



Adherence and its Associated Factors of HIV Exposed Infants Enrolled in Prevention of Mother to Child Transmission (PMTCT) Program in Selected Health Facilities of Addis Ababa, Ethiopia, 2020: Retrospective Cross Sectional Study

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Abstract

Background: Besides, there were an estimated 22,827 people newly infected during 2017, of whom 60.5% are females. Ethiopia has developed an HIV/AIDS prevention, care, and treatment strategic plan in an investment case approach that is being implemented from 2015–2020. The PMTCT service is available throughout the country at health centers and hospitals for mothers who have had an ANC follow-up. To assess adherence and identify factors associated with HIV exposure in infants for PMTCT follow-up.

Method: A cross-sectional retrospective study was done to assess the HIV-exposed infants' clinical adherence to PMTCT follow up schedules. All HIV exposed infants who were on follow up in the ART and PMTCT clinics of St. Paul's Hospital Millennium Medical College, Yekatit 12 Hospital Medical College, and Selam Health Center beginning from September 2016 to January 2019 were included in the study consecutively. All health facilities were practicing option B+ on the PMTCT program. This study was conducted from January 2019 to May 2019, and data collection was done using a well-designed questionnaire and a review of mothers' and infants' medical record charts and the HMIS log book. Descriptive and logistic regression analysis was performed to assess the association between dependent and independent variables. Differences are considered statistically significant at $p < 0.05$, and their strength is presented using an odds ratio (OR) and 95% confidence interval (CI).

Result: Among the 302 enrolled HIV-exposed infants, 27 (8.9%) were diagnosed as HIV positive. Factors associated with good clinical adherence were paternal positive serostatus (concordance) (AOR = 2.26, 95% CI: 1.18, 4.36, p

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Keywords: PMTCT; Adherence; HIV Exposed Infants; HIV/AIDS.

Abbreviations: AIDS: Acquired Immune Deficiency Syndrome; ART: Anti retroviral therapy; AZT: Zidovudine; CD4: Cluster of Diffentiation 4; EDHS: Ethiopian Demographic Health Survey; EPHI: Ethiopian Public Health Institute; FHAPCO: Federal HIV/Aids Prevention and Control Office; HEI: HIV Exposed Infant; HIV: Human Immuno deficiency Virus; IRB: Institutional Review Board; LTFU: Loss to Follow up; NVP: Nevirapine; PMTCT: Prevention of Mother to Child Transmission; SPSS: Stastical Program for Social Sciences; UNGASS: United Nation General Assembly Special Session on HIV/Aids.

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= 0.015), follow-up in the same place/facility of delivery (AOR = 10.09, 95% CI: 5.5, 18.35, $p = 0.001$), maternal lower WHO stage (AOR = 4.22, 95% CI: 1.34, 13.21, $p = 0.014$), and final serostatus of the infant (AOR = 3.7, 95% CI: 1.01, 13.48, $p = 0.049$).

Conclusion and Recommendation: The level of HIV infection among infants born to HIV-positive mothers is high as compared to the national and WHO goals. The overall clinical adherence of the infants was found to be poor, and significant numbers of children were lost to follow-up. The facility of enrollment, antenatal care of the mother, stages of HIV illness of the mother, and fathers' serostatus were factors that were significantly associated with adherence to follow-up.

Introduction

Globally, HIV/AIDS is still the leading cause of mortality among women of reproductive age and contributes greatly to the death of infants and children. Since 2000, 38.1 million people have been infected with HIV, and 25.3 million have died of AIDS-related deaths [1]. In 2017 there were an estimated 36.7 million people who were living with HIV of which 17.8 million were women and 2.1 million were children under 15 years of age [2]. Sub-Saharan Africa remains the worst affected region in the global AIDS epidemic resulting 11.4 million orphans [3]. This region of Africa is the home for only 12% of the global population, yet accounts for 71% of the global burden of HIV infection [4]. In 2013 Sub-Saharan Africa had 2.3 million children who were living with HIV/AIDS. In the same year, an estimated 350,000 children were newly infected with HIV [4, 5]. According to United Nations AIDS report of 2018 everyday there are about 5000 new HIV infections (adults and children) and among these 500 are children less than 15 yr and 66% occur in sub-Saharan countries [2].

In Ethiopia, the first confirmed cases of HIV were detected in 1984 and the first hospitalized AIDS patients were reported in 1986 [6]. According to Ethiopian Public Health Institute HIV related estimation and projections, in 2017 the national HIV prevalence is 1.16% and there are a total of 722,248 people living with HIV, of which 60.5% are female above 15 years of age and 8% were children below 15 years of age [7]. According to Ethiopian Demographic Health Survey 2016 data, there were 65,088 children living with HIV in 2016. In June 2011, the Joint United Nations Programme on HIV/AIDS (UNAIDS) introduced the *Global Plan Towards the Elimination of New HIV Infections Among Children by 2015 and Keeping Their Mothers Alive*, which called for a 90% reduction in new childhood HIV infections and a 50% reduction in HIV-related maternal deaths by 2015 [8, 9]. United Nations Programme on HIV/AIDS (UNAIDS) set the 90-90-90 target by 2020 which aims to end the epidemics of HIV by 2030. Several countries in sub-Saharan Africa, including Botswana, Namibia and Swaziland, have now achieved the United Nations General Assembly Special Session (UNGASS) goal of 80% coverage with significant reductions in new infant infections by effective Prevention Mother to Child Transmission (PMTCT) programs [10].

In Ethiopia PMTCT guideline was published in 2001 then the program was launched in September 2003 then facility based service delivery was initiated in 13 pilot health centers on Feb 2004 [11]. However, due to lack of free access of anti-retroviral

(ARV) prophylaxis in the country until 2005, the challenge remained even after the guideline has developed. In 2005, free ARV was launched to everybody who was in need [12].

Adherence to PMTCT can be classified into two, the first is adherence to the medications called Drug Adherence (Antiretroviral drugs or cotrimoxazol preventive therapy) and the second is adherence to the follow up schedule called Clinical adherence. Assessing adherence to drugs is usually difficult and may require blood tests to measure the serum level of each drug which is not feasible in resource limited countries like Ethiopia therefore assessing adherence to follow up schedules (clinical adherence) would be appropriate [13].

In Ethiopia, little is known about the adherence of HIV-exposed infants. Measuring the effectiveness of PMTCT by its different parameters is crucial to improving its implementation and detecting its shortcomings. Among these parameters, One of the gold standard metrics is HIV-free survival of HIV-exposed infants [14]. So this study will assess the adherence of HIV-exposed infants who have been enrolled in the PMTCT programme and to the recommended follow-up schedules, and it will also identify factors associated with the adherence of HIV-exposed infants.

Method and Materials

Study area, period and design

An institution-based retrospective cross-sectional study was conducted. This study was conducted in Addis Ababa, Ethiopia, which is the capital city of the country with an estimated total population of 3,197,000 and a sex ratio of 0.91. The city has a total of 14 governmental hospitals and 73 health centres [15]; among these health care facilities, the study was done in 2 public hospitals in Addis Ababa (St Paul's Hospital Millennium Medical College and Yekatit 12 Hospital Medical College) and one health centre (Selam Health Center). This study was conducted from January 2019 to May 2019.

Population

Source population

All HIV-exposed infants in Addis Ababa who have been enrolled in the PMTCT program

Study population

All HIV-exposed infants who have been enrolled in PMTCT at SPHMMC, Yekatit 12 Hospital Medical College, and Selam Health Center between September 2016 and January 2019

Inclusion criteria

All HIV-exposed infants who have been enrolled in PMTCT in these health facilities and who have attained 18 months of age.

Exclusion criteria

HIV exposed infants with incomplete registration data.

Sampling techniques and sample size

Sample size was not calculated because of the limited number of study subjects. All 302 HIV-exposed infants who were enrolled for follow-up between September 2016 to January 2019 and who fulfilled the inclusion criteria were consecutively included in the study.

Dependent variable

Adherence to follow up schedules

Independent variables: Age of the mother, WHO stage of the mother, Last CD 4 count during pregnancy, Viral load of the mother, Time of ART initiation during the pregnancy, Age of the HIV exposed infant at the time of enrolment to PMTCT follow up, ART prophylaxis for the HIV exposed infant, Place of Delivery, Partner testing and result and Facility

Operational definitions

1) Prevention of mother-to-child transmission (PMTCT): Refers to the reduction of new pediatric HIV infections through the promotion of primary prevention of HIV amongst women, the provision of ART for HIV-infected pregnant women, and promoting access to care for HIV-exposed infants.

2) HIV-exposed infant: is a child born to an HIV-positive woman whose age ranges from 0 months to 18 months.

3) Antiretroviral therapy (ART): The use of three or more ARVs at the same time to treat HIV infection.

4) ARV prophylaxis: the use of ARV drugs in the mother and/or infant for a short period of time to reduce MTCT.

5) Exclusive breast feeding (EBF): Occurs when an infant is fed breast milk only without any other foods or liquids for the first six months of the infant's life.

6) Adherence: A patient who fulfilled the minimum required number of follow up/Visit attending clinic and coming to the follow up clinic on the recommended time schedule regularly.

7) Lost to follow-up (LTFU): An infant who did not return for a follow-up visit to monitor or check his or her HIV infection status.

8) Defaulter: Patient/infant who has missed 2 or more of his/her follow-up schedules

9) Transfer out: A patient who has been accepted into another institution to continue follow-up and treatment after beginning follow-up in one.

10) Seropositive: A patient who is confirmed to be Positive by HIV antibody test or a patient who fulfills the criteria for presumptive HIV infection and diagnosed by a physician to have presumptive HIV infection

Data collection procedures

Data collection has been done using a structured data extraction format accomplished by reviewing mothers' and infants' medical record charts and the HMIS log book. The data collectors were given training on the research objective, the questionnaire, how to review charts, fill out the data, and abstract findings to assure the quality of the data. The data collectors were nurses who have been working in PMTCT, ART, and MCH clinics. The questionnaire was developed in English and used to collect data after being pre-tested before the study period. A modification of the questionnaire was made based on the pre-test. The wording and sequence of questions were designed in such a way that the logical flow of ideas went from general to specific. The principal investigator has supervised the data collectors daily.

Data management and analysis

The data was coded and entered into the EPI data application version 3.1 and exported to the Statistical Package for Social Sciences (SPSS) version 20 for analysis. The primary outcome variable was categorized as "0" for HIV-negative individuals and "1" for HIV-positive individuals. Final infant HIV status was determined by either a PCR or rapid HIV test, as appropriate to the infants' age and breastfeeding option. If the PCR was performed before 18 months of age but six weeks after the cessation of breast-feeding, or if a rapid test was performed at 18 months of age, the HIV test was considered final. Descriptive statistics were used to describe infant and mother characteristics. Data was modeled using logistic regression to evaluate factors associated with the clinical adherence of HIV-exposed infants. Differences were considered statistically significant at $P < 0.05$, and their strength is presented using an odds ratio (OR) and 95% confidence interval (CI).

Table 1: Socio demographic characteristics of mothers and fathers of HIV exposed infants in Addis Ababa, Ethiopia, August 2019. (n=302).

Variables	Frequency (n)	Percentage (%)
Age of mothers(years)		
15 – 19	4	1.3
20 – 24	26	8.6
25 – 29	139	46.0
30 – 34	97	32.1
35- 49	36	11.9
Marital status of the mother		
Single	52	17.2
Married	142	47.0
Unmarried	55	18.2
Divorced/Separated	49	16.2
Widowed	4	1.3
Address		
Addis Ketema	84	27.6
Gulele	91	30.1
Kolfe keraniyo	108	35.8
Burayu	19	6.3
Mother's Status		
Alive	300	99.3
Dead	2	0.7
Father's Status		
Alive	298	98.7
Dead	4	1.3
Serostatus of father		
Positive	149	49.3
Negative	52	17.2
Unknown	101	33.4

Result

Socio demographic data of Parents

The study included 302 mother-infant pairs, and the median age of the mothers was 30 years. The majority of them, 236 (78.1%), were between the ages of 25 and 34. Based on the marital status, 142 (47%) mothers were married, 52 (17.2%) were single, 55 (18.2%) were unmarried, 49 (16.2%) were divorced or separated, and 4 (1.3%) were widowed. All mothers were alive except for two who died before their infants reached 18 months. Among the fathers, 297 (98.3%) of them were alive, but three of them have died. Among the fathers, 149 (49.3%) of them were diagnosed with HIV with an HIV antibody test, while 52 (17.2%) were seronegative, and 101 (33.4%) were not tested for HIV at the time of follow-up. (Table1).

Obstetric characteristic of HIV positive mothers

The majority of the mothers were diagnosed before the pregnancy 176(58.3%), while 79(41.7%) were diagnosed during the pregnancy and 17(5.6%) were diagnosed during labor and delivery. Among the mother who has been diagnosed during the pregnancy 31(10.3%) were diagnosed during 1st trimester and 37(12.3%) were diagnosed during 2nd trimester and 41(13.6%) on 3rd trimester. About 277(91.7%) of the mothers had ANC follow up among these 139(46%) had ANC follow up at Health center, 102(33.8%) at Public Hospitals and 36(11.9%) were having ANC follow up at private Centers but among all mother enrolled in the study 25(8.3%) mothers didn't have any ANC follow up. Those mothers who had ANC follow up about 189(62.6%) of them started their ANC follow up beginning from 1st trimester, 58(19.2%) on 2nd Trimester and 30(9.9%) on 3rd trimester.

Among 302 mothers in this study 279 (92.4%) of them had documented CD4 count and the median CD4 count was 509.9 cell/mm³. There were only 79(26.2 %) mothers documented viral load during the pregnancy and the median Viral load was 1099.5 cell/mm³. Regarding the mode of delivery 76 mother (25.2%) delivered with Caesarian delivery while 10 mothers(3.3%) had instrumental delivery and the rest 216 (71.5%) has delivered via SVD. When we look at the WHO AIDS stage of the mothers near or at delivery 71(23.5%) were labeled as Stage 1,140(46.4%) were labeled as stage 2 and 53(17.5%) were labeled as stage 3 and 38(12.6%) were labeled as Stage 4.

Regarding the place of delivery 9(3%) infants were home delivery, 77(25.5%) were delivered at health center, 24(7.9%) delivered in private health facilities and the vast majority of infants 192(63.6%) were delivered in public Hospitals. Regarding the time of ART initiation of the mothers 173(57.3%) of them were started on ART before the pregnancy, 108(34.8%) mothers were started during pregnancy, 21(7.0%) were started during labor and delivery and 8(2.6%) mothers were started on ART after delivery. (Table 2).

PMTCT follow up and health characteristics of HIV exposed infants

Among the infants who has been enrolled in the study 144(47.7%) were males and 158 (52.3%) were females and the median age of the infants during the data collection period was 27 month. Based on the birth weight 210 (69.5%) of the infants had normal birth weight and 13 (4.3%) were macrocosmic and 9(3%) infants were having Very low birth weight while the rest of 70(23.2%) were having low birth weight. (Table 3).

Table 2: Obstetric characteristic of HIV positive mothers in Adis Ababa, Ethiopia (n=302) August 2019.

Variables	Frequency (n)	Percentage (%)
Parity		
Para I	138	45.7
Para II	99	32.8
Para III	49	16.2
Para IV	16	5.3
Place of ANC follow up		
Health center	139	46
Public Hospital	102	33.8
Private Health care	36	11.9
Viral load		
Has Viral load	79	26.2
Has no viral load	223	73.8
Time of maternal diagnosis		
Before pregnancy	176	58.3
During 1 st Trimester	31	10.3
During 2 nd Trimester	37	12.3
During 3 rd Trimester	41	13.6
During labour and delivery	17	5.6
Time of ART initiation		
After delivery	8	2.6
During labour and delivery	21	7
During 1 st Trimester	27	8.9
During 2 nd Trimester	44	14.6
During 3 rd Trimester	37	12.3
Before pregnancy	173	57.3
WHO stage of the mother		
Stage 1	71	23.5
Stage 2	140	46.4
Stage 3	53	17.5
Stage 4	38	12.6
Place of delivery		
Home delivery	9	3
Health center	77	25.5
Private Health facility	24	7.9
Public Hospitals	192	63.6
Mode of delivery		
SVD [¥]	216	71.5
Cesarian delivery	76	25.2
Instrumental delivery	10	3.3

*= WHO: World Health Organization

¥ = SVD: Spontaneous vaginal delivery

Table 3: Socio demographic characteristics of HIV exposed infants in Addis Ababa, Ethiopia (n=302) August 2019.

Variables	Frequency (n)	Percentage (%)
Sex		
Male	144	47.7
Female	158	52.3
Birth Weight		
1000-1499 gram	9	3
1500-2499 gram	70	23.2
2500- 3999 gram	210	69.5
4000 gram or more	13	4.3

PMTCT enrollment and intervention for HIV exposed infants

The majority of the infants, 204 (67.5%), were enrolled at 6 weeks, 79 (26.2%) between 6 and 12 weeks, and 19 (6.3%) after 12 weeks. Regarding the feeding option for the first 6 months, the majority of the infants were on exclusive breastfeeding, which is 218 (72.2%), about 62 (20.5%) were getting exclusive replacement feeding, and the rest, 22 (7.3%), were on mixed feeding. Most of the infants—288 (95.4%)—have received ART prophylaxis, but still, 14 (4.6%) infants didn't receive any ART prophylaxis. Among the infants who received ART prophylaxis, all of them were on Nevirapine syrup. When the ART prophylaxis was started, 213 (70.5%) were started within 24 hours of delivery, 57 (18.9%) were started between 24 and 48 hours after delivery, and the rest (18%) were started after 48 hours. Regarding the duration of ART prophylaxis, 249 (82.5%) patients took it for 6 weeks, but 6 (2%) infants discontinued the medication before 6 weeks. There were 33 infants for whom 12 weeks of Nevirapine were prescribed due to the mother's high risk status, but only 14 (4.6%) completed the medication for 12 weeks, while the rest, 19 (6.3%), discontinued the medication before 12 weeks. Regarding cotrimoxazole preventive therapy (CPT), 295 infants (97.7%) have received CPT, and 7 infants (2.3%) didn't take CPT at all. Of the 200 infants who have received CPT, 200 (66.2%) were started at 6 weeks, while the rest of 83 (27.5%) were started after 6 weeks.

A total of 286 (94.7%) infants had a virological test (DBS), with 195 (64.6%) infants having the test at 6 weeks, the remaining 91 (30.1%) infants having the DBS test after 6 weeks, and 16 (5.3%) infants not having a DBS test at all. When we look at the results of the DBS tests among the infants, 262 (86.8%) were negative for HIV while 24 (7.9%) were found positive and were started on ART. (Table 4).

Adherence of the HIV exposed infants to PMTCT follow up

The average number of follow-up visits in the PMTCT clinic was found to be 12.4; the maximum was 22, and the minimum was one. When we look at the attendance of infants on each of the follow-up schedules, we see that at the 10th week, 230 (76.2%) infants, at the 14th week, 261 (86.4%) infants, at the 5th month, 224 (74.2%) infants, at the 6th month, 218 (72.2%) infants, at the 9th month, 213 (70.5%) infants, at the 12th month, 199 (64.9%) infants, and at the 15th month, On the last follow-up schedule, which was at 18 months, there were only 206 (68.2%) infants who were on follow-up, while 80 (26.5%) infants were defaulters. Additionally, there were 12 (4%) HIV-exposed infants who were transferred to other health facilities

Table 4: PMTCT enrollment and intervention characteristics of HIV exposed infants in Addis Ababa, Ethiopia (n=302) August 2019.

Variables	Frequency (n)	Percentage (%)
Age of enrollment		
At 6 week	204	67.5
6 – 12 week	79	26.2
After 12 week	19	6.3
ART prophylaxis		
Received	288	95.4
Didn't receive	14	4.6
Time of ART prophylaxis initiation		
Within 24 hr of delivery	213	70.5
Between 24 – 48 hr	57	18.9
After 48 hr of delivery	18	6
Duration of ART prophylaxis		
6 week	249	82.5
12 week	19	6.3
Discontinued before 6 week	6	2
Discontinued before 12 week	14	4.6
Cotrimoxazol preventive therapy (CPT)		
Received	294	97.4
Didn't receive	8	2.6
Time of CPT initiation		
6 week	200	66.2
6 – 12 week	83	27.5
After 12 week	11	3.6
Feeding option		
Mixed feeding	22	7.3
Exclusive breast feeding	218	72.2
Exclusive formula feeding	62	20.5
Time of DBS test		
At 6 week	195	64.6
6 – 12 week	78	25.8
After 12 week	13	4.3
Result of DBS test		
Negative	262	86.8
Positive	24	7.9
Not done at all	16	5.3

for different reasons. Among the defaulters, 35 infants came back for follow-up, an HIV test was done, and their serostatus was documented, but the rest, 45 (14.9%), were lost to follow-up and did not return to check or monitor their HIV serostatus (LTFU). At the end of 18 months of follow-up, there were a total of 4 deaths (1.3%) out of 302 enrolled HIV-exposed infants. When we see the adherence of HIV-exposed infants, 172 (57.5%) infants were adherent to follow-up, while 114 (37.5%) infants were not adherent to follow-up. The remaining 16 (5.3%) infants' adherence cannot be assessed because 4 of them were dead before 18 months of age, and 12 infants were transferred to other health facilities. (Table 5)

Table 5: Follow up adherence of HIV exposed infant in Addis Ababa, Ethiopia (n=302), August 2019

Schedule	Frequency (n)	Percentage (%)
Follow up at 6 th week		
Yes	204	67.5
No	98	32.5
Follow up at 10 th week		
On follow up	230	76.2
Transferred out	3	1
Missed follow up	69	22.8
Follow up at 14 th week		
On follow up	261	86.4
Defaulter	30	9.9
Missed follow up	6	2
Transferred out	5	1.7
Follow up at 5 th month		
On follow up	224	74.2
Defaulter	49	16.2
Transferred out	9	3
Missed follow up	18	6
Death	2	0.7
Follow up at 6 th month		
On follow up	218	72.2
Defaulter	61	20.2
Transferred out	11	3.6
Missed follow up	10	3.3
Death	2	0.7
Follow up at 9 th month		
On follow up	213	70.5
Defaulter	60	19.9
Transferred out	10	3.3
Missed follow up	17	5.6
Death	2	0.7
Follow up at 12 th month		

On follow up	199	65.9
Defaulter	75	24.8
Transferred out	12	4
Missed follow up	13	4.3
Death	3	1
Follow up at 15 th month		
On follow up	194	64.2
Defaulter	79	26.2
Transferred out	12	4
Missed follow up	14	4.6
Death	3	1
Follow up at 18 th month		
On follow up	206	68.2
Defaulter	80	26.5
Transferred out	12	4
Death	4	1.3
LTFU*	45	14.9
Follow up facility		
At the place of delivery	171	56.6
Outside place of delivery	131	43.4
Overall adherence to follow up		
Adherent	172	57
Not adherent	114	37.7
Not assessed	16	5.3

* = LTFU: Loss to follow-up

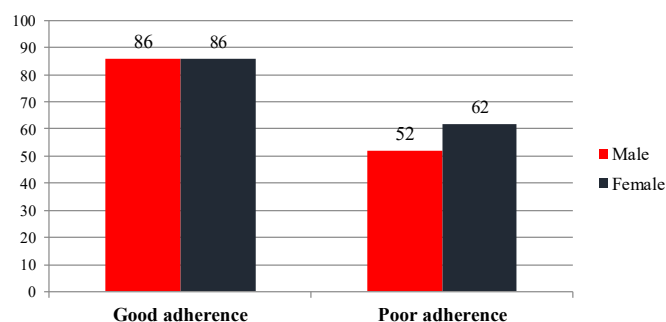


Figure 1: Adherence to follow up and LTFU at the end of 18 month.

Table 6: Factors associated with clinical adherence of HIV exposed infants in Addis Ababa, Ethiopia (n=302) August 2019.

Variables	Adherence		COR(95%CI)	p-value	AOR(95% CI)	p-value
	Poor	Good				
Final sero-status						
Negative	103	172	9.602(3.23-28.54)	0.001	3.687(1.01,13.48)	0.049
Positive	23	4	1		1	
Marital status						
Single	34	18	1.22 (0.56, 32.12)	0.99		
Separated	27	22	0.34 (0.21, 12.4)	0.24		
Unmarried	22	33	3.4 (0.99, 20.52)	0.87		
Widowed	4	0				
Married	40	102	1			
PMTCT facility						
In the same facility	32	139	11.035(6.46,18.9)	0.001	10.09(5.55,18.35)	0.001
Outside facility	94	37	1		1	

Place of delivery						
Home	6	3	0.102(0.01,2.01)	0.13		
Health centers	40	37	1.07(0.486,2.394)	0.85		
Public Hospitals	73	119	2.5(0.76,8.55)	0.12		
Private Health facility	8	16				
Serostatus of father						
Positive(concordant)	42	99	2.987(1.769,5.04)	0.001	2.26(1.18,4.36)	0.015
Negative(Discordant)	16	34	3.013(1.492,6.08)		1	
ART prophylaxis						
Yes	114	174	9.158(2.01,41.68)	0.004	0.596(0.104,3.42)	0.561
No	12	2	1		1	
ANC follow up						
Yes	106	173	10.88(3.16,37.50)	0.09		
No	20	3	1		1	
WHO stage of the mother						
Stage 1	19	52	8.819 (3.54,22.1)	0.001	4.22(1.34,13.21)	0.014
Stage 2	47	93	6.376(2.79,14.56)	0.001	3.26(1.16,9.19)	0.025
Stage 3	31	22	2.287(0.91,5.77)	0.08	1.277(0.428,3.81)	0.661
Stage 4	29	9	1		1	

COR: Crudes odds ratio AOR: adjusted odds ratio CI: confidence interval

* = WHO: World Health Organization

¥ = SVD: Spontaneous vaginal delivery

Factors associated with clinical adherence

At multivariate analysis, 4 variables remained statistically significant these are final serostatus of the infant, place of PMTCT follow up, serostatus of the father and WHO AIDS stage of the mother. Infants whose final serostatus is negative were 3 times more likely to adhere to follow up than sero positive infants (AOR=3.68, 95% CI,1.01, 13.48 p=0.049) and Infants who were having PMTCT follow up in their place of delivery (in the same health facility) were 10 times more likely to be adherent as compared to infants who were having follow up in other health facility.(AOR= 10.09, 95% CI:5.55,18.35 p= 0.001). Infants whose mother were classified as WHO stage I were found to be 5 times more likely to be adherent (AOR=5.039, 95% CI:1.715,14.806 p = 0.014).The last variable which has statistically significant association with clinical adherence was paternal HIV sero status. Infants whose fathers were tested and known to be HIV positive were 2 times more likely to adhere than their counterparts. (OR = 2.26, 95% CI:1.199, 4.444 p =0.015) (Table 6).

Discussion

HIV infection level among HIV exposed infant in Ethiopia among HIV exposed infants was 5% - 9.6% with PMTCT and 10.5% without PMTCT [16]. In this institutional retrospective study, among 302 enrolled HIV exposed infants 27 (8.9%) infants were diagnosed to have HIV positive.

In this study more than one third 114(37.7%) of the infants were having poor clinical adherence and on the last follow up schedule i.e at 18 month of age, there were only 206(68.2%) infants who were on follow up while 80(26.5%) infants were defaulters. Among the defaulters, 35 infants came to the clinic before 24 month of age due to various reasons for which HIV test was done and their serostatus was documented but the remaining 45(14.9%) were lost from the follow up and did not return to check/monitor the HIV serostatus(LTFU). The magnitude

of LTFU in this study is lower than the reports in other studies. For instance study done in Addis Ababa 9 years back showed that about 31% infants were eventually lost from the follow up at the age of 18 month(LTFU)(17). This could be explained by increased coverage and availability of PMTCT services in the country over the past 10 years which enrolled a number of infant-mother pairs with the nearest possible distance. Despite advances in knowledge of effective interventions to save lives of HIV exposed infants, still many infants don not access the full package of services because of loss to follow up (LTFU). A systemic review and meta-analysis on the magnitude of loss to follow-up of HIV exposed infants published on 2013, which includes most of sub-Saharan counties including Ethiopia, showed that the percentage of LTFU ranged from 10.1 to 68.1% [18]. And the pooled estimate of LTFU in this meta-analysis among six sub-Saharan countries was 49.08% which is much higher than our result.

There are number of reasons for poor adherence of infants on the follow up. For instance infants' mothers may face various difficulties while on follow up including a fear that treatment in the facility would lead to stigmatization and discrimination by the community and most importantly from their own families. Another possible reason could be that when the infants' first DBS (PCR) test result at the age of 45 days is negative, the mother may think that it is not necessary to continue follow up further.

Our study also showed that there are a number of factors which are strongly associated with good clinical adherence. The first factor associated with good clinical adherence(adherence to the follow up) is paternal serostatus so infants whose father has been tested and known to positive were found to be 2 times higher odds for infants to adhere than their counterparts(AOR=2.308 95% CI:1.2,4.4 P= 0.012). Similar finding was also depicted in the previously mentioned study done in Addis Ababa which states that infants whose fathers were tested for

HIV with known result were found to be 3 times higher odds for infants to adhere with follow up and treatment than those who didn't know their HIV status (95% CI, 1.0, 9.0) [17]. Other studies conducted in various countries of Africa have shown that HIV test result disclosure and male-partners involvement on HIV/AIDS prevention, care and support package through community mobilization promoted PMTCT intervention uptake as well as adherence with prophylactic treatment and follow up [19].

The second factor associated with clinical adherence was the place or facility of follow-up. Infants who were on follow-up at their place of delivery were 9 times more likely to be adherent than infants who had been on follow-up at another facility. Mothers who have been diagnosed with HIV or AIDS frequently face stigma from various segments of the population. Hence, they usually prefer to attend a facility with which they are familiar, and after delivery, mothers prefer to continue their own and their infant's follow-up in the same health facility than in any other facility. The other factor associated with clinical adherence was the mothers WHO AIDS stage. Mothers who were classified as WHO stage I were five times more adherent than mothers who were stage IV. Mothers who have advanced AIDS defining illnesses are usually sick and are not capable of visiting health institutions more frequently unless they are supported by other family members, and their infants usually miss the follow-up schedules, resulting in poor adherence.

Although assessing home delivery was not our primary goal, it was discovered that 9 (33%) of all mothers enrolled in this study delivered at home. This can have a significant impact not only on the infant's outcome and adherence, but also on the risk of exposure and transmission to other family members who attended the home delivery. And among the mothers who delivered at home, 7 of them did not have any ANC follow-up, while 2 mothers had ANC follow up. This might indicate that there is an increased likelihood of home delivery if there is no antenatal follow-up and no proper counseling of mothers, which was also reflected in another study, Arbaminch (South Ethiopia). The study conducted in the Arba Minch has reported that out of 74 HIV-positive pregnant women, only 7% gave birth to their babies at health care institutions. HIV stigma in a community has prevented HIV-positive women from using health facilities so as not to disclose their HIV status to others [20].

This study showed that the level of HIV infection among infants born to HIV-positive mothers is high. The overall adherence of HIV-exposed infants to follow up was found to be poor, and a significant proportion of infants were lost to follow-up, which might also underestimate the proportion of seropositive infants. The ANC and WHO AIDS stage of the mother, the facility of enrollment, and the HIV status of the father were significantly associated with the adherence of exposed infants to follow-up. All health facilities that have delivery services should have their own PMTCT clinic so that the mother can continue her and her infant's PMTCT follow-up in the same facility to improve clinical adherence (adherence to follow-up).

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Ethical approval

Ethical clearance was obtained from Institutional Review Board (IRB) from the Saint Paul's Millennium Medical College. The information gained from the medical charts was used only for research purpose.

Contributors: FM conceptualized and designed the study; collected, analyzed and interpreted the data; and drafted the manuscript. YG were involved in data analysis, drafting of the manuscript and advising the entire research paper. They were also involved in the interpretation of the data and contributed to manuscript preparation. All authors have read and approved the final manuscript.

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