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Original Research

Utilization of Early Infant Diagnosis of HIV Infection and Associated Factors in Western Ethiopia: Cross-sectional Study

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Abstract

Due to high risk of death before two years of age among HIV-infected infants and increasing availability of pediatric antiretroviral treatments, World Health Organization recommends early HIV testing for all exposed infants to the virus. This study assessed utilization of and associated factors with early infant diagnosis of HIV among HIV exposed infants and young children. We conducted a cross-sectional study from March 01to April 30 in 2014 in the Western Oromia Region, Ethiopia. The study included four weeks to eighteen months aged HIV exposed infants and children and mother pairs enrolled in Anti-retroviral Treatment (ART) or Prevention of Mother to Child Transmission (PMTCT) clinics at 27 health facilities. We carried out bivariate and multivariate logistic regression analyses using SPSS 16.0 software to assess the presence and degree of association between dependent and independent variables using odd ratios with 95% confidence intervals. A *P*-value < 0.05 was considered for statistical significance. Of the total 349 infants/mother pairs, included in our study, the proportion of HIV testing among HIV exposed infants/young children was 83.7% with 6 weeks median age for HIV testing. Mothers residing in urban [AOR= 2.92, 95% CI (1.15-7.40)], who have less number of live children [AOR= 3.37, 95% CI (1.38-8.22)], and who disclose their sero-status to their partner [AOR= 3.29 95% CI (1.05-10.29)] were more likely to utilize early HIV infection testing service. Presence of mother support group at the health facility [AOR= 6.55, 95% CI (2.88 – 14.90)], and early age enrollment of infants to care [AOR= 4.52, 95% CI (2.00-10.27)] were also significant predictors for testing of HIV exposed infants and young children. Utilization of early infant diagnosis of HIV infection was relatively high among children enrolled in ART and/or PMTCT clinics in studied health facilities when compared to previous literatures. However, there were still a number of (16.3%) HIV exposed infants and young children which were not tested for HIV. Thus adequate counseling of mothers on benefits of HIV sero-status disclosure and early enrollments of HIV exposed infants to care, and giving attention to rural attendants are needed.

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INTRODUCTION

Early identification of infants infected with HIV followed by prompt ART treatment and appropriate management helps to reduce morbidity and mortality from HIV as it is progressing fast among pediatric age group. About one third and half of HIV infected infants die before their first and second year of birth, respectively, if not diagnosed and enrolled in to care (Joint United Nation Programme on HIV AIDS, 2013; WHO, 2010; UNAIDS, UNICEF, WHO, 2013).

All infants exposed to HIV should be tested, even if their mothers received Anti-retrovirals (ARVs) for Prevention of Mother to Child Transmission (PMTCT). World Health Organization (WHO), in its guideline on provider initiated HIV testing, recommends early infant HIV diagnosis to be performed at an age of 6 weeks or any time subsequently initiated by the responsible health care providers (Federal HIV/AIDS Prevention and Control Office Federal Ministry of Health of Ethiopia, 2007; WHO, 2010; World Health Organization, 2010).

The WHO recommends immediate initiation of ART upon diagnosis of HIV infection in infants and young children, irrespective of their cell differentiation 4 plus ($CD4^+$) T-lymphocyte counts. Therefore, identification of all HIV exposed infants, early HIV testing, follow up for

results, linkage of those found positives to treatment, growth monitoring, and final HIV status determination after complete weaning would ensure proper utilization of Early Infant Diagnosis (EID) for HIV exposed infants and young children (Federal HIV/AIDS Prevention and Control Office Federal Ministry of Health of Ethiopia, 2007; Fonjungo *et al*., 2013).

Serological assay HIV antibody detection which is suitable in adults cannot be reliably used for confirmatory HIV diagnosis among infants as the interpretation of positive HIV antibody testing is complicated due to maternal HIV antibody that can persist for some 18 months. Thus more suitable diagnostic testing methods (Deoxy ribose nucleic acid polymerase chain reaction (DNA-PCR) are required tests that depend on detection of HIV virus antigen (HIV DNA) in infants' blood whereby dry blood spot (DBS) can be used as a sample taking technique (Federal HIV/AIDS Prevention and Control Office Federal Ministry of Health of Ethiopia, 2007; WHO ,2010).

Even though early infant diagnosis is expanding in many countries overall testing for infants remain low. In resources limited settings, evidences showed several contributing factors for many challenges facing EID services uptake (UNAIDS, UNICEF, WHO, 2013). In 2012, in low and middle income countries, only 39% of children born from known HIV positive women were estimated to access to HIV testing within the recommended two months of their birth (UNAIDS, UNICEF, WHO, 2013).

In Ethiopia, DNA PCR for EID of HIV was introduced in 2006 at a laboratory owned by the Ethiopian Health and Nutrition Research Institute (EHNRI) in Addis Ababa. A total of 2848 infants were tested from April 2006 to April 2008 at this central laboratory, it was the only with capability to perform EID, that resulted in 546 (19.2%) positive samples. This method was then expanded to other regional laboratories in 2008. In 2010, an additional 16,985 HIV exposed infants were tested and of these 1, 915 (11.3%) found positive, at all laboratories (where the service is available) in the country including that at EHNRI (Fonjungo *et al*., 2013).

However, in Ethiopia despite the service availability, it was not consistently utilized. The WHO-UNICEF joint report in 2013 estimated that only 19 % of infants born from women living with HIV/AIDS were tested for HIV in 2012. As to Center for Disease Control (CDC) Ethiopian office report in 2012, 45% of known HIV exposed infants were tested in DNA-PCR (UNAIDS, UNICEF, WHO, *2013;* CDC Ethiopia, 2012).

Psychosocial, socio-demographic and health system factors need to be addressed for proper and sustained EID service utilization as they contribute for EID for HIV to improperly be utilized (Torpey *et al*., 2012). Thus, this study is therefore assessed utilization of early infant diagnosis of HIV infection service and factors affecting in Western Oromia Region, Ethiopia.

METHODS AND MATERIALS

Study Design, Setting and Population

We employed an institutional based cross-sectional quantitative study to collect data from 4 weeks to 18 months aged HIV exposed infants /young children and mother pairs enrolled in ART and/or PMTCT clinics from March 01, 2014 to April 30, 2014 at 27 health facilities. Facilities included were 7 hospitals and 20 health centers in four zones (East Wollega, Horo Guduru, West Wollega and Kelem Wollega) of West Oromia Region, Western Ethiopia. Total population of the study area is about 4.67 million, with estimated 1:1 sex ratio. These four zones have a total of 9 hospitals and 164 health centers.

In the area a total of 67 health facilities (9 hospitals and 58 health centers) were providing EID of HIV exposed infants' service. Here EID is done through DBS sampling technique whereby samples are referred to one referral regional laboratory performing DNA-PCR testing. The EID service provision was not uniformly initiated at all health facilities. It was started at all hospital in 2006, at some 37 health centers in 2010 and expanded to the rest of health centers in 2012.

During the study period there were about 400 exposed infants aged at birth to 18 months and enrolled in the service. Of all 67 health facilities providing EID service, 35 health facilities have no enrolled HIV exposed infants and 5 have very few (only 1 or 2) enrolled infants. Thus we included only 27 health facilities in the study.

Sample Size, Recruitment and Selection of Subjects

All infant-mother pairs having complete registers and follow-up cards from selected health facilities were included in the study. From register of health facilities 376 HIV-exposed infants and young children aged 4 weeks to 18 months were identified. Of these twenty-seven were excluded due to incomplete records resulting in a total sample size of 349 HEI infant and young children - mother pairs for our study.

Data Collection Tools and Measurements

Data were collected by four data clerks, who were familiar and experienced with ART registrations and follow-up cards. Two nurses were assigned as supervisors on data collection process.

Checklists, adapted from national pediatric HIV care and treatment guidelines of Ethiopia (CDC, 2012), were used to extract data related to the objectives of the study from mothers and infants HIV chronic care charts. Data collected includes mothers' socio-demography (maternal age, marital status, residence (urban or rural), total number of children, level of education, distance from a health facility and occupation)); time mothers learned their HIV status and whether they were enrolled in and adherent with care; place of infant delivery; PMTCT interventions; infant feeding mode; infants' enrollment age; infants' HIV testing status; infants' age during HIV testing and HIV test result.

Procedures for infant HIV testing in the study health facilities: Dry blood spot (DBS) sample was collected from infants (preferably at 6 weeks age or as early as possible) by ART/PMTCT health care providers at ART/PMTCT clinic of the health facilities. Then samples were properly dried and sent to nearby referral regional laboratory through postal office or courier. The referral regional laboratory run the tests by DNA-PCR machine after running quality control sample and verifying the quality of the test procedure. The test result was immediately communicated to the service provider at the specific health facility via telephone and postal service. Health

care providers communicated child test result to caretakers during their visit of chronic care appointment schedule.

Data Quality Management

Data collectors who are familiar and experienced with registers were assigned to increase for data accuracy and completeness. To decrease biases we selected those with no health profession background. Checklists were adopted considering the content and layout of the records to make ease of accessing necessary information, and pre-checked with records. Data collectors and supervisors were trained on how to use records and fill the checklists. The principal investigator and supervisors checked all data from each health facilities for completeness, accuracy, and consistency immediately following data collection.

Data Processing and Analysis

Data were entered into Epi-data version 3.1, cleaned and exported to SPSS version 16 for analysis. Descriptive statistics (simple frequency tables, graphs and charts) was used to summarize data. Odds ratio with 95 % confidence interval was used to assess the presence and degree of association between dependent and independent variables. A p-value of less than 0.05 was considered statistically significant. Moreover, for variables with p-value less than 0.25 in bivariate analyses, multivariate logistic regression analysis was carried out to control for possible confounding effects and to assess the separate effect of variables. In addition, collinearity diagnostics of variables were carried out and ensured for the absence of multicollinearity among independent variables by considering tolerance value of less than 0.1 or variance inflation rates (VIF) of greater than 10 as indicator for significant multicollinearity. Goodness of model fitness was also checked by the Likelihood ratio test and Omnibus test.

Ethical Considerations

Ethical clearance was obtained from Jimma University, College of Public Health and Medical Sciences ethical committee. Permission from Zonal and Woreda Health offices and health facilities' managers were also obtained. Names or identification number of HIV exposed infants and their mothers were not included in the data extraction checklists to ensure confidentiality.

RESULTS

Socio-demographic characteristics of study population

Among 349 HIV exposed infants and young children recruited into the study, 180 (51.6%) and 169 (48.4%) were males and females respectively. The mean age of HIV exposed infants and young children was 10.1 (± 4.5) months.

Of the 349 HIV exposed infants and young children, 342 (98.0%) and 7 (2.0%) were taken care by their mothers, and fathers and/or other guardian (mothers' friend, grandmother and blood relative), respectively. The mean age of the mothers was 28 (±5. 4) years and in average each mother has 2 children. About two third (67.9%) of the mothers were urban dwellers, 68.5% live within 10 kilometers of health facilities, 139 (39.8%) did not attend formal education and 292 (83.7%) were married (Table 1).

Table 1: Socio-demographic characteristics of HIV exposed infants and their mothers, Western Oromia Region, Ethiopia 2014.

Variables (n=349)		Frequency	
		Number	Percent
Sex of the infant	Male	180	51.6
	Female	169	48.4
Caretaker relation to infant/child	Mother	342	98.0
	Father or other guardian	7	2.0
Age of mother (years)	15- 24	83	23.8
	25 – 34	214	61.3
	>=35	52	14.9
Mother residence	Urban	237	67.9
	Rural	112	32.1
Mother educational status	No education/illiterate	139	39.8
	Primary School	135	38.7
	Secondary and above	75	21.5
Marital status	Married	292	83.7
	Single	17	4.9
	Divorced or widowed	40	11.5
Mother employment	Employed	18	5.2
	Not employed	331	94.8
Distance from health facility	<10km	239	68.5
	>=10km	110	31.5

HIV Chronic Care Follow-Up and PMTCT Interventions

Table 2 summarizes HIV chronic care follow-up, and PMTCT interventions of mothers and infants. Two hundred fifty (71.6%), 75 (21.5%) and 24 (6.9%) of HEI mothers had known their HIV sero-status before pregnancy, during pregnancy, and during or after delivery respectively. Almost all mothers, 346 (99.1%) have been following ART chronic care service since their enrollment. About 85% of mothers had disclosed their HIV sero-status with majority (80.5%) of them did it to their male partners. Three in five (60.2%) mothers of HEI were linked to mother support group at health facility. Regarding place of

delivery, 84.5% and 15.5% of mothers gave birth at health institutions and home, respectively. The mean enrolment age of infants to HEI care was 2 months with minimum and maximum ages at birth and 14 months consequently. Regarding PMTCT interventions and infant feeding, 91.1% of HEI had received ARV prophylaxis and exclusive breast feeding was the most common (98%) reported mode of infant feeding.

Table 2: HIV chronic care follow-up and PMTCT interventions of mothers and infants, Western Oromia Region, Ethiopia 2014

Variables		Frequency	
		Number	Percent
Period mother heard her sero status (N=349)	Before pregnancy	250	71.6
	During pregnancy	75	21.5
	During or after delivery	24	6.9
Mother currently in care (N=349)	Yes	346	99.1
	No	3	0.9
Mother disclosure HIV status (N=349)	Yes	327	93.7
	No	22	6.3
To whom disclose Sero status (N=327)	Husband	281	80.5
	Mother	10	2.9
	other relative	36	10.3
Adherence of mother(N=349)	Good	316	90.5
	Fair	20	5.7
	Poor	13	3.7
Mother support group linked with(N=349)	Yes	210	60.2
	No	139	39.8
Enrollment age of the infant(N=349)	At birth to 6 weeks	295	84.5
	Greater than 6 weeks	54	15.5
Place of infant delivery(N=349)	Health institution	295	84.5
	Home	54	15.5
Mother received PMTCT interventions(N=349)	Yes	340	97.4
	No	9	2.6
Infant received PMTCT interventions(N=349)	Yes	318	91.1
	No	31	8.9
Mode of infant feeding(N=349)	Exclusive breast feeding (6m)	342	98.0
	Replacement (formula)	4	1.1
	Mixed feeding	3	0.9

HIV Exposed Infants and Young Children HIV Testing

The proportion of HIV testing among HIV exposed infants and young children was 83.7% with the median testing age of 6 weeks. Among tested infants and young children 53.1% and 46.9% were male and female, respectively. Gender disaggregated HIV testing proportions were 86.1% and 81.1% for male and female infants, respectively. From 281 (96.2%) samples whose their DNA-PCR results returned from testing facility (referral laboratory) to their respective health care facilities, 5.3% were found HIV positive (Table 3).

Table 3: HIV exposed infants and young children HIV testing, Western Oromia Region, Ethiopia 2014

Variables		Frequency	
		Number	Percent
Infant tested (DNA-PCR) (N=349)	Yes	292	83.7
	No	57	16.3
Test result received(N=292)	Yes	281	96.2
	Pending	10	3.4
	No	1	0.3
Infants HIV test results (=281)	Positive	15	5.3
	Negative	266	94.7

Factors Associated with Testing of HIV Exposed Infants and Young Children

In the bivariate analysis (table 4), mother residence, maternal educational level, number of live children a mother has, mother's HIV sero-status disclosure, presence of mother support group at facility, mother and infant PMTCT interventions, place of delivery, and early age of infant enrollment were found significant predictors for testing of HIV exposed infants and young children.

Table 5 shows multivariate logistic regression analyses of factors associated with testing of HIV exposed infants and young children. Mothers' residence, number of live children the mother has, mother's HIV sero-status disclosure, presence of mother support group at health facility, and early age enrollment of infant to care were independent significant predictor for testing of HIV exposed infants and young children.

Table 4: Bivariate logistic regression analyses of factors associated with testing of HIV exposed infants and young children, Western Oromia Region, Ethiopia 2014

Factors (N=349)		Infant tested for DNA PCR		OR (95% CI)	*P* value
		Yes Number (%)	No Number (%)		
Sex of the infants	Male	155(53.1)	25(46.9)	1.45 (0.82- 2.56)	0.20
	Female	137(46.9)	32(56.1)	1.00	
Relation to HEI	Mother	286 (83.6)	56 (16.4)	0.85 (0.10- 7.21)	0.80
	Other, guardian	6 (85.7)	1 (14.3)	1.00	
Residence	Urban	209 (88.2)	28(11.8)	2.61(1.46-4.65)	0.001
	Rural	83(74.1)	29(25.9)	1.00	
Marital status	Married	247(84.6)	45(15.4)	1.00	0.28
	Single	15(88.2)	2(11.8)	1.37(0.30-6.18)	
	Divorced or Widowed	30(75.0)	10(25.0)	0.55(0.25-1.20)	
Educational status	No formal education	109(78.4)	30 (21.6)	1.00	0.02
	Primary	112(83.0)	23(17.0)	1.34(0.73-2.45)	
	Secondary & above	71(94.7)	4(5.3)	4.89(1.65-14.46)	
Distance from Health facility	<10km	204(85.4)	35(14.6)	1.46(0.81-2.63)	0.20
	>=10km	88(80.0%)	22(20.0%)	1.00	
HEI mother age	15- 24	70(84.3%)	13 (15.7%)	1.13(0.44-2.86)	0.97
	25 – 34	179(83.6%)	35(16.4%)	1.07(0.48-2.39)	
	>=35	43(82.7%)	9(17.3%)	1.00	
Occupational status	Employed	18(100%)	0(0%)	3.36E8	1.00
	Not employed	274(82.8%)	57(17.2%)	1.00	
	4 and above	37(67.3%)	18(32.7%)		
Time mother heard of her sero-status	Before pregnancy	213(85.2)	37(14.8)	2.88(1.15-7.21)	0.02
	During pregnancy	63 (84.0)	12(16.0)	2.63(0.92-7.50)	
	During or after delivery	16(66.7)	8(33.3)	1.00	
Mother in chronic care	Yes	291(84.1)	55(14.9)	10.58(0.94 - 118.73)	0.06
	No	1(33.3)	2(66.7)	1.00	
Mother HIV disclosure status	Yes	279(85.3)	48(14.7)	4.02(1.63 - 9.93)	0.003
	No	13(59.1)	9(40.9)	1.00	
Mother support group linked with	Yes	200(95.2)	10(4.8)	10.22(4.94 - 21.11)	0.00
	No	92(66.2)	47(33.8)	1.00	
Mother PMTCT* interventions	Yes	287(84.4)	53(15.6)	4.33(1.13 – 16.66)	0.03
	No	5(55.6)	4(44.4)	1.00	
Place of infant delivery	Health institution	262(88.8)	33(11.2)	6.35(3.32 – 12.14)	0.00
	Home	30(55.6)	24(44.4)	1.00	
Type of facilities infants enrolled	Hospitals	125(85.6)	21(14.4)	1.28(0.71-2.30)	0.40
	Health centers	167(82.3)	36(17.7)	1.00	
Infant received PMTCT*	Yes	274(86.2)	44(13.8)	4.50(2.06 – 9.82)	0.00
	No	18(58.1)	13(41.9)	1.00	
Infant enrollment age	At birth to 2 months	263(89.2)	32(10.8)	7.09(3.70-13.55)	0.00
	Greater than 2 months	29(53.7)	25(46.3)	1.00	
Infant feeding mode	Exclusive breastfeeding for 6wk	286(83.6)	56(16.4)	1.00	0.88
	Replacement or mixed feeding	6(85.7)	1(14.3)	0.85(0.10 – 7.21)	

* PMTCT: Prevention of mother to child transmission

Utilization of infants HIV testing service was higher among urban dweller mothers when compared to their rural counter parts [AOR= 2.92, 95% CI (1.15-7.40)]. Mothers who has few (1-3) number of live children are also more likely to utilize infants HIV testing service when compared to mothers having relatively high (>= 4) number of live children [AOR= 3.37, 95% CI (1.38-8.22)], and mothers who disclose their sero-status to their partner or to others are more likely to bring their infants for HIV testing when compared to mothers who did not do so [AOR= 3.29, 95% CI (1.05-10.29)].Utilization of infant HIV testing service was also higher among mothers attending health facilities having mother support group as compared to those attending health facilities without mother support group [AOR= 6.55, 95% CI (2.88 – 14.90)]. In addition, rate of infants HIV testing was higher among infants enrolled to care at their earlier age (birth to 2 months) when compared to those infants enrolled at their late age (greater than 2 months) [AOR= 4.52, 95% CI (2.00-10.27)].

Table 5: Multivariate logistic regression analyses of factors associated with testing of HIV exposed infants and young children, Western Oromia Region, Ethiopia 2014

Factors (N=349)	HIV testing		COR (95% CI)	*P* Value	AOR (95% CI)	*P* Value
	Yes (%)	No (%)				
Residence						
Urban	209 (88.2)	28(11.8)	2.61(1.46-4.65)	0.001	2.92(1.15-7.40)	0.02
Rural	83(74.1)	29(25.9)	1.0		1.00	
Educational status						
No formal education	109(78.4)	30 (21.6)	1.00		1.00	
Primary	112(83.0)	23(17.0)	1.34(0.73-2.45)	0.01	1.02(0.46-2.23)	0.67
Secondary & above	71(94.7)	4(5.3)	4.89(1.65-14.46)		1.76(0.49-6.38)	
Distance from Health facility						
<10km	204(85.4)	35(14.6)	1.46(0.81-2.63)	0.20	0.50(0.20 – 1.26)	0.14
>=10km	88(80.0)	22(20.0)	1.00		1.00	
Number of live children						
1 to 3	255(86.7)	39(13.3)	3.18(1.65-6.13)	0.00	3.37(1.38-8.22)	0.01
4 and above	37(67.3)	18(32.7)	1.00		1.00	
Time mother heard her sero-status						
Before pregnancy	213(85.2)	37(14.8)	2.88(1.15-7.21)		1.34(0.36-5.06)	
During pregnancy	63 (84.0)	12(16.0)	2.63(0.92-7.50)	0.08	0.76(0.17-3.46)	0.67
During /after delivery	16(66.7)	8(33.3)	1.00		1.00	
Mother currently in care						
Yes	291(84.1)	55(14.9)	10.58(0.94 - 118.73)	0.06	7.06(0.16-309.74)	0.31
No	1(33.3)	2(66.7)	1.00		1.00	
Mother disclosure HIV status						
Yes	279(85.3)	48(14.7)	4.02(1.63 - 9.93)		3.29(1.05-10.29)	0.04
No	13(59.1)	9(40.9)	1.00	0.003	1.00	
Mother support group present						
Yes	200(95.2)	10(4.8)	10.22(4.94 - 21.11)	0.00	6.55(2.88 – 14.90)	0.00
No	92(66.2)	47(33.8)	1.00		1.00	
Mother PMTCT*						
Yes	287(84.4)	53(15.6)	4.33(1.13 – 16.66)		0.41(0.04 – 4.69)	0.47
No	5(55.6)	4(44.4)	1.00	0.03	1.00	
Place of infant delivery						
Health institution	262(88.8)	33(11.2)	6.35(3.32 – 12.14)		1.80(0.71-4.54)	0.22
Home	30(55.6)	24(44.4)	1.00	0.00	1.00	
Infant received prophylaxis						
Yes	274(86.2)	44(13.8)	4.50(2.06 – 9.82)		3.34(0.93-12.02)	0.07
No	18(58.1)	13(41.9)	1.00	0.00	1.00	
Infant enrollment age						
At birth to 2 months	263(89.2)	32(10.8)	7.09(3.70-13.55)	0.00	4.52(2.00-10.27)	
Greater than 2 months	29(53.7)	25(46.3)	1.00		1.00	

*PMTCT: Prevention of mother to child transmission

DISCUSSION

The main objective of early infant diagnosis of HIV infection is to detect HIV infection in infants and young children that allows health care providers to offer optimal care and treatment of HIV infected children, assists in decision making on infant feeding, and avoids needless stress in mothers and families. To achieve this objective the service has to be available and properly utilized by caretakers of HEI at health facility level (WHO, 2010).This study aimed to determine the magnitude of HIV testing and factors associated with its utilization using the available DBS, DNA PCR method among HIV exposed infants and young children in Western Oromia Region, Ethiopia.

In this study, 83.7% of HIV exposed infants aged 4 weeks to 18 months among all enrolled at healthcare facilities of Western Oromia region were tested. The study finding is nearly in agreement with what was reported in Tanzania which was 87% (Gregory, 2012) but higher than that reported from Malawi (71.6%) (Dube *et al*., 2012), Kenya (67%) (Ciaranello *et al*., 2011) and Zambia (10%) (Torpey *et al*., 2012). The finding is also higher than the report from study conducted in Addis Ababa, Ethiopia, where 52% of HIV exposed children tested (Alemnesh *et al.,* 2011), and national HIV exposed infant testing estimates reported by WHO-UNICEF (19%) and CDC-Ethiopia (45%) (UNAIDS, UNICEF, WHO, 2013; CDC Ethiopia, 2012). This result showed that utilization of EID of HIV infection in the study area was high relative to previous studies conducted in different countries. Integration of EID in to expanded program of immunization (EPI) services, decentralization of the services to primary health care, expanded testing referral laboratory and support from non-governmental organizations (NGO) partners may explain the high utilization of the service in health facilities in our study

area. The other possible explanation for this higher finding might also be time (recent time) of the study; because awareness of mothers increases through time. Even though the coverage was good (83.7%), still 16.3% of HIV exposed infants and young children were not tested for HIV, which is against WHO recommendations which asserted that all HIV exposed infants should be tested at their early age 4-6 weeks (WHO, 2010). Therefore, more efforts are needed to maximize identification and testing of HIV exposed infants by strengthening EID of HIV infection testing with PMTCT services and other potential entry points.

The current Ethiopian national algorithm for EID of HIV infection recommends testing of HIV exposed infants at the age of 4-6 weeks or as early as possible thereafter (Federal HIV/AIDS Prevention and Control Office Federal Ministry of Health (2007). In this study, the median age of HIV testing was 6 weeks, which is consistent with WHO recommendations (WHO, 2010). But it is in contrast to findings from Tanzania (4 weeks) (Gregory, 2012) and Mozambique (5 months) (Rebecca *et al*., 2011). The median age of EID testing found in this study might have been contributed by more sensitization through mother counseling, increased awareness on EID of HIV infection and integrating the appointment for DBS sample collection with 6 weeks EPI service.

The study identified some factors which were associated with HIV testing among HIV exposed infants and young children.

This study showed that urban dwelling mothers were more likely to utilize EID service when compared to rural residents. This difference might be due to the fact that urban mothers have better access to health services and have information about infants early HIV testing than their rural counterparts.

Mothers who have less number of live children were also more likely to utilize EID of HIV infection when compared to mothers who have more number of live children. This is similar to findings of a study conducted in Addis Ababa, Ethiopia, where number of children mother possess was significantly associated with HIV testing of HIV exposed infants and young children (Matinhure, 2013). This service utilization difference might be due to the fact that mothers with relatively high number of live children may be over burdened by giving care to children and may give relatively less attention to HIV exposed infant testing service when compared to mothers with few number of live children. The other possible explanation might be that mothers with few live children may be more careful of their infants and seeking institutional care when compared to mothers with relatively high number of live children.

Mothers' disclosure of HIV sero-status was also found to be one predictor for early HIV testing of HIV exposed infants. Mothers who disclosed their HIV sero- status were more likely to utilize EID services than those who did not, which is similar findings with a study conducted in Kenya (Hassan *et al*., 2012). Mothers who disclose their HIV sero-status can bring their infants to health service for HIV testing and counseling without fear of partner/relatives since they disclosed their status when compared to mothers who did not disclose their sero-status, might be possible explanation for this difference.

Linkage of mothers to mother support group at health facility were also significantly associated with HIV testing of exposed infants and young children. Similarly, a study conducted in Kenya revealed that the presence of the psychosocial support group was significantly associated with HIV testing of HEI (Hassan *et al*., 2012). This difference might arose because mothers who are linked to health facilities with available mother support group may get adequate counseling and information about early HIV testing of HIV exposed infants when compared to mothers linked to health facilities without mother support group.

Early enrollment of HIV exposed infants and young children to care were also found as predictor for utilization of EID service. This might be due to children who are enrolled to care in their late age may be antibody tested because of their older age.

The study was conducted in 27 health facilities with different recruitments and working practices (hospitals and health centers).This enables it to reflect on the diversity of practical management of EID of HIV infection in a diverse population living in Western Oromia region. And this can be taken as the strength of the study. On the other hand the study has some limitations as well: (1) it used secondary data, (2) it was carried in a health facility levels and (3) it included participants who came to the clinic for services. Thus it may not represent those who are potentially in the community and had no opportunity to reach the health care facility for services. The other limitation is that health care related factors for utilization of EID service were not assessed.

CONCLUSIONS

Utilization of early infant diagnosis of HIV was relatively high in health institutions of Western Oromia Region. The study demonstrated that there is difference in utilization of early HIV diagnosis service of HIV exposed infants in place of residence, number of children mother have, HIV sero-status disclosure status of mothers, availability of mother support groups, and enrollment age of infants to care. Hence, there is need to provide adequate counseling of mothers on benefits of HIV sero-status disclosure to their partner, family planning and early enrollments of infants to care with an eye on rural attendants. Also further researches using primary data by including all possible potential factors of EID service utilization are recommended.

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Conflict of Interest

The authors declared that no competing interests exist

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