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The impact of some socio-demographic factors on the HIV infection among pregnant women in Akwa Ibom state

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Abstract
The study access the impact of some socio-demographic factors on the HIV/AIDS infection among pregnant women in Akwa Ibom State using a binary response regression model (logistic model).The data for this study was collected from University of Uyo Teaching Hospital, Uyo, and Akwa Ibom State, Nigeria. The data were collected for a period of three years from 2010 to 2012. The data showed the HIV status of 5902 pregnant women who visited the hospital together with their socio-economic characteristics: age, marital status, employment status, place of residence, level of education. From the result of the analysis marital status, place of residence and level of education has a negative relationship with the probability of a pregnant woman having a positive HIV status as shown by their corresponding coefficients which are-1.0471 for marital status, -0.1261 for place of residence and - 0.0612. Age, employment status has a positive relationship with the probability of the pregnant women having a positive HIV status. Together all the regressor have a significant impact on the HIV status of pregnant women at 10% level of significance as shown by LR statistic which is 10.09 with a probability value of 0.07. The $R^2 = 0.0213$ showed that 2.13% of the variation in the dependent variable can be explained by the explanatory variables. It is therefore recommended that efforts should be made to encourage people generally to be married especially the adults that are already sexually active so that they will likely be limited to their partners. Also, people should be encouraged to get educated as this will bring enlightenment that will equip them with adequate knowledge about HIV. In addition, more enlightenment programme on the prevention of this scourge (HIV) should be carried down to the rural areas as our study has shown that pregnant women living in rural areas are prone to HIV infection than those living in rural areas.

Keywords: HIV/AIDS, pregnant women logistic regression, probability

Introduction
The emergence of Human Immunodeficiency Virus (HIV) and the Acquired Immune Deficiency Syndrome (AIDS) on the global scene has been a major source of concern worldwide. HIV/AIDS is a major public health concern and cause of death in many parts of Africa. Although Africa is home to about 14.5% of world's population, it is estimated to be home to 69% of all people living with HIV and to 72% of all AIDS death in 2009. Worldwide, an estimated 38.6 million people are living with HIV, nearly half of them are women and girls between the ages of 15 and 24 years. And though the spread of the virus has slowed in some countries, it has escalated or remained steady in orders. In 2005, more than 4 million people were newly infected with HIV; 25 million have died of AIDS since. Ochei and Ucheya (2012) [8].
Though everyone is at risk of contracting the virus, Afe and Egbochuku (2004) [1] report that the prevalence data on HIV/AIDS in adolescents indicate that younger women, gay and bisexual teens, young people from poor ethnic backgrounds have a higher rate of HIV/AIDS relative to their peers'. In Nigeria, more women are now living with HIV/AIDS most of who are in the active reproductive age-group. The HIV seroprevalence among Nigeria pregnant women has been on the increase, from 1.8% reported in 1991, 3.8% in 1993, 4.5% in 1995 to 5.4% in 1999 and most recently to 5.8% in 2001.

This alarming increase has been of great concern and the figures reported so far may even be a conservative estimate as the data were obtained from sentinel surveys. Ninety percent of children living with HIV were infected by their mothers Dim *et al* (2004). Nigeria accounts for one third of all new HIV infections among children in the 21 priority countries in sub-Saharan Africa: the largest number of any country. HIV prevalence among young women aged (15-24 years) is estimated to be three times higher than among men of the same age. Each year, 55 per cent of AIDS related deaths occur among women and girls. Nigeria has the highest number of pregnant women living with HIV and the number of HIV+ children, after South Africa and Mozambique; and the highest estimated number of pregnant women living with HIV in need of ARVs to prevent mother to child transmission of HIV."

UN Report (2013). According to the Association of people living with HIV/AIDS in 2013 about 210, 000 pregnant women were living with HIV/AIDS in Nigeria.

Although so much has been written about the epidemiology of the HIV/AIDS and the factors fuelling the epidemic in Nigeria, no much is known of the socio- demographic and economic characteristics of people diagnosed with HIV/AIDS. Information on the characteristics of people living with HIV/AIDS is important for the evolvement of sustainable and purposeful intervention programs to enable those infected cope with the virus. The main objective of this study is therefore to analyze the social-demographic characteristics of pregnant women with HIV/AIDS status in Akwa Ibom State using a logistic Regression approach

Methodology

The data for this study was collected from University of Uyo Teaching Hospital, Uyo, Akwa Ibom State, Nigeria. The data were collected for a period of three years from 2010 to 2012. The data showed the HIV status of 5902 pregnant women who visited the hospital together with their socio-economic characteristics - age, marital status, employment status, place of residence, level of education. The information will be presented as follows:

Table 1: Description of the Variables

S/N	Variable	Label	Description
1	HIV AIDS Status	Y Y = 1,	if the pregnant woman is HIV positive
		Y = 0,	if the pregnant woman is not HIV positive
2	Age	X_1 =	Age in years of the pregnant woman
3	Marital Status	X_2=1	if the pregnant woman is married
		X_2= 0	if the pregnant woman is not married
4	Employment Status	X_3 = 1	if the pregnant woman is employed
		X_3 = 0	if the pregnant woman is unemployed
5	Place of residence	X_4= 1	if the pregnant woman is living in urban area
		X_4= 0	if the pregnant woman is living in rural area
6	Level of Education	X_5= 1	if the pregnant woman is a graduate
		X_5= 0	if the pregnant woman is not a graduate

Our objective is to fit a probability model on the HIV status and socio-economic characteristics of the pregnant woman and to assess the influence of these factors on the HIV status of pregnant women. Since the dependent variable of interest (HIV status of the pregnant woman) has two quantitative outcomes 0 and 1, it is binary response analysis which will be analyzed using logit regression.

Logit Regression: Is a technique which allows for estimating the probability that an event occurs or not, by predicting a binary dependent outcome from a set of explanatory variables. In this study, HIV status is the dependent variable while the socio-economic characteristics are the explanatory variable. The model in explicit stochastic equation form is

$$P_i = E(Y = 1/X_i)$$

$$= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_5 X_5 + U_i (1)$$

Where Y is the probability of pregnant woman being HIV positive, X's are the socio-economic characteristics, β's are known as the parameters of the model, $U_i$is the stochastic or error term

$$P_i = E(Y = 1/X_i) = \frac{1}{1 + \exp(-Z_i)} (2)$$

Where $Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_5 X_5$

Equation 2 is known as (cumulative) logistic distribution function. Here Z_i ranges from - ∞ to + ∞, P_i ranges between 0 and 1. P_i Is non-linearly related to Z_i.

The probability of a pregnant woman being HIV negative is

$$1 - P_i = \frac{1}{1 + \exp(Z_i)} (3)$$

Therefore, one can write

$$\frac{1 + \exp(Z_i)}{1 + \exp(-Z_i)} = \frac{P_i}{1 - P_i} (4)$$

Equation 4 is the odd ratio that is the ratio of probability that a pregnant woman will be HIV positive to the probability that the pregnant woman will be HIV negative.

$$L_i = ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_5 X_5 + U_i (5)$$

Where L_i is called the logit. The estimation of the logit parameters is done using maximum likelihood method.

4. Results and Discussion

The results are given in Table 2 and are obtained using Eviews 7.

Table 2: Logit Model Estimation

Variable	Coefficient	Std. Error	Z-Statistics	Probability
C	- 3.3408	0.6720	-4.0712	0.0000
$X_1$0.0464	0.0289	1.6069	0.1081	
X_2-1.0471	0.4174	-2.5086	0.0121	
$X_3$0.5740	0.4263	1.3464	0.1782	
X_4-0.1261	0.2661	-0.4738	0.6357	
X_5-0.0612	0.4363	-0.1403	0.8884	
Mc Fadden R^2 = 0.0213		LR Statistic (5df) = 10.0937		P = 0.0726

The estimated probability model on HIV status and socio-economic factors is given below.

$$P_i = E(Y = 1/X_i) = -3.3408 + 0.0464X_1 - 1.0471X_2 + 0.5740X_3 - 0.1261X_4 - 0.0612X_5 \quad (6)$$

From Table 2, the partial slope coefficient measures the change in estimated logit for a unit change in the value of the regressor (holding other regressors constant). Thus the coefficient 0.0464 for age means that with other variables held constant, as the age increases by a unit, on the average the estimated logit increases by about 0.05 units, suggesting a positive relationship between the age and the probability of a pregnant woman having a positive HIV status. Also, the marital status coefficient of -1.0471 means with other variables held constant if marital status increases by one unit on average the estimated logit decreases by 1.05 showing a negative relationship between marital status and the probability of a pregnant woman having a positive HIV status. In addition to marital status, both place of residence and level of education showed a negative relationship with probability of the pregnant woman having a positive HIV status as shown by their corresponding coefficients which are -0.1261 for place of residence and - 0.0612 for level of education. Also, in addition to age, employment status has a positive relationship with the probability of the pregnant women having a positive HIV status with a coefficient of 0.5740. Although statistically only marital status is significant at 5% and 10% level of significance respectively, together all the repressor have a significant impact on the HIV status of pregnant women at 10% level of significance as shown by LR statistic which is 10.09 with a probability value of 0.07. The R^2 = 0.0213 showed that 2.13% of the variation in the dependent variable can be explained by the explanatory variables. This is however not surprising. According to Gujarati and Porter (2009) [3] in binary regression models, goodness of fit is of secondary importance. What matters is the expected signs of the regression coefficients and their statistical and/or practical significance.

Table 3: Odd ratios of Logit estimation

Y	Odds Ratios	Std. Error	Z-Statistics	Probability
$X_1$1.0475	0.0302	1.6069	0.1081	
$X_2$0.3510	0.1465	-2.5086	0.0121	
$X_3$1.7753	0.7568	1.3464	0.1782	
$X_4$0.8815	0.2346	-0.4738	0.6357	
$X_5$0.9406	0.4104	-0.1403	0.8884	
Mc Fadden R^2 = 0.0213		LR Statistic (5df) = 10.0937		P = 0.0726

The odds ratio gives the amount of change expected in the HIV status of the pregnant women when there is a unit change in one socio-economic characteristic holding other socio-economic characteristics in the model constant. The odd ratio is non negative. The odds ratios are the exponential of the logit coefficients. If the odds ratio is greater than one then the odd of a pregnant woman being HIV positive increases. If the odd is less than one then the odd of a pregnant woman being HIV positive decreases.

From Table 3, a unit change in age and employment status increases the odds of a pregnant woman being HIV positive by 1.0475 and 1.7753 respectively. Also, a unit change in marital status, place of residence and level of education decreases the odds of a pregnant woman having a HIV positive status by 0.3510, 0.8815, and 0.9406 respectively.From the results, as the age of the pregnant woman increases the odds of her being HIV positive equally increases. This is however not surprising. According to Siegel and Swanson (2004) [9], the reproductive age of women is between the ages of 15-49 years under normal circumstance, which means pregnant women are expected to be within this age bracket. Thus as the age increases the odds of being HIV positive also increases. This might be as a result of increase in sexual activities with age and per harps increase in other risky behaviours. Also a unit change in employment status favours the odds for increase in HIV status of pregnant women. From the result, it can be seen that the employment status of a pregnant woman will not make her not to be prone to HIV infection.

From the results obtained so far, it is therefore clear that married pregnant women have a smaller probability of being HIV positive. This is obvious in the sense that married pregnant women are likely to have only one sexual partner (their husbands) which decreases their chances of being HIV positive since the more sexual partners a person has the greater the risk of the person being HIV positive. Furthermore, the place of residence from our analysis decreases the odds of the pregnant woman being HIV positive. This can be attributed to the fact that those living in urban areas are exposed to adequate information through their access to radio, television, newspapers and other social Medias which people living in rural areas may not likely have access to. This continuous exposure to basic information on prevention of HIV/AIDS infection through print and electronic media makes HIV status of the pregnant women to decrease based on their area of residence. Also the level of education showed an inverse relationship with the HIV status of the pregnant women. Education brings knowledge and

transformation which decreases the odd of a pregnant woman being HIV positive. Education provides the pregnant woman with the adequate knowledge of the mode of transmission, ways of prevention and how to avoid risky behaviors which decreases the odds of HIV AIDS in pregnant women.

Conclusion

Thefight against HIV amongst pregnant women must be sustained to reduce the rate of mother to child transmission. From the result of the study being married, living in urban area and being educated up to tertiary level help in the reduction of HIV infections of pregnant women. It is therefore recommended that efforts should be made to encourage people generally to be married especially the adults that are already sexually active so that they will likely be limited to their partners. Also, people should be encouraged to get educated as this will bring enlightenment that will equip them with adequate knowledge about HIV. In addition, more enlightenment programme on the prevention of this scourge (HIV) should be carried down to the rural areas as our study has shown that pregnant women living in rural areas are prone to HIV infection than those living in rural areas. This shows that, most efforts of agencies that are charged with the responsibility of educating people on the methods of preventing the spread of HIV centre on urban areas, while little efforts are spent in rural areas.

References

1. Afe JO, Egbochuku EO. HIV/AIDS Education for teachers. A proposal for Curriculum renewal. Journal of the Nigerian Academy of Education 2004;1(2):130-141.
2. Green WH. Econometric Analysis 5th edition New Jersey: Pearson Education Inc 2003.
3. Gujarati DN, Porter DC. Basic Econometrics 5th edition New York: McGraw Hill Inc 2009.
4. Hadgu Bariagaber. Demographic and Socio-Economic Consequences of HIV/AIDS in Sub-Saharan Africa. Botswana Journal of African Studies 2001;15(2):168-184
5. Johnston J, Dinardo J. Econometric Methods 4th edition New York: McGraw Hill Inc 2003.
6. Laah JG, Ayiwulu E. Socio-Demographic Characteristics of Patients Diagnosed with HIV/AIDS in Nasarawa Eggon. Asian Journal of Medical Science 2010;2(3):114-120.
7. Modo IVO *et al*. Socio-Cultural Factors Responsible for Increasing Rate of HIV/AIDS in Akwa Ibom State of Nigeria Ethno Med 2011;5(2):141-147.
8. Ochei UM, Ucheya RE. The Impact of Some Socio-Demographic Factors on HIV Infection in Edo, Delta, Bayelsa, Rivers and Cross River State. Nigeria Journal of Pharmaceutical and Applied Science Research 2012;1(2):15-26.
9. Siegel JS, Swanson DA. The Methods and Materials of Demography 2nd edition California: Elsevier Academic Press 2004.
10. Pelgueiras A, *et al.* (Eds), AIDS: Safety Sexuality and Risk. London; Taylor and Francis 1995.
11. Pennington J. HIV in Nigeria 2007. Retrieved on April 11, 2007 from http://www.avert.org/aidsnigeria.htm