MEMORIAL UNIVERSITY OF NEWFOUNDLAND

ECONOMICS 6009

PROJECT PAPER

Frequency and timing of Antenatal Care in Ghana: Explaining the role of the National Health Insurance

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November 29, 2022

Abstract

This study employed the 2014 Ghana Demographic Health Survey data to examine the effect of the National Health Insurance Scheme coverage on the frequency and timing of antenatal care in Ghana. It employed both the logistic and multinomial logistic regression models. It was found that women who are covered by the National Health Insurance Scheme are more likely to seek antenatal care than those who are not covered. The results also revealed significantly that women who are covered by the National Health Insurance Scheme do not delay in antenatal care initiation compared to their counterparts who are not covered by antenatal care. The study recommends that the government of Ghana should implement policies that will increase Ghanaian women's subscription to the National Health Insurance Scheme. The Ministry of Health should also educate the general public on the need for early antenatal care initiation through the mass media (radio, television, and newspapers).

Keywords: Antenatal care, NHIS, maternal health, Ghana

1 Introduction

Maternal and child health constitute a major challenge in developing countries (Abekah-Nkrumah and Abor, 2015). Every year, more than half a million women die from birth-related complications, and in developing countries, maternal mortality rate is projected at 480 deaths per 100,000 live births (Addai, 2000; Owoo and Lambon-Quayefio, 2013). Many studies, including Gonzalez et al. (2009) and Lambon-Quayefio and Owoo (2014), have investigated and highlighted the relevance of maternal health care in reducing maternal and child mortality. In 2002, the World Health Organisation (WHO) introduced an antenatal care (ANC) model termed as Focused ANC (FANC) model, which recommended that pregnant women should attend four ANC visits during their pregnancy period. However, only 64 percent of them attended the WHO-minimum visits during the period 2007-2014 (World Health Organization, 2016). About 303,000 women and adolescent girls died as a result of pregnancy and birth-related complications in 2015 (Alkema et al., 2016). In same year, low resource settings recorded about 2.6 million stillborns (Blencowe et al., 2016).

World Health Organization (2016) defines ANC as the care that pregnant women and adolescent girls receive from skilled healthcare professionals provide to ensure the best health conditions for both mother and baby during pregnancy. ANC encompasses the identification of risk, prevention, and management of pregnancy or birth-related or concurrent diseases and health education and promotion (World Health Organization, 2016). Hence, the timing of seeking antenatal care is as essential as the number of visits to achieve a maximal impact on perinatal, neonatal, and maternal health. Ameyaw et al. (2017) recommends that women should seek antenatal care early during pregnancy as it is keen on maintaining maternal and fetal wellbeing. Against this backdrop, the WHO has developed a new ANC model known as the 2016 WHO ANC model. This model recommends a minimum of eight ANC contacts, with the first visit expected to happen in the first trimester and two visits required to happen in the second trimester. It recommends as much as five contacts to occur in the third trimester as an antenatal risk for mother and child is the greatest at this stage (World Health Organization, 2016). This new model recognizes the value of the time of ANC visit.

This study intends to examine the effect of National Health Insurance Scheme (NHIS) on the timing and frequency of antenatal care in Ghana. It also intends to examine other significant factors that influence the timing and frequency of antenatal care in Ghana.

2 Maternal Health Policy in Ghana

Until 2003, Ghana's health sector operated the *cash-and-carry* system, where people paid for healthcare at the point of service. This system eased the health expenditure in the government of Ghana's budget but impeded demand for healthcare services for the poor.

The NHIS was then rolled out in 2003 to play a vital role in increasing demand for healthcare services for all and sundry. It was meant to abolish the *cash-and-carry* system and allow its subscribers to seek free healthcare. In 2005, the maternal health policy was implemented in all the ten regions in Ghana, and it allowed women to seek free maternal healthcare services. It was integrated into the NHIS in 2010 by allowing all women who are covered by the NHIS to seek free maternal healthcare, including antenatal care, postnatal, and neonatal health care. It has since allowed many pregnant women who are covered with NHIS to be able to access free antenatal and neonatal care services (Owoo and Lambon-Quayefio, 2013; Brugiavini and Pace, 2016).

As far as the maternal health policy is concerned, there are some unanswered questions: (1) What is the effect of NHIS coverage on the frequency of antenatal visits? (2) Do women who are covered by the NHIS seek ANC earlier than their counterparts who are not covered? (3) What other significant factors affect the timing and frequency of antenatal care? These are questions that this study aims to investigate.

This study differs from Abor et al. (2011), Arthur (2012), Dixon et al. (2014) and Fenny et al. (2019) as it attempts to investigate whether women who have subscribed to the NHIS seek ANC earlier than their counterparts by examining the effect of NHIS coverage on all the timing divisions of the pregnancy period: the first, second and third trimester.

The study tests the hypothesis that there is no significant relationship between NHIS coverage and the frequency and timing of antenatal care.

3 Literature Review

Lambon-Quayefio and Owoo (2014) revealed that antenatal care reduces the risk of neonatal deaths in Ghana. Arthur (2012) and Owoo and Lambon-Quayefio (2013) found that even after controlling for NHIS coverage, richer Ghanaian women appear to use more antenatal care services than poorer women. They also found that Ghanaian women who are covered by the NHIS are more likely to seek antenatal care than those who are not covered. Ameyaw et al. (2017) concurred that the poor women whom the NHIS covered were noted to have relatively higher access to

antenatal care more than their unsubscribed counterparts.
Sakeah et al. (2017) revealed that Ghanaian women with low socio-economic status were less likely to report at least four ANC visits during pregnancy if they did not possess health insurance. Abor et al. (2011) found that the age of the mother, her education, economic status, geographic location, and place of residence influence the intensity of use of antenatal services. Chen et al. (2003) found that there is a positive relationship between NHIS and the utilization of antenatal care. Dixon et al. (2014) used negative binomial and logit models, and they found that women enrolled in the NHIS in Ghana make more antenatal visits compared with their counterparts who are not covered by the NHIS. Exavery et al. (2013) used a multinomial logistic regression and found out that the risk of delaying ANC initiation in Tanzania was high for unwanted pregnancies.

4 Methodology and Data

This study employs the 2014 Ghana Demographic Health Survey (GDHS), and it is the sixth in a series of population and health surveys (PHS) conducted in Ghana. [1] It is implemented by the Ghana Statistical Service (GSS), the Ghana Health Service (GHS) and the National Public Health Reference Laboratory (NPHRL) of the GHS. The survey aimed at generating reliable data on fertility, childhood mortality, and maternal and child health. [2] Three standard Demographic and Health Surveys (DHS) questionnaires were used for the 2014 GDHS: the woman's questionnaire, man's questionnaire, and the household questionnaire. The Woman's Questionnaire compiled information on Background characteristics (age, education, and the like), woman's work, and antenatal, delivery, and postnatal care.

4.1 Child Health Production and the Demand for Health Inputs Model

This study follows a theoretical framework that Rosenzweig and Schultz (1983) and Rosenzweig and Schultz (1982) modeled. The framework assumed that the preference ordering of a household over child health H, X goods, and Y goods could

[1] The data is available upon request from
https://www.dhsprogram.com/data/dataset_admin/login_main.cfm

[2] The survey followed a two-stage sample design. In the first stage, 427 clusters were selected, 216 in urban areas, and 211 in rural. In the second stage, a systematic sampling of about 30 households was undertaken, and they were chosen from each cluster to constitute the total size of the sample. Eligibility for interview involved all women within the age range 15-49 years who were either permanent residents of the chosen households or visitors who stayed in the household the night before the survey.

be characterized by a utility function subject to the usual properties:

$$U = U(X, Y, H) \tag{1}$$

Let child health production be described by the function:

$$H = F(Y, Z, \omega) \tag{2}$$

Where $F_y, F_z, F_\omega \neq 0$. H represent the health of each of the household's children. X denotes health-neutral consumer goods (have no effect on H such as shoes and books). Y denotes health-related consumer goods (have an effect on H such as smoking). Z denotes other bought or family inputs such as medical services that do not augment utility other than through their effects on H. ω represents family-specific health endowments or unobserved biological factors or the portion of child health emanating from either genetic traits or environmental factors uninfluenced by parental behavior, but known to them.

The family maximizes Equation 1, given Equation 2, which is assumed to be known, and subject to the household budget constraint, represented by Equation 3 below:

$$I = P_x X + P_y Y + P_z Z \tag{3}$$

Where I is exogenous money income. The P_x, P_y, P_z are exogenous prices of the X, Y and Z respectively. [3] The first-order maximization conditions are as follows:

$$\lambda P_x = U_x \tag{4}$$

$$\lambda P_y = U_y + U_H F_y \tag{5}$$

$$\lambda P_z = U_H F_z \tag{6}$$

where λ is the Lagrangian multiplier.[4] The household's reduced-form demand functions for the goods, including the health inputs, derived from the maximization process are as follows:

$$X = \delta_x(P_x, P_y, P_z, I, \omega) \tag{7}$$

$$Y = \delta_y(P_x, P_y, P_z, I, \omega) \tag{8}$$

[3] According to Rosenzweig and Schultz (1982), this model has some important characteristics. Thus, other goods must be purchased or utilized to influence health in a way described by Equation 2 since health cannot be bought directly. Also, the household does not maximize H, rather they see it as one utility-augmenting good for which reason they must trade off other goods.

[4] Condition (6) depicts that the health investment good Z is consumed just because child health H contributes to utility.

$$Z = \delta_z(P_x, P_y, P_z, I, \omega) \tag{9}$$

The health outcome reduced-form demand equation will be written similarly as:

$$H = \gamma_h(P_x, P_y, P_z, I, \omega) \tag{10}$$

Given that;

$$dH = F_y dY + F_z dZ + F_\omega d\omega \tag{11}$$

The effects of the changes in *prices* on child health through medical services can be derived from these equations as one applies the chain rule;

$$\frac{dH}{dP_X} = F_y\left(\frac{dY}{dP_X}\right) + F_z\left(\frac{dZ}{dP_X}\right) \tag{12}$$

$$\frac{dH}{dP_Y} = F_y\left(\frac{dY}{dP_Y}\right) + F_z\left(\frac{dZ}{dP_Y}\right) \tag{13}$$

$$\frac{dH}{dP_Z} = F_y\left(\frac{dY}{dP_Z}\right) + F_z\left(\frac{dZ}{dP_Z}\right) \tag{14}$$

Where $\frac{dH}{dP_Z}, \frac{dY}{dP_Z}, \frac{dZ}{dP_Z} > 0$

Since $\frac{d\omega}{dP_i} = 0$, $i = x, y, z$, Equations 12, 13, and 14 depict that price effect on child health depend on the effects of changes in prices on the demand for health production inputs and on the marginal products of these inputs in the production of health. Following Rosenzweig and Schultz (1983), this study estimates the health input demand function Z (Equation 9).

Z measures as demand for antenatal care services. One important health input or medical service identified in the health literature is antenatal care. P_z measures as the price or cost of seeking antenatal care. I measures as wealth. [5] [6]

4.2 Model Specification

In other to capture adequate care, some studies including Addai (2000), Magadi et al. (2000), Asundep et al. (2013), Abekah-Nkrumah and Abor (2015), Sakeah et al. (2017), and Fenny et al. (2019), as argued by Abor et al. (2011), have focused on pregnant women's decision to use or not to use maternal health care services and the number of visits. They use the WHO-minimum requirement of four visits per pregnancy, as was suggested in the FANC model (World Health Organization, 2016)

[5]The study employs data from the 2014 GDHS, and as far as it is concerned, there are no data available to measure P_x and P_y even though they are relevant variables.

[6]This model was chosen as it allows us to know the indirect effect of NHIS coverage on child health

and group all antenatal visits below four as equivalent to no visits. This approach is applied in this study.
Due to the dummy and categorical nature of the dependent variables, this study employs the logistic and multinomial logistic regression model to estimate two econometric models of the form:

$$Y_i = \beta_0 + \beta_1 P_i + \beta_2 W_i + \beta_3 A_i + \beta_4 N_i + \beta_5 D_i + \beta_6 Z_i + \beta_7 T_i + \mu_i \qquad (15)$$

Where Y_i is the dependent variable which is binary measured as 1 if a woman attends *at least four or more* antenatal care visits and 0 if otherwise in the first regression. In the second regression, Y_i is measured as a categorical variable taking 0, 1, and 2. Y_i takes 0 and denotes *first trimester* if a woman booked her first antenatal visit in the first three months. Y_i takes 1 and denotes *second trimester* if she booked it in the second three months, and it takes 2 if she booked *first antenatal* visit in the last three months of pregnancy (third trimester). P_i and W_i capture NHIS coverage and *wealth* respectively. NHIS is measured as 1 if the woman is covered by the *National Health Insurance Scheme* and 0 if otherwise. *Wealth* is measured as a categorical variable. It takes 0, 1, 2, 3, and 4 which represent *poorest*, *poorer*, *middle*, *richer* and *richest* categories respectively. A_i is a vector of household socioeconomic characteristics such as *maternal education*, *occupational status*, *marital status*, *maternal age. Maternal education* is a categorical variable that takes 0, 1, and 2 representing *no educational level*, *primary level of education* and *secondary or higher level of education* categories respectively. *Occupation* is measured as 0 if the woman is *unemployed*, and as 1 if she is *employed. Marital status* is measured as a categorical variable. It takes 0, 1 and 2 representing *never married*, *formerly married* and *currently married. Maternal age* is grouped into three categories as influenced by the literature. It takes 0, 1 and 2 if the woman's age is within the range 15 to 24, 25 to 34, and 35 to 49 respectively. N_i captures the *number of women* in the household and it is a continuous variable. D_i represents whether or not *distance* is a problem in accessing health facility. It takes 0 if *distance is not a problem* and 1 if *distance is a problem.* Z_i and T_i capture Y_i by *regional variations* and *place of residence* respectively. *Place of residence* is measured as 1 for *rural* and 0 for *urban* residence. The error term μ_i captures the effect of all unobserved characteristics on the dependent variables. The variables in the model have been selected with recourse to the general empirical literature.

4.3 Empirical Estimation

The regression models employed in this paper are logistic and multinomial logistic regression models as antenatal visits is a dummy variable, and timing of antenatal visits is a categorical variable. Logit is chosen over probit because of the computational advantages (**?**).

Assume X explanatory variables and an unordered categorical variable y [7] (categorized as 1, 2, 3, ... , m). In this study, we assume m= 3 outcomes: *first trimester*, *second trimester* and *third trimester*. With the multinomial logit model, a set of coefficients, β^1, β^2 and β^3 corresponding to each outcome is estimated: [8]

$$Pr(y=1) = \left(\frac{e^{X\beta^{(1)}}}{e^{X\beta^{(1)}} + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}\right)$$

$$Pr(y=2) = \left(\frac{e^{X\beta^{(2)}}}{e^{X\beta^{(1)}} + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}\right)$$

$$Pr(y=3) = \left(\frac{e^{X\beta^{(3)}}}{e^{X\beta^{(1)}} + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}\right)$$

There is more than one solution to β^1, β^2 and β^3 that leads to the same probabilities for $y = 1$, $y = 2$ and $y = 3$ so this model is unidentified. One has to set β^1, β^2 or β^3 to 0 in order to identify the model.

For instance, if one sets β^1=0, then the remaining coefficients β^2, β^3 will measure the relative change to the $y = 1$ group. Thus, we get the following equations:

$$Pr(y=1) = \left(\frac{1}{e^{X\beta^{(1)}} + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}\right)$$

$$Pr(y=2) = \left(\frac{e^{X\beta^{(2)}}}{e^{X\beta^{(1)}} + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}\right)$$

$$Pr(y=3) = \left(\frac{e^{X\beta^{(3)}}}{e^{X\beta^{(1)}} + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}\right)$$

The relative probability of $y = 2$ to the base outcome is:

$$\frac{Pr(y=2)}{Pr(y=1)} = e^{X\beta^{(2)}}$$

Let's call this ratio the relative risk. Also, if one sets $\beta(2)$=0, then β^1, and β^3 will measure the change relative to the $y = 2$ group. These will have different coefficients since they have different interpretations; nonetheless, the predicted probabilities for

[7] This characteristic of y distinguishes the use of multinomial logit from ordered logit, OLS regression and the logistic regression models

[8] multinomial logit is selected over ordered logit because the dependent variable *time of first antenatal care visit* is a categorical variable however it is assumed to have no ordering, hence the information conveyed by the ordered nature has no reasonable use (Exavery et al., 2013), given the objectives of the study.

y=1, 2, and 3 will remain the same. Thus either parameterization will be a solution to the same underlying model.[9] It is worth noting that the exponentiated value of a coefficient is the relative-risk ratio for a one-unit change in the corresponding variable. [10] For instance, if we assume that X and β_k^2 are vectors equal to $(x_1, x_2, ..., x_k)$ and $(\beta_1^2, \beta_2^2, ..., \beta_k^2)$ respectively, then the ratio of the relative risk of one-unit change in x_i is:

$$\left(\frac{e^{\beta_1^{(2)} x_1} + ... + \beta_i^{(2)}(x_i + 1) + ... + \beta_k^{(2)} x_k}{e^{\beta_1^{(2)} x_1} + ... + \beta_i^{(2)} x_i + ... + \beta_k^{(2)} x_k} \right) = e^{\beta_i^{(2)}}$$

This study estimates the probability that a woman will seek for ANC and whether she will book her first ANC earlier or not based on NHIS coverage, and household and other characteristics measured by series of variables.

[9] see https://www.stata.com/manuals13/rmlogit.pdfrmlogitlongfreese2014

[10] Thus, the risk is measured as the risk of the outcome relative to the base outcome.

5 Results and Discussion

An analysis of the data showed that the number of antenatal visits during pregnancy ranged from one to 20 visits, with a mean of 6.7 visits (Appendix A). However, the majority of births (89.96 percent) had received between two and ten antenatal visits.

Table 1: Multinomial Logistic Regression for the timing of Antenatal Care

	2nd trimester relative to 1st trimester	3rd trimester relative to 1st trimester
Variables	Related risk ratio	Related risk ratio
NHIS coverage: *covered*	0.9484	0.6646*
Wealth Index:		
poorer	1.0972	0.9270
middle	0.801*	0.5371*
richer	0.5826***	0.3239**
richest	0.3477***	0.0287***
Education Level:		
primary	1.0316	0.8843
secondary/higher	0.9197	0.6033
Occupation: *Employed*	0.8564*	0.4412***
Marital Status:		
formerly married	0.6360**	1.7422
currently married	0.6115***	0.9120
Mother's Age:		
25-34 *years*	0.9344	0.6418*
35-49 *years*	1.0268	0.8026
Number of women	1.0772	1.2724*
Distance: *Big Problem*	1.1523*	1.1978
Residence: *Rural*	1.1913*	1.2827
Region:		
Western	0.3599***	0.5934
Central	0.6824**	0.5877
Greater Accra	0.8878	2.2851
Volta	0.4762***	1.3047
Eastern	0.6291***	1.6486
Ashanti	0.6097***	1.2595
Brong Ahafo	0.5306***	0.9011
Upper-East	0.3648***	0.2499***
Upper-West	0.4717***	0.3077**
constant	1.7769***	0.2204***
Observations	4152	4152

* p<0.1, ** p<0.05, *** p<0.01

Most women (65 percent) booked their first antenatal visits in the *first trimester*. This study investigated the empirical relationship that exists between the frequency and timing of antenatal care visits and NHIS coverage. The Breusch-Pagan test and the White test proved that heteroscedasticity is present in the regression models as displayed in Appendix B. Hence, robust standard errors are reported for both models to correct for the heteroscedasticity. The Variance Inflation Factor shows that there is no multicollinearity in the model.

Table 2: Marginal Effects from Logistic Regression Model

Variables	Antenatal Care Visits
NHIS coverage: *covered*	0.0776***
Wealth Index:	
poorer	0.0391**
middle	0.0727***
richer	0.1388***
richest	0.1694***
Education Level:	
primary	0.0163
secondary/higher	0.0553***
Occupation: *Employed*	0.0480***
Marital Status:	
formerly married	-0.0020
currently married	0.0334
Mother's Age:	
25-34 *years*	0.0070
35-49 *years*	0.0145
Number of women	-0.0135**
Distance: *Big Problem*	-0.0118
Residence: *Rural*	0.0100
Region:	
Western	0.0774***
Central	0.0729***
Greater Accra	-0.0196
Volta	-0.0310
Eastern	-0.0478*
Ashanti	0.1038***
Brong Ahafo	0.0949***
Upper-East	0.1447***
Upper-West	0.1073***
Observations	4263

* p<0.1, ** p<0.05, *** p<0.01

The most relevant result emerging from this study is that irrespective of socio-economic and demographic factors, women who are *covered* by NHIS do not delay in ANC initiation compared to their counterparts who are *not covered* by ANC (Table 1). Hence, we reject the null hypothesis and conclude that NHIS coverage significantly affects the timing of antenatal care visits. Dixon et al. (2014) did not find significant results for the association between NHIS coverage and the timing of antenatal care in Ghana, and this could be because the data collection for the GDHS they used took place shortly after the implementation of the NHIS maternal exemption policy was created. Thus, the most current GDHS as used in this study is providing new evidence of the relationship between NHIS coverage and the timing of antenatal care in Ghana after the public has become very much aware of the policy. Our regression confirmed significantly that *richer* women do not delay ANC initiation compared to their counterparts who are in the *poor* category. It was significantly revealed that women who are *employed* do not delay ANC initiation compared to those that are *unemployed*. These results corroborate the findings of Arthur (2012) and Dixon et al. (2014), which depicted that women of higher socio-economic status are more likely to seek ANC earlier. The study also found that women that were *formerly married* or are *currently married* do not delay ANC initiation compared to those that are *never married*. The lesser risk ratio for delaying ANC initiation for those who are *currently married* can be attributed to the motivation that women receive from their husbands to seek prenatal care earlier. The study found that women within the age range 25-34 *years* do not delay ANC initiation compared to those that are within the age range 15-24 years. The study confirmed a significant delay of ANC initiation for mothers who live in a household where there are many women. This result contradicts Fenny et al. (2019) who found that the number of co-resident women positively affect inequalities in the timing of the first antenatal visit in Ghana. The regression confirmed a significant delay for ANC initiation when the distance is a *big problem* as compared to when the distance is *not a problem*. The study also revealed that women who live in *rural* areas delay ANC initiation relative to their counterparts who live in the *urban* areas. This could be attributed to the perceived lower quality of health care in such areas.

From Table 2, it was found that women who are *covered* by the NHIS are more likely to seek *antenatal care* than those who are *not covered*. This result is consistent with evidence from Dixon et al. (2014), Dzakpasu et al. (2012), Mensah et al. (2010), and Owoo and Lambon-Quayefio (2013). Being covered by NHIS increases the average probability of seeking antenatal care by 0.0776. Thus, women who have subscribed to the NHIS are eight percentage points more likely to attend antenatal care than their counterparts who are not covered by the NHIS. Hence, this shows that reducing the financial barriers in accessing ANC increases the demand for ANC in Ghana. We then reject the null hypothesis and conclude that NHIS coverage significantly affects the frequency of antenatal care visits.

Those who have *secondary or higher education* are more likely to seek *antenatal care*. This result is consistent with Arthur (2012), who found that women with secondary or higher levels of education are more likely to attend ANC compared to their counterparts who do not have an education. The *wealth* category has a positive relationship with *antenatal care* visits. This result corroborates Abor et al. (2011), Arthur (2012), and Ameyaw et al. (2017), who found a positive relationship between wealth status and the use of maternal health services such as antenatal care. This result depicts that financially sound women are more likely to seek at least four prenatal care visits. Women in the *richest* category are thirteen, ten, and three percentage points more likely to seek ANC than their counterparts in the *poorer*, *middle*, and *richer* category. *Occupation* has a positive relationship with *antenatal care* visits. Thus, having a job increases the average probability of seeking *antenatal care* by 0.048. Women who live in households where there are a lot of other *women* are less likely to seek for *antenatal care*. This outcome may be attributed to the ease of accessing antenatal and neonatal health information from their neighbours (women) rather than seeking ANC. This result contradicts Fenny et al. (2019) who found that the number of co-resident women positively affect inequalities in ANC in Ghana. Other significant results varied according to which *region* the woman resides.

6 Conclusion and Policy Recommendations

This study attempted to examine the effect of NHIS on the frequency and timing of ANC in Ghana. It was found that women who have subscribed to the NHIS are more likely to demand ANC and also less likely to delay ANC visit. Against this backdrop, the study recommends that the government should implement policies that will increase Ghanaian women's subscription to the NHIS. The Ministry of Health should also educate the general public on the need for early ANC initiation through the mass media (radio, television, and newspapers). Based on the new ANC model, this study proposes that the GSS, the GHS, and the NPHRL should consider taking data on the number of ANC visits that pregnant women undertake in the various timing divisions of the pregnancy period to aid future research. I intend to estimate the effect of the timing of antenatal care visits on neonatal mortality in Ghana in the future.

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A Summary Statistics

Variables	Obs	Mean	Std Dev.
Antenatal Care	4294	6.734	7.128
Timing of Antenatal visit	4163	3.25	2.502
National Health Insurance	9393	0.66	0.474
Wealth Index	9396	1.851	1.429
Education Level	9396	1.329	0.84
Occupation	9381	0.748	0.434
Marital Status	9396	1.257	0.916
Mother's age	9396	0.982	0.831
Number of women	9396	0.553	0.824
Distance	9393	0.285	0.451
Residence	9396	0.49	0.5
Region	9396	4.336	2.854

B Post-Estimation Test

Variable	Frequency of ANC	Timing of ANC
Test	Prob >Chi2	Prob>Chi2
Breusch-Pagan Test	0.0000	0.0000
White Test	0.0000	0.0000

C Variance Inflation Factor (VIF)

Timing	VIF	1/VIF
NHIS coverage: *covered*	3.41	0.292847
Number of women	1.24	0.805769
Occupation: *Employed*	5.65	0.177120
Education Level:		
Primary	1.85	0.539753
Secondary or higher	3.82	0.262062
Wealth Index:		
poorer	2.22	0.449856
middle	2.62	0.381082
richer	3.11	0.321430
richest	3.57	0.279753
Marital Status:		
formerly married	1.69	0.592667
currently married	9.35	0.106936
Mother's age:		
25-34 *years*	3.69	0.270755
35-49 *years*	2.97	0.336463
Distance: *Big Problem*	1.54	0.648067
Residence: *rural*	3.20	0.312013
Region:		
Western	2.08	0.481038
Central	2.09	0.478027
Greater Accra	2.09	0.478869
Volta	1.69	0.592762
Eastern	1.92	0.519634
Ashanti	2.12	0.472374
Brong Ahafo	1.96	0.509479
Upper-East	1.65	0.605621
Upper-West	1.56	0.641849
Mean VIF	2.80	

D Variance Inflation Factor (VIF)

Visit	VIF	1/VIF
NHIS coverage: *covered*	3.35	0.298937
Number of women	1.24	0.803316
Occupation: *Employed*	5.61	0.178317
Education Level:		
Primary	1.85	0.539151
Secondary or higher	3.77	0.265578
Wealth Index:		
poorer	2.23	0.448766
middle	2.60	0.384051
richer	3.08	0.324408
richest	3.53	0.283296
Marital Status:		
formerly married	1.69	0.591601
currently married	9.22	0.108417
Mother's age:		
25-34 *years*	3.68	0.271979
35-49 *years*	2.98	0.335060
Distance: *Big Problem*	1.56	0.641967
Residence: *rural*	3.18	0.314815
Region:		
Western	2.06	0.486293
Central	2.07	0.48330
Greater Accra	2.07	0.482840
Volta	1.71	0.586095
Eastern	1.91	0.522755
Ashanti	2.08	0.479951
Brong Ahafo	1.93	0.517201
Upper-East	1.63	0.614627
Upper-West	1.54	0.650395
Mean VIF	2.77	