Progress Towards UNAIDS 95-95-95 Targets Among People Living with HIV (PLHIV): A Longitudinal Analysis from Uttarakhand, India (2020–2025)

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ABSTRACT

Background: The UNAIDS 95-95-95 framework represents the global benchmark for ending the AIDS epidemic by 2030. India, with approximately 2.35 million people living with HIV (PLHIV), faces significant regional heterogeneity in achieving these targets. Uttarakhand — a Himalayan state characterised by low HIV prevalence, dispersed population, and terrain-related structural barriers — remains underrepresented in sub-national HIV research.

Objectives: To compare Uttarakhand's performance on the three 95-95-95 indicators with national averages (2020–2025), assess temporal trends, and estimate the gap between current performance and the UNAIDS targets.

Methods: A retrospective longitudinal descriptive study was conducted using secondary programmatic data from the National AIDS Control Organization (NACO) Annual Reports and the NACO Sankalak Report, 7th Edition (2025). Descriptive statistics and arithmetic projection modelling [$P_t = P_0(1 + rt)$] were applied.

Results: Uttarakhand's First 95 (diagnosis) improved from 51.1% (2020-21) to 76.3% (2024-25), yet trailed the national average (83.9%), leaving an 18.7 percentage-point gap. The Second 95 (ART coverage) reached 77.9% versus the national 86.6%, a 17.1 percentage-point deficit. Remarkably, the Third 95 (viral suppression) was achieved at 95% by 2023-24. District-level analysis identified Haridwar and Udham Singh Nagar as moderate-burden districts.

Conclusion: While Uttarakhand has achieved the viral suppression target, critical gaps persist in diagnosis and ART coverage. Intensified case-finding, linkage-to-care strategies, and district-targeted interventions are urgently needed to meet the 2030 elimination goal.

Keywords: UNAIDS 95-95-95; HIV care continuum; Uttarakhand; PLHIV; antiretroviral therapy; viral suppression; longitudinal analysis; India; sub-national HIV targets

INTRODUCTION

The Human Immunodeficiency Virus (HIV) epidemic continues to pose a formidable challenge to global public health. In 2024, an estimated 40.8 million individuals were living with HIV worldwide, with approximately

630,000 AIDS-related deaths recorded during the same period.[1] In response to the ongoing epidemic, the Joint United Nations Programme on HIV/AIDS (UNAIDS) established the ambitious 95-95-95 targets in 2021 as a strategic roadmap to end the AIDS epidemic by 2030. These targets mandate that 95% of all PLHIV know their HIV status (First 95), 95% of those diagnosed receive continuous antiretroviral therapy (ART) (Second 95), and 95% of those on ART achieve durable viral suppression (Third 95).[2]

India bears one of the world's largest HIV burdens, with approximately 2.35 million PLHIV as of 2025.[3] Under the National AIDS Control Programme Phase-V (NACP-V, 2021–2026), India has aligned its national strategy with the Sustainable Development Goals (SDGs), targeting an 80% reduction in annual new HIV infections and AIDS-related deaths. However, the path to achieving the 95-95-95 targets in India is characterised by significant regional and demographic heterogeneity. Despite the 'treat all' policy adopted in 2017, structural barriers — including human resource shortages, supply chain weaknesses, and persistent social stigma — continue to undermine the HIV care cascade.[3,4]

Uttarakhand, a Himalayan state in northern India, presents a unique epidemiological context. It is a geographically challenging, predominantly hilly region with a low HIV prevalence, dispersed rural population, and limited healthcare infrastructure in remote areas. The bulk of existing HIV research in India has focussed on high-burden states such as Andhra Pradesh, Tamil Nadu, and Maharashtra, leaving sub-national evidence from low-prevalence Himalayan settings like Uttarakhand largely absent from the literature.[4] This gap limits the ability of policymakers to design contextually appropriate interventions for the state.

This study aims to address this gap by providing a systematic longitudinal analysis of Uttarakhand's progress towards the UNAIDS 95-95-95 targets over the five-year period 2020–2025, benchmarked against national averages, and by projecting the timeline for achieving the First 95 target.

RESEARCH GAP AND RATIONALE

A review of existing literature reveals four critical gaps that this study seeks to address:

1. Limited longitudinal, state-specific evidence from geographically unique and low-prevalence regions such as Uttarakhand, which differs markedly from high-burden states in its epidemiological, demographic, and health-system profile.

2. The predominant focus of existing literature on high-burden states has resulted in systematic underrepresentation of Himalayan settings in national HIV programmatic analyses.

3. Inadequate district-level stratified analysis to identify intra-state variations in HIV burden, which are essential for resource allocation and targeted outreach.

4. Underexplored programmatic gaps in diagnosis and ART coverage within low-prevalence contexts, which constrain the development of targeted strategies toward the 2030 HIV elimination goals.

Understanding Uttarakhand's progress toward these global benchmarks will strengthen HIV control strategies, optimise resource allocation, and serve as a model for other low-prevalence Himalayan states.

OBJECTIVES

1. To compare the performance of Uttarakhand on the 95-95-95 indicators with national averages from 2020 to 2025.

2. To assess temporal trends in the 95-95-95 indicators in Uttarakhand over the study period.

3. To estimate the current gap between Uttarakhand's performance and the UNAIDS 95-95-95 targets, and to project the timeline for achieving the First 95 target.

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HYPOTHESES

Null Hypothesis (H_0): There is no significant gap between Uttarakhand's performance and the UNAIDS 95-95-95 targets.

Alternative Hypothesis (H_1): Uttarakhand has not yet achieved the First and Second UNAIDS 95-95-95 targets and shows measurable gaps compared to national averages.

MATERIALS AND METHODS

5.1 Study Design

A retrospective longitudinal descriptive study design was employed, utilising secondary programmatic data analysis across a five-year period (2020–2025).

5.2 Study Setting

The study was conducted in Uttarakhand, India — a north Himalayan state with 13 districts, a population of approximately 10.09 million (Census 2011), and a predominantly hilly terrain. The state operates a network of ART centres distributed across all 13 districts under the national HIV programme.

5.3 Data Sources

Data were extracted from the following official, peer-validated sources:

1. National AIDS Control Organization (NACO) Annual Reports (2020–21 to 2024–25)
2. NACO Sankalak Report: Status of National AIDS Response (State Fact Sheets), 7th Edition, 2025[4]
3. HIV Estimation 2025: Technical Report, NACO, Ministry of Health and Family Welfare, Government of India[3]

These publications provide validated, comprehensive data on HIV epidemiology, testing coverage, ART uptake, and viral suppression trends at national and state levels in India.

5.4 Study Population

People Living with HIV (PLHIV) registered under the HIV programme in Uttarakhand constituted the study population. Aggregate programmatic data at the state and district levels were used.

5.5 Variables and Operational Definitions

Three UNAIDS indicators were operationally defined and assessed:

1. First 95 — Proportion of PLHIV who are aware of their HIV status (diagnosis coverage).
2. Second 95 — Proportion of diagnosed PLHIV currently receiving antiretroviral therapy (ART coverage).
3. Third 95 — Proportion of PLHIV on ART who have achieved viral suppression (viral load < 1000 copies/mL).

5.6 Data Analysis

Descriptive statistical methods were applied to evaluate year-wise trends in all three indicators and to compare Uttarakhand's performance against national averages. To project the timeline for achieving the First 95 target, the arithmetic projection method was employed using the formula:

$$P_t = P_0 (1 + r \cdot t)$$

Where: P_t = projected proportion at time t; P_0 = baseline proportion (2020–21); r = average annual rate of increase derived from multi-year trend data; t = time in years.

5.7 Ethical Considerations

The study was conducted following approval from the Institutional Ethics Committee (IEC). Since the research involved retrospective secondary data analysis using anonymised, aggregate-level programmatic data without any identifiable patient information, a waiver of informed consent was obtained from the IEC.

RESULTS

6.1 First 95: Diagnosis Coverage

Uttarakhand demonstrated a consistent upward trend in HIV diagnosis coverage (First 95) over the five-year study period. The proportion of PLHIV aware of their HIV status increased from 51.1% in 2020–21 to 76.3% in 2024–25, representing an absolute increase of 25.2 percentage points. However, the state consistently trailed the national average across all study years. In 2024–25, the national average for diagnosis coverage stood at 83.9%, placing Uttarakhand 7.6 percentage points below the national figure and 18.7 percentage points below the UNAIDS target of 95% (Table 1).

Using the arithmetic projection formula, with P_0 = 51.1%, an average annual increment (r) of approximately 5.04 percentage points per year, and the 2024–25 value of 76.3%, the projected year for achieving 95% coverage is estimated to be 2028–29, assuming the current rate of improvement is sustained.

Table 1: First 95 (%) Progress Report — Uttarakhand and India (2020–2025)

Year	2020-21	2021-22	2022-23	2023-24	2024-25	Target (95%)
Uttarakhand (%)	51.1	58.4	65.2	71.8	76.3	95.0
India (%)	72.3	75.6	78.9	81.2	83.9	95.0

6.2 Second 95: ART Coverage

The Second 95 indicator (proportion of diagnosed PLHIV receiving ART) demonstrated a fluctuating trend in Uttarakhand over the study period. ART coverage was 74.8% in 2020–21, improved to 76.1% in 2021–22, dipped slightly to 75.3% in 2022–23, and subsequently rose to 78.6% in 2023–24. In 2024–25, ART coverage stood at 77.9%, compared to the national average of 86.6%, representing a 17.1 percentage-point gap from the UNAIDS target. The observed fluctuations in ART coverage may reflect attrition at various points in the care cascade, including loss to follow-up, treatment interruptions, and supply chain challenges (Table 2).

Table 2: Second 95 (%) Progress Report — Uttarakhand and India (2020–2025)

Year	2020-21	2021-22	2022-23	2023-24	2024-25	Target (95%)
Uttarakhand (%)	74.8	76.1	75.3	78.6	77.9	95.0
India (%)	80.4	82.1	83.7	85.3	86.6	95.0

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6.3 Third 95: Viral Suppression

The Third 95 (proportion of PLHIV on ART achieving viral suppression) represents the most notable achievement in Uttarakhand's HIV programme. Viral suppression rates showed a progressive and sustained increase, rising from 84.2% in 2020–21 to 91.3% in 2022–23, and achieving the UNAIDS target of 95% in 2023–24. This level was maintained through 2024–25, aligning Uttarakhand's performance with the national figure and the UNAIDS benchmark. This outcome reflects the effectiveness of ART delivery systems, adherence counselling, and clinical follow-up mechanisms within the state's HIV programme (Table 3).

Table 3: Third 95 (%) Progress Report — Uttarakhand and India (2020–2025)

Year	2020-21	2021-22	2022-23	2023-24	2024-25	Target (95%)
Uttarakhand (%)	84.2	88.5	91.3	95.0	95.0	95.0
India (%)	88.1	90.4	92.6	94.8	95.0	95.0

6.4 District-Level Analysis

District-level stratification of HIV burden across Uttarakhand's 13 districts revealed significant intra-state variation. Haridwar and Udham Singh Nagar were identified as the two moderate-burden districts, with adult HIV prevalence ranging from 0.4% to 1.0%, which is higher than the state average. These districts, characterised by high population density, migrant worker populations, and proximity to major highways, represent priority areas for intensified HIV case-finding and ART retention strategies. The remaining eleven districts reported very low adult HIV prevalence (<0.4%), consistent with the state's overall low-prevalence epidemiological profile (Table 4).

Table 4: District-wise Distribution of ART Centres and HIV Prevalence in Uttarakhand

District	ART Centre	Adult HIV Prevalence	Burden Category
Haridwar	ART Centre, Haridwar	0.4–1.0%	Moderate
Udham Singh Nagar	ART Centre, Rudrapur	0.4–1.0%	Moderate
Dehradun	ART Centre, Dehradun	<0.4%	Low
Nainital	ART Centre, Haldwani	<0.4%	Low
Pauri Garhwal	ART Centre, Pauri	<0.4%	Very Low
Tehri Garhwal	ART Centre, Tehri	<0.4%	Very Low
Chamoli	ART Centre, Gopeshwar	<0.4%	Very Low
Uttarkashi	ART Centre, Barkot	<0.4%	Very Low
Rudraprayag	ART Centre, Rudraprayag	<0.4%	Very Low
Bageshwar	ART Centre, Bageshwar	<0.4%	Very Low

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Almora	ART Centre, Almora	<0.4%	Very Low
Champawat	ART Centre, Champawat	<0.4%	Very Low
Pithoragarh	ART Centre, Pithoragarh	<0.4%	Very Low

DISCUSSION

The findings of this longitudinal analysis offer important insights into Uttarakhand's trajectory toward the UNAIDS 95-95-95 targets and highlight both achievements and persistent programmatic gaps in the state's HIV care cascade.

The most significant finding of this study is Uttarakhand's achievement of the Third 95 (viral suppression) target by 2023–24 and its sustenance through 2024–25. This is a remarkable programmatic success for a state with a challenging geographical terrain and dispersed population. The achievement of viral suppression at the state level is consistent with the national trend and is broadly comparable to global high-performing settings.[1,2] This success can be attributed to the effective functioning of ART delivery systems under NACP-V, strong adherence counselling at ART centres, and targeted support for PLHIV on treatment.

In contrast, the First 95 (diagnosis) remains the most critical bottleneck in Uttarakhand's HIV care continuum. Despite a 25.2 percentage point improvement over five years, a gap of 18.7 percentage points persists between the current rate (76.3%) and the 95% benchmark. This finding is consistent with those reported by Arya et al. (2025) in Northeast India's seven sister states, where diagnosis coverage was identified as the primary programmatic gap.[2] The underdiagnosis of PLHIV in Uttarakhand is likely driven by multiple factors: stigma-related reluctance to seek testing, limited access to HIV testing services in hilly and remote areas, inadequate awareness among the general population, and potentially low healthcare utilisation rates in rural regions. The projected timeline of 2028–29 for achieving the First 95 target underscores the urgency of accelerated case-finding efforts, particularly given the 2030 deadline.

The Second 95 (ART coverage) showed fluctuating trends, suggesting vulnerabilities in linkage-to-care and treatment retention. The observed dip in ART coverage in 2022–23 may reflect disruptions in service delivery, loss to follow-up, or data reporting issues. The gap of 17.1 percentage points from the 95% target is concerning and indicates that a substantial proportion of diagnosed PLHIV in Uttarakhand are not on ART. Hawal et al. (2025) similarly reported challenges in ART retention in a five-year cohort study from Southern India, emphasising the need for structured retention programmes.[1]

The district-level analysis provides actionable intelligence for programme planners. The identification of Haridwar and Udham Singh Nagar as moderate-burden districts is epidemiologically consistent with their demographic profiles: both are densely populated industrial and commercial hubs with significant migrant worker populations, factors well-established as drivers of elevated HIV risk. These districts merit prioritised and intensified programmatic responses, including targeted outreach, community-based testing, and strengthened retention-in-care mechanisms.

The structural barriers documented in the literature — including human resource shortages at ART centres, supply chain weaknesses, and the 'treat all' policy implementation challenges — are likely especially pronounced in Uttarakhand's hilly districts.[3,4] Innovative service delivery models, such as community ART groups, mobile testing units, and telemedicine-based follow-up, may help bridge these structural gaps in geographically challenging settings.

LIMITATIONS

This study has several limitations that should be considered when interpreting its findings:

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1. Reliance on secondary programmatic data from NACO may be subject to reporting bias, data incompleteness, and loss to follow-up among patients, which could lead to under- or overestimation of achievement across the HIV care cascade, as well as and variations in surveillance quality across different reporting years and districts.

2. The retrospective descriptive design using aggregate state-level data precludes causal inference and limits the exploration of individual-level determinants influencing gaps in the HIV care continuum.

3. The arithmetic projection method, while useful for estimating timelines, assumes a linear rate of improvement, which may not accurately reflect future programmatic realities, including potential acceleration or deceleration of progress.

4. District-level data on viral suppression rates were not available, limiting the granularity of the Third 95 analysis.

5. The reliance on quantitative programmatic indicators alone may not adequately capture social determinants such as stigma, discrimination, migration, and socioeconomic barriers, which are critical to understanding why certain groups lag behind the 95-95-95 targets.

6. As the findings are derived from a single Himalayan state, generalisability to other regions of India with differing healthcare infrastructure, demographic profiles, and HIV prevalence may be limited.

CONCLUSION

This longitudinal analysis demonstrates that Uttarakhand has made measurable progress toward the UNAIDS 95-95-95 targets between 2020 and 2025, with the remarkable achievement of the Third 95 (viral suppression) target serving as a testament to the effectiveness of the state's ART delivery systems. However, critical and widening gaps persist in the First 95 (diagnosis, gap: 18.7%) and Second 95 (ART coverage, gap: 17.1%), representing the most urgent unfinished business in the state's HIV programme.

To bridge these disparities and align with the 2030 goal of ending the AIDS epidemic, targeted and context-sensitive public health strategies are essential. These must include intensified community-based HIV case-finding — particularly in moderate-burden districts such as Haridwar and Udham Singh Nagar — improved linkage-to-care mechanisms, innovative service delivery models to overcome terrain-related barriers, and anti-stigma campaigns to promote voluntary testing. Sustained political commitment, adequate resource allocation, and robust data systems for real-time programmatic monitoring will be pivotal to accelerating Uttarakhand's journey toward the 95-95-95 targets.

Future research should incorporate qualitative assessments to better understand patient- and system-level barriers affecting progression through the HIV care continuum. Stratified analyses based on age, gender, rural–urban residence, and key population groups could help identify disparities and guide targeted interventions. Strengthening patient tracking systems, improving retention-in-care mechanisms, and expanding community-based testing and counselling services may further enhance progress toward the UNAIDS goals. Additionally, integrating digital follow-up systems, adherence support programmes, and stigma-reduction initiatives could improve treatment uptake and viral suppression rates. Continuous monitoring and periodic evaluation will be essential to sustain achievements and ensure that no vulnerable population is left behind in the effort to end HIV as a public health threat by 2030.

AUTHOR CONTRIBUTIONS

Aditya Seth: Conceptualisation, data extraction, analysis, and manuscript preparation. Vineetha Kothiyal: Literature review, data validation, and manuscript editing. Romila Rawat: Methodology, data interpretation, and critical revision of the manuscript. All authors have read and approved the final version of the manuscript.

Ethical Approval

This study was conducted following approval from the Institutional Ethics Committee of Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand, India. A waiver of informed consent was granted given the retrospective, anonymised, and aggregate nature of the secondary programmatic data used.

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Conflicts Of Interest

The authors declare no conflicts of interest.

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