

Postnatal Follow-Up of Newborns Born to HIV-Positive Mothers: Challenges and Prospects in Southern Morocco

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Abstract

Original Research Article

Context: Mother-to-child transmission (MTCT) of HIV can reach 15–45% in the absence of prophylaxis. Thanks to PMTCT programs combining maternal antiretroviral therapy, neonatal prophylaxis, and artificial feeding, this risk is reduced to less than 1%. In Morocco, only 410 pregnant women living with HIV were identified in 2023, with PMTCT coverage, after stagnating, reaching 70% in 2024. In southern Morocco, postnatal follow-up of exposed newborns and maternal knowledge of PMTCT remain insufficient. **Objective:** To assess the quality of postnatal follow-up of newborns from HIV-positive mothers and the level of maternal knowledge on PMTCT in the pediatric department of Bel Mehdi Hospital in Laâyoune, in order to identify gaps and propose solutions adapted to the specificities of southern Morocco. **Methods:** A descriptive and prospective study over 18 months including 18 HIV-positive women and their 18 newborns. Data were collected via PMTCT registries, a structured questionnaire, and pediatric follow-up. **Results:** Eighteen mother-child pairs were included. Mean maternal age: 30 years. HIV status: 61.1% were known to be HIV-positive before pregnancy, 33.3% were diagnosed during pregnancy, and 5.5% were diagnosed at delivery without antenatal treatment. Undetectable viral load in the third trimester: 61.1%. Neonatal antiretroviral prophylaxis (ART) was administered within 12 hours in 66% of cases and after 48 hours in 26%. Monotherapy was used even in high-risk infants. One case of HIV PCR was identified (5.5% of those tested), corresponding to a confirmed mother-to-child transmission (MTCT); treatment with AZT was initiated immediately. Postnatal consultations were attended in 53.3% of cases. BCG vaccination was delayed in 83.3% of cases. Formula feeding was practiced in 83.3% of cases. Maternal knowledge of PMCT was satisfactory in 22.2% of cases. **Conclusion:** Postnatal care remains only partially compliant with national recommendations. These findings underscore the urgent need to strengthen maternal education, staff training, and access to care in outlying regions of Morocco. **Keywords:** Pediatric HIV; PMTCT; Postnatal follow-up; Exposed newborn; ARV prophylaxis; Laâyoune; Morocco; Southern Provinces.

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1. INTRODUCTION

"In the Sahara Desert, where life emerges despite the aridity, every birth is a promise. Behind every data point in this study, there is a newborn to protect and a mother to support."

HIV infection remains a global public health challenge. In 2023, according to the WHO, 39.9 million people were living with HIV, including 1.4 million children [1]. That same year, 120,000 children worldwide contracted HIV, almost exclusively through mother-to-child transmission (MTCT) [2]. The postnatal period represents a critical window for intervention: early neonatal antiretroviral prophylaxis, virological

diagnosis, appropriate vaccinations, and nutritional counseling play a crucial role in protecting the child.

In 2023, 84% of pregnant women living with HIV worldwide received antiretroviral therapy [2]. By May 2024, 19 countries and territories had been certified by the WHO as having eliminated mother-to-child transmission of HIV [2]. Morocco aims to join this list before 2030.

In Morocco, 23,000 people were living with HIV at the end of 2023, with 970 new infections and 390 AIDS-related deaths that year [3]. The number of pregnant women living with HIV was estimated at 410

in 2023. After years of stagnation around 44% (2021), PMTCT coverage in Morocco reached 70% in 2024, a sign of positive momentum, but still far from the 95-95-95 target set by UNAIDS [3, 4]. The mother-to-child transmission rate, which was 20% in 2008, decreased to 8% in 2018 [5], but remains high compared to international standards where complete PMTCT coverage achieves less than 1%.

The Laâyoune-Sakia El Hamra region in southern Morocco presents a unique health profile. A vast and sparsely populated Saharan territory, it is characterized by a mixed population (sedentary, nomadic, and migrant populations from sub-Saharan Africa) and by the remoteness of referral centers for specialized virological testing. The stigma associated with HIV, amplified by conservative community structures and the fear of family rejection, constitutes an additional barrier specific to this region.

To our knowledge, no study has specifically analyzed the postnatal follow-up of newborns exposed to HIV in southern Morocco. This study aims to fill this gap by evaluating the quality of this follow-up within the pediatric department of Bel Mehdi Hospital in Laâyoune, analyzing maternal knowledge, and proposing solutions adapted to local realities.

2. MATERIALS AND METHODS

2.1. Study Area

The study was conducted in the pediatric department of Bel Mehdi Hospital in Laâyoune, the regional referral hospital for the southern provinces of Morocco (Laâyoune-Sakia El Hamra). The city of Laâyoune has approximately 262,791 inhabitants and is the main urban center of a region characterized by a desert climate, marked social heterogeneity, and access to specialized care that is sometimes limited by distance and infrastructure.

2.2. Type of study

This is a descriptive and prospective study conducted over a period of 18 months. It evaluates the quality of postnatal follow-up of newborns exposed to HIV and maternal knowledge regarding PMTCT.

2.3. Population and inclusion criteria

The target population included HIV-positive women who gave birth at Bel Mehdi Hospital or a partner facility, and their newborns. Inclusion criteria :

- HIV seropositivity confirmed by two sequential rapid tests ;
- A live newborn, resulting from the current pregnancy ;
- Childbirth in the study area ;
- Verbal agreement from the mother after information on the objectives of the study.

Incomplete records and mother-child pairs lost to follow-up before the first postnatal consultation were excluded.

2.4. Sample Size

A total of 18 mother-child pairs were recruited consecutively over the 18 months of the study, reflecting the exhaustiveness of the cases taken care of within the structure.

2.5. Data Collection

The data was collected from three sources:

- PMTCT registers and medical records: obstetric data, viral load, ARV protocol, pediatric follow-up;
- Structured questionnaire administered face-to-face during postnatal consultations, exploring sociodemographic characteristics, PMTCT knowledge, ARV adherence, breastfeeding practices and local beliefs;
- Structured pediatric follow-up: HIV PCR results, vaccination status, feeding method, consultations performed.

2.6. Variables studied

Main variables:

neonatal ARV prophylaxis (time to initiation), HIV PCR results (at 48 h and after 3 months), vaccination status (BCG, national schedule), feeding method, rate of compliance with postnatal consultations, and PMTCT maternal knowledge score.

2.7. Statistical Analysis

The data were analyzed using SPSS. Quantitative variables were expressed as mean $\pm$ standard deviation and qualitative variables as percentages. Associations were tested using the chi-square test ($p < 0.05$).

2.8. Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki. All participants gave informed consent. No information relating to the mothers' HIV status was recorded in the child's health record, in accordance with the HAS 2024 recommendations [7].

3. RESULTS

3.1. Sociodemographic and obstetric characteristics of mothers

The study included 18 HIV-positive women with a mean age of 30 years (range : 21–41 years). The majority were housewives (77.8%), with a primary school education or lower in 71% of cases. Regarding HIV status : 61.1% were already known to be HIV-positive before pregnancy, 33.3% were diagnosed during pregnancy at prenatal care, and 5.5% were diagnosed at delivery without having received antenatal treatment. An undetectable viral load in the third trimester was observed in only 61.1% of patients. The partner was HIV-positive in 83.3% of cases. These results are summarized in Table 1.

Table 1: Sociodemographic and obstetric characteristics of the 18 mothers included

Features	N (%) or result
Total number included	18
Average maternal age (years)	30 years old (21–41 years old)
Maternal age: < 25 years	11.1% (n=2)
Maternal age: 25–35 years	61.1% (n=11)
Maternal age: > 35 years	27.8% (n=5)
Gesture	Primiparous : 55.6% (n=10) — Multiparous : 44.4% (n=8)
Marital status	Married : 77.7% (n=14) — Single/other : 22.3% (n=4)
HIV positive partner	Yes : 83.3% (n=15) — No : 16.7% (n=3)
Education level	Illiterate : 33.3% Primary : 38.8% Secondary : 16.6% Higher education : 11.1%
Professional status	Housewife : 77.8% (n=14) — Employed : 22.2% (n=4)
HIV status at the start of PMTCT	Known before pregnancy : 61.1% (n=11) During pregnancy : 33.3% (n=6) At delivery: 5.5% (n=1)
Undetectable viral load in the 3rd quarter	61.1% (n=11)
ARV treatment received	TDF + 3TC + EFV / other protocol
Method of delivery	Route followed (vaginal delivery or planned cesarean section): 72.2% (n=13) — Route not followed: 27.8% (n=5)
Term of pregnancy	Full-term : 77.7% (n=14) — Premature : 22.3% (n=4)
Premature rupture of membranes > 4 h	Yes : 22.3% (n=4) — No : 77.7% (n=14)
Planned pregnancy	Yes : 22.3% (n=4) — No : 77.7% (n=14)

3.2. Postnatal follow-up of newborns exposed to HIV

The results of postnatal follow-up for the 18 newborns are presented in Table 2. Neonatal antiretroviral (ARV) prophylaxis was initiated within the first 12 hours of life in 66% of newborns (n=12). Furthermore, 26% of infants (n=5) received prophylaxis after 48 hours, which significantly increases the risk of transmission. These delays primarily involved mothers diagnosed at delivery (5.5% of the cohort), mothers who concealed their HIV status from healthcare staff, and organizational dysfunctions within the maternity ward (lack of a readily available stock of neonatal ARVs, unfamiliarity with the PMTCT protocol among some on-call healthcare workers, and delays in transfer to the HIV referral center).

Regarding the type of protocol used, contrary to national and international recommendations, even high-risk newborns were often treated with monotherapy (AZT), whereas the NIH 2024 Guidelines and the 2024 National PMTCT Protocol recommend triple ARV therapy for 2 to 6 weeks for high-risk infants, adapted to maternal viral load, treatment received during pregnancy, gestational age and infant weight.

One case of HIV PCR was identified during the first sample collection (5.5% of newborns tested), corresponding to confirmed mother-to-child transmission. This infant was born to a mother whose viral load was detectable in the third trimester and whose postnatal prophylaxis had been initiated late. Immediate antiretroviral therapy with zidovudine (AZT) was started upon confirmation of the diagnosis, in accordance with WHO recommendations. Regarding follow-up, only 53.3% of the recommended consultations were attended. BCG vaccination was delayed in 83.3% of newborns, in accordance with international recommendations. Exclusive formula feeding was practiced in 83.3% of infants (n=15); however, 16.7% of mothers (n=3) breastfed despite their HIV status. Regarding cotrimoxazole (CTX) prophylaxis, it was administered to only 5 infants (27.8%), corresponding to the only cases where the clinician deemed it indicated. According to WHO recommendations and the national PMTCT 2024 protocol, cotrimoxazole should be prescribed to all infants exposed to HIV from 4 to 6 weeks of age and continued until definitive exclusion of the infection, highlighting a concerning underutilization in our series.

Table 2: Postnatal follow-up parameters of the 18 newborns exposed to HIV

Postnatal monitoring parameter	N (%) or result
Total number of newborns	18
Sex: Male	55.5% (n=10)
Sex: Female	44.4% (n=8)
Birth weight < 2500 g	33.3% (n=6)
Birth weight ≥ 2500 g	66.6% (n=12)
Gestational age: Term	77.7% (n=14)
Gestational age: Premature	22.3% (n=4)

Postnatal monitoring parameter	N (%) or result
ARV prophylaxis received at birth	Yes: 94.4% (n=17)
ARV Dispensing Location	Maternity: 33.3% (n=6) — HIV Reference Center: 66.6% (n=12)
ARV prophylaxis within the first 12 hours of life	66% (n=12)
ARV prophylaxis between 12 and 48 hours	8% (n=1)
ARV prophylaxis after 48 hours of life — high risk	26% (n=5) — increased risk of TME
Type of prophylaxis used	AZT monotherapy (including in high-risk infants)
Duration of prophylactic treatment	4 weeks
HIV PCR at 48 hours of age	Rarely performed (no laboratory on site)
HIV PCR positive on the first sample (confirmed MTCT)	5.5% of those tested (n=1) — TME confirmed
Treatment initiated (infected infant)	Zidovudine (AZT) — immediate start
Negative HIV PCR test — 3-month follow-up (other cases)	94.4% (n=17) negative excluding TME cases
Recommended postnatal consultations were followed.	53.3%
Delayed BCG vaccination (in accordance with recommendations)	83.3% (n=15)
Inactivated vaccination schedule followed (Hepatitis B, Pneumococcal, Inactivated Polio)	100%
Exclusive formula feeding	83.3% (n=15)
Breastfeeding despite being HIV positive	16.7% (n=3) — Residual risk of TME
Cotrimoxazole prescribed	27.8% (n=5)
100% coverage (free care)	100%

3.3. Maternal knowledge and practices related to PMTCT

The assessment of maternal knowledge revealed significant and concerning gaps. Only 22.2% of mothers (n=4) had good overall knowledge of PMTCT. Exclusive formula feeding was practiced by 83.3% of mothers (n=15), while 16.7% (n=3) continued

breastfeeding despite their HIV-positive status. Detailed results are presented in Table 3.

"You can't protect what you don't understand. A mother who doesn't know that her milk can transmit the virus to her child is a mother who hasn't truly received support yet."

Table 3: Maternal knowledge about PMTCT and breastfeeding practices (n=18)

Knowledge item assessed	Correct (%)	Incorrect (%)
Risk of HIV-related mother-to-child transmission	72.2% (n=13)	27.8% (n=5)
Role of maternal ARVs in the prevention of MTTE	55.6% (n=10)	44.4% (n=8)
Importance of neonatal ARV prophylaxis	44.4% (n=8)	55.6% (n=10)
Risk of transmission via breastfeeding	33.3% (n=6)	66.7% (n=12)
The need for HIV PCR testing in infants	27.8% (n=5)	72.2% (n=13)
Importance of maternal ARV adherence	44.4% (n=8)	55.6% (n=10)
Type of feeding: Exclusively artificial.	83.3% (n=15)	—
Type of breastfeeding: Breastfeeding despite HIV status	—	16.7% (n=3)
SATISFACTORY GLOBAL KNOWLEDGE OF PMTCT	22.2% (n=4)	77.8% (n=14)

4. DISCUSSION

4.1. The specific context of southern Morocco: a systemic challenge

Our study is situated within a unique geographical and social context. The Laâyoune-Sakia El Hamra region, at the intersection of Saharan nomadic traditions and sub-Saharan migratory flows, presents specific challenges that have not yet been documented in the Moroccan literature on PMTCT. Geographic isolation, the scarcity of local virology laboratories, population mobility, and the fear of stigmatization are obstacles that exacerbate the shortcomings already observed at the national level.

The presence of sub-Saharan migrant populations in the region is an epidemiological factor that justifies a specific strengthening of screening and PMTCT programs in the southern provinces [6, 8]. The overall Moroccan context shows that at the end of 2022, 53.8% of those infected experienced internalized stigma that discouraged them from seeking care [9]; in a Saharan context where communities are close-knit, this stigma is probably even more effective.

4.2. Neonatal ARV prophylaxis: between progress and unacceptable delays

The results of our neonatal follow-up highlight a critical issue: only 66% of newborns received their antiretroviral (ARV) prophylaxis within the first 12

hours of life, whereas the WHO and NIH recommend administration as early as possible, ideally within the first 6 hours, particularly for high-risk infants. Even more concerning, 26% of infants received their prophylaxis after 48 hours, which significantly increases the risk of transmission.

According to the NIH 2024 Guidelines [19], all newborns exposed to HIV should receive antiretroviral therapy (ART) from birth, with a regimen tailored to four parameters : maternal viral load, maternal treatment during pregnancy, gestational age, and infant weight. For high-risk infants, triple ART for 2 to 6 weeks is recommended. However, in our series, even high-risk newborns were often treated with monotherapy, highlighting a significant gap that needs to be addressed.

“Every hour that passes without prophylaxis after the birth of an infant exposed to HIV is not wasted time: it is an open window of vulnerability that the virus can exploit. Prevention begins in the first hour, not at the first consultation.”

4.3. International Comparison

Our confirmed mother-to-child transmission (MTCT) rate of 5.5% among tested infants is significantly higher than European standards. In the French ANRS cohort, the MTCT rate is only 1.3% among mothers on antiretroviral therapy [21]. This comparison illustrates the extent of the progress still to be made, but it should not obscure the structural factors that explain this gap: limited resources, geographical remoteness, and late screening. In Canada, a study covering 1997–2016 demonstrates that rigorously implemented PMTCT makes it possible to achieve a MTCT rate of less than 1% [15].

4.4. HIV PCR and early diagnosis: a logistical gap

The near-total absence of 48-hour HIV PCR testing in our series is not the result of clinical negligence, but rather a structural deficiency: the lack of a local virology laboratory necessitates transporting samples to reference centers, with delays incompatible with early therapeutic decision-making. This logistical gap has real consequences, as illustrated by our case of confirmed mother-to-child transmission (MTCT). The deployment of point-of-care PCR technologies, already successfully implemented in Zambia and Burkina Faso [18], represents the most appropriate response to the logistical constraints of southern Morocco.

4.5. Follow-up of postnatal consultations

The adherence rate to recommended postnatal consultations of only 53.3% reflects a reality documented in African literature, but is particularly concerning in a context where each missed appointment represents a lost opportunity for follow-up care for a vulnerable infant. In the specific context of southern Morocco, these losses to follow-up result from a combination of factors: family mobility (semi-nomadic

lifestyle), transportation difficulties, social pressure, and fear of being recognized by healthcare facilities.

4.6. Breastfeeding and postnatal transmission

Exclusive formula feeding in 83.3% of infants represents a significant adherence in a Saharan context where breastfeeding is deeply ingrained culturally. However, the 16.7% of mothers (n=3) who breastfed despite their HIV-positive status represent a direct residual risk. This behavior is explained by gaps in knowledge (66.7% of mothers are unaware of the risk of mother-to-child transmission via breast milk), family and community pressure, and the shame associated with refusing to breastfeed in a Saharan society.

4.7. Cotrimoxazole: an underutilized prophylaxis

Cotrimoxazole (CTX) prophylaxis was administered to only 5 out of 18 infants (27.8%) in our series. According to WHO recommendations and the 2024 national PMTCT protocol, cotrimoxazole should be systematically prescribed to all infants exposed to HIV from 4 to 6 weeks of age, regardless of virological status, and continued until definitive exclusion of the infection (negative PCR test upon cessation of breastfeeding). This medication plays a crucial role in the prevention of opportunistic infections, particularly pneumocystis pneumonia (PCP), the leading cause of death in HIV-infected infants. The underutilization observed in our setting likely reflects a lack of awareness of the protocol among some prescribers, confusion regarding the indication criteria, or a stock shortage. This issue constitutes a priority training area for the healthcare staff in the department.

4.8. Maternal knowledge: the missing link

The low level of maternal knowledge (22.2% overall good knowledge) is probably the most significant finding of our study, as it underlies all the other gaps. The lack of knowledge regarding the role of neonatal PCR (72.2% incorrect answers), newborn ARV prophylaxis (55.6% errors), and the risk of mother-to-child transmission (MTCT) through breastfeeding (66.7% errors) paints a clear picture of information priorities. These results align with observations in Cameroon, where the separation of PMTCT and maternity services has been identified as a major obstacle to the quality of maternal information [16].

4.9. Perspectives: towards a care model adapted to the Saharan context

The data from this study make it possible to identify a set of priority solutions for the specific context of southern Morocco:

- Introduce systematic and universal HIV screening from the first prenatal consultation, with results returned in less than 24 hours thanks to approved rapid tests;
- Strengthening local virological capacities: deployment of point-of-care PCR tests in regional referral hospitals in the South;

- Develop therapeutic education programs integrating Saharan cultural specificities, with the use of community mediators fluent in the Hassani dialect;
- Establish an active follow-up system (telephone reminders, home visits by trained community agents) to improve retention in care;
- Strengthen continuing education for healthcare staff on PMTCT protocols and on compassionate communication with HIV-positive women;
- Integrate structured psychosocial support from the moment the diagnosis is announced, taking into account the local family and community context.

4.10. Strengths and limitations

The main strength of this study is its originality: the first 18-month prospective study specifically dedicated to postnatal HIV follow-up in southern Morocco, with exhaustive inclusion of all cases. It generates essential field data for any health policy adapted to this context. Its main limitations are the small sample size (n=18), a consequence of the local HIV prevalence, and the absence of a comparator group. Multicenter studies in the southern provinces of Morocco are needed to confirm and expand upon these findings.

5. CONCLUSION

Our 18-month study conducted at Bel Mehdi Hospital in Laâyoune provides an initial overview of postnatal care for newborns of HIV-positive mothers in southern Morocco. While the widespread adoption of formula feeding represents real progress, major shortcomings persist: 26% of newborns received their antiretroviral prophylaxis (ART) with a critical delay, 48-hour PCR testing is virtually nonexistent, 46.7% of postnatal appointments are missed, and 77.8% of mothers lack adequate knowledge about PMTCT (prevention of mother-to-child transmission). Even more concerning, a confirmed case of mother-to-child transmission was identified (positive PCR test: 5.5% of those tested), directly attributable to an uncontrolled viral load and a delay in neonatal prophylaxis. This infant was treated with AZT, but their infection could have been prevented.

These figures are not mere percentages. Each one represents an insufficiently protected child and an insufficiently supported mother. The specific context of southern Morocco—its remoteness, its Saharan culture, its nomadic population, its sub-Saharan migration flows—demands a tailored response, not simply the application of protocols designed for northern metropolises.

Morocco, committed to eliminating mother-to-child transmission of HIV by 2030, has the institutional resources to meet this challenge. This study provides the

necessary field data to ensure targeted, effective, and humane interventions.

Conflicts of interest and financing

The authors declare no conflict of interest. This study received no external funding.

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