Available at www.ijcasonline.com ISSN 2349 – 0594

International Journal of Modern Chemistry and Applied Science

International Journal of Modern Chemistry and Applied Science 2015, 2(2), 108-120

Binary Logistic Regression Analysis in Assessing and Identifying Factors that Influence the Use of Family Planning: The Case of Ambo Town, Ethiopia

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Abstract:

The fertility rate in developing country is very high but issue in Ethiopia is really an agony. According to the report of 2008 Ethiopian Demographic and Health Survey reveals that Ethiopian woman gives birth on average to 5.9 children. The main goal of the study is to assess and identify factors that influence the use of family planning in Ambo town. Of 1,567 mothers of the target population 148 mothers were randomly selected from the study area. Descriptive statistical measures, chi square and binary logistic regression model were used for the analysis in the study. The result of the study reveals that majority of mothers almost three fourth (71.62%) them didn't used contraceptive methods but only around one fourth (28.38%) of mothers used the contraceptive methods, Out of the mothers who have no habits of using contraceptive methods, 87.18% and 89.36% were illiterate and have more than five children's averages respectively.The result of the binary logistic regression model also reveals that age, educational level, marital status, number children, frequency to follow up of media were the most potential explanatory variables that had a significantly impact on the use of family planning. It was also concluded that mothers at earlier reproductive age were better announced in using family planning as compared to other reproductive age group. The log odd of mothers who were using family planning in the higher level of education was increased by 756.601 as compared to those are in illiterate level of education. Therefore, it was concluded that mothers who were experienced with education are good in using contraceptive method as compared to who were never enrolled in education. From the result of the study it was concluded that mothers who daily hear information from media were a good understanding in using contraceptive method. Binary logistic regression model fit the model well. Therefore, it is more advisable if the government and Ministry of Health of Oromia National Regional State of Ethiopia works cooperatively and puts their attention in giving an awareness creation program for mothers who are not using contraceptive method. It is better in encouraging mothers to education, giving an awareness creation program on family planning and daily encouraging mothers to follow government media.

Key Words: Family Planning, Binary Logistic, chi square and odd ratio

1. Introduction

1.1. Background of the study:

The world population is increasing from time to time at unprecedented speed. From day to day it is becoming a global concern as many countries in many parts of the world face the difficulty of sustaining their population. In most developing countries in general, and in Sub-Saharan Africa in particular, the problem of population growth and reproductive health challenges include: high maternal mortality, high population growth rate, total fertility rate and much unmet need for family planning in the world. The situation in Ethiopia is still much worse than most African countries (ETR, 2007). Ethiopia is one of the developing countries with high growth rate of population, high level of maternal and child mortality. The population growth rate of the country is among the highest in Sub-Saharan Africa (CSA, 1999). Women in the reproductive age group (15-49), constitute a substantial percent of the total female population. Furthermore the country has a youth age structure in which 40% of the population is under age 15. This indicates that there is considerable momentum for population growth. This, together with the high level of fertility and a low level of contraceptive use, suggests that the population will continue to grow at a faster pace for at least another generation.

The family Guidance association of Ethiopia is indigene nous, not, for profit, volunteer, based organization with over 45 years of

experience in providing dedicated, quality and abroad range of sexual and reproductive health (SRH) service in Ethiopia, completing the governmental efforts. The association was established in 1966 by a few dedicated volunteers from healthy and social work back grounds [1]

Family planning (FP) was hardly known in Ethiopia during the establishment, although there were growing incidence of morbidity and mortality of mothers, thus, the need of family planning was essential.

FCAE is an affiliate member of international Planned Parenthood federation (IPPE) since 1971. The sole objective was to promote public awareness and understanding towards responsible sexual life, reproductive processes, family planning and the effects of population growth on socio economic development through diverse educational programs considering the high occurrence of material morbidity and mortality.

The first few years of the association life faced difficulties conservative thoughts and opposition towards population control and family and the community at large. This needed wise and carefully introduction of family planning program. This lead to the establishment of FP information dissemination services in Addis Ababa, with as small publicity as there was fear that they attempt to introduce service provision at large scale may invite opposition keeping its stand, FGAE made it clear that this wasn't a program of population control, rather a preventive health measure to be served on need basis assured then existing government, that family planning would be done without any expense to the government and without any public statement of policy as well.

As professor Andargatchew Tesfaye, one of the founders of association wrote, "The association from its very inception recognized that it could not meet alone, the family planning needs of the Ethiopian population. Therefore, its major intension was not only to introduce and expand the values of family planning service for family welfare and development, but involve as many government and non-government agencies as possible [2]

Fertility is one of the three principal components of population dynamics that determine the size and structure of the population of a country [3]. Differentials in fertility behaviour and fertility levels in different areas and among population strata or characteristics have been among the most pervasive findings in demography. It is essential to identify the risk factors associated with high fertility and to provide services to address those who are at risk. To develop effective strategies for fertility control, it is necessary to understand the factors affecting fertility. It is hypothesized that women in vulnerable groups, such as those who got married at an early age, are illiterate, are living in rural areas, are poorest, and have very little knowledge of contraceptives, have high fertility. Therefore, the main goal of the study is binary logistic analysis in assessing and identifying factors that influence of the use of family planning in the case of Ambo Town, Ethiopia.

1.2. Statement of the problem

High fertility rates could be one of the major deterrents to sustained economic growth in SSA countries. The ill-effects of population growth can be examined at macro and micro levels. At a macro level, high population growth combined with stagnant income can result in growing income inequalities, lack of economic opportunities and high level of unemployment. In SSA countries where productivity level is low, food production cannot keep up with population growth, which leads to food insecurity. SSA countries are predominantly agricultural based which puts pressure on land use. Densely populated area results in limited arable land for production and consumption. [4]

There is use of family planning problem in Ambo town. For instance, when the family planning method is not used in appropriate, some problems like: social, health, economy, financial and etc may face the society.

Those are mainly addressed by the following questions:

- What is the magnitude of using family planning in the study area?
- What are the major factors that affect the use of family planning?

1.3.Objective of the study

1.3.1. General objective

The main goal of the study is statistical modeling in assessing and identifying factors that influence the use of family planning: The Case of Ambo Town, Ethiopia.

1.3.2. Specific Objectives

- To assess the level of family planning practice among the residents of the town.
- To identify factors that influences the use of family planning in the study.
- To recommend the society regarding to the use of family planning.

1.4.Significance of the study

It is hoped that the findings from this research could be useful in many ways:

- It can be used as a guide line for policy makers, monitoring and evaluation activities of the government and different concerned agencies.
- It is also used for identifying factors that are statistically associated with family planning in the study area.
- Particularly the results of the study will benefit family planning programmer.

2. Data and Methodology

2.1. Description of the study area and period

Ethiopia is the Federal Democratic Republic composed of nine national regional states and two sub self-administered distinct woredas. The study town, Ambo Town is located in West Shoa Zone in the regional state of Oromia, Ethiopia. West Shoa Zone is one of the 17 zones of Oromia National Regional State in Ethiopia. Ambo is one of the well-known 360 woreda's in Oromia regions, part of west shoa zone. It is located at 112 km west of Addis Ababa on the main road of Nekemte. In West Shoa Zone there are currently 34 rural and 3 urban kebeles. Ambo town consists of three kebeles these are kebele one, kebele two, and kebele three which is administered by Ambo administrative town and any health related assistance and medical facility, awareness creation on the use of family planning for mothers is not the same for each kebeles. In addition to this, these kebeles are used for geographical identification. The majority of the populations are farmers and Christians. The town has an estimated total population of 64, 423 in 2014. Of them 32, 945 (50.03%) are male and 31,478 (49.97%) are female. Educational institutions available in the town were primary, secondary, preparatory, different private and government colleges, and one higher public institution. Even though, almost all the societies are not knowledgeable with regard to different way of life like: economical use, use of family planning, personal hygiene, environmental protection still there is a gap of the use of family planning as the report [5].The research was carried out for the period of one year that is from August, 2013-June, 2014.

2.2.1. Study Population

The target population consists of all mothers at Ambo Town. A total of 1567 of mothers within the age interval of 15-49 years were considered.

2.2.2. Study design

The data which is cross-sectional were collected from the target population through a structured questionnaire since the data has been collected at a point of time.

2.2.3. Data Source and Method of data collection

To conduct the study well, the data is obtained from primary source. Both questionnaire and face to face interview were used in the study. The information for this study obtained by face to face interview method.

2.2.4. Sampling procedure and sample size determination

Sample size determination is the act of choosing the number of observations or replicates to include in a statistical sample. The sample size is an important feature of any empirical study in which the goal is to make inferences about a population from a sample. In practice, the sample size used in a study is determined based on the expense of data collection and the need to have sufficient sample sizes involved in the study. For example, in a survey sampling involving stratified and cluster sampling there would be different sample sizes for each population. Therefore, based on the nature of our data and study Probability to proportional size is used. To determine the sample size we use the following formula (Sample proportional method from Cochran 3rd edition).

$$\boldsymbol{n = \frac{(Z_{\alpha/2})^2 pq}{d^2} = 148}$$

Where, $\boldsymbol{Z(\alpha/2) = 1.96, d = 0.08, p = 0.5, q = 0.5}$

p Indicates that the probability that mothers use contraceptive method, and q denotes the probability that mothers don't use contraceptive method. In addition to this the formula also denotes that respectively $Z\left(\frac{\alpha}{2}\right)$ and $d$respectively standard normal value and allowable margin of error. Therefore, 51, 49 and 48 women are selected from each Kebele respectively by sample proportional methods.

Table 1: Number of Mothers Taken from the Primary Sampling Unit at Ambo Town, 2014

Sites	N_h	Sample
Kebele one	528	51
Kebele two	521	49
Kebele three	508	48
Total	1567	148

Where, N_h the total number of employees within the h^{th} strata, N is the total number of mothers in Ambo Town. And the sampling procedure used in this study is one stage sampling on the basis of stratification sampling technique that maximize accuracy of the information obtained about the population and it will increase the precision of estimate. First, Ambo town is stratified into three kebeles as kebele one, kebele two and kebele three. In addition to this within each stratum homogeneity on the basis of medical facility and number of health facility. And between kebeles heterogeneity is considered assuming that facilities allocated for each kebeles are different.

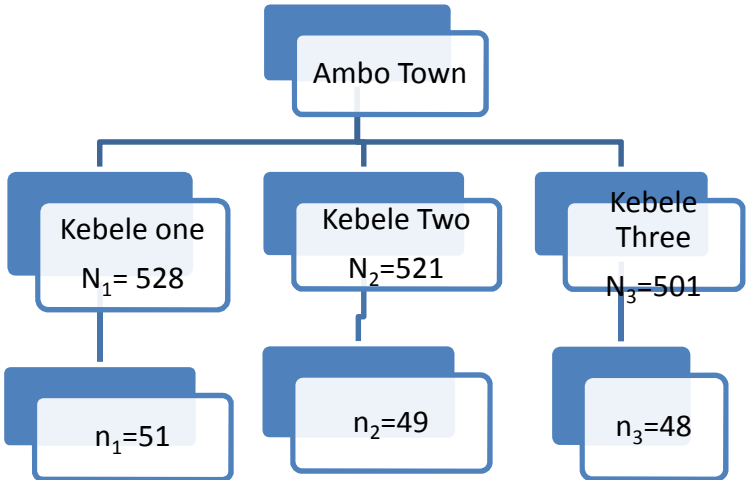

Figure 1: *sampling procedure in the study area, Ambo Town, 2014*

2.3.Variable Identification

Dependent Variable: The response variable considered in the study is family planning which is binary random variable and coded as mothers used of a family planning method by 1and those who not used of family planning method coded is denoted by 0.

Explanatory Variables: The explanatory variables that are considered in the study that predict the response variables are listed as follow.

- Educational level of women
- Age of women
- Educational level of husband
- Marital status
- Number of children
- Religion
- Occupation
- House hold income
- Wealth index
- Frequency of listening media

2.3. Methods of data analysis

After collecting the data by designing questionnaire and face to face interviewing, it is necessary to analyze the collected data by using appropriate statistical tools. Data analysis is a critical study by which we extract information from the collected data. Methods of data analysis used in this study are both descriptive and inferential statistics.

2.3.1. Descriptive Statistics

In this study frequency distribution and graphs were used. Bar charts are used diagrammatic representation of nominal and ordinal data. In this study it is used for nominal data representation.

2.3.2. Inferential Statistics

Based on the nature of the study and objective stated in the introduction part the following relevant inferential statistics were used.

2.3.2.1. Chi Square Tests

Ch-squareis used to test whether there is association between the use of family planning and predictor variables considered in study or not.

The chi square test statistics is:

$$\chi^2 = \sum\sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \quad \ldots\ldots\ldots\ldots\ldots\ldots[2]$$

With degrees of freedom equal to numbers of categories minus one i.e. (R - 1) (C - 1) where:-

R is row and C is column

O_{ij} – observed frequency

E_{ij} – expected frequency

The null hypothesis of chi square test is no association between categorical variables while alternative hypothesis is there is an association. If the calculated value is greater than the tabulated value reject the null hypothesis and accept the alternative hypothesis.

Basic assumption of chi square test

- The sample must be randomly selected from the population.

- The population must be normally distributed for the variable under study.
- Each cell and every individual object is independent of each other i.e. the observation should be independent of each other.
- It requires sufficiently large expected frequency for one cell.

2.3.2.2. Logistic regression

Logistic regression analysis extends the techniques of multiple regression analysis to research situations in which the outcome variable is categorical. Generally, the response variable is binary, such as (use or not use, save or no save, presence or absence, success or failure etc) in logistic regression. Further,Logistic regression analysis is statistical technique examines the influence of various factors on a dichotomous outcome by estimating the probability of the event's occurrence. It describes the relationship between a dichotomous response variable and a set of explanatory variables. The logistic model is special case of generalized linear model [6] where the assumptions of normality and constant variance of residuals are not satisfied. Binary (binomial) logistic regression is the form of regression we is used when the dependant variable is a dichotomous and the predictor variables are of any type.

Basic assumption of logistic regression

Once the model is fitted checking the validity of inferences drawn from modern statistical modeling techniques depends on the assumptions of the statistical model being satisfied. Assumptions were should consider for the efficient use of logistic regression as given below [7]. The following are the basic assumptions:

- Logistic regression assumes meaningful coding of the variables. Logistic coefficients were difficult to interpret if not coded meaningfully. The convention for binomial logistic regression is to code the dependent class of interest as 1 and the other class as 0.
- Logistic regression does not assume a linear relationship between the dependent and independent variables.
- The dependent variable must be categorical.
- The independent variables need not be interval, no normally distributed, no linearly related and no equal variance within each group.
- The groups must be mutually exclusive and exhaustive; a case can only be in one group and every case must be a member of one of the groups.
- Larger samples are needed than for linear regression because maximum likelihood coefficients are large sample estimates.
- The logit regression equation should have a linear relationship with the logit form of the dependent variable.
- Absence of multicollinearity.
- It does not need a linear relationship between the dependent and independent variables. Logistic regression can handle all sorts of relationships; it applies a non linear log transformation to the predicted odds ratio.
- The error terms need to be binomially distributed.
- The assumption of homoscedesticity is not necessary in logistic regression. Logistic regression can handle ordinal and nominal data as independent variables.
- Logistic regression requires the dependent variable to be categorical (Mostly binary).

Since logistic regression assumes that's P (y =1) is the probability of the event occurring, it is necessary that the dependent variables is coded accordingly. That is for the factor level I the dependent variables should represent the desired outcome. Logistic regression assumes linearity of independent variables and log odds. Otherwise, the logistic regression underestimates the strength of the relationship and reject the relationship easily, that is being not significant (not rejecting the null hypothesis) where it should be significant. Logistic regression requires quite large sample sizes.

2.3.2.3. Odds ratio

The odds of an event happenings (e.g. the event that Y = 1) is defined as the ratio of the probability that the event will occur divided by the probability that the event will not occur. That is, the odd of event A is given by:

$$Odds(E) = \frac{P(A)}{P(A^{'})} = \frac{P(A)}{1 - P(A)} \quad \text{.....[3]}$$

Where A is an event defined related to the use of family planning.

2.3.2.4. The Model of Binary Logistic Regression Model

The dependent variable in logistic regression is usually binary that is the dependent variable can take the value 1 with a probability of success π, or the value 0 with probability of failure $1 - \pi$. This type of variables is called a Bernoulli (binary) variable. The relationship between the predictor and response variables is not a linear function in logistic regression instead log it transformation of π is used. Consider a collection

of P explanatory that the outcome is present to denote by:

$$p\left(\frac{\pi}{1-\pi}\right) = \frac{\exp\ (B_o + B_1x_1 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + B_px_p)}{1 + \exp(B_o + B_1x_1 + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_ox_p)}$$

Then log odds of having y =1 is modeled as a linear function of the explanatory variables as:

$$Ln\left(\frac{\pi}{1-\pi}\right) = (B_o + B_1x_1 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + B_px_p: O \leq \pi \leq 1$$

Where β_o is intercept and B_1……. B_P is regression coefficients of the explanatory variables.

2.3.2.5. Methods of Estimation of Logistic Regression

The most commonly used method of estimating the parameters of a logistics regression model is the method of maximum like hood (ML). In generally, the sample likelihood function is defined as the joint probability function of random variables specifically, suppose (x1,x2,……,xp) are p independent random observations Since yi is the Bernoulli random variable the probability function of yi is:

$$(Y = yi) = \pi i^{\,yi} \quad (1-\pi i)^{1-yi}, yi = 0, or\ 1, i = 1, 2, \ldots\ldots\ldots\ldots n,$$

Since y's are assumed to be independent, the joint probability function or likelihood function is given by log (y_1, y_2…..y_n) =

The log likelihood functions as:

$$L(\beta_o, \beta_1, \ldots \beta_p) = \sum_{i=1}^{n} yi\ (\beta_o + \beta_1 x_1 + \beta_2 x_2 \ldots . + \beta_p x_p) - \sum_{i=0}^{n} \ln\{1 + \exp(\beta_0 + \beta x_1 + \beta_2 x_2 +, \ldots\ldots . + \beta_p x_p\}.$$

The most effective and well known Newton Raph SOL iterative method can solve the equations.

2.4. Test of goodness of model fit

2.4.1. Pseudo R^2 for logistic regression

In logistic regression, there is no true R^2 value as there is in OLS regression. However, because of deviance can be thought of as a measure of how poorly the model fits (i.e. lack of fit between observed and predicted values), an analogy can be made to sum of squares residual in ordinary least squares.

The proportion of un accounted for variance that is reduced by adding variables to the model is the same as the proportion of variance accounted for or R^2

$$R^2\ logistic = \frac{-2LL\ null - 2LLk}{-2LL\ null}$$

Where the null model is the logistic model with just the constant and the k model contains all predictors in the model. The Cox and Snell R – square are computed as follows:

$$Cox\ and\ Snell\ Pseudo - R^2 = 1 - \frac{\left[-\frac{2LLnull}{-2LLk}\right]\frac{2}{n}}{1 - [-2LLnull]^{\frac{2}{n}}}$$

2.4.2. Hosmer Lemeshaw Test

In order to finds the overall goodness of fit, Hosmer and Lemeshaw proposed grouping the values of the estimated probabilities. Hosmer Lemeshaw goodness of fit test divides subjects in to deciles bases on predicted probabilities and computers a chi square from observed and expected frequencies using theses grouping strategies, the hosmer Lemeshaw goodness fit of statistic, C is obtained by calculating using the formula:

$$\widehat{C} = \sum_{i=0}^{n} \frac{(O_k - n\prime k\pi k)^2}{nk\ \pi k\ (1-\pi k)}$$

Where of denotes the no of groups n'k is the number of observation in the k^{th} group, O_k is the sum of the y values for the k^{th} group. Hosmer and Lemeshaw (1980) demonstrated that under the null hypothesis that the filled logistic regression model is the correct model, the distribution of statistic C is well approximated by the chi squared distention with g – 2 degrees of freedom. This test is more reliable and robust than the traditional chi square test.

2.4.3. The Likelihood Ratio Test

The likelihood ration test (LR) test is performed by estimating two models and comparing the fit of one model to the fit of the other removing predictor variables from a model will almost always make the model fit less well (i.e, a model will have a lower log likelihood), but it is necessary to test whether observed difference in model fit statistically significant.

The likelihood ration does this by comparing the log likelihoods of the two models. It this difference is statistically significant, then the restrictive model the one with more variables is said to fit the data significantly better than the more restrictive model. If one has the log likelihoods from the models, the livelihood ration statistic is fairly easy to calculate. The likelihood ratio test is performed to test the overall significance of all coefficients in the model on the basis of test statistic:

$$G^2 = [(-2LL_nL_o) - (-2L_nL_O)]$$

Where, L_o is the likelihood of the null model and L_n is the likelihood of the saturated model.

The statistic G^2 plays the same role in logistic regression as the numerator of the partial F test does in linear regression. Under the global null hypothesis, H_o, $B_1 = B_2 = \ldots\ldots\ldots = B_p = 0$

The statistic G^2 follows a chi square distribution with p degrees of freedom and measures how well the independent variable affects the response variable.

3.Results and discussions

The data comprised a sample of 148 mothers, who were in age of 15-49 in Ambo Town. The data collection period was August, 2013-June, 2014. The response variable considered in this study was the usage of family planning of mothers (used or not used).

This chapter is mainly aimed to deal with the result and discussions of the study. The main goal of the study is to assess and identify factors that influence the use of family planning in case of Ambo town. The response variable considered in this study is binary with having two possible expected outcomes coded as 0 form others not using contraceptive method and 1 for mothers using contraceptive method. The result of Descriptive and Inferential Statistics are summarized and described in this chapter in order to assess and identify factors that influence use of family planning in the study area. The data were analyzed using SPSS version 16.

3.1.Results of descriptive Statistics

Of the target population, 148 mothers were randomly selected in the study. From the graph below it is observed that majority (71.62%) mothers don't used contraceptive method while only 28.38% used contraceptive methods. The descriptive bar graph is given here below (Figure 2).

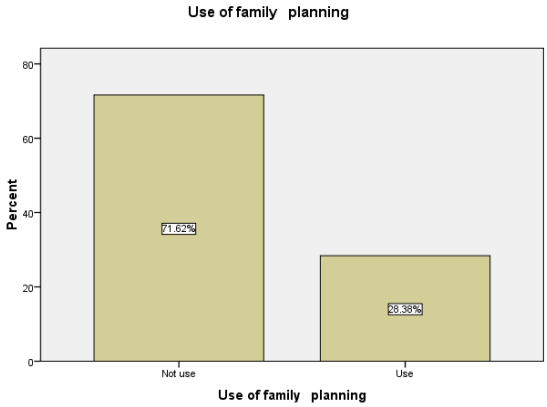

Figure 2: *Simple Bar chart of to assess the use of family planning in Ambo Town. 2014*

As it is revealed from the graph above it is observed that around three fourth of mothers don't use contraceptive method in the study area (Figure 2).

3.2.Summary of descriptive statistics

The following table indicates descriptive statistics and summary statistics of variables related with the dependent variable. From the above table shows that use of family planning methods differs by women's age. For instance, 42.42% of women in 15-24 age intervals are not using family planning methods and the remaining 57.85% are using family planning methods. As it is observed from the above table 4.1, women who are in age interval 34-44 are better on family planning usage (that is 38.46% of them are using and 61.54% of them are not using family planning methods).

Respondents' response on mother's educational level show that 39.13% are in higher, 20.83% is in secondary, 92.86% are in Primary educational level uses family planning methods. Almost majority of respondents around 87.18% of illiterate are not using family planning methods. The result also shows that 34.29%, 17.86%, 32% and36% of husbands is in level of education: no education, primary, secondary and higher respectively. Marital status is also important factor that affect use of family planning methods. Based on the above table, 41.17% of married women are using family planning methods. While 8.57%, 19.05% and 25% are single, widowed and divorced are using family planning methods respectively.

The above table also shows that women those have one or two children uses family planning most in frequency i.e. 57.9%.

With regards to religion, family planning usage of women is highest for orthodox (37.5%) followed by 31.03% of Catholics. The lowest family planning usage (20%) of women was recorded for followers of protestant religions.

Table 2. Frequency distribution of family planning usage status of women in Ambo Town, 2014

Variables	Category	Use of family planning				
		Using		Not using		Total
		count	Row N %	count	Row N %	Count
Age of women	15-24	14	42.42%	19	57.58%	33
	25-34	10	16.13%	52	83.87%	62
	35-44	10	38.46%	16	61.54%	26
	>=45	8	29.63%	19	70.37%	27
Educational level of mother	Illiterate	5	12.82%	34	87.18%	39
	Primary	13	92.86%	1	7.14%	14
	Secondary	15	20.83%	57	79.17%	72
	Higher	9	39.13%	14	60.87%	23
Educational level of husband	Illiterate	12	34.29%	23	65.71%	35
	Primary	5	17.86%	23	82.14%	28
	Secondary	16	32.00%	34	68.00%	50
	Higher	9	36.00%	16	64.00%	25
Marital status	Single	3	8.57%	32	91.43%	35
	Married	30	41.17%	42	58..33%	72
	Widowed	4	19.05%	17	80.95%	21
	Divorced	5	25.00%	15	75.00%	20
Number of children	No child	1	14.29%	6	85.715%	7
	1-2	11	57.90%	8	42.10%	19
	3-4	25	33.33%	50	66.67%	75
	>=5	5	10.64%	42	89.36%	47
Religion	Orthodox	12	37.50%	20	62.50%	32
	Protestant	7	20.00%	28	80.00%	35
	Muslim	9	30.00%	21	70.00%	30
	Catholic	9	31.03%	20	68.97%	29
	Others	5	22.73%	17	77.27%	22
Income	<500	6	26.09%	23	73.91%	29
	501-1500	8	20.00%	32	80.00%	40
	1501-2500	11	29.73%	26	70.27%	37
	2501-3500	9	36.00%	16	64.00%	25
	Above3500	8	47.09%	9	52.94%	17
Occupation	Gov't	9	42.86%	12	57.14%	21
	office	6	35.29%	11	64.71%	17
	House wife	10	29.41%	24	70.59%	34
	Merchant	7	17.07%	34	82.93%	41
	Daily labor	10	28.57%	25	71.43%	35
	Others					
Wealth index	Poor	6	15.79%	32	84.21%	38
	Medium	22	26.19%	62	73.81%	84
	Rich	14	53.85%	12	46.15%	26
Frequency of listening media	Not at all	17	11.53%	26	88.47%	43
	Rarely	8	18.60%	35	81.40%	43
	Once week					
	Every	16	39.56%	29	60.44%	45
	week	1	67.12%	16	68.12%	17

The average income of house hold is another important factor with regard to usage of family planning methods. The highest percentage of family planning usage is observed in the income interval above3500 (47.07%) and lowest

percentage of family planning usage is observed in the interval 501-1500 (20%).

The women's occupation is also important factor with regard to usage of family planning methods. The highest percentage of family planning usage is observed in government office workers (42.86%) and lowest percentage of family planning usage is observed in the daily labor (17.07%).

Wealth index also has its own effect on the using of family planning methods. Around 15.79% of poor, 26.18% of middle and 53.85% of rich women are using family planning methods. This indicates that prevalence rate of family planning usage increases as households' economic status increases.

The exposure of women to mass media like frequency of listening to different media is another variable to affect using of family planning methods. For example, the highest proportion (39.56%) of women who are using family planning methods listen media once a week. On the other hand, the lowest rate of family planning usage (11.53%) has been observed in the category of women who are not listening media at all.

Table 3: Result of test of association between predictors and the use family planning

variables	Value	Df	p-value
Age of women	9.102[a]	3	0.028
Educational level of mother	36.606[a]	3	0.000
Educational level of husband	7.633[a]	3	0.054
Marital status	14.176[a]	3	0.003
Number of children	16.529[a]	3	0.001
Religion	3.004[a]	4	0.0557
Type of women occupation	5.163[a]	4	0.271
Average monthly household income	5.891[a]	4	0.207
Wealth index	11.458[a]	2	0.003
Frequency of listening to the media	9.437[a]	3	0.024

FM indicates Use of Family Planning

As it is observed from the table above age of mothers, educational level of mothers, educational level of husband, number of children, marital status, type of women occupation, average monthly household income and frequency of listening of media are statistically significantly associated with the use of family planning at 5% level of significance comparing with P-value(Table 2).

2.5. Results of analysis of binary logistic Regression

In this, the result of binary logistic regression and significance and impact of each explanatory variable on the response variable is discussed.

Table 4.Omnibus test of model coefficients

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	103.266	15	.000
	Block	103.266	15	.000
	Model	103.266	15	.000

The table above shows model which includes all predictors. Values shown in the Omnibus Tests of Model Coefficients is given in a Chi-Square of 103.266 which is significant at 0.05. This is a test of the null hypothesis that adding the predictors to the model has not significantly increased our ability to predict use of family planning method made by our subjects. Since our omnibus test is significant at 5% level of significance it can be concluded that adding the

predictors to the model have significantly increased our ability to predict family planning method. Likelihood ratio test is the most common assessment of overall model fit in logistic regression, which is simply the chi-square difference between the null model (i.e., with the constant only) and the model containing the predictors. Under Model Summary above we see that the -2 Log Likelihood statistics is 73.296[a].This statistic measures how poorly the model predicts the use of family planning method, the smaller the statistic the better the model.

Table 5. Model summary

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	73.296[a]	.502	.721

a. Estimation terminated at iteration number 8 because parameter estimates changed by less than .001.

SPSS does not give us this statistic for the model that had only the intercept; we know it to be 176.562 (73.296+ 103.266). Adding the predictors reduced the -2 Log Likelihood statistics by 176.562-73.296 = 103.266, which is the $X2$ statistic for omnibus test. The value of Cox & Snell $R2$ and Nagelkerke $R2$are good enough.Cox and Snell or Nagelkerke $R2$ is an analogous statistic in logistic regression to the coefficient of determination $R2$ in linear regression, but not close analog. The model summary provides some approximation of $R2$statistic in logistic regression. Cox and Snell's R^2 attempts to imitate multiple R^2 based on likelihood. In this study Cox and Snell R^2indicates that 50.2% of the variation in the dependent variable use of family planning method was explained by the explanatory variables. Nagelkerke R^2 in model summary table above is 0.721, which indicates that 72.1% of the variability in the dependent variable using of family planning method was explained by the explanatory variables.

Table 6. Homers and Lemeshow test

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	8.912	8	.350

As it is observed from the above table, P-value = 0.350 which is greater than the level of significance α=0.05, hence data fits the model well. Therefore our fitted logistic regression model is good fit **(Table 5)**.

Contingency Table for Hosmer and Lemeshow Test

		Use of family planning = Not use		Use of family planning = Use		
		Observed	Expected	Observed	Expected	Total
Step 1	1	13	12.999	0	.001	13
	2	13	12.992	0	.008	13
	3	15	14.958	0	.042	15
	4	15	14.794	0	.206	15
	5	12	12.768	2	1.232	14
	6	14	12.155	0	1.845	14
	7	14	12.331	1	2.669	15
	8	8	9.132	7	5.868	15
	9	1	3.592	14	11.408	15
	10	1	.277	18	18.723	19

. The Hosmer-Lemeshow test is performed by dividing the predicted probabilities into 10 groups based on percentile ranks and then computing a Pearson chi-square that compares the predicted to the observed frequencies. A non significant chi-square indicates a good fit to the data and also p-value is 0.35 which is significant therefore our fitted logistic regression model is good fit.

Observed - This indicates the number of 0's and 1's that are observed in the dependent variable (use of family planning).

Predicted - These are the predicted values of the dependent variable based on the full logistic regression model. Table 4.11 shows how many cases are correctly predicted (102 cases are observed to be 0 and are correctly predicted to be 0; 32 cases are observed to be 1 and

are correctly predicted to be 1) and how many cases are not correctly predicted (10 cases are observed to be 0 but are predicted to be 1; 10 cases are observed to be 1 but are predicted to be 0).

Table 7. Classification table

Classification Table [a]

Observed			Predicted		
			Use of family planning		Percentage Correct
			Not use	Use	
Step 1	Use of family planning	Not use	102	4	96.2
		Use	10	32	76.2
	Overall Percentage				90.5

a. The cut value is .500

Overall Percentage - This gives the overall percent of cases that are correctly predicted by the full model. Overall our predictions were correct 134(102+32) out of 148 times, for an overall success rate of 90.5%. As we can see, this percentage has increased from 71.6 (Table 6) for the null model to 90.5 for the full model (Table 4.11).We could focus on error rates in classification. A false positive would be predicting that the event would occur when, in fact, it did not. Our decision rule predicted the use of family planning methods 36 times. That prediction was wrong 4/36 times, for a false positive rate of 4/36 =11.11 %. A false negative would be predicting that the event would not occur when, in fact, it did occur. Our decision rule predicted that not using family planning methods are 112 times. Since, most of the covariates are categorical to compute odds ratio we need to have a reference category. Result of binary of logistic the multiple logistic regression coefficients can be estimated using the maximum likelihood estimation method implemented in the SPSS package (Table 7). **T**he estimated coefficients and standard errors of the estimates that are used in computing the Wald statistic and the odds ratio (Exp)) are presented in Table 7.The significance of the Wald statistic indicates the importance of the predictor variable in the model.

3.2.2. Discussions

The study has provided an insight into the factors that determine the use of family planning in Ambo town. According to the results, about 71.62% of the respondents have no the habit of using of contraceptive method. Out of the mothers who have no habits of using contraceptive methods 87.18% and 89.36% were illiterate and have more than five children's averages respectively.

The most important covariates identified in the multiple logistic regressions are age, education, marital status, number of children's, and frequency of following media. Therefore, age, education, marital status, number of children's, and frequency of following media were significantly associated with the use of contraceptive method. The result of the binary logistic regression model presented in the above Table 7 use of family planning was assigned a value of '1' if the respondents use family planning method and' 0' if not. The reference category of each dichotomously measured independent variable has a value of one and the values for other categories are compared to that of the reference category. A value less than one imply that individuals in that category have a lower probability of use of family planning methods than individuals in the reference category. The log odd of mothers who were using family planning in the age interval 25-34 is decreased by the amount of 1.8% as compared to the age interval15-24 controlling other variables in the model (Coeffient = -4.041, OR=0.018, P=0.002, CI=[0.001, 0.236]).

The log odd of mothers who were using family planning in the secondary level of education is increased by 9.163 as compared to those are in illiterate level of education (Coefficient = 2.215, OR=9.163, P=0.094, CI=[0.684, 122.812]).

The log odd of mothers who were using family planning in the higher level of education is increased by 756.601 as compared to those are in illiterate level of education (Coefficient = 6.629, OR=756.601, P=0.006, CI=[6.681, 8583.96]).

The log odd of mothers who were follow medias every week their use of family planning is increased by 1.988 more times as compared to those were don't follow at all(Coefficient =0.687, OR=1.988, P=0.001, CI=[0.905, 4.350]).

The log odd of mothers who were follow medias once a week their use of family planning is increased by 1.378 more times as compared to

2.5.1. Logistic regression analysis

Table.8. Results of binary logistic regression analysis

Table 3.7: Results of Binary logistic Regression Analysis

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP (B) Lower	Upper
Age (Ref: 15-24)			10.866	3	.012*			
25-34	-4.041	1.326	9.287	1	.002*	.018	.001	.236
35-44	-1.961	1.216	2.602	1	.107	.141	.013	1.525
+44)	-.307	1.065	.083	1	.773	.735	.091	5.927
Edu ref: illitrate			14.943	3	.002*			
Primary	-8.103	2.391	11.488	1	.001*	3304.472	30.486	358185.4
Secondary	2.215	1.324	2.798	1	.094	9.163	.684	122.818
Higher	6.629	2.413	7.546	1	.006*	756.601	6.681	85683.096
Marital ref: single			12.070	3	.007*			
Married	-3.672	1.288	8.129	1	.004*	39.327	3.151	490.849
Widowed	.472	1.716	.076	1	.783	1.603	.055	46.335
Divorced	-5.273	2.396	4.843	1	.028*	195.092	1.781	21373.764
NC ref: No children			9.549	3	.023*			
<=2	-1.512	1.909	.628	1	.428	.220	.005	9.288
3-4	-2.085	2.033	1.052	1	.305	.124	.002	6.676
+4)	-6.027	2.525	5.697	1	.017*	.002	.000	.340
Media ref: noatall			8.645	3	.034*			
rarely	0.113	0.332	0.115	1	.0.735	1.119	.0.61	2.604
once per week	0.321	0.370	.0.753	1	0.385	1.378	.0.121	7.205
evry day	0.687	0.209	10.792	1	0.001	1.988	.0.905	.4.350
Constant	-1.489	2.241	.441	1	.506	.226		

*** singificant at 5%, ref- is reference category**

Those were don't follow at all (Coefficient =0.321, OR=1.378, P=0.385, CI=[0.121, 7.205]).

The log odd of mothers who were follow medias rarely their use of family planning is increased by 1.119 more times as compared to those were don't follow at all(Coefficient =0.113, OR=1.119, P=0.735, CI=[0.061, 2.605]).

The log odd of mothers who had 1 and 2 children, their use of family planning is decreased by 0.220 as compared to mothers who had no a child (Coefficient =-1.512, OR=0.220, P=0.428, CI=[0.005,9.288]).

The log odd of mothers who had 3 and 4 children, their use of family planning is decreased by 0.124 as compared to mothers who had no a child (Coefficient =-2.085, OR=0.124, P=0.305, CI=[0.002,6.678]).

The log odd of mothers who had more than 5 children's , their use of family planning is decreased by 0.002 as compared to mothers who had no a child (Coefficient =-6.027, OR=0.002, P=0.017, CI=[0.000,0.343]).

4. Conclusions and Recommendations

4.1. Conclusions

The result of this study shows that mothers who were not using contraceptive method are very high as compared to those who were using it Ambo Town. In addition to this, age of mothers, educational level of mother, educational level of husband, number of children, marital status and frequency of listening of media are statistically significantly associated with the use of family planning. Moreover, the result of binary logistic regression model shows that age, marital status, level of education, number of children mothers have, frequency mother's to follow media were potential explanatory variables that have a significant effect on the use of family planning. The log odd of mothers who were enrolled in the higher level of education was better used family planning as compared to those who never enrolled in education. From the result of the study it was also concluded that at earlier reproductive age of mothers better has a habit of using contraceptive method than other age category. Moreover, it was concluded that mothers who frequently had the habit to follow media had a good habit of using family planning as compared to others.

4.2. Recommendations

Based on the results obtained in this study the following recommendations were drawn:

- It is more advisable if the government puts its attention in giving an awareness creation program for mothers who are not using contraceptive method.
- Expand medical facilities in areas specifically where the use of family planning is very low.
- Encourage mothers to involve actively in education.
- Strongly advice mothers to have the habit of listening different media.
- Further study is advisable and recommended on some of variables that were not incorporated under this study.

5. Acknowledgments

First of all great thank goes for my almighty God Jesus for all his encouragement and continues help to conduct this research and finalize it to this stage. I gratefully acknowledge the Ambo University for helping me relevant material to undertake the study. I would also acknowledge Ambo Town Health Bureau of Ethiopia for

providing transportation, research assistants during extensive community- based survey.

I wish to express my deepest gratitude to my supervisors Mr Tufa Kolola (Masters of Public Health) and Mr Ashenafi Senbeta (Masters in Applied Statistics) researchers, lecturers in Debre Berhan University and Ambo University respectively, Ethiopia. I cannot have sufficient words to thank you for your dedicated and highly qualified support, swift feedback, friendliness, patience and understanding. Your advice and encouragement gave me confidence to think critically and laid a foundation to work independently. Without your close guidance, it would have been difficult to accomplish this work.

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