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Assessing the Outcome of Pmtct Intervention Among Infants Born by Hiv-Positive Mothers at Iringa Regional Referral Hospital, Southern Tanzania 2023

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ABSTRACT

Objectives: The objective of this study was to assess the outcome of the Prevention of Mother-to-Child Transmission (PMTCT) intervention among infants born to HIV-positive mothers at Iringa Regional Referral Hospital (IRRH) in Southern Tanzania.

Study Design: A cross-sectional study design was employed to investigate the population of HIV-exposed infants attending PMTCT follow-up at IRRH. Data were collected on infant HIV infection status and demographic characteristics.

Results: The study found that the prevalence of HIV-infected infants on PMTCT follow-up at IRRH was 4.1% in 2020, 1.3% in 2021, and 2.7% in 2022. These results underscore the continued risk of mother-to-child transmission (MTCT) of HIV in resource-limited settings, despite ongoing PMTCT interventions.

Conclusion: The study concludes that there remains a significant risk of MTCT of HIV among infants on PMTCT follow-up. It is recommended to include exclusive breastfeeding for the first six months, encouraging HIV-exposed mothers to join peer support groups, and enhancing couple counseling on infant feeding methods and treatment adherence.

Keywords: Pediatric HIV infections, Human Immunodeficiency Virus, Pregnant Women and HIV Transmission, Child Health

INTRODUCTION

1.1 Background

The global community has long sought to eliminate pediatric HIV infections and improve maternal, newborn, and child health in the context of HIV. Achieving these goals requires effective prevention of mother-to-child transmission (PMTCT) strategies that safeguard future antiretroviral therapy (ART) efficacy. Lifelong ART for all pregnant women (Option B+) has emerged as the most effective strategy, ensuring sustained viral suppression, simplicity in implementation, and cost-effectiveness. Where Option B+ is unavailable, alternatives like Option A and Option B also show efficacy, provided adherence is mai-

ntained.

Preventing HIV transmission relies heavily on ART to block HIV replication, reducing transmission by over 96% under optimal conditions. However, challenges such as adherence, limited resources, and drug resistance remain. Suboptimal ART exposure during pregnancy can lead to resistant HIV strains, affecting both mothers and infants. Despite these challenges, global progress is evident: pediatric HIV infections dropped by 58% between 2000 and 2014, largely due to expanded PMTCT programs.

The World Health Organization (WHO) has updated PMTCT guidelines over the years, moving from single-dose nevirapine (sdNVP) to more robust regimens like Options A, B, and B+. However, sdNVP remains in use in some regions despite its associated drug resistance risks. Exclusive breastfeeding (EBF) with maternal or infant ART is recommended for HIV-positive mothers, balancing the benefits of breastfeeding with minimized transmission risks.

In sub-Saharan Africa, where 90% of pediatric HIV cases occur, countries like Tanzania have made significant strides. From 2009 to 2016, pediatric HIV infections in Tanzania dropped from 26,900 to 10,000 due to improved PMTCT coverage. Yet, gaps remain, necessitating continued evaluation of PMTCT programs to meet global targets. This systematic review assesses the impact of implementing post-2010 WHO PMTCT guidelines to identify barriers and inform strategies for achieving elimination goals.

1.2 Statement of the problem

Effective prevention of mother-to-child transmission (PMTCT) can reduce HIV transmission rates from 15–45% without intervention to as low as 2% with proper measures (UNAIDS, 2020). Despite progress through PMTCT's four pillars, gaps persist due to suboptimal program quality, drop-offs in service uptake, low maternal education, poor HIV transmission knowledge, and stigma. In Iringa, Tanzania, the prevalence of HIV among children under five born to HIV-positive mothers remains largely unknown, hindering informed policymaking and targeted interventions. Understanding the epidemiology of pediatric HIV is critical to identifying opportunities for reducing the risk of transmission.

1.3 Justification

The main context of the study is mainly to understand the progress made with the PMTCT intervention at IRRH Iringa Tanzania, concerning the risk of MTCT of HIV among exposed under-5 year's children. Continuous epidemiological surveys are crucial in this pediatric population, as they will help to know how interventions are working keep track of the progress and utilize lessons learned for modification of intervention measures and/or development of new interventions.

1.4. Significance of the Study

The study findings will be a basis for scaling up and strengthening PMTCT program to eliminate new HIV infections among infants to the policymakers and add knowledge to existing findings on the transmission of new HIV infections towards universal millennium development goals on goals 4, 5, and 6.

It is hoped that IRRH will utilize the study findings through teaching based on the findings identified in the study. This will promote evidence-based practice in helping mothers on PMTCT program to eliminate new infections among infants and guide them in planning health programs for mothers on the PMTCT program.

1.5. Research Objectives

1.5.1. Broad Objective

To assess the outcome of PMTCT intervention among Infants Born by HIV-positive mothers attending

Iringa Regional Referral Hospital, Southern of Tanzania from 2020 to 2023.

1.5.2. Specific Objectives

1. To determine the prevalence of new HIV infections among infants born from HIV-positive mothers on PMTCT follow-up at IRRH.
2. To determine the demographic characteristics of infants with new HIV infections whose mothers are on PMTCT follow-up at IRRH.
3. To compare the prevalence of new HIV+ children in three consecutive years (2020, 2021, 2022).

1.6. Research Question

- What is the status of new HIV infections among infants whose mothers are on PMTCT follow up at IRRH?
- Which gender predominates on being HIV positive under PMTCT program at IRRH.
- Which year has more HIV+ incidences between 2020, 2021 and 2022?

1.7 Study Hypotheses

1.7.1 Null Hypothesis

- There are no HIV infections among infants born from HIV-positive mothers on PMTCT follow-up at IRRH.

1.7.2 Alternative Hypothesis

- There are new infections among infants born from HIV-positive mothers on PMTCT follow-up at IRRH.

1.8. Limitation of the study

The researcher did not encounter obstacles apart from the few incomplete data removed during analysis.

1.9 Operational Conceptual Framework

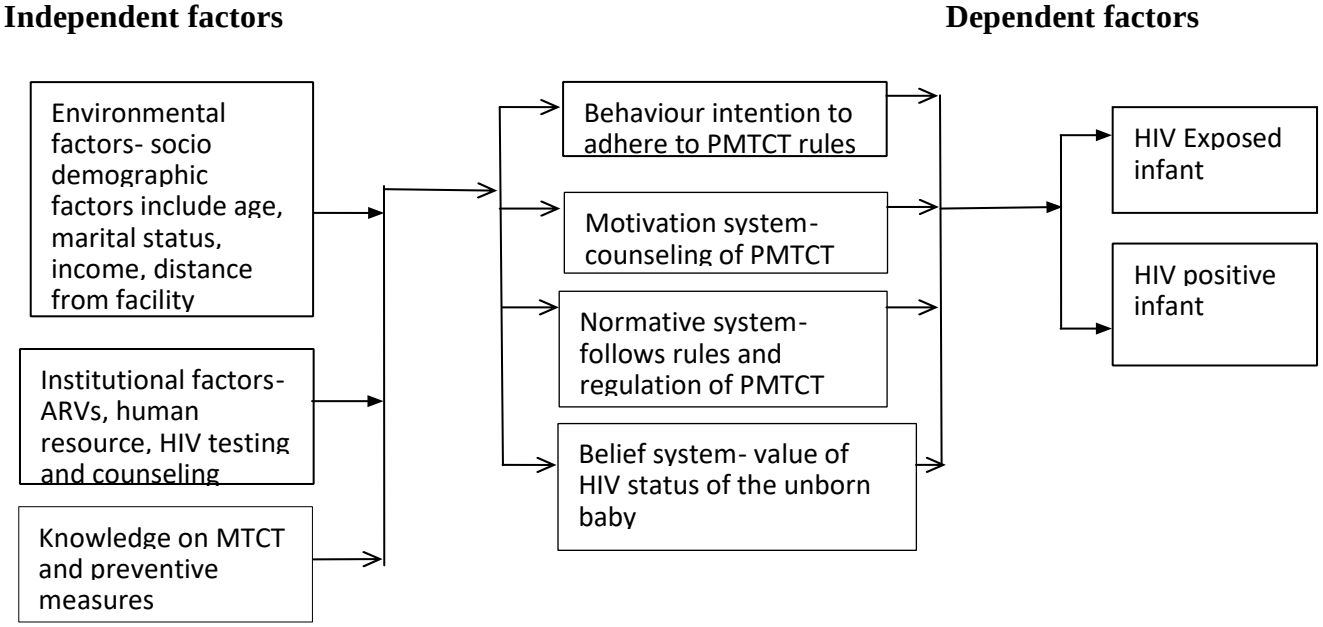

Figure 1: Conceptual Framework modified from the Health Action Model by Green and Tones, 2010.

2.0 LITERATURE REVIEW

2.1. Introduction

2.1.1 HIV Transmission

Globally, around 11% of HIV infections are among babies who acquire the virus from their mothers; 10% result from injecting drug use; 5-10% due to sex between men; and 5-10% occur in healthcare settings. Sex between men and women accounts for the remaining proportion – around two-thirds of new infections. It is estimated that 33.3 million people are living with HIV; 5.2 million are HIV infected each year, and 2 million children die annually from AIDS-related illness (WHO/UNAIDS/UNICEF, 2008).

The joint United Nations Program of HIV/AIDS states that 90-95 % of the people infected with HIV in the world live in African countries, which are poor and cannot afford antiretroviral drugs and formula milk supplies to prevent MTCT of HIV through breastfeeding. Kenya is one of the countries in Sub-Saharan Africa burdened by HIV (KAIS, 2007).

The HIV prevalence in Kenya is approximately 7.4% and there are more HIV-infected people in the rural areas than in urban areas (KAIS, 2007). In 2007, about 100,000 children were living with HIV while 19,000 new infections occurred (NASCOP, 2006). MTCT of HIV through breastfeeding remains the leading cause of HIV infections in children in Kenya (NASCOP, 2006). Central province reported 96,321 HIV cases in 2008. Deaths from HIV in the province stood at 10,808 with 3,783 (35%) being children (NASCOP, 2006). Kiambuu District has the second highest HIV prevalence in Central Province and in 2007, 32,653 HIV/AIDS cases were reported in the district with 21,526 cases in the rural areas (NACC, 2007). Central province has 25 more women than men suffering from HIV/AIDS with the women prevalence standing at 6.3% compared to men's 2.9 % (KAIS, 2007).

2.2. Mother-to-Child Transmission of HIV and Associated Risk Factors.

One of the tragic consequences of the HIV/AIDS pandemic is the mother-to-mother-to-child transmission (MTCT) of HIV. MTCT occurs when an HIV-positive woman passes the virus to her baby. This can occur during pregnancy, labour and delivery, or breastfeeding. Without treatment, around 15-30% of babies born to HIV-positive women will become infected with HIV during pregnancy and delivery. A further 5-20% will become infected through breastfeeding (Ngacha et al., 2005; Doherty et al., 2006; Nduati et al., 2005). If a mother has cracked nipples or mastitis (a type of breast inflammation), or if her baby has infections or sores in its mouth, then the risk of HIV transmission is probably increased (Kaggayi et al., 2008).

Another risk factor believed to influence HIV transmission rates is the concentration of virus in a mother's breast milk, which is known as the "viral load" (Coovadia et al., 2008). Breastfeeding is a tradition in Africa, and breast milk is the major source of nutrition for infants during the first years of life but in the context of HIV, it will contradict the guidelines on infant feeding among HIV-positive mothers Ngacha et al., 2005.

In addition, breastfeeding provides psychological support, and child-spacing benefits, and reduces infant and child morbidity and mortality by protecting children from diarrhea diseases, pneumonia and other infections (Thairu et al., 2005). Unfortunately, between 10 and 20 percent of HIV-infected mothers will pass the virus to their babies through extended breastfeeding up to 2 years (Kagaayi et al., 2008).

2.3 Breast Feeding

Several factors were found to be associated with an increased risk of MTCT through breastfeeding. High maternal viral load measured during pregnancy (Onyango et al., 2007) or after delivery and a low CD4/CD8 ratio (Medley et al., 2005) has been associated with an increased rate of MTCT through breastfeeding.

The risk of HIV transmission through breastfeeding is greatest in early infancy (before six months of age) and persists as long as breastfeeding continues (Otieno, et al., 2007; Nduati et al., 2005). Studies found that a longer duration of breastfeeding is associated with increased risk of MTCT (Onyango et al., 2007; Doherty et al., 2006; Ngacha et al., 2005).

A randomized clinical trial in Nairobi suggested that the volume of milk ingested is an important factor in breast milk transmission of HIV (Otieno et al., 2007). Another study also found that infant oral thrush before six months of age is a risk factor for post-natal infection of children (Ngacha et al., 2005). Some studies found that inflammatory conditions such as mastitis were assessed clinically (Kagaayi et al., 2008; Doherty et al., 2006) or biologically by measuring the sodium level in breast milk (Thairu et al., 2005), fissures (Becquet et al., 2005) and breast abscesses increase the risk of MTCT through breastfeeding. A carefully designed study conducted in Kwa Zulu Natal in South Africa provided crucial confirmatory evidence that when HIV-positive mothers breastfeed exclusively their babies have a significantly lower risk of infection from HIV. Mixed feeding before or after 14 weeks nearly doubled the transmission risk and the addition of solids increased the risk 11-fold. The same study reported that mortality by three months of age for replacement-fed babies was more than 27 double (15%) that of those who were exclusively breastfed (Coovadia et al., 2007). These findings added to the previous cumulated evidence about the additional risk of HIV transmission for non-exclusive breastfed babies (Ngacha et al., 2005).

2.4 Infant Feeding Options and Post-Partum

HIV-infected African mothers face the challenge of choosing between breastfeeding, risking HIV transmission, or avoiding breastfeeding, which may reveal their status. Mixed feeding, combining breastfeeding with other foods increases HIV transmission risks compared to exclusive breastfeeding, with the rates at 6 months of 1.31% for exclusively breastfed infants versus 4.4% for mixed-fed infants. Exclusive breastfeeding for six months is safer when replacement feeding is not feasible.

PMTCT programs face challenges in supporting optimal feeding practices and ensuring sustained Antiretroviral Therapy (ART) throughout breastfeeding. For instance, Ethiopia reduced new pediatric HIV infections by 57% from 2009 to 2013, yet the final transmission rate remained at 25%, highlighting gaps in ART adherence and infant diagnosis. Effective PMTCT requires addressing cultural norms, expanding counseling, and strengthening healthcare systems to support adherence to WHO guidelines.

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter covers the research design and methodology including sampling, study population, consenting procedures, data collection, data analysis, quality control measures and ethical consideration.

3.2 Study design

Cross-Sectional study design by using retrospective document review was conducted from June to August 2023, among HIV-exposed infants born to HIV-positive mothers who attend ART services at IRRH.

3.3 Study area

The study was conducted at Iringa Regional Referral Hospital. The Hospital is located in Iringa Municipal.

3.4 Source and Study Population

The Source and study populations were all HIV-exposed infants paired with their mothers enrolled at the PMTCT clinic of Iringa Regional Referral Hospital Tanzania.

3.4.1 Inclusion criteria

During the study period, the study participants were HIV positive mothers registered in PMTCT program with infants below 18 months and had been tested for HIV status. The mothers with infants were coming for their PMTCT follow up, postnatal clinic and immunization services for their infants.

3.4.2 Exclusion criteria

Children with a document, which lacks important data due to transfer out or transfer in and stopped treatment, follow up.

3.5 Sample size determination

3.5.1 Sample size

The sample size was calculated as shown below

The formula of sample size

$n= Z^2 \times P\ [1-P]/D^2$

WHERE:

n = sample size required

Z = standard normal deviation set at 1.96

P = prevalence of contraceptive use among women of reproductive age 50 %

D = standard set at 0.05

n= (1.96)2(0.5) (1-0.5)/0.052

*NB. Therefore the sample size n=**384** people. For the matter of comparison in the three years, it was decided to include all children reported at IRRH in those three years.*

3.6 Research assistant/data collectors

Four research assistants were recruited and trained in order to avoid information bias when documenting data from the registers. Those who had background information on research methods were given priority. These received two days of training.

To collect data from the registers, a structured data extraction tool was developed. The tool was adapted from the national standard HEI follow-up formats and the PMTCT registration logbook, which includes socio-demographic information, information on ARV prophylaxis for mother and infant, delivery site, infant feeding practices, and other important variables.

3.7 Pre-testing

Pre-testing of the research instruments was done before the actual data collection to enhance the validity and reliability of the responses. Pre-testing was done using a purposive sample of 30 data sheets from the register.

3.8 Data processing

Cleaning of data was done during data processing

3.9 Ethical consideration

Permission to conduct this study was sought from the IRRH management Team Authority. No names of participants were used to identify participants during data collection, report, dissemination or publication of study findings.

3.10 Dissemination of research findings

Research Findings were compiled, written and presented to the management of IRRH. The findings will be published in relevant journals to add knowledge on the goal of elimination of new HIV infections amo-

ng infants born of HIV positive mothers on PMTCT program.

4.0 RESEARCH RESULTS

4.1 Introduction.

This chapter presents a detailed analysis of the data, interpretation and explanation of the findings with regard to stated objectives. The chapter is divided into five sections based on the study specific objectives; Socio-demographic information of the children; time for testing, the outcome of the tests, and a comparison of the outcome of the tests in the three years.

In this study, the researcher wanted to find out what the outcomes of the PMTCT prevention program was. The program aimed at preventing the transmission of HIV from mothers to their children. The study investigated all children tested in the duration of three years. i.e (2020, 2021, 2022).

4.2 Number of children tested.

The total number of children involved in the study in the three years were as shown in the Figure 2. It shows that in the year 2022 more children were tested as compared to the two previous years.

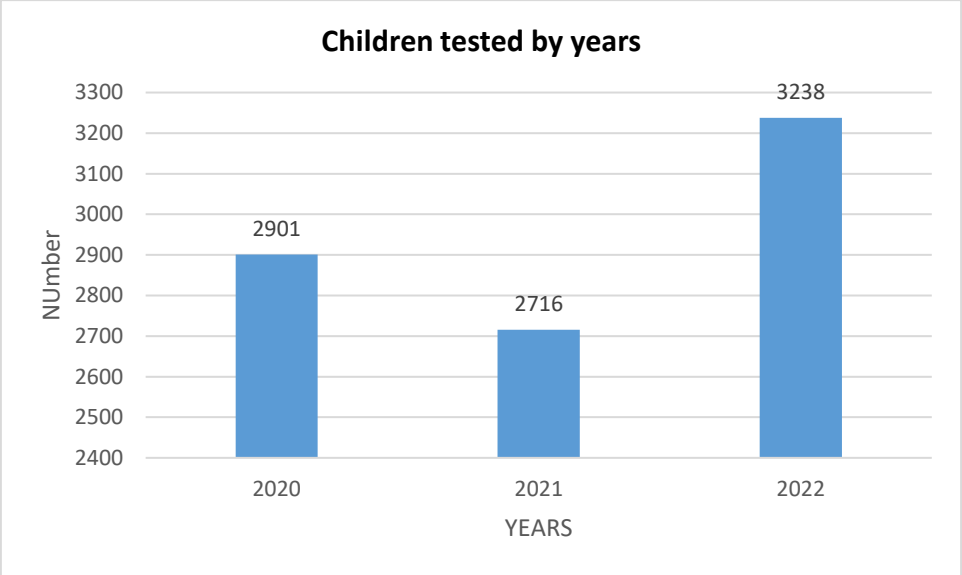

Figure 2: Total number of children tested by years. n = 8855

4.3 The demographic characteristics of children tested.

When the researcher categorized tested children by gender, the results were as shown by Figure 3. It shows in general that more children were tested in the year 2022, however when compared between males and females it was found that there were more male children in the year 2022 but in the years 2021 and 2020 female children dominated.

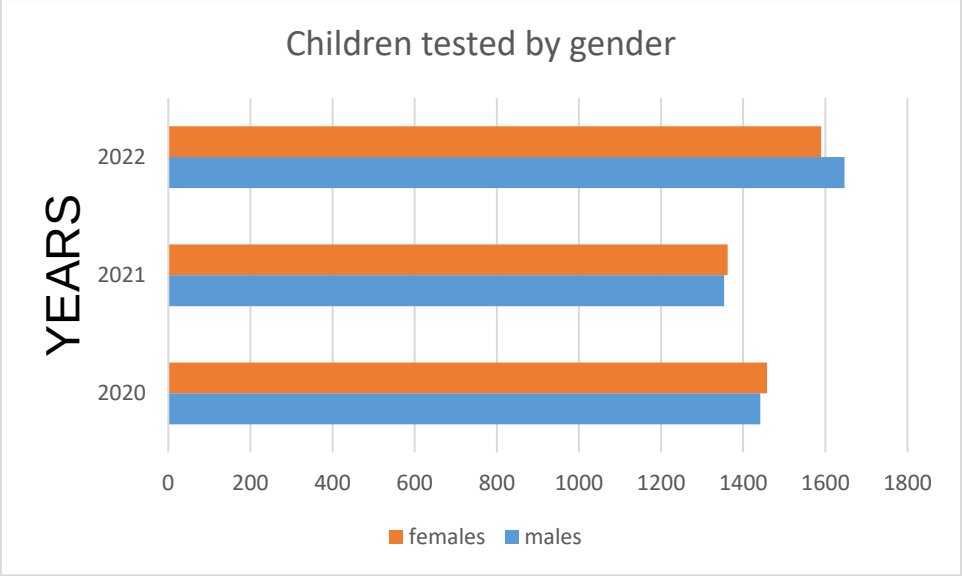

Figure 3: Children tested by gender

4.4 The number of children tested by weeks and their results

When the researcher compared the testing by weeks in the year 2020, 2021 and 2022 the results were as shown in Figure 4. Consequently, a researcher reported the number of positive cases on each test. Results show that the majority of children tested in week 2 with the highest peak in the year 2022. The least were tested in week 4 where there were no cases at all in the years 2020 and 2021. Generally, the researcher observed that there was a variation in the weeks of testing the majority of children across the three years. The reason for this variation is another area for further research.

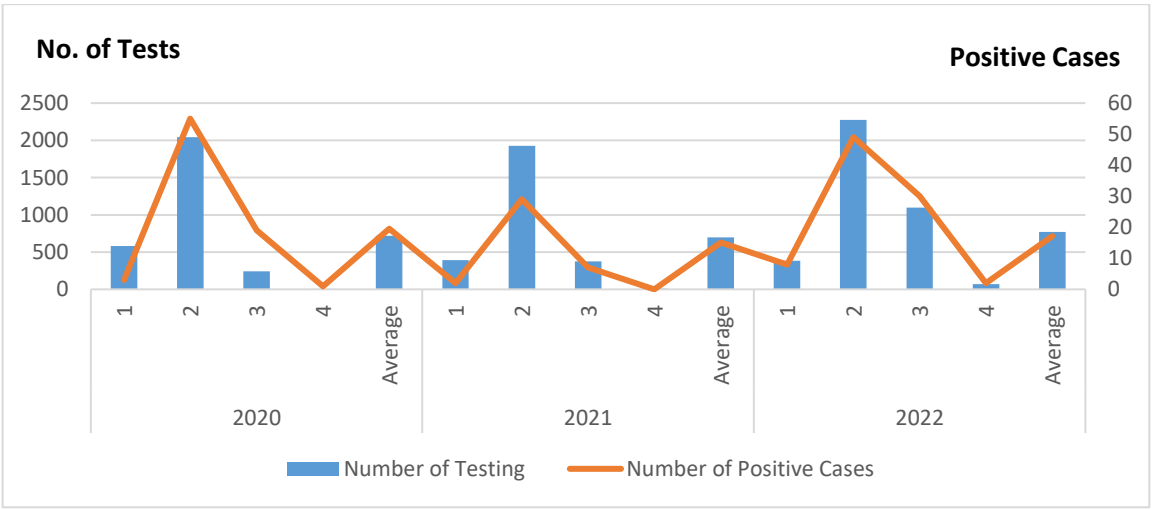

Figure 4: Number of testing and their respective results

The testing of children did follow the agreed algorithms. The results of the tests from week 0 to week 4 were as shown in Figure 4. In 2022, the number of HIV-positive children was found to be higher than in the two previous years. When the researcher wanted to find out the number of HIV + children who were detected after how many weeks post-delivery, the outcome in both years majority of the children were in week 2 whereas the least were detected in week 4.

4.5 Reason and frequency of testing

In this case, the researcher wanted to find out the frequency of testing among for different types of tests among the children. The results for year 2020, 2021 and 2022 are indicated in Figure 5. It shows that in 2020 majority of the children were tested under Normal investigation (Test) whereas the least group was tested for confirmation. It indicates that in 2020 the frequency of normal investigation was the highest.

NB. *Under frequency of testing, in the three years majority of children were tested under normal investigation followed by repeat and confirmation test was the least.*

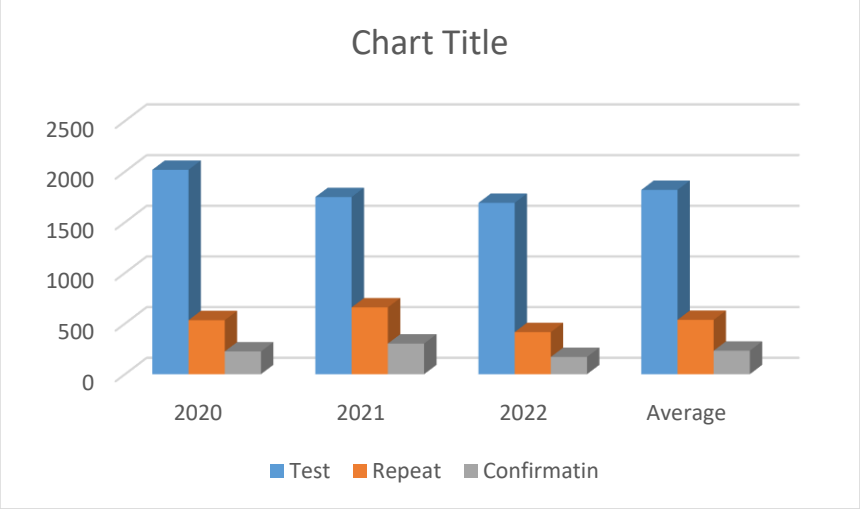

Figure 5: Types of Tests (Reason for Frequency Testing)

4.6 Outcome of tests by gender

The outcome of tests by gender was found to be as shown in Table 1. It shows that in the year 2020 female positive children dominated by 56.3%. However, in the following year (2021) the trend changed and male-positive children dominated by 68.4%. The same trend was observed in the year 2022 whereby male-positive children dominated by 58.4%. When the number of children who were HIV positive was added together, it was found that male children dominated female children (54.5%) in terms of being positive to HIV.

Table 1: Outcome of tests by Gender in 2020, 2021 and 2022

Years	Total positive	males	%	females	%
2020	87	38	43.6	49	56.3
2021	38	26	68.4	12	31.5
2022	89	52	58.4	37	41.5
Total	214	116	54.2	98	45.7

5.0 DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion of the survey findings.

Prevention of mother-to-child transmission of HIV-1 is a major public health challenge in many resource-poor countries including Tanzania. This study is based on a retrospective analysis of data from a routine PMTCT program in a referral hospital.

According to this study, among HIV-exposed infants on follow-up at the PMTCT clinic of Iringa Regional

Referral Hospital, it was found that the prevalence of HIV-infected children was 4.1%, 1.3% and 2.7% in the years 2020, 2021 and 2022) respectively. The study included only those infants whose mothers tested HIV positive and followed up until the infant's HIV status was confirmed.

When this was compared to high-income countries with a prevalence of (<2%) and reports from India (6.5%) and South Africa (5.9%). It seems that in the mentioned countries the prevalence was even higher than the expected percentage. The goal of Prevention of Mother to Child Transmission (PMTCT) is to minimize new HIV infection with PMTCT interventions which can reduce to as low as 2%.

5.2 Limitations

As we used secondary data from a PMTCT clinic, it was difficult to control for inconsistencies and missing values. The maternal HIV-1 viral load duration of the disease and the child's vaccine status were not recorded and could not be taken into account. This study did not aim to differentiate when MTCT occurred i.e. pre-partum, intrapartum or post-partum period. The fact that all potential factors were not included and assessed may affect the generalization of predictors in this study. Despite these limitations, to the best of our knowledge, this study presented primary results of the effectiveness of routine PMTCT in Iringa Regional Referral Hospital.

5.3 Conclusion

There is a high risk of MTCT of HIV among exposed infants on follow-up at the PMTCT clinic of the Iringa Referral Hospital. The findings of this study will provide valuable information for policymakers in the PMTCT scaling-up program to focus on factors that put children at risk of acquiring HIV from their mothers.

5.4 Recommendation

To reduce HIV transmission in low-resource settings, healthcare workers should promote exclusive breastfeeding for six months and cessation thereafter, if feasible and safe, as early cessation reduces new infections in infants. Peer support groups should encourage HIV-positive mothers to adopt exclusive breastfeeding, which is protective. Addressing self-stigmatization and discrimination is crucial, with couples counseling recommended to support disclosure, infant feeding choices, and treatment adherence. Additionally, healthcare providers should empower mothers to consider formula feeding where viable and ensure antiretroviral therapy is provided to all infants to move toward eliminating new HIV infections

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