

Adherence to Prevention of Mother-to-Child Transmission Service and its Effect on HIV Status of Children Born to HIV Mothers in Tema Metropolis

Andrews Asamoah^{1*} and Ruth Panford²

¹Department of Science, Harbin Normal University, Harbin, China

²Department of Curriculum and Instruction, Renmin University of China, Beijing, China

*Corresponding author: Andrews Asamoah, Department of Science, Harbin Normal University, Harbin, China, E-mail: kbasamoah83@gmail.com

Received date: October 25, 2021; **Accepted date:** November 9, 2021; **Published date:** November 16, 2021

Citation: Asamoah A, Panford R (2021) Adherence to Prevention of Mother-to-Child Transmission Service and its Effect on HIV Status of Children Born to HIV Mothers in Tema Metropolis. Health Sys Policy Res Vol.8 No.S3: 11.

Abstract

Background: WHO has estimated that 15%-45% of infants exposed to HIV are likely to be infected vertically and this continues to remain a challenge for management of HIV in children even with the existence of HIV and AIDS Anti-Retroviral Treatment (ART). Prevention of Mother-to-Child Transmission (PMTCT) of HIV program was put in place by WHO to reduce mother-to-child transmission of HIV in children born to HIV positive pregnant women. Although there is an availability of PMTCT interventions, utilization of the services is limited in Sub Saharan Africa including Ghana and this has resulted in high infection rates among children. The study therefore seeks to assess the factors that influence adherence to PMTCT in an urban setting and its effect on early infant diagnosis PCR results.

Method: This study adopted a cross-sectional design with retrospective review of all existing folders of HIV positive pregnant women who registered with Tema General Hospital between 2012 and 2016. A total of 316 records of HIV pregnant women who utilize ART clinic were retrieved, however, 253 records of pregnant women were used for the study due to incomplete records of other pregnant women. Bivariate and multiple logistics regression analysis were conducted to test significant factors that influence adherence to PMTCT programme. Linear regression analysis was conducted to determine factors that influence EID PCR results of children born to the HIV positive pregnant mothers.

Results: The mean age of the study participants is 30.4 and nearly half 124 (49.0%) had only JHS education. About three-fourth (73.9%) are self-employed while majority (79.1%) are married. The proportion of PMTCT non-adherence among HIV pregnant women was 198 (78.3%) while non-HIV serostatus disclosure was 52 (20.6%). The PCR result for children born to the HIV positive mothers showed a positivity rate of 3.6%. Adherence to PMTCT programme was significantly influenced by disclosure of HIV serostatus to sexual partners (AOR: 6.1; CI: 1.7-22.4) and adequate knowledge about HIV and PMTCT (AOR-7.4; 3.5-9.7). The PCR HIV positivity result of EID was significantly associated with adherence to PMTCT ($p=0.004$), disclosure of HIV status ($p=0.015$) and receiving prophylaxis at birth ($p=0.000$).

Conclusion: PMTCT adherence still remains a challenge among HIV pregnant women affecting the fundamentals of the mother-to-child prevention strategies. HIV and PMTCT education should be strengthened at ART clinics as well as integrating HIV education at focus antenatal care services.

Keywords: PMTCT; Adherence; HIV positive; Pregnant mothers; HIV/AIDS

Background

Globally, the AIDS epidemic has continually remained one of the most deadly and destructive health infectious diseases that have ever come in this world [1]. Approximately 39.5 million people are said to be living with HIV globally including an estimated 17.7 million women and 2.3 million children less than 15 years. The majority of these people are in the Sub Saharan Africa [2]. As HIV prevalence increases, the number of children infected with HIV increases with an increasing risk among HIV positive pregnant mothers [3]. Globally, approximately 90% of HIV infection among infants is acquired through mother-to-child transmission of HIV [3-5]. Without any preventive measure, the risk of HIV infection among children through mother-to-child transmission is estimated at 15% to 40% especially in low income countries [6,7]. Meanwhile, the rate of risk of infections increases with an increase in HIV prevalence among pregnant women. It is estimated that almost 16 million women in general are living with HIV with an estimated 1.4 million pregnant women with the risk of transferring the virus to their children [8]. Children who hitherto lived with HIV had limited life span, mostly dying before they reach adolescents. However, with the introduction of Highly Active Anti-Retroviral Therapy (HAART) coupled with appropriate paediatrics care, the life span of HIV positive children are prolonged over time [9-10].

WHO has estimated that 15%-45% of infants exposed to HIV are likely to be infected vertically and this continues to remain a challenge for management of HIV in children even with the existence of HAART [11,12]. The HAART interventions provide that the uptake of medication and nutritional requirement with specific food and fluids makes it a bit difficult for ensuring that children survive until adulthood. Again, the side effect of the medication for children and their lactating mothers frustrates

the effectiveness of the HAART approach [13]. Owing to these challenges, WHO implore that, all efforts should be put in place to ensure that children prior to their birth, during birth and after birth are not infected. Prevention of Mother-to-Child Transmission (PMTCT) of HIV programs was put in place by the World Health Organization (WHO) to reduce mother-to-child transmission of HIV in children born to HIV positive pregnant women. The PMTCT programme is aimed at reducing the risk of HIV infection among children from infected mothers [14-16]. Additionally, the PMTCT programme is acknowledged as a highly effective intervention which has the potential of improving both maternal and child health. Because of its effectiveness, the programme has been in existence and operational since 1998 and continues to remain a major tool for reducing the transmission of HIV infection from mother to the child [6].

In Ghana, the PMTCT programme is implemented using the WHO approved four guideline and recommended approach. Per the recommendation, countries are encouraged to facilitate the process of preventing women and pregnant mothers from getting infected with HIV. However, when there are infections among pregnant women, measures should be put in place to ensure that the mother does not transfer to the infant with the adoption of a number of approaches including appropriate treatment and care [6,17]. Although there is an availability of PMTCT interventions, some countries in Sub Saharan Africa including Ghana are not fully patronizing the services and some children are still being infected with the virus. In 2012, PMTCT coverage in Sub Saharan Africa ranged from 13% to more than 95% across 21 Sub Saharan African countries [18]. Challenges with patronage of PMTCT programmes have resulted in a number of HIV infections among children [3]. In 2016, for instance, 12% of children born to HIV-mothers were infected with HIV, with 9.4% infection occurring during 6-weeks of gestation while the remaining occurring at post 6-weeks' gestation [17,19]. However, as the intercity of the PMTCT programme increases, the rate of Early Infant HIV Diagnosis (EID) positivity trend decreased from 12% in 2016 to 8% in 2017 and thereafter maintained relatively stable to 2019 with rate of 7% and 8% for 2018 and 2019 respectively. However, one of the major challenges with the EID assessment is that not all children who are exposed to HIV through pregnancy were tested. In 2016, for instance, only 29% of exposed children were tested while 51%, 70% and 75% children who were exposed to HIV were tested in 2017, 2018 and 2019 respectively [20].

Regional breakdown of mother-to-child transmission showed that in 2019 while the national EID PCR test results showed an 8% infection rate, Greater Accra recorded 9% infection rate while Tema Municipality 10.4%. As the number of children exposed to HIV through pregnancy increases, the risk of infection among the children may equally increase if preventive measures are not strengthened. The risk of exposure increases when adherence to PMTCT programmes are limited [17]. The study therefore seeks to assess the factors that influence adherence to PMTCT in an urban setting and further analyse the effects of adherence to EID PCR results.

Materials and Methods

Study setting

The study was carried out at Tema General Hospital within the Anti-Retroviral Therapy Clinic in the Tema Municipality of Greater Accra Region. Tema General Hospital (TGH) is a district hospital established in 1954. It serves a population of 397,220. It is patronized by the people of Tema and its satellite towns and villages. The ART clinic is an Out-Patients Department (OPD) service providing unit in TGH. It also provides HIV service which was started in 2003 as just HIV testing and counselling for only pregnant women during ante natal visits. It now has an average attendance of 110 general HIV clients per each clinic day. Provision of PMTCT services is key at the ART Clinic. The Clinic sees an average of 5 newly diagnosed HIV positive pregnant women per clinic day which is run twice in a week (Tuesdays and Thursdays). The services offered include Testing and Counselling (HTC) for the general public as well as provision of ARVs for People living with HIV in general. The ART Clinic also provides Post Exposure Prophylaxis (PEP) of ART to Staff who accidentally gets exposed to HIV in their line of duties.

Study design

This study adopted a cross-sectional design with retrospective review of all existing folders of HIV positive pregnant women who registered with the facility between 2012 and 2016. The study looked at two outcome variables: Adherence to PMTCT and HIV results of children born to HIV positive pregnant women. Adherence to PMTCT was measured by client's visit to ART clinic as per appointment schedules and uptake of ARVs prophylaxis (measures pill count) as per records.

Study participants and sampling

The study participants were pregnant women who were HIV positive and were attending ART clinic at TGH for 5-year period between January 2012 and December 2016. Pregnant women who were not HIV positive but had other STIs including syphilis were excluded from the study. Again, pregnant women whose HIV statuses were known before 2012 or after 2016 were not included in the study. Pregnant women who did not deliver at the facility even though they utilized ARV services at the facility were also excluded from the study. A total of 316 records of HIV pregnant women who utilize ART clinic were retrieved. The records were reviewed to check accuracy of all relevant information as per the study focus. After the thorough review and assessment, a total of 253 records of pregnant women were used for the study due to incomplete records of other 63 HIV +pregnant women.

Data analysis

Data was analysed using Stata/IC 14.1 and described using mean, frequency and percentages to report descriptive statistics. Single and multiple regressions logistics analysis were also conducted to determine association between demographic characteristics and PMTCT adherence. Multiple regression analysis was also run to ascertain whether adherence to PMTCT

as well as demographic and other factors have any significant effect on EID PCR test. All associations were pinned to a p-value<0.05 which was considered statistically significant.

Ethical consideration

Ethical clearance for the study was obtained from the Ethical Committee of the Ghana Health Service, Research and Development Division. Approval for the study was received as GHS-ERC: 054/02/18. Folders were identified by their ID codes rather than names. Approval was further sought from the Management of the facility and the ARV Clinic to use the available data records of HIV+pregnant women.

Results

The characteristics of the 253 study participants are presented in Table 1. The mean age of the study participants is 30.4 with majority (n=159; 62.9%) within the age 25-34 years. The study participants were predominantly Christians 226 (89.3%). Nearly half 124 (49.0%) of the participants only had Junior Secondary School education with only 15 (5.9%) of the participants attaining tertiary level of education. Nearly three-fourth of the participants are self-employed while majority (n=200; 79.1%) are married (Table 1).

Variable	Frequency	Percentage (%)
Age		
15-24	38	15
25-34	159	62.9
35-44	56	22.1
Religion		
Christian	226	89.3
Muslim	27	10.7
Educational level		
None	35	13.8
Primary	36	14.3
JSS	124	49
Secondary	43	17
Tertiary	15	5.9
Occupation		
Unemployed	42	16.6
Self Employed	187	73.9
Formal Sector	16	16.3
Others	8	3.2
Marital status		
Single	26	10.2
Divorced	5	2
Married	200	79.1

Co-habituating	22	8.7
----------------	----	-----

Table 1: Socio-demographic characteristics of participants.

Other characteristics of HIV-positive pregnant women under PMTCT programmes are presented in Table 2. Majority (n=198; 78.3%) of the participants adhered regularly to the PMTCT programme while 52 (20.6%) did not disclose their HIV-positive status to their sexual partners. Mode of delivery among the pregnant women were largely spontaneous (n=209; 82.6%) with majority (n=225; 89.0%) practiced exclusive breastfeeding after delivery. More than 10% of the participants' children did not receive ARV prophylaxis at birth. The PCR results of the children born to the HIV positive pregnant women showed that 9 (3.6%) of the various pregnancies resulted in HIV positive for EIDs. Less than a quarter of the study participants had low knowledge about HIV.

Variable	Frequency	Percentage (%)
Adherence		
Non-Adherence	55	21.7
Adherence	198	78.3
Disclosure		
No	52	20.6
Yes	201	79.4
Mode of Delivery		
Spontaneous	209	82.6
Caesarean	44	17.4
Infant feeding		
Exclusive breastfeeding	225	89
Replacement feeding	14	5.5
Mixed feeding	14	5.5
Received ARV prophylaxis at birth		
No	30	11.9
Yes	223	88.1
EID PCR test		
Negative	244	96.4
Positive	9	3.6
Knowledge about HIV		
Low	62	24.5
High	191	75.5

Table 2: Other characteristics of HIV-positive pregnant mothers under PMTCT programme.

Socio-demographic and HIV-related factors influencing adherence to PMTCT

Bivariate and multivariate analysis of the factors associated with PMTCT adherence is summarized in Table 3. Out of the

eight variables that were analysed, five of the variables including educational level, marital status, HIV disclosure to partner, receiving other prophylaxis and knowledge on HIV were significantly associated with adherence to PMTCT among pregnant women. Pregnant women who had primary, JHS and SHS level of education had higher probability of adhering to PMTCT than women who had no education or had tertiary education (Primary: COR-3.5; CI: 1.6-7.7; JHS: COR-4.2; CI: 2.7-6.5; SHS:COR-3.8; CI:1.8-79). HIV positive pregnant women who are married have 3.8 times higher odds of adhering to PMTCT programme than HIV positive pregnant women who are single or cohabitating (COR-3.8; CI: 2.7-5.3) while women who have disclosed their HIV status to their sexual partners had 3.3 times the odds of adhering to PMTCT programme than those who had not disclosed their HIV serostatus (COR-3.3; CI: 1.7-6.5). Again, pregnant women who received ARV prophylaxis for their children at birth were 3.9 times more likely to adhere to PMTCT programme than those who did not receive ARV prophylaxis for their children at birth (COR-3.9;CI:1.7-8.6). Similarly, women who showed an improved and adequate knowledge in HIV issues had 4.8 chances of adhering to PMTCT programme than their counterparts who had limited knowledge on HIV issues (COR-4.8; CI: 4.6-9.7).

However, after subjecting the variables including the significant variables into multiple regressions, only two variables, disclosure to partner and knowledge about HIV showed significant association with adherence to PMTCT. Pregnant women who disclosed their HIV serostatus to their partners had 6.1 chances of adhering to PMTCT programme than those who had not disclosed (AOR-6.1; CI: 1.7-22.4) while those with adequate knowledge on HIV issues had 7.4 chances of adhering to PMTCT than those with limited knowledge (AOR-7.4; 3.5-9.7) (**Table 3**).

Variable Description	Adherence n=198; (row %)	Unadjusted or (CI)	Adjusted or (CI)
Age			
15-24	27(71.1)	1	1
25-34	129(81.1)	1.8(0.8-3.9)	2.0(0.4-9.3)
35-44	42(75.0)	1.2(0.5-3.1)	1.3(0.2-7.9)
Educational level			
None		1	1
Primary	28(77.8)	3.5(1.6-7.7)	1.7(0.3-11.4)
JHS	100(80.6)	4.2(2.7-6.5)	1.6(0.4-7.0)
SHS	34(79.1)	3.8(1.8-7.9)	1.9(0.3-14.6)
Tertiary	11(73.3)	2.7(0.9-9.6)	0.9(0.1-12.8)
Occupation			
Unemployed	32(76.2)	1	1
Self-employed	148(79.1)	1.2(0.5-2.6)	0.7(0.2-2.6)
Formal sector	11(68.7)	0.7(0.2-2.4)	0.9(0.1-9.7)
Others	7(87.5)	2.2(0.2-19.9)	10.2(0.5-23)
Religion			

Muslim	21(77.8)	1	1
Christian	177(78.3)	1.0(0.4-2.7)	0.5(0.1-2.5)
Marital status			
Single	22(84.6)	1	1
Divorced	5(100.0)	0.8(0.3-3.7)	0.1(0.3-3.5)
Married	158(79.0)	3.8(2.7-5.3)	1.0(0.1-7.4)
Co-habituating	13(59.1)	1.4(0.6-3.4)	0.3(0.0-3.1)
Disclosure			
No	31(59.6)	1	1
Yes	167(83.1)	3.3(1.7-6.5)	6.1(1.7-22.4)
Received ARV prophylaxis at birth			
No	16(53.3)	1	1
Yes	182(81.6)	3.9(1.7-8.6)	1.4(0.3-6.8)
Knowledge on HIV			
Low	16(25.8)	1	1
High	182(95.3)	4.8(4.6-9.7)	7.4(3.5-9.7)

Table 3: Bivariate and Multivariate analysis of factors influencing adherence to PMTCT.

The PCR results of the children showed that 9 (3.6%) were positive with HIV. **Table 4** shows the analysis of bivariate and multivariate analysis of factors that determines the results of PCR of EID. At bivariate analysis, adherence to PMTCT (p=0.004), disclosure of HIV status (p=0.015) and receiving ARV prophylaxis at birth (p=0.000) were found to be significantly associated with the outcome of PCR of EID among children born to HIV+ pregnant women (**Table 4**).

PCR Results			
Variable Description	Negative n=9; (%)	Positive n=244; (%)	p-value
Adherence to appointment and ARVs			0.004
Non-adherence	49(89.1)	6(10.9)	
Adherence	195(98.5)	3(1.5)	
Disclosure			0.015
No	48(92.3)	4(7.7)	
Yes	196(97.5)	5(2.5)	
Received ARV prophylaxis at birth			0.007
No	24(80.0)	6(20.0)	
Yes	220(98.6)	3(1.4)	
Knowledge on HIV			0.171
Low	58(93.5)	4(6.5)	
High	186(97.4)	5(2.6)	
Mode of delivery			0.921
SVD	201(96.2)	8(3.8)	

Caesarean section	43(97.7)	1(2.3)	
Infant feeding		0.161	
Exclusive breast feeding	7(3.1)	7(3.1)	
Replacement feeding	2(14.3)	2(14.3)	
Mixed feeding	14(100.0)	0(0.00)	

Table 4: Bivariate analysis of factors that determines results of PCR test of EID.

Discussion

Strategies and approaches to reduce mother-to-child transmission of HIV are well documented and are available to all [4,6,16,21]. Most of these strategies are most summarized in WHO 5-Year Strategic Vision for preventing mother-to-child transmission. The strategies have revolved overtime with Ghana adopting the strategies since 2003 including the revised one in 2010 [17,22]. This study therefore sought to identify some of the basic factors that may hinder adherence to PMTCT with its ripple effect on PCR of EID.

This study recorded non-adherence rate of 21.7% among HIV positive pregnant women. This result is relatively higher than 12.9% reported in Ethiopia [23], 16.0% reported in Kenya [24], 16.3% reported in Zambia and 19.7% as reported in Nigeria but recorded same result of 21.7% as reported in Nigeria [12,25,26]. However, the result is much lower than a number of studies ranging from 26.5% in a global meta-analysis study [27], 27.0% in Ghana [28], 37.1% and 37.4% in Nigeria [29,30], to 50.9% in Uganda which was limited to only 59 study participants and adopted qualitative approach to study [31]. Averagely, higher adherence rate are record among pregnant women compared to general person living with HIV [32]. Pregnant women are generally ready to go the extra mile to ensure the survival of their children. Reasons for non-adherence were not subjected to analytical review, however, the PMTCT records showed reasons such distance to the facility, fear of stigma and difficulties in swallowing the pills were cited as most common reasons. Similar findings were made in Nigeria were reasons such as forgetfulness, living far away from the hospital, side effects of the drug and a sense of feeling better were link to non-adherence[12].

Disclosure of HIV serostatus among sexual partners continues to remain a challenge in promoting PMTCT programme among pregnant women. In most cases, non-HIV serostatus disclosure exceeds 10% among HIV positive partners. This study observed a higher non-HIV serostatus disclosure rate of 20.6% among the pregnant women and 17.5% among pregnant women who are married. The findings from this study is relatively higher than other studies that have shown non-disclosure rates of 6.9%, 14.3%, but lower than 25%, 27% and 39% [33-37]. However, various studies have shown a strong association between serostatus disclosure and adherence to PMTCT programme. The study observed a significant association between serostatus disclosure and adherence to PMTCT and this is in consistent with

several studies [12,26,23,33,36]. Serostatus disclosure of HIV among sexual partners have been noted as a major entry point for promoting PMTCT and reducing further infection of HIV among couples [36,38,39]. It is therefore important to facilitate process that will enhance appropriate and timely disclosure of HIV serostatus among partners. Disclosure does not only benefit the infected person but the partner and the public at large [40].

The level of patient's knowledge about HIV and its related strategies including PMTCT has a major influence on patient's attitude and practice over adherence on uptake of medication and response to appointments [41,42]. As shown in other related studies, less than a quarter of the HIV positive women had low knowledge about HIV and PMTCT in the study [28,42]. Significantly, as knowledge on HIV and PMTCT increases, the level of adherence to PMTCT programme increases among HIV positive pregnant women. Comparatively, this study has documented a higher overall level of PMTCT knowledge than some of the findings from previous studies [43-45]. At all levels of analysis, HIV positive pregnant women who had higher levels of HIV knowledge showed significant association with adherence to PMTCT. The findings of knowledge about HIV significantly influencing adherence to PMTCT programmes by HIV positive pregnant women is in agreement with other studies [6,26,46,47]. However, a study in Kumasi observed that knowledge was a major factor in determining PMTCT adherence [28]. Knowledge about the pros and cons of health-related issues is key in addressing the underlining barriers that affects health service utilization. The study further observed that pregnant women who consistently missed their appointments had low knowledge, though this relationship was not analysed. The main means of information for the pregnant women was at the ART centers during ART clinic days. One-on-one awareness was commonly used by the health workers at the facility. At each ART session, health providers provide adequate information to HIV client including HIV pregnant women while strengthening focus antenatal care.

The observed HIV infection among children born to HIV positive mothers (3.6%) was relatively low comparative to studies in Nigeria where 10% infection rate was observed, 15.7% in Ethiopia and 31.7% in Zimbabwe [48-50]. The finding of the study was similar to a study in Nigeria where PCR results showed 3.6% [51]. Significant factors that influenced the outcome of the PCR among children born to positive pregnant women include adherence to appointments and ARVs, disclosure to sexual partner and receiving ARV prophylaxis at birth. Only 0.55% of the children whose mothers adhered to ART refill appointment date became HIV positive. This could be as a result of key knowledge on MTCT prevention by women as observed in the client knowledge levels of PMTCT.A systematic review and meta-analysis by reported negative correlation between maternal ART adherence and mother to child transmission and that as adherence to ARVs increases, the risk of HIV infection among children born to HIV positive mother reduces [27]. Administering ARV prophylaxis at birth also showed significant association with mother-to-child infection as confirmed in other studies where the odds of mother-to-child transmission is higher among children who did not receive any prophylaxis as compared to those who received ARV prophylaxis [49,50]. Kim, et al. also

confirmed the finding on the association between disclosure and mother to child infection. Kim, et al. argued that the reluctance on the part of HIV positive mothers to disclose their status to partners is mostly due to the fear of stigma and this they believed leads to HIV infection in their children [44]. Though, several studies over the years have shown stigma to be on the decrease, it continues to pose threats to disclosure especially among sexual partners. Disclosure of HIV status among sexual partners makes it easier especially for pregnant women to earn the support of their partners and significant others to adhere to ARVs and appointments which subsequently reduces the risk of mother-to-child transmission. Again, early disclosure also makes it easier for pregnant women to continue to receive HIV care for themselves and their unborn babies. This goes to support the views and conclusions in literature reviewed that one's disclosure of HIV status to partners and significant others are a major facilitator for retention in care while non-disclosure represents a barrier [52-56].

Conclusion

This study revealed that non-adherence to PMTCT programme was relatively high among the HIV positive pregnant women. Although majority of the HIV positive pregnant women had disclosed their serostatus to their sexual partners, the absence of disclosure by some of the pregnant women reduced the rate of adherence significantly to PMTCT programme. Similar, pregnant women who missed a number of appointments and received limited awareness and education on HIV and PMTCT could not adhere fully to PMTCT programme. Increasing targeted awareness and education is key in enhancing HIV pregnant women's understanding on the need for serostatus disclosure. Improved knowledge has consequent effect on adherence and disclosure. The PCR results of the children born to the pregnant women showed a low infection rate, however, the rate of infection was relatively higher among HIV pregnant women who had irregular adherence. Poor disclosure does not only reduce adherence to PMTCT but further increases the risk of mother-to-child infection as was observed in this study. The dynamics in PMTCT adherence may differ from one area to the other. It is therefore important to conduct further studies using rural setting to understand the various factors that may impede the successful implementation of PMTCT.

References

1. World Health Organization (2009) United Nations Program on HIV/AIDS, AIDS epidemic update. Geneva.
2. Joint United Nations Program on HIV/AIDS (UNAIDS) (2017) Global report 2017. UNAIDS.
3. Joint United Nations Program on HIV/AIDS (UNAIDS) (2013) Global report 2013. UNAIDS.
4. UNAIDS (2010) Africa prepares to eliminate mother-to-child transmission of HIV by 2015. Feature Story.
5. UNICEF (2011) State of the World's Children 2011.
6. World Health Organization (2010) Towards universal access: scaling up priority HIV/AIDS interventions in the health sector.
7. De-Cock K, Fowler M, Mercier E, de-Vincenzi I, Alnwick D, et al. (2000) Prevention of mother-to-child HIV transmission in resource-poor countries: Translating research into policy and practice. *JAMA* 283: 1175-1182.
8. Puthanakit T, Aupribul L, Oberdorfer P, Akarathum N, Kanjananit S, et al. (2007) Hospitalization and mortality among HIV-infected children after receiving highly active antiretroviral therapy. *Clin Infect Dis* 44: 599-604.
9. Mothi SN, Karpagam S, Swamy HV, Mamatha ML, Sarvode SM (2011) Paediatric HIV-Trends and challenges. *Indian J Med Res* 134: 912-919.
10. Cardoso CA, Pinto JA, Candiani TM, Carvalho IR, Linhares RM, et al. (2012) The Impact of highly active antiretrovirals therapy on the survival of vertically HIV-infected children and adolescents in belo horizonte, Brazil. *Mem Inst Oswaldo Cruz* 107: 532-538.
11. World Health Organization (2014) Global Health Observatory, Mother-to-child HIV transmission.
12. Igwegbe AO, Ugboaja JO, Nwajiaku LA (2010) Prevalence and determinants of non-adherence to antiretroviral therapy among HIV-positive pregnant women in Nnewi, Nigeria. *IJMMS* 2: 238-245.
13. Montreal M, Cunha RV, Trinca LA (2002) Compliance to antiretroviral medication as reported by AIDS patients assisted at the University Hospital of the Federal University of Mato Grosso do Sul. *Braz J Infect Dis* 1: 8-14.
14. Brocklehurst P, Volmink J (2002) Antiretrovirals for reducing the risk of mother-to-child transmission of HIV infection. *Cochrane Database Syst Rev* 2: CD003510.
15. Lorenz AA, Ferreyra C, Alvarez A, Palma PP, Velilla E, et al. (2011) Effectiveness of a PMTCT programme in rural western Kenya. *AIDS Care* 23: 274-280.
16. Anoje C, Aiyenigba B, Suzuki C, Badru T, Akpoigbe K, et al. (2012) Reducing mother-to-child transmission of HIV: Findings from an Early infant diagnosis program in South-South Region of Nigeria. *BMC Public Health* 12: 184-186.
17. UNAIDS (2017) 'Start Free Stay Free AIDS Free: 2017 progress report' [pdf]
18. WHO, UNICEF and UNAIDS, (2013). Global update on HIV treatment: Results, impact and opportunities WHO report in partnership with UNICEF and UNAIDS. June2013
19. Ghana AIDS Commission (2018). Ghana HIV Status Report for 2017.
20. Ghana AIDS Commission and National AIDS Control Programme (2020). 2019 HIV Sentinel Survey Report.
21. Ikechelu JI, Ugboaja JO, Kalu SO, Igboelina DO (2009) Outcome of Prevention Of Mother to Child Transmission (PMTCT) of HIV infection programme in Nnewi, Southeast Nigeria. *Niger J Med* 20: 421-425.
22. Ghana AIDS Commission and National AIDS Control Programme (2010). 2009 HIV Sentinel Survey Report.
23. Ebony H, Yebo H, Alemayehu M (2015) Level of adherence and predictors of adherence to the Option B+ PMTCT programme in Tigray, northern Ethiopia. *Intl J Infect Dis* 33: 123-129.
24. Thomas T, Masaba R, Borkowf C, Ndivo R, Zeh C, et al. (2011) Triple-antiretroviral prophylaxis to prevent mother-to-child HIV transmission through breastfeeding: The kisumu breastfeeding study, Kenya: A clinical trial. *PLoS Med* 8: e1001015.

25. Carlucci JG, Kamanga A, Sheneberger R, Shepherd B, Jenkins CA, et al. (2008) Predictors of adherence to antiretroviral therapy in rural Zambia. *PubMed* 47: 615-622.
26. Ekama SO, Herbertson EC, Addeh EJ, Okafor GCV, Onwujekwe DI, et al. (2012) Pattern and determinants of antiretroviral drug adherence among Nigerian pregnant women. *J Pregnancy*.
27. Nchega JB, Uthman OA, Anderson J, Peltzer K, Wampold S, et al. (2012) Adherence to antiretroviral therapy during and after pregnancy in low, middle and high-income countries: A systematic review and meta-analysis. *AIDS* 26: 2039-2052.
28. Boateng D, Kwapon GD, Baffour AP (2013) Knowledge, perception about Antiretroviral Therapy (ART) and Prevention of Mother-to-Child Transmission (PMTCT) and adherence to ART among HIV positive women in the Ashanti Region, Ghana: A cross-sectional study. *BMC Women's Health* 13: 2-9.
29. Olowookere SA, Fatiregun AA, Akinyemi JO, Bamgbose AE, Osagbemi GK (2008) Prevalence and determinants of nonadherence to highly active antiretroviral therapy among people living with HIV/AIDS in Ibadan, Nigeria. *J Infect Dev Ctries* 2: 369-372.
30. Shaahu VN, Lawoyin TO, Sangowawa AO (2008) Adherence to Highly Active Antiretroviral Therapy (HAART) at a Federal Medical Centre. *Afr J Med Med Sci* 37: 29-36.
31. Buregyega E, Naigino R, Mukose A, Makumbi F, Esiru G, et al. (2017) Facilitators and barriers to uptake and adherence to lifelong antiretroviral therapy among HIV infected pregnant women in Uganda: A qualitative study. *BMC Pregnancy and Childbirth* 17: 94-96.
32. Moral LJM, Enriquez LBK, Palmieri PA, Vasquez GM, Bravo UEE, et al. (2019) Adherence to antiretroviral therapy and the associated factors among people living with HIV/AIDS in Northern Peru: A cross-sectional study. *AIDS Res Ther* 16:22-25.
33. Shamu S, Zarowsky C, Shefer T, Temmerman M, Abrahams N (2014) Intimate partner violence after disclosure of HIV Test results among pregnant women in harare, Zimbabwe. *Plos One* 9: 10-15.
34. Taye G, Dereje H, Endrias M (2010) HIV Positive Status disclosure among women attending art clinic at Hawassa University Referral Hospital, South Ethiopia. *East Afr J Public Health* 7: 89-93.
35. Walcott MM, Hatcher AM, Kwena Z, Turan JM (2013) Facilitating HIV status disclosure for pregnant women and partners in rural Kenya: A qualitative study. *BMC Public Health* 13: 1115-1119.
36. Sendo EG, Cherie A, Erku TA (2013) Disclosure experience to partner and its effect on intention to utilize prevention of mother to child transmission service among HIV positive pregnant women attending antenatal care in Addis Ababa, Ethiopia. *BMC Public Health* 13:765-767.
37. Brittain K, Mellins CA, Remien RH, Philips T, Zerbe A, et al. (2018) Patterns and predictors of HIV-Status Disclosure among pregnant women in South Africa: Dimensions of disclosure and influence of social and economic circumstances. *AIDS Behav* 22: 3933-3944.
38. Kenya National Bureau of Statistics (KNBS) and ICF Macro: Kenya demographic and health survey 2008–09. Calverton, Maryland: KNBS and ICF Macro; 2010.
39. Curran K, Baeten JM, Coates TJ, Kurth A, Mugo NR, et al. (2012) HIV-1 prevention for HIV-1 sero-discordant couples. *AIDS rep* 9: 160-170.
40. Duff P, Kipp W, Wild TC, Rubaale T, Ojony JO (2010) Barriers to accessing highly active antiretroviral therapy by HIV positive women attending Anti natal Clinic in a regional hospital in Western Uganda. *J Int AIDS Soc* 13:37.
41. Wenger N, Gifford A, Liu H, Chesney M, Golin C (1999) Patient characteristics and attitudes associated with HAART adherence.
42. Falnes EF, Tylleskär T, Paoli MM, Manongi R, Engebretsen IM (2010) Mothers' knowledge and utilization of prevention of mother to child transmission of HIV in Northern Tanzania. *J Int AIDS Soc* 13: 36.
43. Ackerman W, Kwiek JJ (2013) Role of placenta in adverse perinatal outcomes among HIV-1 seropositive women. *J Nippon Med Sch* 80: 90-4.
44. Kim MH, Ahmed S, Buck WC, Preidis GA, Hosseinipour MC, et al. (2012) Journal of International AIDS Society. *AIDS* 15: 17389.
45. Kim MH, Zhou A, Mazenga A, Ahmed S, Markham C, et al. (2016) Why Did I Stop? barriers and facilitators to uptake and adherence to ART in option B+ HIV care in Lilongwe, Malawi. *Plos One* 11: e0149527.
46. Deressa W, Seme A, Asefa A, Tesfomes G, Enqusellassie F (2014) Utilization of PMTCT services and associated factors among pregnant women attending antenatal clinics in Addis Ababa, Ethiopia. *BMC Pregnancy and Childbirth* 14: 328.
47. Alemu MY, Ambaw F, Smith WA (2017) Utilization of HIV testing services among pregnant mothers in low income primary care settings in northern Ethiopia: A cross sectional study. *BMC Preg Childbirth* 17: 199.
48. Ogunbosi BO, Oladokun RE, Brown BJ, Osinusi KI (2011) Prevalence and clinical pattern of paediatric HIV infection at the University College Hospital, Ibadan, Nigeria: A prospective cross-sectional study. *Italian J Pediatrics* 37:1.
49. Wudineh F, Damtew B (2016) Mother-to-Child Transmission of HIV infection and its determinants among exposed infants on care and follow-up in dire Dawa City, Eastern Ethiopia. *AIDS Res Treat* 6: 1.
50. Gumbo FZ, Duri K, Kandawasvika GQ, Kurewà NE, Mapingure MP, et al. (2010) Risk factors of HIV vertical transmission in a cohort of women under a PMTCT programat three peri-urban clinics in a resource-poor setting. *J Perinatol* 30: 717-723.
51. Ugochukwu EF, Kalu SO (2009) Early Infant Diagnosis of HIV Infection in South-eastern Nigeria: Prevalence of HIV Infection Among HIV-Exposed Babies. *West Afr J Med* 29: 3-7.
52. Adeniyi VO, Thomson E, Goon DT, Ajayi IA (2015) Disclosure, stigma of HIV positive child and access to early infant diagnosis in the rural communities of OR Tambo District, South Africa: A qualitative exploration of maternal perspective. *BMC Pediatr* 15: 98-100.
53. Adetokunboha OO, Oluwasanub M (2015) Eliminating mother-to-child transmission of the human immunodeficiency virus in sub-Saharan Africa: The journey so far and what remains to be done. *J Infect Public Health* 9: 396-407.
54. du Plessis, E., Shaw, S.Y., Gichuhi, M. et al. (2014) Prevention of mother-to-child transmission of HIV in Kenya: Challenges to implementation. *BMC Health Serv Res* 14: S10.
55. Hassan AS, Sakwa EM, Nabwera HM, Taegtmeier MM, Kimutai RM, et al. (2012) Dynamics and constraints of early infant diagnosis of HIV infection in rural Kenya. *AIDS Behav* 16: 5-12.
56. Mugasha C, Kigozi J, Kiragga A, Muganzi A (2014) Intra-facility linkage of HIV-positive mothers and HIV-exposed babies into HIV chronic care: rural and urban experience in a resource limited setting. *Plos One* 9: e115171.