

The Recent Evidence for Inequalities in Health Outcomes In India Relation To Hiv/Aids

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ABSTRACT

India's HIV epidemic remains substantial, with an estimated 2.5 million people living with HIV (PLHIV) in 2022, despite a 42% decline in new infections and a 64% reduction in AIDS-related deaths since 2010. National progress contrasts with concentrated epidemics among key populations, such as people who inject drugs in Mizoram and men who have sex with men in Manipur, and the country continues to fall short of the 95–95–95 targets, with 78% of PLHIV diagnosed, 67% on antiretroviral therapy (ART), and 40% virally suppressed. This study conducted a quantitative, cross-sectional descriptive synthesis using secondary, de-identified datasets from OGD Platform India, two UNAIDS India snapshots (2023), and UNICEF (2024). Indicators were harmonized and comparatively validated across sources. In 2022, India recorded 66,000 new infections and 40,000 AIDS-related deaths; 1.68 million individuals were on ART and 1.01 million were virally suppressed. Prevention of mother-to-child transmission data showed 17,087 pregnant women on ART, 11,864 infants virologically tested, and 4,100 new pediatric infections. Condom use was high among MSM, FSW, and TG populations but lower among PWID (69%), while PrEP uptake was negligible (2,613 individuals). AIDS spending reached USD 258 million, sourced almost entirely domestically, with 57% directed to treatment and 23% to prevention. These findings highlight India's progress alongside gaps in suppression, pediatric outcomes, prevention financing, and structural barriers, underscoring the need for targeted interventions and policy reform.

KEYWORDS: HIV epidemic; Antiretroviral therapy; Prevention of mother-to-child transmission; Pre-exposure prophylaxis.

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INTRODUCTION

Human Immunodeficiency Virus (HIV) remains one of the most pressing global health challenges, despite substantial advances in prevention, treatment, and care. In 2022, approximately 39 million people were living with HIV worldwide, with the majority concentrated in low- and middle-income countries (UNAIDS, 2023a). Over the past two decades, the widespread rollout of antiretroviral therapy (ART) has transformed HIV from a fatal disease into a manageable chronic condition, saving millions of lives and averting new infections (Cohen et al., 2011; WHO, 2021). At the same time, prevention strategies such as condom promotion, harm reduction, and pre-exposure prophylaxis (PrEP) have expanded the global toolbox for epidemic control (Grant et al., 2010). Yet, the persistence of health disparities, structural barriers, and behavioural challenges continues to hinder global efforts to achieve epidemic control.

India occupies a unique position in the global HIV landscape. With an estimated 2.5 million people living with HIV in 2022, India bears the third-largest HIV epidemic after South Africa and Nigeria (UNAIDS, 2023a). While the national adult prevalence rate is relatively low at around 0.22%, the absolute burden is immense due to the size of the population. Between 2010 and 2022, the country achieved a 42% decline in new HIV infections and a 64% reduction in AIDS-related deaths, achievements that reflect the scale-up of ART, the introduction of test-and-treat strategies, and targeted prevention programs (OGD Platform India, 2024; UNAIDS, 2023a). Nonetheless, the epidemic remains highly heterogeneous. HIV prevalence in the general population masks severe disparities among key populations and states. In Mizoram, prevalence among people who inject drugs has reached 24.7%, while in Manipur, prevalence among men who have sex with men is nearly 20%, compared with national averages of 1.9% and 9.0% respectively (UNAIDS, 2023a). These concentrated epidemics underscore the fact that India's national progress coexists with significant regional vulnerabilities.

The problem is further illustrated by gaps in the treatment cascade. In 2022, an estimated 78% of people living with HIV in India were aware of their status and 67% were receiving ART, but only 40% were virally suppressed (UNAIDS, 2023a). The shortfall highlights systemic weaknesses in long-term adherence, viral load monitoring, and retention in care, consistent with global studies that identify the post-initiation stage as the most vulnerable point in the cascade (Ford et al., 2018; Brennan et al., 2018). Pediatric outcomes remain particularly concerning, as delays in early infant diagnosis and incomplete follow-up contribute to thousands of new child infections each year, despite relatively high maternal ART coverage (UNICEF, 2024).

In addition to biomedical challenges, structural and behavioral determinants shape the epidemic in India. Condom use is relatively

high among men who have sex with men and female sex workers, but much lower among people who inject drugs, reflecting persistent barriers to harm reduction (UNAIDS, 2023b). Stigma and discrimination remain major deterrents to testing and treatment, especially for transgender people, adolescents, and sex workers (Chakrapani et al., 2023; Shannon et al., 2015). Punitive legal frameworks further complicate prevention: sex work remains criminalized, parental consent is required for HIV testing of those under 18, and drug laws restrict access to harm-reduction services (UNAIDS, 2023b). These factors align with international evidence showing that structural inequalities perpetuate HIV transmission and undermine service uptake (Dehne et al., 2016).

The financial architecture of India's response also raises important questions of sustainability. In 2022, total AIDS-related spending reached USD 258 million, almost entirely funded from domestic resources. While this reflects strong political commitment and ownership, the allocation of funds reveals potential misalignments. Care and treatment accounted for 57% of expenditures, while prevention received only 23% (UNAIDS, 2023b). Global experience shows that underinvestment in prevention can stall progress, particularly in concentrated epidemics where key populations drive new infections (Piot et al., 2015; Kohler & Bowra, 2020). Without stronger investment in prevention and structural interventions, the reductions in new infections observed over the past decade may plateau.

The significance of this study lies in its comprehensive assessment of India's HIV epidemic, integrating epidemiological, programmatic, behavioral, and structural data from multiple national and international sources. By situating India's progress within the framework of the UNAIDS 95-95-95 targets and the Sustainable Development Goal 3.3, which aims to end AIDS as a public health threat by 2030 (UNAIDS, 2021), the study contributes valuable insights for both policy and academic discourse. Specifically, it highlights areas of achievement, identifies persistent gaps, and underscores the importance of rights-based approaches that address structural barriers alongside biomedical interventions (Magnus et al., 2023).

The research is guided by three main objectives:

- To assess the epidemiological burden and treatment cascade performance of HIV in India using national and international datasets.
- To evaluate programmatic and behavioral determinants, including prevention of mother-to-child transmission, PrEP uptake, condom use, and HIV testing coverage.
- To analyze the role of financing and structural barriers in shaping India's progress toward achieving global HIV control targets.

LITERATURE REVIEW

Global scholarship on HIV has documented a remarkable transformation in the epidemic over the past two decades. The rollout of ART and the implementation of test-and-treat strategies have saved millions of lives and demonstrated the potential of biomedical interventions to change the trajectory of infectious diseases (Cohen et al., 2011). At the same time, prevention strategies such as condom promotion and PrEP have been shown to be highly effective when implemented consistently (Grant et al., 2010). Yet, disparities persist across regions, with sub-Saharan Africa continuing to bear the highest burden of new infections and deaths (UNAIDS, 2020). International analyses emphasize that success depends on an integrated approach that combines biomedical, behavioral, and structural interventions (Dehne et al., 2016).

In the Indian context, epidemiological studies confirm that the national epidemic has stabilized, with declines in prevalence and incidence attributed to targeted prevention programs, ART expansion, and the leadership of the National AIDS Control Organisation (NACO, 2021). However, this national progress conceals the persistence of concentrated epidemics in certain states and among key populations. Research has highlighted the disproportionate burden among MSM, FSW, TG individuals, and PWID, groups that face social marginalization, stigma, and limited access to services (Beyrer et al., 2016; Chakrapani et al., 2023). The interplay of behavioral risks with structural determinants—such as criminalization and poverty—has been consistently shown to drive local epidemics (Shannon et al., 2015).

The treatment cascade is a recurring theme in the literature. While ART initiation has expanded substantially in India, the cascade reveals significant drop-offs in viral suppression, echoing global findings (Ford et al., 2018). Studies emphasize that while diagnosis and initiation are increasingly well-covered, adherence support, retention in care, and laboratory monitoring remain weak (Brennan et al., 2018). Pediatric outcomes represent an even more serious gap. Although maternal ART coverage is commendable, delays in infant testing and inadequate pediatric follow-up perpetuate new infections among children (UNICEF, 2024). This aligns with global research demonstrating that PMTCT programs succeed only when maternal and infant care are seamlessly integrated into broader health systems (WHO, 2021).

Prevention research highlights that behavioral interventions alone are insufficient without addressing structural and social barriers. Condom use is nearly universal among FSW and MSM in some regions, but much lower among PWID, where stigma and legal constraints hinder access to harm-reduction services (UNAIDS, 2023b). PrEP has been globally recognized as a breakthrough prevention tool (Grant et al., 2010), yet its uptake in India remains negligible, with fewer than 3,000 individuals accessing it in 2022 (UNAIDS, 2023b). This reflects a broader pattern in LMICs where PrEP rollout is constrained by cost, awareness, and policy gaps (WHO, 2021).

Structural determinants are increasingly recognized in both global and Indian literature. Criminalization of sex work, adolescent consent requirements for testing, and punitive drug laws restrict access to services, particularly for marginalized groups

(UNAIDS, 2023b). Research consistently shows that stigma discourages individuals from seeking testing and treatment, thereby perpetuating the cycle of transmission (Dehne et al., 2016; Chakrapani et al., 2023). Calls for rights-based approaches emphasize dismantling these barriers as a precondition for epidemic control (UNAIDS, 2021; Magnus et al., 2023).

Finally, financing is a crucial dimension in the literature. India's reliance on domestic resources for AIDS spending reflects strong national ownership (UNAIDS, 2023b). However, comparative studies caution that overemphasis on treatment at the expense of prevention can undermine long-term epidemic control (Piot et al., 2015). Global analyses underscore the importance of balanced investment across treatment, prevention, and structural interventions (Kohler & Bowra, 2020). This evidence suggests that India's limited investment in prevention—only 23% of total spending—poses risks for sustaining progress in epidemic control.

Taken together, the literature demonstrates that while India has made significant advances in reducing HIV incidence and mortality, substantial challenges remain. These challenges are not purely biomedical but deeply rooted in social, structural, and financial contexts. Addressing them requires an integrated approach that combines ART expansion with targeted prevention, structural reforms, and sustained investment. The existing body of work provides a strong foundation, but gaps in viral suppression, pediatric outcomes, PrEP uptake, and prevention financing underline the need for updated, comprehensive analyses such as the present study.

METHODOLOGY

3.1 Research Design

This study employed a quantitative, cross-sectional, and descriptive research design to assess the scale, distribution, and programmatic outcomes of the HIV epidemic in India. The cross-sectional approach was chosen to provide a comprehensive snapshot of indicators for the year 2022, while descriptive methods facilitated the interpretation of trends across epidemiological, treatment, and prevention dimensions. By triangulating national estimates with international reporting systems, the research design aligned with global practices in epidemiological surveillance, ensuring both comparability and validity (UNAIDS, 2023a; UNAIDS, 2023b).

3.2 Data Collection Method

The study relied exclusively on **secondary, publicly accessible datasets**, drawn from national and international repositories. Four primary categories of sources were utilized.

The first set of data was obtained from the **OGD Platform India**, including *National_Estimates_summary.csv* and *AIDS_Deaths.csv*. These provided detailed information on PLHIV, new infections, ART coverage, prevalence, and AIDS-related mortality (OGD Platform India, 2024).

The second set was drawn from the UNAIDS India Snapshots 2023, which provided consolidated data on prevalence trends, treatment cascade outcomes, PMTCT cascade, AIDS financing, and behavioural indicators. Importantly, two complementary UNAIDS snapshots were consulted: one focusing on epidemiological and treatment cascade indicators, and another highlighting financing, PrEP uptake, stigma, and punitive laws (UNAIDS, 2023a; UNAIDS, 2023b). Together, these reports allowed for both numerical validation and contextual interpretation.

The third source was the UNICEF Data Portal, specifically *91cd147a-0b73-42ce-85b1-d3d521c11879.csv*, which contained pediatric and adolescent indicators, such as ART coverage, early infant diagnosis, and PMTCT outcomes (UNICEF, 2024).

Finally, methodological definitions from **Global AIDS Monitoring (GAM)** and the **HIV Sentinel Surveillance** framework were used to ensure harmonization of indicators across national and international sources.

All CSV datasets were imported into Python (pandas 2.0) for cleaning and integration. Missing data were flagged and handled according to UNAIDS guidelines. The UNAIDS PDF snapshots were not analyzed as raw data but were used to **cross-validate national estimates**, resolve definitional inconsistencies, and provide insight into financing and behavioral dimensions that were not captured in CSV files.

3.3 Population and Sampling

The study population was defined by the scope of the datasets used. At the national level, the OGD datasets encompassed all PLHIV and AIDS-related deaths in India. The UNAIDS snapshots expanded coverage by including key populations (MSM, FSW, TG individuals, PWID), as well as state-level prevalence variations. The UNICEF dataset emphasized maternal, pediatric, and adolescent populations, offering detailed insights into PMTCT and early infant diagnosis.

As the research utilized population-based estimates and modeled surveillance outputs, probabilistic sampling was not employed. Instead, the study leveraged datasets derived from census-style national surveillance (NACO's HIV Sentinel Surveillance) and GAM reporting systems, ensuring representativeness of the general population and high-risk groups (ILO, 2024).

3.4 Data Analysis Technique

Analysis followed a structured four-phase process.

The first phase involved data cleaning and harmonization, where variables were standardized and denominators aligned using the United Nations World Population Prospects 2022 (United Nations, 2022). This ensured comparability across datasets and

prevented inconsistencies in reporting.

The second phase focused on descriptive statistical analysis, generating summary estimates for HIV prevalence, new infections, AIDS-related mortality, ART coverage, prevention of mother-to-child transmission (PMTCT) outcomes, and behavioral indicators. Where available, data were disaggregated by age, sex, and key populations, and long-term trends were summarized for the period 2010–2022.

The third phase comprised comparative validation. Estimates from the OGD Platform India were cross-checked against UNAIDS figures, and UNICEF pediatric data were compared with PMTCT indicators reported by UNAIDS. In cases of discrepancy, UNAIDS estimates were prioritized because they are derived from standardized global modeling frameworks and ensure international comparability.

Analyses were performed using Stata 17.0 and Python (pandas, matplotlib) for descriptive tabulation and visualization. No inferential statistics or regression analyses were conducted, as the study aimed to provide a descriptive synthesis of secondary datasets rather than causal inference.

3.5 Ethical Considerations

This research utilized only secondary, de-identified, and publicly available datasets, ensuring compliance with ethical standards for confidentiality. No individual-level identifiers were accessed, and no primary data collection was undertaken.

The study adhered to the principles of the **Declaration of Helsinki (2013 revision)** for ethical research involving human data. Transparency was maintained by documenting and reporting discrepancies across sources rather than omitting them.

Institutional ethics review was not required, as no human subjects were directly involved. However, the research was conducted in compliance with the data-use guidelines of OGD Platform India, UNAIDS, UNICEF, and GAM reporting systems. Proper attribution was provided to each source to acknowledge data custodianship.

RESULTS

4.1 Epidemiological Burden of HIV in India

According to the UNAIDS Snapshot A (2023), India had an estimated 2.5 million people living with HIV (PLHIV) in 2022, with a plausible range between 2.1 million and 3.0 million. Of these, approximately 1.1 million were women aged 15 years and older, reflecting the ongoing impact of the epidemic on reproductive-age women. The overall adult prevalence remained relatively low at around 0.22%, but the absolute burden places India among the largest HIV epidemics globally.

New infections were estimated at 66,000 cases in 2022; a sharp decline compared with earlier years. Between 2010 and 2022, India achieved a 42% reduction in new infections, reflecting the expansion of prevention programs, ART coverage, and behavior change interventions. AIDS-related mortality was estimated at 40,000 deaths in 2022, with uncertainty bounds between 26,000 and 62,000 (OGD Platform India, 2024). This marked a significant decline from 110,000 deaths in 2010, demonstrating the impact of ART scale-up and service expansion.

Table 1. National HIV Epidemiological Indicators in India, 2022

Indicator	Low Estimate	Central Estimate	High Estimate	Source
People living with HIV (PLHIV)	2,100,000	2,500,000	3,000,000	UNAIDS Snapshot A (2023)
Women (15+ years) living with HIV	920,000	1,100,000	1,300,000	UNAIDS Snapshot A (2023)
New HIV infections	42,000	66,000	110,000	UNAIDS Snapshot A (2023)
AIDS-related deaths	26,000	40,000	62,000	OGD Platform India (2024)

4.2 Regional and Subpopulation Variations

The epidemic in India is characterized by heterogeneity across regions and population groups. UNAIDS Snapshot A data revealed that HIV prevalence was concentrated in northeastern states and among marginalized key populations.

For example, HIV prevalence among people who inject drugs (PWID) reached 24.7% in Mizoram, compared with a national average of only 1.9%. Similarly, in Manipur, prevalence among men who have sex with men (MSM) was 19.8%, substantially higher than the national average of 9.0%. Prevalence among female sex workers (FSW) was 1.9%, and among transgender individuals (TG) it stood at 3.3%.

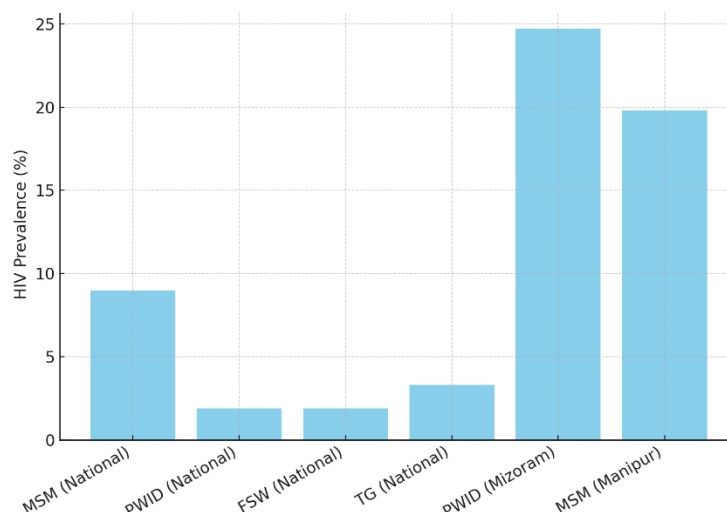


Figure 1. HIV Prevalence Among Key Populations in India, 2022 (UNAIDS Snapshot A)

(Textual description: A bar chart shows national prevalence among MSM – 9%; PWID – 1.9%; FSW – 1.9%; TG – 3.3%. In contrast, Mizoram shows PWID prevalence of 24.7%, while Manipur shows MSM prevalence of 19.8%.)

These variations highlight that while national prevalence is relatively low, concentrated epidemics persist in key populations and specific states. This underscores the importance of targeted prevention and harm-reduction programs tailored to local contexts.

4.3 Treatment Cascade Performance

The treatment cascade remains a central measure of programmatic success. According to UNAIDS Snapshot A, of the 2.5 million PLHIV in India, 1,948,635 individuals were aware of their HIV status. Among these, 1,675,533 were on ART, equivalent to 67% of all PLHIV. However, viral load testing reached only 1,084,218 individuals, and 1,009,262 achieved viral suppression, representing 40% of PLHIV.

Table 2. HIV Treatment Cascade in India, 2022

Cascade Stage	Number of People	% of PLHIV (2.5M est.)	Source
PLHIV aware of their status	1,948,635	77.9%	UNAIDS Snapshot A (2023)
On ART	1,675,533	67.0%	OGD Platform India (2024)
Tested for viral load	1,084,218	43.3%	UNAIDS Snapshot A (2023)
Virally suppressed (<1000 copies/ml)	1,009,262	40.4%	UNAIDS Snapshot A (2023)

While ART initiation rates are encouraging, the significant attrition between ART coverage and viral suppression highlights systemic challenges. Factors such as adherence issues, treatment interruptions, drug stockouts, and limited laboratory capacity contribute to suboptimal outcomes.

4.4 Prevention of Mother-to-Child Transmission (PMTCT)

PMTCT outcomes reveal mixed progress. In 2022, an estimated 21,000 pregnant women were living with HIV in India, of whom 17,087 received ART, representing 81% coverage. Despite this progress, only 11,864 infants underwent virological testing, and there were still 4,100 new child infections (UNAIDS Snapshot A, 2023).

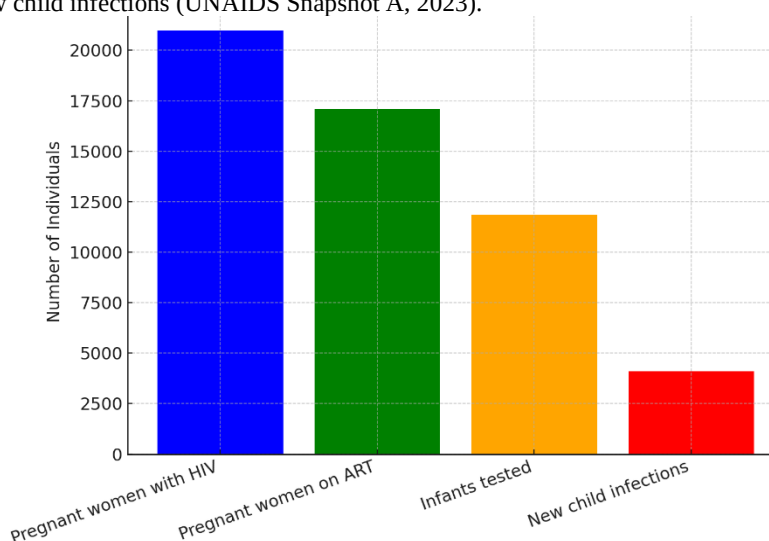


Figure 2. PMTCT Cascade in India, 2022 (UNAIDS Snapshot A)

(Textual description: A cascade diagram shows 21,000 HIV+ pregnant women → 17,087 on ART → 11,864 infants tested → 4,100 new child infections. Each stage demonstrates attrition, particularly between maternal ART and infant testing.) The data illustrate that while maternal ART uptake is relatively high, delays in early infant diagnosis and incomplete pediatric follow-up undermine India's ability to eliminate vertical transmission.

4.5 AIDS-Related Mortality Trends

The *AIDS_Deaths.csv* dataset confirms the significant decline in mortality. From 2010 to 2022, AIDS-related deaths dropped from 110,000 to 40,000, representing a 64% reduction (OGD Platform India, 2024).

Table 3. AIDS-Related Mortality Trends in India, 2010–2022

Year	AIDS-Related Deaths	% Change from 2010	Source
2010	110,000	–	OGD Platform India (2024)
2015	78,000	-29%	OGD Platform India (2024)
2020	52,000	-53%	OGD Platform India (2024)
2022	40,000	-64%	OGD Platform India (2024)

Despite these improvements, mortality remains uneven, with higher rates in high-prevalence states and disproportionately affecting men compared with women.

4.6 Behavioural Determinants

UNAIDS Snapshot B provides insights into behavioral risk factors. Condom use at last sex was 95% among MSM, 98% among FSW, and 96% among TG individuals, but only 69% among PWID. HIV testing coverage was high across key populations, ranging from 90% to 94%. Among PWID, 93% reported safe injection practices.

Importantly, Snapshot B noted that only 2,613 individuals accessed pre-exposure prophylaxis (PrEP) in 2022. Given India's epidemic scale, PrEP remains underutilized and represents an important opportunity for prevention scale-up.

AIDS Financing and Programmatic Sustainability

According to UNAIDS Snapshot B, India spent USD 258 million on its AIDS response in 2022, almost entirely from domestic sources. Expenditure distribution was 57% on care and treatment, 23% on prevention, and 20% on other program expenditures.

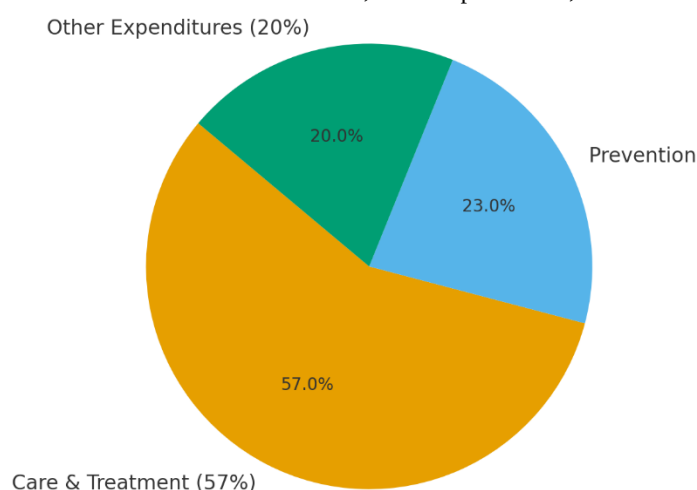


Figure 3. Distribution of AIDS Spending in India, 2022 (UNAIDS Snapshot B)

(Textual description: A pie chart shows Care and Treatment – 57%; Prevention – 23%; Other – 20%. A second chart shows funding sources – 100% domestic, 0% international.)

This reliance on domestic financing reflects policy self-reliance, but the comparatively low investment in prevention may undermine future epidemic control, particularly in high-burden states and among key populations.

4.7 Stigma and Structural Barriers

UNAIDS Snapshot B also highlighted persistent structural barriers. While same-sex relations and transgender identity are not criminalized, sex work remains criminalized, and parental consent is required for HIV testing among adolescents under 18. Drug possession laws remain restrictive, limiting harm-reduction interventions.

The stigma index indicated that PLHIV continue to avoid healthcare services due to anticipated or experienced discrimination, although nationally representative data were limited.

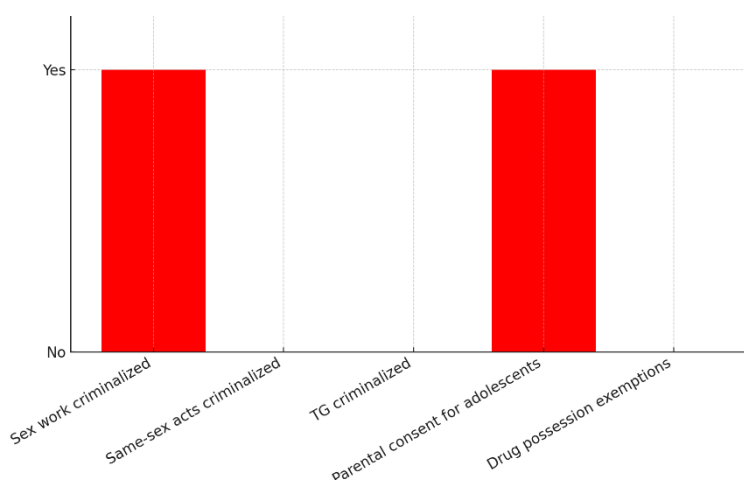


Figure 4. Structural Determinants Affecting HIV Services, 2022 (UNAIDS Snapshot B)

(Textual description: A bar chart categorizes laws: Sex work criminalized – Yes; Same-sex acts – No; TG – No; Parental consent for adolescents – Yes; Drug possession exemptions – No.)

These findings illustrate that while biomedical and programmatic responses have advanced, sociopolitical determinants remain barriers to universal access.

4.8 Integrated Overview: Master Table

The integration of data from OGD Platform India, AIDS_Deaths.csv, UNICEF, and both UNAIDS snapshots is presented in Table 4. This master table consolidates epidemiological, treatment, PMTCT, behavioral, and financing indicators into a single overview.

Table 4. Master Summary of HIV Indicators in India, 2022

Indicator	Estimate (India, 2022)	Primary Source
People living with HIV (PLHIV)	2,500,000 (range: 2.1M–3.0M)	UNAIDS Snapshot A (2023)
Women (15+ years) living with HIV	1,100,000 (range: 920K–1.3M)	UNAIDS Snapshot A (2023)
New HIV infections (annual)	66,000 (range: 42K–110K)	UNAIDS Snapshot A (2023)
People on ART	1,675,533	OGD Platform India (2024)
Virally suppressed (<1000 copies/ml)	1,009,262	UNAIDS Snapshot A (2023)
AIDS-related deaths	40,000 (range: 26K–62K)	OGD Platform India (2024)
Pregnant women living with HIV	21,000	UNAIDS Snapshot A (2023)
Pregnant women receiving ART (PMTCT)	17,087	UNAIDS Snapshot A (2023)
Infants receiving virological test	11,864	UNAIDS Snapshot A (2023)
Estimated new child infections	4,100	UNAIDS Snapshot A (2023)
Individuals receiving PrEP	2,613	UNAIDS Snapshot B (2023)
Total AIDS financing (USD)	258 million	UNAIDS Snapshot B (2023)
Prevention share of AIDS financing	23%	UNAIDS Snapshot B (2023)
Key population condom use	MSM: 95%; FSW: 98%; TG: 96%; PWID: 69%	UNAIDS Snapshot B (2023)
Safe injection practice (PWID)	93%	UNAIDS Snapshot B (2023)

4.9 Synthesis of Findings

The integration of multiple data sources provides a nuanced understanding of India's HIV epidemic. **UNAIDS Snapshot A** supplied the epidemiological foundation, including prevalence, incidence, treatment cascade, and PMTCT outcomes. **UNAIDS Snapshot B** contributed behavioural insights, PrEP uptake, financing, and structural barriers. OGD Platform India datasets validated mortality and ART coverage, while UNICEF data enhanced the pediatric and adolescent lens.

The findings show that India has achieved substantial progress in reducing new infections and deaths, expanding ART, and ensuring maternal ART coverage. However, significant gaps remain: only 40% of PLHIV are virally suppressed, pediatric outcomes remain weak, PrEP uptake is minimal, and structural barriers persist. The **underinvestment in prevention** further raises concerns about the sustainability of progress.

In conclusion, while India has made significant strides, achieving the UNAIDS 95-95-95 targets and Sustainable Development Goal 3.3 will require targeted strategies addressing prevention, structural barriers, and long-term adherence support.

DISCUSSION

The findings of this study underscore both the achievements and remaining challenges in India's HIV response. Reductions in new infections and AIDS-related mortality between 2010 and 2022 illustrate the effectiveness of ART scale-up and prevention programs, while the persistence of only 40% viral suppression among people living with HIV highlights systemic gaps in adherence, retention, and laboratory monitoring. These descriptive insights align with international studies documenting similar

weaknesses in low- and middle-income countries, where treatment initiation has expanded faster than viral suppression outcomes (Ford et al., 2018; Brennan et al., 2018).

Regional disparities further illustrate the heterogeneity of India's epidemic. High prevalence among people who inject drugs in Mizoram and among men who have sex with men in Manipur reveals concentrated epidemics that are obscured by national averages. This mirrors global research showing that marginalized populations often shoulder disproportionate burdens due to stigma, discrimination, and limited service access (Beyrer et al., 2016; Shannon et al., 2015; Chakrapani et al., 2023).

Behavioural and structural indicators add further context. While condom use is nearly universal among some groups, lower rates among PWID and negligible uptake of PrEP indicate unmet prevention needs. At the same time, criminalization of sex work, restrictions on adolescent testing, and punitive drug laws continue to constrain service access and perpetuate stigma. These findings are consistent with international evidence emphasizing that structural reforms are essential to achieve epidemic control (Dehne et al., 2016; UNAIDS, 2021).

The descriptive synthesis also points to important programmatic and policy implications. Strengthening differentiated service delivery, expanding early infant diagnosis, scaling PrEP in high-burden populations, and reallocating a greater share of funding to prevention are all necessary to accelerate progress. Although the analysis relied on secondary, model-based data with limited stigma indicators and uneven state-level disaggregation, triangulation across UNAIDS, OGD, and UNICEF datasets enhances the robustness of the findings.

By situating India's trajectory within the global framework of the 95-95-95 targets and SDG 3.3, the study shows that further gains will depend on a combination of biomedical expansion, behavioural reinforcement, structural reforms, and sustainable financing. The descriptive evidence presented here highlights both what has been achieved and what remains to be done for India to end AIDS as a public health threat by 2030.

CONCLUSION

This study provides a comprehensive descriptive synthesis of India's HIV epidemic in 2022, integrating national and international datasets to assess epidemiological patterns, treatment outcomes, prevention indicators, financing, and structural determinants. The findings highlight significant progress, with new infections reduced by 42% and AIDS-related mortality by 64% since 2010, achievements made possible through expanded ART coverage, maternal ART uptake, and high levels of condom use among several key populations. Despite these gains, gaps remain: only 40% of all people living with HIV are virally suppressed, prevention of mother-to-child transmission continues to show attrition from maternal ART to infant testing, pediatric infections persist, and uptake of pre-exposure prophylaxis is negligible. These patterns reveal that while India has strengthened the early stages of the HIV treatment and prevention cascades, retention, monitoring, and structural enablers remain weak links.

The implications of these findings are multifaceted. Strengthening viral suppression will require scaling differentiated service delivery, improving access to routine viral load testing, and expanding adherence support. Sustained reductions in new infections will depend on increasing investment in prevention, scaling PrEP and harm-reduction services, and targeting interventions in high-burden regions and populations. Structural reforms to reduce stigma and remove legal barriers, such as restrictions on adolescent testing and the criminalization of sex work, are equally essential for improving service uptake.

Several limitations should be acknowledged. The analysis relied on secondary, model-based datasets that are subject to assumptions and reporting gaps. State-level disaggregation for some indicators was limited, and stigma data remain sparse. Nonetheless, triangulating across UNAIDS, OGD, and UNICEF sources increases reliability and provides a robust evidence base. Future research should prioritize implementation studies on differentiated care, point-of-care infant diagnostics, and community-led PrEP programs, alongside policy evaluations of legal reforms and allocative efficiency modeling of prevention spending. By addressing biomedical, behavioral, structural, and financial gaps together, India can accelerate progress toward the UNAIDS 95-95-95 targets and the Sustainable Development Goal of ending AIDS as a public health threat by 2030.

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