^{-1})\Gamma(y+1)}\left(\frac{\alpha^{-1}}{\alpha^{-1}+\mu}\right)^{\alpha^{-1}}\left(\frac{\mu}{\mu+\alpha^{-1}}\right)^{y} \quad \text{.....2.2}$$

where $\Gamma(.)$ denotes the gamma integral that specializes to a factorial for an integral argument. Hence, the negative binomial model is more general than the Poisson model, because it accommodates overdispersion and reduces to the Poisson model as $\alpha \to 0$ . The covariates (X) in our empirical model are age, square of age, education level, location, literacy, wealth index, geopolitical zone, place of antenatal, and year dummy which equals 1 if year=2008 and equals 0 if year=2003.

The data used in the study were secondary data from the Nigeria Demographic and Health Surveys (NDHS) for 2003 and 2008 which were designed to provide estimates of population and health indicators for Nigeria as whole, urban and rural areas, and the six geo-political zones. Representative probability samples of 7,864 and 36,000 households were selected for the 2003 and 2008 NDHS sample respectively. The sample was selected using a stratified two-stage cluster design consisting of 365 clusters for 2003 and 888 clusters for 2008 and enumeration areas were developed from 1991 and 2006 population census frame respectively. In the second stage, a complete listing of households was carried out in each selected cluster. An average of 21 and 41 households was respectively selected in every cluster in 2003 and 2008 by equal probability systematic sampling. All women age 15-49 and all men age 15-59 who were residents of the households were interviewed. The instrument used for data collection was questionnaire.

## 3. Discussions on Findings

Table 1 shows the overall summary statistics of the variables while table 2 shows the summary statistics by geopolitical zones. The national average number of antenatal visits by a pregnant woman in Nigeria over the study period was about 4 times with high variability. That is, the standard deviation is higher than the mean

 

which is characteristic of this kind of distribution. The mean age of pregnant women is about 39 years with minimum of 15 and maximum of 49 years. This is uniformly distributed across the geopolitical zones as shown in table 2. Sector defined as urban shows an average of 0.27 indicating that about 73 percent of the sampled women were from the rural area. This is true in almost all the geopolitical zones except in the South East and South South with greater proportion of the sampled women coming from the urban area as shown in table 2. Since education level of women is coded 0 for no education, 1 for primary education, 2 for secondary and 3 for higher education, the mean value of 0.79 suggests majority of the women have low level of education. But a look at the zonal variation as shown in table 2 reveals that women sampled from the South have, on the average, higher level of education compared to the North. This is worst in the North West followed by the North East.

There is also evidence of low literacy rate as indicated by the low mean and this worst in the Northern geopolitical zones than in the South. The mean value of wealth index is 2.65, implying that majority of the households from where the pregnant women were drawn were of middle income, although significant number is below this mean, suggesting widespread national (asset) poverty. However, the zonal average shows that households drawn from the South have higher average wealth index compared to households in the North. Again, average wealth index in the North East and North West is below the national average. Looking at the place of antennal visits, we observe that more women visit government hospitals and health centers followed by the number that visits health centers and private hospitals and clinics. Zonal averages show that women in the North East and North West visit government hospitals and health centers more than women in the South especially in the South East.

Table 3 shows the distribution of the number of antennal visits in Nigeria over the sample period. About 41 percent of pregnant women did not visit any hospital or clinic during pregnancy and about 54 percent of the women made less than 4 visitds. Table 4 shows the results of the poisson and negative binomial estimates of determinants of antenatal visits in Nigeria. Since the equidispersion property was violated we chose to account for the over dispersion by estimating a negative binomial model and compared the results with poisson estimates with robust standard errors. The corresponding marginal effects are also shown in the second and fourth columns of table 4. Since the negative binomial model is well-specified in the presence of over dispersion, we interpreted our results based on the estimates of the negative binomial model. The results indicate the importance of higher level of education of women on antenatal visits. For example, one additional level of education increases the number of antenatal visits relative women who have no education and this is statistically significant at the secondary and higher levels of education. Having secondary education increases the number of antenatal visits by about 8.6 percent, while having higher education increases antenatal visits by about 23.5 percent. In terms of marginal effects, having secondary education leads to an increase of about 1 more antenatal visit, whereas having a higher education leads to 3 more antenatal visits relative to women with no education. The effect of primary education on antenatal visits though positive, is not statistically significant. Household income proxied by wealth index has significant positive effect on the number of antenatal visits. For example, one unit increase in wealth index would increase antenatal visits by about 13.6 percent. In terms of marginal effects, one additional increase in wealth would lead to more than 1 increase in antenatal visits.

 

There are significant differences in antenatal visits by geopolitical zones. The base category in our model is North Central. Our results show that pregnant women in the North East and North West would have respectively 18 percent and 10.7 percent lower antenatal visits relative to North Central. In terms of marginal effects, antenatal visits in the North East and North West are respectively about 1 and 2 lower than in the North Central. On the other hand, our results show higher percentage increase in antenatal visits in the South East, South West, and South South relative to North Central and this corresponds to 29.8, 43.2 and 96.4 percent respectively. In terms of marginal effects, this translates to about 3, 5 and 13 more antennal visits respectively in the South East, South West, and South South relative to the North Central.

The results in table 4 show that the place of antenatal visits has significant impact on the number of antenatal visits and this varies also by geopolitical zones as shown in table 5. Overall we found that choosing government hospital, government health center and government health post or dispensary, decrease antenatal visits by 1.74 percent, 3.27 percent and 15.6 percent respectively. This reduction is not significant for health centers. These results reflect the carefree attitude of women that choose government hospitals for antenatal probably due to the fact that since many people choose government hospitals for antenatal because it is cheaper, the quality of care reduces and the likelihood that women would be forced to attend is low. On the other hand, private hospitals and others for antenatal increase the number of visits by 5 percent and 15.3 percent respectively. This might be due to the fact that private hospitals are more expensive and those who choose them are wealthier and are more likely to be serious or that private hospitals institute disciplines that make people that chose them visit more often. Our results show that between 2003 and 2008, antenatal visits declined significantly by about 11.8 percent. In terms of marginal effects, it implies that pregnant women in 2003 attended more than one additional antenatal visits compared to pregnant women in 2008. Our results show that antenatal visit increases in women age until the age of 44 when it begins to decrease. This might be due to experience or limited rate of pregnancy at that age. Living in urban area is, on the average, associated with about 3 percent increase in antenatal, this is not statistically significant.

Table 5 shows the estimates of the Negative Binomial model by geopolitical zones. The results show the differential effect of education on antenatal on zonal basis. Though, having secondary education has positive effect on antenatal visits in all the zones, this is only statistically significant in the North Central and North West. Again, the effect of higher education is statistically significant in the all the geopolitical zones except in the South West and South South. However, higher education has larger effect in the North Central and South East where it increases the number of antenatal visits by 42 percent and 45 percent respectively. The impact of additional increase in wealth index is significant and similar across the geopolitical zones. Living in the urban area has positive and significant effect on antenatal in North Central and North East leading to about 8 percent and 29 percent increase in antenatal visits. Surprisingly, living in urban area reduces antenatal visits in all other geopolitical zones and this is highly significant in the South East.

Regional estimates show mixed findings in terms of the effect of place of antenatal on the number of antenatal visits. The results show that government hospitals, health centers and health posts are more effective in promoting antenatal in the North East and North West, while they are less effective and in most cases have negative and significant impact on antenatal in other geopolitical zones. Private hospitals have positive impact on the number of antenatal visits in the Southern zones than in the North except perhaps in the North West. This is because; private hospitals are becoming more and more popular in the South than in the

 

North. Between 2003 and 2008, reduction in antenatal visits significantly occurred in all the geopolitical zones except in the North East that experienced 24.5 percent increase in the number of antenatal visits.

## 4. Recommendations and Conclusion

Our findings have important implications for the design of health policy especially as it concerns maternal health in Nigeria. First, policies that will increase the opportunity for women to have more years of education would have effective impact on utilisation of care in terms of number of antenatal visits. Our findings show that government owned health institutions are not being effective in encouraging women to attend antenatal care. Efforts should be made to reposition government hospitals and health centers to provide quality care and to introduce methods that would make it interesting for pregnant women to increase the number of visits. Health sector interventions should be regional specific instead of being holistic. Also, policies that will increase income generating activities by the household will be very effective in improving maternal health and thus move the country closer to MDG targets for maternal health by 2015.

## References

Adesegun, Fatusi and Babalola Stella. (2009). Determinants of Use of Maternal Health Services in Nigeria-Looking Beyonf Individual and Household Factors. *Biomed Central Pregnancy Childbirth*, Online Journal List, Vol 9.

Adewunmi, A. Rabiu, K. and Tayo, A. (2009). Gestational Age of at Antenatal Bookings in Lagos, South-West Nigeria . *The Internet Journal of Gynecology and Obstetrics*, ISSN: 1528-84339.

Aniebube, U. U. and Aniebube, P. N. (2010). Women's Perception as a Barrier to Focused Antenatal Care in Nigeria: The Issue of Fever Antenatal Visits. *Oxford Journals of Health Policy and Planning* , Vol: 26, Issue 5.

Awusi, V. O. . (2009). Determinants of Antenatal Care Services Utilization in Emevor Village, in Nigeria. *Benin Journal of postgraduate Medicine* , Vol. 11.

Cameron, C.A. and Trivedi, P.K. (2009). *Microeconometrics Using Stata.* College Station, Texas: Stata Press Publication.

Chuku, S. (2008). Low Birth Weight in Nigeria: Does Antenatal Care Matter. *Institute of Social Studies*.

Ibeh, C. C. (2008). Is Poor Maternal Mortality Index in Nigeria, a problem of Care Utilisation: A Case Study of Anambra State. *African Reproductive Health*, Vol. 12 No.2 pages 132-140.

Karl, peltzer and Banji, A. (2005). Utilisation of Antenatal Care in a Nigerian Teaching Hospital. *African Journal of Reproductive Health*, Vol. 9 No.3.

 

NPC (2000), *Nigerian Demographic and Health Survey (Nigeria DHS 1999).* Calverton, Maryland: National Population Commission and ORC/Macro.

NPC (2001), Children's and Women's rights in Nigeria: A Wake-up Call. Situation Assessment and Analysis. *National Planning Commission*.

Nwogu, E. C. (2009). Utilisation of Maternity Care in Nigeria. *Global Journal of Pure and Applied Sciences*, Vol.15, No.3: 439-437.

Okonofua, F. E.; A. Abejide and Roger, A. . (1992). Maternal Mortality in Ile-Ife, Nigeria: A Study of Risk Factors Studies in Family Planning. Vol 23 (5): 319-324.

WHO (2003), *Antenatal Care in Developing Countries.* Geneva: WHO Publications on Reproductive Health.

WHO (2004), *Lifetime Risk of Maternal Deaths.* Geneva: World Health Organisation.

**RESULTS APPENDIX**

**Table 1 Summary Statistics of the Variables (Overall)**

| | mean | sd | min | max |
|---|---|---|---|---|
| Antenatal visits | 3.61 | 3.73 | 0 | 10 |
| age | 29.22 | 7.44 | 15 | 49 |
| Urban | 0.27 | 0.45 | 0 | 1 |
| education level | 0.79 | 0.93 | 0 | 3 |
| literacy | 0.69 | 1.05 | 0 | 9 |
| wealth index | 2.65 | 1.38 | 1 | 5 |
| Region | 3.00 | 1.57 | 1 | 6 |
| **Place of Antenatal**: | | | | |
| govt. hospital | 0.50 | 1.06 | 0 | 9 |
| govt. health center | 0.38 | 1.06 | 0 | 9 |
| govt. health post | 0.15 | 1.01 | 0 | 9 |
| private hospital/clinic | 0.34 | 1.05 | 0 | 9 |
| others | 0.12 | 0.99 | 0 | 9 |
| Year==2008 | 0.82 | 0.38 | 0 | 1 |

 

**Table 2 Summary Statistics of the Variables by Geopolitical Zone**

| | NC | | NE | | NW | | SE | | SW | | SS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mean | sd | mean | sd | mean | sd | mean | sd | mean | sd | mean | sd |
| antinatal | 3.98 | 3.27 | 2.43 | 2.98 | 1.59 | 2.88 | 5.73 | 3.25 | 5.17 | 3.75 | 7.95 | 3.05 |
| age | 29.28 | 7.33 | 28.65 | 7.56 | 28.63 | 7.73 | 30.93 | 7.03 | 29.60 | 7.15 | 30.42 | 6.71 |
| Urban | 0.27 | 0.44 | 0.25 | 0.43 | 0.17 | 0.37 | 0.42 | 0.49 | 0.25 | 0.43 | 0.55 | 0.50 |
| educlevel | 0.93 | 0.92 | 0.42 | 0.74 | 0.29 | 0.65 | 1.47 | 0.84 | 1.55 | 0.75 | 1.53 | 0.89 |
| literacy | 0.74 | 1.08 | 0.36 | 0.86 | 0.28 | 0.80 | 1.27 | 1.02 | 1.33 | 1.12 | 1.43 | 1.03 |
| wealth index | 2.76 | 1.34 | 2.01 | 1.15 | 2.23 | 1.18 | 3.29 | 1.31 | 3.33 | 1.25 | 3.84 | 1.28 |
| **Place of** | | | | | | | | | | | | |
| **Antenatal**: | | | | | | | | | | | | |
| govt. hospital | 0.46 | 0.95 | 0.68 | 1.52 | 0.85 | 1.32 | 0.27 | 0.56 | 0.39 | 0.79 | 0.32 | 0.54 |
| govt hlth cter | 0.40 | 0.95 | 0.64 | 1.52 | 0.41 | 1.36 | 0.19 | 0.52 | 0.32 | 0.78 | 0.23 | 0.50 |
| govt hlth post | 0.14 | 0.88 | 0.36 | 1.52 | 0.24 | 1.34 | 0.02 | 0.36 | 0.05 | 0.67 | 0.02 | 0.30 |
| Prvt hospital | 0.33 | 0.94 | 0.30 | 1.52 | 0.28 | 1.35 | 0.49 | 0.60 | 0.28 | 0.77 | 0.39 | 0.56 |
| others | 0.09 | 0.86 | 0.27 | 1.51 | 0.20 | 1.33 | 0.03 | 0.38 | 0.06 | 0.67 | 0.04 | 0.34 |
| 2008(D) | 0.84 | 0.37 | 0.82 | 0.38 | 0.81 | 0.40 | 0.81 | 0.39 | 0.83 | 0.38 | 0.84 | 0.36 |
| Observations | 3721 | | 4785 | | 5723 | | 1429 | | 2119 | | 2177 | |

**Table 3 Distribution of Number of Antenatal Visits between 2003 and 2008**

| Antenatal Visits | freq | Pct(%) | Cumpct(%) |
|---|---|---|---|
| 0 | 8277 | 41.48 | 41.48 |
| 1 | 393 | 1.97 | 43.45 |
| 2 | 776 | 3.89 | 47.34 |
| 3 | 1328 | 6.66 | 53.99 |
| 4 | 1464 | 7.34 | 61.33 |
| 5 | 1338 | 6.71 | 68.04 |
| 6 | 1300 | 6.51 | 74.55 |
| 7 | 898 | 4.50 | 79.05 |
| 8 | 1014 | 5.08 | 84.13 |
| 9 | 357 | 1.79 | 85.92 |
| 10 or more | 2809 | 14.08 | 100.00 |
| Total | 19954 | 100.00 | |

 

**Table 4 Poisson and Negative Binomial Estimates of Determinants of Antenatal Visits in Nigeria**

| | Poisson | Margeff | Nbinomial | MargeffNB |
|---|---|---|---|---|
| antvsts | | | | |
| age | 0.0260* | 0.258* | 0.0161* | 0.159* |
| | (0.013) | (0.013) | (0.043) | (0.043) |
| agesq | -0.000337* | -0.00334* | -0.000183 | -0.00182 |
| | (0.044) | (0.044) | (0.146) | (0.146) |
| Urban | -0.00450 | -0.0447 | 0.0291 | 0.289 |
| | (0.839) | (0.839) | (0.108) | (0.109) |
| Primary | 0.00340 | 0.0338 | 0.00566 | 0.0561 |
| | (0.906) | (0.906) | (0.799) | (0.799) |
| Secondary | 0.0776* | 0.780* | 0.0856** | 0.861** |
| | (0.030) | (0.033) | (0.004) | (0.004) |
| Higher | 0.190*** | 2.048*** | 0.235*** | 2.577*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| literacy | 0.00521 | 0.0517 | 0.00346 | 0.0343 |
| | (0.677) | (0.677) | (0.739) | (0.739) |
| wealth index | 0.136*** | 1.354*** | 0.136*** | 1.345*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| North East | -0.214*** | -1.991*** | -0.180*** | -1.695*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| North West | -0.140*** | -1.317*** | -0.107*** | -1.022*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| South East | 0.281*** | 3.117*** | 0.298*** | 3.330*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| South West | 0.409*** | 4.732*** | 0.432*** | 5.032*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| South South | 0.922*** | 12.62*** | 0.964*** | 13.39*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| **Place of antenatal:** | | | | |
| Govt. hospital | -0.0414* | -0.411* | -0.0174 | -0.173 |
| | (0.035) | (0.035) | (0.312) | (0.312) |
| Govt. health center | -0.0197 | -0.196 | -0.0327 | -0.324 |
| | (0.348) | (0.348) | (0.071) | (0.071) |
| Govt. health post | -0.218*** | -2.161*** | -0.156*** | -1.546*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Prvt. hospital/clinic | 0.0662** | 0.657** | 0.0491* | 0.486* |
| | (0.001) | (0.001) | (0.010) | (0.010) |
| antenatal care: other | 0.211*** | 2.095*** | 0.153** | 1.514** |
| | (0.000) | (0.000) | (0.001) | (0.001) |

 

| | | | | |
|---|---|---|---|---|
| Year==2008 | -0.141*** | -1.463*** | -0.118*** | -1.208*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Constant | 1.275*** | | 1.363*** | |
| Observations | 12050 | 12050 | 12050 | 12050 |
| Pseudo $R^2$ | 0.249 | 0.249 | 0.060 | 0.060 |
| alpha | | | 0.558 | 0.558 |
| chi2 | 5835.8 | 5835.8 | 5075.5 | 5075.5 |

Marginal effects; *p*-values in parentheses

(d) for discrete change of dummy variable from 0 to 1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

**Table 5 Negative Binomial Estimates of Determinants of Antenatal Visits in Nigeria by Geopolitical Zone**

| | NC | NE | NW | SE | SW | SS |
|---|---|---|---|---|---|---|
| antvsts | | | | | | |
| age | 0.0210 | 0.00451 | -0.0159 | -0.00101 | 0.0332 | 0.0421* |
| | (0.198) | (0.759) | (0.369) | (0.971) | (0.175) | (0.034) |
| agesq | -0.000229 | 0.0000179 | 0.000281 | 0.0000672 | -0.000417 | -0.000600 |
| | (0.375) | (0.940) | (0.327) | (0.875) | (0.284) | (0.052) |
| Urban | 0.0770* | 0.290*** | -0.0249 | -0.151** | -0.00334 | -0.0361 |
| | (0.049) | (0.000) | (0.584) | (0.004) | (0.953) | (0.385) |
| Primary | 0.0368 | 0.00520 | -0.0307 | 0.0652 | 0.0317 | 0.0140 |
| | (0.370) | (0.893) | (0.573) | (0.510) | (0.761) | (0.816) |
| Secondary | 0.154* | 0.0206 | 0.170* | 0.218 | 0.0456 | 0.0742 |
| | (0.011) | (0.735) | (0.034) | (0.078) | (0.695) | (0.285) |
| Higher | 0.421*** | 0.262** | 0.253* | 0.451** | 0.210 | 0.0917 |
| | (0.000) | (0.005) | (0.017) | (0.001) | (0.121) | (0.264) |
| literacy | -0.0132 | 0.0146 | 0.00231 | 0.0456 | 0.00438 | 0.00237 |
| | (0.544) | (0.537) | (0.946) | (0.169) | (0.873) | (0.911) |
| wealth index | 0.176*** | 0.0676*** | 0.0829*** | 0.176*** | 0.147*** | 0.101*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| **Place of Antenatal** | | | | | | |
| govt. hospital | -0.00657 | 0.161*** | 0.394*** | -0.144* | 0.00380 | -0.112** |
| | (0.880) | (0.001) | (0.000) | (0.032) | (0.946) | (0.005) |
| govt hth center | -0.128** | 0.161*** | 0.315*** | 0.141 | -0.157** | 0.0726 |
| | (0.005) | (0.001) | (0.001) | (0.050) | (0.008) | (0.095) |

 

| | | | | | | |
|---|---|---|---|---|---|---|
| govt. others | -0.198** | 0.118* | 0.0371 | -0.578* | -0.0515 | -0.258* |
| | (0.005) | (0.041) | (0.773) | (0.012) | (0.800) | (0.024) |
| prvt. hospital | -0.0428 | 0.119 | 0.363*** | 0.0871 | 0.129* | 0.0680 |
| | (0.360) | (0.101) | (0.001) | (0.170) | (0.041) | (0.088) |
| Other private | 0.354* | -0.552*** | -1.061** | 0.443** | 0.0375 | 0.273*** |
| | (0.016) | (0.000) | (0.002) | (0.009) | (0.834) | (0.000) |
| Year==2008 | -0.429*** | 0.245*** | 0.00124 | -0.0816 | -0.210*** | -0.192*** |
| | (0.000) | (0.000) | (0.976) | (0.185) | (0.000) | (0.000) |
| Constant | 1.384*** | 0.933*** | 1.473*** | 1.649*** | 1.566*** | 2.182*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| lnalpha | | | | | | |
| Constant | -0.651*** | -1.135*** | -0.961*** | -0.379*** | -0.262*** | -0.568*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Observations | 2754 | 2376 | 1613 | 1315 | 1710 | 2282 |
| Pseudo $R^2$ | 0.034 | 0.022 | 0.012 | 0.021 | 0.012 | 0.006 |
| alpha | 0.522 | 0.322 | 0.383 | 0.684 | 0.769 | 0.566 |
| chi2 | 583.5 | 281.0 | 112.7 | 193.5 | 145.1 | 119.0 |

*p*-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$