APPLICATION OF BINARY LOGISTIC REGRESSION MODEL: DETERMINANTS OF CONTRACEPTIVE UTILIZATION

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Abstract *:* Contraceptives uptake among the youth has been a sensitive and controversial issue in the society that has resulted to various social problems that include unwanted pregnancies and sexual transmitted infections among others. This requires intervention measures that will promote contraceptive use in order to reduce unwanted pregnancies, sexual transmitted diseases and slow down the spread of sexually transmitted diseases and infection among university students. This study focuses on analysis of clinical data of contractive utilization on youth using binary logistic regression. Stratified random sampling was applied to identify 453 undergraduate students participants . The study established that based on gender, more than 45% females are likely to use contraceptives compared to men, undergraduate students who were from religions like catholic 27% are more likely, protestants 24% more likely and other Christian denomination are 52% less likely to use contraceptives unlike their Muslim counterparts who are 72% more likely to use contraceptives. Use of alcohol does not have association with use of contraceptives though 1% of students who take alcohol are less likely to use contraceptives compared to those who don't take alcohol. Sexually active are 16% more likely to use contraceptives.

Index Terms *– sexually transmitted diseases, sContraceptive ,Sexually transmitted infections, logistic regression model*

I. INTRODUCTION

Previous studies show that there are 1.8 billion young people worldwide and nearly 90 percent of these live in developing countries (Kayongo, 2013). One fourth of world population is between age 10 and 24years while a third of the total population of sub Saharan Africa is aged between 10-24 years (Tessema & Bayu, 2013). The age between 15 and 24 years is where a large number of university students lie. Some studies have shown that this is the age group that begins to actively explore their sexuality (Kayongo, 2013).

According to the population reference bureau (2013) many girls aged 15 to 19 years were pregnant or had already given birth. This was cited in Zimbabwe, Senegal, and Colombia, where more than one in five teenagers from rural areas was affected. In Zimbabwe, Senegal, Colombia, and Peru, more than one-quarter of teens in this age group from the poorest 20 percent of households had begun childbearing. In Peru, the rate of early childbearing was nearly six times greater. The Ministry of State for Planning, National Development and Vision 2030 (2010), reported that youth (15 – 35 years) accounted for 38 percent of the total population in Kenya. Youth aged 10-24 constituted about 36 percent of the total Kenyan population (Kenya National Bereave of Statistics, 2009). The age of University undergraduate students happen to fall in this group. Previous studies indicate that Complications after unsafe abortion caused 13 per cent of maternal deaths (Nduvi, 2015). Just like other students in institutions of higher learning, university students in Kenya engage in self-destructive behaviors that lead to sexual transmitted infections (STIs) or human immunodeficiency virus (HIV) and unwanted pregnancies (Kiptoo et al, 2013). To mitigate the dangers that come with unprotected sex, public clinics, hospitals and University clinics offer for free a variety of contraception methods. There is also the they can be allowed back and retain the scholarship in case of Government sponsored students. In countries like England, Scotland and Wales, such students are protected by the Equality Act (2010) which provide for legal protection for students during pregnancy and maternity. It stipulates pregnancy and maternity to be a protected characteristic and prohibits discrimination on such grounds (Equality Act 2010). Majority of sexually active youth are not using contraception. Only 5 percent, nationally, use the most effective type (Keenan, 2015). This predisposes them to a wide range of reproductive health problems, including sexually transmitted infections like HIV/AIDS, teenage pregnancy, unsafe abortion practices and school dropout among others. Utilization of contraceptives among university students in Kenya and how they could be protected from a wide range of reproductive health problems is therefore a major concern. It was against this background that the study sought to determine utilization of contraceptives among university students in Kenya.

II. REVIEW OF RELATED LITERATURE

Most of the students in the universities are between 20 and 24 years old indicating that they are emerging adults. For instance students of University of Nairobi reported that parents viewed them as independent adults who should be responsible for themselves. They therefore seemed to have more autonomy over how they lived. On the other hand students from Strathmore University seemed to be more dependent on their parents, and had more parental control over their lives (Kananu, et al;2014). The high social and economic costs of youth pregnancy and childbearing can have short- and long-term negative consequences for young parents, their children, and their community (Osulah, 2007). In Kenya, majority of university students, though adults are still under the care of parents and do not have sources of income. The students affected by pregnancy need time and good health to concentrate on their studies and adequately prepare for their exams so that they can pass well and look for employment, which is often awarded on the basis of good certificates (Ochieng, 2016). Some of the challenges pregnant university students experience as they try to balance between parenthood and studies include: interruption or termination of education, deprivation and poverty, it attempts to satisfy unmet emotional needs for intimacy, bonding and being needed. It also relates to the girl's search for identity or becoming a mother as the girl feels she has attained a certain identity and status (Sibeko, 2012). Statistics show that many young women who become pregnant while attending college and choose to parent their child will quit school and often never return (Mangel, 2010). Most times pregnant students drop out of school due to pressures they experience, including stigmatization associated with early pregnancy; isolation from friends; and lack of provision from family, friends, schools, social service agencies, and other organizations (Kost, 2015). In the case of pregnancies resulting from peer consensual sex, the education of girls is likely to suffer more than that of their male counterparts (Ochieng', 2016). By age 22, only around 50 percent of teen mothers have received a diploma and only 30percent have earned a certificate, whereas 90 percent of women who did not give birth during adolescence receive diploma (National Center for Health Statistics, 2011). Teen fathers have a 25 to 30 percent lower probability of graduating from high school than teenage boys who are not fathers (Fletcher & Wolfe, 2012). Up to 13,000 Kenyan girls drop out of school every year as a result of unintended pregnancy.

Unsafe pregnancy termination contributes to maternal mortality which currently estimated at 488 deaths per 100,000 live births (Lawrence et al; 2013). The desire to continue with one's education has led to procuring abortions among Kenyan undergraduate students. This may also be due to the adverse social effect that having a child may have on the lives of the students. This may be in the form of stigma, reputation being tainted, burdens on their relationships, and so on (Kananu et al, 2012). Children born to teenage mothers are also more likely to suffer health, social, and emotional problems than children born to older mothers. Women who become pregnant during their teens are at increased risk for medical complications, such as premature labor, and social consequences (Remedy Health Media, 2015).

III. RESEARCH METHODOLOGY

3.1 Logistic Regression Model

Binary logistic regression is used to analyze binary outcome variables. It also make use of the relationship between independent variables and dependent (or outcome) variable that is discrete. This model can be used to examine the effect of a particular exposure on the outcome variable including:

- Comparing the level of an outcome variable in two exposure groups.
- Comparing more than two exposure groups, through the use of indicator variables to estimate the effect of different levels of a categorical variable, comparing to a baseline.

Logistic regression model, models a transformation of the outcome variable rather than the outcome variable itself that is log of outcome is modeled. The general form of the model;

log odds of outcome = $\log\left(\frac{\pi}{1-\pi}\right) = \beta_0+\beta_1X_1+\beta_2X_2+\ldots.+\beta_pX_p$ [1]

Binary logistic regression is a generalized linear model. A generalized linear model is where the linear model for the exposure variables is said to be related to the outcome via a link function. The link function for logistic regression is the logit (log odds) function. The quantity on the right hand side of the equation is the linear predictor of the log odds of the outcome, given the particular value of the p exposure variables X_1 to X_P. The β's are regression coefficients associated with the p exposure variables.

The transformation of the probability, or risk, π of the outcome into the log odds is known as the logit function. $logit\ (\pi) = \log\left(\frac{\pi}{1-\pi}\right)$ thus the name logistic. Odds can take any value between 0 and infinity. The log odds are not constrained at all; they can take any value negative and positive infinity. Binary logistic model has a link function of logit, measure of exposure effect is odds ratio and the effect of the model is multiplicative. The model is fitted using the maximum likelihood approach to obtain maximum likelihood estimates. The logistic regression model can be transformed (that is, p) to the logit transformation.

Logistic regression uses the logit of the proportion as the outcome variable. The logit of a proportion p is the log odds: $logit(p)=log_e\left(\frac{p}{1-p}\right)$ [2]

The logit can take any value from minus infinity, when p=0, to plus infinity, when p=1. We can fit regression models to the logit which are very similar to the ordinary multiple regression and analysis of variance models found for data from a normal distribution. We assume that relationship is linear on the logistic scale.

$$log_e\left(\frac{p}{1-p}\right) = b_0+b_1x_1+b_2x_2+\ldots+b_mx_m \quad [3]$$

Where $x_1\ldots x_m$ are the predictor variables and p is the proportion to be predicted. The effects of the predictor variables are found as log odds ratios, unlike the ordinary linear regression equation that might predict proportions less than zero or greater than one, which would be meaningless .For a continuous predictor variable, the coefficient is the change in log odds for an increase of one unit in the predictor variable. The antilog of the coefficients, the odds ratio is the factor by which the odds must be multiplied for a unit increase in the predictor. Two units increase in the predictor increase the odds by square of odds ratio.

3.2 Multiple Logistic Regression Model

Logistic regression can be extended to multiple logistic regression having more than one independent variable. Some of the independent variables can be categorical and others continuous. Therefore with k risk variables $x_1, x_2, \ldots\ldots x_k$, then the model is:

$$\log\left(\frac{\pi}{1-\pi}\right) = \boldsymbol{\alpha} + \boldsymbol{\beta_1 x_1} + \cdots + \boldsymbol{\beta_k x_k} \quad [4]$$

If the independent variables are categorical, the data is tabulate by all levels of the co-variables. The mode then implies that in a particular cell of the table we will have the same probability say π_i and this probability may differ from cell to cell. Then π_i can be estimated by p_i which is the proportion of individual who have a particular exposure in that cell.

3.3 Model Validation

An important question is whether the logistic model describes the data well. If the logistic model is obtained from grouped data then there is no problem comparing the observed from grouped data, the groups and those predicted by the model.

There are a number of ways that the model may fail to describe the data well and these include:

1. Lack of important covariate
2. Outlying observations

3.3.1 Lack of important covariates

This can be investigated by trying all available covariates, and the possible interactions between them. Provided the absent covariate is not a confounder, then inference about the particular covariate of interest is usually affected by its absence.

3.3.2 Outlying observations

It can be difficult to check when the outcome variable is binary. However, some statistical packages do provide standardized residuals. That is, residuals by their estimated standard errors. These values can be plotted against values of independent variables to examine pattern in the data. It is also important to look for influential observations, perhaps a subgroup of subjects that if deleted from the analysis would result in a substantial change of the values of regression coefficient outcome.

3.4 Estimation of Parameters

In Estimation by maximum likelihood the data is proportion to the probability of obtaining the data. For data of know distribution form, and where the mean value is given in terms of a generalized linear model, the probability of the observed data can be written down using the appropriate probability distribution. For example, with logistic regression the probability for each group or individual can be calculated using the binomial product of these probabilities and the likelihood of the whole data is the product of these probabilities over all groups or individuals. This likelihood depends on the values of regression coefficients and the maximum likelihood estimates of these regression coefficients are those values that maximize the likelihood that is the values for which the data are most likely to occur. The method also gives the standard errors of the estimated regression coefficients and significant tests of specific hypothesis. By analogy with the analysis of variance for a continuous variable, the analysis of deviance is used in generalized linear models.

3.4 Deviance

It twice the difference between the log-likelihood of a perfectly fitting model and that of a current model and has an associated degree of freedom (DF) that is equal to the difference in the number of parameters between these two models.

The signature of an effect on a single degree of freedom may be tested by the ratio of its estimate to its standard error (SE), assessed as a standardized normal deviate. This is known as the Wald test, and its square as the Wald χ.The procedure of fitting a model using the maximum likelihood method usually involves iteration that is repeating a sequence of calculations until a stable solution is reached. Fitted weights are used and, since these depend on the parameter estimates they change from cycle to cycle of the iteration. The approximate solution using empirical weights could be the first cycle in this iterative procedure and the whole procedure is sometimes called iterative weighted least square.

IV. RESULTS AND DISCUSSIONS

4.1 Data variables

Contraceptive use: takes a binary outcome 1 as Yes to using contraceptive and 0 as No to not using contraceptive.

Gender: 1 for male and 2 for female

Religion: 1 None, 2 Catholics, 3 Protestant, 4 Muslim, 5 Christian.

Education: 1 first year, 2 second year, 3 third year, 4 fourth year

Alcohol: 1 will be No to alcohol use and 2 yes to alcohol use.

Sex: The variable sex involves undergraduate students who have engaged in sexual intercourse or not. It take for Yes to having had sexual intercourse in the past 6 months and 2 No to not had sexual in the past 6 months. Therefore, is an indicator variable which takes 1 for a Yes or 0 for No. based on responses.

4.2 Descriptive statistics

The study outcome was summarized using pie- chat as indicated below:

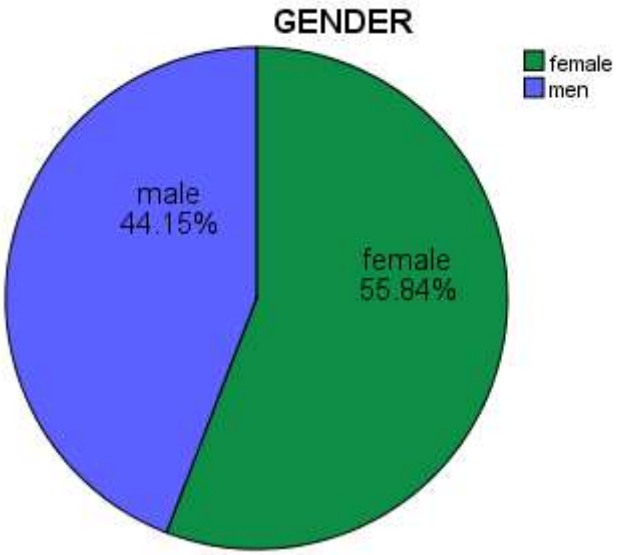

Figure 1: Distribution of Gender

The male sample was at 44.15 % while the female counterpart at 55.84%. There were more females than males in the study. Female were 253 and males were 200 .

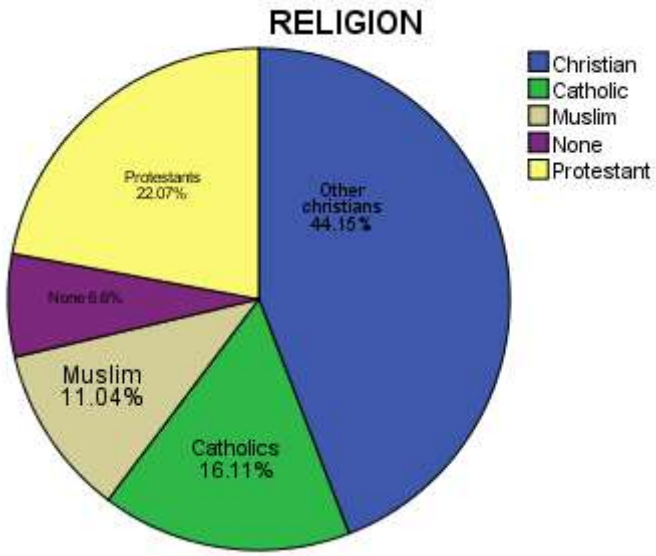

Figure 2 Representation based on Religion

Other Christians were the majority 200 students (44.15%) followed by protestants 100 (22.07%) then Catholics 73 (16.11%) followed by Muslims 50 (11.04%) and non-religion 30 (6.6%)

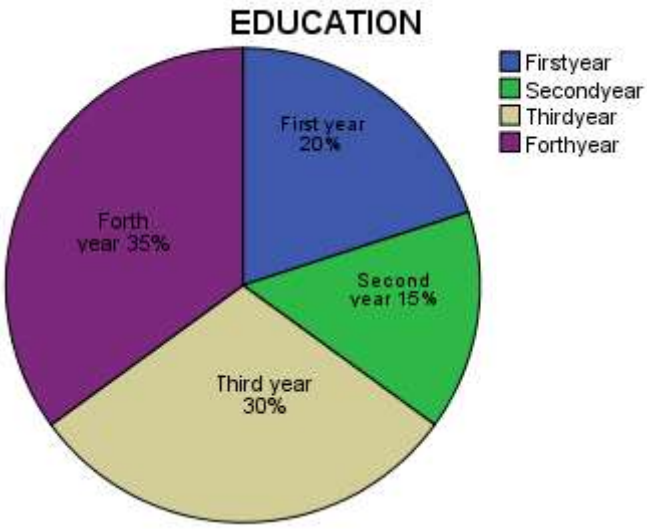

Figure 3: Representation based on year

Fourth years were the majority 70 (35%) followed by third years 60 (30%) then first years 40 (20%) and lastly second years 30 (15%).

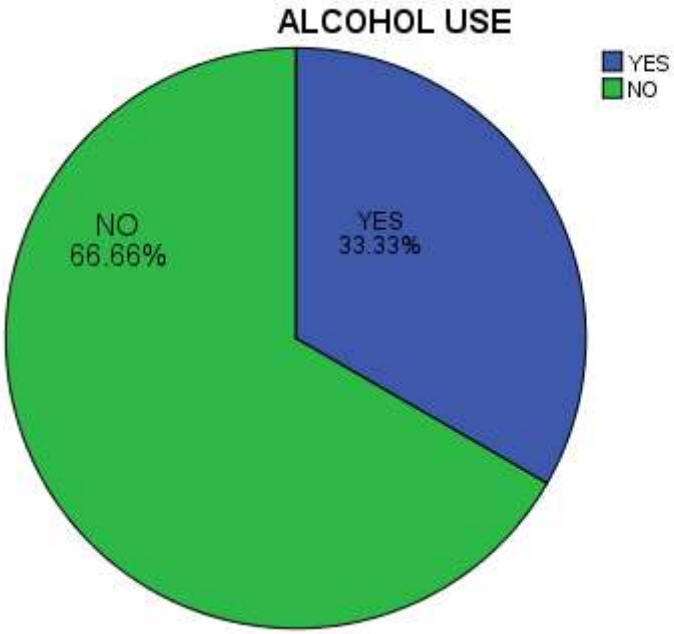

Figure 4:Alcohol Consumption

There was about 100 (66.66%) students who don't take alcohol and 50 (33.33%) who take alcohol.

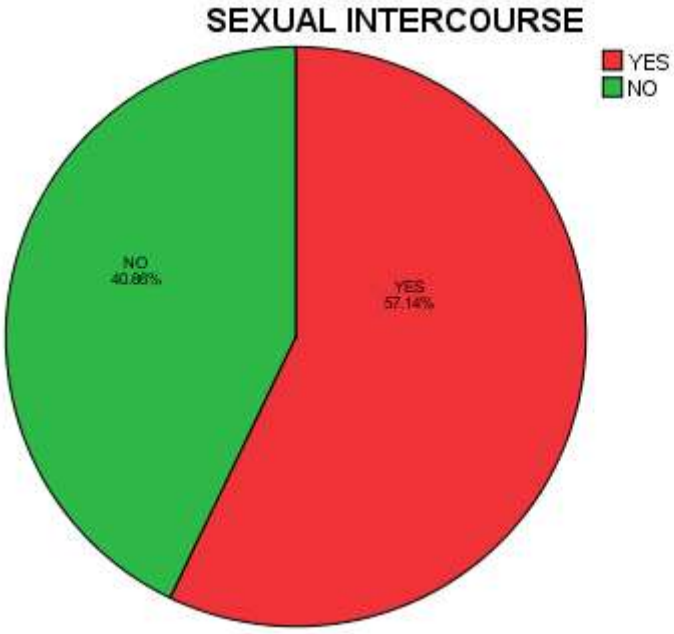

Figure 5 : Sexual activity

Majority of the students are sexually active because of the youthfulness. Consisting of 200 (57.14) who had sex in the past six months and 150 (40.86%) who had not had sex in the past six months.

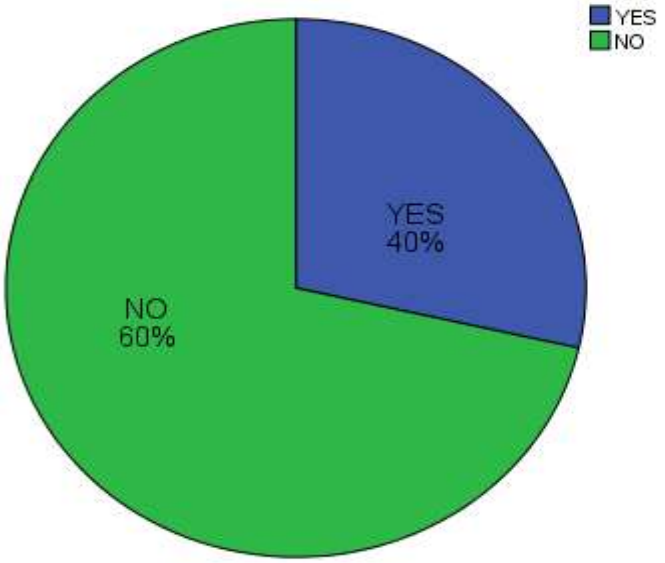

Figure 6: contraceptive utilization

Half of the students reported not to use contraceptives considering they are sexually active. There were 150 (60%) who said NO to using contraceptives and 100 (40%) said Yes to using contraceptive

V. CONCLUSION

The study showed that contraceptive use is more common among female students at 45% more than male students. The report showed female students using contraception was 89.1%, 9.3% used pill, 5.2 were using the intra uterine contraceptive device, 25.6% injectable, 57.6% used male condoms, 5.9% female condoms,11.5% used withdrawal and 5.5% used emergency contraception.Religion has major influencing on decision in Africa, Kenya, therefore the study wanted to find out if it does influence students in decision making on contraceptive use. The study shows undergraduate students who are in catholic are 27% more likely to use contraceptives compared to those who do not belong to any religion. 24% of Protestants are more likely to use contraceptive as compared to those who don't belong to any religion. 50% of Muslims are more likely to use contraceptive as compared to students who do not belong to any religion. Whereas most students who belong to other Christian denomination are, 51% less likely to use contraceptive as compared to those who belong to no religion. Muslim students are using contraceptive more irrespective of the belief of their religions that sexual intercourse and use of contraceptive is to be practiced within marriage. There is no association between contraceptive use and the different religions. Though religion was stated by 'various factors accounted for the low use of family planning services. These included partner's approval, quality of the services, friendliness of the staff administering the services and the woman's knowledge about family planning services. Other factors included the woman's income level, proximity to the provider and the religious background of the woman'.Undergraduate students who take alcohol are 1% less likely to use contraceptive as compared to those who don't take alcohol, this percentage is small therefore shows that alcohol has no much association on the undergraduate students decision to use contraceptives or not. Whether students take alcohol or not, they are not likely to use contraceptives.Sexually active students are 17% more likely to use contraceptive as compared to those who are not sexually active. A small percentage of students who are sexually active are not using contraceptive.

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