COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE

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DETERMINENTS OF ANTENATAL HEALTH CARE UTILIZATION IN ETHIOPIA

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ABSTRACT

Antenatal Care can be defined as the care provided by skilled health-care professionals to pregnant women and adolescent girls in order to ensure the best health conditions for both mother and baby during pregnancy and it is one of the pillars of maternal health services. This study is an attempt to identify the determinant factor that affect Antenatal health care utilization in Ethiopia. In this study the data source was Ethiopian Demographic and Health Survey conducted in 2016(EDHS 2016) by the Central Statistical Agency (CSA) with a total of 4140 women of age 15-49 year groups. The data were analyzed by SPSS. The study used both descriptive and inferential statistics method of data analysis, which means from descriptive frequency table and from inferential statistics chi-square test of independency and binary logistic regression was used. The descriptive analysis of the study revealed that the coverage of Antenatal health care utilization from governmental health center/station was 60.6% in the country. From the chi square test of association variables like women education level, religion, women occupation, region, place of residence had significant association with Antenatal health care utilization. From the result of binary logistic regression region, residence, religion, women occupation and women education are significant predictors of Antenatal care utilization. Government should be creating awareness to improve women's utilization of Antenatal health care service and reduce maternal mortality in the rural area and less user regions.

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ACRONYMS

ANC	Antenatal care
CSA	Central Statistics Agency
EDHS	Ethiopian Demographic and Health Survey
SNNPR	South Nation Nationality People Region
SPSS	Statistical Package for Social Science
STIs	Sexually Transmitted Infections
UNICEF	United Nations Children's Fund
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Antenatal Health Care refers to pregnancy related health care provided by a doctor or a health worker in a health facility or home. Antenatal Care is care before birth and includes education, counseling, screening and treatment to monitor and to promote the well-being of the mother and fetus (WHO,2010). Antenatal care (ANC) provides a measure of access to the health system and improve the health outcomes for the mother and newborn baby. Antenatal Care can be defined as the care provided by skilled health-care professionals to pregnant women and adolescent girls in order to ensure the best health conditions for both mother and baby during pregnancy and it is one of the pillars of maternal health services(WHO, 2011). Pregnancy is one of the most important periods in the life of a woman, a family and a society. Extraordinary attention is therefore given to antenatal care by the health care systems of most countries. The goal of antenatal care is to prevent health problems in both infant and mother and to see that each newborn child has a good start. The care provided needs to be appropriate and not excessive. New technologies need to be implemented continually, while older services need to be reconsidered. The care for each pregnant woman needs to be individualized based on her own needs and wishes. Health services generally consider that it begins with a pregnant woman's first visit to receive antenatal care and continues until birth.

Worldwide, 85 percent of pregnant women received antenatal care with skilled health care providers at least once only 49 percent received at least four antenatal visits in sub-Saharan Africa (UNICF, 2017). Antenatal care (ANC) provides a stand for central healthcare tasks, including health promotion, screening and diagnosis, and disease prevention. It remains to be a vital health care tool to reduce the risk of stillbirths, preterm labor and pregnancy complications (WHO, 2016).Globally, 287000 women die of pregnancy-related complications annually, with (99%) of it occurring in the developing countries and (1%) in developed countries (WHO, 2012)

WHO indicate that in developing countries, ANC also reduces maternal mortality and morbidity directly through detection and treatments of pregnancy related or inter current illnesses (malaria,

anemia and syphilis) that are prevalent and have an impact on maternal and neonatal health.Malaria in pregnancy increases the chance of maternal anemia, abortion, stillbirth, prematurely, intrauterine growth retardation and infant low birth weight. It is estimated that as many as 30% of deaths during pregnancy in Africa directly result from malaria infection and malarial anemia as many as 10,000 maternal deaths each year in Africa. In Ethiopia, the levels of ANC and infant mortality and morbidity are among the highest in the world. One explanation for poor health outcomes among women and children is the none use of modern health care services by a sizable proportion of women in demonstrated that the utilization of available antenatal health services is very low in the country (Mekonnen and Asnakech, 2002).

According to the 2016 Ethiopian demographic and health survey report; 62 percent of women who gave birth in the five years preceding the survey received antenatal care from a skilled health care provider at least once for their last birth and only 32 percent had four or more ANC visits for their most recent live birth (EDHS,2016).

The utilization of Antenatal health care is one of the important factors to reduce the incidence of maternal mortality (Mahari, 2012). Essential interventions in ANC include identification and management of obstetric complications such as preeclampsia, tetanus toxoid immunization, and intermittent preventive treatment for malaria during pregnancy. ANC is also an opportunity to promote the use of skilled attendance at birth and healthy behaviors such as breastfeeding, early postnatal care, and planning for optimal pregnancy spacing. Many use of skilled attendance at birth and healthy behaviors such as breastfeeding, early postnatal care, and planning for optimal pregnancy spacing.

In Ethiopia, even if there is improvement in maternal health care service utilization including antenatal care; most of the women did not attend minimum number of visit recommended by World Health Organization. While adequate care during pregnancy and delivery is essential, health care service utilization is extremely low. Most of the previous studies conducted in Ethiopia reflected low utilization of antenatal care in the towns and city(Yibeltal T, *et al*. 2016).
In addition, knowledge of the recommended number of ANC visits and attitude towards antenatal care service, educational status, decision-making power, monthly income and wealth status of the respondents remains to be barrier for antenatal care service utilization (Wilunda C, *et al*. 2015).

1.2. Statement of the Problem

Improving Antenatal health of population is becoming not only an integral part of overall health development strategy but also, maternal health mortality, child mortality and family planning problems remain to be high due to the low level of ANC utilization.

Teklemariam E, *et al*.2015 2017 conducted a study in Boke Woreda in Western Hararge, Oromia Region Ethiopia by using bivariate and multivariate logistic regressions model to identify determinants of ANC services utilization among womenfor only three month (first trimester), but our study would be conducted by using binary logistic regression modelto identify determinants of ANC services utilization for nine months or pregnancy period of women (all trimester).

The basic researches questions would be addressed in this study were;

- What is the prevalenceof Antenatal health care utilization?
- What are the crucial factors that affect Antenatal health care utilization in Ethiopia?

1.3 Objectives of the study

1.3.1 General objective

The general objective of this study was to identify the determinant factor affecting Antenatal health care utilization in Ethiopia.

1.3.2 Specific objective

The specific objectives of this study were;

- To assess the frequency of Antenatal health care utilization.
- To identify the factor that affects Antenatal health care utilization.

1.4. Significance of the study

Antenatal care is one of the most important health care services. Every pregnant woman needs full access to Antenatal care services.The study would be used as base line information for concerned governmental bodies, nongovernmental organizations or health service providers to plan and act in motivating our mothers to use Antenatal care and institutional delivery service. The findings of this study would be serving as a reference for giving intervention accordingly by the health care providers and others who concerned; for conducting further researches; and also it would have special importance for health care providers because it might serve as base line for filling gaps of the actual practices An antenatal care. It also might help for understanding of past behaviors of health services practices, planning of the future and for the purpose of the current of maternal health service.

1.5. Scope of the study

This study was focused on the investigation of factors related to Antenatal health care utilization of women in Ethiopia.

CHAPTER TWO

LITERATURE REVIEW

2.1 Empirical Literature Review

Women's comprises over one half of human kind. Improving their reproductive health is essential for improving general health. It is the basis for women's empowerment and one of the foundations of social and economic development. Thus, investing in their health is an investment in development; it is also an investment in the future generation, (EDHS, 2012).

In India, Rani*, et al* stated that ANC was central to the continuum of medical care that was necessary before and during pregnancy, at childbirth, and postpartum. ANC is important in reducing maternal mortality, low birth weight, and prenatal morbidity and mortality. It is also an opportunity for mothers to access skilled care at delivery, usually at a health facility. Those authors to investigate the socio-economic differentials in the quality (clinical and interpersonal) of antenatal care and also the correlation between differentials in the quality and utilization of antenatal care. They concluded that poor quality of antenatal care is likely to reduce its utilization. Policy and program interventions to improve the quality of care of antenatal care, especially for the poor and other disadvantaged population groups, more so in north India, are essential to improve maternal health outcomes. Literature concluded that, the levels of antenatal care utilization were found to be high among women with higher economic status, better education, few children, married women and employed women.

Ali*, et al*. conducted a study in eastern Sudan of Kassala state in 2010, it was across-sectional community-based study to the women who had been pregnant within the last year, or pregnant more than 14 weeks. The study found 90% of investigated women had at least one visit. Only 11% of the investigated women had greater than four antenatal visits, while 10.0% had not attended at all. Out of 811 women who attended at least one visit, 483 (59.6%), 303 (37.4%) and 25 (3.1%) women attended antenatal care in the first, second and third trimester, respectively. In logistic regression analyses, while maternal age and residence were not associated with inadequacy of antenatal care (less than visits), high parity and husband education less than secondary level were associated with inadequacy of antenatal care.

In Balkh Province of Afghanistan, Hadi,*et al.* 2007 conducted a researchon the inaccessibility and utilization of antenatal health care services; they found the utilization of ANC services was differentiated by the participation of women in activities. The use of each of the ANC services was significantly lower among women who were involved in economic activities than among those not economically active. This indicates that involvement in such activities might have created extra burden on them and reduced the time they had available for receiving such services. Again they said that age of the women appeared to be negatively associated with the use of ANC.

A number of factors have also been identified as the major causes of poor utilization of Antenatal health care services: age of mothers, family size, religion, educational status, Occupation of respondent, Attitude of women towards ANC, work condition tetanus toxoid vacation, sleep under mosquito net, etc. Use of Antenatal health care services is expected to be associated with demographic and socioeconomic factors (Fausdar R, 2012).

Kedir H,(2018) conducted a study in Ethiopia depend on 2000 to 2016 EDHS data set by using pooled cross sectional study exploring trend and barriers of antenatal care utilization in Ethiopia. The study showed that the proportion of ANC utilization was 27.6%, 28.2%, 34.5%, and 62.9% in 2000, 2005, 2011, and 2016 respectively. The proportion of ANC utilization of EDHS was increased significantly from 2000 to 2016. Had pregnancy complication, low education of mothers, Low economic status, no media exposure, poor husband education, the rural residence of mothers were the barriers predicted for the utilization of ANC.

Teklemariam E*, et al*. 2017 conducted a study in Boke Woreda in Western Hararghe, Oromia Region Ethiopia by using bivariate and multivariate logistic regressions model to identify determinants of ANC services utilization among women in Boke Woreda, Ethiopia. The study showed that all selected pregnant women (339 participants) were interviewed with 100% response rate. Maternal age, travelling time to the health facilities, client welcomed appreciation, maternal knowledge on ANC services: previous service utilization, parity, gravidity, and service waiting time were found to be the determinants of antenatal care services. Therefore; Policy makers and stakeholders in the area have to focus their intervention on the identified factors in order to improve the ANC service utilization.

Birhanu D, *et al.* 2014 conducted a study in Abuna Gindeberet district, West Shewa, Oromiya region, Ethiopia by using bivariate and multivariate model to assess antenatal cares utilizations and associated factors from rural health extension workers in Abuna Gindeberet district of West Shewa Oromia regional state, Central Ethiopia. The study showed that five hundred seventy nine (82.4%) of the mothers had received antenatal care services during their recent pregnancy. From total mothers used antenatal care services, four hundred twenty three of them (73.1%) received the service from health extension workers. Age, educational level of respondent, distance from health post, decision makers in household and being model family were found to be statistically significant with antenatal care services utilization from health extension workers. Antenatal care service utilization from rural health extension workers was high. Age, educational level of the respondent, distance from health post, parity, decision making way and being a model family were among the predictors of antenatal care utilization from health extension workers. Thus, focusing the identified factors could improve and sustain antenatal care services from rural health extension worker.

Ethiopia's ANC mortality rate continues at an unacceptably high level. While maternal mortality figures vary widely by source and are controversial .The best estimate for Ethiopia suggest over 25,000 women and girls die each year due to pregnancy related complications. Additionally, more than 500,000 Ethiopian women and girls will suffer from disabilities caused by complications during pregnancy and child birth each year (FelekeW,*et al*. 2015).

A study conducted by Ayenew, *et al*. 2018 by using Bayesian regression model to prevent death or disability during pregnancy and childbirth, maternal mortality remains a major burden in many countries, including Ethiopia and to assess the status of antenatal care utilization and determinant of utilization of antenatal care service visit among pregnant women in Amhara regional state. Age, educational level, residence were the predictors of antenatal care utilization.

Reducing maternal mortality and disabilities will depend on identifying and improving those women and girls, including most care that is Antenatal care. Thus appropriate utilization of materiality care services is importance in the wellbeing of mother as well as her children. Adequate utilization of Antenatal care can also help reducing mortality morbidity among mothers and children. Antenatal care is important for mother treatment of complications arising before delivery, especially for births that occurred at home (EDHS, 2011).

Nigatu, *et al*. conducted a study in most rural region of Ethiopia, SNNPR in 2015 by using Binary logistic regression model to assess the utilization of antenatal care service. The study showed that the coverage of ANC service is only 29%; however, the national coverage is 34% which indicates that the use of antenatal care service is very low in the region. Moreover, only 17.2% of women with a live birth in the five years before the survey made four or more ANC visits during the length of their pregnancy.

In Ethiopia, where largest proportions of births take place at home, postnatal care by health professional is extremely low and uncommon. Delivery and Antenatal care are still far from common place among pregnant women in Ethiopia. The Ethiopian Demographical and health survey (2011, EDHS) data shows that most deliveries still occur at home and are assisted by medically unskilled birth attendants. Among all live births out of the live births in the five years, preceding the survey, almost 95% took place outside a health facility. There exists marked variation both in utilization of delivery and postnatal care services as function of women's back ground characteristics (Chandiok,N, 2015).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. The Study Area

The study which analyzes the determinant of Antenatal health care utilization was conducted in Ethiopia. Ethiopia is one of the African countries which were located in the eastern part of Africa around the place called horn of Africa. This place located in the north eastern extension of the continent. The country lies west of Somalia, north of Kenya, east of Sudan, south of Eretria and Djibouti with the area of 1,127,127 square kilometers (435,186 square miles). The country has 9 region (Oromiya, Amhara, Tigray, Affar, Somali, Ben-Gumuz, SNNPR, Gambela, and Harari) and two city administration that is (Dire-Dawa and Addis-Ababa).

3.2. Study Population

The target population in this study was all women who can gave birth, from 15-49 age groups who were included in 2016 Ethiopian Demographic and Health Survey (EDHS) data.

3.3. Data Source and Method of Data Collection

Data Collection is an important aspect of any type of research study. In this study secondary source of data collection was applied. The data for this study was obtained from the Central Statistical Agency (CSA) under the Demographic and Health Survey conducted in 2016.

3.4. Variable of the study

In this study two types of variables are applied. These are dependent variable and independent variables that are supposed to predictors of the dependent variable.

Dependent variable; is a variable whose values depend on the independent variables what being measured in an experiment or evaluated in a mathematical equations and sometimes called outcome variable.

In this study the dependent variable is Antenatal health care utilization. $Y = \begin{cases} 0 = \text{Mothers don}'\text{t utilized Antenatal care} \\ 1 = \text{Mothers utilized Antenatal care} \end{cases}$

Independent Variable; Independent variables are the variable stands alone and not affected by other variable.The following table shows the list of independent variable with their description.

Table 3.1 Independent variable included in our study

Variable designation	Independent Variables	Description of Variable
X_1	Age in 5-year group	0=15-19,1=20-24,2=25-29,3=30-34,4=35-39,5=40-44,6=45-49
X_2	Religion	0=Orthodox,1=Catholic,2=Protestant,3=Muslim, 4=Traditional, 5=Other
X_3	Current marital status	0=Single,1=Married,2=Widowed,4=Divorced,
X_4	Occupation	Occupation of mother; 0=don't work, 1=employed, 2=merchant,3=skilled worker, 4=other
X_5	Education Level	0=Ilitrate,1=primary,2=Secondary,3=Higher,
X_6	Wealth index combined	1=Poor,2=Midle,3=Rich
X_7	Type of place of residence	1=urban ,2=rural
X_8	Region	1=Tigray, 2=Afar, 3=Amhara, 4=Oromia, 5=Somali, 6=Benshangul,7=SNNP, 8=Gambela,9=Harari,10=Addis Ababa,11=Dire Dawa

3.5. Method of data analysis

Data analysis means the process of extracting relevant information from the data and finally giving conclusion from the output. The data was analyzed by using SPSS statistical software. In this study both descriptive and inferential statistics was used. The study used descriptive statistics like tables and inferential statistics like chi-square test of independence and binary logistic regression.

3.5.1. Descriptive statistics

Descriptive statistics is a part of statistics that deal with methods and techniques of organizing, summarizing, presenting, reporting and arranging the data without making generalization beyond the data. It summarizes mass of the numerical data in to meaningful form by using various statistical techniques such as tables, charts, graphs, and so on.

3.5.2. Inferential statistics

It describes the data with making inference or conclusion and summarizing source of numerical data into meaningful form. It is the procedure by which we reach conclusion about population on information obtained in the sample drawn from that population by using chi-square and binary logistic regression.

3.5.3 .Chi-square test of independence

Chi-square ($\chi 2$) is a statistical measure with the help of which it is possible to access the significance of the difference between the observed frequencies and expected frequencies obtained from some hypothetical universe. It is a measure of the different between the observed and expected counts. In addition it helps us to determine whether two categorical variables are associated or not. In order to do that chi-square test may be applicable both the frequencies must be grouped in the same way and the theoretical distribution must adjust to give the same total frequency, which is equal to that of observed frequency.

The Assumption of Chi-square Test of independency was:

- The observation must be independent of each other.
- The sample must be randomly selected from the population.
- The expected frequency of each category must be at least 5.
- It is always positively skewed.

The Statistical Test:

$$X^2{}_{cal} = \frac{\Sigma_{i=1}^{r}\Sigma_{j=1}^{c}(O_{ij}-E_{ij})^2}{E_{ij}} \quad \text{(i=1, 2.....r, j=1, 2,3 …c)}$$

The degree of freedom associated with contingency table possessing r-row and c-columns=(r-1) (c-1) Where, χ^2_{cal}=chi square calculated, O_{ij}=is the observed frequency

E_{ij}= expected frequency,r= number of row variables, C= number of column variable

Test of Hypothesis

H_0: Response and explanatory variable are independent vs.H_1;the response and explanatory are dependent.

Decisions: - We reject Ho if $X^2{}_{cal} > X^2{}_{tab}$or p-value less than level of significance, otherwise we do not reject Ho and giveConclusion based on the decision.

3.6. Logistic regression model

Logistic regression is a special case of generalized linear models in which the mean of the response variable is related to explanatory variables through a regression equation. The elements of such a model are a distribution for the response variable and a function that links the distribution to the explanatory variables called a link function. Logistic regression can be binary, multinomial and ordinal logistic regression. The response variable is usually dichotomous for the response taken as success and failure. Logistic regression model in a single explanatory variable x for binary response variable(Y =1, as probability of success and Y = 0, as probability of failure) and when is probability of success at value x. The binary logistic regression is a type of regression which used to when the dependent variables dichotomous and the independent variables are any type.

Assumptions of Logistics Regression

- It does not assume a linear relationship between the dependent and independent variable
- The dependent variable need not to be homoscedastic for each level of independent.
- The independent variables need not be interval, not normally distributed, not linearly related, not of equal variance within each group.
- Logit transformation is linear.
- No multicollinearity and No outliers.

3.6.1 Binary Logistic Regression Model

Binary logistic is used when the response or dependent variable is categorical. The independent variable may be quantitative, categorical and combination of the two. Logistic regression can be used to predict a dependent variable on the basis of continuous and (categorical independent variables) and to determine the percent of variance in the dependent variable explained by the independents; to rank the relative importance of independent variables; to assess the interaction effect and to understand the impact of covariate control variables. But in logistic regression our dependent variable in this case is dummy variable, which take the value of (0) for mothers do not utilize antenatal care and (1) mothers utilize antenatal care.

i.e. $Y_i\begin{cases}0 = \text{mothers donot utilizeAntenatal health care}\\ 1 = \text{mother utilize Antenatal health care}\end{cases}$ with qualitative response which result either success or failure. The log odd of the success is model with more than one explanatory variables x; for binary response variable is given as;

Model: - Log it $[\pi(x)] = \log\left[\frac{\pi(x)}{1-\pi(x)}\right] = \beta_0+\beta_1x_1+\ldots. +\beta_{PXP}$ ..... (3.2)

Where: π, the probability of success (probability of something happened).

$1-\pi$ the probability of failure, β_0, is constant term, X1, X_2... X_P are independent (explanatory) variables, β_1, β_2… β_P are the Coefficients of independent variables.

The relationship between the predictor and response variables is not a linear function in logistic regression; instead of, the logistic regression function, which is the logit transformation of π, is used. Consider a collection of explanatory variables denoted by the vector $x'=(x_1, x_2\ldots_p)$. Let the conditional probability that the outcome is success is denoted by p (y=1/x) =π

$\pi(x) = \frac{\exp(\beta0+\beta1x1+\cdots+\beta pxp)}{1+\exp(\beta0+\beta1x1+\cdots+\beta pxp)}$ ..... (3.3)

3.6.2 Odds ratio (θ)

It is the measure of how much the greater or(less) the odds are to subjects possessing the risk factor to experience a particular out comes.In binary logistic regression analysis, odds ratio is the exponential of the estimated coefficient$\hat{\beta}$ i.e. $e^{\hat{\beta}}$.

$$Odd\left(Y_i = 1\right) = \left(\frac{P_i}{1 - P_i}\right) = e^{\alpha + \beta xi}$$, i=1, 2….. P ..... (3.4)

$e^{\beta}$is the factor that odds changes when the i^{th} independent variable increase by one unit.

Assumptions of binary logistic regression

- Binary logistic regression predicts the odds of an event occurring, which is based on the probability, of that event occurring. Precisely, the odds of an event occurring is

Odds=$\frac{\text{probabilityof succes}}{\text{probabilityof failur}} = \frac{p}{1-p}$, where probability of success=p, probability of failure=q or 1-p

- In binary logistic regression residuals follow a binomial rather than a normal distribution.
- Binary logistic regression assumes that there no multicolinearity.

3.7 Parameter Estimation for Logistic Regression

3.7.1 Maximum Likelihood Estimation

The goal of logistic regression is to estimate unknown parameters; this parameter estimation involves like maximum likelihood estimation. The logistic regression uses maximum likeli-hood estimation after transforming the dependent variable in to a logic variable. The parametric approach to statistical modeling of family of probability distribution is the binomial for the response variable. Likelihood ratio used to explore the extent to which the fitted response obtained from the postulated model compares with the observed data.

The equation to parameter estimation in logistic regression is the likelihood function for given ($X_{1,}$ $X_{2...}X_n$) can be expressed as;

$$L(\beta|Y) = \prod_{i=1}^{n} \text{Prob}(y_i|X_{i1}, X_{i2}, \dots, X_{ik}) = \prod_{i=1}^{n} \left[\frac{e^{X\beta}}{1+e^{XB}}\right]^{y_i} \left[\frac{1}{1+e^{XB}}\right]^{1-y_i}$$

The likelihood-ratio test statistic is given by:-

$$G^2 = -2\log(L_0/L_1) = -2[\log(L_0) - \log(L_1)] \quad \text{(3.5)}$$

Where L_0 is the log likelihood value of the model which has the intercept term only and L_1 is the log likelihood value of the full model.

3.7.2. Model adequacy checking

Once a model has fit to a given data, it is a good statistical practice to check the adequacy of the model, which is essentially checking the agreement between the observed values under the model. If the agreement between the observed and the corresponding fitted values is good, the model may be acceptable. If not, the current form of the model will certainly not be acceptable and the model will need to be revising. This aspect of the adequacy of a model is widely referred to as goodness of fit. We used Hosmer-Lemshow and Likelihood ratio testto decide whether the model is adequately checked or not.

3.8. Goodness-of-fit of the Model

The goodness of fit or calibration of a model measures how well the model describes the response variable. Assessing goodness of fit involves investigating how close values predicted

by the model with that of observed values. The appropriateness of the fitted logistic regression model needs to be examined before it is accepted for use as in the case of all regression models. In practice, several different measures exist for determining the significance or goodness of fit of a logistic regression model. In this study we were used Hosmer-Lemshow, likelihood ratio test and Omnibus test to decided goodness of fit of the model.

3.8.1. Hosmer-Lemshow Test

The Hosmer-Lemshow test statistic evaluates the goodness-of-fit of the model by creating 10 equal groups of subjects and then compares the number actually in each group (observed) to the number predicted by the logistic regression model. The test is similar to a $\chi 2$ test statistic and has the advantage of partitioning the observations into groups of approximately equal size, and therefore, there are less likely to be groups with very low observed and expected frequencies. In this case, better model fit is indicated by a smaller difference in the observed and predicted classification. The Hosmer-Lemeshow test statistic is given by:

The test statistic is: $G^2HL=\sum_1^k(\frac{(o_k-Ek)^2}{(Ek(1-\frac{EK}{NK})})$…..…….…… (3.6)

Where, O_k and E_k are the observed and expected number of events in the k^{th} group, and k is a variance correction factor for the k^{th} group.

3.8.2. Likelihood-Ratio Test

The likelihood ratio test statistic (LRT) is the most common test for assessment of overall goodness of fit of logistic regression model. The likelihood ratio test is used to test the significance of a number of explanatory variables. This is appropriate for a variety of types of statistical models. The likelihood-ratio test is used to test the ratio of the maximized value of the likelihood function for the full model (L_{ful}) over the maximized value of the likelihood function for the reduced model(L_{red}).

The likelihood-ratio test statistic is given by:

$$\mathrm{LRT} = -2[\log(\mathrm{l_{red}}) - \log(\mathrm{l_{ful}})] \quad \text{(3.7)}$$

Where, $\boldsymbol{l_{red}}$ and $\boldsymbol{l_{ful}}$ are the log likelihood function of the reduced and full model, respectively.

3.8.3 Omnibus Test

The Omnibus test is the method of testing the coefficients andthe significance of the model, which means the overall model, is significant if all variables are included in the model.

3.9. Statistical tests of individual parameters

3.9. 1. Wald Test

The Wald test is also an alternative test which is commonly used to test the significance of the individual logistic regression coefficients for each independent variable (that is, to test the null hypothesis in logistic regression analysis that a particular logit (effect) coefficient is zero i.e.$H_0: \beta_i = 0$ $v_s H_1: \beta_i \neq 0$.The Wald test statistic is:

$$W = \frac{\hat{\beta}_i^{\,2}}{\mathrm{var}(\hat{\beta}_i)} \quad \text{..... (3.8)}$$

For large sample size this test statistic has an approximate chi-square distribution with one degree of freedom. Furthermore, likelihood ratio test and score test also used for a significance test of the null hypothesis $H_0: \beta_i = 0$.they all exploit the large sample normality of maximum likelihood estimators.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 RESULT

4.1.1 DESCRIPTIVE STATISTICS

In this paper we were going to analyses factors that may affect Antenatal health care utilization in Ethiopia. The data used in this study were obtained from the 2016 Ethiopian Demographic and Health Survey (EDHS) data collected by CSA.

In this study a total of 4140 women 15-49 age group were chosen from the main sample in the EDHS 2016 considered from nine regional states and two cities administrative.

Table 4.1 Percentage of Antenatal care utilization: government health center/ station

		Frequency	percent
Valid	No	1630	39.4
	Yes	2510	60.6
	Total	3140	100.0

In the above tabular value from 4140 respondent 2510(60.6%) women are utilized Antenatal healthcare and 1630(39.4%) respondents are not utilized Antenatal care.

Distribution of Antenatal care utilization with independent variable

Table 4.2 Summary of descriptive statistics

	Antenatal care utilization: governmental health station/center			
	Categories	Don't utilized Antenatal care	Utilized Antenatal care	Total
		count	count	Count
Agein 5-year groups	15-19	79(4.8%)	127(5.1%)	206(5.0%)
	20-24	332(20.4.0%)	565(22.5%)	897(21.7%)
	25-29	506(31.0%)	732(29.2%)	1238(29.9%)
	30-34	350(21.5%)	555(22.1%)	905(21.9%)
	35-39	244(15.0%)	358(14.3%)	602(14.5%)
	40-44	88(5.4%)	127(5.1%)	215(5.2%)
	45-49	31(1.9%)	46(1.8%)	77(1.9%)
Marital status	Single	16(1.0%)	17(0.7%)	33(0.8%)
	Married	1543(94.7%)	2357(93.9%)	390(94.2%)0
	Widowed	12(0.7%)	28(1.1%)	40(1.0%)
	Divorced	59(3.6%)	108(4.3%)	167(4.0%)
Mother education	No education	801(49.1%)	1318(52.5%)	2119(51.2%)
	primary	497(30.5%)	833(33.2%)	1330(32.1%)
	Secondary	181(11.1%)	246(9.8%)	427(10.3%)
	Higher	151(9.3%)	113(4.5%)	264(6.4%)
Religion	Orthodox	526(32.3%)	1052(41.9%)	1578(38.1%)
	Catholic	9(0.6%)	17(0.7%)	26(0.6%)
	Protestant	361(22.1%)	409(16.3%)	770(18.6%)
	Muslim	719(44.1%)	1014(40.4%)	1733(41.9%)
	Traditional	4(0.2%)	10(0.4%)	14(0.3%)
	Other	11(0.7%)	8(0.3%)	19(0.5%)
Respondent occupation	Don't work	577(35.4%)	983(39.2%)	1560(37.7%)
	Employed	547(33.6%)	963(38.4%)	1510(36.5%)
	Merchant	243(14.9%)	223(8.9%)	466(11.3%)
	Skilled	13(0.8%)	22(0.9%)	35(0.8%)
	Other	25015.3(%)	319(12.7%)	569(13.7%)
Region	Tigray	138(8.5%)	426(17.0%)	564(13.6%)
	Afar	88(5.4%)	165(6.6%)	253(6.1%)
	Amhara	100(6.1%)	362(14.4%)	462(11.2%)
	Oromia	195(12.0%)	291(11.6%)	486(11.7%)
	Somali	148(9.1%)	159(6.3%)	307(8.8%)
	Benshangul	209(12.8%)	154(6.1%)	363(8.8%)
	SNNPR	257(15.8%)	339(13.5%)	596(14.4%)
	Gambela	119(7.3%)	156(6.2%)	275(6.6%)
	Harari	171(10.5%)	90(3.6%)	261(6.3%)
	AddisAbaba	116(7.1%)	174(6.9%)	290(7.0%)
	Dire Dawa	89(5.5%)	194(7.7%)	283(6.8%)
Residence	Urban	503(30.9%)	621(24.7%)	1124(27.1%)
	Rural	1127(69.1%)	1889(75.3%)	3016(72.9%)
Wealth index combined	Poor	619(38.0%)	1036(41.3%)	1655(40.0%)
	Medium	264(16.2%)	379(15.1%)	643(15.5%)
	Rich	747(45.8%)	1095(43.6%)	1842(44.5%)

From the above table 4.2 based on ages; the highest percentage of respondent who utilized Antenatal health care was observed in the age group 25-29 (29.2%) followed by 20-24(22.5%) and the lowest percentage of women who utilize Antenatal healthcare was observed in the age group 45-49 (1.8%) followed by 40-44(5.1%) age group. Depending on Marital status the highest percentage of women who utilized Antenatal healthcare was observed among married (93.9%)and the lowest percentage that utilized Antenatal health care was single (0.7%). Based on educational status;the highest proportion of the individual's women that utilized Antenatal healthcare were primary education (33.2%) and the lowest percentage ofwomen that utilized Antenatal healthcare were observed in higher education (4.5%). The percentage of antenatal care utilization was differed based on religious of women. The highest proportion of women who utilized Antenatal healthcare was orthodox (41.9%)and the lowest percentage of women that utilized Antenatal care was observed in religion of others (0.3%) followed by traditional (0.4%). Depending on occupational status; women Antenatal healthcare utilization was affected by occupational status. Occupational status that is don't work (39.2%) was the most percentage from other records, and the least percentage of women utilized Antenatal healthcare was recorded in those respondents who were skilled worker (0.9%). Besides, the above table shows that the proportion of women who utilized Antenatal healthcare differed from one region to another. The greatest number of individual's women who utilized Antenatal care was recorded in Tigray region (17.0%) and the smallest number of women who utilized Antenatal care individuals was recorded in Harari(3.6%). The proportion of women that utilized Antenatal healthcare in urban areas was different from the rural areas. The proportion of women who utilized antenatal care was 62.6% in rural areas while it was 55.2% in urban areas and also the proportion of women Antenatal healthcare utilization varies by wealth index combined. The highest percentage of women who utilized Antenatal healthcare was observed among from rich (43.6%) as opposed to the lowest percentage women who utilized Antenatal healthcare recorded for residingin medium (15.1%) followed by poor (41.3%).

4.1.2.1 Result of Chi-square test of independence

Table 4.3Association of Antenatal care utilization with selected explanatory variables

Independent variable	χ^2 value	Degree of freedom	P-value
Age in 5- year groups	4.118[a]	6	0.66
Current marital status	3.824[a]	3	0.281
women education level	41.196[a]	3	0.00
Religion	49.219[a]	5	0.00
Women occupation	46.875[a]	4	0.00
Region	263.62[a]	10	0.0
Residence	18.701[a]	1	0.00
Wealth index combined	4.534[a]	2	0.104

Where 'a' 'is 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.78.

Hypothesis test:

H_0: there is no significant association between response and explanatory variables.

H_1: there is a significant association between response and explanatory variables.

From Table4.3 above Variables which had p-value of Pearson chi-square less than α=0.05 was considered to have significant association with Antenatal healthcare utilization at 5% level of significance; whereas variables which had p-value of Pearson chi-square greater than a value of α=0.05 had no significant association with Antenatal healthcare utilization. Accordingly, women education level, religion, women occupation, region, place of residence had significant association with Antenatal healthcare utilization.The rest variablesage, current marital status and wealth combined index had not significant association with Antenatal health care utilization.

Table 4.4 Result of binary logistic regression

Variable	Category	B	S.E	Wald	df	sig.	Exp(β)	95% CI for Exp(β)	
								Lower	upper
Age(15-19 ref)	20-24	0.170	0.166	0.040	1	0.308	1.185	.855	1.641
	25-29	0.010	0.164	0.004	1	0.951	0.990	0.634	1.364
	30-34	.043	.170	0.063	1	0.802	1.044	0.748	1.456
	35-39	0.084	0.178	0.224	1	0.636	0.919	0.649	1.303
	40-44	-0.184	0.214	0.737	1	0.391	0.832	0.547	1.266
	45-45	-0.135	0.292	0.215	1	0.643	0.873	0.493	1.548
Marital (status single ref)	married	0.397	0.362	1.205	1	0.272	1.488	0.732	3.023
	widowed	0 .899	0.513	3.070	1	0.080	2.458	0.899	6.724
	divorced	0.563	0.399	1.989	1	0.158	1.755	0.803	3.836
women education (no education ref)	primary	0.063	0.089	0.500	1	0.479	1.065	0.894	1.268
	secondary	-0.067	0.141	0.226	1	0.635	0.935	0.709	1.233
	higher	0.542	0.181	10.012	1	0.002	1.564	1.208	1. 741
Religion (orthodox ref)	Catholic	0.492	0.434	1.282	1	0.258	1.635	0.698	3.831
	Protestant	-0.115	0.124	0.851	1	0.356	0.892	0.699	1.138
	Muslim	0.227	0.106	4.587	1	0.032	1.255	1.019	1.546
	Traditional	0.623	0.607	1.053	1	0.305	1.864	0.568	6.121
	Others	-0.588	0.482	1.492	1	0.222	0.555	0.216	1.427
Region (Dire Dawaref)	Tigray	-0.695	0.193	12.960	1	0.000	0.499	0.342	0.728
	Afar	0.155	0.153	1.021	1	0.312	1.168	0.864	1.577
	Amhara	-0.909	0.156	33.928	1	0.000	0.403	0.297	0.547
	Oromia	-1.190	0.185	41.190	1	0.000	0.304	0.211	0.437
	Somali	-1.581	0.161	96.532	1	0.000	0.206	0.150	0.282

	Benshangul	-0.826	0.159	27.135	1	0.000	0.438	0.321	0.597
	SNNPR	-0.627	0.188	11.176	1	0.001	0.534	0.370	0.772
	Gambela	-1.911	0.191	100.426	1	0.000	0.148	0.102	0.215
	Harari	-0.362	0.180	4.040	1	0.044	0.697	0.490	0.991
	Addis Ababa	-0.398	0.189	4.449	1	0.035	0.672	0.464	0.972
Residence (rura lref)	urban	0.252	0.111	5.141	1	0.023	1.286	1.035	1.599
Wealth index combined (rich ref)	poor	-0.170	0.102	2.776	1	0.096	0.843	0.690	1.031
	middle	0.164	0.096	2.923	1	0.087	1.178	0.976	1.421
Women occupation (Don't work ref)	Employed	0.122	0.087	1.976	1	0.160	1.130	0.953	1.339
	Merchant	-0.292	0.148	3.872	1	0.049	.747	0.558	.999
	skilled worker	0.030	0.376	0.006	1	0.937	1.030	0.493	2.151
	Other	-0.137	0.124	1.225	1	0.268	.872	0.684	1.112
constant		0.460	0.425	1.172	1	0.279	1.584		

The significance of the Wald statistic tells the importance of the predictor variable in the model. The columnexp (β) is the factor by which the odds of practice of Antenatal healthcare utilization change when the i^{th} independent variable increases by one unit. If β_i is positive exp(β_i) will be greater than one, which means the odds of Antenatal care utilization increases. If β_i is negative, exp (β_i) will be less than one, which means the odds of Antenatal care utilization decreases.

Interpretation ofsignificant variablesof Odd ratio

From the above table 4.4 we can interpret the odds ratio of region by using the reference category of Dire Dawa.

Based on region; women who utilize Antenatal health care follow Tigray is 50.1% times less likely than that of followed Dire Dawa (the reference category) controlling for other variable in the model. The estimated odds ratio of women that utilized Antenatal health care follows Amhare is 59.7% times less likely than that of followed Dire Dawa (the reference one) controlling for other variable in the model. The estimated odds ratio of women that utilized Antenatal health care follow Oromia, Somali, Benshangul, SNNPR, Gambela, Harari and Addis Ababa have (69.6%, 79%, 56.2%, 46.6%, 85.2%, 30.3% and 32.8%) respectively times less likely than that of followed Dire Dawa (the reference one) controlling for other variable in the model.

For variable residence; the reference category is rural. The estimated odds ratio of women that utilized Antenatal health care follows urban is 1.286 times more likely than that followed rural controlling for other variable in the model.

Depending on religion, the reference category is Orthodox. The estimated odd ratio of women who utilized Antenatal health care follows muslim is 1.255 times more likely than that of followed Orthodox.

Similarly women occupation; for the reference category don't work, the estimated odds ratio of women who utilize Antenatal health care follows merchant are 25.3% times less likely than that of followed don't work controlling for other variable in the model.

The odds ratio of women education using the reference category of no education, women who utilize Antenatal health care follows higher education is 1.564 times more likely than that of followed no education (the reference category) controlling for other variable in the model.

4.1.2.3. Model adequacy checking

After a logistic regression model has been fitted, a global test of goodness of fit of the resulting model should be performed. It is necessary to see the appropriateness, adequacy and usefulness of the fitted model. The most commonly used technique is the likelihood ratio test and the Hosmer-Lemeshow test.

4.1.2.3.1 The Hosmer –Lemeshow Test

The "Hosmer and Lemeshow Test" is a measure of fit which evaluates the goodness of fit between the predicted and observed probabilities in classifying the response variable.The test is similar to a $\chi 2$ goodness of fit test.

Table 4.5 Hosmer and Lemeshow Test

Chi-square	df	Sig
12.345	8	.136

The "Hosmer and Lemeshow Test" is similar to the -2log likelihood test, we want this chi-squared value ($\chi 2_{0.05,8}$=12.345) to be low and non-statistically significant (p-value=0.136) if the predicted and observed probabilities matched correctly. In this case we can see that the test is statistically insignificant (p >.05), suggesting that the probabilities of predicted versus observed values of the response variable match up as correctly as we would like. Therefore, our fitted logistic regression model is good fit.

Table 4.6 omnibus tests of model coefficients

	Chi-square	df	Sig.
Step1 step	359.921	34	.00
Block	359.921	34	.00
model	359.21	34	.00

Interpretation: table4.6shows results of "Omnibus Test." "Omnibus" means "overall," and so this output tells whether the model with all explanatory variables predicts the response better than the intercept only in the model.

H_0; all coefficients of the model are zero.

H_1= not H_0 (at list one of coefficietionts of the model is different from zero).

Since from the above table Omnibus tests of model coefficient is on step 1, enter all the variables in the model. The coefficient here gives as a measure of how well the model fits. It is the null hypothesis states that information about the independent variables does not allow us to make better prediction of the dependent variable. Therefore we conclude that this chi-squared value is significant. In this case the chi-square is significant and interpreted us the model fits well.

Table 4.7 Model Summary of Logistic Regression

Step	-2Loglikelihood[a]	Cox &Snell R square	Nagelkerke R square
1	5190.850[a]	.083	.113

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

From the table4.7we see that the value of -2 Log Likelihood statistics is5190.850.This statistic measures how the model predicts the decisions.Cox and Snell R^2 or Nagelkerks R^2 is analogous statistic in logistic regression to the coefficient of determination R^2 in linear regression. In this study Cox and Snell R^2 indicate that, about 8.3% of variable Antenatalcare is explained by the independent variable. Also Nagelkerke R^2indicates that 11.3% of variable Antenatal care is explained by the independent variable.

4.1.2.4 Interpretation for coefficients of significant variables

4.1.2.4.1Wald test

Since Wald test is used to test the statistical significance of individual coefficient (β) in the model and the test statistic is similar to chi-square test statistic of one degree of freedom.

The hypothesis to be tested is:

Ho: The coefficient no associated with the predictor is equal to zero

H1: The coefficient associated with the predictor is not equal to zero

To conclude that the given coefficient is significant to model based on the following:-

i. The chi-square (Wald) statistics must be greater than tabulated statistic ($\chi^2_{0.05,1}$)

ii. P- Values of coefficients are less than the level of significance, α=0.05.

For **β_1:-** From the parameter estimation above; the chi-square statistics (Wald) =214.239 is greater than $\chi^2_{0.05,1} = 3.84$ the p-values for the β_1 =0.000 is less than 0.05 level of significance. Thus based on this result we conclude that the coefficient of Region is significant to the model.

For **β_2:** From the parameter estimation above; the chi-square statistics (Wald) = 12.882 is greater than $\chi^2_{0.05,1} = 3.84$ the p-values for the β_2 =0.023 is less than 0.05 level of significance. Thus based on this result we conclude that the coefficient of religion is significant to the model.

For β_3: From the parameter estimation above; the chi-square statistics (Wald) = 14.027 is greater than $\chi^2_{0.05,1} = 3.84$ the p-values for the β_3 =0.012 is less than 0.05 level of significance .Thus based on this result we conclude that the coefficient of education is significant to the model.

For **β_4**: From the parameter estimation above; the chi-square statistics (Wald) = 10.709 is greater than $\chi^2_{0.05,1} = 3.84$ the p-values for the β_4 =0.030 is less than 0.05 level of significance. Thus based on this result we conclude that the coefficient of women occupation is significant to the model.

4.2. Discussion

This study provides information to identify the well-known factors that influence Antenatal care utilization based on 2016 Ethiopian Demographic and Health survey (EDHS) data.

This study had focused on Binary logistic regression model of the determinants of utilization of Antenatal healthcare service among women of reproductive age group in Ethiopia.

The explanatory variables that identified as determinant factors of Antenatal health care services utilization were: Region, residence, religion, women occupation and women education was found to have significance effect on Antenatal healthcare utilization in Ethiopia.

Educational level was identified to be the significant factor for utilization of Antenatal healthcare. The findings of this study showed that there is a significant difference in the Antenatal health care utilization of mothers' educational level. This finding seemed to be consistent with other studies (Birhanu D, *et al.* 2014).

The finding of this study shows that residential differences had a significant effect on Antenatal healthcare utilization. Women who lived in urban areas were more likely to have more utilization of Antenatal care than rural women. This finding seemed to be consistent with other studies (Ayenew M, *et al*. 2018).

According to our findings, Region has been found to have a significant effect on Antenatal healthcare utilization. Similarly educations of women, occupation of women and religion have been found to have a significant effect on Antenatal healthcare utilization. Educations of women, occupation of women and religion combined were the determinant factors of Antenatal healthcare utilization. This finding seemed to be inconsistent with other studies (Teklemariam E, *et al.* 2017).

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CHAPTER FIVE

CONCLUSION AND RECOMMONDATION

5.1 CONCLUSIONS

The main objective of this study was to investigate the factor that affecting Antenatal health care utilization in Ethiopia. According to the result this study was attempted to examine the impact of some factors on Antenatal healthcare utilization of women. EDHS 2016 data was used to analyze how the dependent variable or Antenatal healthcare utilization was affected by a set of independent variables like mother's educational level, age, marital status, religion, wealth index combined, Residence, Region, and mother occupation.

The findings of this study showed that women education, religion, women occupation, region, place of residence had a significant association with Antenatal health care utilization ($p < \alpha = 0.05$) and age, current marital status and wealth index combined had no significant association with women Antenatal health care utilization. From the result of binary logistic regression Region (Tigray, Amhara, Oromia, Somali, Benshangul, SNNPR, Gambela, Harari and Addis Ababa) residence (rural), religion (muslim), women occupation (merchant) and women education (higher education)are significant predictors of Antenatal healthcare utilization.

5.2 RECOMMONDATION

Based on the findings of our study, the following recommendations are put forward to bring about reduction in factors that affect Antenatal health care utilization.

- The government should make effort to expand governmental health centre for all region.
- Government should be creating awareness to improve women's utilization of Antenatal health care service and reduce maternal mortality in the rural area and less user regions.
- All mothers should take care of their health condition when they become pregnant during work times by taking of rest.
- Government shouldfacilitate all women's the right to educate in order to increase Antenatal health care utilization.

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Appendix

Table 1.1Case processing summary

Unweighted cases		count	Percent
Selected cases	Included in Analysis	4140	100.0
	Missing cases	0	.0
	Total	4140	100.0
Unselected cases		0	.0
Total		4140	100.0

Table 1.2Dependent variable encoding

Original Value	Internal Value
Don't utilized Antenatal care	0
Utilized Antenatal care	1

Table 1.3Classification Table[a,b]

Observed			Predicted		
			Antenatal care utilization: government health center/station		Percentage correct
			Don't utilized Antenatal care	Utilized Antenatal care	
Step0	Antenatal care utilization	Don't utilized Antenatal care	0	1630	.0
		Utilized Antenatal care	0	2510	100.0
		Overall percentage			60.6

Table 1.4Categorical Variables Coding

		Parameter coding										
		Frequency	1	2	3	4	5	6	7	8	9	10
Region	Tigray	564	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	Afar	253	1.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	Amhara	462	.000	1.000	.000	.000	.000	.000	.000	.000	.000	.000
	Oromia	486	.000	.000	1.000	.000	.000	.000	.000	.000	.000	.000
	Somali	307	.000	.000	.000	1.000	.000	.000	.000	.000	.000	.000
	Benishangul	363	.000	.000	.000	.000	1.000	.000	.000	.000	.000	.000
	SNNPR	596	.000	.000	.000	.000	.000	1.000	.000	.000	.000	.000
	Gambela	275	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
	Harari	261	.000	.000	.000	.000	.000	.000	.000	1.000	.000	.000
	AddisAdaba	290	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.000
	Dire Dawa	283	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000
Age	15-19	206	.000	.000	.000	.000	.000	.000				
	20-24	897	1.000	.000	.000	.000	.000	.000				
	25-29	1238	.000	1.000	.000	.000	.000	.000				
	30-34	905	.000	.000	1.000	.000	.000	.000				
	35-39	602	.000	.000	.000	1.000	.000	.000				
	40-44	215	.000	.000	.000	.000	1.000	.000				
	45-49	77	.000	.000	.000	.000	.000	1.000				
Religion	Orthodox	1578	.000	.000	.000	.000	.000					
	Catholic	26	1.000	.000	.000	.000	.000					
	Protestant	770	.000	1.000	.000	.000	.000					
	Muslim	1733	.000	.000	1.000	.000	.000					
	Traditional	14	.000	.000	.000	1.000	.000					
	Other	19	.000	.000	.000	.000	1.000					

	Don't work	1560	.000	.000	.000	.000						
Women occupation	Employed	1510	1.000	.000	.000	.000						
	Merchant	466	.000	1.000	.000	.000						
	Skilled worker	35	.000	.000	1.000	.000						
	Other	569	.000	.000	.000	1.000						
	Don't educated	2119	.000	.000	.000							
Women education	Primary	1330	1.000	.000	.000							
	Secondary	427	.000	1.000	.000							
	Higher	264	.000	.000	1.000							
	Single	33	.000	.000	.000							
Current marital status	Married	3900	1.000	.000	.000							
	Widowed	40	.000	1.000	.000							
	Divorced	167	.000	.000	1.000							
Wealth	Poor	1655	.000	.000								
	Middle	643	1.000	.000								
	Rich	1842	.000	1.000								
	Urban	1124	.000									
Residence	Rural	3016	1.000									

Table 1.5Classification table for block one

Observed		Predicted		
		Antenatalcare utilization: government health center/station		Percentage correct
		Don't utilized Antenatal care	Utilized Antenatal care	
Step1 Antenatal care utilization	Don't utilized Antenatal care	566	1064	34.7
	Utilized Antenatal care	412	2098	83.6
Overall percentage				64.3