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**Predictors of Antenatal Care Utilization in Primary Healthcare Centers in Eight Rural Communities in Delta State, Nigeria.**

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**Abstract**

**Background:** We examined the socio-demographic factors that influence early timing and an adequate number of ANC visits in Primary Healthcare Centers (PHCs) in eight randomly selected rural communities in Ughelli North Local Government Area (LGA), Delta State, Southern Nigeria.

**Methods:** The study was a cross-sectional household survey that enlisted 900 women within the reproductive ages. A structured questionnaire was used to elicit information from the respondents. Extracted data were analyzed with Stata version 13.0 for windows. Univariate, bivariate, and multivariate analyses were conducted.

**Findings:** The results revealed that 53.1% of the women with recent birth utilized ANC in PHCs. Predictive factors for early ANC visits in PHCs were employment status of women [aOR: 19.15,  $\rho = 0.04$ ], prior experience with pregnancy-related complications [aOR: 638.95,  $\rho = 0.00$ ], walking for at least 60 minutes to the nearest health center [aOR: 0.11,  $\rho = 0.02$ ] and at least five births [aOR: 8.35,  $\rho = 0.04$ ]. Predictive factors for a minimum of four ANC visits in PHCs were walking for at least 60 minutes to the nearest health center [aOR: 0.001,  $\rho = 0.00$ ], rating quality of care in the nearest health center as good [aOR: 26.78,  $\rho = 0.00$ ] and excellent [aOR: 1,527.95,  $\rho = 0.00$ ], and reporting at least secondary educational qualification [aOR: 10.47,  $\rho = 0.07$ ]. The odds for making early ANC visits [aOR: 0.09,  $\rho = 0.00$ ] and a minimum of four ANC visits in PHCs [aOR: 0.24,  $\rho = 0.05$ ] were respectively 91% and 76% significantly less likely for respondents drawn from set of communities without PHCs in reference to those from set of communities with PHCs.

**Conclusion:** Intervention programmes designed to improve women's access to PHCs should address distance barriers, improve quality of care and expand education opportunities for women in the study area.

**Keywords:** Predictors, Antenatal care, Utilization, Primary Healthcare Centers, Rural communities, Delta State, Nigeria.

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## Introduction

Available evidence shows that countries in sub-Saharan African (SSA), Nigeria, inclusive are lagging in Antenatal care (ANC) coverage. A WHO survey on the coverage of maternity care showed that while almost all pregnant women in developed countries attend ANC; coverage remains low in SSA [1] due to several factors which include poor health-seeking behaviour, social and cultural barriers, lack of access to services and poverty [2]. Globally, notable progress has been made in ANC coverage rate, which reflected in a 70% increase between 1990 and 2013 [3-5]. However, SSA has recorded slow progress, and for Nigeria, ANC utilization rate has consistently remained below the global average [6]. In 2013, the global ANC utilization rate (at least one visit) was 81%, and for SSA, it was 75%, while the rate for Nigeria ranged between 61% and 66% [7-8]. Nigeria's poor performance in terms of the number of women that utilized ANC is more glaring when we compare Nigeria's rate with neighboring African countries: Ghana [78.2%], Sierra Leone [76.0%], Liberia [78.1%] and Lesotho [70.4%] [9].

It is, therefore, no source of surprise that SSA accounts for a disproportionate burden of maternal mortality. Available evidence shows that about 585 000 women die yearly from pregnancy-related complications, and out of this, SSA accounts for 66% [10], Nigeria constitutes about 2% of global population yet accounts for over 14% of global maternal mortality burden [8, 11-12]. It is believed that high maternal mortality in SSA is due to the underutilization of maternal care services [13]. In SSA, the deplorable state of maternal health outcomes is because a good number of women do not use modern healthcare services. Consistent medical checkup has been recommended as an intervention strategy to reduce the risk of both maternal and neonatal mortality [14]. NDHS [7] reported that among the women surveyed who delivered within the last five years of the survey, 17% did not have access to ANC, 30-37% did not undergo any medical tests or examination, 27% were not administered tetanus toxoid (TT) injection and 40% were never informed of the danger signs of complications [15].

From the available evidence, maternal death is higher among women who do not attend ANC and those who deliver without skilled birth attendants (SBAs) [16-17]. Nigeria's women's attitude towards ANC has been reported to be unimpressive. Available evidence shows that while several Nigerian women do not attend ANC, those who attend do not make early visits and do not make up to a minimum of four ANC visits, which is the minimum recommended number. A good number of women who utilize ANC still do not deliver their babies in health facilities. The WHO [18] recommends ready access by women to evidence-based maternal and perinatal healthcare (antenatal, Intrapartum and postnatal care) as an essential intervention for improving maternal and perinatal outcomes in low resource settings. However, many women in Nigeria do not keep to this recommendation.

The benefit of ANC is well documented in the literature. Pregnant women are advised to attend ANC to track the progress of their pregnancy and put in place necessary measures to avert complications in case of potential risks. Evidence has shown that women who start ANC within the first three months of their pregnancies more often record better pregnancy outcomes than women who either start late or refrain from using care [19, 20]. ANC guarantees optimal health for both mothers and newborn babies. Appropriate care during pregnancy is essential for the health of the mother and the development of the unborn baby, promotion of healthy behaviours and parenting skills, and establishes a link between the women and the health system [6, 21]. While utilization of ANC is beneficial, also important is the gestational age of the pregnancy when a woman begins to attend ANC and the number of times she attends. According to Arthur [21], to maximize the benefits from ANC, a woman must begin the service in the first three months of pregnancy and maintain a minimum of four visits. WHO [22] recommends a minimum of four visits for pregnant women before delivery if the woman cannot make the recommended number of visits by physicians. Villar et al. [23] revealed that a maximum of four visits suffice for uncomplicated pregnancies, and more visits may be recommended for complicated pregnancies. Concerning early timing of ANC

visits, the WHO [22] has recommended that pregnant women should attend ANC in the first trimester of pregnancy, but the most recent survey revealed that in Nigeria only 14.6% of rural women began ANC within the first four months of pregnancy and for urban women 23.1% started at the same time [7].

A significant disparity exists in maternal care utilization between rural and urban women; poor and the rich and women living in Southern and Northern geopolitical zones. Several health facilities are located in the urban part of the country where rural women may not be able to get to due to transportation problems and poor road networks [24]. Available evidence shows that while 86% of urban women utilized ANC from skilled ANC providers (doctor, nurse/midwife, or auxiliary nurse), only 46.5% of rural women received ANC from such sources [12]. Of the women surveyed in the last NDHS [7], while 74.5% of urban women made at least four ANC visits, it is only 38.2% of rural women that made at least four ANC visits [7]

PHC has been recommended as the health system strategy to improve access of women to SBAs and ANC, particularly in low-resource settings such as Nigeria [17]. In 2006, the Nigerian Presidential Committee in a report titled, "Accelerating the attainment of MDG -5" reported that poverty and the attendant's inability to pay for healthcare services were the major barriers hindering women from accessing safe maternal care [25]. To reduce financial barriers to maternal and childcare services, the Federal Ministry of Health (FMOH) in 2007 recommended that all states (the second tier of government) should implement the policy of free maternal and child care services. By December 2009, the National Primary Healthcare Development Agency (NPHCDA) initiated the Midwife Services Scheme (MSS), a programme designed to redress supply bottlenecks in the provision of maternal healthcare services in the rural part of Nigeria. By the end of 2010, over 50% of Nigerian States have implemented the policy of free care services to mothers and newborn babies [12, 17]. In 2007 the Nigerian government launched the Integrated Maternal and Child Health (IMCH) policy, which was designed to provide a continuum of care to women from the

preconception period to the immediate postnatal period [17]. IMCH aims at addressing barriers to maternal care utilization to the vulnerable section of society. To increase access to maternal care in the rural part of the country, the FMOH adopted PHC as the implementation strategy of the policy. Despite this, evidence has shown the underutilization of PHCs by rural Nigerian women [26], and consequently, a yawning disparity in maternal health outcomes exists between both regions. Why do rural women still utilize ANC far less than their urban counterparts despite the innovative approach of PHCs, designed to bring care to the doorstep of rural women?

Predictors of ANC utilization have been the subject of several studies in Nigeria, though a good number of the studies did not disaggregate ANC into its primary health component. There remain gaps in the study considering the dearth of research studies on predictors of ANC in Primary Healthcare Centers (PHCs). In Nigeria, there are only a few studies that focused on maternal care utilization in PHCs. For instance, in a descriptive study, Ejembi et al. [26] investigated the determinants of ANC and family planning utilization in PHCs. However, the study was a mere descriptive study. Also, Egbewale & Odu [27] investigated people's perception of PHCs and also determinants of utilization of healthcare services in PHCs but did not focus on maternal care utilization. Okonofua et al. [12] utilized both descriptive and analytical techniques to investigate the predictors of both ANC and SBAs in twenty communities in Edo State. However, this study did not consider the early timing of ANC visits and a minimum of four ANC visits; this constitutes the gap that this present study filled. This is the first study that assessed predictors of ANC in PHCs in Ughelli North LGA, Delta State Southern Nigeria. The motivation of this study originated in this context, and it is poised to fill the gaps in both normative and empirical literature. It is believed that the findings from this study will provide evidence-based information on the socioeconomic predictors of maternal care utilization in PHCs focusing on early timing of ANC visits and a minimum of four ANC visits in eight randomly selected rural communities in Delta State, Southern Nigeria.

## Conceptual Framework

This study is built on the conceptual framework of Andersen and Newman [28]. This framework was initially developed in the 1960s and was principally designed to understand the predictors of healthcare utilization in the United States of American (USA). However, the framework has been utilized in research outside the USA, as reported by a systematic review of studies that utilized the model between 1998 and 2011[29]. According to this model, health service utilization is a form of individual characteristics that are influenced by the health system and societal factors. The societal determinants include technology and societal norms such as healthcare financing, and it affects the individual determinants directly and through health system factors [12]. Health system determinants include resources-volume and distribution of labour and capital for health care, organization- patient's access to the healthcare system and structure – what happens after entry into the health system. The individual characteristics that influence healthcare utilization behaviour are categorized into three: predisposing factors, enabling factors and need-based characteristics [6]. Predisposing factors are the ability to secure health services and it includes demographic characteristics such as age, sex, marital status, past illness, social structure (education, race, occupation, family size, ethnicity, religion, and residential mobility) and beliefs (values about health and illness, attitudes towards health services/ providers, knowledge about diseases). Past studies show that individual characteristics are significant predictors of healthcare utilization. For instance, women that are married have been reported to utilize maternal care services better than their unmarried counterparts. The past illness factors show that women experience with pregnancy-related complications, birth order and past experiences with the health system can influence their maternal care behaviour [28, 30].

The enabling factors are the means or resources require to access healthcare services. Enabling factors include family resources (income, wealth, health insurance, and other sources of third-party payment, type

of regular source of payment and accessibility to them) and community characteristics (ratio of health personnel to patients, health facility density ratio, rural-urban location). It, therefore, follows that women's access to maternal care services depends in part on the availability of services and access to resources to pay for services.

The need-based characteristics include the perception of the need for health services, whether individual, social or clinically-evaluated perception of need [31]. Individual perception of illness in terms of his or her vulnerability to illness, consequences of illness and benefits from the utilization of services will influence his/her behaviour in utilizing care. For instance, a woman who once suffered obstetric complications and who foresees that possible complications may result in either death or disability may take a measure to protect herself. According to Andersen & Newman [28], these factors represent the most immediate determinants of health service utilization. The need-based component suggests that the utilization of maternal health services can be dictated by a woman's perception of the relative benefits of modern health services versus traditional methods of care. Added to this is a woman's understanding of child-birth related complications and her desire to deliver safely and obtain a healthy baby.

## Materials and Methods

### Study Communities

This study is a community-based cross-sectional study design that employed quantitative data collection method to investigate the predictors of early timing of ANC visits and a minimum of four ANC visits in PHCs in eight randomly selected rural communities in Delta State: Unukpo, Agbarha-otor, Saniko, Oguname, Uneni, Ewereni, Umusu, and Ekkerhawwe. These eight communities are located in Ughelli North local government council. Ughelli North is one of the LGAs in Delta State. It lies between 90 45 'N and 80 43'E with a landmass of 818 square km.

### Sample Size Calculation

The data for the study was obtained from 900

women residing in eight randomly selected communities in Ughelli North L.G.A. The sample size was selected using Cochran's [32] sample size formula. This method uses the risk the researcher is willing to take which is commonly called the margin of error at a particular alpha level, which in the present study is adopted as 0.05, and 50% assumed maternal care utilization in PHCs, which was the rate used by a previous Nigerian study [12]. A sample size of 900 was selected using a standard formula for sample size as follows:  $n = \frac{Z^2 pq}{d^2}$ , which is used for large and finite populations [32].

Where:

n = sample size, Z=Standard Score corresponding to 95% confidence interval that is,1.96, d = proportion of sample Error permitted in a given situation(that is, 5%), P = The prevalent rate of maternal care utilization from PHCs (that is,50% ), q = 1-p or percentage of failure rate =1-50%. Hence, the sample size can be worked out below:

$$n = \frac{Z^2 pq}{d^2},$$
$$n = \frac{1.96^2 \times 0.50 \times 0.50}{0.05^2}$$
$$n = \frac{3.8416 \times 0.50 \times 0.50}{0.0025}$$
$$n = \frac{0.9604}{0.0025}$$

$$n = 384$$

A multi-stage sampling technique was used in selecting respondents for the study. Data collection involved three stages. In the first stage, a purposive sampling technique was utilized in selecting four political wards out of the eleven political wards that make up Ughelli North LGA. The selected wards were: Agbarha-otor ward, Ewereni Ward, Orogun ward I, and Agbarho ward II.

In the second stage, a simple random sampling technique was used in selecting two communities from each political ward. We observed that some communities have PHCs while others do not, hence in each political ward, one community with PHC and one without PHC was selected. For Agbarha-otor ward, Agbarha-otor community was selected

for having PHC while Saniko selected for having no PHC. For Orogun ward, Ovara Unukpo was selected for having PHC while Umusu selected for having no PHC. For Agbarho ward II, Oguname was selected without PHC, and Ekreerhawwe selected for having PHC. For Ewereni ward, Ewereni community was selected for having PHC while Uneni selected without PHC.

In the third stage, household survey was conducted. Through the aid of lead contact persons, the research team made a tour around the communities, counting the number of houses in major roads and streets, and identifying houses with at least one woman that met the inclusion criteria. The eligibility criteria were the age 15-49 years, ever married, currently pregnant, or have had a birth in the past five years preceding the survey and must be currently residing in the communities. A second tour was made round the communities on separate days. This time it was only houses marked with qualified women that were visited. Before the visitation, community town criers were made to announce early in the morning that women within the reproductive ages should wait at their various homes during a specified period to see the research team. In houses where more than one eligible woman was on the ground at the time of the survey, simple balloting was used to select one out of them

The research plan proposed an equal number of 113 women to be selected from each community because there is no accurate population data to enable proportional sampling. However, some communities have fewer women who met the eligibility criteria, and fewer than 113 were surveyed in these communities. Hence, the number of women surveyed in communities with larger population size was increased to get the required study sample size of 900.

The analysis of data showed that all the communities were fairly covered in the selection of participants. However, Ekreerhawwe has more participants 132 [14.7%], followed by Agbarha-otor 125 [13.9%]; Oguname 120 [13.3%]; Uneni 117 [13.0%], Ewereni 114 [12.7%], Umusu 101 [11.2%]; Ovara Unukpo 104 [11.6%] and Saniko 87 [9.7%] have the

least numbers of participants [analysis not presented in Table].

#### Variables and Measures

Two outcome indicators were utilized in this study. They were early timing in ANC utilization in PHCs and a minimum of four ANC visits in PHCs. Early timing in ANC in PHCs is a binary variable, and it was coded 1 for ANC utilization in PHCs within the first three months of pregnancy and 0 otherwise. A minimum of four ANC visits in PHCs is binary variable coded as 1 for ANC visit of at least four visits in PHCs and 0 otherwise. Drawing from the Andersen and Newman [28] model and past studies [12], thirteen independent variables were utilized for the study. The independent variables laced under the various determinants as espoused by Andersen and Newman [28] are predisposing factors [maternal age, maternal education, religion, marital status, woman's level of autonomy and perception of quality of care in the nearest health center]; enabling factors [income and employment status and time involved in traveling to the nearest health center], need-based characteristics [The number of children ever given birth to, pregnancy-related complications and birth preparedness].

Maternal age is a continuous variable and measures in years of the participants, maternal education is categorical and coded into no formal education, primary education, secondary education, and higher education. Marital status is classified into married, living together, single, separated, and widow. The number of children ever given birth to ascertains the number of children the woman has ever had. It is categorized into 0-2, 3-4 and  $\geq 5$ . Religion is categorized into Catholic, other Christians, Islam, African traditional religion, and others. Employment status is binary and categorized into working and not working. Monthly income is categorized in to the following groups: < N5, 000, 5,000-9,999; 10,000-14,999; 15,000-99,999. Time engage in walking to the nearest health centers (in minutes) considered three categories of < 30 minutes' walk, between 30 and 59 minutes' walk and at least 60 minutes' walk.

Perception of quality of care render in the nearest health centers assessed respondents' valuation of care rendered in the nearest PHCs. We considered the following options: poor, good and excellent. Being classified as one prepared for birth entailed undertaking one of the following: saving money for delivery, had a transport arrangement, made an arrangement with a blood donor, and identified where the baby was born. History of pregnancy-related complications was categorized into yes for respondents who once suffered pregnancy-related complications and no otherwise. Exposure to media index was generated by asking participants questions on the number of times they watch television (TV) and listening to the radio. Three categories of responses were provided to participants. The response options are everyday as opportunity allows, at least once a week and not all. The option of everyday as opportunity allows is scored 2 marks; at least once a week scored 1 mark, and 0 was attached to the option of not at all. The responses were aggregated to generate five categories of exposure to media index: no exposure [0%], low exposure [11%-30%]; moderate exposure [31%- 50%]; high exposure [51%- 69%] and very high exposure [70%-100%]. We generated index for woman's autonomy by probing in to seven core areas of household decision-making: Ownership of land /house, participation in woman's healthcare decision, participation in household's large purchase decision, participation on household's decision on daily minor purchase, participation on household's decision on choice of food to cook and freedom to visit friends and relatives. Ownership of land or house was included in the study because women in the study area were allowed to own land or house if they wish. The response options provided were respondent alone, the husband, respondent and husband and others. We assigned 1 mark to the response respondent alone, 0.5 marks to the husband alone, and zero to every other response that precludes the respondents. Using principal component analysis, five-category index of autonomy was generated: no autonomy (0%), low autonomy [7%-30%], moderate autonomy [31%-50%], high autonomy [51%- 69%] and very high autonomy [70%-100%]. Women's participation in

household decision-making in areas of healthcare, minor daily purchase, major purchase, freedom to visit friends and relatives, and ownership of land/ house have been used by several studies as a proxy for women's autonomy[12].

#### Data Collection Procedure

The women were interviewed to elicit information from them on the pattern of utilization of ANC in PHCs in the course of last pregnancy using a pre-tested adapted questionnaire. The questionnaire was administered through a face-to-face interview and was fielded in either Pidgin English or English language. Trained field Research Assistants with one-day training assisted in administering the questionnaires. The questionnaire was structured into five sections. Section 1 focused on respondent's background, Section 2 on husband's characteristics and respondent's participation in household decisions, section 3 reproductive history, section 4 on Antenatal care, Intrapartum and postnatal care experiences during last pregnancy and section 5 on reasons for use and no use of PHCs for various maternal care needs. The responses generated from these sections established the foundation upon which the study was situated in its socio-cultural context. Data collection lasted for three months. During the fieldwork, interviewers were closely monitored by field supervisors who performed spot checks and possibly re-interviewed where appropriate.

#### Data Analysis

The distribution of the respondents' socioeconomic characteristics, together with their attitude towards maternal care (early timing of ANC visits and a minimum of four ANC visits) was expressed as simple percentages and frequencies. Bivariate analysis was conducted to examine whether a significant association existed between the two outcomes indicators and the various socioeconomic factors, using the Pearson's chi-square ( $\chi^2$ ) test at 5% level of significance. The binary logistic regression was utilized to examine the various socioeconomic factors influencing the two outcome indicators while adjusting for the effect

of other predictors. The model has advantages over others [multiple regressions] because it ensures prediction of the probability of choice within ranges (1, 0), easier, and more convenient to compute since it is based on the cumulative ordered logistic probability function.

The variables included in the logistic regression model were those variables that were either significant at 1%, 5%, or 10% level of significance or conceptually important drawing from previous studies on maternal care utilization in Nigeria. The results of the logistic regression were presented as odds ratio (OR) with a 95% confidence interval for the pooled observation and both sets of communities. Some variables that were significant at the bivariate level were not included because of problems of collinearity.

Some of the independent variables were re-coded both for the chi-square test and binomial logistic regression analysis because of few numbers of cases in some categories. Variables that were re-coded include maternal age, religion, maternal education, and marital status. Maternal age was initially a continuous variable, but they were categorized for frequency distribution. Religion was re-coded into three categories: Catholic Christian, other Christian and others. This is owing to a few numbers of persons in the categories of pagan and African Traditional Religion. Marital status was also recoded because of the few numbers of cases in the categories: separated, widowed, and single; they were lumped together as others; hence, marital status was re-categorized into married, living together, and others. Only a few numbers of participants and their spouses have post-secondary education; hence, secondary education and post-secondary education were lumped together as at least secondary education, so education was re-coded into no formal education, primary education, and higher education. To remove women without previous birth experience, the number of children ever given birth to was recoded into 1-2, 3-4, and  $\geq 5$ .

For the two indicators (a minimum of four ANC visits and early timing of ANC visits), attempts were made to estimate separate models for both sets of communities based on whether the

variable "communities" was significant at 5%. The variable "communities" was binary, hence coded 1 for respondents drawn from communities with PHCs and 2 for those from communities without PHCs. In cases where the variable "communities" was significant, it was possible to deduce that different sets of predictors influence the particular outcome, hence separate analyses for that particular indicators were made for both sets of communities. However, where the variable communities were not significant, only an estimated model for the pooled observation was made.

Both the early timing of ANC visits and a minimum of four ANC visits were bounded for women who reported they utilized PHCs as the place of ANC providers. Of the 819 women who reported recent birth in the last five years preceding the survey, 435 of them utilized ANC in PHCs. These were the women use for the analysis of the determinants of early timing of ANC visits and a minimum of four ANC visits in PHCs. The analyses were bounded for users of PHC for ANC because it is only users that can use timely and adequately.

#### Ethical Consideration

This study is part of a study designed to assess barriers to maternal care utilization in PHCs in the rural part of Delta State, Southern Nigeria. Ethical clearance and Approval to conduct the study was obtained from the University of Benin Ethics Review Committee with protocol number ADM/E22/A/VOL.VII/14689. Permission to undertake the survey was sought from the leaders of the various communities (that is, Ovie) and chiefs of the study area where the survey was conducted. Also, consent was obtained from the heads of individual households where participants were drawn from. Finally, informed consent was obtained from participants. Participants were informed of the purpose of the study and were assured of confidentiality. They were educated that they had the choice to discontinue the study if they had wish without consequences. Finally, participants were made to sign a consent form, which showed that they understood very well what was explained to them and that they also gave their consent to partake in the survey.No

names or specific contact information was obtained from participants as they were identified by unique numbers.

#### Results

Socio-demographic characteristics of the respondents

The demographic characteristics of the women are presented in Table 1 above. For simplicity and easy comprehension, we present summary statistics for the pooled observation and for both sets of communities that are for communities with PHCs and those without PHCs. For the pooled observation, the average maternal age is 34.4 years with a standard deviation (SD) of 7.2 years. Participants drawn from the set of communities with PHCs have higher average maternal age than those from the sets of communities without PHCs [34.9 years vs. 33.9 years]. The majority of the participants belong to the age group 35-39 [29.9%]. For the set of communities with PHCs, 32.7% [n= 155] belong to the age group 35-39, while for the set of communities without PHCs, 26.8% [n = 114] belong to the same age group. A large proportion of respondents reported primary educational qualification [54.4%]. Other Christians constitute the vast majority [49.1%], with more participants reporting other Christians in the set of communities without PHCs compared to the set of communities with PHCs [50.8% vs. 47.6%]. Approximately 95% of the women were engaged in economic activities outside their homes. Analysis of detailed of employment revealed that they were largely engaged in the informal sector. Approximately 38% [n = 383] earned less than N5, 000. In the set of communities with PHCs, the majority of the women earned less than N5 000 [52.5%], while for the set of communities without PHCs majority earned between N (5,000-9,999) [38.4%].

Analysis of media exposure showed that the majority of women had high media exposure [40.9%]. More women had high media exposure among the sets of communities without PHCs compared to those with PHCs [45.4% vs. 36.8%]. The majority of women are married [65.2%]. Slightly above 30% were in a consensual union (32.7%). More women were in informal union among the set of communities



with PHCs than the set of communities without PHCs [42.9% vs. 21.2%]. The majority of the women live in homes where they have to walk for at least 60 minutes to the nearest health center [57.7%]. A higher proportion of women will need to walk for at least 60 minutes among the set of communities without PHCs than those with PHCs [72.5% vs. 54.9%]. While 65.6% of the women rated the quality of care in the nearest health center to be poor; 6.3% rated good, and 28.1% rated excellent. More women rated poor among the set of communities without PHCs than among the set of communities with PHCs [74.8% vs. 57.3%]. Approximately 68% of the women reported no previous pregnancy-related complications. More women reported they once suffered pregnancy-related complications among the set of women without PHCs than among the set of women with PHCs [32.2% vs. 31.4%]. A higher proportion of women did not prepare for delivery [67.8%]. Analysis of woman's level of autonomy shows that the majority of the respondents reported low autonomy (43.6%). More women reported low autonomy among the set of communities with PHCs compared to the set of communities without PHCs [54.5% vs. 31.8%].

Examination of reproductive characteristics revealed that the majority of the respondents reported that they have given birth to at least five children [41.2%]. Approximately, 27.0% [n = 244] of the respondents were currently pregnant. More women reported current pregnancy among the sets of communities with PHCs compared to the set of communities without PHCs [32.2% vs. 21.4%]. Approximately 75% [n = 182] of currently pregnant women utilized ANC and approximately 69% utilized care in PHCs.

As touching delivery care, 819 women had a birth in the last five years preceding the survey. Approximately 77% [n = 627] of women with

recent birth went for ANC checkup in the course of pregnancy, and 435 [69.4%] went for ANC checkup in PHCs.

#### Factors Associated with Early Timing of ANC Visits in PHCs

The Chi-square test, which examined the association between socio-demographic factors and early timing of ANC visits in PHCs is presented in Table 2. The early timing of ANC in PHCs was significantly associated with maternal age, maternal education, religion, exposure to media, time involved in walking to the nearest health centers, perception of the quality of care rendered in the nearest health center, pregnancy-related complications and birth preparedness [ $p < 0.05$ ]. A higher proportion of women within the age bracket 16-19 [50%] compared to those within any other age group made early ANC visits in PHCs. Again, 40.5 % of respondents who reported formal/ primary education made early ANC visits in PHCs compared to 24.3% of those who reported secondary/higher education. An examination of religion revealed that 51.1% of women who reported other religions (traditional African worshippers, pagan) made early ANC visits in PHCs. Majority of the women who reported low media exposure [48.9%] made early ANC visits in PHCs when compared to any other level of media exposure. While 63.1% of those who lived within 30 minutes' walk to the nearest PHCs made early visit in PHCs; 16.0% of those who live within 30-59 minutes' walk made early visit in PHCs and 17.7% of those who lived within at least 60 minutes' walk made early ANC visits in PHC. A higher proportion of women who rated the quality of care in nearest PHCs as excellent made early ANC in PHCs [54.9%] compared to women who rated poor [28.8%] and good [35.5%].

**Table 1: Percent distribution of the respondents by personal, family and reproductive characteristics by sets of communities**

Characteristic	Pooled observation	Communities with PHCs	Communities without PHCs
<b>Number of respondents</b>	<b>900</b>	<b>475(52.8)</b>	<b>425(47.2)</b>
<b>Personal Characteristics</b>			
<b>Maternal Age:</b>			
Mean(SD)	34.4(7.2)	34.9(7.4)	33.9(6.9)
16-19	21(2.4)	12(2.5)	9(2.2)
20- 24	81(9.0)	45(9.5)	36(8.5)
25-29	130(14.5)	59(12.5)	71(16.7)
30-34	176(19.6)	75(15.8)	101(23.8)
35-39	269(29.9)	155(32.7)	114(26.8)
40-49	222(24.7)	128(27.0)	94(22.1)
<b>Maternal Education:</b>			
<b>No formal Education</b>	<b>193(21.4)</b>	<b>104(21.9)</b>	<b>89(20.9)</b>
Primary	490(54.4)	271(57.1)	219(51.5)
Secondary	205(22.8)	72(8.0)	85(20.0)
Higher	12(1.3)	28( 3.1 )	32(7.5)
<b>Religion:</b>			
Catholic	368(40.9)	193(40.6)	175(41.2)
Other Christians	442(49.1)	226(47.6)	216(50.8)
Islam	30(3.0)	21(4.4)	12(2.8)
Traditionalist	35(3.9)	23(4.8)	11(2.6)
Others	25(2.8)	12(2.5)	11(2.6)
<b>Monthly Income (N):</b>			
<5,000	383(42.6)	249(52.5)	134(33.5)
5000-9,999	291(32.3)	128(26.9)	163(38.4)
10,000-14,999	166(18.4)	85(17.9)	81(19.1)
15,000-99,999	60(6.7)	13(2.7)	47(11.1)
<b>Media Exposure:</b>			
None	177(19.7)	69(14.5)	108(25.4)
Low	175(19.4)	102(21.5)	73(17.2)
Moderate	147(19.3)	102(21.5)	45(10.6)
High	368(40.9)	175(36.8)	193(45.4)
Very high	33(0.7)	27(5.7)	06(1.4)
<b>Employment Status:</b>			
Working	859(95.4)	451(94.9)	408(96)
Not Working	41(4.6)	24(5.1)	17(4.0)
<b>Marital Status:</b>			
Married	587(65.2)	257(54.1)	330(77.6)
Living together	294(32.7)	204(42.9)	90(21.2)
Widowed	04(0.4)	04(0.8)	01(0.2)
Divorced	08(0.9)	07(1.5)	03(0.7)
Separated	07(0.8)	02(0.4)	01(0.2)
<b>The time involved in walking to the nearest health center (in minutes):</b>			
< 30	326(36.2)	169(35.6)	157(25.1)
30 - 59	55(6.1)	45(9.5)	10(2.4)
≥ 60	519(57.7)	261(54.9)	258(72.5)
<b>Perception of Quality of Care in Nearest Health Center:</b>			
Poor	590(65.6)	272(57.3)	318(74.8)
Good	57(6.3)	37(7.8)	20(4.7)
Excellent	253(28.1)	166(34.9)	87(20.5)

\*Analysis for determinants of early timing of ANC visits and a minimum of four ANC visits in PHCs were bounded for the 435 women of recent birth who reported utilizing ANC from PHCs

Table 1 Cont'd

Characteristic	Pooled observation	Communities with PHCs	Communities without PHCs
<b>Pregnancy-Related Complication:</b>			
No	614(68.2)	326(68.6)	288(67.8)
Yes	286(31.8)	149(31.4)	137(32.2)
<b>Birth Preparedness Plan:</b>			
No	610(67.8)	322(67.8)	288(67.8)
Yes	290(32.2)	153(32.2)	137(32.2)
<b>Woman's level of autonomy:</b>			
No autonomy	147(16.3)	41(8.6)	106(24.9)
Low autonomy	394(43.6)	259(54.5)	135(31.8)
Moderate autonomy	248(27.6)	103(21.7)	145(34.1)
High autonomy	74(8.2)	48(10.1)	26(6.1)
Very high autonomy	37(4.1)	24(5.1)	13(3.1)
<b>Reproductive Characteristics</b>			
The number of children ever given birth to:			
0-2	183(20.3)	120(25.2)	63(14.8)
3- 4	346(38.4)	165(34.7)	181(42.6)
5+	371(41.2)	90(40)	181(42.6)
<b>Currently pregnant:</b>			
Yes	244(27.1)	153(32.2)	91(21.4)
No	656(72.8)	322(67.8)	334(78.6)
<b>ANC:</b>			
Yes	182(74.6)	120(78.4)	62(68.1)
No	62(25.4)	33(21.6)	29(31.9)
<b>Place of ANC:</b>			
Other govt. Hospital	22(12.1)	11(9.2)	11(17.7)
PHC	126(69.2)	88(73.3)	38(61.3)
Private hospital	20(10.9)	10(8.3)	10(16.1)
Others/home	14(7.7)	11(9.2)	3(4.8)
<b>Recent Birth (n = 819)</b>			
<b>Antenatal care:</b>			
No	192(23.4)	80(18.8)	112(28.4)
Yes	627(76.6)	345(81.2)	282(71.6)
<b>Place of Antenatal Care:</b>			
Other govt. Hospital	72(11.4)	20(5.8)	52(19.5)
PHC	435*(69.4)	238(68.9)	197(69.9)
Private hospital	66(10.5)	54(15.7)	12(4.3)
Others	54(8.6)	33(9.6)	21(7.4)

\*Analysis for determinants of early timing of ANC visits and a minimum of four ANC visits in PHCs were bounded for the 435 women of recent birth who reported utilizing ANC from PHCs

**Table 2: Association between Antenatal Care Utilization and Respondents' Socio-demographic Characteristics**

	Early timing of ANC Visits in PHCs			A minimum of four ANC Visits in PHCs	
	Number	Yes N (%)	Chi2/prob.	Yes N (%)	Chi2/prob.
<b>Maternal Age:</b>					
16-19	6	03 (50.0)		02 (33.3)	(5) = 2.12
20 -24	23	11 (47.8)		09 (39.1)	$\rho = 0.83$
25-29	62	27 (43.5)	(5) = 11.84	24 (38.7)	
30 -34	93	39( 41.9)	$\rho = 0.04^{**}$	28(30.1)	
35-39	131	34(25.9)		41(31.3)	
40-49	120	51(42.5)		43(35.8)	
<b>Maternal Education:</b>					
No formal/primary	365	148 (40.5)	(3) = 11.84	123 (33.7)	(3) = 2.11
Secondary/higher	70	17 (24.3)	$\rho = 0.03^{**}$	24(34.3)	$\rho = 0.55$
<b>Religion:</b>					
Catholic	168	66 (39.3)	(2) = 4.74	56(33.3)	(3) = 0.08
Other Christians	222	76 (34.2)	$\rho = 0.09^{***}$	75( 33.8)	$\rho = 0.96$
Others	45	23(51.1)		16( 35.6)	
<b>Marital Status:</b>					
Married	285	112(39.3)	(2) = 1.24	88(30.9)	(3) = 4.34
Living together	138	50( 36.2)	$\rho = 0.54$	56(40.6)	$\rho = 0.11$
Others	12	03 (25.0)		03( 25.0)	
<b>Employment Status:</b>					
Working	417	161 (38.6)	(1) = 1.96	140(33.6)	(3) = 0.22
Not Working	18	04( 22.2)	$\rho = 0.16$	07 (38.9)	$\rho = 0.64$
<b>Exposure to Media:</b>					
No Exposure	86	34 (39.5)	(4) = 9.27	28( 32.6)	(3) = 7.48
Low Exposure	94	46(48.9)	$\rho = 0.06^{***}$	36 (38.3)	$\rho = 0.11$
Moderate Exposure	75	23(30.7)		29 (38.7)	
High Exposure	168	60(35.7)		47(27.9)	
Very High Exposure	12	02(16.7)		07(58.3)	
<b>Woman's level of autonomy</b>					
:					
No autonomy	57	18(31.6)	(4) = 4.04	17(29.8)	(4) = 6.48
Low autonomy	222	92(41.4)	$\rho = 0.40$	75 (33.8)	$\rho = 0.17$
Moderate autonomy	103	33(32.0)		33 ( 32.0)	
High autonomy	35	14(40.0)		18(51.4)	
Very high	18	08(44.4)		04 (22.2)	
<b>The number of children ever given birth to:</b>					
1-2	66	19(28.8)	(2) = 2.92	23( 34.8)	(4) = 0.05
3-4	174	67(38.5)	$\rho = 0.23$	59(33.9)	$\rho = 0.97$
5+	195	79(40.5)		65(33.3)	

\* $p < 0.01$ , \*\* $p < 0.05$  \*\*\* $p < 0.1$ .

Table 2: Cont'd

	Early timing of ANC Visits in PHCs			A minimum of four ANC Visits in PHCs	
<b>Monthly Income (N):</b>					
0	18	04(22.2)	(4) = 5.11	07(38.8)	(4) = 11.46
<5,000	181	78(43.1)	$\rho = 0.28$	63 (34.8)	$\rho = 0.02^{**}$
5,000 -9,999	148	52( 35.1)		37(25.0)	
10,000 -14,999	74	25(33.8)		35( 47.3)	
15,000- 99,999	14	06( 42.9)		05(35.7)	
<b>The time involved in walking to the nearest health center (in minutes):</b>					
< 30	195	123(63.1)	(2) = 94.95	140 (71.8)	(2) = 230.26
30 - 59	25	04(16.0)	$\rho = 0.00^*$	04 (16.0)	$\rho = 0.00^*$
$\geq 60$	215	38(17.7)		03(1.4)	
<b>Perception of Quality of Care in Nearest Health Center:</b>					
Poor	260	75 (28.8)	(2) = 26.72	04 (1.5)	(2) = 331.66
Good	31	11 (35.5)	$\rho = 0.00^*$	12 (38.7)	$\rho = 0.00^*$
Excellent	144	79 (54.9)		131 (90.9)	
<b>Pregnancy-Related Complication:</b>					
Yes	170	158(92.9)	(2) = 358.68	87(51.2)	(2) = 32.69
No	265	07(2.6)	$\rho = 0.00^*$	60( 22.6)	$\rho = 0.00^*$
<b>Birth Preparedness Plan:</b>					
No	265	10( 3.8 )	(2) = 336.04	62( 23.4)	(2) = 32.76
Yes	170	155(91.2)	$\rho = 0.00^*$	85( 50.0)	$\rho = 0.00^*$

\* $p < 0.01$ , \*\* $p < 0.05$  \*\*\* $p < 0.1$ .

While 92.9% of women who reported they once suffered pregnancy-related complications made early ANC visits in PHCs only 2.6% of those who did not have such experience met such standards. Birth preparedness plan influenced early timing in use of PHCs so that 91.2% of women who in the course of last pregnancy prepared for delivery made timely ANC visits in PHCs while 3.8% of those who made no preparation were able to make their ANC within the first three months of pregnancy. Other variables which include, marital status, woman's level of autonomy, employment status, number of children ever given birth to, and monthly income were not found to be significantly associated with early timing of ANC visits in PHCs [ $\rho > 0.05$ ].

#### Factors Associated with a minimum of Four ANC Visits in PHCs

The Chi-square test, which examined the association between socio-demographic factors and a minimum of four ANC visits in

PHCs is presented in Table 2. A minimum of four ANC visits in PHCs was significantly influenced by monthly income, time involved in walking to the nearest health centers, perception of the quality of care rendered in the nearest health center, pregnancy-related complications, and birth preparedness [ $p < 0.05$ ]. A higher proportion of women who earned between N (10,000 -14,900) [47.3%] made a minimum of four ANC visits in PHCs. While 71.8% of those who lived within 30 minutes' walk to the nearest PHCs made at least four ANC visit in PHCs; 16.0% of those who live within 30-59 minutes' walk made early visit and 7.9% of those who lived within at least 60 minutes' walk made at least four ANC visits in PHCs. A higher proportion of women who rated the quality of care in nearest PHCs as excellent made at least four ANC visits in PHCs [90.9%] compared to women who rated poor [38.7%] and good [1.5%]. Experience with previous pregnancy-related complications

significantly influenced a minimum of four ANC visits in PHCs [P = 0.00].

Consequently, 51.2% of women who once experienced pregnancy-related complications made a minimum of four ANC visits in PHCs only 22.6% of those without such experience made up to four ANC visits in PHCs. Also, birth preparedness significantly influenced a minimum of four ANC visits in PHCs [p = 0.00].

While 50% of women who prepared for delivery made a minimum of four ANC visits in PHCs it is only 23.4% of those who did not prepare that met this standard. The other variables which are maternal age, maternal education, religion, marital status, employment status, exposure to media, woman's level of autonomy and number of children ever given birth to were not found to be significantly associated with a minimum of four ANC visits in PHCs [p>0.05].

**Table 3: Logistic Regression Model Predicting the Likelihood of making early ANC visits in PHC.**

Variables	Adjusted Odd ratios (probability values)		
	Pooled observation	Communities with PHCs	Communities without PHCs
<b>Maternal age:</b>			
16–19(ref)	1.00	1.00	1.00
20–24	7.29 (0.51)	17.06(0.62)	0.50(0.69)
25–29	0.77 (0.93)	0.09(0.70)	1.34(0.86)
30–34	0.19 (0.58)	0.11(0.70)	0.61(0.76)
35–39	0.15 (0.52)	0.04(0.57)	0.24(0.39)
40–49	0.21 (0.61)	0.17(0.71)	0.35(0.53)
<b>Maternal Education:</b>			
None(ref)	1.00	1.00	1.00
Primary	1.89(0.44)	2.99(0.39)	1.37(0.62)
≥Secondary	0.27(0.22)	1.16(0.05)**	0.58(0.49)
<b>Employment Status:</b>			
Not working(ref)	1.00	1.00	1.00
Working	19.15(0.04)**	176.99(0.01)*	1.95(0.59)
<b>Number of children ever given birth to:</b>			
1-2(ref)	1.00	1.00	1.00
04-Mar	3.08(0.22)	10.11(0.42)	0.83(0.81)
5+	8.35(0.04)**	30.17(0.02)**	1.22(0.81)
<b>Exposure to Media:</b>			
No exposure(ref)	1.00	1.00	1.00
Low exposure	2.43(0.38)	1.54(0.78)	1.23(0.89)
Moderate Exposure	4.21(0.20)	21.69(0.14)	1.98(0.78)
High Exposure	2.15(0.42)	2.60(0.55)	2.15(0.98)
Very High Exposure	0.21(0.36)	0.34(0.62)	3.56(0.11)

\*p<0.05 \*\*p<0.01 \*\*\*p<0.001.ref: reference category ----- Variables omitted from a model.

Table 3: Cont'd

Variables	Adjusted Odd ratios (probability values)		
	Pooled observation	Communities with PHCs	Communities without PHCs
<b>The time involved in walking to the nearest health center (in minutes):</b>			
< 30 minutes (ref)	1.00	1.00	1.00
30-59 minutes	0.33(0.42)	0.16(0.00)*	
≥ 60 minutes	0.11(0.02)**	0.05(0.04)**	0.22(0.00)
<b>Perception of Quality of Care in Nearest Health Center:</b>			
Poor (ref)	1.00	1.00	1.00
Good	0.88(0.91)	0.24(0.37)	0.34(0.26)
Excellent	0.71(0.69)	0.41(0.47)	1.28(0.04)**
<b>Pregnancy-Related Complication:</b>			
No (ref)	1.00	1.00	1.00
Yes	638.95(0.00)*	2079.6(0.00)*	2.34(0.74)
<b>Birth preparedness plan:</b>			
No (ref)	1.00	1.00	1.00
Yes	9.73(0.12)	11.32(0.17)	1.45(0.45)
<b>Communities:</b>			
Communities with PHCs (ref)	1.00	-----	-----
Communities without PHCs	0.09(0.00)*		
Number of observation	435.00	255.00	177.00
LR Chi2	477.40	272.42	84.52
Probability	(0.00)*	(0.00)*	(0.00)*
Count R <sup>2</sup>	0.83	0.84	0.35

\*p<0.05 \*\*p<0.01 \*\*\*p<0.001.ref: reference category ----- Variables omitted from a model.

#### Determinants of Early Timing of ANC in PHCs

The individual-level variables that significantly predict early timing in ANC utilization in PHCs include employment status, number of children ever given birth to, time involved in traveling to the nearest health center, pregnancy-related complications, and the set of communities [Table 3]. First, we examine the goodness-of-fit of the early ANC model by estimating the count R<sup>2</sup>. The count R<sup>2</sup> puts at 72% shows that the selected socio-demographic factors account for 83% variation in early timing of ANC visits in PHCs, while only 17% could not be accounted for. Thus, the early ANC model has impressive goodness-of-fit. Also, the entire model is statistically significant given the log-likelihood

statistics [477.4] with  $\rho = 0.00$ . The odds for reporting early timing of ANC visits in PHCs are significantly higher for working women [aOR: 19.15,  $\rho = 0.04$ ]. Women who reported at least five births  $\geq 5$  [aOR: 8.35,  $\rho = 0.04$ ] reported an approximately eight-fold increase in the odds for making early ANC visits in PHCs. Women who have to walk for at least 60 minutes to the nearest healthcare centers [aOR: 0.11,  $\rho = 0.02$ ] were 89% significantly less likely to make early ANC visits in PHCs. Those who reported they once experience pregnancy-related complications [aOR: 638.95,  $\rho = 0.00$ ] were 638.95 times significantly more likely to make early ANC visits in PHCs. There was a statistically significant difference between the two sets of communities concerning making

early ANC visits in PHCs. Making early ANC in PHCs was significantly less likely in the set of communities without PHCs [aOR: 0.09,  $p = 0.00$ ]. Thus, separate analyses were conducted for the two sets of communities to determine what differences there might be between them in the predictors of early ANC utilization in PHCs. For the set of communities with PHCs, maternal education, employment status, number of children ever given birth to, time involved in traveling to the nearest health center, and pregnancy-related complications are the significant predictors of early ANC visits in PHCs. In reference to women who reported no formal education, those who reported at least secondary educational qualification [aOR: 1.16,  $p = 0.05$ ] were 16% significantly less likely to make early ANC visits in PHCs. Working women [aOR: 176.99,  $p = 0.01$ ] were 176.99 times significantly more likely to make early ANC visits in PHCs when compared with non-working women. In reference to those who lived within 30 minutes' walk to the nearest healthcare center, those who live within 30-59 minutes' walk [aOR: 0.16,  $p = 0.00$ ] and those who live at least 60 minutes' walk to the nearest healthcare centers [aOR: 0.05,  $p = 0.04$ ] were respectively 84% and 95% significantly less likely to make early ANC visits in PHCs. Women who reported they once experience pregnancy-related complications [aOR: 2079.6,  $p = 0.00$ ] were 2,079.6 times significantly more likely to make early ANC visits in PHCs. Among the set of communities without PHCs, it is only perception of the quality of care in the nearest healthcare center that significantly influenced early ANC visits in PHCs. In reference to women who reported the quality of care in the nearest healthcare center as poor, those who rated excellent [aOR: 1.28,  $p = 0.04$ ] were 28% significantly more likely to make early ANC visits in PHCs.

#### Determinants of a Minimum of Four ANC Visits in PHCs

The individual-level variables that significantly influence a minimum of four ANC visits in PHCs include maternal education, time involved in traveling to the nearest health center, perception of the quality of care in the nearest health center, and the sets of communities [see Table 4]. First, we examine the goodness-of-fit of a minimum of four ANC visits in PHCs model

by estimating the count  $R^2$ . The count  $R^2$  puts at 88% shows that the selected socio-demographic factors account for 88% variation in a minimum of four ANC visits in PHCs, while only 12% could not be accounted for. Thus, the minimum of four ANC model has impressive goodness-of-fit. Also, the entire model is statistically significant given the log-likelihood statistics [477.20] with  $p = 0.00$ . The odds for reporting a minimum of four ANC visits in PHCs are significantly higher for women who reported at least secondary educational qualification [aOR: 10.47,  $p = 0.07$ ] compared with those with no formal education. In reference to women who lived within 30 minutes' walk to the nearest health centers, those who lived within 30-59 minutes' walk [aOR: 0.02,  $p = 0.00$ ] and at least 60 minutes' walk [aOR: 0.00,  $p = 0.00$ ] were respectively 98% and 100% significantly less likely to make a minimum of four ANC visits in PHCs. There was a statistically significant difference between the two sets of communities with respect to making a minimum of four ANC visits in PHCs. Making a minimum of four ANC in PHCs was significantly less likely in the set of communities without PHCs [aOR: 0.24,  $p = 0.00$ ]. Thus, separate analyses were conducted for the two sets of communities to determine what differences there might be between them in the predictors of at least four ANC visits in PHCs. Among sets of communities with PHCs, maternal education, time involved in traveling to the nearest healthcare centers, and perceptions of the quality of care rendered in the nearest healthcare center were the significant predictors of a minimum of four ANC visits in PHCs. In reference to women who reported no formal education, those who reported primary educational qualification [aOR: 35.11,  $p = 0.04$ ] were 3,411% significantly more likely to make a minimum of four ANC visits in PHCs. In reference to women who require less than 30 minutes' walk to the nearest healthcare centers, those who require 30-59 minutes' walk [aOR: 0.01,  $p = 0.01$ ] and those who require at least 60 minutes' walk [aOR: 0.00,  $p = 0.00$ ] were respectively 99% and 100% significantly less likely to make a minimum of four ANC visits in PHCs. In reference to those who rated the quality of care in the nearest healthcare center to be poor, those who rated good [aOR: 53.42,  $p = 0.00$ ]



reported an approximately 53-fold increase in the odds for making a minimum of four ANC visits in PHCs. Among the set of communities without PHCs, only monthly income was the significant predictor of a minimum of four ANC in PHCs. In reference to women who were not employed, those who earned below N5, 000 [aOR: 3214870,  $\rho = 0.00$ ], between N (5,000-9,999) [aOR: 2243775,  $\rho = 0.00$ ]; between N(10,000-14,999) [aOR: 554026.60,  $\rho = 0.00$ ] and between N(15,000-99,999) [aOR: 5.31e+13,  $\rho = 0.00$ ] were respectively 3214870, 2243775, 554026.60 and 5.31e+13 significantly more likely to make a minimum of four ANC visits in PHCs.

## Discussion

The study investigated in eight rural communities the factors that determine early timing in ANC visits and a minimum of four ANC visits in PHCs. Unlike past studies that focused on maternal care in general (that is, not considering the source where the care is utilized from), this study focused on the PHC component of maternal health services. The study was motivated by the fact that the PHC system is the most affordable and accessible healthcare system that can provide basic ANC and delivery care to pregnant women living in the rural part of Nigeria. In Nigeria, there are few secondary and tertiary healthcare centers, and they are often located in urban areas where rural women cannot travel to due to distance and transport costs [17]. Hence, PHCs offers rural women the opportunity to utilize modern health care services.

The result from the study revealed that 53.1% (435/819) of women with recent birth utilized ANC in PHCs. ANC coverage rate in PHCs recorded in this study is average. The ANC coverage rate in PHCs reported in this study is above the coverage rate of 29.6% reported by Ejembi et al. [26], but lower than the coverage rate of 62.1% recorded by Okonofua et al. [12] and 79% recorded by Alenoghena, Isah and Issara [31]. The utilization rate can be said to be unimpressive given that the PHC system is the closest healthcare, and there are more PHCs compared to secondary and tertiary healthcare facilities in the rural part of Nigeria.

This study, therefore, corroborates the report made by Okonofua et al. [12] and Yaya et al [33], that PHCs are underutilized for maternal care needs. In the literature, several factors were reported as barriers to women intending to utilize maternal care from PHCs. Notable among the barriers is the poor quality of care [12]. Hence, there should be a complete renovation of PHC facilities in the study area, to improve the quality of care rendered in PHCs.

We reported that women who reported at least secondary education were significantly more likely to make a minimum of four ANC visits in PHCs. Among the set of communities with PHCs, women who reported at least secondary educational qualifications were 16% significantly more likely to make early ANC visits in PHCs. This finding conforms to that of Ajayi & Osakinle [34], who advocated for a minimum of secondary education for women in the study area. It is, therefore pertinent that intervention programs should be initiated that encouraged rural women to have a minimum of primary education. School curriculum should be designed to have topics on reproductive health where women will be taught on the benefits of both early timings in the use of ANC and adequacy of ANC visits.

We also found that time involved in traveling to the nearest healthcare center was a significant predictor of a minimum of four ANC visits and early ANC visits in PHCs. Respondents whose homes were more than 60 minutes' walk to the nearest health center were respectively 99% and 99.9% significantly less likely to make early ANC visits and a minimum of four ANC visits in PHCs. It shows there are still several underserved communities in the rural part of Delta State and that PHCs are not evenly distributed across the rural part of Nigeria. Women who live far away from health centers will find it difficult to start ANC checkups, and even when they do start, they may not meet up with the recommended number of visits. Distance barriers are particularly prominent in poor-resource settings such as the rural part of Nigeria [34]. Several of the women in the rural part of the country are engaged in the informal sector and often may not have the money to pay as transport fare to health centers. Besides, the opportunity costs of time in traveling to

health centers may discourage several Nigerian women from making up to four ANC visits in PHCs. This is linked to the scarcity of health facilities especially in the rural part of the country [35]. Gage [36] reported a strong tie

between the quantity and quality of ANC and distance to health facilities.

**Table 4: Logistic Regression Model Predicting the Likelihood of making a minimum of four ANC visits in PHC.**

Variables	Adjusted Odd ratios (probability values)		
	Pooled observation	Communities with PHCs	Communities without PHCs
<b>Maternal Education:</b>			
None(ref)	1.00	1.00	1.00
Primary	5.56(0.10)	35.11(0.04)**	0.46(0.67)
≥Secondary	10.47(0.07)***	14.11(0.14)	1.10e+14(0.99)
<b>Monthly Income(N):</b>			
0(ref)	1.00	1.00	1.00
<5,000	0.31(0.49)	0.45(0.32)	3214870(0.00)*
5,000–9,999	0.22(0.38)	0.17(0.78)	2243775(0.00)*
10,000–14,999	0.55(0.74)	2.11(0.45)	554026.60(0.00)*
15,000–99,999	-----	1.35(0.78)	5.31e+13(0.00)*
<b>Number of children ever given birth to:</b>			
1-2 (ref)	1.00	1.00	1.00
04-Mar	1.20(0.84)	7.22(0.10)	0.06(0.18)
5+	1.89(0.49)	1.79(0.59)	0.71(0.80)
<b>Employment Status:</b>			
Not working (ref)	1.00	1.00	1.00
Working	3.11(0.67)	1.87(0.98)	2.31(0.87)
<b>Time involved in walking to the nearest health center (in minutes):</b>			
< 30 minutes (ref)	1.00	1.00	1.00
30-59 minutes	0.02(0.00)*	0.01(0.01)*	0.67(.078)
≥ 60 minutes	0.00(0.00)*	0.00(0.00)*	0.89(0.98)
<b>Perception of Quality of Care in Nearest Health Center:</b>			
poor (ref)	1.00	1.00	1.00
Good	26.78(0.00)*	53.42(0.00)*	1.62e+16(0.99)
Excellent	1527.95(0.00)*	11.98(0.65)	2.91e+17(0.99)
<b>Pregnancy–Related Complication:</b>			
No(ref)	1.00	1.00	1.00
Yes	0.72(0.76)	2.31( 0.78)	14.96(0.12)
<b>Birth preparedness plan:</b>			
No(ref)	1.00	1.00	1.00
Yes	2.63(0.74)	4.56(0.78)	6.11(0.89)
<b>Communities:</b>			
Communities with PHCs (ref)	1.00	-----	-----
Communities without PHCs	0.24(0.05)*		
<b>Number of observation</b>	<b>435.00</b>	<b>256.00</b>	<b>179.00</b>
<b>LR Chi2</b>	<b>477.20</b>	<b>300.70</b>	<b>178.11</b>
<b>Probability</b>	<b>(0.00)*</b>	<b>(0.00)*</b>	<b>(0.00)*</b>
<b>Count R<sup>2</sup></b>	<b>0.88</b>	<b>0.89</b>	<b>0.84</b>

t\*p<0.05 \*\*p<0.01 \*\*\*p<0.001.ref: reference category

----- Variables omitted from the model.

--- -omitted due to problems of collinearity

There is a need to establish more health centers that render ANC services in the rural part of Nigeria [35]. According to Fagbamigbe

& Idemudia [6], for ANC coverage rate in developing countries to catch up with the rate in developed countries the ANC must be rendered free of charge with services rendered to

pregnant women at their doorsteps and one health center should be sited within each 15 km radius.

The study further revealed that respondents with at least five births were more likely to make early ANC visits in PHCs. This conforms to findings from a Columbian study [37], though at variance with past Nigerian study [6], an Indian report [38] and an Ethiopian study [39] and a Ghana study that reported that ANC utilization reduces as mother's age increased and with increasing birth order [23]. The finding supports the views maintained by several authors that women who have given birth to several numbers of children have a better knowledge of maternal complications and are more apt to adopt precautionary measures to avert complications. This calls for programs and policies that will ensure early timing in the use of ANC and promote positive maternal care behaviour among all women irrespective of parity. Intervention programmes designed to improve maternal care behaviours should focus more on younger women with a few numbers of children.

Our study concurs with the report from other studies that women with a history of pregnancy-related complications are more likely to utilize maternal care services promptly [40, 41, 42]. This study report that women who once experienced pregnancy-related complications reported higher odds of making early visits in PHCs. Women who once experience complications take precautionary measures to avoid further complications, hence they are more likely to initiate early ANC visits.

We found out that women who were employed were significantly more likely to make early ANC visits in PHCs. This finding conforms to the findings from several other studies [44, 45]. The reason adduced for the result is that employed women have access to financial resources, and as such, they may not necessarily depend on their husbands for healthcare-related needs. A recent Nigerian study reported that women who depended on their husbands to fund their health expenses suffered delays in accessing modern maternal care services [46]. Also, women who are engaged in economic activities outside the

homes are mobile and socialize with people even at the places of work; and they can easily acquire information that will improve their attitude towards modern care usage [44]. Also, among the set of communities without PHCs, monthly income significantly influenced the initiation of early ANC visits. Women who were employed and earning income reported higher odds for making early ANC visits. It is not any source of a surprise given that utilization of maternal care involves a lot of costs incurred in medication, transportation, and consultation [44]. Therefore, intervention programmes designed to improve women's health in the study area should focus on unemployed women without a source of income.

Finally, the results revealed that women drawn from among the set of communities without PHCs were less likely to make early ANC visits and a minimum of four ANC visits in PHCs. The odds for making early ANC visits and a minimum of four ANC visits in PHCs were respectively 91% and 76% significantly less likely for respondents drawn from among the set of communities without PHCs. A different set of factors accounted for the two indicators among the two sets of communities. This discrepancy hence suggests that predictors of ANC utilization vary by geographical locations even though the communities were all located in the same political wards. Intervention programmes designed to improve ANC utilization among the communities must first understand the contextual determinants of ANC utilization in both sets of communities.

### **Strength and Limitations**

The strength of this study is that it disaggregated maternal care into its PHC component; hence, the study investigated predictors of ANC from the most essential and entry care level. However, the findings of the study should be viewed in light of three limitations. First, the study did not examine the complete factors that may influence ANC utilization. It focused only on the demand-side factors, while the supply-side factors were ignored. To yield deeper insight into the factors that influence ANC utilization, both demand and supply-side factors should be examined simultaneously. Second, the data analyzed

were obtained through verbal reports and were not subjected to any form of validation, such as the use of health facility cards. Third, there is a tendency that respondents gave socially-desirable responses.

## Conclusion

Women in the study area utilized ANC from PHCs moderately. Distance barriers, perception of the quality of care, and employment status are among the factors that influence women's decision to make an early and a minimum of four ANC visits in PHCs. Intervention programmes that initiate innovative models that address these barriers will no doubt improve women's attitudes in initiating early ANC visits and making a minimum of four visits in PHCs

## Abbreviations

SSA: sub-Saharan African; PHC: Primary Health Care; ANC: Antenatal care; WHO: World Health Organization; UNICEF: United Nation Children Education Fund; UNFPA: United Nation Fund for Population Agency; NDHS: National Demographic Health Survey; MCH: Maternal and Child Health; NPHCDA: National Primary Health Care Development Agency; MDG: Millennium Development Goals; FMoH: Federal Ministry of Health; MSS: Midwife Services Scheme; IMCH: Integrated Maternal and Child Health.

## Acknowledgments

The author is grateful to the data collectors particularly Grace Chioma Igbojekwe

## Funding

None.

## Competing Interests

None declared.

## Availability of Data and Materials

The dataset used and analyzed during the current study is available from the corresponding author on reasonable request.

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