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Infant Outcomes of HIV Positive Mothers Based on HIV PCR Test Result at Jayapura District Hospital

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Abstract: Mother Mother-to-child transmission (MTCT) is the primary route of HIV infection in children under 14 years. Despite the expansion of prevention of mother-to-child transmission (PMTCT) programs and increased antiretroviral therapy (ART) coverage, 17,000 children aged 0–14 years were living with HIV in Indonesia in 2023. This retrospective study analyzed infants born to HIV-positive mothers between January 2018 and December 2022, including only those with HIV polymerase chain reaction (PCR) test results. Of 86 infants, 21 (24.4%) tested positive for HIV, while 65 (75.6%) tested negative. Among those with positive results, 76.2% had an APGAR score <7, 90.5% were term, and 85.7% had a birth weight of ≥2500 grams. All infants received ART prophylaxis, and 91.9% were formula-fed. Infants whose mothers did not receive ART before birth or during labor had a 15-fold higher risk of HIV infection. Additionally, discontinuation of ART prophylaxis before six weeks of age increased the risk fourfold. These findings highlight the importance of early detection of HIV in pregnant women, optimising ART adherence during pregnancy, and providing ART prophylaxis to infants to reduce HIV transmission. Strengthening prevention of mother-to-child transmission (PMTCT) programmes is needed to reduce infant HIV cases in high-prevalence areas such as Papua.

Keywords: Antiretroviral Therapy (ART); HIV; Neonate; PCR test.

Introduction

Although most HIV-infected pregnant women have access to ART, HIV is still the main cause of death in women of childbearing age and contributes greatly to infant and child mortality in the world. In 2023, it is estimated that around 570,000 people will be living with HIV in Indonesia, consisting of 180,000 women and 17,000 children under 14 years old (UNAIDS, 2023). More than 90% of children living with HIV worldwide contracted it from their mothers while still in the womb, at birth, or through breast milk. Based on data from the world health organization (WHO), around 1.2 million pregnant women will be infected with HIV, 84% among them have received ART in the PMTCT program (WHO, 2023). Usage long-term combination antiretroviral therapy (cART) during pregnancy, has been shown to reduce MTCT of HIV from 25% to <1% (Obstetric Practice HIV Expert Work Group, 2018).

Papua is a province which has a highly burden of HIV infection. In 2023, around 52,793 people living with HIV/AIDS, with a mortality rate of 7% (BPS Jayapura, 2023). The number of cases of HIV-positive pregnant women in 2023 will also increase by 1.97%, making Papua is the first province with the highest percentage of HIV-positive pregnant women in Indonesia (Kementerian Kesehatan RI, 2024). MTCT efforts have been carried out for a long time, but in reality, pregnant women who undergo HIV screening or pregnant women who are infected with HIV and receive ART in Papua are still very low. According to Tumangke et al., (2017) the low coverage of PMTCT is due to the low number of

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mothers' first pregnancy visits (K1) to the health center, so that many pregnant women do not know their HIV status. This is increase the risk of HIV transmission from mother to child.

Mother-to-child transmission (MTCT) or perinatal transmission of HIV is one of the main challenges in the HIV/AIDS response, especially in countries with high infection rates (Ghoma Linguissi et al., 2019; Kassa, 2018; Olakunde et al., 2019). HIV transmission from mother to infant can occur during pregnancy through the placenta, during delivery due to contact with infected body fluids, or through breastfeeding after birth (Chilaka & Konje, 2021; Megli & Coyne, 2022). Without adequate intervention, the risk of transmission can reach 25-42% (Hurst et al., 2015; Potty et al., 2019; Spooner et al., 2019). Although prevention of mother-to-child transmission (PMTCT) programmes have been developed globally, there are still gaps in service coverage, especially in areas with limited health access.

Detection of HIV infection in infants born to HIV-positive mothers is challenging, as maternal antibodies can persist in the infant's body up to 18 months of age, making conventional antibody tests inaccurate (Du Plessis, 2018; Kiilu, 2021; Smit, 2021). Therefore, HIV polymerase chain reaction (PCR) testing is the main diagnostic method recommended by the World Health Organisation (WHO) for at-risk infants (Dunning et al., 2017; Martin et al., 2017; Sherman & Mazanderani, 2020). PCR tests can detect viral genetic material (HIV RNA or DNA) in the blood of infants as early as 4-6 weeks of age, enabling earlier diagnosis than serological methods (Bharat et al., 2018; Mukendi, 2021; Ochodo et al., 2021). With PCR technology, infected infants can be identified and started on antiretroviral therapy (ART) as soon as possible, increasing the chances of controlling infection and halting disease progression (Canals et al., 2018; Hidayati, 2020; Obeagu & Obeagu, 2025).

Early detection of HIV in infants is critical to determine appropriate medical interventions and improve their chances of survival (Jean-Philippe et al., 2017; Lassi et al., 2015; Wagner et al., 2015). Infants diagnosed with HIV early are more likely to receive ART before the infection progresses to severe disease, thereby reducing morbidity and mortality. Studies Goulder et al. (2016) show that infants who receive ART soon after diagnosis have significantly better survival rates than those who start therapy only after developing clinical symptoms. In addition, early detection allows healthcare providers to counsel mothers on breastfeeding or formula feeding options to reduce the risk of postnatal transmission.

Several studies have examined the impact of maternal HIV infection on neonatal outcomes, including increased risks of preterm birth, low birth weight, and perinatal mortality (Navér et al., 2024; Yang et al., 2019). However, few studies have specifically analyzed the HIV infection status of infants exposed to HIV in Indonesia, particularly in Papua. The use of HIV polymerase chain reaction (PCR) testing is essential for early infant diagnosis and treatment initiation. WHO recommends PCR testing between 4–6 weeks of age to detect HIV infection in infants and ensure timely ART initiation (Ebuy et al., 2020; Kementerian Kesehatan RI, 2019).

This study has high urgency in understanding and reducing mother-to-child HIV transmission in Papua, the area with the highest HIV prevalence in Indonesia. Although the prevention of mother-to-child transmission (PMTCT) program has been implemented, the number of babies born with HIV is still quite high due to late diagnosis, low coverage of antiretroviral therapy (ART) for pregnant women, and limited access to health services. This study is important because it not only evaluates HIV status in infants based on PCR tests, but also identifies factors that contribute to HIV transmission, such as maternal ART use and infant adherence to ART prophylaxis.

This study aims to assess the outcomes of infants born to HIV-positive mothers based on HIV PCR test results and identify factors associated with HIV transmission. Unlike previous studies that primarily focused on birth outcomes, this research provides a more comprehensive analysis by evaluating both neonatal health indicators and the direct transmission of HIV. The findings will contribute to the development of targeted interventions to enhance PMTCT strategies and reduce infant HIV infections, particularly in high-prevalence areas such as Papua.

Method

This retrospective study was conducted at the Jayapura Regional General Hospital (RSUD Jayapura), from April 2024 to August 2024. The general population in this study were infants born to HIV positive mothers at Jayapura District Hospital during the 2018 - 2022 period, with a sample size according to the number of infants who met the inclusion and exclusion criteria.

The inclusion criteria were: infants born to HIV positive mothers at the Jayapura District Hospital and who have undergone examinations and have HIV PCR

test results. Exclusion criteria were infants born to HIV positive mothers but who have major congenital abnormalities or the mother has a history of other serious infectious diseases. Data collection was carried out by reviewing the medical records of the mother and infant as well as evidence of the results of the infant HIV PCR test at the clinic of voluntary counselling and testing (VCT) Jayapura District Hospital (Ebuy et al., 2020).

Data collected and entered into the application The Statistical Package for the Social Science version 25 (SPSS v25) to be analyzed. Descriptive statistics were used to describe infant and maternal characteristics. Data were modeled using chi square and logistic regression to evaluate factors associated with clinical compliance in HIV-exposed infants. Differences were considered statistically significant at P<0.05, and their strength was presented using odds ratios (OR) and 95% confidence intervals (CI).

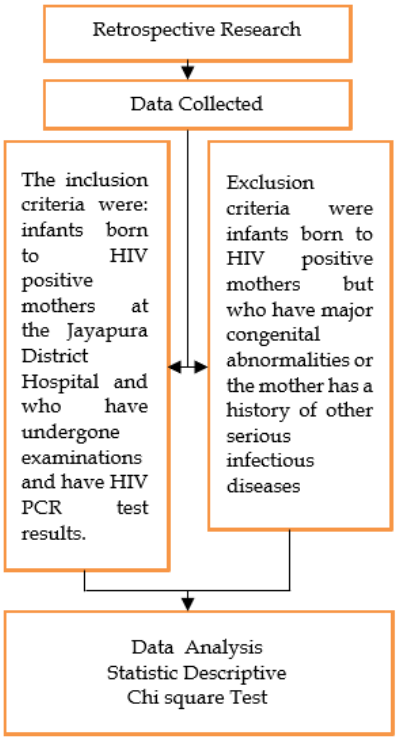

Figure 1. Research Flowchart

Result and Discussion

This study involved 86 mother-infant pairs (Table 1), and the average age of mothers was 21 years. The majority of mothers, 49 (57.0%) were aged between 25 and 34 years. Based on gestational age, 27 (31.4%) mothers were primigravida and 59 (68.6%) were multigravida. Based on marital status, 54 (62.8%) mothers were legally married, 32 (37.2%) mothers were not legally married. A total of 21 (24.4%) mothers were diagnosed before pregnancy, 22 (25.6%) mothers were diagnosed during pregnancy, and at most 43 (50.0%) mothers only found out about their HIV status when they were about to go into labor and give birth at the hospital. Regarding the timing of starting ART, the majority of 36 (41.9%) mothers only started using ART after giving birth because they only found out about their HIV status when they were about to give birth, while 29 (33.7%) mothers started using ART during the first, second and third trimesters of pregnancy, and 21 (24.4%) mothers used ART before pregnancy. Regarding the mode of delivery, 27 (31.4%) mothers gave vaginal delivery and 59 (68.6%) mothers gave birth through section caesarean (SC).

Among the 86 infants enrolled in the study, 44 (51.2%) were male and 42 (48.8%) were female. The number of infants born with asphyxia was higher, 62 (28.0%) compared to infants born without asphyxia, 24 (72.0%). Almost all 77 (89.5%) infants were born at term (≥37 weeks), and only 9 (10.5%) infants were born preterm (<37 weeks). The majority of 62 (72.1%) infants born exposed to HIV had normal body weight (≥ 2500 gr) and appropriate gestational age (AGA). All infants were given ART prophylaxis, zidovudine, which was given 24 hours after the infant was born. Regarding the duration of prophylaxis administration, 65 (75.6%) infants used it for ≥ 6 weeks, while 21 (24.4%) infants stopped taking medication before 6 weeks of age. None infants were given exclusive breast milk, almost all 79 (91.9%) infants were given formula milk, and 7 (8.1%) infants were given mixed food (breast milk + formula milk). The average time for infant HIV PCR testing is carried out when the infant is 4 weeks to 18 months old. Based on two HIV PCR test of infants, it was found that 21 (24.4%) infants had a positive HIV PCR test, and 65 (75.6%) infants had a negative HIV PCR test.

Table 1. Characteristics of infants born to HIV positive mothers

Variable	Frequency (N=86)	Percentage (%)
Gender		
Male	44	51.20
Female	42	48.80
Shoes APGAR		
No asphyxia (≥7)	24	72.00
Asphyxia (< 7)	62	28.00
Gestational Age		
Term (≥ 37 weeks)	77	89.50
Preterm (< 37 weeks)	9	10.50
Birth Weight		
Normal (≥ 2500 gr)	62	72.10

Variable	Frequency (N=86)	Percentage (%)
LBW (< 2500 gr)	24	27.90
Birthweight-for-gestational-age	66	76.70
AGA	20	23.30
SGA		
ART Prophylaxis Status		
6 weeks	65	75.60
< 6 weeks	21	24.40
Dining options		
Breast milk	0	0
Formula milk	79	91.90
Mix (breast milk + formula milk)	7	8.10
HIV PCR test results		
Positive	21	24.40
Negative	65	75.60

A total of 86 infants born to HIV-infected mothers were analyzed and divided into 2 groups PCR HIV positive (21 infants) and PCR HIV negative (65 infants). History outcome infants based on the HIV PCR results listed in table 2. There was no significant difference between the number of infants with positive HIV PCR results and infants with negative HIV PCR results based on gender, APGAR score, gestational age, birth weight, and birthweight-for-gestational-age.

Table 2. Outcome infants based on HIV PCR test results

Infant Outcomes	HIV PCR Results	
	Positive n (%)	Negative n (%)
Gender		
Male	12 (57.10)	32 (49.20)
Female	9 (42.90)	33 (50.80)
APGAR score		
Asphyxia (< 7)	16 (76.20)	46 (70.80)
No asphyxia (≥ 7)	5 (23.80)	19 (29.20)
Gestational Age		
Term (< 37 weeks)	19 (90.50)	58 (89.20)
Preterm (≥ 37 weeks)	2 (9.50)	7 (10.80)
Birth weight		
Normal (≥ 2500 gr)	18 (85.70)	44 (67.70)
LBW (< 2500 gr)	3 (14.30)	21 (32.30)
Birthweight-for-gestational-age		
AGA	18 (85.70)	48 (73.80)
SGA	3 (14.30)	17 (26.20)

On Table 3 it was explained that 86 infants born to HIV-infected mothers were analyzed and divided into 2 groups, PCR HIV positive (21 infants) and PCR HIV negative (65 infants). Bivariate analysis showed that there was no significant relationship between delivery method, birth weight, gestational age, birthweight-for-gestational-age, APGAR score, and feeding choice on the infant HIV PCR results. Meanwhile, it is known that only 2 factors have a significant relationship with infant HIV PCR results, namely maternal ART and infant prophylactic ART. Infants born to mothers without ART or not receiving ART before giving birth or during labor 15 times the risk of getting a positive HIV PCR result compared to infants born to mothers who have received ART before giving birth or during labor (OR = 15.667; 95% CI: 4.112 - 59.685; p<0.001). Regarding the ART prophylaxis factor, infants who took ART prophylaxis for <6 weeks or stopped taking medication were 4 times more likely to have a positive HIV PCR result (OR = 4.858; 95% CI: 1.681 - 14.039; p<0.001) compared to infants who took ART prophylaxis until 6 weeks of age, the majority of whom had a negative HIV PCR result.

Table 3. Factors associated with infant HIV PCR test results

Variable	PCR HIV		OR (95% CI)	P Value
	Positive (n=21)	Negative (n=65)		
Delivery method				
SC	16	43	1.64	0.389
Vaginal	5	22	(0.530 - 5.058)	
Birth weight				
Normal (≥ 2500 gr)	18	44	0.35	0.109
LBW (< 2500 gr)	3	21	(0.093 - 1.318)	
Gestational age				
Term (≥37 weeks)	19	56	0.65	0.606
Preterm (< 37 weeks)	2	9	(0.130 - 3.303)	
Birthweight-for-gestational-age				
AGA	18	48	0.47	0.263
SGA	3	17	(0.123 - 1.800)	
APGAR score				
No asphyxia (≥ 7)	5	19	1.32	0.630
Asphyxia (< 7)	16	46	(0.424 - 4.123)	

Variable	PCR HIV		OR (95% CI)	P Value
	Positive (n=21)	Negative (n=65)		
ART Mother				
With ART	3	47	15.67	0.000
Without ART	18	18	(4.112 - 59.685)	
Infant ART prophylaxis				
6 weeks	8	57	4.85	0.002
< 6 weeks	13	8	(1.681 - 14.039)	
Dining options				
Breast milk	0	0	0.72	0.528
Formula milk	16	63	(0.270 – 1.961)	
Mixed	5	2		

Discussion

This research is the first research to assess the outcome of infants born to HIV-infected mothers at Jayapura District Hospital based on the infant's HIV PCR test results and factors related to the PCR test results. Among 86 infants born to HIV positive mothers during the 5-year period (2018-2022), there were 21 incidents of MTCT (24.4%). This figure is quite high, possibly due to the small number of infants born to HIV mothers included in this study due to some mother-infant pairs being lost to follow up

In infants with positive HIV PCR results, the majority (76.2%) had an APGAR score of <7, (90.5%) were term, (85.7%) had a birth weight of ≥2500 grams, and (85.7%) were appropriate for the gestational age. In this study, no differences were found between infants with a low birth weight <2,500 gr and infants with a birth weight ≥ 2,500 gr for the final results of the infant's HIV PCR. These results are different from a large study conducted on infants exposed to HIV in Nigeria, which showed that low birth weight ≤2,500 gr had a higher risk of getting HIV positive results compared to infants with birth weight >2,500 gr. Although the mechanism of interaction between maternal HIV and low birth weight in infants is still unknown, one of the causes is thought to be placental inflammation due to HIV infection which disrupts placental function (Adelekan et al., 2022). However, based on studies conducted by European Collaborative Study, neither birth weight nor height was related to HIV infection status neonates (Indarti et al., 2020).

In our study, mothers who did not receive ART before delivery or during delivery were fifteen times more likely to transmit HIV to their infants compared with mothers who received ART. A finding from a systematic review and meta-analysis in Ethiopia also showed that HIV-positive women without intervention were seven times more likely to have HIV-positive children (Kassa, 2018). Research conducted in Zimbabwe also found that compared to mothers without antiretroviral drug use, MTCT among mothers starting ART preconception and during pregnancy was lower by 88% and 75%, respectively (Dinh et al., 2018). This may occur because taking ART before pregnancy can suppress the viral load and prevent HIV transmission to the fetus, so that once an HIV diagnosis is made in pregnancy, ART treatment should be initiated as soon as possible regardless of the mother's CD4 count or viral load (Tadewos et al., 2021).

This study also found that infants who received ART prophylaxis in the form of Zidovudine for < 6 weeks or withdrew from the drug were four times more likely to have positive HIV PCR results compared to infants who received ART prophylaxis until 6 weeks of age, most of whom had negative HIV PCR results. Prophylaxis during the first 6 weeks of life to infants born to HIV positive mothers has been shown to contribute to infection prevention in this study. This is in accordance with the guidelines American Academy of Pediatrics (AAP) which organizes administration of Zidovudine (possibly with other antiretroviral agents) to the infant should be initiated as soon as possible after birth and certainly within 6 to 12 hours of delivery. Delaying prophylaxis can reduce the likelihood that infection can be prevented. In most animal studies, antiretroviral prophylaxis initiated 24 to 36 hours after exposure was not very effective at preventing infection (Chadwick et al., 2020).

Almost all infants in this study, 79 (91.9%) of them received formula milk. Although sixteen infants tested HIV PCR positive were given formula milk, this study shows that formula milk does not increase the chance of the infant testing positive for HIV. However, it is worth noting that two of the HIV-exposed infants we studied received mixed feeding (breast milk + formula) and all tested negative for HIV. This is surprising because other researchers have highlighted the high risk of MTCT if feeding methods are mixed. Infants who received mixed

feeding were found to be 8 times more likely to be seropositive compared to infants who were exclusively breastfed (Menbere et al., 2024).

In this study, mothers who did not receive antiretroviral therapy during pregnancy or before delivery, and infants who did not receive antiretroviral prophylaxis until six weeks of age had a significantly increased risk of mother-to-child transmission of HIV. This study has limitations, one of which is that there is no data on maternal CD4 counts or viral loads which may have a related relationship between the outcome of infants born and the final results of the infant's HIV PCR. It is hoped that further research can be carried out to achieve maximum results.

Conclusion

This study indicates that the rate of mother-to-child transmission (MTCT) of HIV at Jayapura District Hospital remains high, with 24.4% of infants born to HIV-positive mothers testing positive for HIV PCR. The primary factors contributing to transmission were the absence of antiretroviral therapy (ART) use by mothers before or during delivery and the discontinuation of ART prophylaxis in infants before six weeks of age. Infants born to mothers without ART had a 15-fold higher risk of HIV infection, while stopping ART prophylaxis before six weeks increased the risk fourfold. These findings emphasize that evidence-based interventions, such as optimizing early HIV detection in pregnant women, expanding ART coverage during pregnancy, and ensuring adherence to ART prophylaxis in infants, are crucial for reducing HIV transmission rates. Beyond the clinical context, this study's findings can also be applied in public health education and policy development, particularly in training healthcare professionals on the importance of MTCT prevention. Additionally, similar approaches could be adopted for preventing and managing other maternal-to-child infectious diseases, such as hepatitis B and syphilis, by strengthening screening strategies, early interventions, and treatment adherence. Thus, this research is not only relevant to HIV but also provides broader insights into the management of maternal and neonatal infectious diseases globally.

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Author Contributions
James Thimoty: Conceptualization, data collection, analysis, manuscript drafting, and final approval.
Kurnia Sari: Methodology design, data validation, manuscript review, and editing.
Both authors have read and approved the final manuscript.

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Conflicts of Interest
The authors declare no conflicts of interest related to this study.

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