

An Application of Binary Logistic Regression to Determine Factors Influencing the Use of Contraceptives among Women of Reproductive Age in Nigeria

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Abstract The relationship between selected demographic and socioeconomic variables and current use of contraception were examined using logistic regression technique. Information on current contraceptive use was provided by 4403 out of 3385 currently married women aged 15-49 interviewed in the 2008 Nigeria Demographic and Health Survey. Highest educational level, wealth status, ethnicity, region of residence, respondent's occupation, knowledge of any method of contraceptives and number of living children emerge as the most important explanatory variables of current contraceptives use while ages of women, rural-urban residence and religious affiliation were observed of non-significant effect on contraceptives use. The ratio of a woman in the reproductive age using is 0.000487 per any contraceptive method compared to non-usage of contraceptives whereas the ratio of odd of a woman in the reproductive age using contraceptives is 0.00532 per any contraceptives method compare to non-usage of contraceptives. As a policy measure, information, education and communication programmes on family planning should be intensified and women should be encourage to pursue education to highest level.

Keywords Current usage of Contraceptives, Logistics Regression, Women of reproductive age

1. Introduction

The world population has being on the increased since God created man after He blessed them saying be fruitful, multiply, replenish the earth, subdue and have dominion [3]. From just two people then the world is now made up of over seven billion people based on recent statistics [8]. This astronomical growth of human population has being a bit of concern to population expert, economist and world government in general. This is due to the fact that world resource is scarce as believed by economist and this called for efficient management of these resources among the people and the control of the increase of world population.

Although the world population is being control by death through various means natural disaster, accident etc. The rate at which these occur cannot be compare to the rate of births which is the way human population increases. This led us to find way to control birth rate in other to control world population and this gives birth to the use of contraceptives.

In Africa, contraceptives usage has been on for centuries through the use of local means in order to control birth or space child birth. These traditional methods of contraception are shrouded in mystery and superstition and involve the use of local herbs and charms to prevent pregnancies. Other methods include prolong breastfeeding, polygamy, prolonged abstinence reinforced by taboos and value placed on virginity. Even though the users of these local contraceptives belief that they are effective yet they are difficult to explain scientifically.

In this study, we want to know the association between modern contraceptives and traditional contraceptives on ages, sex, educational level, number of children, religion, region, wealth quintiles, place of residence knowledge of any contraceptives method and respondent's occupation.

2. Data Analysis Method

The analysis of this research work will be limited to the variable available in our data viz types of contraceptives, ages, educational level, number of children, religion, region, ethnicity, wealth quintiles, place of residence knowledge of any contraceptives method and respondent's occupation.

Based on the above listed variables cross-tabulation will be carried out comparing contraceptives use with each of the variables. By this we want to know the association between

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modern contraceptives and traditional contraceptives on ages, sex, educational level, number of children, religion, region, wealth quintiles, place of residence knowledge of any contraceptives method and respondent's occupation.

Furthermore, the statistically analysis tool that we will engage in this research work is logistic regression.

2.1. Source of Data

The data for this research work is obtained from Annual Abstract of Statistics (2009) a publication of National Bureau of Statistics and the data itself is the Nigeria Demographic and Health Survey (2008) conducted by National Population Commission [4,6]. The 2008 NDHS is a national sample survey designed to provide up-to-date information on background characteristics of the respondents; fertility levels; nuptiality; sexual activity; fertility preferences; awareness and the use of family planning methods; breastfeeding practices; nutritional status of mothers and young children; early childhood mortality and maternal mortality; maternal and child health; and awareness and behaviour regarding HIV/AIDS and other sexually transmitted infections. The target groups were women age 15-49 years and men age 15-59 years in randomly selected households across Nigeria. Information about children age 0-5 years was also collected, including weight and height.

Table 1. Shows the percentage distribution of uses and non-usage of contraceptives

USES AND NON-USAGE OF CONTRACEPTIVES		
CONTRACEPTIVES METHODS	Frequency	% of women using or not using
not using	28982	86.8
pill	457	1.37
iud	209	0.63
injections	666	2.00
diaphragm	1	0.003
condom	1345	4.03
female sterilization	98	0.29
periodic abstinence	556	1.67
withdrawal	430	1.29
other	287	0.86
Norplant	13	0.04
lactational amenorrhea	328	0.98
female condom	10	0.03
foam or jelly	3	0.009

2.2. Data Processing and Analysis

The data processing and analysis was carried-out using the SPSS 16.0 statistical package. And these included test of independence to determine relationship between the independent variables and the dependent variable using frequency tables, contingency tables and the Pearson's Chi-square and the logistic regression to find the best model.

2.3. Definition and Scale of Variables

The following are the variables used in this study and their scales.

Current ages of women (x_1) is the ages of women at the time of this study which is grouped as follows: 15 – 19, 20 – 24, 25-29, 30-34, 35-39, 40-44, 45-49.

Highest educational level (x_2) is the highest level of education each respondents have acquired ranges from no education, primary education secondary, higher education.

Religion (x_3) is the type of faith the respondent practice grouped as Catholics, other Christian, Islam, traditionalist and others.

Wealth index (x_4) is the indicator of the financial status of respond ranges from poorest, poorer, middle, richer, richest.

Region of residence (x_5) is the part of the country the respondents reside among the six geopolitical zone of the nation grouped as north east, north west, north central, south east, south west, south-south.

Place of residence (x_6) is the type of area the respondent resides either rural or urban.

Ethnicity (x_7) is the tribe the respondents belong such as igbo, hausa, Fulani, ijaw, efik, Yoruba, tiv, Ibibio, igala, others.

Respondent occupation (x_8) is the type of job he or she is engaged with such as not working, manager, clerical, sales, agric self employed. Agric employee, household & domestic, services, skilled, unskilled, don't know.

Number of living children (x_9) is the number of respondent children that are alive presently.

Knowledge of any contraceptives (x_{10}) is the awareness of respondent of any method of contraceptives grouped as knows no method, knows only folkloric, knows only traditional method, knows only modern method.

3. Analysis and Interpretation

The analyses reported here are based on information on current contraceptive use provided by 33,385 women of ages 15-49. The dependent variable was current use of a traditional or modern contraceptive method as reported by the women. Modern methods comprise the pill, IUD, injection, vaginal methods, condom and female sterilisation; traditional methods include periodic abstinence (rhythm), withdrawal and use of substances such as herbs. Current use of contraception is preferred to ever-use because of its greater precision and its more direct implications for family planning programmes.

Two separate analyses were performed. The first examines bivariate relationships between selected demographic, social and economic variables and current contraceptive use. The second analysis uses a multivariate stepwise logistic regression technique to assess the relative importance of the selected variables. The dependent variable is a dichotomous response variable that was assigned the value 1 if the respondent was using any contraceptive

method and 0 if not using any method. The results of logistic regression analysis are given as regression coefficients, odds ratios (if greater than unity, the probability of being a current user is higher than that of being a non-user), and p values, to assess the relative importance of the selected variables.

3.1. Cross Tabulation

For each of the ten variables there is a cross tabulation and chi-square table for test of independence. The test is to define the significant influence of the Demographic and socio-economic variables on the contraceptives use among women of reproductive age. The level of significant used for the purpose of the survey is 0.05 with 95 per cent accuracy. The decision is based on the critical region that we accept the null hypothesis if the p -value is greater than 0.05, otherwise reject the null hypothesis. Based on the test of independence, it is obvious that there is a significant association between the demographic and socioeconomic factors and contraceptive use and hence, conclude that the ages of women, educational level, religion, wealth index, number of living children, ethnicity, region of residence, respondent's occupation, type of place of residence and knowledge of any method have significant influence on the contraceptive use in Nigeria.

3.2. Model Fitting

Modelling is done using the logistic regression technique and SPSS is used to run the data.

Response variable used:

$$Y_i = \begin{cases} 1 \text{ (using),} & \text{if any contraceptive is used} \\ & \text{by the respondent} \\ 0 \text{ (not using),} & \text{otherwise} \end{cases}$$

Predictor variables used:

- x_1 - Current ages of women
- x_2 - Highest Educational Level
- x_3 - Religion
- x_4 - Wealth Index
- x_5 - Region of residence
- x_6 - Place of residence
- x_7 - Ethnicity
- x_8 - Respondents Occupation
- x_9 - Number of living Children
- x_{10} - Knowledge of any contraceptives method

3.3. Estimating the Parameters for the Full Model

The full model:

$$\pi = e^z / 1 + e^z \quad (1)$$

where

$$\begin{aligned} Z &= \beta_0 + \beta_1 x_1 + \dots + \beta_n x_n \\ &= -7.487 - 0.019x_1 + 0.517 x_2 + 0.002x_3 + 0.213 x_4 \\ &\quad + 0.127x_5 - 0.067x_6 + 0.10x_7 + 0.006x_8 + 0.160x_9 + 1.223x_{10} \end{aligned} \quad (2)$$

Table 2. Variables in the equation

	B	SE	Wald	df	Sig.	Exp.
x_1	-.019	.014	1.806	1	.179	.981
x_2	.517	.024	452.698	1	.000	1.677
x_3	.002	.002	1.085	1	.298	1.002
x_4	.213	.019	126.062	1	.000	1.238
x_5	.127	.010	155.062	1	.000	1.136
x_6	-.067	.041	2.653	1	.103	.935
x_7	.010	.002	17.661	1	.000	1.010
x_8	.006	.002	7.616	1	.006	1.006
x_9	.160	.011	195.465	1	.000	1.173
x_{10}	1.223	.062	387.754	1	.000	3.396
Constant	-7.487	.215	1.209E3	1	.000	.001

3.4. Selection of the Best Model

The forward selection technique with Likelihood Ratio Test Criterion is used to select the best fitting model that describes the relationship between the probability of outcome variable and the set of independent variables.

The -2log-likelihood of the model, at the ninth iteration, is 20778.261 and the Log Likelihood Ratios 469.906, 188.196, 155.484, 17.150, 6.939, 355.704, 1366.662, with p -value equals to 0.00. This means that Respondent's occupation is an important determinant of using contraceptives given that highest educational level, knowledge of any contraceptives method, number of living children, wealth index, region of residence and ethnicity are already in the model.

The best model: $\pi = e^z / 1 + e^z$, where

$$\begin{aligned} Z &= \beta_0 + \beta_1 x_1 + \dots + \beta_n x_n \\ &= -7.627 + 0.513 x_2 + 0.226 x_4 + 0.126x_5 + 0.10x_7 \\ &\quad + 0.006x_8 + 0.148x_9 + 1.222x_{10} \end{aligned}$$

3.5. Determining Best Model Goodness of Fit

Therefore, using the Likelihood Ratio Test to determine the fit of the data to the best model as follows.

Hypothesis:

H_0 : there is no difference between observed and model predicted value

H_1 : there is difference between observed and model predicted value

Decision Rule: Reject H_0 if $LR > \chi_{8,0.05}$ otherwise accept

$$\begin{aligned} LR &= -2 \ln (L_0/L_1) \\ &= \frac{20778.281}{20772.818} = 1.0002629 \end{aligned}$$

$$\chi_{8,0.05} = 23.792$$

Decision: since $LR < \chi_{8,0.05}$, we therefore accept H_0 .

Conclusion: there is no difference between observed and model predicted at $\alpha = 0.05$ level of significance. This means that the model estimated does fit the data at $\alpha = 0.05$ level of significance.

3.6. Parameters Hypothesis Testing

To assess whether any of the predictors are similar, linear combinations of the parameters are tested to see if they are significantly different from zero.

Hypothesis:

$$H_0: \beta_2 = \beta_4 = \beta_5 = \beta_7 = \beta_8 = \beta_9 = \beta_{10}$$

$$H_1: \beta_2 \neq \beta_4 \neq \beta_5 \neq \beta_7 \neq \beta_8 \neq \beta_9 \neq \beta_{10}$$

Decision Rule: Reject H_0 if p-value is less than $\alpha = 0.05$ level of significance.

Decision:

Compare p-values to α at 0.05, it shows that the p-values of the parameters are less than 0.05 meaning that we reject H_0 which implies that the predictors make significant contribution to the response variables.

3.7. Model Interpretation

If the values of the variables in the model are set at zero for an individual, the probability that an individual will use contraceptives is found as follows:

$$\pi(\text{using}/0) = 1/1 + e^{-z} = 1/1 + e^{7.627} = 0.000487$$

This means that, out of every 100,000 of such people, 487 will use contraceptives.

In terms of odd, we have:

$$\text{Odd}(\pi) = e^{-7.627} = 0.000487$$

The ratio of odd of a woman in the reproductive age using contraceptives is 0.000487 per any contraceptives method when none of the factors is considered.

Next, assuming, the variables in the model are set at one, for the same individual above, the chance of using contraceptives will be:

$$\pi(\text{using}/1) = 1/1 + e^{-z} = 1/1 + e^{5.236} = 0.00529$$

It means out of 10,000 of this people, 529 of them will use contraceptives

Then the Odd is

$$\text{Odd}(\pi) = e^{-5.236} = 0.00532$$

The ratio of odd of a woman in the reproductive age using contraceptives is 0.00532 per any contraceptives method when the factors are considered.

4. Discussion of Findings

This research was carried-out to establish the influence of demographic and socio-economic factors on usage of contraceptives by women of reproductive age in Nigeria. An in-depth review of past literature, which highlights the types of contraceptives available, reasons for usage, their advantages and low level of contraceptives usage in Nigeria was observed this created research gap and this serves as one of the basis of this study. The dataset used for this study is the Women's dataset of the 2008 National Demographic and Health Survey and the chapter on analysis showcase frequency distribution of the socio-economic characteristics, bivariate cross tabulations, and chi-square p-values obtained

to determine the significance of the stated hypotheses and logistics result based on SPSS package.

The frequency distributions described the proportion of the respondents in their various socio-economic factors and it also described the mean age of respondents which is 29 years. The cross tabulations also described the categories (factors) in relation to how they influence contraceptives use and their significance was established by Chi-square p-values with alpha set at 5 per cent.

The findings revealed that 13.2% of women use any kind of contraceptives and this leaves out a very big chunk of 86.7% not yet decides for.

The test of hypotheses of independence revealed that current ages of women, highest level of education, wealth index, region of residence, ethnicity, respondent's occupation, type of place of residence, religion, knowledge of any contraceptives method and number of living children significance effect on the use of contraceptives in Nigeria.

But our logistic analysis revealed further that seven out of the ten predictors variables included in the fitted model are very important determinant of usage of contraceptives and they are highest educational level, wealth status, region of residence, ethnicity, respondent's occupation, knowledge of any contraceptives method and number of living children emerges as the most important explanatory variables. On the other hand, current age of women, place of residence and religion has no significant effects on current use of contraception.

It is quite obvious from our study that current use of contraceptives increased with increase in level of education and this was supported by [9,5]. The more a community is well read the more they are prone to use contraceptives.

Moreover, this study revealed that the use of contraceptives is greatly influence by wealth status of women. This cannot be far from the fact that poor folks may find it easier to spend their money on other things they consider essential than contraceptives. This finding is in support by other studies [2,7].

Furthermore, numbers of living children have very significant effect on the use of contraceptives. The study revealed that the more the numbers of children the more people use contraceptives. This means that contraceptive usage increased with the number of living children. This is an indication of level of awareness of population control which is the main reason for family planning. This finding is in support by other studies [1].

Our findings revealed that our best model is very reliable and has a good fit to our data and that the seven variables highest educational level, wealth status, region of residence, ethnicity, respondent's occupation, knowledge of any contraceptives method and number of living children made significant contribution to our response variable (usage of contraceptives).

In terms of odd ratios, we saw that the ratio of odd of a woman in the reproductive age using contraceptives is 0.000487 per any contraceptives method when none of the variables is considered whereas the ratio of odd of a woman

in the reproductive age using contraceptives is 0.00532 per any contraceptives method when the variables are considered.

5. Conclusions

From our study, though majority of women are yet to use contraceptives i.e. there is low usage yet the modern method of contraceptives has greater coverage. This cannot be unconnected with its availability, predictability, effectiveness and ease of use than traditional method of contraceptives.

The educational level of women and their knowledge are very distinguishing factors for them to use contraceptives and this underscore importance of education of our women and creating awareness in the respect of contraceptives use.

It is also worthy of note that religion and ages of women do not really count as much in determining whether a woman use contraceptives or not. This can only be trace to the level of education of women because when someone is enlightened he or she will be able to make decision that is beneficial regardless of any external factors.

The southern region of Nigeria has a greater population of contraceptives user than the Northern part and this may be because of the more urbanisation and educational level of the people in southern region.

5.1. Recommendations

The world is undoubtedly on seven billions population mark and this is hopefully will rise to nine billion by the middle of this century [8]. This indeed will necessitate proactive measure to manage population explosions that the world is experiencing. One of the major ways to do this is to control child birth and this is where contraceptives come handy. There are policies implication to the government to ensure that this translate to actionable points.

First, government should encourage people in northern region to embrace education even to the highest level since this form the link that make many to embrace contraceptives. As higher level of education is attained people have high tendency of usage of contraceptives to control birth.

Secondly, there should be an advocacy or agency that will bring on board various religious leaders to educate them on the importance of contraceptives and the implications to better standard of living as our study revealed that knowledge of method of contraceptives helps women to use it.

Thirdly, the government should step up awareness campaign on the advantage of contraceptives to the betterment of society to cover a wide range of areas in other to capture many who are yet to adopt contraceptives.

Finally, women at all levels should be encouraged to pursue education to the highest level possible.

5.2. Suggestions for Future Studies

This study can be explored further in following area:

Logistic regression of factors influencing men usage of contraceptives.

Statistical analysis of usage of contraceptives and sexual transmitted diseases.

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