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## EPIDEMIOLOGY | RESEARCH ARTICLE

# Factors associated with HIV-positive sero-status among exposed infants attending care at health facilities in Bahir Dar administration, Ethiopia: Evidence from medical records

Asmamaw Ketemaw Tsehay\*

**Abstract:** One of the health problems in Ethiopia is the high rate of HIV morbidity and mortality among pregnant and lactating women, and their infants. Therefore, this study aims to assess factors associated with HIV-positive sero-status among exposed infants attending care at health facilities in Bahir Dar administration, Ethiopia. A facility-based cross-sectional study was carried at prevention of mother-to-child transmission (PMTCT) of HIV clinics in Bahir Dar administration, Ethiopia. The study participants were HIV-exposed infants enrolled at these clinics from 1 January to 30 December 2018. The data were taken from PMTCT logbooks and patient medical records. Data entered into Epi Info (V 3.5.1) and analysed by SPSS (V 20.0). Both bivariate and multivariate analyses carried out to identify factors associated with mother-to-child transmission of HIV. A total of 477 infant medical records were included in the study. The transmission of HIV from mother to child was 27 (5.8%, 95% confidence interval [CI]: 4.1, 8.3). Home delivery (adjusted odds ratio [AOR] = 3.2, 95% CI: 1.8, 10.2), infant not receiving antiretroviral (ARV) prophylaxis at birth (AOR = 4.1, 95% CI: 2.4, 13.5), episiotomy (AOR = 5.0, 95% CI: 2.2, 13.1) and mixed infant feeding practices (AOR = 4.4, 95% CI: 2.1, 14.4) were significantly associated with maternal to child transmission of HIV in the study. The rate of HIV infection among infants born from HIV-positive mothers was high. Factors associated with HIV sero-status of HIV exposed infants were home delivery, mixed feeding, episiotomy and ARV prophylaxis at birth.



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### ABOUT THE AUTHOR

Asmamaw Ketemaw Tsehay is interested in medical health researches, especially on the information gathered from medical records and health survey data. He has a professional experience in different health sectors, governmental hospitals and private clinics as Medical Laboratory Technologist after obtaining his bachelor of science in this field. He also has MPH in Health informatics at University of Gondar and has experience on infectious disease prevention and control while working as Public Health Officer in the health department of Ethiopia. Currently, he is working as Lecturer and Researcher at Bahir Dar University College of Medicine and Health Science.

### PUBLIC INTEREST STATEMENT

Mother-to-child transmission (MTCT) of HIV is the spread of HIV from a woman living with HIV to her child during pregnancy, childbirth (also called labour and delivery), or breastfeeding (through breast milk). Since it was possible to minimize the transmission of HIV from the mother to the child, determining associated factors is important to work on it. Therefore, the aim of the research was to identify some factors that were associated with MTCT of HIV. Women with the virus and get birth at their home were at more risk to transmit the infection to the newborn. Therefore, pregnant women who contracted with HIV/AIDS should deliver at a health facility and start antiretroviral prophylaxis as early as possible.

**Subjects: Obstetrics, Gynecology & Women; S Health; Pediatrics & Child Health; Reproductive Medicine**

**Keywords: Factors; HIV sero-status; infant; Ethiopia**

## 1. Introduction

An estimated 36.7 million people were living with HIV worldwide, where the majority were located in low- and middle-income countries. Of these, 25.5 million living in sub-Saharan Africa and 2.1 million were children under 15 years of age (UNAIDS, 2015a, 2017). The transmission of HIV from HIV-positive mother to their child during pregnancy, labour, delivery or breastfeeding is called mother-to-child transmission (MTCT). In the absence of any intervention, transmission rates range from 15% to 45% (WHO). Globally, 120,000 AIDS-related deaths and 160,000 new infections among children were reported (UNAIDS, 2016a). To eliminate new HIV infection, early recognition of HIV and timely management with appropriate prevention, care and treatment is helpful (UNAIDS, 2013a; WHO U, 2012). Factors for MTCT includes HIV viral load, advanced maternal AIDS-related illness, route of delivery, mixed feeding, breastfeeding and low CD4 (cluster of differentiations 4) cell counts during pregnancy (Tadele, Tamiso, & Tadele, 2014).

MTCT of HIV is one of the biggest challenges of the HIV/AIDS pandemic (UNADIS, 2016; UNAIDS, 2010). Mostly, the infections occurred during the breastfeeding. More than half of new infections among sub-Saharan children occur after the first 6 weeks of life (UNICEF, 2016a). In 2013, Ethiopia adopted WHO prevention of mother-to-child transmission (PMTCT) programmatic shift, option B+ strategy which recommends lifelong antiretroviral therapy regardless of a CD4 count or clinical stage (FDRE-HAPCO, 2012; FMOH, 2015). Even though HIV is among the major contributor for infant mortality, only 54% of children exposed to HIV in 21 highest-burden countries were tested for the virus within the recommended 2 months (Agency CS, ICF International, 2012; UNAIDS, 2012; UNAIDS, 2015b).

About 33% of children living with HIV/AIDS die before the age of 1 year because of recurrent opportunistic infections (Kendall, 2014; UNAIDS, 2016b, 2016c, 2013b; UNICEF, 2016b). In sub-Saharan Africa, where 90% of the total numbers of pregnant women with HIV have been exist, HIV during pregnancy is associated with various undesirable such as maternal death, abortion, stillbirth and low birth weight (Kebede & Gebeyehu, 2013; Kim et al., 2012; Ngene et al., 2013; Thayaparan et al., 2012). The high rate of HIV morbidity and mortality among exposed infants is still the main health challenge in Ethiopia (FDRE-HAPCO, 2012). The average rate of MTCT of HIV was 18% in Ethiopia that was among 21 high burden countries. Previous studies also indicate the country as among the 10 countries with the highest MTCT (Tadele et al., 2014; Zeleke & Zeleke, 2013). There was little evidence on the risk of HIV infection among infants born to mothers with HIV. Therefore, this study aims to assess factors associated with HIV-positive sero-status among exposed infants attending care at health facilities in Bahir Dar City as evidenced from medical records.

## 2. Methods

### 2.1. Study population and design

There were 10 governmental health facilities at Bahir Dar administration, and all of them were PMTCT sites. A facility-based cross-sectional study was carried at all PMTCT clinics at Bahir Dar City. The study participants were HIV-exposed infants enrolled at PMTCT clinics of Bahir Dar City from 1 January to 30 December 2018. PMTCT registration book and HIV-exposed infant's card were the source of the data. All the records of study subjects registered in the past 1 year for PMTCT were sampled for the study. The study subjects were HIV-exposed infants who had a DNA-PCR test results or rapid antibody test results and found registered on PMTCT medical records.

## **2.2. Sampling and data collection**

All exposed infants who had their HIV sero-status in the past 1 year were sampled. Therefore, the actual sample size for the study was 477. Checklist for data collection was developed from adopting national HIV-exposed infant follow-up form to compile the required information. Infants enrolled at PMTCT from 1 January to 30 December 2018 with a recorded DNA/PCR test result were included in the study, and subjects were excluded if the variable of interest has incomplete information. The data were collected from records of HIV-exposed infant care follow-up medical records at PMTC follow-up rooms. It takes a month to collect the data from the charts, from 4 November 2018 to 3 January 2019. The data were collected by experienced nurses who were trained on the comprehensive HIV care and PMTCT services.

## **2.3. Data analysis**

After collection, the data entered into Epi Info Version 7 and then analysed using SPSS 20. Exploration of data made to check for any inconsistencies, coding error, out of range and missing values, and appropriate corrections made before starting analysis. Descriptive analysis of socio-demographic information, infant follow-up information, maternal PMTCT service and infant final HIV sero-status was carried out. All variables significant at  $p < 0.2$  in the bivariable analysis were included in the multivariable logistic regression model, and forward stepwise method of model selection was used to select factors that were associated with the outcome variable. Pearson's correlation matrix was used to check for collinearity between all variables and models fitted with and without adjustment for highly correlated variables. Finally, multivariable logistic regression model was done with 95% confidence interval (CI) and their adjusted odds ratios (AORs) were calculated. A variable significant at  $p \leq 0.05$  in the final model was considered as significant factors for infant HIV sero-status.

## **2.4. Ethical consideration**

Ethical clearance was obtained from Bahir Dar University, College of Medicine and Health Science Ethical Review Committee. We did not provide informed consent for the study subjects, since the data are secondary. The data retrieved from each health centre's HIV-exposed infant records and PMTCT registration logbooks entirely used anonymously, without a name or identification number. The collected data were kept strictly confidential.

## **3. Results**

### **3.1. Socio-demographic characteristics**

A total of 477 infant medical records of PMTCT with maternal follow-up data were included in the study. The mean age of infant's mother was 27 years (SD  $\pm$  4.4 years). The minimum and maximum age of HIV-infected mothers were 19 and 43 years, respectively. The greater number of infant mothers was in the age of 25–34 years, which accounts for 308 (64.6%). A total of 381 (80%) mothers were residing in urban areas and the remaining 96 (20%) were came from rural areas. Majority of HIV-infected mothers, 315 (66%), were not able to read, as shown in Table 1. On their occupational status, 232 (48.6%) mothers were employee and the remaining 174 (36.5%) and 72 (15.1%) were homemakers and others, respectively.

### **3.2. Clinical characteristics of mothers and infants**

Most of the exposed infants, 401 (84.1%), enrolled to HIV care within 6 weeks of life, and out of this, 94.2% infants got ARV (antiretroviral) prophylaxis for MTCT of HIV. Even though all HIV-exposed infants received co-trimoxazole preventive therapy (CPT), regarding the time of initiation, 371 (77.8%) of infants started CPT within the recommended time that was within 6 weeks of birth. Growth pattern of HIV-exposed infants were normal for 467 (98%) infants. Regarding infants feeding, 423 (88.7%) infants practised exclusive breastfeeding before 6 months. Higher number of mothers ( $n = 454$ ) (95.2%) delivered their child at health institution. Spontaneous vaginal delivery was 412 (86.4%) and the remaining 65 (13.6%) was episiotomy. Forty-two (8.8%) mothers was at late AIDS stage (WHO stage III or IV) at the time of delivery. Among HIV-

**Table 1. Socio-demographic characteristics of study subjects on PMTCT care in Bahir Dar administration, Ethiopia**

| Variables                         | Frequency | Per cent |
|-----------------------------------|-----------|----------|
| Place of residence                |           |          |
| Urban                             | 381       | 80       |
| Rural                             | 96        | 20       |
| Maternal age (years)              |           |          |
| 15–24                             | 102       | 21.4     |
| 25–34                             | 308       | 64.6     |
| ≥35                               | 68        | 14.2     |
| Sex of the infant                 |           |          |
| Male                              | 225       | 47.2     |
| Female                            | 252       | 52.8     |
| Literacy of the mother            |           |          |
| Able to read and write            | 162       | 34.0     |
| Unable to read and write          | 315       | 66.0     |
| Place of delivery                 |           |          |
| Health institution                | 454       | 95.2     |
| Home                              | 23        | 4.8      |
| Occupational status of the mother |           |          |
| Homemaker                         | 174       | 36.5     |
| Employee                          | 232       | 48.6     |
| Others                            | 72        | 15.1     |

exposed infants in this study, 27 (5.8%, 95% CI: 4.1, 8.3) were HIV infected. Clinical factors associated with HIV sero-status of exposed infants are summarized in Table 2.

### 3.3. Factor associated with MTCT of HIV

Mixed feeding, infants ARV prophylaxis, mode of delivery and delivery at home had significant association for HIV transmission among HIV-exposed infants in multivariable logistic regression. Infants not receiving ARV prophylaxis at birth were four times at higher risk of HIV infection compared to infants who receive ARV prophylaxis (AOR = 4.1; 95% CI: 2.4, 13.5). Mothers who delivered their infants at home had three times higher risk of mother-to-child HIV transmission (AOR = 3.2, 95% CI: 1.8, 10.2) compared to those delivered at health institutions (Table 3).

Mothers delivered their babies with episiotomy had higher risk of transmitting HIV to their baby. Mother delivered with episiotomy had five times (AOR = 5.0, 95% CI: 2.2, 13.1) increase risk of transmission of HIV than mother who delivered with spontaneous vaginal delivery. Infants who practised mixed feeding before 6 months of age had four times (AOR = 4.4, 95% CI: 2.1, 14.4) more risk for HIV infection than infants who were on exclusive breastfeeding.

## 4. Discussion

This study finds the rate of HIV infection among exposed infants was higher than the national targets and the WHO report, which states that it should be below 5% with effective intervention. Factors associated with the transmission of HIV from mother to infants were episiotomy during childbirth, delivery at home, not receiving ARV prophylaxis at birth and mixed feeding before 6 weeks of age. The proportion of HIV among infants born from HIV-positive mother was 5.8%, higher rate of transmission compared to high income countries as well as global target in 2015, which was 2% among non-breastfeeding and 5% from breastfeeding women (UNAIDS, 2015a). This may be due to low availability of PMTCT services for HIV-positive pregnant women and

**Table 2. Clinical characteristics of mothers and infants at PMTCT follow-up clinics in Bahir Dar administration, Ethiopia**

| Variables   | Frequency (%) | Rate of HIV infection (%) |
|---|---------------|---------------------------|
| HIV status of exposed infants                           | 477 (100)     | 27 (5.8)                  |
| Infants growth pattern                                  |               |                           |
| Normal  | 467 (98)      | 23 (4.9)                  |
| Growth failure  | 10 (10)       | 4 (40)                    |
| No. of weeks of infant enrolment                        |               |                           |
| ≤6 weeks  | 401 (84.1)    | 17 (4.2)                  |
| >6 weeks  | 76 (15.9)     | 10 (13.2)                 |
| Infant ARV prophylaxis at birth                         |               |                           |
| Yes   | 460 (96.4)    | 22 (4.5)                  |
| No  | 17 (3.6)      | 5 (29.4)                  |
| Infant feeding option before 6 months                   |               |                           |
| Exclusive breastfeeding                                 | 423 (88.7)    | 19 (4.5)                  |
| Mixed feeding   | 54 (11.3)     | 8 (14.8)                  |
| No. of weeks co-trimoxazol preventive therapy initiated |               |                           |
| ≤6 weeks  | 371 (77.8)    | 13 (3.5)                  |
| >6 weeks  | 106 (22.2)    | 14 (13.2)                 |
| Mode of delivery  |               |                           |
| Vaginal   | 412 (86.4)    | 16 (3.9)                  |
| Episiotomy  | 65 (13.6)     | 11 (16.9)                 |
| Mothers HIV stage                                       |               |                           |
| WHO stages I and II                                     | 435 (91.2)    | 20 (4.6)                  |
| WHO stages III and IV                                   | 42 (8.8)      | 7 (16.7)                  |

difficultness of avoiding breastfeeding due to economic problem in our study settings. The magnitude is lower than Ethiopian national MTCT estimate in 2012 (17%), Dire Dawa report (15.7%) and Gondar University Referral Hospital (10%) (FDRE-HAPCO, 2012; Koye, 2013; Zeleke & Zeleke, 2013). The rate of MTCT was similar to the reports from studies in East and West Gojjam zones – 5.9% (Nurilign et al., 2017) and Southern Ethiopia – 4.2% (Tadele et al., 2014). Lower MTCT rate is reported at Enugu, Nigeria, that is 1% (Iloh et al., 2015). According to the WHO report, even though transmission rate ranges from 15% to 45% in the absence of any intervention, this rate can be reduced to below 5% with effective intervention during pregnancy (WHO, 0000).

Mixed feeding was significantly associated with MTCT of HIV (AOR = 4.4, 95% CI: 2.1, 14.4). The findings of this study was found to be similar with a study in Makurdi, Nigeria, where mixed feeding increased the risk of HIV for infant born from HIV-positive mothers 26-fold (Anigilájé, Dabit, Ageda, Hwande, & Bitto, 2013); and from the study conducted in Angola, in which maternal milk exposure before 6 months increased the risk of HIV for infant born from HIV-positive mothers fivefold (Lussiana et al., 2012). Several similar studies from resource-limited countries have also reported mixed feeding was a positive determinant for HIV transmission (Kalu & Ugochukwu, 2010; Kurewa et al., 2011) including Ethiopia (Birlie, Diriba, Sisay, Gurmessa, & Seyoum et al., 2016; Damtew. & Wudineh, 2016; Zeleke & Zeleke, 2013). This could be due to mixed feeding that is associated with gastrointestinal ulceration secondary to diarrheal disease. As a result, the virus can quickly enter the infant's bloodstream through the ulcerated gastrointestinal tissue (FMOH, 2014).

**Table 3. Multivariate analysis of mother-to-child transmission of HIV among exposed infants in Bahir Dar administration, Ethiopia**

| Variable   | HIV status |          | COR (95% CI)        | AOR (95% CI)      |
|--|------------|----------|---------------------|-------------------|
|  | Negative   | Positive |                     |                   |
| Place of residence                                       |            |          |                     |                   |
| Urban  | 359        | 22       | 1                   | 1                 |
| Rural  | 91         | 5        | 1.8 (1.9, 8.7)***   | 0.8 (0.1, 2.4)    |
| Place of delivery  |            |          |                     |                   |
| Health institution                                       | 433        | 21       | 1                   | 1                 |
| Home   | 17         | 6        | 6.5 (3.2, 24.6)***  | 3.2 (1.8, 10.2)*  |
| No. of weeks of infants at enrolment                     |            |          |                     |                   |
| ≤6 weeks   | 383        | 17       | 1                   | 1                 |
| >6 weeks   | 66         | 10       | 3.04 (2.2, 8.6)***  | 2.1 (0.9, 6.8)    |
| No. of weeks co-trimoxazole preventive therapy initiated |            |          |                     |                   |
| ≤6 weeks   | 357        | 13       | 1                   | 1                 |
| >6 weeks   | 92         | 14       | 3.4 (1.7, 6.6)***   | 0.7 (0.2, 2)      |
| Infants' growth pattern                                  |            |          |                     |                   |
| Normal   | 444        | 23       | 1                   | 1                 |
| Growth failure   | 6          | 4        | 12.8 (4.4, 40.8)*** | 3.2 (1.6, 12)     |
| Infants' ARV prophylaxis                                 |            |          |                     |                   |
| Yes  | 438        | 22       | 1                   | 1                 |
| No   | 11         | 5        | 7.58 (3.5, 25.4)**  | 4.1 (2.4, 13.5)** |
| Infant feeding option <6 months                          |            |          |                     |                   |
| Exclusive breastfeeding                                  | 404        | 19       | 1                   | 1                 |
| Mixed feeding  | 46         | 8        | 8.3 (4.2, 26.0)***  | 4.4 (2.1, 14.4)** |
| Mode of delivery   |            |          |                     |                   |
| Vaginal  | 396        | 16       | 1                   | 1                 |
| Episiotomy   | 54         | 11       | 6.2 (2.3, 15.4)***  | 5.0 (2.2, 13.1)** |
| Mothers HIV stage  |            |          |                     |                   |
| WHO stages I and II                                      | 415        | 20       | 1                   | 1                 |
| WHO stages III and IV                                    | 35         | 7        | 11 (5.2, 23.3)***   | 2.8 (0.87, 8.8)   |

p-Value: \*<0.05; \*\*<0.01; \*\*\*<0.001; COR, crude odds ratio; AOR, adjusted odds ratio.

Place delivery was also a significant associated factor for HIV transmission. Infants born at home had three times more likely to be infected with HIV than infants of mothers who delivered at health institutions. This study agrees with other studies from developing countries (Kurewa et al., 2011; Ogunbosi & Osinusi, 2011; Zeleke & Zeleke, 2013). The reason for this can be lack of PMTCT interventions during and after labour and delivery for mothers who gave birth at home. Therefore, the women will miss interventions available at health facilities, like the use of standard infection prevention practices, use of partograph to follow the progress of labour, use of ARV prophylaxis and safe delivery practices (FMOH, 2014). ARV prophylaxis at birth was another determinant factor for MTCT of HIV infection. Infants who did not start ARV prophylaxis immediately after birth were five times at higher risk for HIV infection than infants who receive prophylaxis at birth, similar to the findings in Ethiopia, Kenya and Brazil (Damte. & Wudineh, 2016; Finocchiaro-Kessler, Gautney, & Kristine et al., 2015; Matheus Costa Da Rosa et al., 2015). An infant receiving ARV prophylaxis minimizes infection by reducing the risk of HIV acquisition from mother to baby during pregnancy, labour and delivery, and breastfeeding.

Surgical cuts at the opening of the vagina during birth contributed the transmission of HIV to the newborn. Mothers who delivered with the help of episiotomy were five times higher to infect their infant with the virus than those who delivered with spontaneous vaginal delivery that agree with the finding in Angola (Lussiana et al., 2012) – when mother delivered vaginally minimizes the risk of acquiring HIV by 37%. This may be due to laceration and bleeding in episiotomy, which increase the risk of HIV infection for infants born from HIV-positive mothers. Largely, this study identified the factors associated with HIV-positive sero-status among exposed infants attending care at health facilities in Bahir Dar City as evidenced from medical records. However, further studies should be considered to explicitly determine those factors associated with the transmission of HIV/AIDS from mother to their child.

## 5. Limitations of the study

Since the study was conducted in the resource-limited setting, there are some limitations:

- The validity of the data collection tool
- Inclusion of exposed infants <24 months who were tested with antibody test in the study subjects
- Since the study was cross-sectional, there were no follow-ups
- The study did not include C-section or vacuum-assisted deliveries, because the health centres had no such services like hospitals

## 6. Conclusion

The rate of HIV infection among infants born from HIV-positive mothers was high. Factors associated with HIV sero-status of HIV-exposed infants were home delivery, mixed feeding, episiotomy and ARV prophylaxis at birth. Bahir Dar administration should strengthen capacitating health workers on PMTCT of HIV and community education to minimize home delivery and to practise exclusive breastfeeding on health centres that provide PMTCT services.

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### Data sharing statement

All unpublished data related to this research project are available with the author.

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