



## Trends in Early Infant Diagnosis of HIV: A Regional Analysis of Punjab, Pakistan

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### ABSTRACT

**Introduction:** Early Infant Diagnosis (EID) of HIV plays a vital role in detecting HIV infection in infants born to HIV-positive mothers, enabling timely initiation of antiretroviral therapy (ART). Since maternal antibodies persist in infants for several months, virological tests like PCR and GeneXpert are essential for early and accurate diagnosis. This study aimed to analyse trends in Early Infant Diagnosis (EID) of HIV across various cities in Punjab, Pakistan. **Methodology:** A retrospective longitudinal study was conducted at the Punjab AIDS Control Program, Lahore, including 214 HIV-exposed infants aged 0–18 months, whose mothers were on antiretroviral therapy (ART) for at least six months. Data were retrospectively extracted from medical records covering November 2022 to June 2024. HIV testing was conducted using GeneXpert and Polymerase Chain Reaction (PCR) techniques to ensure early and accurate diagnosis. **Results:** The results showed an overall HIV positivity rate of 16%, with the highest prevalence observed among infants aged 0–5 months (14 cases) and 11–15 months (12 cases). Geographical analysis indicated that Lahore had the highest number of HIV-exposed infants (101 cases), followed by DG Khan (16 cases) and Faisalabad (13 cases). Major risk factors for parental transmission included blood transfusions, spousal transmission, and injecting drug use (IDU). **Conclusion:** The study highlights significant regional disparities in EID prevalence and emphasizes the need for strengthening early diagnostic interventions to improve infant health outcomes in Punjab.

### INTRODUCTION

HIV is a growing problem throughout the world. HIV is also known as Human Immuno-deficiency syndrome. In 1981, AIDS was identified as a new disease that was mostly found in male homosexuals, intravenous drug users, and homophiliacs in the United States, as well as among sexually active heterosexuals in certain tropical African nations. In 1983, HIV was identified, and in 1984, it was connected to AIDS and to populations that were at a high risk of contracting the disease. Additionally, the serological test was introduced (1). The oldest infected cohorts are homosexual men and homophiliacs, even though by the end of the 1990s, HIV will primarily affect heterosexual people in western nations (2). HIV prevalence in Pakistan's four main populations is startlingly high: people living with injecting drugs (PWID) at 38.4%, transgender people

(TGs) at 7.1%, men who have sex with men (MSM) at 4.2%, and female sex workers (FSW) at 2.2%, despite the fact that the prevalence rate in the country's general population is estimated to be less than 0.1% (3).

HIV transmission from mother to child is far more common in poor nations than in developed ones, and heterosexual transmission is the main method of transmission in most of these nations. In Southeast Asia and Central and South America, homosexual transmission is more prevalent than in Africa. Injection-related transmission is most common in portions of central and south America, as well as south and south-east Asia. It is still possible to contract HIV from contaminated blood, particularly in parts of South Asia and Sub-Saharan Africa. In certain nations, commercial

blood donation increases the risk of HIV infection from transfusions, not only for recipients but also for donors who might contract the virus from handling contaminated equipment (4). There was a lot of worry in the early days of the epidemic about the so-called casual or non-sexual spread of HIV, most of which focused on contact with saliva. Several epidermal logical studies and natural AIDS case surveillance data showed that HIV is spread by contact with food that contains infected fluids, mainly semen (5).

HIV can be spread by tainted blood and blood products from a mother to children during pregnancy or childbirth, or by a father having intercourse with mission women. The most common vertical and blood bond transmission of HIV is highly effective. Since only roughly 0.3% of people with large bone needles are efficient, the same recipe and a unit of tainted blood always result in an infected navel. For the most part. Concentration of ICS in occluded vertical to ask mission most likely results in infection of approximately 25% of new bones, which is less effective and highly variable to improve understanding of the components required in HIV transmission (6).

There are various modes of transmission from mother to child transmission of HIV. HIV can be passed from mother to child prior to, during, or following delivery, while it is still difficult to determine the relative importance of each of these routes. Clinical and analytical data suggest several potential infection mechanisms, such as the mother's illness and viral load, the fetus's exposure to contaminated maternal bodily fluids during pregnancy and delivery, and nursing. To identify the time frame of transmission from mother to baby information is still needed. This information would help identify strategies to help prevent HIV infection and recommend when to start treatment. Interrupting transmission may be challenging if infection primarily occurs in the early stages of pregnancy, but intervention may be more practical if transmission primarily happens in the late stages of pregnancy or following delivery (7).

EID assists healthcare providers in identifying newborns that have been exposed to HIV shortly after birth, thus allowing for the prompt initiation of ART and other essential treatments (8).

Early detection reduces the risk of mother-to-child transmission and improves the health outcomes for infants infected with HIV, which helps greatly to the attainment of international goals for HIV prevention and treatment as well as the decrease of vertical transmission rates (9). An estimated 1.4 million pregnant women worldwide are projected to be living with HIV each year, and their unborn children are at risk of contracting the virus while they are in utero, during labor and delivery, and while they are nursing. One Due to the effectiveness of PMTCT programs, the number of new pediatric HIV infections has drastically decreased, from 490,000

(430,000–560,000) in 2000 to 160,000 (100,000–220,000) in 2016 (10,11,12). After impressing on the importance of Early infant diagnosis of HIV as an issue of global importance, following is a brief explanation of HIV and its pathogenesis.

Globally there are about 37 million people that are living with HIV infection currently, and over 75 million people that have been infected with the virus. An elevated risk of infectious and oncological consequences results from untreated HIV replication, which also causes gradual depletion of CD4+ T cells and a variety of immunological abnormalities. Along with several other prevalent morbidities, HIV infection also leads to bone disease, cardiovascular disease, and renal and hepatic dysfunction (13).

Our study aimed to check regional trends and prevalence of EID in Punjab, Pakistan.

## MATERIAL AND METHODS

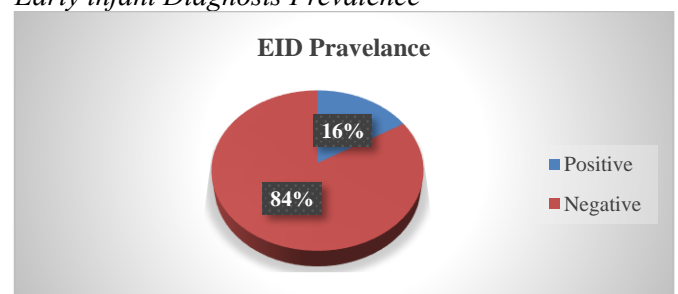
This retrospective longitudinal study was conducted at the Punjab AIDS Control Program, Lahore, to analyze trends in Early Infant Diagnosis (EID) of HIV across various cities in Punjab. The study assessed 214 HIV-positive infants enrolled in the program, focusing on infants aged 0–18 months who were born to HIV-positive mothers on antiretroviral therapy (ART) for at least six months. Data were retrospectively extracted from medical records covering the period from November 2022 to June 2024, including information on EID prevalence, maternal and parental transmission factors, and the geographical distribution of cases across Punjab.

HIV testing was conducted using both GeneXpert and Polymerase Chain Reaction (PCR) techniques, ensuring early and accurate detection of HIV infection in exposed infants. Statistical analysis was performed to evaluate trends in EID prevalence, regional variations, and potential parental factors contributing to transmission. Data analysis was conducted using SPSS. Ethical approval was taken from PACP as well, and all patient data were anonymized to maintain confidentiality.

## RESULTS

Among 214 infants, 179 infants were HIV negative and 35 were positive. Positivity ratio was 16%.

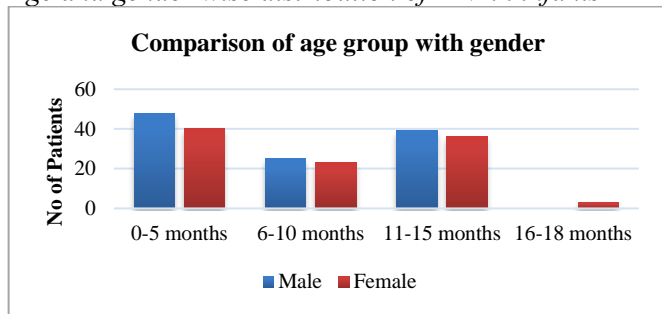
**Figure 1**  
*Early infant Diagnosis Prevalence*



Among the 214 infants screened, the majority (88) were between 0-5 months old, of whom 14 tested positive and 74 were negative. In the 6-10 months age group, 7 out of 48 infants were HIV-positive, whereas 41 tested negatives. Among infants aged 11-15 months, 12 out of 75 were diagnosed as positive, and 63 were negative. In the smallest age group of 16-18 months, 3 children were tested, with 2 found positive and only 1 negative.

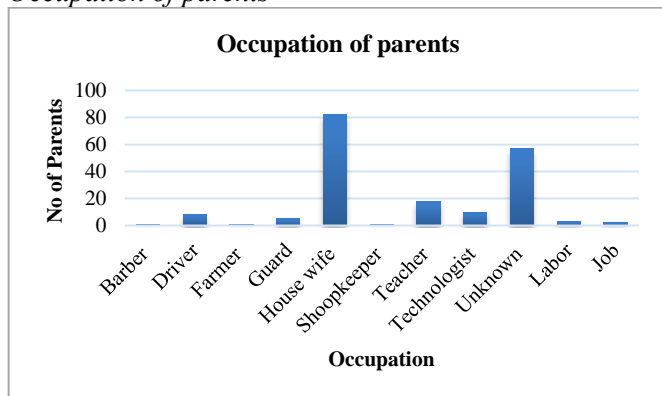
Out of the total infants tested, 96 males were negative, and 16 were positive, while 83 females were negative, and 19 were positive.

**Figure 2**  
Age and gender wise distribution of HIV in infants



The occupation analysis revealed that 82 mothers were housewives, 18 fathers were teachers, 10 were technologists, 8 were drivers, 5 were guards, and 57 had unknown occupations. The risk group categorization of parents showed that 58 belonged to the general population, 43 were classified as highly suspected cases, 46 were injecting drug users (IDU), 28 were men who have sex with men (MSM), 7 were tuberculosis (TB) patients, and 6 were female sex workers (FSW).

**Figure 3**  
Occupation of parents



Among HIV-positive parents, blood transfusion was a transmission factor in 30 cases, while 20 cases were linked to FSW (Female sex workers) contact, 12 to MSM (Men Having sex with men) relations, and 28 to spousal transmission. Surgical procedures contributed to 12 cases, 55 cases had unknown transmission origins, and 23 cases were associated with IDU (Injecting drug users).

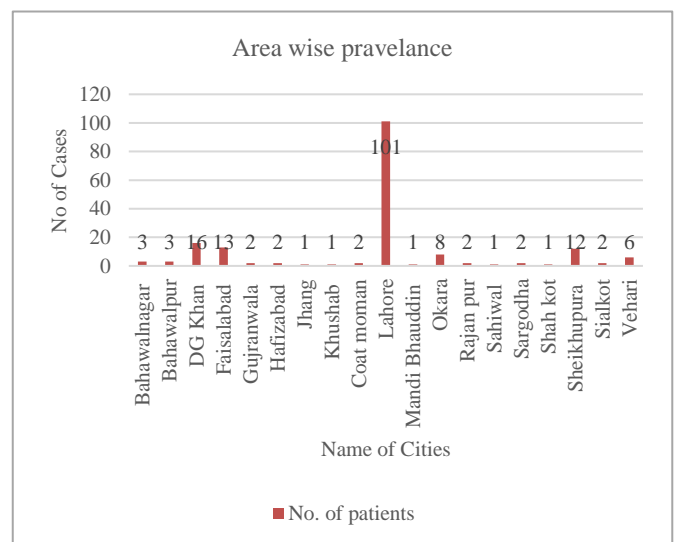
**Table 1**  
Reasons of HIV transmission in parents

Reason of transmission of Parents	
Reasons	No. of patients
Blood transfusion	30
FSW	20
MSM	12
Spouse	28
Surgical	12
Unknown	55
IDU	23

The highest number of cases was recorded in Lahore, with 101 infants, followed by DG Khan with 16 cases and Faisalabad with 13 cases. Other regions, including Sheikhpura (12 cases), Vehari (6 cases), and Okara (8 cases), reported lower numbers. Cities such as Bahawalnagar, Bahawalpur, Gujranwala, Hafizabad, and Khushab had only 1 to 3 reported cases.

**Table 2**  
Geographical distribution of HIV cases in various cities of Punjab

Area Vise prevalence	
City name	No. of patients
Bahawalnagar	3
Bahawalpur	3
DG Khan	16
Faisalabad	13
Gujranwala	2
Hafizabad	2
Jhang	1
Khushab	1
Coat Moman	2
Lahore	101
Mandi Bhauddin	1
Okara	8
Rajan pur	2
Sahiwal	1
Sargodha	2
Shah Kot	1
Sheikhpura	12
Sialkot	2
Vehari	6



## DISCUSSION

Although Pakistan's projected HIV burden was still modest, the rising number of infections has recently raised concerns about the country's healthcare authorities in a concerning state about public health and safety regulations. As a result, the nation's HIV infection rate has increased from a low to a high rate. More HIV cases with a high death rate were recorded in 2019(14).

Our study found that the highest number of HIV-positive infants were in the 0-5 months (14 out of 88) and 11-15 months (12 out of 75) age groups. These findings align with research conducted in India by Kamble et al. (2023), which highlighted those delays in early HIV testing led to late ART initiation, resulting in worse clinical outcomes (15). These findings reinforce the importance of strengthening EID programs in Punjab, particularly ensuring that infants receive their first virological test within six weeks of birth as recommended by the WHO.

The present study observed that female infants had a slightly higher HIV positivity rate (19 cases) than males (16 cases), although the difference was not statistically significant. This trend is consistent with findings in sub-Saharan Africa, where gender disparities in healthcare access, cultural norms, and care-seeking behavior influence EID outcomes. However, biological factors are not known to play a significant role in gender-based HIV susceptibility among infants. The slight difference in our study could be attributed to variations in healthcare-seeking behavior among parents, as some studies suggest that male infants are often prioritized for medical care in certain communities (16).

Financial constraints remain a significant barrier to the widespread implementation of PoC EID testing. Our study highlights the need for cost-effective strategies to expand testing in resource-limited settings. Emmert-Fees et al. (2022) conducted a global review and found

that while PoC testing is more expensive than centralized laboratory testing, it provides long-term cost savings by reducing infant HIV complications (17). Adopting similar approaches in Pakistan could help balance cost-effectiveness with improved health outcomes.

The highest number of cases in our study were reported in Lahore (101), followed by DG Khan (16) and Faisalabad (13). These findings align with global trends, where urban centers report higher HIV prevalence due to increased mobility, healthcare access disparities, and socio-economic factors (Mugisa et al., 2022) (18). These geographical variations suggest the need for region-specific interventions in Punjab, such as targeted awareness campaigns and improved healthcare services in high-prevalence areas.

## CONCLUSION

The findings of this study underscore the importance of Early Infant Diagnosis (EID) of HIV as a critical component in reducing mother-to-child transmission (MTCT) in Punjab. A 16% positivity rate among tested infants suggests a persistent risk of vertical HIV transmission, particularly in high-burden regions like Lahore, DG Khan, and Faisalabad. The study identified parental risk factors such as blood transfusions, injecting drug use, and spousal transmission, which contribute significantly to the spread of HIV. The results highlight the need for region-specific interventions, including expanded access to timely HIV screening, improved maternal ART adherence, and targeted awareness campaigns in high-prevalence areas. Strengthening Point-of-Care (PoC) diagnostic facilities and ensuring that infants receive their first HIV test within six weeks of birth can significantly improve early detection and treatment outcomes. These efforts are crucial in achieving national and global HIV prevention goals and reducing paediatric HIV burden in Pakistan.

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