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Modeling Age at first pregnancy among teenage Women in Nigeria: A Survival Analysis Approach

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Abstract

Cox PH model has been the most popular model known in literature for survival time data when the baseline hazard function is unspecified. Discrete time model is used when only the interval in which the event of failure occurs is known or the event itself occurs in discrete time scale. In addition to the observed factors collected on individuals, there often exist unobservable covariates in the data at cluster level which if not accounted for during analysis, may lead to loss of information and biased estimates. This paper uses Cox model and discrete-time logit model to investigate the effect of some covariates (risk factors) on the hazard of age at first pregnancy for teenagers. The analysis explicitly account for the unobserved heterogeneity (frailty) at the level of ethnicity which was included as a random effect in the models. Comparison was made between the models with and without random effects to know which one performs best. Teenage pregnancies were viewed within the broader socio-economic and socio-cultural environment in which the adolescents operate. The results of the analysis reveals that the teenage pregnancy depend on geopolitical zone, location of residence, level of educational attainment, marital status, religion, circumcision, sex in exchange of gift, the age of first sexual initiation, HIV/AIDS status and the use of contraceptives.

Keywords: Cox proportional hazard model; Discrete-time logit model; unobserved heterogeneity; Teenage pregnancy; Akaike Information Criterion.

1. Introduction

Teenage pregnancy is an unintended pregnancy during adolescence (aged 10-19 years). This has been a public health concern both in developed and developing countries (Sayem and Nury, 2011). The rates of adolescent pregnancy have been on the increase, particularly in the poorest countries (World Health Organization, 2008), and this has posed a great threat and danger to child development. According to the American College of Obstetricians and Gynecologist, Approximately 750,000 of 15-19-year-olds becomes pregnant each year (Langham, 2010). UNICEF (2001) reports that more than 10% of all births worldwide occur to adolescent mothers.

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It is believed that pregnancy can take place as soon as a female gets to the age of puberty, with menarche (first menstrual period) normally taking place around age 12 or 13 (Onyiriuka, et al., 2012). Sixty percent (60%) of girls have their first sexual intercourse before their 13th birthday (Guttmacher Institute, 2004 and Maliki, 2012). Studies have shown that substantial numbers of teenagers have a positive or ambivalent attitude towards pregnancy (Jaccard et al., 2003, Condon et al., 2001, Stevens-Simon et al., 1996). Teenage pregnancies and births during adolescence are considered risky and the teenage birth rate is deemed an indicator of reproductive health politics (Kirchengas, 2009). However, teenage pregnancy and its attendant problems are more prevalent in developing countries than in the developed nations. More than one third of women from developing countries gave birth before the age of 20 (Hanna, 2001; Furstenberg, 1998; Singh and Darroch (2000). Adolescents who have completed at least 7 years of schooling (in developing countries) are more likely to delay marriage until after the age of 18 years (Salako et al., 2006), and this possibly increases the length of time that they are exposed to the risk of adolescent pregnancy.

Although sexual activities among the adolescents are widespread around the world, the determinants and consequences are likely to vary from one region to another. Early pregnancies are more pronounced and detrimental in Sub-Saharan African (SSA) countries, most of which experience high levels of poverty (Maureen Were, 2007). Nigeria has been one of the countries where the prevalence of teenage pregnancy is high. Studies have documented results on this from various part of the country. For example, in recent studies, Maliki (2012) carried out a study on the effect of teenage pregnancy on adolescents in Amassoma community of Southern Ijaw Local Government Area of Bayelsa State in Nigeria using simple percentages. Aderibigbe et al. (2011) carried out a descriptive cross sectional study of teenage pregnancy and prevalence of abortion among In-school Adolescents in North Central Nigeria.

Often, demographic survey data involve hierarchically structured geographical information grouped into identified clusters such as states, geographic regions, ethnic groups or census blocks (Abiodun et al., 2014a). In such a setting, subjects residing within the same cluster are often exposed to similar unobserved heterogeneity which needs to be accounted for during analysis. One way of accounting for such unobserved heterogeneity is to include it in the model as cluster specific random effect.

Most of time-to-event data collected in demographic studies are usually modeled using Cox proportional hazard function (Baschieri and Hinde 2007, Abiodun et al., 2014b) on the basis of assumption that time is measured on a continuous scale. However, most of the information collected from women in demographic surveys are often given in retrospect and therefore cannot be adequately recorded on continuous scale.

In this study therefore, discrete–time and Cox Proportional Hazard models were comparatively used to examine the socioeconomic and demographic factors influencing age at teenage pregnancy among Nigerian teenagers, and also the extent of heterogeneity in adolescent pregnancy rates within and across ethnicity.

The models were extended to include random effects, also known as frailty, in order to account for unobserved heterogeneity due to various ethnic groups in Nigeria. For the study, females in their teen age group (between 13 to 19 years) were taken as 'teenagers'. Consequently, the terms 'adolescent' and 'teenagers' are used interchangeably to refer to females aged 13-19 years.

Section 2 of the paper describes the data and methodology used in analyzing the data are presented, in Section 3, analyses of data using Cox proportional hazard model and discrete-time logit model, both with and without random effects, are carried out and the results presented. Finally, discussion and conclusion of the results are presented in section 4.

2. Materials and Methods

2.1. Data

The data used for this study were extracted from the 2005 and 2007 National HIV/AIDS and Reproductive Health (NARHS) Survey. NARHS is a nationally representative household survey of females (aged 15–49 years) and males (aged 15–64 years). The primary objective of NARHS is to provide reproductive and sexual health information with the factors that influence it. It also provides current and reliable data on the impact of HIV/AIDS and reproductive health behaviors in Nigeria. From the main data of the survey for year 2005 and 2007, a database for all female respondents aged 15–49 years were created and complete information were extracted on teenage pregnancy (respondents who got pregnant for the first time between age 13-19years). Age at first pregnancy between age 13 and 19 years inclusive was considered as the survival time in this study. Female respondents who had never been pregnant as at the time of the survey were right censored. There were 10081 and 11521 respondents for year 2005 and 2007 respectively. Of this figure, information required for this study were available for only 3428 females aged 15-49 years and analyses were based on these respondents.

2.2. The Cox Proportional Hazard Model

Cox Proportional Hazards model (Cox, 1972) is often used for continuous survival time data to investigate covariate effects on hazard function. It is a semi parametric model for continuous-time data and is typically employed when the “exact” timing of an event is known (e.g. numbers of days on admission before death). It is the most flexible continuous-time model, and therefore the most frequently applied. It estimates the relationship between the hazard rate and explanatory variables without making any assumptions about the shape of the baseline hazard function. For an individual i with covariate vector x_i, the Cox (1972) proportional hazards model for examining the relationship of hazard function with sets of covariates is then given as

$$\mathrm{h}(t/x_i) = h_o(t)e^{x'\beta}, \qquad (1)$$

where $x = (x_1, x_2, x_3 \ldots x_p)$ is a p-vector of explanatory variables, $h_o(t)$ is the baseline hazard function (unspecified) and exp ($x'\beta$) is the relative risk associated with covariate value x.

Very often, survival data are grouped into clusters and it is necessary to capture variation in the hazard rate due to such clusters or groups. For the data under study individual respondents belongs to various ethnic groups and thus have been grouped into 23 identified ethnic groups. One common way to account for this is to include in the model a random effect, also known as frailty (Blossfeld and Rohwer 2002). In Cox model, frailty is usually incorporated by including a gamma distributed random effect in multiplicative way on the hazard, and is given by

$$h_o(t/x_i) = h_o(t)e^{x'\beta}u_g, \qquad (2)$$

where u_g is the frailty (random effect) for ethnic group $g, g = 1,2,.,.,.23$.

2.3. Discrete-Time Survival Analysis

Discrete-time models are generally used in econometric survival analysis when only the interval in which an event occurs is known or the event itself occurs in discrete intervals (e.g. the year in which a respondent get married, the month of death of a child). Even though events under study theoretically occur at any point in time, durations in years may be measured in discrete time units. One interesting feature of discrete time model is that it allows for non-proportional hazards and time-varying covariates. To record event occurrence in discrete intervals, continuous time is divided into an infinite sequence of adjoining time periods. Let T represent the discrete random variable that indicates the time period t when the event of failure occurs for a randomly selected individual from the population. The event occurrence is inherently conditional since an individual can experience the target event only once $[0, a_1), [a_1, a_2), [a_2, a_3), [a_3, a_4), \dots, [a_{t-1}, a_t), [a_t, a_\infty)$. By characterizing T into its conditional probability density function, the discrete hazard function which is the conditional probability that an event will occur in time period t given that it has not already occurred in a previous time period is given by

$$h(t) = Pr(T = t \mid T \geq t) \quad (3)$$

and the discrete survival function which is the probability of not experiencing the event of failure through time t is given by

$$S(t) = Pr(T > t) = \prod \left(1 - h(t)\right) \quad (4)$$

2.4. Model Consideration for Discrete-Time Model

Analysis of discrete survival time, unlike the continuous survival time requires some restructuring of the data due to the nature of censoring. The data file is restructured into a person-period format by expansion. The restructured dataset is often called a person-period file. Assume that the data are collected on n individuals and survival information on each of them is recorded as (t_i, δ_i), $i = 1,2,3 \dots$ n. From the data observed (the event time t_i and the censoring indicator δ_i), for each time interval t up to t_i, a binary response y_{it} is created where t_i is the number of interval for which individual i is observed, and all individuals regardless of whether or not their duration is censored will have $y_{it} = 0$ for interval $t = t_i$

$$y_{it} = \begin{cases} 0 & t < t_i \\ 1 & t = t_i,\ \delta_i = 1 \\ 0 & t = t_i, \delta_i = 0 \end{cases}$$

Therefore, after restructuring the data into person-period format, the failure process of individual i can then be considered as a sequence of binary response outcomes which follow a binomial distribution

$$y_{it} = \begin{cases} 1 \text{ if } t = t_i \text{ and } \delta_i = 1 \\ 0 \text{ otherwise} \end{cases}$$

where δ_i is the censoring indicator which takes value 1 if individual i has failure event at time t and value 0 if individual i is censored.

Discrete-time logit model for modeling hazard functions with discrete outcome is commonly used. It utilizes a series of binary regression models at each time point (Allison, 1982; Arjas and Haar, 1987). The baseline hazard and a shift parameter that captures the effects of the predictor variable on the baseline hazard function are the two attributes of a discrete-time model. An extension of the proportional hazards model to discrete time by working with the conditional odds of failure at each time t_j given survival up to that point proposed by Cox (1972) is given by

$$\frac{h(t/x_i)}{1-h(t/x_i)} = \frac{h_0(t)}{1-h_0(t)} exp\{x_i'\beta\} \quad (5)$$

$$= \alpha_t + exp\{x_i'\beta\} \quad (6)$$

where $h(t/x_i)$ is the hazard at time t for an individual with covariate values x_i, $h_0(t)$ is the baseline hazard at time t and $exp\{x_i'\beta\}$ is the relative risk associated with covariate values x_i.

Taking logistic transformation of both sides of the equation, a model on the logit of the hazard or conditional probability of event of failure occurring at t given survival up to that time is obtained as follows:

$$\text{Logit } h(t/x_i) = \alpha_t + x_i'\beta \quad (7)$$

where $\alpha_t = logit\ h_0(t)$ is the baseline logit- hazard and

$x_i'\beta$ is the effect of the covariates on the logit of the hazard.

Model (7) essentially treats time as a discrete factor by introducing one parameter α_t for each possible time t and is commonly known as the proportional odds model because, as in the proportional hazards model, the effects of covariates are assumed constant across the observation period.

In an attempt to capture variation in the hazard rate due to clustering across individuals in the population the discrete time logit model can be extended to account for unobserved heterogeneity

(Lewis and Raftery, 1999, Manda and Meyer, 2005). In a discrete-time model, frailty can also be incorporated by including a normally distributed random effect in the linear predictor which gives an extension of the logit model of (7) that allows for unobserved heterogeneity and is given by

$$logit\ h(t_j/x_i) = \alpha_i + x_i'\beta + u_g \tag{8}$$

where u_g is a random effect due to cluster $g = 1,2,.,.,.,.23$ which is normally distributed with zero mean and variance σ_u^2. Failure to account for unobserved heterogeneity might lead to biased estimate in the standard logit model.

3. Data Analysis and Results

From the 2005 and 2007 National HIV/AIDS and Reproductive Health Surveys (NARHS), information on whether or not, the respondent has ever been pregnant was collected and age at first pregnancy was recorded in years. The response (dependent) variable for this study is age at first pregnancy of the respondent at teen age (13-19) years and those who have never been pregnant within this age were considered right censored at their current age. Apart from age at first pregnancy which is the response variable, information on covariates (categorical, continuous and frailty) which were thought to be associated with teenage pregnancy were included in data analysis. These include: Year of study - 2005,2007; Geopolitical Zones-South-East, South-West, South-South, North-West, North-Central, North-West (reference category); Level of educational attainment-koranic, primary, secondary and higher (reference category); Current age of respondents (in years) which are grouped as: (15-19)years (reference category), (20-24)years, (25-29)years, (30-39)years and (40-49)years; Marital status - currently married, never married, widowed and divorced (reference category); Location - rural (reference category), urban; Religion - Islam, Christianity, others and no religion (reference category); whether the respondent has formal education or not- ”yes” or “no”; whether the respondent is circumcised or not - ”yes” or “no”; Did the respondent attend religious service or not-”yes” or “no”;how important is the religion to the respondent-important and not important(reference category),whether the respondent had sex in exchange of gift- ”yes” or “no”;ever heard of HIV or not- ”yes” or “no”;whether the respondent have been tested for HIV/AIDS or not- ”yes” or “no”;whether the respondent is using contraceptive or not- ”yes” or “no” and Age at first sexual initiation(in years) as the continuous covariate while Ethnicity is Frailty (Random effect) covariate.

Models (1) and (2), without and with frailty under Cox model framework and Models (7) and (8), without and with frailty under discrete time model framework were then applied to the data. Models (1) and (7) included all the listed covariates above as fixed effects while ethnicity was included in Model (2) and (8) as random effect (frailty). All analyses were carried out using STATA (version 10.0).

3.1. Descriptive Analysis

The distribution of respondents were obtained as follows: In 2005; 1669(48.69%) respondents experienced teenage pregnancy and 1759(51.31%) experienced it in 2007. By geopolitical zone, of all teenage pregnancy, 1162(33.92%), 704(20.55%), 666(19.44%), 295(8.61%), 200(5.84%) and 399(11.65%) were from North-West, North-East, North-Central, South-West, South-East, South-South respectively. With respect to locality, 900(26.25%) were living in urban area while 2528(73.75%) were living in rural area. 1970(42.53%) had some form of formal education while 1458(57.47%) had no formal education. By their level of educational attainment, 87(4.41%) had higher education while 653(33.13%), 784(39.78%), 447(22.68%) had secondary, primary and koranic education respectively. There were 655(19.11%), 713(20.80%), 611(17.82%), 881(25.70%) and 568(16.57%) in the age groups 15-19, 20-24, 25-29, 30-39 and 40-49years respectively. 664(19.37%) were circumcised while the remaining 2764(80.63%) were not. 580(16.92%) were using contraceptive while 2848(83.08%) were not. With respect to their marital status, 2892(84.36%), 393(11.46%), 58(1.69%) and 85(2.48%) were currently married, never married, divorced and widowed respectively. 2222(64.82%) practiced Islam, 1189 (34.68%) were Christians while 13(0.38%) practiced other religions and 4(0.12%) had no religion.

3.2. Results of Cox proportional Hazard and Discrete-time Analyses

The results for models (1), (2), (7) and (8) are presented in the Table 1. The estimated hazard ratio (HR) for Cox proportional hazard model and estimated odds ratio (OR) for Discrete-time model respectively and the p-values to justify whether or not each predictor variable in the model is significant are presented. The contribution of each factor in the model is determined by its hazard ratio for Cox model and odds ratio for Discrete-time model. Both measures the increase (+) or decrease (-) in the hazard/odds of teenage pregnancy due to the influence of the respective risk factor.

The results in Table 1 show the effects of some of risk factors on teenage pregnancy. The relative performances of the models are shown in Table 2. Based on the AIC and Log-likelihood criteria the Discrete time model with or without random effects is preferred since they have smaller values than Cox models). Hence the results of the discrete model are therefore used for discussion. It is also observed that discrete time model without random effects (AIC=23663.32) are better than the corresponding models with random effects (AIC=23703.02). Further, As observed, the measure of random effect (frailty) are, Sigma_u =0.0007 (Discrete time model) and Theta=0.0027 (Cox model), with Likelihood-ratio of rho=0; chibar2(01)=0.00; p-value=1.000. The implication of the foregoing results is that the null hypothesis of "No random effect" is upheld. The factors that seem to affect teenage pregnancy are religion, marital status, use of contraceptive, age-group, age at first sexual initiation, age at first sex and religion. Respondents who are married, never married (p=0.03) and widowed were less likely to have teenage pregnancy with the odds of 0.96, 0.65 and 0.91 respectively, relative to those that were divorced The odds of having teenage pregnancy among respondents that did not use contraceptive is 1.87 times higher ($p<0.001$) than for those that did use contraceptive. Respondents within age-groups 20-24, 25-29, 30-39 and 40-49 had odd ratios of 1.54,1.51,1.51, and 1.50, which are similar but significantly ($p<0.001$) higher than those aged 15-19 which implies that there were more teenage pregnancies in those age groups. Age at first sexual initiation is significant in the model whereby a one year increase in age at first sex decreases the odds of teenage pregnancy by a factor of 0.9570. That is, the earlier the age at first sex the greater the chances of teenage pregnancy.

Table 1: Results of Cox model (with and without frailty) and discrete-time logit model (with and without random effects) of ethnicity showing the hazard ratio, odd ratio, p-value and estimates of random effects parameters.

Covariates		Cox Model Without Frailty	Cox Model With Frailty	Discrete-Time Model Without Frailty	Discrete-Time Model With Frailty
		Hazard ratio (p-value)		Odds ratio (p-value)	
Year		0.9564 (0.238)	0.9479 (0.163)	1.0179 (0.647)	1.0143 (0.714)
Zone	Northwest	1.0299 (0.784)	1.0529 (0.666)	1.0186 (0.867)	0.9896 (0.923)
	Northeast	1.0811 (0.467)	1.1162 (0.353)	1.0204 (0.854)	1.0015 (0.989)
	Northcentral	1.1401 (0.190)	1.1765 (0.145)	1.0565 (0.593)	1.0240 (0.814)
	Southwest	0.8667 (0.169)	1.0000 (0.378)	0.9864 (0.898)	0.9574 (0.682)
	Southsouth	1.1363 (0.193)	1.1557 (0.188)	1.0660 (0.527)	0.9972 (0.977)
Location		0.9838 (0.711)	0.9873 (0.772)	0.9884 (0.797)	0.9329 (0.117)
Attended school		1.0329 (0.792)	1.0414 (0.742)	1.0611 (0.642)	1.0688 (0.601)
Level of Education	Quranic	1.1000 (0.466)	1.0933 (0.496)	0.9389 (0.641)	0.9124 (0.498)
	Primary	0.9349 (0.580)	0.9309 (0.556)	0.9643 (0.772)	0.9320 (0.574)
	Secondary	0.8336 (0.143)	0.8315 (0.138)	0.9153 (0.489)	0.9024 (0.422)
Religion	Islam	2.6055 (0.081)	2.5360 (0.090)	1.1570 (0.796)	0.1469 (<0.001)
	Christianity	2.3899 (0.111)	2.3490 (0.118)	1.1740 (0.775)	0.1536 (<0.001)
	Others	3.1568 (0.051)	3.1371 (0.052)	1.1642 (0.802)	0.1499 (<0.001)
Marital-Status	Currently married	0.7583 (0.015)	0.7556 (0.014)	0.9609 (0.734)	0.7727 (0.013)
	Never married	0.4488 (<0.001)	0.4468 (<0.001)	0.6513 (0.003)	0.5018 (<0.001)
	Widowed	0.6219 (0.007)	0.6204 (0.007)	0.9064 (0.586)	0.7286 (0.066)
Circumcision		0.8982 (0.014)	0.8743 (0.015)	0.9616 (0.482)	0.9326 (0.206)
Attend Religion		0.7516 (0.043)	0.8994 (0.046)	0.9992 (0.989)	1.0101 (0.853)
How important the religion		1.2375 (0.166)	0.7532 (0.169)	0.9565 (0.831)	0.9679 (0.876)
Sex- exchange of gift		0.9012 (0.055)	1.2374 (0.056)	1.0170 (0.884)	0.8927 (0.282)
Heard of HIV		1.1004 (0.240)	0.9031 (0.250)	1.0290 (0.749)	0.9688 (0.727)
Have you been tested		2.1241 (0.159)	1.0997 (0.162)	0.9850 (0.831)	0.9809 (0.785)
Contraceptive		2.1241 (<0.001)	2.1178 (<0.001)	1.8749 (<0.001)	1.7431 (<0.001)
Age–group	20-24years	1.3868 (<0.001)	1.3893 (<0.001)	1.5376 (<0.001)	1.4979 (<0.001)
	25-29years	1.2911 (<0.001)	1.2998 (<0.001)	1.5080 (<0.001)	1.4807 (<0.001)
	30-39years	1.3779 (<0.001)	1.3847 (<0.001)	1.5129 (<0.001)	1.4507 (<0.001)
	40-49years	1.3282 (<0.001)	1.3292 (<0.001)	1.5027 (<0.001)	1.4226 (<0.001)
Age at first sex		0.7452 (<0.001)	0.7448 (<0.001)	0.9570 (<0.001)	0.9270 (<0.001)
			Theta =0.0027		Sigma_u =0.0007
					Rho=1.47e-07
				Likelihood-ratio of rho=0; chibar2(01)=0.00; p-value=1.000	

Table 2: Relative performance of the models with and without random effects.

Model	Number of Observations	Loglikelihood	AIC
Cox	3428	-22281.59	44621.18
Cox with random effects	3428	-22273.24	44604.49
Discrete-time	56316	-11801.66	23663.32
Discrete-time with random effects	56316	-11821.51	23703.02
Discrete-time using forward selection method	56316	-11803.7	23623.4

To reduce the effect of intercorrelation of the factors, Forward Selection procedure was used to select factors that affect time to first pregnancy. The orders of variable selection are Contraceptive Use, Never Married and Age at First Sex. The results are presented in Table 3. According to these results, contraceptive was first selected which shows a significant increase of 2.17 in the odds of having teenage pregnancy for those that were not using contraceptive. Those that were single (never married) had significant reduced risk 0.61 of having teenage pregnancy. Lastly, the age at first sexual initiation was found to be significant in the model and increases in the age at first sexual initiation reduced the odds of teenage pregnancy by 0.97.

Table 3: Results of Forward Elimination method for Discrete-Time Model

Covariates	**Odds Ratio (OR)**	**SE(OR)**	**P-value**	**95% C.I**
Contraceptive	2.1674	0.1544	<0.001	(1.8848, 2.4922)
Never married	0.6117	0.0506	<0.001	(0.5201, 0.7196)
Age at first sex	0.9690	0.0094	0.001	(0.9506, 0.9877)

4. Discussion and Conclusion

Cox proportional hazard and Discrete-time survival models were used with categorical and continuous covariates. Besides modeling the influence of covariates, random effects were incorporated into the analysis in order to account for unobserved heterogeneity. Akaike Information Criterion (AIC) was used to select the preferred model for the data. Discrete-Time model without random effects was selected. Forward Elimination method was then used to select factors that contribute significantly to the model.

The results of the selection procedure showed that non usage of contraceptive increases risk of teenage pregnancy by up to 117%. It also shows that the higher the age at first sex, the lower the risk of teenage pregnancy. Those who were never married had lower risk (up to 39%) of teenage pregnancy. Although age of the respondent at the time of survey was a significant risk factor when all the variables were included in the model, it was not selected by the Forward selection procedure. This is so because there is a significant correlation ($r=0.362$, $p<0.01$) between age at first sex and current respondents age (group). The results also showed that the level of teenage pregnancy, based on data for 2005 was not different from that of 2007, although the risk was slightly higher in 2007. Risk of teenage pregnancy was similar in all geo-political zones though slightly higher with respondents from North-West, North-East, North-Central and South-South. Urban residents had lower risk of experiencing teenage pregnancy compared to those in rural areas. Respondents with formal education had slightly, though not significant higher risk of teenage pregnancy than those with no formal education. Those who practice Islam, Christianity and other religion had higher, though not significant risk of teenage pregnancy. The risk of teenage pregnancy for those who were not circumcised was slightly lower. Risk of teenage pregnancy for those who did not use contraceptive was higher than those who used it. Respondents who were currently older than 19 years were more likely to be involved in teenage pregnancy than those aged 15-19 years. Increase in the respondent's age at first sexual initiation reduced the risk of teenage pregnancy. This might be due to increase in the level of education and awareness through various media on the danger of getting pregnant at such school age

There was no ethnic variation in teenage pregnancy within Nigeria. This was observed from non rejection of the null hypothesis of "No random effect". Thus the results of the discrete model with or without ethnicity were similar. In summary, contraceptive use, age at first sexual initiation and marital status are important risk factors in teenage pregnancy.

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