Novelty Journals

International Journal of Novel Research in Healthcare and Nursing
Vol. 2, Issue 1, pp: (10-17), Month: January - April 2015, Available at: www.noveltyjournals.com

Use of Logistic Regression Analysis to Determine Significant Factors That Affect Contraceptive Use among Teenagers in Yala and Luanda Towns, in Kenya

Omwonyo, B.O.A[1]., Kibua, T.[2], Ayugi, S[3]

[1,2]Kenyatta University, Department of Actuarial Science and Statistics, P.O. Box 43844-00100,

[3]Nairobi Technical University of Kenya

Abstract: **In Sub-Saharan Africa, Kenya is one of the countries that face an alarming population growth especially among teenagers. To stem the growth in population, contraceptive use and awareness needs to be increased. Teenagers are highly exposed to problems like insufficient contraceptive supply. The main objective of this study is to investigate the factors that determine contraceptive use among teenagers between the age of 13-18 years.**

Methodology: Data was collected through stratified sampling with the aid of questionnaires; with a number of 520 teenagers nested from five secondary schools within Yala and Luanda towns of Western Kenya. Descriptive statistics were used to highlight the level of contraceptive awareness.

Results: 62 percent of the teenagers who use contraceptives are aware about contraceptive use as opposed to 57 percent of the teenagers who are aware about contraceptive use and do not use them. The results of the logistic regression analysis revealed that age at first sexual intercourse, accessibility, partners' involvement, source of contraceptives and presently sexually active were significant determinants of contraceptive use.

Conclusion: This study indicates that teenagers should be impacted with sufficient and correct information about contraceptives and their uses. Contraceptives should also be made readily available and abordable.

1. INTRODUCTION

Adolescence or a teenager is a cultural phenomenon and has no universal definition (1). However, it is conditionally defined as a transition period of life between childhood and adulthood (2) or the period between the age of ten years to nineteen years (3). Adolescence is also defined as the time for first experience of various kinds such as being out of the direct control of parents, first sexual experiences, transition from school to work and from the role of cared for, to the caregiver (4).

In Sub-Saharan Africa, many developing economies are characterized by the rapid population growth that is partly attributed to high fertility rate, high birth rates accompanied by steady declines in death rates, low contraceptive prevalence rate and high but declining mortality rate (5). To address this, many countries in the Sub-Saharan Africa including Kenya focused their attention on birth control measures, especially the use of family planning services by developing policies and programmes like the Adolescent Reproductive Health and Development Policy (6). High numbers of school dropouts have been recorded for most of the adolescents due to unwanted and unplanned pregnancies despite existence of several options contraception methods. Documentation has it that most adolescents do not use them and engage in activities that make them susceptible to the risks of sexually transmitted infections and unwanted pregnancies.

International Journal of Novel Research in Healthcare and Nursing
Vol. 2, Issue 1, pp: (10-17), Month: January - April 2015, Available at: www.noveltyjournals.com

This is a public health concern that needs to be addressed. Addressing adolescent sexually related health issues continues to be a major challenge to governments and programs in Sub-Saharan Africa including Kenya. The inadequacies of programs to effectively meet the sexually reproductive health information and service needs of adolescents exposes them to undesired health consequences such as the risk of acquiring sexually transmitted infections (7). This has led to renewed interest in contraceptive use and awareness among adolescence (8). Therefore, there is a need to investigate the factors affecting contraceptives use among the teenagers and the level of awareness of different types of contraceptives. The outcome of this research is to sensitize and strengthen mechanisms used by Ministry of Health and Sexual Reproductive Health program providers to enhance appropriate knowledge about contraceptive use and choice amongst teenagers and even adults. This aids in addressing issues of reducing or preventing the uncertainties faced by teenagers.

1.1 Study Objectives:

The main goal of this study was to determine factors affecting contraceptive use and level of contraceptive awareness among teenagers using logistic regression analysis.

Specifically, the study sought:

i. To summarize the descriptive statistics on factors that affect contraceptive use amongst teenagers between the ages of 13-18 years.

ii. To fit a logistic regression model to the data sampled from Luanda and Yala towns and to use it to determine important factors that affect the level of contraceptive use.

iii. Make some inferences on contraceptive use and level of awareness and recommend some policy adjustment in the relevant areas.

2. METHODOLOGY

To be able to collect data, a cross sectional study design was proposed to obtain data from various schools in the two regions. The target population for the study involved teenagers between 13-18 years from five secondary schools selected randomly to participate in the study. Data was collected with the aid of questionnaires. The sampling technique used for this study was Stratified random sampling since the population of study is heterogeneous. The target population was divided into two strata (Yala and Luanda) proportionately to ensure that each stratum selected had a proportional number of teenagers. Simple random sampling was used to select the sample size for each stratum. This gave each participant an equal chance to participate in the study. Therefore 520 teenagers were selected to participate in the study. Descriptive statistics in the form of tables of percentages are to be used. A logistic regression model is fitted to the data and consequently used to determine the important factors affecting contraceptive use among the teenagers. The independent variables were age at first sexual intercourse, accessibility, partners' involvement, source of contraceptives, level of awareness and knowledge among many others. Participation of the teenagers was voluntary and consent was obtained from them. Sample size were obtained by proportional allocation where n_h was the sample size for each stratum such that

$$n = \sum_{h=1}^{L} n_h$$

Therefore the binary regression model is

$$\log\left(\frac{\pi_i}{1-\pi_i}\right) = \sum_{p=1}^{P} x_{ip}\beta_p + \varepsilon_i \qquad \text{for i=1, 2,…, N} \qquad (2.1)$$

Where

$\beta_1, \beta_2, ..., \beta_p$ are the regression slope coefficients

$x_{i1}, x_{i2}, ..., x_{ip}$ are the corresponding values of the *X*-variables

International Journal of Novel Research in Healthcare and Nursing
Vol. 2, Issue 1, pp: (10-17), Month: January - April 2015, Available at: www.noveltyjournals.com

ε_i is the random error term.

2.1 Parameter Estimation and Model Prediction:

To find the estimates β of the logistic regression model, the frequently used method is the maximum likelihood estimation method. Since the likelihood equations of the model are not in analytical form, we therefore use Newton-Raphson method to find the estimates. The logistic regression model can also be written as

$$\log\left(\frac{\pi_i}{1-\pi_i}\right) = \underset{\sim}{x}^T \underset{\sim}{\hat{\beta}} \text{ for i= 1, 2,…, N} \quad (2.2)$$

The log likelihood function is $\ell(\hat{\beta}) = y^T X \underset{\sim}{\hat{\beta}} - m^T \log\left[1+\exp\left(X \underset{\sim}{\hat{\beta}}\right)\right]$ (2.3)

where $X = \begin{bmatrix} x_1^T \\ \vdots \\ x_n^T \end{bmatrix}$, $\underset{\sim}{m} = \begin{bmatrix} m_1 \\ \vdots \\ m_n \end{bmatrix}$, $\underset{\sim}{\pi} = \begin{bmatrix} \pi_1 \\ \vdots \\ \pi_n \end{bmatrix}$ and $\underset{\sim}{y} = \begin{bmatrix} y_1 \\ \vdots \\ y_n \end{bmatrix}$

To find the estimates, we calculate the first and the second derivatives of the likelihood function.

Therefore, $\dot{l}(\hat{\beta}) = X^T\left[\underset{\sim}{y} - m o \underset{\sim}{\pi}\left(\underset{\sim}{\hat{\beta}}\right)\right] = X^T\left[\underset{\sim}{y} - \underset{\sim}{\mu}\left(\underset{\sim}{\hat{\beta}}\right)\right]$ (2.4)

where o denotes Hadamard or element-wise product.

The second derivative is $\ddot{l}(\beta) = -\sum_{i=1}^{n}\left\{x_{ij}x_{ik}v_i\left(\underset{\sim}{\hat{\beta}}\right)\right\} = -X^T v\left(\underset{\sim}{\hat{\beta}}\right)X$ (2.5)

that is, the j^{th} row and the k^{th} column element of $X^T v\left(\underset{\sim}{\hat{\beta}}\right)X$ is $\sum_{i=1}^{n} x_{ij}x_{ik}v_i\left(\underset{\sim}{\hat{\beta}}\right)$

where $v\left(\underset{\sim}{\hat{\beta}}\right)$ is a diagonal matrix.

The Newton-Raphson method iterates via

$$\underset{\sim i+1}{\hat{\beta}} = \underset{\sim i}{\hat{\beta}} + \left(X^T v\left(\underset{\sim}{\hat{\beta}}\right)X\right)^{-1} X^T\left(\underset{\sim}{y} - \underset{\sim}{\mu}\left(\underset{\sim}{\hat{\beta}}\right)\right) \text{ for i=1,2,…,N} \quad (2.6)$$

until convergence (hopefully) to the MLE $\underset{\sim}{\hat{\beta}}$.

We substitute parameters in model equation (2.6) above to obtain a fitted model below

$$\log\left(\frac{\pi_i}{1-\pi_i}\right) = \sum_{p=1}^{P} x_{ip}\beta_p \quad (2.7)$$

Where again from model (2.7) we can compute the probability of success e.g. the probability of a teenager who has accessibility to contraceptives ends up using them. This is given by $\hat{\pi}_i = \frac{e^{\sum_{k=0}^{P} \beta_k x_{ik}}}{1 + e^{\sum_{k=0}^{P} \beta_k x_{ik}}}$

Therefore, we can compute $\log\left(\frac{\pi_i}{1-\pi_i}\right) = \sum_{p=1}^{P} x_{ip} \hat{\beta}_p$ for i = 1, 2,…, N then consequently the probability of success. Hence we can use this for model prediction, a process by which a model is created or chosen to try to best predict the probability of an outcome (9).

3. RESULTS AND DISCUSSIONS

From the population interviewed, as shown in Table 1, 87% were using contraceptives while 13% were not using contraceptives. Among the teenagers who were using contraceptives, 84% resided in Yala town while 88% in Luanda town. The highest percentage of contraceptive use is observed among the female teenagers (87%) and lowest percentage of contraceptive usage is observed among the male teenagers (86%). Therefore, 14% of male and 13% of female teenagers do not use contraceptives respectively. Contraceptive usage among teenagers is highest for Christians (86%) while the lowest contraceptive usage (14%) is observed among the Muslim teenagers. The highest percentage of contraceptive usage is observed at 18 years (41%) and lowest percentage of contraceptive usage is observed at 21 years (1%). 89% of the teenagers received knowledge from the Chemist, 47% from Friends, 29% from the Media and 77% from their Parents. The major (35%) source of contraceptives is friends while the least (1%) is parents. Results also show that, 66% of the teenagers have contraceptives at their disposal while 34% do not. 68% of the teenagers have accessibility to contraceptives while 32% do not. The well known contraceptive is the condom (89%) while the diaphragm (2%) is the least known contraceptive. For teenagers who use contraceptives, 62% of teenagers have a good level of contraceptive awareness while 12% a very poor level of awareness.

Table 1: Results from Descriptive Analysis

A. General Contraceptive use Among Teenagers	**Category**	**Results in percentage (%)**	
	Yes	**87**	
	No	**13**	
B. Socio-Demographic Factors	**Category**	**Contraceptive Use (%)**	
		Yes	**No**
Town	**Yala**	**84**	**16**
	Luanda	**88**	**12**
Gender	**Female**	**87**	**13**
	Male	**86**	**14**
Religion	**Christian**	**81**	**19**
	Muslim	**79**	**21**
C. Age of a Teenager	**Category(yrs)**	**Contraceptive use (%)**	
	13	**6**	
	14	**10**	
	15	**9**	
	16	**8**	
	17	**15**	
	18	**41**	
	19	**7**	

	20	2		
	21	1		
D. Age At First Sexual Intercourse	Category(yrs)	Contraceptive use (%)		
	11	1		
	12	4		
	13	18		
	14	24		
	15	16		
	16	24		
	17	11		
	18	2		
E. Source of Contraceptives	Category	(%)		
	Friends	35		
	Parents	1		
	Hospital	11		
	Chemist	22		
	Shop	31		
F. Contraceptives Accessibility	Category			
	Yes (%)	No (%)		
	68	32		
G. Contraceptives Availability	Category			
	Yes (%)	No (%)		
	66	34		
H. Source Of Knowledge	Category	Did Receive and Using Contraceptive (%)		Didn't Receive and Using Contraceptive (%)
	Parents	77		23
	Chemist	89		11
	Friends	47		53
	Media	29		71
I. Knowledge of Contraception Method	Category	Yes (%)		No (%)
	Injection	4		96
	Condoms	89		11
	Pills	21		79
	Diaphragm	2		98
J. Level of Contraceptive Awareness	Category	General Level of Awareness (%)	Aware and Using Contraceptives (%)	Not Aware and Using Contraceptives (%)
	Excellent	7	9	12
	Very Good	10	9	9
	Good	62	62	57
	Poor	12	12	16
	Very Poor	9	8	9

International Journal of Novel Research in Healthcare and Nursing
Vol. 2, Issue 1, pp: (10-17), Month: January - April 2015, Available at: www.noveltyjournals.com

3.1 Determinants of Contraceptive Use: Results of Logistic Regression Analysis:

From the results in Table 2 which is believed to be the best fit model, it was revealed that teenagers who have accessibility to contraceptives were 3.8898 times more likely to use contraceptives compared to teenagers who did not have accessibility to contraceptives. Teenagers' age at first sexual intercourse is 1.3019 times more likely to influence use of contraceptive methods. Teenagers that are presently sexually active are 95.91% times less likely to use contraceptives than those who are not. Teenagers whose partners are involved in decision making about contraceptive use are 51.45% times less likely to use contraceptives compared to those whose partners are not. Teenagers who have source of contraceptives are less likely to use them by 8.44%.

Table 2: Maximum likelihood estimates for logistic regression of predicting contraceptive use among teenagers in Yala and Luanda towns

Coefficients	Estimate ($\hat{\beta}_i$)	Std. Error	z value	p-value	Odds Ratio
(Intercept)	0.43045	1.17864	0.365	0.714957	
AG1SEX	0.26379	0.08499	3.104	0.001911 **	1.3019
CONTACES	1.35836	0.37112	3.660	0.000252 ***	3.8898
FAPART	-0.72264	0.30216	-2.392	0.016775 *	0.4855
PSEX	-3.19629	1.27629	- 2.504	0.012267 *	0.0409
SOURECON	-0.08813	0.03108	-2.836	0.004571 **	0.9156

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

3.2 Goodness of Fit and Model Diagnostics for Logistic Regression Model:

Deviance test is a statistic used to determine the worth of a model. The lower deviance value the better the model. From the Table 3, when the model is empty, deviance value = 641.93. As we add and remove insignificant variables, the value varies depending on effect of the variables on the model. Therefore, the best model has a deviance value of 300.37. For model adequacy, the model is checked for possible presence and treatment of outliers and influential values. From Table 4, there are no large values of Cook's distance (Di<1) which means that there are no influential cases having an effect on the model. Therefore this is the best fitted model.

Table 3: Analysis of Deviance Table

Df	Deviance	Resid. Df	Resid. Dev	Pr(>Chi)
NULL		519	641.93	
AG1SEX	1 260.358	518	381.57	< 2.2e-16 ***
CONTACES	1 12.495	517	369.08	0.0004081 ***
SOURECON	1 49.799	516	319.28	1.703e-12 ***
FAPART	1 4.941	515	314.34	0.0262245 *
PSEX	1 13.972	514	300.37	0.0001855 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1f 300.37.

International Journal of Novel Research in Healthcare and Nursing
Vol. 2, Issue 1, pp: (10-17), Month: January - April 2015, Available at: www.noveltyjournals.com

Table 4: Influencial Plot

Stud	Res	Hat	CookD
19	-2.2299284	0.153622952	0.46240494
204	0.8406391	0.250182645	0.15980223
324	-0.2264276	0.198935980	0.03449964
352	-2.4115576	0.004350676	0.11039686
497	-2.4859579	0.005218799	0.13212525

4. CONCLUSION AND RECOMMENDATIONS

From model (2.6) above different predictions were obtained as discussed. It was noted that teenagers who were presently sexually active between 11-14 years, had access to contraceptives and whose partners got involved in decision making in relation to contraceptive use had a 68% possibility of using contraceptives while the likelihood for the teenagers who were sexually active between 15-18 years was 90%.

For teenagers less than 14 years who have no access to contraceptives, are sexually active and have their partners drawn in decision making, have a 39% likelihood of using contraceptives which is very alarming while those at an older age have 76% likelihood of using contraceptives. Teenagers who are not sexually active, have access to contraceptives and have got their partners involved in decision making have a 99% likelihood of using contraceptives regardless of their age. For teenagers below 14 years won are sexually active, have access to contraceptives and whose partners are not involved in decision making have a likelihood of 0.3% to use contraceptives which is very alarming while the teenagers above 14 years have a likelihood of 88% of using contraceptives.

The likelihood of teenagers below 14 years accessing contraceptives from a friend, a hospital, a parent and a shop is 41%, 37%, 34%, and 30% respectively which is very low compared to the teenagers above 14 years as who have a likehood of 67%, 66%, 42% and 85% respectively. As for the chemist, the likehood of teenagers accesing contraceptives was 68% despite their age.

The results in this study indicate that most teenagers are sexually active yet contraceptive use is low which makes teenagers susceptible to the risks of teenage pregnancies and sexually transmitted infections. Therefore, contraceptives should be made easily accessible to the sexually active teenagers through policy intervention by the Ministry of Health. Reproductive health education should be introduced at an early stage of teenagehood to provide them with suffucient and correct information about contraceptions. Contraceptive use awareness should be increased through the Ministry of Social Programmes and the media. Counselling on the importance of contraceptive use should be done on a routine basis to the teenagers. Motivational programs should also be implemented to eradicate the stigma faced by teenagers concerning contraceptive use and accecibility. As for contraceptive source, they should be readily available. The County government should ensure that the cost of contraceptives is reduced to make them affordable and be readily available especially in public and social places at the teenagers' conveniene.

In conclusion, this study indicates that teenagers should be impacted with sufficient and correct information about contraceptives to increase the level of contraceptive awareness, contraceptives should also be made readily available and abordable for the teenagers use.

ACKNOWLEDGEMENT

I would like to acknowledge my supervisors Dr. Kibua and Dr. Ayugi for their valuable guidance with critical, fruitful and insightful comments, suggestions and support at various stages of work, despite his other valuable commitments. I wish to thank Noel Onyango from University of Nairobi, School of Medicine and Dr. Ananda for their cooperation, help and assistance during my research.

REFERENCES

[1] Black, C., & DeBlassie, R. R. (1985). Adolescent pregnancy: contributing factors, consequences, treatment, and plausible solutions. Adolescence, 20(78), 281–290. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/4050569

[2] Raphael, S. (2006). Early Incarceration Spells and the Transition to Adulthood. Conference on the Economics of the Transition to Adulthood.

[3] Burnett, S., Bird, G., Moll, J., Frith, C., & Blakemore, S.-J. (2009). Development during adolescence of the neural processing of social emotion. Journal of cognitive neuroscience, 21(9), 1736–1750.

[4] Schulz, K. M., Molenda-Figueira, H. A., & Sisk, C. L. (2009). Back to the future: The organizational-activational hypothesis adapted to puberty and adolescence. Hormones and Behavior, 55(5), 597–604.

[5] Kirk, D., & Pillet, B. (1998). Fertility levels, trends, and differentials in sub-Saharan Africa in the 1980s and 1990s. Studies in family planning, 29(1), 1–22.

[6] Janisch, C. P., Albrecht, M., Wolfschuetz, A., Kundu, F., & Klein, S. (2010). Vouchers for health: A demand side output-based aid approach to reproductive health services in Kenya. Global public health, 5(6), 578–594. doi:10.1080/17441690903436573

[7] Obare, F., Birungi, H., & Kavuma, L. (2011). Barriers to Sexual and Reproductive Health Programming for Adolescents Living with HIV in Uganda. Population Research and Policy Review, 30(1), 151–163. doi:10.1007/s11113-010-9182-1

[8] Varnhagen, C. K., Svenson, L. W., Godin, A. M., Johnson, L., & Salmon, T. (1991). Sexually transmitted diseases and condoms: high school students' knowledge, attitudes and behaviours. Canadian Journal Of Public Health Revue Canadienne De Sante Publique,

[9] Aroian, L., Brillinger, D., & Krishnaiah, P., (2013). Handbook of Statistics.