OBSTETRIC AND NEWBORN OUTCOMES AND RISK FACTORS FOR LOW BIRTH WEIGHT AND PRETERM DELIVERY AMONG HIV-INFECTED PREGNANT WOMEN AT THE UNIVERSITY COLLEGE HOSPITAL IBADAN

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ABSTRACT

There remains uncertainty about the impact of HIV on pregnancy outcomes and effects of highly active antiretroviral therapy on fetal development. This study describes obstetric outcomes among HIV positive parturients at the University College Hospital, Ibadan. HIV positive parturients were identified in the birth register. During the 30-month period, 318 of 6203 deliveries were HIV positive (5.1%) with 97.6% record retrieval. The mean age of the HIV positive parturients was 31.66 years (± 4.66); the mean gestational age at delivery was 38.02 weeks (± 2.75) and the mean birth weight 2.85kg (±0.59). There were 35.8% (109) preterm births, 2.9% stillbirths and 21.5% low birth weights. The regimen most commonly (198, 64.5%) used was a non-nucleoside reverse transcriptase (NNRTI) based HAART. Preterm births were similar following spontaneous vaginal delivery (31.5%) and elective section (31%) but higher (41.3%) with emergency section (ρ=0.4).

On univariate analysis, the preterm infants had lower mean birth weights (2.46±0.61 vs 2.96±0.44; ρ=0.000). The proportion of preterm births was higher among Low birth weight infants (71.9% vs 28.1%; ρ=0.00). Variables with more preterm births were age >35 years (51.6%), ≤6years of schooling (51.5% vs 48.4%) and being on combination ARV (PI, 37.5% or non-PI, 36.2%). However, these differences did not attain statistical significance. Low birth weight infants had mothers who had higher mean ages (33.28 years ± 4.59 vs 31.28 years ± 4.59, ρ= 0.02), lower mean gestational age at delivery (35.72 weeks ± 3.16 vs 38.49 weeks ± 2.1, ρ= 0.00). Variables with more low birth weight include <12years of schooling and being on mono/ dual therapy (31.8%). These differences were not statistically significant.

On logistic regression, factors that retained an

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association with low birth weight were mean maternal age at delivery (ρ= 0.002; β= 0.904; 95% CI, 0.848 – 0.966) and being on mono/ dual therapy (ρ= 0.039; β= 3.042; 95% CI, 1.055 – 8.768). The only factor that retained an association with preterm birth was mean maternal age at delivery (ρ= 0.015; β= 0.935; 95% CI, 0.886 – 0.987).

HIV positive (especially older) women, have high rates of preterm deliveries and low birth weights. The beneficial effects of HAART on mother-to-child transmission are indisputable but monitoring antiretroviral therapy in pregnancy remains a priority and antenatal surveillance should include fetal growth assessment.

INTRODUCTION

Nigeria, with a 4.1% HIV prevalence reported among pregnant women in the 2010 national sentinel survey, contributes significantly to the global HIV burden [1]. Because women account for about 60% of the total HIV burden in Nigeria, the coexistence of HIV and pregnancy is a common finding [1]. The result is that 315,00 to 625,00 children are delivered annually to HIV infected motehers in Nigeria, with an estimated 63,000 to 125,000 infants acquiring acquiring HIV from their mothers eah year [2]. The result is that Nigeria contributes approximately 10% of the global burden of mother-to-child transmission of HIV infection [3,4].

Some studies [5] have associated HIV in pregnancy with higher rates of adverse pregnancy outcomes such as stillbirths and low birth weight, while others [6,7] have found no adverse effects of HIV infection on pregnancy outcome. In addition, while prevention of mother-to-child transmission of HIV (PMTCT) interventions can reduce the vertical transmission rate of HIV to as low as 1 – 2% [8] and antiretroviral therapy (ART) provides clear benefits, the evidence for the effect of highly active antiretroviral therapy (HAART) on adverse pregnancy outcomes is conflicting. While studies from Europe have provided support for an association between receipt of ART during pregnancy and an increased risk of preterm birth (PTB) and low birth weight (LBW) [9-11], studies from the United States have not consistently associated maternal receipt of ART during pregnancy with these adverse pregnancy outcomes [12-14].

The large number of HIV positive women who require PMTCT services and the uncertainty regarding the pattern of pregnancy outcomes among this group of parturients therefore necessitates the need for constant review. Thus, the objective of this study was to review the pregnancy outcomes – maternal and fetal – among HIV-positive pregnant women who delivered at the labour ward of the University College of Hospital, Ibadan.

METHODS

This retrospective cross-sectional study was conducted at the labour ward of the University College Hospital (UCH), Ibadan. The study period, over 30 months, was from January 2011 to June 2013. The birth register was reviewed and the records of all women identified as HIV positive in this period were retrieved. Information that was obtained was as follows: selected socio-demographic and neonatal characteristics, gestational age at delivery, mode of delivery etc.

The University College Hospital Ibadan offers prevention of mother-to-child transmission (PMTCT) services in the Anti-retroviral Clinic supported by the AIDS Prevention Initiative in Nigeria (APIN) program and the President's Emergency Plan for AIDS Relief (PEPFAR) program. HIV positive pregnant women access

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these services having being referred from the UCH antenatal clinic and other clinics in the environs. PMTCT services provided include opt-out system of HIV testing in pregnancy, antiretrovirals for PMTCT, infant feeding counseling and family planning counseling. In addition women are monitored by regular assay of CD4 count and viral load. Caesarean delivery is offered at no cost to the patient if there are *obstetric indications or viral load above 1,000 copies* per ml close to term (>36weeks gestational age).

Until April 2011, patients were either commenced on zidovudine (AZT) monotherapy or combination therapy of zidovudine and lamivudine (Combivir, CBV) for prophylaxis if CD4 count was more that 200 cells per ml. Women with CD4 count less than 200 cells per ml or symptomatic women with CD4 200-249 cells /ml were commenced on the national first-line regimen of nevirapine (NVP)-based Highly Active Antiretroviral Therapy (HAART). Symptomatic women with CD4 count 250cells/ml and above or women on 2nd line were placed on protease inhibitor (PI) based HAART therapy. Genotypic testing for antiretroviral resistance was not routinely available. After April 2011, all women were commenced on efavirenz based HAART following adoption of the WHO recommendations. Women on second line drugs were placed on PI based HAART. Approval was obtained from the joint UI/ UCH ethics committee.

Statistical analysis was performed with the Statistical Package for Social Sciences (SPSS Inc, Chicago, Ill). Data was summarized with frequency tables and mean (± standard deviation). Information analysed included maternal demographic characteristics and antiretrivoral drug (ARV) type. The pregnancy outcomes evaluated were LBW (<2500 g) and PD (gestational age <37completed weeks).Chi-square (χ^2) test was used for analysis of categorical variables. Continuous variables were analyzed using student's T-test or analysis of variance (ANOVA) for groups more than two. Significance was defined as ρ value <.05. These variables were examined within two groups divided by birth weight (<2500 g and ≥ 2500 g) or gestational age (<38 weeks and ≥ 37 weeks) for statistical significance by Logistic regression analysis. Multivariate Logistic regression analysis was used to explore the potential risk factors for LBW/PD. *All variables in the univariate analysis with P value <0.25* and those deemed clinically significant were entered into multivariate models using stepwise logistic regression. Variables were held in the models if they reached a significance level of $P<0.05$.

RESULTS

During the study period, there were 6203 deliveries. Three hundred and eighteen women (318) were HIV positive giving a prevalence of 5.1%. Of these 307 casenotes were retrieved giving a retrieval rate of 97.6%. Fifty- four of the women were unbooked in UCH, being newly discovered to be HIV positive in labor. The mean age of all the parturients was 31.66 years (± 4.66), while the mean gestational age at delivery was 38.02 weeks (± 2.75). The mean birth weight was 2.85kg (±0.59).

Over half (214, 69.7%) of the patients were in the age range 26 to 35 years (see table 1). While most (236, 76.9%) had at least 12 years of education only 2 patients reported being single. Although, over half (190, 61.2%) of the patients presented at term, the prevalence of preterm delivery was 35.8% (109). Elective cesarean section was the mode of delivery in 27.4% (84) of the patients. The drug regimen most commonly (198, 64.5%) used by the parturients was a non-nucleoside reverse transcriptase (NNRTI) based HAART.

The gestational age at delivery following spontaneous vaginal delivery compared to deliveries after caesarean section showed a similar proportion of preterm deliveries; 31.5% after

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vaginal delivery and 31% after elective cesarean delivery (see table 2). In contrast women who had emergency delivery had more preterm deliveries (41.3%). These differences were however not statistically significant (ρ=0.4). Review of neonatal characteristics revealed a male sex preponderance of 54.7% (see table 3). There were 2.9% stillbirths and 21.5% low birth weights.

Over a third (35.8%) of the infants were born preterm (see figure 1). Table 4 shows the factors that were associated with preterm delivery. The mean birth weight of the preterm infants was lower (2.46±0.61 vs 2.96±0.44). The difference was statistically significant (ρ=0.000). The mean age of the mothers with preterm babies was higher. Compared to the other age groups, mothers older than 35 years had a higher proportion of preterm infants (51.6%). Women with six years or less of schooling also had higher proportion of preterm deliveries (51.5% vs 48.4%). Other factors that demonstrated higher proportion of preterm infants include having emergency CS (42.1%), being low birth weight (71.9% vs 28.1%) and being on combination ARV (PI, 37.5% or non-PI, 36.2%). However, only being low birth weight achieved statistical significance. The differences observed in the other factors did not attain statistical significance.

Table 5 shows the factors that were associated with low birth weight. The mean age of the mothers with low birth weight babies was higher (33.28 years ± 4.59 vs 31.28 years ± 4.59, ρ= 0.02) . The mean gestational age at delivery was also lower (35.72 weeks ± 3.16 vs 38.49 weeks ± 2.1, ρ= 0.00). These differences were statistically significant. Mothers older than 35 years had a higher proportion of low birth weight infants (35.9%). Women with twelve years or more of schooling had lower proportion of low birth weight infants. Other factors that demonstrated higher proportion of low birth weight infants include being preterm (42.6%) or being on mono/ dual therapy (31.8%). However, the factors that were statistically significant were the age of the mother and preterm birth.

On logistic regression the factors that retained an association with low birth weight were mean maternal age at delivery (ρ= 0.002; β= 0.904; 95% CI, 0.848 – 0.966) and being on mono/ dual therapy (ρ= 0.039; β= 3.042; 95% CI, 1.055 – 8.768) while the factor that retained an association with preterm birth was only mean maternal age at delivery (ρ= 0.015; β= 0.935; 95% CI, 0.886 – 0.987).

DISCUSSIONS

The mean age of the parturients was 31.66 years (± 4.66). This is similar to the mean age of 30.1 years (±5.1) reported by van der Merwe et al from South Africa [15]. Majority (78.8%) of the women were in the age group 20-34years, similar to the values reported by Ezechi et al from Lagos (84.7%) and Onah et al in Enugu, (72.6%) both in Nigeria [1,8]. HIV infection in this relatively younger age group has a negative impact on the economy, especially in developing countries. This is on account of this group being sizeable in the workforce.

The overall preterm delivery rate of 35.8% in this cohort of HIV positive women is much higher than the rate of 11.1% reported by Ezechi et al [1], 13.5% by Townsend et al working in England [16] and 13.6% by Taguebue et al who worked in Cameroon [17]. All of these worked with groups of HIV positive women. Mokuolu et al reported a rate of 11.8% among the general obstetric population in a teaching hospital in Southern Nigeria [18]. In Europe and the US, studies in the general obstetric populations have reported preterm delivery rates of 5-10% [19-21] and 12.5% [18,22] respectively. In our cohort of HIV positive women, only older maternal age at delivery and being low birth weight were found to be statistically significant in their association with preterm delivery. The finding of maternal age being

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associated with preterm delivery in this study is contrary to the findings of Ezechi et al [23] and Szyld et al. [24] who found no association between maternal age and preterm delivery in the groups of HIV positive women they studied. However, it has been noted that pregnancy in the parturient of advanced age is associated with significant increase in maternal and fetal risk [25]. This is on account of their demonstrating an increased rate of pre-gestational chronic medical complications such as type 2- diabetes mellitus and chronic hypertension. [25-29].

Although some concordance exists between birth weight and gestational age, they are not interchangeable. Only around two thirds of low birth weight infants are preterm [30]. Term infants maybe of low birth weight because they are 'small for gestational age' or 'light for date' infants. Preterm infants may also be small for gestational age. Thus, they may have neonatal problems additional to those related to shortened gestation, particularly if they are small because of intrauterine growth restriction [30]. In this cohort of HIV positive women, of the 190 term infants 28.1% were LBW while of the LBW infants 9.6% were delivered at term.

There was a higher proportion of preterm birth among women with fewer years of education, although this did not attain statistical significance. Different variables including occupation, type of housing and years of education have been used by different authors as proxy socioeconomic variables [31-33]. Level of education maybe used as a proxy for socioeconomic status. Poor economic background of the mother has been described as one of the most important predictors of spontaneous preterm delivery [30]. The interaction of many factors that contribute to the association of preterm birth with socioeconomic status has been described as being complex. For example mothers who smoke cigarettes are twice as likely as non-smoking mothers to deliver before 32 weeks of gestation. However, while antenatal smoking cessation programs can lower the incidence of preterm birth, other interactions such as better antenatal care, dietary advice or increased social support during pregnancy have not been shown to improve perinatal outcomes or reduce the social inequalities in the incidence of preterm delivery [30].

Patients on combination HAART demonstrated higher preponderance of preterm births. This, however, did not achieve statistical significance. The effect of antiretroviral therapy on prevalence of preterm birth among HIV positive women remains unclear with conflicting data from various research settings. While some demonstrated increased risk of preterm delivery with antiretrovirals [1,9,15,16] others demonstrated no such increase [24,34]. The workers who demonstrated an association between antiretrovirals and preterm delivery have reported this association with the initiation of combination therapy before pregnancy or during the first trimester of pregnancy [1,9,15,35,36].

Various reasons have been proffered for the association of preterm births with HIV and antiretrovirals [16,37]. One of them is the Th2 to Th1 cytokine shift associated with HAART administration. Successful pregnancies are characterised by an increase in Th2 cytokines and suppression of Th1 cytokine production, a Th1 to Th2 cytokine shift [37]. A similar shift is also observed in the disease progression of HIV infection. Fiore et al (2006) hypothesised that the increased risk of premature delivery reported in HIV-infected, HAART-treated pregnant women is mediated through changes in the cytokine environment in pregnancy [37]. They investigated the levels of interleukin IL-2 (Th1) and IL-10 (Th2) in peripheral blood mononuclear cells (PBMCs) 49 HIV-infected women. They were able to demonstrate favourable immunomodulation induced by HAART with increased IL-2 (Th1) and

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decreased IL-10 (Th2). They showed that each unit increase in IL-2-PHA slope was associated with an 8% increased risk of premature delivery (AOR, 1.08; 95% CI, 1.0-1.17; p=0.005). They concluded that HAART use in pregnancy while providing significant benefits in delaying HIV disease progression and reducing the risk of mother-to-child-transmission, may however be counterproductive in terms of successful pregnancy outcome.

It must however be noted that preterm birth may also be associated with a multitude of factors that include family and psychosocial histories. For example, other factors reported by Ezechi et al in their group of HIV positive women include multiple pregnancies, stressful work, and presence of opportunistic infection at delivery [1]. Of particular interest in this cohort is the stratification of gestational age at delivery by mode of delivery. The rate of preterm delivery among women delivering per vaginam was similar to those delivered by elective cesarean delivery. Women delivered by emergency cesarean section however had a higher rate of preterm delivery. Women delivering per vaginam having opted for this mode of delivery antenatally are probably a better reflection of the true prevalence of preterm delivery among HIV +ve women. The prevalence of preterm delivery in this group was 35.5% which is still quite higher than the rate reported in the general obstetric population by Mokuolu et al [18]. Other studies do not perform these stratifications often including all births no matter the mode of delivery.

The prevalence of low birth weight in this group of HIV positive women was 21.5%. This is higher than the rates of 9.4% and 13.0% reported respectively by Ezechi et al [23] and Haeri et al [36]. However, it is similar to the rates of 19.6% and 22.4% reported respectively by van der merwe et al [15] and Yu et al [34]. All four groups worked with HIV positive pregnant women. The conference of Paediatric Association of Nigeria (PANCORF) has reported a LBW prevalence of 14% in the general Nigerian obstetric population [38]. Ahmadu et al. working in Maiduguri reported a prevalence of 12.9% LBW [33], while Ugboma and Onyearugha reported a prevalence of 8.3% [39]. The latter two groups also worked with the general obstetric population.

Only older maternal age at delivery and being preterm were found to be statistically significant in their association with LBW. Links between rising maternal age and LBW especially among blacks have been reported [33,39,40]. Possible reasons for this include the fact that mothers at this age may have less physiologic reserve compared to younger mothers. This is because older mothers are more likely to be multiparous which has a depleting effect on their nutrient store [33]. In addition, as previously noted, this group of mothers are likely to have pregestational chronic medical illnesses [25].

As previously stated, the level of education of the mothers was used as proxy for socioeconomic class (SEC) with lower class being associated with fewer years of education. Women with more years of education had a lower proportion of LBW. It has been suggested that the effect of low SEC factors start at the time of conception through low physiologic reserves, inadequate medical care, poor diet and high risk of infectious diseases [33,41,42]. In addition, women with more years of education could be exposed to information on the importance of prenatal health care coupled with personal and environmental cleanliness, which has been found to reduce the toll of infectious disease [33,41]. Promoting these practices among women, including HIV +ve women, may lower the possibility of mothers giving birth to LBW babies [41].

Interestingly, women on mono/dual therapy had higher proportion of low birth weight infants. This is in spite of their having fewer preterm infants. Various studies have attempted to evaluate the

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effect of maternal ART regimens on adverse infant outcome such as LBW. While some workers have demonstrated increased odds of LBW among HIV +ve women on HAART [16,36] others have found no association between HAART and LBW, no matter the treatment group [9,24,34]. A possible explanation for the increased odds of LBW among HIV positive women on HAART maybe found in the effect of HAART on preeclampsia. An association between HAART and an increased risk of pre-eclampsia has been observed [43-45], and the association of hypertension and pre-eclampsia with increased risks of preterm birth and LBW is well recognized [46,47].

We must caution that our study is an overall evaluation of perinatal outcomes in HIV positive parturients. Our retrospective study design precluded an optimal assessment of medication compliance within this population. In addition, no data was collected on duration of receipt of ART prior to pregnancy. In addition, preterm birth has been associated with a multitude of factors that include family and psychosocial histories for which we could not account. Despite these limitations, we conclude that HIV positive women who use HAART may be at increased risk for preterm birth and low birth weight. Antenatal surveillance in HIV positive mothers should therefore include serial fetal growth assessment by USS. An HIV-infected woman of child bearing age is in the unique position of making treatment decisions which will not only impact on her own health, but may also affect her future children [48,49] (1, 8). Thus health care providers need to discuss future plans with HIV positive women when deciding what kind of antiretroviral therapy to initiate.

Table 1: Characteristics Of HIV Positive Mothers Delivered At UCH Ibadan

Maternal Characteristic	Frequency (307)	Percentage (100.0 %)
Age of mother		
<20	1	0.3%
20-25	28	9.1%
26-30	101	32.9%
31-35	113	36.8%
36-40	55	17.9%
>40	9	2.9%
Educational level		
Tertiary	105	34.2%
Secondary	131	42.7%
Primary	24	7.8%
None	10	3.3%
Others	25	8.1%
Not stated	12	3.9%
Marital status		
Single	2	0.7%
Married	303	98.7%
Not stated	2	0.7%
Gestational age at delivery		
<28	1	0.3%
28-33	18	5.9%
34-37	91	29.6%
= 38	190	61.2%
Not stated	7	2.9%
Mode of delivery		
Vaginal del.	113	37.1%
ELCS	84	27.4%
EMCS	110	35.5%
Drug type		
Mono/ dual	22	7.2%
NonNNRTI	198	64.5%
PI-based	33	10.7%
Unknown	54	17.6%

Table 2: Gestational age at delivery by mode of delivery

Gest. age at delivery	SVD (N=111)	ELCS (N=84)	EMCS (N=109)	
<28	1 (.9%)	0 (.0%)	0 (.0%)	P-value- 0.395
28-33	6 (5.4%)	1 (1.2%)	9 (8.3%)	χ- 8.405
34-37	29 (26.1%)	25 (29.8%)	36 (33.0%)	
38-42	71 (64.0%)	56 (66.7%)	61 (56.0%)	
>42	4 (3.6%)	2 (2.4%)	3 (2.8%)	
Mean GA at delivery	38.01(± 2.99)	38.8 (± 1.52)	37.51(± 2.82)	p=0.153

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Table 3: Characteristics of Infants Delivered To HIV Positive Mothers at UCH Ibadan

Neonatal Characteristic	Frequency (307)	Percentage (100.0 %)
Sex of neonate		
Male	168	54.7%
Female	137	44.6%
Not stated	2	0.7%
Status at delivery		
Alive	294	95.8%
Dead	9	2.9%
Not stated	4	1.3%
Birth weight of infants		
<1.5	8	2.6%
1.5-2.49	58	18.9%
2.5-3.9	231	75.2%
>3.9	5	1.6%
Not stated	5	1.6%
Prematurity		
Preterm	110	35.8%
Not preterm	190	61.9%
Post term	7	2.3%
Low birth weight		
Low birth weight	66	21.5%
Not LBW	236	76.8%
Not stated	5	1.6%

Table 4: Factors Associated With Preterm Birth

	Preterm (N=110)	Not Preterm(N=190)	95% CI	p-value
Maternal Characteristic				
Mean maternal age (years)	32.61±5.09	31.19±4.32	+0.323 to -2.517	0.089
Mean birth weight (kg)	2.48±0.61	2.96± 0.44	-0.596 to -0.354	0.000
Age of mother	**Preterm**	**Not Preterm**	**χ2**	**p-value**
<25	9, 33.3%	18, 66.7%	1.062	0.587
26-30	28, 28.3%	71, 71.9%		
31-35	41, 36.6%	71, 63.4%		
>35	32, 51.6%	30, 48.4%		
Educational level				
Tertiary	35, 34.3%	67, 65.7%	6.616	0.158
Secondary	44, 34.1%	85, 65.9%		
Primary/ none	17, 51.5%	16, 48.5%		
Others	9, 36%	16, 64.0%		
Mode of delivery				
Vaginal del.	39, 35.5%	71, 64.5%	2.428	0.297
ELCS	26, 31.3%	57, 68.7%		
EMCS	45, 42.1%	62, 57.9%		
Sex of baby				
Male	58, 35.6%	105 (64.4%)	0.53	0.718
Female	51, 37.8%	84, 62.2%		
Birth weight at delivery				
LBW	46, 71.9%	18, 28.1%	44.128	0.00
Not LBW	62, 26.7%	170, 73.3%		
Drug type				
Mono/ dual	5, 25.0%	15, 75.0%	1.064	0.587
NonNNRTI	71, 36.2%	125, 63.8%		
PI-based	12, 37.5%	20, 62.5%		

Table 5: Factors Associated With Low B irth Weight (LBW)

LBW (N=66)	Not LBW (236)	95% CI	p-value
Maternal Characteristic			
Mean maternal age (years)	33.28±4.59	31.28±4.59	+0.729 to +3.28	0.02
Mean gest. Age at del. (weeks)	35.78±3.16	38.49±2.10	-3.365 to -2.047	0.000
Age of mother	**LBW**	**Not LBW**	**χ2**	**p-value**
<25	4, 13.5%	25, 86.2%	13.137	0.004
26-30	13, 13.1%	86, 86.9%		
31-35	26, 23.4%	85, 76.6%		
>35	23, 35.9%	41, 64.1%		
Educational level				
Tertiary	18, 17.6%	84, 82.4%	2.247	0.690
Secondary	28, 21.4%	103, 78.6%		
Primary/ none	9, 27.3%	24, 72.7%		
Others	7, 28.0%	18, 72.0%		
Mode of delivery				
Vaginal del.	26, 23.2%	86, 76.8%	2.616	0.27
ELCS	13, 15.7%	70, 84.3%		
EMCS	27, 25.0%	81, 75.0%		
Sex of baby				
Male	33, 19.9%	133 (80.1%)	0.643	0.254
Female	32, 23.7%	103, 76.3%		
Gestational age at delivery				
Preterm	46, 42.6%	62, 57.4%	44.128	0.00
Not LBW	18, 9.6%	170, 90.4%		
Drug type				
Mono/ dual	5, 31.8%	15, 68.2%	1.557	0.459
NonNNRTI	42, 21.4%	154, 78.6%		
PI-based	6, 18.2%	27, 81.8%		

Table 6 Predictors Of LBW And Preterm Delivery

Predictors of LBW				
Educational level	**signif**	**exp (β)**	**95% CI lower**	**upper**
Tertiary	0.638	-	-	-
Secondary	0.155	2.844	0.672	12.32
Primary	0.232	2.314	0.584	0.168
None	0.482	1.810	0.346	9.481
Others	0.442	2.195	0.296	16.285
Maternal age at delivery	0.002	0.904	0.848	0.966
Gest. Age at delivery	0.170	1.041	0.983	1.102
Mode delivery				
Vaginal delivery	0.24	-	-	-
ELCS	0.784	1.095	0.573	2.091
EMCS	0.102	1.954	0.875	4. 367
Drug type				
NonNNRTI	0.176	-	-	-
M/D	0.039	3.042	1.055	8.768
PI	0.054	3.795	0.976	14.765
Predictors of preterm delivery				
Educational level	**signif**	**exp (β)**	**95% CI lower**	**upper**
Tertiary	0.305	-	-	-
Secondary	0.619	1.401	0.371	5.294
Primary	0.569	1.456	0.399	5.308
None	0.359	0.492	0.108	2.242
Others	0.463	2.020	0.308	13.231
Maternal age at delivery	0.015	0.935	0.886	0.987
Mode delivery				
Vaginal delivery	0.427	-	-	-
ELCS	0.347	1.311	0.746	2.305
EMCS	0.222	1.491	0.785	2. 831
Drug type				
NonNNRTI	0.834	-	-	-
M/D	0.563	0.725	0.244	2.156
PI	0.646	0.739	0.204	2. 681

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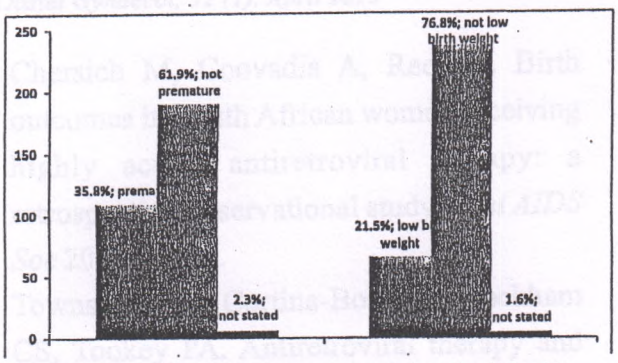

Figure 1; proportion of adverse obstetric outcome - prematurity and low birth weight

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