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Determinants Of Mother-To-Child HIV Transmission Among HIV Exposed Infants In Siaya County, Kenya

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ABSTRACT

In Kenya, approximately 3.3% to 4% of infants born annually are exposed to HIV due to lack of PMTCT interventions. Factors associated with mother – to – child HIV transmission as not been adequately investigated in Kenya. The study aim was to investigate factors associated with mother – to – child HIV transmission (MTCT) among HIV exposed infants in Siaya County. A retrospective cohort study design was adopted. Data involving 179 HIV exposed infants and their HIV infected mothers were abstracted from maternal child health medical records and retrospectively followed up for 18 months. Data analysis was carried out using SAS 9.4. Descriptive statistics was used to characterize the demographic, clinical and laboratory variables while Chi – Square test (95 % CI) was used to test for association of factors influencing (determinants) transmission of mother to child HIV infection. Out of 179 HIV exposed infants, 145 were followed up and 25 (17%) were found positive. This study found that factors associated with MTCT were provision of mother's ARVs at ANC, number of ANC visits, infant prophylaxis, and cotrimoxazale ($p < 0.001$, 95% CI). Immunological factors such as CD 4 count, viral load suppression, and presence of opportunist infections were also associated with MTCT ($p<0.001$, 95% CI). This study recommends consistent provision of maternal ARVs and infant prophylaxis to that HIV infected pregnant mothers; routine monitoring of CD 4 and viral load of HIV infected expectant and lactating mothers; Future studies on evaluation of pre – conception models for HIV infected women intending to conceive.

Key words: Mother-to-child transmission, Prevention of mother-to-child transmission, Determinants and HIV transmission

1. INTRODUCTION

The HIV pandemic has created an enormous challenge to the survival of humankind worldwide. At the end of 2016, an estimated 34 million people were living with HIV globally (UNAIDS, 2016). According to UNAIDS there are 2.5 million new HIV infections of which 330, 000 are children less than 15 years. Most of these children are from sub-Saharan Africa where mother-to-child HIV transmission during pregnancy, delivery, and breastfeeding are the major route of infection. It is believed that about two thirds of infants are infected during pregnancy and at the time of delivery, and about one third are infected through breastfeeding (KAIS, 2014, UNAIDS, 2016), yet there are no sufficient studies towards the determinants.

Statistics indicate that 1,600 infants are infected with HIV) every day and more than 600,000 infants are infected by the virus annually (UNAIDS, 2016), of which AIDS accounts for three per cent of deaths in children under five years of age, and six per cent of those in sub - Saharan Africa, where AIDS has become one of the major killers of young children through the Mother-to-child transmission. Mother-to-child transmission (MTCT) of HIV occurs when HIV is spread from an HIV infected woman to her baby during pregnancy, labor and delivery or breastfeeding (WHO, 2015). For an HIV infected woman not being treated for HIV, the chance of passing

the virus to her child is about 25% during pregnancy, labor and delivery. If she breastfeeds her infant, there is an additional 12% chance of transmission (WHO, 2015). Vertical HIV transmission from mother to child accounts for more than 90% of pediatric AIDS and about 90% of these infections occur in developing countries, mainly Sub-Saharan Africa (UNAIDS, 2012). Globally in 2001, 1.8 million women became infected with HIV and approximately 800,000 children became HIV infected through MTCT (WHO, 2015). Prevention of mother-to-child HIV transmission (PMTCT) interventions have reduced MTCT of HIV to less than 2% in high income countries however, the rate remains high in poor resource settings in Africa ranging between 20% and 45% (De Cock *et al*, 2014).

Kenya is one of the countries most affected by the HIV/AIDS pandemic in the world with high MTCT rate ranging from 12% to 17% in rural and urban areas respectively (KAIS, 2016). Siaya County in Kenya stands with the highest HIV prevalence at 23.7% as compared with the rest of Counties. To effectively reduce MTCT, it is critical to establish the influencing factors towards MTCT among HEIs. This is equally critical in the global SDG 3 and Kenyan 2030 vision progress in child survival and health which cannot be achieved without addressing MTCT among HEIs. We quantitatively investigate the determinants of mother – to - child HIV transmission among HIV exposed infants in Siaya County. HIV-exposed infants (HEIs) and their mothers enrolled in PMTCT clinics between July 2013 and September 2013 were followed up retrospectively and their outcomes assessed at 18 months.

2. METHODOLOGY

2.1 STUDY AREA

The study was done in Siaya County located 100 kilometers south of Kisumu town covering an area of approximately 2,496.1 sq. Kms. The county has a total population of 842, 304 people of which 52 % females and 95% of the locals predominantly from the Luo Community (KNBS, 2009). Siaya county is made up of six Sub - Counties namely; Gem, Rarieda, Ugenya, Ugunja, Bondo and Alego Usonga. The county is one of the counties in Kenya with high HIV burden with a prevalence rate of 23.7% (KAIS, 2016). The six high volume PMTCT clinics randomly selected for the study include Siaya County Referral Hospital; Bondo Sub – County Hospital; Yala Sub – County Hospital; Madiany Sub – County Hospital; Ambira Sub – County Hospital; and Ukwala Health Center.

2.2 RESEARCH DESIGN

A retrospective quantitative cohort research design was adopted for this study. Data was abstracted from MCH medical records that included ante – natal care (ANC) registers, maternity registers and HIV exposed infant (HEI) registers as basis for records review. HIV- exposed infants (HIEs) born between July 2013 and September 2013 to HIV infected mothers enrolled in the six randomly selected MCH clinics were purposively sampled to

participate in the study and were retrospectively followed up as a mother – infant pair for 2 years to evaluate the HIE positivity outcome of the infant at 18 months.

2.3 STUDY POPULATION

In this study, the target population included a cohort of HIV exposed infants (HEIs) born between July 2013 and September 2013 and their mothers enrolled in the 6 randomly selected PMTCT MCH clinics in Siaya county. The reason this period has been chosen for review by the investigators is because the HEIs were to be followed up for 18 months retrospectively and so by July 2015 and September 2015, the cohort of HEIs would have matured allowing their outcomes to be evaluated at 18 months. The abstracted data from all 179 HIV exposed infants (HEIs) born to HIV infected mothers in the 6 high volume PMTCT clinics in Siaya County who were born between July & September 2013 and their positivity status assessed 24 months (2 years) later when they were existing the HEI program were used. This sample (179 HEIs) is above the statistically calculated sample size above.

The 6 PMTCT maternal and child health (MCH) clinics were purposively sampled from among prevention of mother – to – child HIV transmission (PMTCT) clinics in Siaya County. This is because these clinics are among the highest volume PMTCT clinics in Siaya County with good health records management systems at the maternal and child health department. The study is a retrospective quantitative cohort study that involved following up all HIV exposed infants (HEIs) and their mothers between July 2013 and September 2013 in the six PMTCT clinics.

2.4 INCLUSION CRITERIA

All HIV exposed infants (HEIs) who were born to HIV infected mothers between July 2013 and September 2013 in the six PMTCT MCH clinics were eligible for inclusion in to the study and were followed up retrospective to assess their HIV positivity status at 18 months while any infant whose mother died or did not have responsible guardian was excluded in the study.

2.5 RESEARCH INSTRUMENTS

This involved abstraction of data from the MCH records in the six PMTCT clinics. The data abstracted included mother's HIV positive status, age, marital status, antenatal care visits attended, PMTCT interventions received (PMTCT ARVs/ maternal prophylaxis), WHO staging, CD4 counts, presence of HIV opportunistic infections, place of delivery. Mode of delivery and duration of labor was abstracted using the tool from the ANC, Maternity & PNC registers. Data regarding infant's age, sex (gender), baby's birth weight, entry point, ARVs received at 0-6 weeks, (infant prophylaxis), date HIV test results confirmed, PMTCT ARVs received by mother, test at entry (Antibody & DNA/PCR test), infant feeding practice, Antibody (Ab) test at 9 months and Ab test at 18 months will abstracted from the HEI register.

2.6 PILOT TESTING OF INSTRUMENTS

The pilot study was conducted in Ahero Sub – County Hospital, Nyando Sub - County in Kisumu County for a period of one week. This was done to ensure appropriateness and suitability of the data collection tool. It adopted the procedures and sampling techniques outlined in the main study. From the pilot study, out of 71 variables in data abstraction tool, 96% of them were readily available in the MCH registers and this justified the strength of the tools with little correction for precision.

2.7 ETHICAL CONSIDERATION AND DATA COLLECTION PROCEDURE

The approval of study was done by the Board of Post Graduate Studies -Jaramogi Oginga Odinga University of Science and Technology and Jaromogi Oginga Odinga Teaching and Referral Hospital independent review board. Permission was sought from both the health facility in-charges and clinic in-charges to use MCH records. The MCH records used for data abstraction included; antenatal care (ANC) register, Maternity register, post-natal care (PNC) register and HIV exposed infants (HEI) registers. Data was collected within a period of two weeks from these six PMTCT clinics in Siaya County. The data collection process was mainly done by the study team and facility staff with Each HIV exposed infant (HEI) born to HIV infected mother between July and September 2013 in the HEI register was recorded in data abstraction tools.

2.8 DATA ANALYSIS PROCEDURE

The statistical consideration for the study included; descriptive statistics that was used to characterize the demographic, clinical and laboratory variables. Chi – Square test at 95 % confidence interval (CI) was used to test for association of determinants that influence transmission of mother to child HIV infection. Data entry was done in MS Excel then read into SAS 9.4 using MS Windows.

3. RESULTS

3.1 MATERNAL DEMOGRAPHIC CHARACTERISTICS

The mean and median maternal age was 29.7 and 30 years respectively. Mothers aged group 25 - 49 years were the highest proportion (62.0%), followed by 20 – 24 years at 28.5% and 10 – 19 years at 9.5 %. About 67.6% of the HIV infected mothers were in married relationships living with their partners, while about 60.33 % of mothers were in gravidity of < or = order 3 were. More than half (56.42 %) of HIV infected mothers had between 4 to 6 antenatal care (ANC) visits. Mothers who had > than 6 ANC attendance were 12.29 %. The study established that majority (84%) of the HIV infected women delivered in the hospital setting as shown in table 1.

Table 1: Distribution of maternal characteristics

Maternal Characteristics	Frequency	Percent (%)
Age group		
10-19	17	9.5
20-24	51	28.49
25-49	111	62.01
Total	179	100

Marital status of mother		
Married	121	67.6
Widowed	19	10.61
Single	29	16.2
Divorced	7	3.91
Separate	3	1.68
Total	179	100
Gravidity		
< or = 3	108	60.33
4 – 6	67	37.43
> 6	4	2.24
Total	179	100
Number of ANC visits		
1	19	10.61
2	29	16.21
3	8	4.47
4	27	15.08
5	37	20.67
6	37	20.67
7	20	11.17
8	2	1.12
Total	179	100
Place of Delivery		
Hospital	150	84
Non-hospital	29	16
	179	100

3.2 MATERNAL CLINICAL CHARACTERISTICS

The maternal clinical characteristics of the HIV infected mothers that are described in this section include; WHO staging, baseline CD 4, viral load (VL), presence of opportunistic infections, maternal prophylaxis, place of delivery and duration of delivery among others. From the study findings it was established that 37 % of the HIV infected mother were in WHO stage II at entry in to antenatal care (ANC), followed by those in WHO stage I at 32 % while those with WHO stage III & IV were 18 % and 13 % respectively as indicated in the pie chart below. Figure 1 provides details of the same.

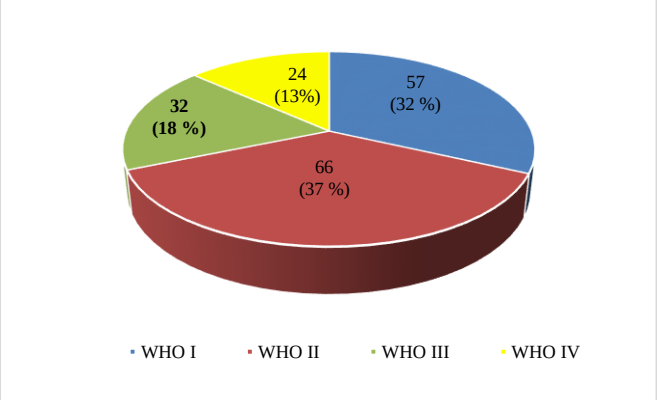


Figure 1: Distribution of WHO staging among HIV infected mothers at entry in to ANC

From study we noted that high proportion (49.7%) of HIV infected mothers who participated in the study had baseline CD 4 values above 500 copies/ microliter. This was followed by those who were in baseline CD 4

category 351 – 500, 151 – 350 and 0 – 150 at 22.9%, 14.5% and 12.9% respectively. Figure 2 shows distribution of baseline CD 4 among HIV infected mothers

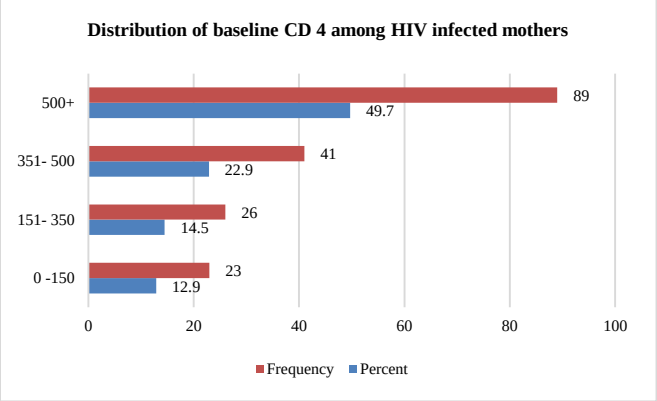
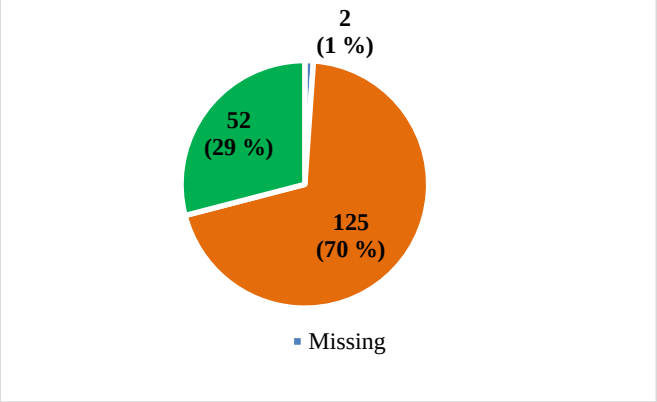


Figure 2: Distribution of baseline CD4 among HIV infected mothers

In this study viral load (VL) suppression was considered to include VLs with lower detectable limit (LDL) and less than 1000 copies / milliliter and those with VL above 1000 copies / milliliter (inclusive of LDL) were considered to be not virally suppressed. Figure 3 shows that majority of HIV infected mothers were virally suppressed at baseline after 6 months of ART initiation at 70 % while those who were not virally suppressed were 39 %. 2 mothers had missing VL results contributing to 1 %.

Figure 3: Distribution of viral load suppression at baseline after 6 months of ART initiation among HIV infected mothers



The study revealed that high proportion of the HIV infected mothers had no opportunist infection at 78.7 %. 10 % of the mothers had tuberculosis (TB) followed by those who had opportunist infections such as pnuemocystis jirovecii pneumonia (PCP), Kaposi's sarcoma, cytomegalovirus (CMV), candidiasis and others. About 68.2% of the HIV infected mothers had labor that last between 0 to 11 hours, those who had more than 14 hours duration of labor at 20.1% and those who had 12 to 13 hours of labor at 11.7% as shown in Table 2.

Table 2: Distribution of opportunistic infections among HIV infected mothers

Opportunistic infection	Frequency	Percent
TB	18	10.0
Kaposi's sarcoma	1	0.6
Cytomegalovirus (CMV)	1	0.6
Pnuemocystis Jirovecii Pneumonia (PCP)	14	7.8
Candidiasis	3	1.7
None	141	78.7
Others	1	0.6
Total	179	100
Duration of labor categories (in hours)		
0 – 11	122	68.2
12 – 13	21	11.7
14+	36	20.1
Total	179	100

In terms of the specific maternal ARVs dispensed, the study revealed that 47% of the HIV infected mothers received highly active antiretroviral therapy (HAART) followed by AZT/3TC/NVP at 32%, interrupted HAART has 2 % and those who were issued with single dose nevarapine (sdNVP) were 1 %. A good proportion of HIV infected mothers at 17% were not issued with maternal ARVs as was indicated in Figure 4.

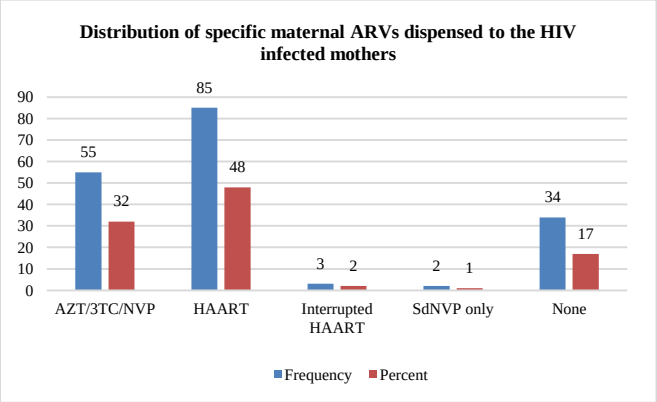


Figure 4: Distribution of specific maternal ARVs dispensed to the HIV infected mothers

3.3 INFANT DEMOGRAPHIC CHARACTERISTICS

The demographic characteristics of the HIV exposed infants (HEIs) described in this section include age, gender, birth weight and infant feeding options at 6 months, 9 months and 18 months.

The study revealed that high proportions (78.8%) of infants born to HIV infected mothers were enrolled in the HEI program at 6 weeks of age. Table 3 shows the distribution of the HIV exposed infants (HEIs) ages in weeks.

Table 3: Age distribution among HIV exposed infants

Infant age in weeks	Frequency	Percent
2	1	0.6
3	10	5.6
4	10	5.6
5	1	0.6
6	141	78.8
7	4	2.2
8	5	2.8

9	3	1.7
Missing	4	2.2
Total	179	100

From the pie chart below (Figure 4.7) it is evident that just about half of the HIV exposed infants (HEIs) were males at 51.4% while female HEIs were 48.6%.

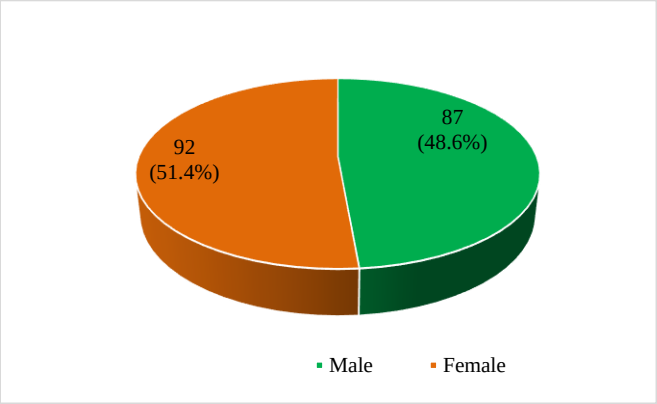
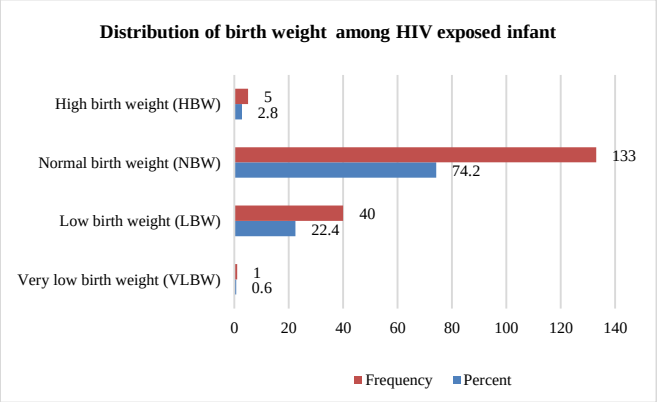


Figure 5: Distribution of gender among HIV exposed infants

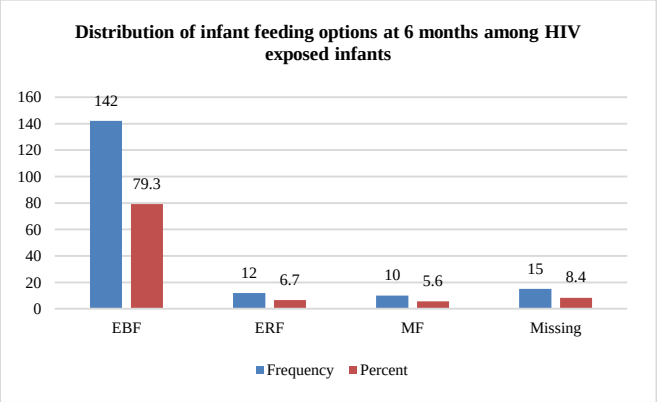
The study established that a high proportion of infants at 74.3% had normal birth weight (NBW). Up to 22.4% of infants had low birth weight (LBW), followed by those with high birth weight (HBW) and very low birth weight (VLBW) at 2.8% and 0.6% respectively. Figure 4.8 provides more details.

Figure 6: Distribution of birth weight among HIV exposed infants



The study assessed infant feeding options or practices among HIV exposed infants (HEIs) at 6 months, 12 months and 18 months. These 3 time points of infant feeding practices are discussed below in details. The study has also revealed that at 6 months a high proportion of infants had exclusive breastfeeding (EBF) options at 79.3% followed by exclusive replacement feeding (ERF) and mixed feeding (MF) at 6.7% and 5.6% respectively. About 8.4% infant had missing infant feeding option data at 6 months. Figure 4.9 provides a summary of the distribution of infant feeding options at 6 months.

Figure 7: Distribution of infant feeding options at 6 months among HIV exposed infants



3.4 INFANT FEEDING OPTIONS

Infant feeding options were also reviewed at 9 months among the HIV exposed infants (HEIs) which showed that 60.3% of HEIs were still being breast fed (BF) while 26.3% of HEIs had already stopped breast feeding all together. About 81.6% had no breast feeding (No BF) option while those who still had breast feeding options (BF) at 18 months were 4.5% as was expected. 13.9% HEIs had missing data on breast feeding option as shown in table 4.

Table 4: Distribution of infant feeding options at 9 months and 18 months among HIV exposed infants

Infant feeding options at 9 months	Frequency	Percent
BF	108	60.3
No BF	47	26.3
Missing	24	13.4
Total	179	100
Infant feeding options at 18 months		
BF	8	4.5
No BF	146	81.6
Missing	25	13.9
Total	179	100

3.5 HIV INCIDENCE RISK AMONG EXPOSED INFANTS

Out of 179 HIV exposed infants (HEIs) born to HIV infected mothers who were enrolled in the study 145 of them were followed through to 18 months. Of the 145 HEIs, 25 of them were positive at 18 months as they exit the HEI program giving an overall HIV prevalence rate of 17%.

With regards to specific HIV prevalence among HEIs in the 6 PMTCT health facilities that participated in the study, Madiany sub – county hospital (Rarieda sub – county) had the highest prevalence at 19.2%, followed by Ambira sub – county hospital (Ugunja sub – county) and Ukwala sub – county hospital all at 17.7%, Bondo sub – county hospital at 17.1%, Yala sub – county hospital at 15.4% and finally Siaya county referral hospital had a HIV incidence risk of 15%. The Table 5 provides more details on the HIV incidence risk among HEIs in these health facilities.

Table 5: Specific HIV prevalence among HEIs in the six health facilities

Health facility	HIV status at 18 months of follow up	
	Pos (n, HIV incidence risk %)	Neg (%)
Ambira sub - county Hospital	6.0 (17.7)	28.0 (82.4)
Bondo sub - county Hospital	6.0 (17.1)	29.0 (82.9)
Madiany sub - county Hospital	5.0 (19.2)	21.0 (80.8)
Siaya County Referral Hospital	3.0 (15.0)	17.0 (85.0)
Ukwala sub - county Hospital	3.0 (17.7)	14.0 (82.4)
Yala sub - county Hospital	2.0 (15.4)	11.0 (84.6)
Total	25(17)	120(83)

3.6 DETERMINANTS ASSOCIATED WITH HIV TRANSMISSION AMONG HIV EXPOSED INFANTS

The association between determinants of mother – to – child HIV transmission (MTCT) was determined using Chi – Square test at 95% confidence interval (CI). From the study, it was found that determinants such as provision of mother's ARVs at ANC (maternal PMTCT prophylaxis), infant neverapine (NVP) and cotrimoxazale (CTX) were significantly associated with mother – to – child HIV transmission (MTCT) among HIV exposed infants each with a p value of 0.001 at 95% CI. Immunological determinants such as CD (cluster of differentiation) 4 count and viral load (VL) suppression had association with mother – to – child HIV transmission which were found to be statistically significant ($p<0.001$, 95% CI). The study also established that the presence of opportunist infections such as tuberculosis (TB), pnuemocystis jirovecii pneumonia (PCP), Kaposi's sarcoma and Cytomegalovirus (CMV) among others were significantly ($p<0.0001$, 95% CI) associated with MTCT.

The study findings demonstrated that determinants such as number of antenatal care (ANC) visits (attendance), place of delivery and duration of labor (in hours) had significant association ($p<0.0001$, $p<0.0001$ and $p<0.0002$ respectively at 95% CI) with mother – to – child HIV transmission (MTCT).

This study found out that infant feeding options at different time points had varied association with mother – to – child HIV transmission (MTCT). The association between infant feeding options at 6 months and MTCT was found to be statistically significant ($p<0.0001$) while infant feeding options at 12 months and 18 months were not significantly associated with MTCT ($p<0.7792$ and $p<0.0116$ respectively at 95% CI). Table 6 provides more details on the p – values of these determinants to show their association with MTCT.

Table 6: Association between determinants of mother – to – child HIV transmission

Determinant (contributing variable)	Category	HIV status at 18 months		$\chi 2$	p value
		Positive n (%)	Negative n (%)		
Mother's ARVs prophylaxis dispensed at ANC (Maternal PMTCT prophylaxis)	Yes	6(5.2%)	110(94.8%)	124.5	<.0.001
	No	19(63.3%)	11(36.7%)		
CD4 Count	0-150	8(61.5%)	5(38.5%)	82.2	<.0.001
	151-350	6(28.6%)	15(71.4%)		
	351-500	6(15.4%)	33(84.6%)		
	500+	5(6.9%)	67(93.9%)		
VL at 6 months of ART initiation	Suppressed	7(6.2%)	107(93.8%)	73.0	<.0.001
	Not Suppressed	18(58.1%)	13(41.9%)		
Presence of opportunistic infections	Yes	19(79.2%)	5(20.8%)	125.1	<.0.001
	No	6(5.0%)	115(95.0%)		
Number of ANC visits attended	<4 visits	18(50.0%)	18(50.0%)	55.2	<.0.001
	4+ visits	7(6.4%)	102(93.6%)		
Place of delivery	Not hospital	20(90.9%)	2(9.1%)	98.6	<.0.001
	Hospital	5(4.1%)	118(95.9%)		
Duration of labor (hours)	0-11 hours	5(4.8%)	99(95.2%)	106.2	<.0.002
	12-13 hours	6(28.6%)	15(71.4%)		
	14+ hours	14(70.0%)	6(30.0%)		
Feeding_option_6months	EBF	13(10.8%)	107(89.2%)	22.6	<.0.001
	ERF	5(38.5%)	8(61.5%)		
	MF	7(58.3%)	5(41.7%)		
Feeding_option_12months	BF	16(16.2%)	82(83.8%)	0.1	0.7792
	No BF	7(15.9%)	37(84.1%)		
Feeding_option_18months	BF	6(54.5%)	5(45.5%)	6.4	0.0116
	No BF	21(84.0%)	116(96.7%)		
Both NVP and CTX given at 6 weeks	No	19(76.0%)	6(24.0%)	97.9	<.0.001
	Yes	6(5.0%)	114(95.0%)		

3.7 OUTCOMES OF HIV EXPOSED INFANTS (HEIS) AT 18 MONTHS

The study also sought to evaluate outcomes at 18 months of follow ups among the HIV exposed infants (HEIs). It was observed that at 18 months of exit from the HEI program a high proportion of HEIs were negative at 64.2% followed by HEI positives at 17%. Transferred out, lost to follow up (LTFU) and dead outcomes were 8.0%, 8.0% and 2.8% respectively. The Figure 8 provides a summary of the HEI outcomes at 18 month of follow up.

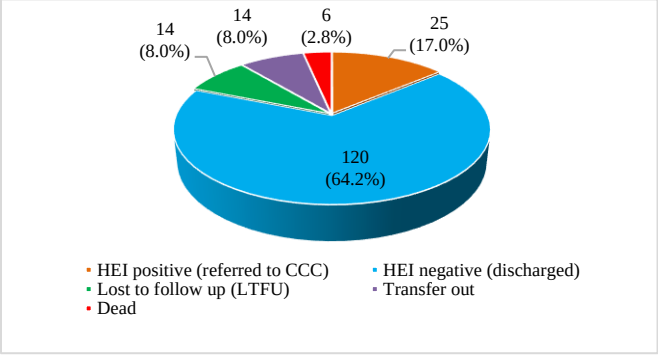


Figure 8: HEI outcomes at 18 months of follow up

4. DISCUSSIONS

4.1 PREVALENCE OF HIV AMONG EXPOSED INFANTS BORN TO HIV INFECTED MOTHERS

Findings of this study reveal an overall prevalence of 17% among HIV exposed infants after 18 months of follow up. This is somewhat comparable to HIV prevalence of Siaya County which at about 24.7% making the county one of highest burden HIV counties in Kenya (Kenya County HIV Profile Report, 2015). The findings are also in line with a similar study done by Abere et al. 2012 that found similar HIV prevalence among HIV exposed infants (Abere et al, 2012). For the 6 PMTCT maternal & child health clinics that participated in the study their specific HIV prevalence among HEIs is similar with the study on HEIs that was done in Kisii level 5 Hospital (Abere et al, 2012).

Most of the HIV prevalence observed in these PMTCT health clinics mimic the high prevalence observed in Siaya county by Kenya HIV AIDS indicator survey (KAIS) conducted in Kenya (KAIS, 2015). The findings from this survey (KAIS, 2015) also showed Siaya County has a high HIV burden county and the second highest HIV prevalent county in Kenya as was evidenced in the Kenya County HIV Profile Report (Kenya County HIV Profile Report, 2015).

4.2 DETERMINANTS OF HIV TRANSMISSION AMONG HIV EXPOSED INFANT

The findings of this study reports that determinants such as provision of mother's antiretroviral (ARV) drugs at entry into antenatal care (ANC), infant neverapine (NVP) at entry into ANC and cotrimoxazale (CTX) at entry into ANC were significantly associated with mother – to – child HIV transmission (MTCT) among HIV exposed infants (HEIs). These findings are consistent with other studies that were done in Africa and Europe that made similar findings (Ioannidis et al, 2015, Cooper et al, 2015, Guay et al, 2014 and WHO, 2016).

Ioannidis et al. (2015) found out that antiretroviral (ARV) drugs have been shown to reduce the risk of transmission even among women with HIV RNA levels <1,000 copies/mL (Ioannidis, 2001). Guay et.al, 2014 established that a regimen as simple as one dose of nevirapine (a nonnucleoside reverse transcriptase inhibitor, NNRTI) given to mother at the onset of labor and to the baby within the first 72 h of life (but as close to birth as possible) was associated with a 41% relative reduction in the risk of transmission through to 18 months (Guay et.al, 2014).

World Health organization (WHO) has also shown that rate of mother – to – child HIV transmission can be reduced to levels below 5% with effective interventions such as timely provision of maternal and infant anti – retroviral therapy (WHO, 2016).

The study findings has also reported a significant association between baseline immunological determinants such as CD (cluster of differentiation) 4 count and viral load (VL) suppression and mother – to – child HIV transmission. These findings are in agreement with studies that were done by Ngwede et al., (2013), Garcia et al., (2014) and Shearer, (2013) that found that lower baselineCD4+ counts and high baseline VL were associated

with a higher risk of mother – to – child HIV transmission (MTCT) among HIV exposed infants (Ngwede et al., 2013, Garcia et al., 2014 and Shearer 2013).

The findings are also in accordance with a study that was done among children born to HIV infected women that found out that women with advanced HIV disease are more likely to show high baseline viral loads during the first months of life and are at a higher risk of developing AIDS or dying thus at a higher chance of transmitting the virus to their uninfected children (Shearer, 2013).

The current study has found associations between presence of opportunist infections such as tuberculosis (TB), Pnuemocystis Jirovecii Pneumonia (PCP), Kaposi's sarcoma and cytomegalovirus (CMV) among others and MTCT ($p<0.0001$, 95% CI). This is in accordance with a study that was done by Ngwede et al, (2013) that showed that low CD4+ counts were associated with more advanced disease and sicker mothers who were more likely to transmit the virus to their infants than HIV-infected mothers who are still clinically healthy (Ngwede et. al, 2013).

The study findings also demonstrated that determinants such as number of antenatal care (ANC) visits (attendance), place of delivery and duration of labour (in hours) had significant association with mother – to – child HIV transmission (MTCT). These findings are consistent with the findings that were established by Ngwede et al., (2013) that showed that those who delivered in hospital had a reduced risk of MTCT (Ngwede, 2013). Landesman et al., (2016) also found out that the risk of mother – to – child HIV transmission (MTCT) among HIV exposed infants (HEIs) increased by about 2% for every additional hour of duration of ruptured membranes during labor which clear shows that long duration of labor were associated with increase chances of MTCT (Landesman et al, 2016).

The study findings have shown that infant feeding options at different time points had varied association with mother – to – child HIV transmission (MTCT). The association between infant feeding options at 6 months and MTCT was found to be statistically significant while the study failed to find an association between infant feeding options at 12 months and 18 months and MTCT. Studies done elsewhere have shown that infant feeding option was associated with MTCT with some postulating that mixed feeding was riskier than exclusive breast or formula feeding. (Coustaudis, 2015, Perinatal HIV Research Unit, 2016 and ICW, 2015). These finding of the current study are also consistent with Kourtis et. al, 2015 that found out that for breastfeeding populations, if the period of breastfeeding is shortened from the 18-24 months (as is common in resource - limited settings) to the 6-12 months recommended by WHO, breastfeeding - associated HIV transmission falls markedly, as does the total rate of MTCT (Kourtis et al, 2015).

4.3 OUTCOMES OF HIV EXPOSED INFANTS (HEIS)

The study findings has reported HEI outcomes after 18 months of follow up as follows; 64.2 % being negative, 17% being positive, and transferred out, lost to follow up (LTFU) and dead outcomes were 8.0%, 8.0% and

2.8% respectively. The mother – to – child HIV transmission rate of 17% reported by the study is in accordance with HIV prevalence rate from Kenya AID Indicator Survey report by NASCOP (KAIS, 2015).

The findings of the current study are somewhat consistent with findings that were made by Abere et al, (2014) who did a similar study in a similar setting in Kisii County referral hospital and found out that out of HIV exposed infants (HEIs) sampled from the population 13.5 % of them were HIV positive after 18 months of follow up (Abere et al, 2014).

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

- The study identified determinants such as maternal anti – retroviral drugs (ARVs), infant ARVs, CD 4, viral load (VL), opportunist infections (OIs), number of ANC attendance (visits), place of delivery and duration of delivery to be associated with mother – to – child HIV transmission (MTCT). However, for infant feeding options the study established that this factor (determinant) had varied associations at different time points with significant association being observed at 6 months while at 12 months and 18 months, the association of infant feeding options was not significant.

5.2 RECOMMENDATIONS

- HIV infected expectant mothers should be consistently provided with maternal ARVs (PMTCT prophylaxis) and infant prophylaxis (nevarapine) to reduce the risk of mother – to – child HIV transmission among HIV exposed infants (HEIs). It is also recommended that HIV infected expectant and lactating mothers should have their CD 4 and viral load routinely monitored as these immunological factors were significantly associated with mother – to – child HIV transmission (MTCT). The study team recommends that HIV infected mothers and their exposed infants (HEIs) should be provided with cotrimoxazole (CTX) drug which is an antibiotic to reduce the chances of them contracting opportunist infections (OIs) which were significantly associated with MTCT.
- HIV infected mothers should be encouraged to consistently attend ANC clinic and deliver in a hospital setting under the care of a skilled attendant as these determinants were associated with MTCT significantly. The mothers should be encouraged to offer exclusive breastfeeding practices to their infants at 6 months because of the significant association that was observed at the 6 months. We have recommended that HIV infected expectant mothers should not be allowed to go for prolonged labour during delivery as this had a significant association with MTCT.
- There is a need to evaluate pre – conception models for HIV infected women intending to conceive so that they are prepared accordingly based on the determinants of mother – to – child HIV transmission in order to reduce the risk of these mothers transmitting the HIV virus to their exposed infants. Such studies will provide more insight to health professional working in PMTCT program to evaluate and consistently

monitor immunological factors such as CD 4, viral load and opportunistic infections of HIV infected women with intention to get pregnant prior to conception.

– There is a need to investigate the association of retention among HIV infected mothers and mother – to – child HIV transmission in terms of HEI positivity outcomes at 18 months. Such a study would bring out aspects on whether retention of HIV infected mothers would influence chance of mother – to – child HIV transmission.

6. REFERENCE

Anigilaje Emmanuel Ademola and Olutola Ayodotun, (2013). Prevalence and Clinical and Immunoviralogical Profile of Human Immunodeficiency Virus-Hepatitis B Coinfection among Children in an Antiretroviral Therapy Programme in Benue State, Nigeria. ISRN Pediatr. 2013: 932697.

Anon, (2015). The mode of delivery and the risk of vertical transmission of human immunodeficiency virus type 1. *N Engl J Med*, 340, 977-87.

AVERT, (2015) (http://www.avert.org/hiv-aids-sub-saharan-africa.htm - accessed on 3rd Aug 2015 at 8.30pm).

Avy Violari, F.C.Paed., Mark F. Cotton, M.Med., Ph.D., Diana M. Gibb, M.D., Abdel G. Babiker, Ph.D., Jan Steyn, M.Sc., Shabir A. Madhi, F.C.Paed., Ph.D., Patrick Jean-Philippe, M.D., and James A. McIntyre, F.R.C.O.G. for the CHER Study Team, (2008); Early Antiretroviral Therapy and Mortality among HIV-Infected Infants; N Engl J Med 2014; 359:2233-2244 November 20, 2014DOI: 10.1056/NEJMoa0800971.

Bartlett, J. E., II; Kotrlik, J. W.; Higgins, C. (2014). "Organizational research: Determining appropriate sample size for survey research" (PDF). Information Technology, Learning, and Performance Journal. 19 (1): 43–50.

Chuachoowong R, Shaffer N, VanCott TC, et al. (2013). Lack of association between human immunodeficiency virus type 1 antibody in cervicovaginal lavage fluid and plasma and perinatal transmission, in Thailand. *J Infect Dis*, 181, 1957-63.

Clemens J, Elyazeed RA, Rao M, et al, (2013). Early initiation of breastfeeding and the risk of infant diarrhea in rural Egypt. *Pediatrics*, 104(1): e3.

Clemens JD, Rao MR, Chakraborty J, et al, (2015). Breastfeeding and the risk of life threatening enterotoxigenic Escherichia coli diarrhea in Bangladeshi infants and children. *Pediatrics*, 100: e2.

Clemetson DBA, Moss GB, Willerford DM, et al, (2015). Detection of HIV DNA in Cervical and Vaginal secretions. *JAMA*, 269, 2860-2864.

Cooper ER, Charurat M, Mofenson L, Hanson IC,Pitt J, Diaz C, Hayani K, Handelsman E, Smeriglio V and Hoff R, Blattner W, (2015). Women and Infants' Transmission Study Group. Combination antiretroviral strategies for the treatment of pregnant HIV-1-infected women and prevention of perinatal HIV-1 transmission. J Acquir Immune Defic Syndr,. 29(5): p. 484-94.

Coustoudis A, Pillay K, Spooner E, Kuhn L and Coovadia HM, (1999). Influence of infant feeding patterns on early mother to child transmission of HIV-1 in Durban South Africa; A prospective cohort study. South African Vitamin A Study Group. Lancet 1999, 354(9177):471–476.

Coutsoudis A (2013). Influence of infant feeding patterns on early mother-to-child transmission of HIV-1 in Durban, South Africa. Ann N Y Acad Sci 918: 136-144.

Coutsoudis A, Pillay K, Spooner E, Kuhn L and Coovadia HM (2015). Randomized trial testing the effect of vitamin A supplementation on pregnancy outcomes and early mother-to-child HIV-1 transmission in Durban, South Africa. South African Vitamin A Study Group *AIDS*, 13, 1517-24.

De Cock KM, Fowler MG, Mercier E, de Vinci I, Saba J, Hoff E, Alnwick DJ, et al, (2014). Prevention of Mother to child HIV transmission in resource poor countries: translating research into policy and practice. JAMA 2000, 283(9):1175–1182.

Dexter SC, Pinar H, Malee MP, Hogan J, Carpenter MW and Vohr BR, (2015). Outcome of very low birth weight infants with histopathologic chorioamnionitis. *Obstet Gynecol*, 96, 172-7.

Garcia PM, Kalish LA, Pitt J, Minkoff H, Quinn TC, Burchett SK, Kornegay J, Jackson B, Moye J, Hanson C, Zorrilla C and Lew JF, (2014). Maternal levels of plasma human immunodeficiency virus type 1 RNA and the risk of perinatal transmission. Women and Infants Transmission Study Group. N Engl J Med, 341(6):394–402.

Goedert JJ, Duliege AM, Amos CI, Felton S and Biggar RJ, (2013). High risk of HIV infection for first-born twins. The International Registry of HIV-exposed Twins. *Lancet*, 338, 1471-5.

Gourlay A, Birdthistle I, Mburu G, Iorpenda K, Wringe A, (2013). Barriers and facilitating factors to the uptake of antiretroviral drugs for prevention of motherto- child transmission of HIV in sub-Saharan Africa: a systematic review. J Int AIDS Soc 16: 18588.

Guay LA, Musoke P, Fleming T, Bagenda D, Allen M, Nakabiito C, Sherman J, Bakaki P, Ducar C, Deseyve M, Emel L, Mirochnick M, Fowler MG, Mofenson L, Miotti P, Dransfield K,Bray D, Mmiro F and Jackson JB, (2014). Intrapartum and neonatal single-dose nevirapine compared with zidovudine for prevention of mother-to-child transmission of HIV-1 in Kampala, Uganda: HIVNET 012 randomised trial. *Lancet.*, 354: 795-802.

HIVNET 012, (2004). A Phase IIB Trial to Determine the Efficacy of Oral AZT and the Efficacy of Oral Nevirapine for the Prevention of Vertical Transmission of HIV-1 Infection in Pregnant Ugandan Women and Their Neonates.

I. A. Moth, A. B. Ayayo, and D. O. Kaseje, "Assessment of utilisation of PMTCT services at Nyanza Provincial Hospital, Kenya," Journal of Social Aspects of HIV/AIDS Research Alliance, vol. 2, no. 2, pp. 244–250, 2005. View at Google Scholar · View at Scopus.

ICAP (International Center for AIDS Care and Treatment Programs), (2016). "Improving Retention, Adherence and Psychosocial Support within PMTCT Services: A Toolkit for Health Workers." Columbia University: 2016. Print.

International Community of Women Living with HIV/AIDS (ICW), (2015). Ioannidis JP, Abrams EJ and Ammann A (2015). Perinatal transmission of human Immunodeficiency virus type 1 by pregnant women with RNA virus loads <1000 copies/ml. J Infect Dis 2001, 183(4):539–545.

Janz, Nancy K.; Marshall H. Becker (1984). "The Health Belief Model: A Decade Later". Health Education & Behavior. 11 (1): 1 - 47. doi:10.1177/109019818401100101.

John GC, Nduati RW and Mbori-Ngacha DA (2014). Correlates of mother-to-child human immunodeficiency virus type 1 (HIV-1) transmission: association with maternal plasma HIV-1 RNA load, genital HIV-1 DNA shedding, and breast infections. *J InfectDis*, 183, 206-212.

Joint United Nations Programme on HIV/AIDS (UNAIDS) (2016). Follow-up to the 2001 United Nations General Assembly Special Session on HIV/AIDS, Progress Report on the Global Response to the HIV/AIDS Epidemic.

Kaneda T, Shiraki K, Hirano K and Nagata I, (2014). Detection of maternofetal transfusion by placental alkaline phosphatase levels. *J Pediatr*, 130, 730-5.

Kenya AIDS Indicator Survey (KAIS), (2014).

Kenya AIDS Indicator Survey (KAIS), (2016).

Kenya HIV Estimates, (2016).

Kenya National Bureau of statistics census (KNBS), (2009).

Kinuthia, J., Kiarie, J., Farquhar, C., Richardson, B. A., Nduati, R., Mbori-Ngacha, D. and John-Stewatt, G., (2014). Uptake of prevention of mother to child transmission interventions in Kenya: Health systems are most influential than stigma, *Journal of International Aids society*, 14 : 61.

Kourtis AP, Bramson B, van der Horst C, et al, (2015). Low absolute neutrophil counts in African infants. J Int Assoc Physicians AIDS Care (Chic Ill);4(3):73-6.

Lallemant M, Jourdain G, Le Coeur S et. al (2014). A trial of shortened zidovudine regimens to prevent mother-to-child transmission of Human Immunodeficiency Virus Type 1 N. Eng J Med 343:982-91.

Landesman SH, Kalish LA, Burns DN, Minkoff H, Fox HE, Zorrilla C, et al, (2016). Obstetrical factors and the transmission of human immunodeficiency virus type 1 from mother to child. N Eng J Med 1996, 334:1617–1623.

Loussert-Ajaka I, Mandelbro L, Delmas, M, et al. (2013). HIV-1 detection in Cervicovaginal secretions during pregnancy. *AIDS*, 11, 1575--1581.

Manda SO, (1999). Birth intervals, breastfeeding and determinants of childhood mortality in Malawi. *Soc Sci Med*, 48, 301-12.

Marinda E, Humphrey JH, Iliff PJ, Mutasa K, Nathoo KJ, Piwoz EG, Moulton LH, Salama P, Ward BJ and ZVITAMBO Study Group, (2013). Child mortality according to maternal and infant HIV status in Zimbabwe. Pediatr Infect Dis J. Jun;26(6):519-26.

Mock PA, ShafferN, Bhadrakom C, et al, (2014). Maternal viral load and timing of mother-to child HIV transmission, Bangkok, Thailand. Bangkok Collaborative Perinatal HIV Transmission Study Group. *AIDS*, 13, 407-14.

Morrow AL, Reves RR, West MS, Guerrero ML, Ruiz-Palacios GM and Pickering LK, (2016). Protection against infection with Giardia lamblia by breast-feeding in a cohort of Mexican infants. *J Pediatr*, 121, 363-70.

Mwanyumba F, Claeys P, Gaillard P, et al, (2013). Correlation between maternal and infant HIV infection and low birth weight: a study in Mombasa, Kenya. *Journal of Obstetrics and Gynaecology*, 21, 27-31.

Nduati R, John G, Mbori-Ngacha D, et al, (2015). Effect of breastfeeding and formula feeding on transmission of HIV-1: a randomized clinical trial *JAMA*, 283, 1167 -74.

Ngwede, S., Gombel, N., Midzi, S., Tshimanga, M., Shambira, G., and Chadambuka, A., (2013). Factors associated with HIV infection among children born to mothers on the prevention of mother to child transmission programme at Chitungwiza Hospital, Zimbabwe. *BMC Public Health*, 13:1181.

O. J. Igumbor, S. Pengpid, and C. L. Obi, "Effect of exposure to clinic-based health education interventions on behavioural intention to prevent mother-to-child transmission of HIV infection," Journal of Social Aspects of HIV/AIDS Research Alliance, vol. 3, no. 1, pp. 394–402, 2006.

Onyango AW, Esrey SA and Kramer MS, (2016). Continued breastfeeding and child growth in the second year of life: a prospective cohort study in Western Kenya *Lancet*, 354,2041-5.

Padian Nancy S., McCoy Sandra I., Karim Salim Abdool, Hasen Nina, Julia Kim, Michael Bartos, Elly Katabira, Stefano Bertozzi, Bernhard Schwartländer, and Myron S. Cohen, (2014). HIV prevention transformed: the new prevention research agenda. Lancet; 378(9787): 269–278. doi: 10.1016/S0140-6736(11)60877-5.

Perinatal HIV Research Unit (2014), Journ- AIDS fact sheet, page 21. Accessed from http//www.journaids.org

PMTCT Programmes Towards the Elimination of New HIV Infections Among Children by 2015 and Keeping Their Mothers Alive.

Popkin BM, Adair L, Akin JS, Black R, Briscoe J and Flieger W, (2015). Breast-feeding and diarrheal morbidity. *Pediatrics*, 86, 874-82.

Ryder RW, Manzila T, Baende E, et al, (2015). Evidence from Zaire that breast-feeding by HIV-1-seropositive mothers is not a major route for perinatal HIV-1 transmission but does decrease morbidity. *AIDS*, 5, 709-14.

S. Landesman, L. Kalish, D. Burns et al., (2016). Obstetrical factors and the transmission of Human immunodeficiency virus type 1 frommother to child. TheWomen and Infants Transmission Study, *New England Journal of Medicine*, vol. 334, no. 25, pp. 1617–1623.

Shearer W.Z, Ekpini, E. and Nduati, R.W. (2013) Prevention of Mother-to-Child Transmission of HIV-1 in Africa. *AIDS*, 11, S79-S87.

Siddiqui, Taranum Ruba; Ghazal, Saima; Bibi, Safia; Ahmed, Waquaruddin; Sajjad, Shaimuna Fareeha (2016-11-10). "Use of the Health Belief Model for the Assessment of Public Knowledge and Household Preventive Practices in Karachi, Pakistan, a Dengue-Endemic City". PLOS Neglected Tropical Diseases. 10 (11):e0005129.

The International Perinatal HIV Group, (2014) "The mode of delivery and the risk of vertical transmission of human immunodeficiency virus type 1," *New England Journal of Medicine*, vol. 340, pp. 977–987.

UNAIDS (2012). UNAIDS report on the global AIDS epidemic, Geneva.

UNAIDS (2013 & 2016). Global Fact Sheet", Joint United Nations Programme on HIV and AIDS. UNAIDS best practice collection (http://data.unaids.org/publications/IRCpub02/ jc750-paediatric-pov_en.pdf accessed 12/May/15)

UNAIDS (2013). Geneva; Paediatric HIV infection and AIDS: UNAIDS point of view.

UNAIDS (2013). UNAIDS Report on the global AIDS epidemic, Geneva.

UNAIDS (2016). UNAIDS report on the global AIDS epidemic, 2012. Geneva.

UNAIDS Report on the global AIDS epidemic 2012. Geneva: UNAIDS; 2012.

UNAIDS: Paediatric HIV infection and AIDS: UNAIDS point of view. UNAIDS best collection. Geneva; 2016. (http://data.unaids.org/publications/IRCpub02/jc750 paediatric-pov_en.pdf accessed 12/07/15.].)

Violari Avy, F.C.Paed., Mark F. Cotton, M.Med., Diana M. Gibb, M.D., Abdel G. Babiker, Jan Steyn., Shabir A. Madhi, F.C.Paed Patrick Jean Philippe, M.D., and James A. McIntyre, F.R.C.O.G. for the CHER Study Team, (2014). Early Antiretroviral Therapy and Mortality among HIV-Infected Infants. N Engl J Med 2008; 359:2233-2244 DOI: 10.1056/NEJMoa0800971.

Weinberg GA (2014). The Dilemma of Postnatal Mother-to-Child Transmission of HIV.

WHO (2013). Effect of breastfeeding on infant and child mortality due to infectious diseases in less developed countries: a pooled analysis. WHO Collaborative Study Team on the Role of Breastfeeding on the Prevention of Infant Mortality. *Lancet*, 355, 451-5. World Health Organization (WHO) HIV Report (2015).

WHO Report (2013). Guidelines on antiretroviral drugs (ARVs) for HIV infected pregnant women.

WHO Report (2015). A short guide on Methods Measuring the Impact of National

WHO Report (2015). Global Health Observatory (GHO) data (http://www.who.int/gho/hiv/en/accessed on 6th Aug 2015 at 11.30am).