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EPIDEMIOLOGICAL TRENDS AND TRANSMISSION ROUTES OF HIV INFECTION IN THE FERGANA REGION: A RETROSPECTIVE STUDY (2010–2024)

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Abstract

Background: HIV infection remains an important public health problem in Uzbekistan, particularly in regions with high population density and intensive migration. The Fergana region is one of the areas where the epidemiological situation of HIV requires continuous monitoring and analysis.

Objective: The aim of this study was to analyze the epidemiological trends, geographical distribution, and transmission routes of HIV infection in the Fergana region during the period 2010–2024.

Methods: A retrospective epidemiological study was conducted using official surveillance data from the regional HIV monitoring system. HIV incidence rates were calculated per 100,000 population. District-level distribution, modes of transmission, and demographic characteristics of people living with HIV were analyzed using descriptive epidemiological methods.

Keywords: HIV infection; epidemiology; transmission routes; migration; sexual transmission; Fergana region; Uzbekistan

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Introduction

In the subsequent stage of our study, a **retrospective epidemiological analysis of HIV incidence** was conducted in the Fergana region. The findings indicate that **HIV infection currently represents a significant public health and social challenge** in the region. Over the past decade, the spread of HIV has demonstrated a **consistently increasing trend**. As of 2024, approximately **4.8–5.0 thousand people living with HIV** have been officially registered in the Fergana region. This corresponds to an incidence rate of **145–150 cases per 100,000 population**, which exceeds the **national average indicators of Uzbekistan**. The **high population density** of the Fergana Valley, combined with **intensive social and migratory mobility** and a substantial flow of **labor migration abroad**, creates favorable conditions for the spread of HIV. Epidemiological analyses demonstrate that **HIV infection is unevenly distributed across the region** (Figure 3.4). The **highest incidence rates** were recorded in **Kokand city, Sokh district, Fergana city, and Dangara district**. Kokand city represents one of the **primary HIV hotspots** in the region, with incidence rates reaching **180–200 cases per 100,000 population**. This elevated burden is directly associated with **high population density, industrial urban structure, labor migration**, and the prevalence of **high-risk behaviors**, including **unprotected sexual intercourse and injection drug use**.

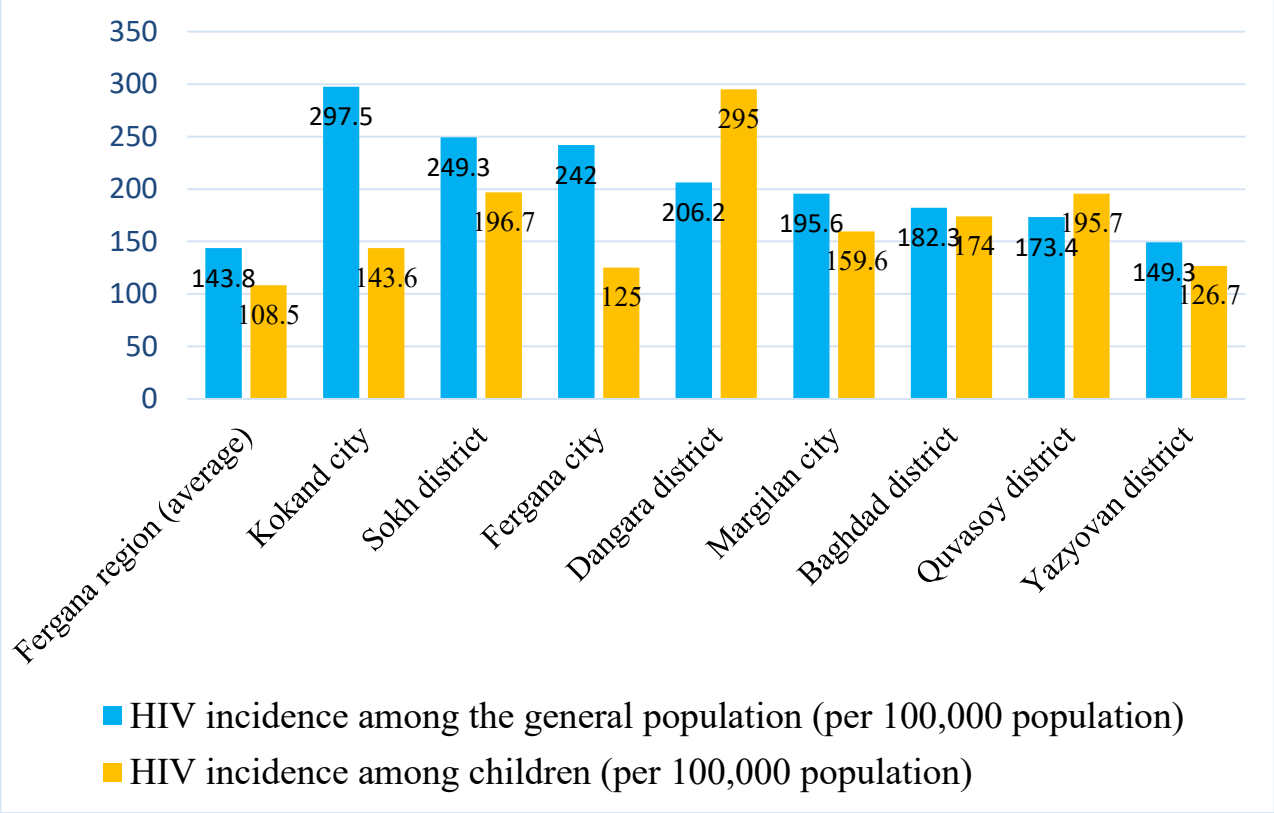

Figure 1. District-level HIV incidence in the Fergana region, 2014–2024

Similarly, **Sokh district**, due to its **border location**, is characterized by an increased risk of **cross-border HIV transmission**, with migration-related contacts contributing to the rising number of newly detected cases. **Fergana city** also demonstrates relatively high incidence rates, which can be

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partly attributed to a **well-developed healthcare infrastructure**, ensuring broader access to diagnostics and, consequently, higher case detection.

In other districts of the region, including **Margilan city, Baghdad district, and Quvasoy district**, HIV prevalence remains at a **moderate level**, with **sexual transmission predominating**. Notably, in **Margilan city**, the increasing incidence among **women of reproductive age** has heightened the risk of **vertical (mother-to-child) transmission**.

Among children, HIV infection is observed predominantly as a result of **vertical transmission**. Higher pediatric HIV rates in **Dangara, Sokh, and Kokand** are associated with a **higher prevalence of HIV among pregnant women** and **insufficient coverage of antenatal HIV screening**.

Table 1. Number of people living with HIV and total population in the Fergana region as of 2024

Region (city/district)	Number of people living with HIV (persons)	Population (thousand)	HIV per 100,000 population
Fergana region	4,144.7	3,984.0	104.0
Fergana city	328.4	369.2	88.9
Kokand city	313.6	376.5	83.3
Quvasoy city	103.2	132.8	77.7
Margilan city	257.9	253.5	101.7
Oltiariq district	233.1	232.4	100.3
Qoshtepa district	213.3	220.0	97.0
Baghdad district	238.2	214.6	111.0
Buvayda district	252.7	228.3	110.6
Beshariq district	247.2	229.8	107.5
Quva district	280.7	247.0	113.6
Uchkuprik district	246.9	231.4	106.7
Rishton district	221.2	210.8	104.9
Sokh district	86.1	82.5	104.4
Tashloq district	221.9	212.2	104.6
Uzbekistan district	241.3	224.0	107.8
Fergana district	226.0	214.9	105.1
Dangara district	181.0	198.6	91.1
Furqat district	129.8	136.5	95.1
Yazyovan district	122.2	127.1	96.1

Although lower HIV incidence rates have been recorded in Yazyovan and Furqat districts, the relatively smaller number of registered HIV cases should not be interpreted as an indicator of epidemiological safety. On the contrary, this pattern may reflect delayed diagnosis or low HIV testing coverage in certain settings. According to epidemiological surveillance data, a substantial proportion of the population in these districts has never undergone HIV testing during their lifetime. Consequently, official statistics may not fully capture the hidden epidemiological burden.

Across the Fergana region, sexual transmission remains the predominant route of HIV spread, accounting for approximately 70–75% of all cases, while injection-related transmission represents

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about 20–25%. The higher prevalence of HIV among the socially active population aged 20–39 years highlights the strong association between the epidemiological process and social determinants. Key factors directly influencing HIV transmission include population mobility and migration, the presence of high-risk behaviors, socioeconomic challenges, low levels of health literacy, and insufficient awareness of HIV infection.

From an epidemiological perspective, it can be concluded that the spread of HIV in the Fergana region is closely linked to territorial and social factors. The highest-risk zones are concentrated in Kokand, Sokh, and Fergana cities, where targeted prevention measures, active screening, and enhanced awareness-raising activities should be intensified. Regular HIV testing among key populations, including migrant men, people who inject drugs, and women of reproductive age, is essential. Furthermore, it is necessary to expand coverage of antiretroviral therapy (ART) and to ensure the full implementation of programs for the prevention of mother-to-child transmission (PMTCT) in order to reduce vertical transmission.

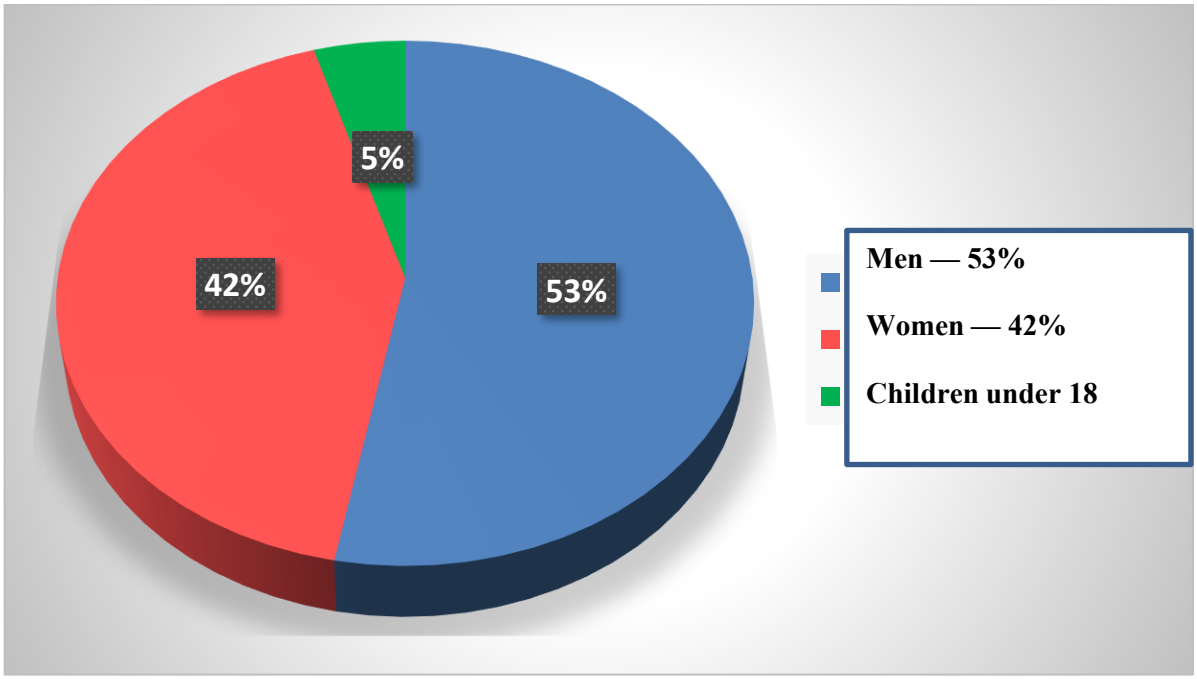

Figure 2. Annual dynamics of HIV transmission routes in the region (2010–2024 analysis)

As illustrated in the figure above, men constitute the majority of people living with HIV (53%). This pattern indicates the significant role of sexual transmission and labor migration–related factors in the spread of the virus. The higher prevalence of HIV among men is associated, on the one hand, with high-risk sexual behaviors (including unprotected intercourse and multiple sexual partners) and, on the other hand, with injection drug use.

Women account for 42% of all cases. In recent years, this proportion has shown a steady increasing trend, indicating that HIV infection is no longer confined to so-called “key populations” but is increasingly spreading among women of reproductive age within the general population. This trend confirms the predominance of heterosexual transmission. From an epidemiological perspective, the rising HIV burden among women also increases the risk of vertical (mother-to-child) transmission,

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underscoring the importance of mandatory HIV testing for pregnant women and full coverage with antiretroviral therapy (ART) for prevention purposes.

Children under the age of 18 account for 5% of cases. This relatively low proportion primarily reflects the effectiveness of perinatal prevention programs, including the prevention of mother-to-child transmission (PMTCT). Nevertheless, the fact that this indicator has not reached zero suggests that vertical transmission still occurs in some cases, potentially due to delayed diagnosis or incomplete adherence to ART.

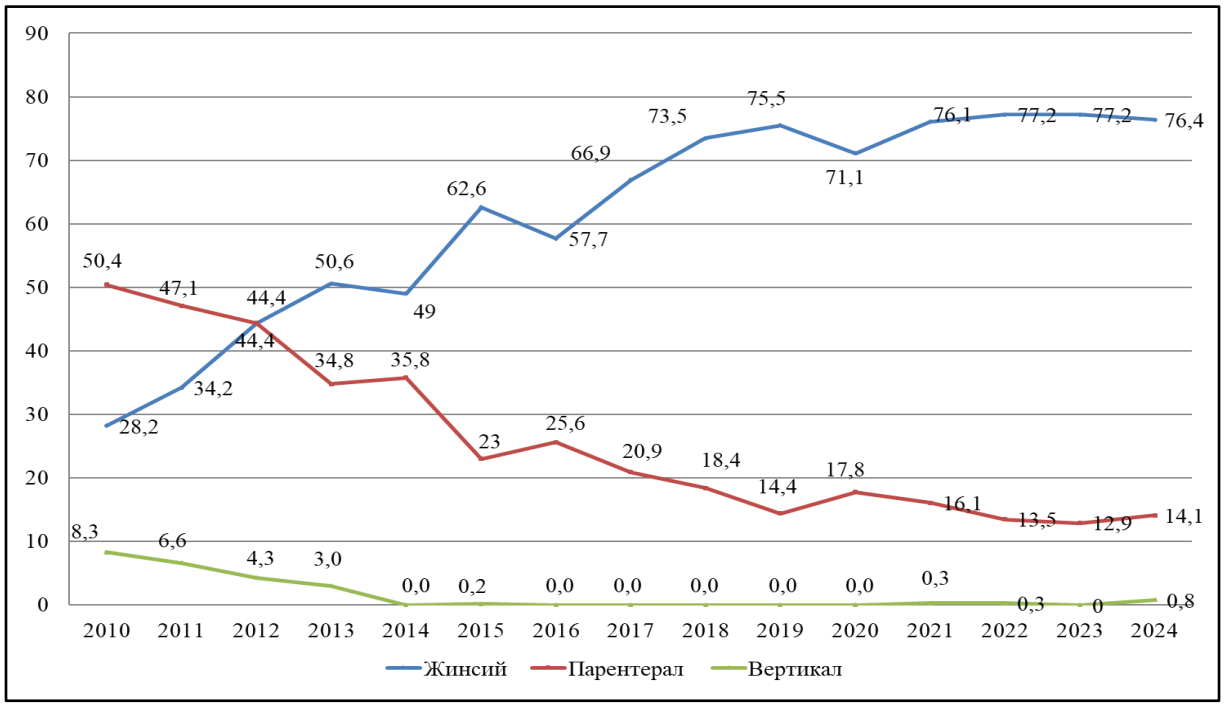

Figure 3. Annual dynamics of HIV transmission routes in the region (analysis for 2010–2024)

Between **2010 and 2024**, the **modes of HIV transmission in the Fergana region underwent substantial changes**. In the early years of the observation period (**2010–2012**), the **parenteral route (injection-related transmission)** was the predominant mode, accounting for **50.4% of all cases in 2010**. However, over time, this proportion **consistently declined**, reaching only **14.1% by 2024**. This epidemiological shift can be attributed, on the one hand, to **improved use of sterile medical equipment** and a **reduction in injection drug use**, and on the other hand, to the **increasing contribution of sexual transmission** (Figure 3.6).

In contrast, the proportion of **sexually transmitted HIV infections** increased markedly over the study period. While sexual transmission accounted for **28.2% of cases in 2010**, this share rose steadily to **62.6% in 2015**, **75.5% in 2019**, and reached **76.4% by 2024**. These findings clearly indicate that **sexual contact has become the dominant route of HIV transmission** in the region. This upward trend is largely explained by **social determinants**, including **migration**, **high-risk sexual behaviors**, **insufficient sexual education**, and **low condom use**.

The **vertical route (mother-to-child transmission)** represented the **smallest proportion** throughout the study period. In 2010, vertical transmission accounted for **8.3%**, but this figure declined to **below 1%** over subsequent years. During **2015–2024**, vertical transmission remained **almost negligible**,

reaching **0.8% in 2024**. This reflects the **effectiveness of perinatal prevention programs**, particularly the **prevention of mother-to-child transmission (PMTCT)**, as well as the **expanded coverage of pregnant women with antiretroviral therapy (ART)**.

Overall, during **2010–2024**, the **epidemiological structure of HIV transmission changed fundamentally**: the contribution of the parenteral route decreased sharply, while **sexual transmission assumed a leading role**. This pattern is consistent with broader **national and Central Asian regional trends**. From an epidemiological perspective, these changes indicate a **shift of HIV transmission toward socially active populations of reproductive age**.

Conclusion:

The findings indicate a shift in HIV epidemiology in the Fergana region toward sexual transmission among socially active populations. Strengthening targeted prevention, expanding HIV testing, and improving access to antiretroviral therapy are essential to control the spread of HIV.

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