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St. Paul's Hospital Millennium Medical College

SCHOOL OF PUBLIC HEALTH

MAGNITUDE OF MOTHER TO CHILD TRANSMISSION OF HIV
AND ASSOCIATED FACTORS AMONG HIV EXPOSED INFANTS
IN SOUTH WEST SHOA ZONE, OROMIA, ETHIOPIA, 2022: A
CROSS-SECTIONAL STUDY

BY OLIYAD TEFAYE (BSc)

ADDIS ABABA, ETHIOPIA

OCTOBER 2022



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**ST. PAUL’S HOSPITAL MILLENNIUM MEDICAL COLLEGE GRADUATE
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ABSTRACT

Background: Mother-to-child transmission is the largest source of Human Immunodeficiency Virus (HIV) infection in children under the age of 15. Despite widespread efforts made, the transmission rate is still as high as 18% in Ethiopia. Though there are several HIV-related studies conducted in Ethiopia, evidence is scarce on mother-to-child transmission of HIV and associated factors among HIV exposed infants, particularly in the study area.

Objective: The study aimed to assess the magnitude of mother to child transmission of HIV and associated factors among HIV exposed infants in South West Shoa Zone, Oromia, Ethiopia, 2022.

Methods: This study was conducted in South West Shoa Zone, Oromia from July 2014 to December 2022. Institution based cross-sectional study was conducted. A sample of 361 exposed infants were included in the study. The collected data were entered into Epi-info version 7.2.3.1 and analyzed through Statistical package for the social science version 25. Simple and multivariable binary logistic regression analyses were applied. Strength of association was reported using adjusted odds ratio (AOR), and its 95% confidence interval (CI) and statistical significance were declared at p-value <0.05.

Result: The prevalence of Mother to child transmission (MTCT) of HIV was 9.7%. No Antenatal care (ANC) attendance (AOR: 4.7; 95% CI: 1.15-19.58), absence of antiretroviral (ARV) during ANC (AOR: 6.4; 95% CI: 1.87-21.77), fair adherence to ARV (AOR: 3.6; 95% CI: 1.06-12.57), home delivery (AOR: 6.2; 95% CI: 1.51-25.24), no antiretroviral therapy (ART) during delivery (AOR: 3.7; 95% CI: 1.12-12.10), WHO clinical stage 2 (AOR: 5.0; 95% CI: 1.52-16.94), no infant ARV prophylaxis (AOR: 6.4; 95% CI: 1.42-28.49) and mixed feeding (AOR: 4.0; 95% CI: 1.18-13.67) were independent factors of HIV positive status among HIV exposed infants.

Conclusion: Prevalence of MTCT of HIV which is twofold of the 2020 national target 5%. ANC attendance, ARV during ANC and delivery, place of delivery, ARV adherence, WHO clinical stage, infant ARV prophylaxes and feeding practice were associated with the HIV status of the infants.

Keywords: Risk factors, Exposed infant, HIV, PMTCT, MTCT

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ACRONYMS/ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
ANC	Ante Natal Care
AOR	Adjusted Odds Ratio
ART	Antiretroviral Treatment
ARV	Antiretroviral
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
COR	Crude Odds Ratio
CS	Cesarean Section
CSA	Central Statistical Agency
DHIS 2	District Health Information System two
HAART	Highly Active Antiretroviral Treatment
HEI	Human Immunodeficiency Virus Exposed Infants
HEU	Human Immunodeficiency Virus Exposed Uninfected infants
HIV	Human Immunodeficiency Virus
MTCT	Mother to child transmission
NGO	Non-governmental Organization
PEPFAR	US President's Emergency Plan for AIDS Relief
PMTCT	Prevention of Mother to Child Transmission
SVD	Spontaneous vaginal delivery
UNAIDS	Joint United Nation program on HIV/AIDS
WHO	World Health Organization

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1 INTRODUCTION

1.1 Background

Human Immunodeficiency Virus (HIV) is a leading cause of death and a health threat worldwide. Infants born to HIV positive pregnant women, by definition, are HIV exposed, and these infants can be infected with HIV during pregnancy, delivery or after birth through breastfeeding. While the child with HIV infection can often be identified during the first months of life, HIV infection cannot be excluded until after one year of age, particularly in breastfeeding babies(1).

Progress towards eliminating mother-to-child transmission of HIV has been primarily achieved by dramatically increasing the proportion of pregnant women living with HIV who receive antiretroviral medicines to prevent vertical transmission (2, 3). Mother-to-child transmission (MTCT) is transmitting HIV from HIV-positive mother to their child during pregnancy, delivery or breastfeeding. In the absence of any intervention, transmission rates range from 15% to 45%(4).

According to Joint United Nation program on HIV/AIDS (UNAIDS) 2021 Data, globally, 37.7 million people were living with HIV/AIDS, of which 1.5 million were newly infected with HIV/AIDS 4,000 peoples being newly infected every day. From this, 60% of new infection were in sub-Saharan Africa, of which 10% are among children under 15 years of age, 90% are among adults aged 15 years and older, of whom almost 51% are among women, 31% are among young people (15–24) and 20% are among young women (15–24) (5).

Approximately 150,000 new HIV infections occurred among children globally in 2020, which declined by more than half (53%) from 2010 to 2020, due mainly to the increased provision of antiretroviral therapy to pregnant and breastfeeding women living with HIV. However, that momentum has slowed considerably, leaving particularly large gaps in the testing of infants and children exposed to HIV; i.e, more than two fifths of children living with HIV undiagnosed. The number of children on treatment globally has declined since 2019, leaving almost 800,000 children (aged 0 to 14 years) living with HIV not on antiretroviral therapy in 2020 (5, 6).

In Ethiopia, the recent estimate of 14,842 new infections in 2019 indicates that there is on-going spread of HIV infection in the population. More than 60% of the new infections are occurring in Amhara, Oromia, South Nation and Nationality People, and Tigray. There has been a 44%

reduction in MTCT in 2019 as compared to 2010. Despite this decline in HIV prevalence and the decline in MTCT from 39.55% to 16.90%, this level of MTCT is still far too high(7).

1.2 Statement of the problem

According to United State (US) President's Emergency Plan for AIDS Relief (PEPFAR) report, the numbers of children newly infected with HIV were 130,000 by 2018 and six-week mother-to-child transmission rate 6.3% among 23 focus countries. The number of annual new infections across all PEPFAR-supported countries was 1.3 million in 2016. Over the last several years, there has been a dramatic decline in new pediatric disorders. In 2017, 1 .8 million children under age 15 lived with HIV/AIDS nearly 90 per cent of whom live in sub-Saharan Africa and one new pediatric HIV infection occurred approximately every three minutes(8, 9).

By 2018 in eastern Africa, 10,000 of the 26,000 new infections in children were the result of women not being retained on treatment throughout pregnancy and breastfeeding and according to 2018 World Health Organization (WHO). Centers for Disease Control and Prevention (CDC) report showed that 160,000 infants acquired HIV infection (10).

According to WHO, 690,000 peoples live with HIV, and its prevalence among 15 – 49 years is 1% and 23,000 people were newly infected with HIV by the end of 2018. In this report, women are disproportionally affected by HIV in Ethiopia, and 92% of pregnant women living with HIV accessed Antiretroviral Therapy (ART) to prevent transmission of the virus to their baby, preventing 3,700 new HIV infection among newborns (11).

Ethiopia started to use the option B+ (test and treat) PMTCT throughout the country to eliminate MTCT. The primary purpose of eliminating MTCT was to reduce new pediatric HIV infections by 90% and reduce the mother-to-child HIV transmission rate to less than 2% by 2030 (12). There are known maternal and infant factors that increase the possibility of MTCT. These risks are high maternal viral load, new maternal HIV infection, decreased maternal CD4 count, maternal AIDS stage III and IV, placental infections during pregnancy and delivery (12). A number of challenges to eliminate MTCT were poor performance in implementing enhanced postnatal prophylaxis, gaps in linking HIV exposed infant (HEI) immediately after birth, failure to implement quality improvement interventions, gaps in maternal and HEI cohort monitoring analysis, shortage of

Dried blood sample kits and interruption of exposed infant diagnosis and testing, stock out of cotrimoxazole syrup for HEIs, and lack of trained staff(7).

Although there has been a major decline in MTCT, the high rate of HIV morbidity and mortality among exposed infants is still the main health challenge in Ethiopia as Ethiopia is among 21 high burden countries with an average speed of MTCT of HIV 18% (13). A recent systematic review revealed that almost one in ten HIV exposed infants become HIV positive in Ethiopia (14). Data generated by the Central Statistical Agency (CSA) of Ethiopia showed that the prevalence of HIV among women and men aged 15 – 49 was 0.9 %, and in 2017 an estimated 613,000 people were living with HIV, of whom 62% were female in Ethiopia Demographic and Health Survey HIV Prevalence Report Ethiopia (15).

Even though studies have been conducted in different parts of the country, similar studies have not been done in South West Shoa Zone, so I tried to fill the gap. This study intended to identify associated factors of HIV transmission from mother to child among patients of South West Shoa Zone.

1.3 Significance of the study

The findings of this study primary benefit mothers and infants use service in South West Shoa Zone. The findings of this study may also benefit stakeholders such as health institutions providing PMTCT, ART service in South West Shoa Zone in planning and improving service provision to HIV positive mother of childbearing age. Finally, this study may also serve as an input for further researches in the broader range at a country level.

2 LITERATURE REVIEW

2.1 Magnitudes of mother to child HIV transmission of exposed infant

In a community-based survey conducted in Rwanda regarding HIV free survival among infants born from HIV positive mothers, 3% of them died at the age of nine months, 4 % tested HIV positive, 91.9 % estimated to be HIV free at 24 months among children born from mothers using highly active antiretroviral therapy(16).

According to a study done in Amhara health institutions of Ethiopia among HIV exposed infants, the proportion of HIV infection was 12.4%(17). Similarly, a report from Northwest Ethiopia depicted the magnitude of HIV among infants born to HIV -positive women were 6.1%, and the presence of HIV was diagnosed using both DNA-PCR and HIV antibody test (18).

A study conducted in Ambo Hospital showed that out of HIV exposed infants enrolled in care, 10.4% of them become infected with HIV(19). Whereas the study done in East and West Gojjam Zone, the rate of HIV transmission among infants exposed for HIV were found to be 5.9%(18).

In a study done in public health facilities of Dessie town, Ethiopia, the proportion of MTCT of HIV was reported to be 3.8%. The majority (86.3%) of infants were diagnosed using DNA/PCR, and a large proportion (91.7%) of HEIs were diagnosed by the age of > 6 months(20)

2.2 Factors associated to HIV status among exposed infants

2.2.1 Socio-demographic characteristics factors

According to a study done in Rwanda, in 53 positive children born to HIV positive women, maternal age was a factor associated with HIV infection, with the highest HIV rate among children born to young mothers (15 - 24) and lowest among children born to women aged 23 to 39 years (16). Other study conducted in selected health facilities of East and West Gojjam Zones, North West Ethiopia, indicated that factors that were associated with transmission of HIV from mother to child were children who were born from older mothers (18).

Other study in shows mothers' educational level lower than grade 9-12 and residence in the rural were associated with HIV MTCT(21).

2.2.2 Maternal Gynecological and obstetric factors

According to the study done in the health center and hospital of Amhara Regional State, regarding outcomes of chronic care of HIV exposed antenatal care attendance had a significant association with HIV infection among HEI whereas delivering in a health institution, mode of delivery, and provision of both infant and maternal prophylaxis showed a highly significant association with HIV infection among HIV exposed infants(22). A recent systematic review revealed that home delivery and lack of maternal PMTCT intervention were significantly associated with MTCT of HIV (14).

In North Wollo Zone, North East Ethiopia, HIV transmission was higher in infants from women who knew their HIV status during pregnancy than who knew after delivery as compared to infants from women who knew before pregnancy, infants delivered with assisted vaginal delivery, infants born from mothers who had poor and fair adherence to drug and in infants who born from women with no antenatal care follow up. Other study also shows, absence of ARV intervention to the mother and the infant, vaginal delivery were significantly associated with MTCT of HIV(20).

In study done West Shoa hospitals shows mothers who were included into of a mother-to-mother support program has a protective effect. Thus, mothers who were not included in a mother-to-mother support program had 86.5% more chance of transmitting HIV to their children and Home delivery also increased the chance of transmitting HIV from mother to child by 6 times when compared to those who delivered at the institution. study also indicates, Mothers who were not included in the option B+ protocol has 18-times more chance of transmitting HIV down to her baby(19).

2.2.3 Maternal Clinical and Immunological factors

According to a study done in Rwanda, indicated that children whose mothers were members of people living with HIV, 30% less likely to be infected with HIV and/or death compared with children whose mothers did not receive any antiretroviral (ARV) during pregnancy. Children whose mothers received Highly Active Antiretroviral Therapy (HAART) for PMTCT and 40% less likely to have HIV infection than living children whose mothers had not received HAART (16).

A study done in Addis Ababa indicated that lack of participation in the mother-to-mother support program, low partner involvement, poor ART adherence, positive syphilis test results, maternal malnutrition, was significantly associated with MTCT of HIV(23). An institution-based retrospective follow-up study conducted in two hospitals of Southern Ethiopia also reported that HIV viral load, advanced maternal AIDS-related illness, and low CD4 cell counts during pregnancy were among the factors associated with MTCT(4).

According to a study done in rural Uganda among exposed infants attending care at health facilities showed that mothers who had poor adherence, infants of mothers who were either lost from care or dead were among the factors associated with MTCT(24). Other study done in referral hospital of west Amhara also indicated that poor maternal ART adherence, mother's advanced WHO clinical stage at enrollment and late enrollment of child became determinants for child HIV infection(25)

According study done in South West Ethiopia, mothers at WHO clinical stage 3 or 4 near delivery were 5.8 times at higher risk of transmitting HIV to their exposed infants compared to mothers who were at WHO clinical stage 1 or 2(26).

The study also showed infants whose mothers could not get PMTCT intervention and mothers who became pregnant after they knew they were HIV positive (18).

2.2.4 Infant factors

A study done in two hospitals of Southern Ethiopia among infants who born from HIV positive mother, mean HIV free survival time difference between exclusive breastfeeding, mixed feeding, and exclusive formula feeding were significant. Mixed breastfeeding, ARV prophylaxis, maternal HAART and SdNVP + AZT+ 3TC intervention were independent predictors of HIV positivity among exposed infants (4). A recent systematic review revealed that associated mixed feeding, absence of infant ARV prophylaxis were significantly associated with MTCT of HIV (14).

A study conducted in Dessie town also revealed that several factors are associated with the rate of vertical transmission of HIV. These factors include advanced disease (stage 3 and 4), absence of ARV intervention to the infant, mixed breast and bottle feeding, and long duration of breastfeeding (>12 months)(20).

Report from Dire Dawa City, Eastern Ethiopia, showed that rural residence, home delivery, infant not receiving ARV prophylaxis at birth, mixed feeding practices, and mother-child pairs neither receiving ARV nor were significant independent determinants of MTCT HIV infection(27). Besides, according to a study report from North West Ethiopia, infants' not receiving ARV prophylaxis, mixed feeding, episiotomy and delivery at home had a significant association for HIV transmission among HIV-exposed infants(17).

A study done in Addis Ababa indicated that mixed feeding of the child during the first six months of life was significantly associated with MTCT of HIV(23).

2.3 Conceptual framework

A conceptual framework for the associated factors of HIV status among exposed infants was derived from the literatures (4, 19, 21, 23, 25). The variables of the conceptual work can be grouped into four categories: Maternal factors (gynecological and obstetric), Socio-demographic characteristics of mother, Maternal Clinical and Immunological factors and infant related factors. This model postulates that these variables impact HIV status among exposed infants.

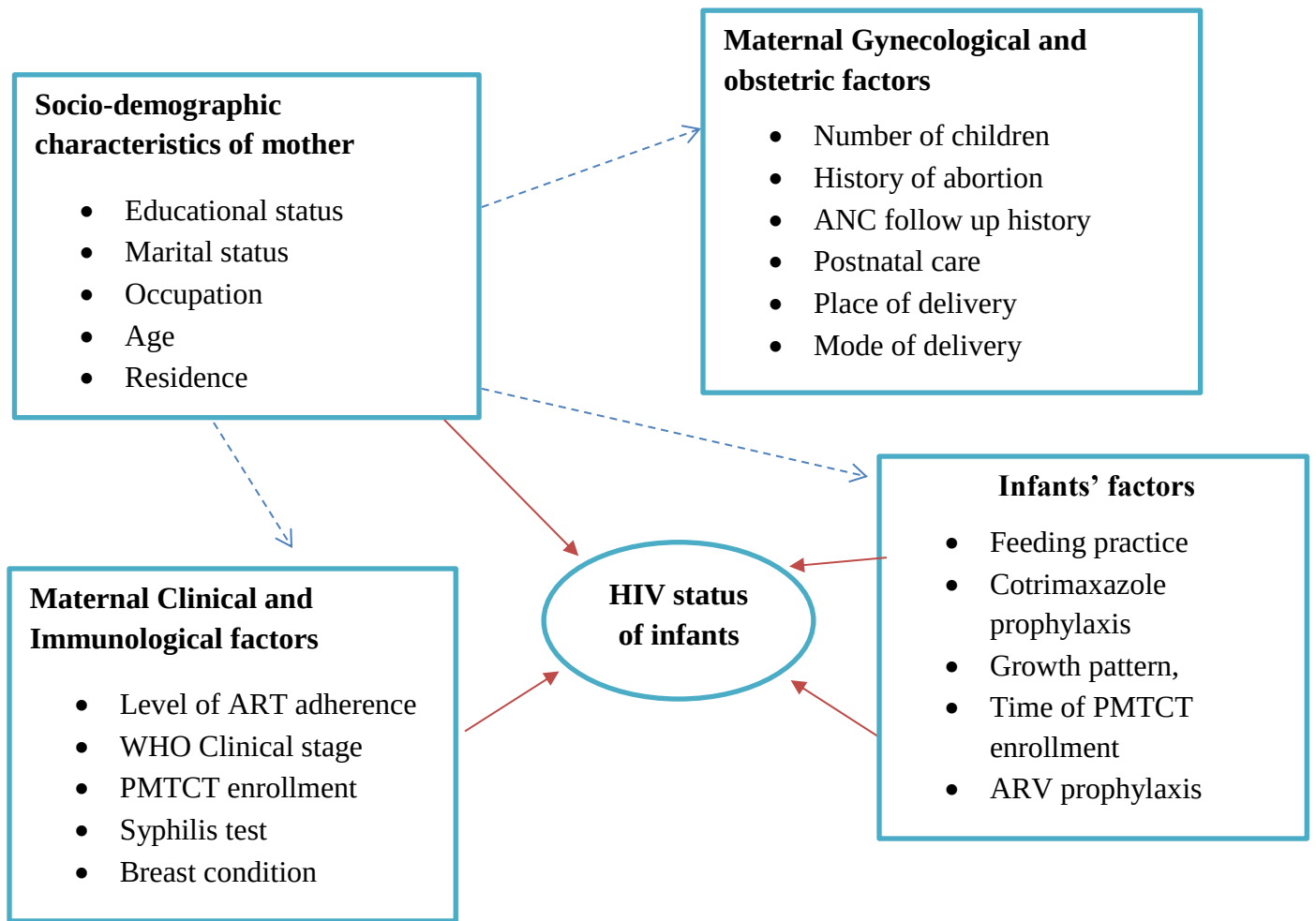


Figure 1 Conceptual framework-describing mother to child transmission of HIV and associated factors among HIV exposed infants: developed from review of related literatures [4, 20, 22, 24, 26].

3 OBJECTIVES

3.1 General objective

To assess magnitude of mother to child HIV transmission and associated factors among HIV exposed infants in South West Shoa Zone, Oromia, Ethiopia, from June 15- July 31, 2022.

3.2 Specific objectives

1. To assess magnitude of mother to child HIV transmission among HIV exposed infants in South West Shoa Zone, Oromia, Ethiopia, from June 15- July 31, 2022
2. To identify factors associated with HIV status among HIV exposed infants in South West Shoa Zone, Oromia, Ethiopia, from June 15- July 31, 2022.

4 METHODS AND MATERIALS

4.1 Study area and period

The study was conducted in South West Shoa Zone, Oromia, Ethiopia. Waliso is capital town of the Zone which is located 120 Km away from Addis Ababa to the south west direction. According to data obtained from South West Shoa health office the Zone has a total population of more than 1.5 million and has 11 administrative districts. There are 6 hospitals of which 5 are public and 1 NGO; and 48 health centers, providing health services including comprehensive maternal and child health care services, including ANC, PMTCT, safe delivery, postnatal care and counseling on infant feeding(28). According to DHIS 2 report of December 2021, number of adults and children who are currently on ART were 3,515. Number of infants born to HIV positive women from July 2014 to December 2020 were 377 (28).

The study was conducted from July 2014- December 2022.

4.2 Study design

Institution-based cross-sectional study design was used.

4.3 Source and study population

4.3.1 Source population

HIV exposed infants born from seropositive mothers who were enrolled in South West Shoa Zone health facilities.

4.3.2 Study population

Infants born to HIV positive mothers and who have a confirmatory test result at or before 18 months of age in South West Shoa Zone health facilities from July, 2014 to December, 2020.

4.4 Eligibility criteria

4.4.1 Inclusion criteria

An infant whose maternal & infant's records are available from July, 2014 to December, 2020, in South West Shoa Zone health facilities.

4.4.2 Exclusion criteria

Infants whose HIV sero status is not known.

4.5 Sample size and sampling procedures

4.5.1 Sample size determination

For the first objective: The magnitude of mother to child HIV transmission.

The sample size of the study participants for the first objective was calculated based on Single population proportion formula.

$$n = \frac{[(Z_{\alpha/2})^2 \times p(1-p)]}{d^2}$$

n = is the size of the sample

Z= is the standard normal value corresponding to the desired level of Confidence (95% confidence level assumed, where corresponding value of $Z_{\alpha/2}$ is 1.96)

d= margin of error = 0.04

P= Proportion of MTCT was 12.4 % of study done in Amhara health institutions of Ethiopia(17).

$$n = \frac{[1.96]^2 \times 0.124[1 - 0.124]}{(0.04)^2} = 261$$

For the second objective: The sample size was determined using two population proportion formula using cross-sectional study with the assumption of power 80, confidence interval of 95% and exposed to unexposed ratio of one to one (1:1) by Epi-Info Version 7.2.3.1 statistical software and 5.0% of controls were exposed to instrumental delivery and odds ratio of 3.3(23) taken from previous similar study which gave the largest sample size of 330 children(Table 1).

Table 1: Sample size determination for study of magnitude of mother to child HIV transmission and associated factors among HIV exposed infants in South West Shoa Zone, Oromia Regional State, Ethiopia, 2022.

Associated factors	%of control exposed	AOR	N	Reference
Three times ANC visits	13.9	2.7	222	(21)
Exclusive breast feeding	87.3	4.9	274	(29)
Instrumental delivery	5.0	3.3	330	(23)
No nevarapine intervention	81.0	5.3	172	(20)

The sample size calculated for the first and second objectives and the largest sample size were 261, 330 respectively. By adding incomplete data set of 10%, the final sample size determined was 363.

4.5.2 Sampling procedure

Health centers and Hospitals that reported at least one child exposed to HIV positive mothers from July 2014 to December 2020 were included in the study. Since, number of HIV exposed infants in health facilities in South West Shoa Zone during the period from July 2014 to December 2020 were only 377 children, all of them with their mothers who were meet the inclusion criteria were recruited into the study. Finally, infants in the inclusion criteria were recorded using a checklist prepared to address the objectives.

4.6 Variables of the study

4.6.1 Dependent variables

HIV status of the infants (positive or negative)

4.6.2 Independent variables

- Socio-demographic characteristics of the mother (educational status, marital status, occupation, age, and residence)
- Obstetric and gynecologic characteristics (number of children, ANC follow up history, number of pregnancy, history of abortion, postnatal care, place of delivery, mode of delivery)
- Maternal clinical and immunological factors (level of ART adherence, PMTCT enrollment, syphilis test, breast condition)
- Infants' factor (feeding practice, ARV prophylaxis given, growth pattern, cotrimaxazole prophylaxis)

4.7 Operational definitions

HIV Exposed infant: Infant born to HIV-infected mother or HIV antibody positive infant < 18 months of age(23).

HIV infection of infant/child: at least one positive HIV DNA-PCR or a positive HIV rapid test after 18 months of age (23).

4.8 Data collection tools and Procedure

The data collection tool was adapted from the medical record of the mother and the child, integrated PMTCT registration and exposed infants' care follow-up registration card. The tool was addressed the socio-demographic, maternal ARV and obstetric factor, maternal clinical and immunological factor and Infant's factor. Three midwifery data collectors and one Health officer supervisor who got training on adult and pediatric ART or PMTCT training background were recruited for the data collection.

Data were collected retrospectively by reviewing maternal charts, ANC follow-up, integrated PMTCT registration, adult HIV care, and treatment follow-up registration, HIV-exposed infants follow up card, using a checklist developed in English since all records are prepared in English.

4.9 Data quality assurance

One day of training was given to data collectors before actual data collection by the principal investigator, and a shared understanding was taken on the data collection tool through a detailed discussion on the data collection process. The whole data collection process were coordinated and supervised by the principal investigator. The data collection tool was pre-tested on 5% of the sample size in other health facilities which provide the same service, and appropriate modification was done before final data collection time. Collected data were checked for completeness, accuracy, and consistency by data collectors and principal investigators every day. Any challenge and problem identified and unclear and ambiguous before actual data collection was managed accordingly through discussion with data collectors, principal investigators, and advisors.

4.10 Data processing and analysis

After collection, data were checked for completeness, accuracy, and consistency daily during data collection, was entered into Epi-info version 7.2.3.1 and exported to SPSS version 25 for analysis. Descriptive analysis was used to summarize the data according to the variable type used. Bivariate analysis were conducted to determine associations between independent and dependent variables. Variables with a p-value < 0.25 in the bivariate analysis were entered into multivariable binary logistic regression models. Adjusted Odds ratios (AOR) with 95% CI were estimated to assess association's strength, and statistical significance was declared at a P-value < 0.05 . Hosmer and Lemeshow test goodness-of-fit statistic value was 0.82 and statistic value more than 0.05 was used

to characterize a model as better fit. Multi-collinearity test was done to check whether independent variables were inter correlated using variance inflation factor (VIF) and value of ten or more was considered for diagnosing multi-collinearity and there were no correlated variables.

4.11 Ethical considerations

Ethical clearance was obtained from the Institutional Review Board of St Paul's Hospital Millennium Medical College. All the data collected were kept confidential and not shared with anyone other than members of the survey team. The names of the patients were not indicated to preserve confidentiality and privacy.

4.12 Dissemination of results

The finding of this study will be presented and disseminated to St Paul's Hospital Millennium Medical College. The results will be disseminated to South West Shoa Health Office, local institutions and other concerned bodies. Finally, effort will be made to publish findings in a peer-reviewed scientific journal.

5 RESULT

5.1 Socio-demographic characteristics of the mother

Three hundred sixty one mother-child pairs were included in the study. The mean $\pm$ SD age of mother was 30.62 ± 4.25 . Majority of mothers (81.4%) were in the age group of 25–35 years and 80.0% of them lived in urban areas. More than three-fourths (88.9%) of mothers were married and more than half (66.2%) had completed primary school and above. More than half (60.8%) of the study participants were housewives (Table 2).

Table 2: Socio-demographic characteristics of mothers of HEIs at Health Facilities in South West Shoa Zone, Oromia, Ethiopia, 2022 (n=361)

Variables	Categories	Frequency	Percentage
Age	< 25 years	23	6.4
	25-35 years	294	81.4
	>35 years	44	12.2
Residence	Urban	288	80.0
	Rural	72	20.0
Level of education	First degree and above	10	2.8
	Secondary and diploma	49	13.5
	Primary	180	49.9
	No formal education	122	33.8
Marital Status	Married	321	88.9
	Divorced	20	5.5
	Others*	20	5.6
Occupation	Employed	17	4.7
	Housewife	219	60.8
	Trader	50	13.9
	Farmer	29	8.1
	Daily laborer	45	12.5

HEIs- Human Immunodeficiency Virus Exposed Infants, **others*** Single, widowed

5.2 Obstetric characteristics of the mothers

Concerning antenatal care (ANC) attendance, 342(94.7%) of the total study participants have attended ANC at least once and majority 330(91.4%) of them gave birth in health institutions. Concerning the mode of delivery 314(87.0%), delivered via spontaneous vaginal delivery (Table 3).

Table 3: Obstetric characteristics of mothers of HEIs at Health Facilities in South West Shoa Zone, Oromia, Ethiopia, 2022 (n=361)

Variables	Categories	Frequency	Percentage
Number of births	≤ 2	127	35.2
	3	120	33.2
	≥ 4	114	31.6
ANC visit	Yes	342	94.7
	No	19	5.3
Place of delivery	Health facility	330	91.4
	Home	31	8.6
Syphilis test result (n=336)	Positive	13	3.9
	Negative	309	92.0
	Not done	14	4.1
Mode of delivery	Emergency CS	33	9.1
	Elective CS	14	3.9
	SVD	314	87.0

ANC-Antenatal care, **CS**- Cesarean section, **SVD**- Spontaneous vaginal delivery

HEIs- Human Immunodeficiency Virus Exposed Infants

5.3 Maternal clinical and immunological characteristics

More than three- fourth (78.7%) of mothers provided ART during ANC. According to the WHO clinical stages, 329(91.6%) were categorized in stage 1 of the classification. Majority (88.9%) of study participants had a good ART adherence (Table 4).

Table 4: Clinical and immunological characteristics of mothers of HEIs at Health Facilities in South West Shoa Zone, Oromia, Ethiopia, 2022 (n=361)

Variables	Categories	Frequency	Percentage
ARV during ANC	Yes	284	78.7
	No	77	21.3
WHO Clinical Stage of the mother	Stage 1	329	91.6
	Stage 2	30	8.4
ART during delivery (n=359)	Yes	257	71.6
	No	102	28.4
ART Adherence	Good	321	88.9
	Fair	34	9.4
	Poor	6	1.7
Time of mother HIV Diagnosed (n=359)	Before pregnancy	254	70.4
	During pregnancy	96	26.6
	After delivery	11	3.0
Mother's breast condition	Normal	351	97.2
	Crackled nipples	10	2.8

ARV- Antiretroviral, **ART-** Antiretroviral Treatment

5.4 Infant/Child-Related characteristics

Majority of the children 336(93.0%) were exclusively feeding within the first six months of their life and 339(93.9%) of them were provided ARV prophylaxis. (Table 5).

Table 5: Infant/Child-related characteristics of HEIs at Health Facilities in South West Shoa Zone, Oromia, Ethiopia, 2022 (n=361)

Variables	Categories	Frequency	Percentage
Infant ARV prophylaxis	Yes	339	93.9
	No	22	6.1
Infant Cotrimaxazole prophylaxis	Yes	344	95.3
	No	17	4.7
Feeding practice within 6 months	EF*	336	93.0
	MF	25	7.0
Age of the infant at enrollment to PMTCT	Less than 6 weeks	333	92.2
	Greater than 6 weeks	28	7.8
Growth pattern	Normal	346	95.8
	Growth failure	15	4.2

ARV- Antiretroviral, **PMTCT-** Prevention of Mother to Child Transmission, **EF*-**Exclusive breast feeding, Exclusive replacement feeding, **MF-** Mixed feeding, **HEIs-** Human Immunodeficiency Virus Exposed Infants

5.5 Magnitude of HIV Status of HEIs

There were 361 exposed infants enrolled at health facilities and among them, 35 (9.7%) children acquired HIV down from their mothers. This made the prevalence of 9.7% for exposed infants in South West Shoa Zone.

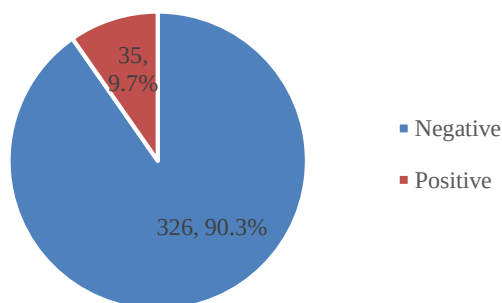


Figure 2 Magnitude of HIV status of HIV exposed infants in South West Shoa Zone, Oromia, Ethiopia, 2022

5.6 Factors associated with MTCT of HIV

First, bivariable logistic analysis was done to identify possible factors associated with MTCT of HIV among HEIs. Consequently, ANC attendance status, ARV during ANC, time of mother HIV diagnosed, ART adherence, WHO clinical stage, place of delivery, ART during delivery, infant ARV prophylaxis, age infant enrolled to PMTCT and infant feeding practice within first 6 month had a P-value less than 0.25. It was fitted into the multivariable binary logistic regression model.

Among the variables included in the final model, mothers who had no ANC attendance were almost five times more likely to have HIV positive infants than those who had attended ANC (AOR: 4.7; 95% CI : 1.15-19.58).

Mothers who had not received ARV during ANC were 6.4 times more likely to have HIV positive infants than those who had received the ARV during ANC (AOR: 6.4; 95% CI: 1.87-21.77). Likewise, mothers who had not received ARV during labor/delivery were 3.7 times more likely to have HIV positive infants than those who had received the AVR during labor/delivery(AOR: 3.7; 95% CI : 1.12-12.10).

Mothers enrolled on PMTCT care at WHO clinical stage-II of HIV were 5 times more likely to have HIV positive infants than mothers who enrolled on PMTCT care at the stage- I (AOR: 5.0; 95% CI: 1.52-16.94). On other hand mothers who had fair adherence to ARV were 3.6 times more likely to have HIV positive infants than those who had good adherence to ARV (AOR: 3.6; 95% CI: 1.06-12.57).

Mothers who delivered at home were 6.2 times more likely to have HIV positive infants than those delivered at health institutions (AOR: 6.2; 95% CI: 1.51-25.24).

Infants who did not receive ARV prophylaxis were 6.4 times more likely to acquire HIV than those who received ARV prophylaxis (AOR: 6.4; 95% CI: 1.42-28.49). On other hand, the odds of being HIV positive in infants was 4.0 times higher among infants on mixed feeding during the first 6 month than infants on exclusive breast feeding (AOR: 4.0; 95% CI: 1.18-13.67) (Table 5).

Table 6: Bivariate and Multivariable Logistic Regression Analysis of Factors Associated with MTCT of HIV among HEIs at Health Facilities in South West Shoa Zone, Oromia, Ethiopia, 2022 (n=361)

Variables	HIV Status		COR (95% CI)	AOR (95%CI)	P-value
	Positive	Negative			
ANC					
Yes	27(7.9%)	315(92.1%)	1.0	1.0	
No	8(42.1%)	11(57.9%)	8.5(3.15-22.88)	4.7(1.15-19.58)	0.03*
ARV during ANC					
Yes	10(3.5%)	274(96.5%)	1.0	1.0	
No	25(32.5%)	52(67.5%)	13.2(5.97-29.06)	6.4(1.87-21.77)	0.01*
Time of mother HIV Diagnosed					
Before pregnancy	15(5.9%)	239(94.1%)	1.0	1.0	
During pregnancy	15(15.6%)	81(84.4%)	2.9(1.38-6.30)	0.3 (0.08-1.15)	0.08
After delivery	5(45.5%)	6(54.5%)	13.3(3.63-48.55)	0.3(0.05-2.36)	0.28
ART adherence					
Good	22(6.9%)	299(93.1%)	1.0	1.0	
Fair	11(32.4%)	23(67.6%)	6.5(2.81-15.04)	3.6(1.06-12.57)	0.04*
Poor	2(33.3%)	4(66.7%)	6.8(1.18-39.17)	2.1(0.20-22.24)	0.54
Place of delivery					
Health facility	20(6.1%)	310(93.9%)	1.0	1.0	
Home	15(48.4%)	16(51.6%)	14.5(6.29-33.56)	6.2(1.51-25.24)	0.01*
ART during delivery					
Yes	8(3.1%)	249(96.9%)	1.0	1.0	
No	27(26.5%)	75(73.5%)	11.2(4.89-25.70)	3.7(1.12-12.10)	0.03*
WHO Stage					
Stage 1	22(6.7%)	307(93.3%)	1.0	1.0	
Stage 2	12(40.0%)	18(60.0%)	9.3(3.98-21.74)	5.0(1.52-16.94)	0.01*
Age at enrollment to PMTCT					
Less than 6 weeks	25(7.5%)	308(92.5%)	1.0	1.0	
Greater than 6 weeks	10(35.7%)	18(64.3%)	6.8(2.86-16.40)	5.9(0.95-37.54)	0.06
Infant ARV prophylaxis					
Yes	22(6.5%)	317(93.5%)	1.0	1.0	
No	13(59.1%)	9(40.9%)	20.8(8.02-54.00)	6.4(1.42-28.49)	0.01*
Infant feeding practice					
EF**	24(7.1%)	312(92.9%)	1.0	1.0	
Mixed feeding	11(44.0%)	14(56.0%)	10.2(4.19-24.93)	4.0(1.18-13.67)	0.03*

*significant at p-value < **0.05**, **EF**** (Exclusive breast feeding and Exclusive replacement feeding)

HEIs- Human Immunodeficiency Virus Exposed Infants, **MTCT**- Mother to Child Transmission,

ANC-Antenatal care, **ARV**- Antiretroviral, **ART**- Antiretroviral Treatment, **PMTCT**- Prevention of Mother to Child Transmission.

6 DISCUSSION

Elimination of MTCT of HIV is one of the priorities of the Ethiopian health sector HIV prevention program targeted to be achieved less than 5% by 2025(7). To realize the goal, regular monitoring of the magnitude and identifying the factors of the MTCT are essential elements. Thus, this study was conducted to assess the maternal socio-demographic characteristics, clinical and obstetric factors and infant factors associated with MTCT of HEIs during pregnancy, delivery and breast feeding period.

Around one in ten HEIs had MTCT and the factors associated with the transmission were absence of ANC attendance, no ART during ANC and delivery, home delivery, fair adherence to ARV, WHO clinical stage 2, no infant ARV prophylaxes and mixed feeding.

There were 361 exposed infants enrolled at study health facilities and among them, 35(9.7%) children acquired HIV down from their mothers. This made the prevalence of 9.7% for exposed infants in South West Shoa. This is slightly lower than the transmission rate of Ethiopia as a whole, which was reported to be 16.9% in 2019(7), Dire Dawa City(15.7%)(29), Amhara health institutions of Ethiopia(12.4%)(17). This was significantly higher than the country's target to reduce the transmission rate to lower than 5% by 2020(30), East and West Gojjam(5.9%)(18), Dessie Town(3.8%)(20). This happened probably due to low activities to mobilize and create awareness among pregnant mothers to follow ANC and attend institutional delivery since the majority of MTCT happened among those who delivered at home. This study also conducted on both HEIs who received intervention with option B+ and not received intervention. Similarly, this study was also comparable with the finding of a study conducted in Ambo Hospital(10.4%)(19).

The finding of this study show that HIV exposed infants whose mothers had no ANC visit were more likely to have a positive status than whose mothers attended ANC, which is similar to a related study done in Dessie Town(20). This is because routine HIV testing at ANC visit enables early identification and initiation of ARV drugs for HIV positive pregnant mothers and continued counseling for institutional delivery readiness during follow up. But other studies conducted in Ethiopia showed no significant association between ANC visit and MTCT of HIV(21, 26). This is probable due to sample size and time of study.

This study revealed that the mothers who had not received ARV during ANC was significantly associated with infant HIV status, which is similar to a related study done in North West Ethiopia

(18), in Rwanda(16). This is due to the fact that lack of prophylaxis increases the viral load and its chance to be transmitted from those mothers to their newborns(31).

Maternal ARV drug intake was also significantly associated with MTCT of HIV. Absence of maternal ARV drug intake prior to delivery seemed to increase the MTCT of HIV, which is similar to the studies conducted in Ethiopia(20, 26). This is as a result of maternal ARV drug intake causing the reduction of maternal viral load and reduced risk of viral transmission to their infants.

Additionally, this study has shown that mothers who fairly adhered to ART were greater than three times more likely to have HIV positive infants than those having good ART adherence. The result is similar but lower in the magnitude of risk than a case-control study conducted in West Amhara(25),but higher in magnitude of risk than conducted in Addis Ababa(23). Fair ART adherence can cause treatment failure resulting in drug resistance which possibly increases viral load and maternal HIV disease progression leading to increased risk of MTCT(24).

The delivery place was another factors of infants` HIV status, where home delivery had a six fold higher odds of HIV infection than health institution delivery. This finding was also comparable to evidence of two studies from Ethiopia reported that home delivery increases the chance of HIV transmission from positive mothers to their newborns (23, 29). This result could be because the risk of MTCT of HIV infection is minimized when skilled professionals in health institutions attend the birth as mothers who delivered at health institutions can use ARV prophylaxes given to the mother during delivery and the newborn right after birth (23). In addition, mothers who delivered at home are more likely not to attend ANC during their pregnancy and also miss the opportunity of taking PMTCT prophylaxis during ANC(29). A study from Kenya also revealed that home delivery puts an infant at a higher risk of HIV transmission and increases the chances of a woman not taking her tablets in delivery or giving their infants prophylaxis(32).

This study revealed children who had been mixed-fed were four times more likely to be positive than those who are exclusively breastfed. This finding is in line with the studies conducted in Addis Ababa(23) and North West Ethiopia(17). The possible reason for this risk difference might be mixed feeding which involves feeding both breast milk and additional foods including formula food can increase the likelihood of damaging the epithelial lining of the child, which in turn may result in infection that increases the risk of infection.

The WHO clinical stage of HIV at enrollment to PMTCT was significantly associated with infant HIV status. This finding is consistent with a survey conducted in South West Ethiopia(33) and West Amhara(25), that documented the severity of maternal clinical stage as significant determinants of infant HIV positivity. This finding may indicate that pregnant mothers with advanced disease stages may have virulent HIV strains that convey less effective passive immunity to their infants(33). Another possible justification could be the advanced clinical stage of HIV exposes to more opportunistic infections that lead to high viral load and immunodeficiency(23)

This study revealed infants who did not receive ARV prophylaxis were more like to have positive HIV status. This was in agreement with studies conducted in Ethiopia which found that ARV prophylaxis for infants was a significant determinant of MTCT of HIV (14, 17, 20). This is due to the viral suppression effect of NVP and might be being without ARV prophylaxis leaves the child unprotected with exposure on any occasion during interaction with his mother including breast feeding.

7 LIMITATIONS

This study has certain limitations. Since it used secondary data source, some of the records were incomplete, and the information gathered was not complete for some subjects, studied factors were based on routinely recorded information, which may not have covered all risk factors of MTCT. Some of the variables obtained from records like maternal viral load, initial CD4 count when enrolled to PMTCT care were incomplete and hence were not included in the analysis.

All factors found in this study cannot determine the cause of infant HIV infection instead only shows association.

8 CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion

Different maternal, obstetric, and child-related factors determining MTCT of HIV during pregnancy, delivery, and post-natal period were identified. Prevalence of MTCT of HIV which is twofold of the 2020 national target 5%. ARV during ANC and delivery, place of delivery, ARV adherence, WHO clinical stage, ARV prophylaxis, and feeding practice were associated with the HIV status of the infants. Counseling as well as setting up linkage with PMTCT and giving ARV intervention to all HIV positive pregnant women and timely initiation of NVP prophylaxis to all HEIs to prevent MTCT of HIV.

8.2 Recommendations

To pregnant mothers

- Mothers need to regularly visit health facilities to have good ARV therapy adherence and get counseling on institutional delivery and exclusive breast feeding.

To health care providers/health facilities

- Promoting ANC service utilization among pregnant women and integrate it to PMTCT
- Health service providers/health institutions should encourage institutional delivery
- Besides, health facilities should initiate ARV prophylaxis for infants and provide timely.

To researchers

- Researchers should conduct a nationwide study to understand the effect of factors identified in this study using large sample size and more robust research designs (Cohort Study) and qualitative component to exploit additional factors affecting MTCT of HIV that were missed in this study due to incomplete information.

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10 ANNEX

10.1 Annex 1: English version of check list

Mother to child transmission of HIV and associated factors among HIV exposed infants in South West Shoa Zone, Oromia, Ethiopia, 2022: A Cross-sectional Study

Code : _____			
Q#	Questions	Response category	Remark
Part. I. Socio- demographic characteristics			
101	Residence of the mother	1. Urban 2. Rural	
102	What was age of mother at delivery in years?	_____	
103	What is mother Occupation?	1. Housewife 2. Employee 3. Student 4. Trader 5. Daily laborer 6. Farmer 7. Others (Specify)_____	
104	What is marital status when she was pregnant?	1. Single 2. Married 3. Widowed 4. Divorced	
105	What is educational status of mother?	1. No formal education 2. Primary 3. Secondary and Diploma 4. First degree and above	
Part. II Maternal gynecological and Obstetric factors			
201	How many times ever pregnant?	_____	
202	How many times gave birth?	_____	
203	History of abortion	1. Yes 2. No	
204	Did mother attend Antenatal care when she was pregnant?	1. Yes 2. No	If No, Go to on 207
205	How many Antenatal care visit(s) have she made?	_____	
206	What was her Syphilis test result during Antenatal care follow-up?	1. Positive 2. Negative 3. Not done	
207	Place of delivery	1. Health facility 2. Home	
208	What was mode of delivery?	1. Emergency Cesarean section 2. Elective Cesarean section 3. Spontaneous vaginal delivery 4. Instrumental delivery 5. Episiotomy	
209	Did she attend PNC follow up?	1. Yes 2. No	

210	When did she know her HIV sero status?	1. Newly diagnosed during ANC 2. Newly diagnosed during labor & delivery 3. Newly diagnosed during Postnatal 4. Known HIV +	
211	Have she taken ART during labor?	1. Yes 2. No	
Part III Maternal clinical and immunological factors			
301	Was the mother enrolled to PMTCT?	1. Yes 2. No	
302	Did she take ARV during ANC	1. Yes 2. No	
303	PMTCT intervention	1. On ART 2. PMTCT 3. None	
304	PMTCT mother-child pairs	1. Both on ARV 2. Either one on ARV 3. Neither on ARV	
305	Initial CD4 count of the mother when enrolled to PMTCT?	_____	
306	Viral load of the mother during pregnancy	_____	
307	WHO clinical stage of the mother when enrolled to PMTCT?	1. Stage 1 2. Stage 2 3. Stage 3 4. Stage 4	
308	Did she takes Cotrimoxazole prophylaxis therapy (CPT)?	1. Yes 2. No	
309	Mother's Breast condition; if breast feeding	1. Normal 2. Cracked nipples 3. Mastitis 4. Breast Abscess 5. Other (specify): _____	
310	ART adherence	1. Good 2. Fair 3. Poor	
Part. IV Infant Factors			
401	Infant age at enrollment to PMTCT	1. ≤ 6 weeks 2. > 6 weeks	
402	Growth pattern	1. Normal 2. Growth failure	
403	Did infant takes Cotrimoxazole prophylaxis?	1. Yes 2. No	

404	Did the infant receive ARV prophylaxis?	1. Yes 2. No	
405	Infant feeding practice within the 1 st 6 months?	1. Exclusive breast feeding 2. Exclusive replacement feeding 3. Mixed feeding	
406	Definitive sero status of the child?	1. Positive 2. Negative	

Declaration

I, the undersigned student declare that this research project is my original work in partial fulfillment of the requirements for the degree of master of public health in **Epidemiology**. I also declare that it has never been presented in this or any other higher institution and that all resources and materials used in the research work have been duly acknowledged.

Name of the student: _____

Signature: _____

Date: _____

Approval of advisors

This research work has been submitted for examination with my approval.

Name of the primary advisor: _____

Signature: _____

Date: _____

Name of the Co-advisor: _____

Signature: _____

Date: _____