AIDS and Behavior
https://doi.org/10.1007/s10461-026-05061-1

ORIGINAL PAPER

HIV and Pregnancy in Türkiye: Gaps and Gains in the Era of Modern ART: A Multicenter Cohort Study

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Accepted: 28 January 2026

Abstract

We aimed to review perinatal outcomes in HIV-positive pregnant women and their infants, as well as Turkish clinicians' approaches to the management of HIV in pregnancy. This multicenter cohort study included pregnant women living with HIV (WLWH) across Türkiye from 2010 to 2024. 209 pregnancies among 162 WLWH were identified. Nearly 90.9% were diagnosed before or during pregnancy, and 90% were on antiretroviral therapy (ART) at delivery. 150 women had viral loads of less than 1,000 copies/mL during labor. The most chosen ART combination during pregnancy was tenofovir/emtricitabine+raltegravir. Most common mode of delivery was cesarean section (78.9%). Among 174 deliveries, 22 (12.6%) were preterm. Regarding newborn prophylaxis, 137 (88.4%) received zidovudine and 34 received nevirapine. 14 infants were breastfed. No congenital malformation, neonatal or maternal mortality was observed. Overall, 13 infants were diagnosed HIV-positive, indicating an MTCT rate of 7.9% in this cohort. Breastfeeding (OR: 30.1, 95% CI: 4.70-193.50, $p < .001$) and absence of ART during pregnancy (OR: 30.9, 95% CI: 5.20-183.90, $p < .001$) were the most prominent variables affecting the infants' HIV positivity. Despite efficient preventative strategies announced over years, we report a high MTCT rate of 7.9%, aligning with previous literature from Türkiye. The findings highlight that the absence of ART and breastfeeding remain critical risk factors for perinatal HIV transmission. This large real-world cohort, reflecting Turkish clinicians' practices, helps define major gaps in MTCT prevention in the modern ART era and provides valuable evidence to inform clinicians, policy makers, and public health strategies.

Keywords HIV · Pregnancy · Vertical transmission · Women

Introduction

Although we have witnessed tremendous progress in diagnosis, care and prevention; the global burden of human immunodeficiency virus (HIV) continues affecting millions as a formidable challenge for public health. According to The Joint United Nations Programme on HIV/AIDS (UNAIDS), there were approximately 40.8 million people living with HIV (PLWH) globally in 2024. Of those, 53% were among women and girls, and 1.4 million were children under 15 years. And also, women and girls were accounting for 45% of all new HIV infections in 2024 [1]. The highest number of new HIV diagnoses comprising young women means most new cases are among the reproductive population. In this scenario, when a woman becomes infected with HIV, the virus not only poses a direct threat to her health but also affects her unborn baby. That is why, reducing perinatal mother-to-child transmission (MTCT) is one of the main goals for the elimination of HIV [2].

HIV may be transmitted from mother to fetus or to the newborn during pregnancy, delivery or after birth. The risk of MTCT can wane to 1–2% or lower if precautions are

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Published online: 17 February 2026

strictly enforced [3]. Updated evidences include the followings to avert MTCT; using antiretroviral therapy (ART) for all pregnant women with HIV and viral suppression below HIV RNA < 1,000 copies/mL before delivery, maternal administration of intravenous (IV) zidovudine (ZDV) during labor if necessary according to the maternal viral load, appropriate newborn's ART prophylaxis and impeding breastfeeding in those not virally suppressed [4–6]. The earlier HIV is recognised and managed, the more favorable the outcomes for both mother and child. Moreover, additional opportunities still exist to reduce perinatal transmission via prenatal HIV testing for all pregnant women to identify the undiagnosed cases.

The HIV epidemic inevitably affects Türkiye as well as the entire world. According to data last updated on November 10, 2025, the Turkish Ministry of Health reported that there were 57,101 PLWH in Türkiye. Among them 10,225 were women and girls, and 372 were children under 15 years of age [7]. Although case series have been published to reflect the situation of HIV infection and pregnancy in Türkiye [8–10], more information is still needed concerning current real-life data.

In this large cohort study, we aimed to provide a comprehensive summary of clinical approaches towards pregnancy and HIV adopted by clinicians representing all geographic regions of Türkiye. We also discussed the impact of HIV on pregnancy and outcomes of babies born to these women and the clinical questions to be addressed regarding factors affecting MTCT.

Materials and Methods

This retrospective, national, multicenter cohort study was designed and coordinated within the HIV Working Group, operating under the Turkish Society of Infectious Diseases and Clinical Microbiology (EKMUD). An open call for participation was announced to all members of the study group, and all volunteers who provided affirmative feedback from 20 centers were enrolled without restriction. Pregnancies of WLWH in Türkiye, aged≥18 years, timeframe from January 2010 to 2024, were included in the study. Data sharing permission was obtained from each hospital directory of the participatory center, for an application for ethics committee approval. After receiving ethical approval, Microsoft Excel files were shared with the participating centers for data collection. All participants were requested to complete the data entry within two months. Each pregnancy of WLWH after getting HIV was recorded as a separate case. Maternal characteristics, perinatal outcomes and ART regimens as well as characteristics and outcomes of infants of WLWH were recorded in detail. Data were collected from the patient's medical records which were archived both manually and digitally. Patients under the age of 18 and those with substantial missing data were deemed ineligible for analysis.

Statistical Analyses

Statistical analyses were executed using SPSS (Statistical Package for the Social Sciences) version 26.0. The normality of the variables was checked with the Kolmogorov-Smirnov test. Categorical variables were assessed using either the $\chi 2$ test or Fisher's exact test. Results were stated as mean ± standard deviation or median (minimum–maximum) for continuous variables and as frequencies and percentages for categorical variables. Univariate and multivariate logistic regression analyses were performed to identify the factors affecting MTCT. Distributions were compared using the Fisher's exact test method and univariate odds ratios were calculated. Variables found to be significant in the univariate analysis were included in the multivariate logistic regression model. Multivariate odds ratios were calculated with the backward stepwise (Wald) method. A two-tailed p-value of <0.05 was considered statistically significant.

Ethical Permission

This study was conducted in accordance with the principles outlined in the Declaration of Helsinki and approved by the Harran University School of Medicine Ethics Committee Commission with the protocol number of HRU/24.05.32.

Results

Study Population and Maternal Characteristics

This study included 209 pregnancies among 162 WLWH. The median gravida was 2 (range: 1–7), and the median parity was 1 (range: 0–6). The mean age at HIV diagnosis was 27.3 ± 5.8 years, and the mean age at pregnancy was 29.1 ± 5.8 years. The majority of participants were Turkish nationals (77.8%). At the time of HIV diagnosis, the mean viral load was 440,608 ± 1,862,323 copies/mL, the mean CD4 + T-cell count was 470 ± 278 cells/μL, and the mean CD8 + T-cell count was 841 ± 469 cells/μL. Partners' HIV status was known for 145 women, and 94 were seroconcordant. The most preferred contraceptive method of couples was withdrawal/pulling out ($n=107$, 66%), and other known methods were male condom ($n=39$, 24.1%), oral contraceptive ($n=6$, 3.7%), and intrauterine device (IUD) ($n=1$, 0.6%).

Among the 162 women, 123 (75.9%) had one pregnancy after HIV diagnosis, 32 (19.8%) had two, six (3.7%) had

Table 1 Maternal ART regimens administered before and during pregnancy

ART Regimens Before Pregnancy	n (%)
TDF/FTC + DTG	54 (25.8)
TDF/FTC + RAL	29 (13.9)
BIC/FTC/TAF	18 (8.6)
3TC + DTG	4 (1.9)
TDF/FTC + LPV/r	31 (14.8)
TAF/FTC/EVG/c	1 (0.5)
No ART	72 (34.4)
ART Regimens During Pregnancy	**n (%)**
TDF/FTC + DTG	65 (31.1)
TDF/FTC + RAL	88 (42.1)
BIC/FTC/TAF	3 (1.4)
3TC + DTG	2 (1)
TDF/FTC + LPV/r	27 (12.9)
TAF/FTC/EVG/c	1 (0.5)
TDF/FTC + DRV/r	1 (0.5)
TDF/FTC + 3TC + DRV/r	1 (0.5)
No ART	21 (10)
ART Switch Due to Pregnancy	**n (%)**
Yes	49 (27.1)
No	139 (73.9)

3TC lamivudine, *ART* antiretroviral therapy, *BIC* bictegravir, *DRV/r* darunavir/ritonavir, *DTG* dolutegravir, *EVG/c* elvitegravir/cobicistat, *FTC* emtricitabine, *LPV/r* lopinavir/ritonavir, *RAL* raltegravir, *TAF* tenofovir alafenamide fumarate, *TDF* tenofovir disoproxil fumarate

three, and one (0.6%) had four pregnancies. When analyzed per pregnancy, HIV diagnosis was made before pregnancy in 135 cases (64.6%), during pregnancy in 55 (26.3%), at delivery in 10 (4.8%), and after delivery in 9 (4.3%). Of the 55 patients diagnosed during pregnancy, the week of pregnancy was known for 54. The median week of pregnancy was 18 (3–39) weeks. Sixteen patients were diagnosed in the first trimester, 22 in the second, and 16 in the third trimester. One hundred and ninety-eight (98%) pregnancies were naturally conceived without assisted reproductive technology, and four (2%) women conceived through in vitro fertilization.

Comorbidities of each patient and coinfections per pregnancy were recorded separately. Fifteen pre-existing diseases were detected in thirteen patients (Diabetes Mellitus: 3, Hyperlipidemia: 3, Hypertension: 3, Celiac Disease: 2, Hypothyroidism: 1, Obesity: 1, Behcet's Disease: 1, Bipolar Disorder: 1). One patient had diabetes mellitus, hypertension, and obesity concomitantly. Twenty-five coinfections were reported, including hepatitis C virus infection, human papillomavirus infection, syphilis, and hepatitis B virus infection ($n=7$, 7, 5, and 1, respectively), and others (gonorrhea, chlamydial infection, vaginal candidiasis).

ART in Pregnancy

Maternal ART regimens administered before and during pregnancy are presented in Table 1. The most preferred ART regimen before pregnancy was tenofovir/emtricitabine + dolutegravir (TDF/FTC + DTG), whereas during pregnancy, tenofovir/emtricitabine + raltegravir (TDF/FTC + RAL) was more frequently used. Twenty-one patients, who were either not yet diagnosed with HIV or declined using ART despite being diagnosed, did not use ART during pregnancy. ART regimens of 49 patients were switched due to pregnancy. The most common reasons for switching ART regimens were following guideline recommendations ($n=30$), neural tube defect risk (NTD) of DTG ($n=16$), ART side effects ($n=2$), and viral breakthrough ($n=1$), respectively.

The majority of the BIC/ FTC/TAF regimen was switched due to pregnancy, and was continued in only three WLWH. Two of them opted for voluntary termination of pregnancy. The remaining woman achieved viral suppression at the time of labor and delivered a healthy, HIV-negative infant with no birth defects. There were four women conceived on 3TC + DTG, and two of whose ART regimens were not changed and continued throughout pregnancy. Both women were virally suppressed at the time of labor, and no congenital anomalies were detected in these HIV-negative babies.

Outcomes of Pregnancies and Babies

Pregnancy complications were observed in 13 of 209 pregnancies, in order of frequency were as follows; oligohydramnios in four, intrauterine fetal death in three and stillbirth in two. Polyhydramnios (one of the pregnancies that resulted in stillbirth), ectopic pregnancy, premature rupture of membrane (PROM) and hydrops fetalis were seen in other pregnancies. Amniocentesis was performed in two pregnancies; one of the babies was lost with hydrops fetalis, and the other baby was born at term and HIV status was negative during follow-up. By the time the report was drafted, all but 17 of the 191 pregnant WLWH had delivered ($n=174$). Of these 174 patients, 17 (8.5%) had spontaneous vaginal birth and 157 (78.9%) underwent a cesarean section (C/S). Four (2%) gestation ended in spontaneous abortion and four women (2%) requested voluntary termination. Among 174 delivery, 152 were full term (> 37 weeks of gestation) and 22 (12.6%) were preterm. There were 172 live births (171 singletons and a set of twin that gave a total of 173 newborns) and two stillbirths. The median gestational week at delivery was 38 (28–41) weeks. Women were divided into four groups according to HIV viral load at the time of delivery. While the viral load of 37 patient was unknown; 135 patients had a negative viral load, 15 patients had between 0 and 1000

copies/mL and 22 patients had > 1000 copies/mL. Among patients with available data, intrapartum IV ZDV was administered in 87 pregnancies and not in 67. There were 82 male (42.3%) and 72 female (53.8%) newborns. The sex of 55 was unknown. ART with oral ZDV was administered to 137 infants (88.4%). Unfortunately, 18 newborns (11.6%) did not receive prophylaxis, and the prophylaxis status of the remaining infants was unknown. Nevirapine (NVP) prophylaxis was initiated in 34 infants, while it was either not administered or the prophylaxis status was unknown in the remaining cases. Fourteen infants were breastfed, whereas 152 were not. Ten infants required hospitalization for respiratory distress. No congenital malformation, neonatal or maternal mortality was observed, except for two stillbirths.

Mother-to-Child HIV Transmission

In this cohort, the HIV status was known for 165 infants. Thirteen infants were diagnosed with HIV, resulting in a MTCT rate of 7.9%. Five of the 13 HIV-infected infants were born to foreign-national mothers. Comparative analysis using Mann-Whitney U tests for continuous variables and Chi-square or Fisher's exact tests for categorical variables revealed no statistically significant differences in baseline maternal characteristics, clinical profiles, or immunological markers between mothers of HIV-positive infants and mothers of HIV-negative infants (all $p > .05$, Table 2).

Univariate and multivariate analyses of factors associated with MTCT are presented in Tables 3 and 4, respectively. The multivariable logistic regression model, which included breastfeeding and absence of ART during pregnancy, was statistically significant (χ^2 (2) = 45.45, $p < .001$) and explained 60.4% of the variance in MTCT (Nagelkerke $R^2 = 0.604$). Within this model, both the absence of ART during pregnancy (adjusted odds ratio [aOR] = 30.9, 95% confidence interval [CI]: 5.20–183.90, $p < .001$) and breastfeeding (aOR = 30.1, 95% CI: 4.70–193.50, $p < .001$) were identified as strong, independent risk factors for perinatal HIV transmission.

Among the 14 breastfed infants, HIV transmission occurred in eight cases (Table 5). In a detailed evaluation of six breastfed babies who become HIV negative; five mothers were diagnosed before pregnancy and were on ART throughout pregnancy. The ART regimen of this five WLWH were TDF/FTC + DTG and five of them were virally supressed both throughout pregnancy and breastfeeding. This six breastfed babies were fed exclusively with breast milk without any additional supply and all of them received ZDV PNP for six weeks and weaned after six months.

A significant association was found between the lack of antenatal ART and the decision to breastfeed (χ^2 (1) = 20.78, $p < .001$). Breastfeeding was substantially more common among mothers who did not receive ART during pregnancy (35%) than among those who did (5%).

Discussion

In this cohort, 90.9% of women were diagnosed with HIV before delivery and 87.2% achieved viral suppression at the time of labor, indicating strong antenatal diagnosis, high ART coverage, and good treatment adherence across the HIV care cascade in women. However, we report a relatively high MTCT rate of 7.9%, with absence of ART during pregnancy and breastfeeding were identified as the most prominent variables influencing HIV positivity in infants.

The mainstay in the care of pregnant women infected with HIV is prevention of vertical transmission. Early HIV diagnosis and rapid ART initiation to ensure viral suppression are essential for MTCT prevention; accordingly,

Table 2 Comparison of Maternal, clinical and immunological profiles in HIV-Positive and HIV-Negative infants

Variable	HIV positive infants ($n = 13$)	HIV negative infants ($n = 152$)	Test Statistic (U)	p-value
Age at HIV diagnosis (years)	27 (16–44)	26 (16–46)	791.0	0.233
Age at pregnancy (years)	29 (19–44)	29 (18–46)	870.0	0.473
Gravidity	2 (1–4)	2 (0–7)	788.0	0.204
Parity	2 (0–3)	1 (0–6)	862.0	0.426
Gestational age at delivery (weeks)	38 (37–40)	38 (28–41)	676.0	0.272
Baseline CD4 count (cells/μL)	375 (202–802)	437 (4–1547)	747.0	0.625
Baseline CD8 count (cells/μL)	1017 (377–1286)	828 (37–1860)	615.0	0.167
CD4 count at delivery (cells/μL) †	409 (202–720)	669 (14–1514)	158.0	NA
CD8 count at delivery (cells/μL) †	997 (377–1272)	700 (38–1860)	201.0	NA

NA not applicable

Continuous variables are presented as Median (Minimum – Maximum)

Group comparisons were performed using the Mann-Whitney U test

The test statistic (U) and the two-tailed p-value are reported

† Formal statistical comparison for CD4 at delivery and CD8 at delivery was not performed due to the small number of observations in the HIV+ group ($n = 5$), which precludes a reliable test

Table 3 Comparative analysis of maternal and obstetric factors affecting perinatal HIV transmission: Demographic, Clinical, and Treatment-Related associations

	Infant HIV status						Univariate			
	Total		Positive		Negative		Exact P_{Value}[c]	OR [95% CI]	χ^2 MH(1)	P[u]
Ethnicity										
Other nationality	44	27%	5	38%	39	26%	0.335	1.81 [0.56–5.86]	0.453	0.501
Turkish	121	73%	8	62%	113	74%		Ref		
Number of pregnancies										
1	95	58%	9	69%	86	57%	na	—		
2	53	32%	1	8%	52	34%				
3	13	8%	2	15%	11	7%				
4	4	2%	1	8%	3	2%				
Pregnancy order										
1	131	79%	11	85%	120	79%	na	—		
2	29	18%	2	15%	27	18%				
3	4	2%	0	0%	4	3%				
4	1	1%	0	0%	1	1%				
Educational Status										
Illiterate	15	9%	2	15%	13	9%	na	—		
Primary school	40	24%	5	38%	35	23%				
High school	47	28%	3	23%	44	29%				
University	27	16%	2	15%	25	16%				
Unknown	36	22%	1	8%	35	23%				
Comorbidity										
Yes	14	8%	0	0%	14	9%	0.605	—		
No	151	92%	13	100%	138	91%				
Partner's HIV status										
HIV Positive	95	58%	9	69%	86	57%	0.536	1.89 [0.48–7.14]		0.358
HIV Negative	57	35%	3	23%	54	36%		Ref		
Time of maternal HIV diagnosis										
Before pregnancy	104	63%	4	31%	100	66%	na	—		
During pregnancy	44	27%	1	8%	43	28%				
At delivery	9	5%	2	15%	7	5%				
After delivery	8	5%	6	46%	2	1%				
Time of maternal HIV diagnosis										
At/After delivery	16	12%	8	73%	8	7%	<0.001	37.33 [8.26–168.72]	34.815	<0.001
Before/During pregnancy	115	88%	3	27%	112	93%		Ref		
Mode of Delivery										
Spontaneous vaginal birth	13	8%	6	46%	7	5%	<0.001	16.9 [4.47–63.81]	21.651	<0.001
Cesarean Section	145	92%	7	54%	138	95%		Ref		
Pregnancy complication										
Yes	3	2%	0	0%	3	2%	na	—		
No	162	98%	13	100%	149	98%				
Amniocentesis										
Yes	1	1%	0	0%	1	1%	na	—		
No	150	99%	12	100%	138	99%				
Intrapartum IV ZDV										
Yes	79	56%	2	17%	77	60%	0.010	0.14 [0.03–0.64]	6.548	0.011
No	62	44%	10	83%	52	40%		Ref		
Neonatal NVP Prophylaxis										
Yes	33	24%	3	25%	30	24%	1.000	1.04 (0.26–4.11)	0.084	0.772
No	103	76%	9	75%	94	76%		Ref		
Neonatal ZDV Prophylaxis										
Yes	127	89%	5	42%	122	93%	<0.001	0.05 [0.01–0.20]	24.179	<0.001
No	16	11%	7	58%	9	7%		Ref		
Breastfeeding										

Table 3 (continued)

			Infant HIV status				Univariate			
	Total		Positive		Negative		Exact P_{Value}[ɕ]	OR [95% CI]	χ^2 MH(1)	P[ʉ]
Yes	14	9%	8	67%	6	4%	<0.001	46.00 [10.77–196.52]	45.301	<0.001
No	142	91%	4	33%	138	96%		Ref		
HBV Coinfection										
Yes	1	1%	0	0%	1	1%	na	—		
No	164	99%	13	100%	151	99%				
HCV Coinfection										
Yes	3	2%	0	0%	3	2%	na	—		
No	162	98%	13	100%	149	98%				
Syphilis Coinfection										
Yes	5	3%	1	8%	4	3%	na	—		
No	160	97%	12	92%	148	97%				
ART Before Pregnancy										
No	60	36%	11	85%	49	32%	<0.001	11.56 [2.47–54.17]	11.952	0.001
Yes	105	64%	2	15%	103	68%		Ref		
ART During Pregnancy										
No	18	11%	9	69%	9	6%	<0.001	35.75 [9.21–138.84]	42.828	<0.001
Yes	147	89%	4	31%	143	94%		Ref		
HIV-RNA (at delivery)										
>1000 copy/mL	20	13%	5	100%	15	10%	na	—		
0-1000 copy/mL	132	87%	0	0%	132	90%				

Data are presented as n (%)

"—" indicates that an odds ratio was not calculated because the variable either served as the reference category or had zero cells in the contingency table, which precludes a valid OR estimation

ɕ P-values were derived from Fisher's exact test

The notation "na" indicates that analysis was not performed due to cell counts that precluded valid testing (e.g., single-category variables or variables with zero counts in one group)

ʉ The p-value is from the Mantel-Haenszel chi-square test (χ^2_{MH} df = 1)

This test evaluates the significance of the adjusted common odds ratio (presented in the "OR [95% CI]" column) controlling for the relevant variable

The reference category for each binary comparison is: Ethnicity (Turkish), Partner's HIV status (Negative), Mode of Delivery (Cesarean Section), Intrapartum IV ZDV (Yes), Neonatal Prophylaxis (No), Breastfeeding (No), ART Before/During Pregnancy (Yes)

Table 4 Multivariate logistic regression analysis of factors affecting mother to child HIV transmission (N = 156)

Predictor	B	SE	Wald	df	p	Odds Ratio	95% CI
No ART During Pregnancy	3.43	0.91	14.19	1	<0.001	30.90	[5.20–183.90]
Breastfeeding	3.40	0.95	12.85	1	<0.001	30.10	[4.70–193.50]
Constant	-4.57	0.78	34.79	1	<0.001	0.01	-

The multivariable logistic regression model, which included breastfeeding and absence of ART during pregnancy, was statistically significant ($\chi^2(2) = 45.45$, $p < .001$) and explained 60.4% of the variance in mother-to-child HIV transmission (Nagelkerke $R^2 = 0.604$)

Within this model, both absence of ART during pregnancy (aOR = 30.90, 95% CI: 5.20–183.90, $p < .001$) and breastfeeding (aOR = 30.10, 95% CI: 4.70–193.50, $p < .001$) were identified as strong, independent risk factors CI, confidence interval; SE, standard error

The reference categories were: ART During Pregnancy = "Yes", and Breastfeeding = "No"

guidelines recommend double testing in early pregnancy and near delivery to avoid missing potential HIV cases [4, 6]. The implementation of routine prenatal HIV testing varies by jurisdiction, and HIV screening is not mandatory in Türkiye. However, Ministry of Health encourages health care providers to perform prenatal HIV testing for every pregnant woman and woman trying to conceive after getting patient's permission [11]. In our study, 90.9% of women were diagnosed before delivery, consistent with previously reported rates from Türkiye (92.3% and 94.6%), reflecting a high level of HIV awareness among patients [8, 9].

It is crucial for pregnant women with HIV are adequately managed with ART to avert MTCT. Since the early clinical trials, ART use in pregnancy has evolved significantly. Initial 1990s data showed that ZDV reduced the relative risk of MTCT by 67.5% [12], and subsequent cohort studies

Table 5 Distribution of infant HIV Status, stratified by maternal ART use during pregnancy and breastfeeding

ART During Pregnancy	Breastfeeding	HIV(+) Infant *n* (% of column)	HIV(-) Infant *n* (% of column)	Total
No ART	Yes	6 (67%)	1 (11%)	7
	No	3 (33%)	8 (89%)	11
	Total	9	9	18
Yes ART	Yes	2 (67%)	5 (4%)	7
	No	1 (33%)	130 (96%)	131
	Total	3	135	138
TOTAL	Yes	8 (67%)	6 (4%)	14
	No	4 (33%)	138 (96%)	142
	Total	12	144	156

* Analysis includes only infants with complete data on both ART exposure and breastfeeding status ($N=156$)

Percentages are column percentages

reported a continued decline in MTCT rates-from 10.4% with ZDV monotherapy to 3.8% with dual ART and 1.2% with highly active ART (HAART)-leading to a paradigm shift in pregnancy management toward combination ART [13]. Moreover, therapeutic choices were modified alongside changing trends in guidelines. In our study ART regimens initiated prior to pregnancy, most commonly TDF/FTC + DTG, were modified during pregnancy primarily to align with guideline-based care and to minimize the potential risk of DTG-associated NTD, which previously reported in the literature [14, 15]. Following reassuring outcome data, international [4–6] as well as current Turkish HIV/AIDS guidelines support DTG use in pregnancy [16]. Concurrently, there was a clear increase in the use of DTG as part of ART in pregnancy regarding practice of Turkish clinicians compared to data from latest publications [9, 10]. After convincing safety results [17], BIC/FTC/TAF is now recommended as an alternative regimen in pregnancy [4, 5, 18], and previously initiated 3TC + DTG may be continued if sustained viral suppression and good tolerability are maintained throughout gestation [4, 18]. In our study, no congenital malformations were identified among infants with in-utero exposure to either BIC or DTG. Similarly, current literature have demonstrated that new ART drugs are not associated with an increased risk of congenital malformations [19–21].

Previously, C/S was the recommended mode of delivery to reduce the risk of MTCT for WLWH [22–24]. In current practice, pregnant WLWH who achieve ≤ 1,000 copies/mL viral load in late pregnancy through effective ART and adherence to care, neither C/S nor IV ZDV prophylaxis offers additional protection against MTCT [3, 25, 26]. Although majority of WLWH were virally suppressed at labor (87.2%), we observed that the most common mode of delivery was C/S in this study. Similarly, the rate of IV ZDV administration during delivery was high (56.5%). This result is consistent with numerous studies indicating a C/S majority and high usage of IV ZDV prophylaxis in WLWH [8–10, 27–29]. It seems that vaginal births are still avoided among WLWH, despite the proven safety data and the low rates of MTCT highlighted in novel guidelines.

Previous studies addressing the relationship between the HIV infection and pregnancy outcomes yielded conflicting results, with some showing higher risks and others reporting no difference in adverse outcomes among HIV-positive and negative women. Arab et al. reported as pregnancy in HIV-infected women is associated with higher adverse mother and infant complications [27]. Yudin et al. advocated that favorable pregnancy outcomes are achievable in HIV-positive women through multidisciplinary care [30], which aligns with our findings showing a low rate of serious comorbidities and pregnancy complications. Studies from Europe reported a threefold greater risk of premature birth among WLWH recieving ART [31–33]. Following reports from North America did not show such increase [34–36]. In our cohort, the preterm birth rate was 12.6%, which was comparable to the Turkish national average of 12.9% reported in 2022 [37]. A meta-analysis by Brocklehurst et al. reported an association between HIV and stillbirth and miscarriage, a finding later supported by studies showing increased risk of pregnancy loss in maternal HIV infection [38–40]. However, in our study, the rates of stillbirth and miscarriage were low, at 1.1% and 2.0%, respectively.

Although the rate of MTCT without intervention ranges from 15% to 45%, MTCT can be prevented through the implementation of effective strategies [41]. World Health Organization (WHO) recommends a global threshold for MTCT as 5% in breastfeeding and 2% in non-breastfeeding populations [42]. As recently reported, MTCT rates are very low, ranging from 0.2% to 1.1% in Europe [43]. Despite improved access to healthcare services and widespread HIV screening during pregnancy and at delivery in our country, we observed a high incidence of MTCT. Although these findings may be disappointing, they are not unexpected, as our analysis covers a long study period during which effective prevention strategies may not have been consistently implemented in earlier years. In addition, 5 of the 13 mothers were foreign nationals, which may contribute to poor adherence and low retention in care due to refugee status. Previous studies from Türkiye have reported MTCT rates of 8.3%, 5.5%, 13.7%, and 6.2%, all of which were higher than the global targets set by the WHO [8–10, 29]. In this cohort, lack of ART during pregnancy and breastfeeding was the strongest predictor of MTCT. Similarly, a recent study from our country, documented that being on ART during pregnancy was the most important predictor of MTCT [10]. Data showing that administering ZDV to the mother during labor and providing infant postnatal prophylaxis (PNP) can

reduce the transmission rate from 25% to 8% still holds true [12]. The majority of infants in this cohort received PNP according to risk classification. Although some national guidelines no longer recommend PNP for low-risk infants [43, 44], others continue to recommend it for all newborns born to WLWH [4–6, 16, 18].

Another important issue for which no consensus has yet been reached is breastfeeding. It has been demonstrated that the risk of HIV transmission through breastfeeding is 15–20% over two years in the absence of maternal ART or infant PNP [4]. Two large open-label, randomized controlled studies showed that the risk of MTCT could be substantially reduced with ART or prolonged infant PNP, but unfortunately not zero [45, 46]. In the light of this information, current guidelines, recommend breastfeeding for women willing to breastfeed their babies in case of complying certain rules [4–6, 16]. In this context, practices regarding breastfeeding vary across Türkiye and also among some clinicians. In our study, eight of 14 breastfed infants were infected with HIV. Mothers without ART in pregnancy had a markedly higher probability of breastfeeding (35% vs. 5% on ART), likely reflecting undiagnosed maternal HIV in the non-ART group and continuation of breastfeeding despite vertical transmission risk. A study from Türkiye demonstrated that nearly one third of breastfed infants were infected with HIV [10]. In another study, only one infant was breastfed and became HIV-infected [9]. On the other hand, Sütçü et al. reported no HIV transmission in any of the three breastfed babies [29]. Due to the lack of good-quality evidence and unsolved questions on breast milk transmission, a more comprehensive dataset appears to be required.

A major strength of this study is that it provides a large-scale description of pregnant WLWH from Türkiye, a setting where data remain limited in the global literature. In addition, it offers an overview of practice trends within this patient population over time.

This study has some limitations. Its retrospective design and the long data collection period (2010–2024) resulted in missing outcome data, particularly for infants. Ongoing pregnancies further limited evaluation of all maternal and perinatal outcomes. We were unable to fully assess potential confounders of abnormal pregnancy outcomes. Additionally, data on ART access coverage among pregnant women in Türkiye were not available, precluding inclusion of this variable.

Conclusion

The results of this study indicate that most WLWH in this cohort had good ART coverage and sustained undetectable viral loads at delivery. Despite successful maternal care in Türkiye, we observed a high rate of MTCT and identified breastfeeding and absence of ART during pregnancy as independent risk factors for pediatric HIV transmission. Our findings highlight the need for a more rigorous evaluation process and the development of a nationally standardized breastfeeding guideline in the context of Türkiye. Although breastfeeding may be safely implemented under certain conditions in some countries, considering the current quality of data, clinical follow-up capacity, and the level of patient education, it is evident that breastfeeding is low-risk but not risk-free. Therefore, decisions regarding breastfeeding should be individualized and made within a multidisciplinary care framework. This large real-world cohort, reflecting Turkish clinicians' practices, helps define current gaps in MTCT prevention in the modern ART era and provides valuable evidence to inform clinicians, policy makers, and public health strategies.

Acknowledgements An oral presentation was delivered at the HIV/AIDS Congress, held in Antalya, Turkey, from 5 to 8 December 2024.

Funding No funds, grants, or other support was received.

Data Availability The data that support the findings of this study are available on request from the corresponding author.

Declarations

Conflict of interest There are no conflicts of interest.

Ethical Approval This study was approved by the Harran University School of Medicine Ethics Committee Commission (decision no: HRU/24.05.32). The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

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