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Review Article

Breakdowns in the HIV Care Cascade: Implications for National HIV Control Programs

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Abstract

Background: The HIV care cascade is widely used to monitor national HIV responses, yet persistent losses across cascade stages continue to undermine epidemic control.
Methods: We conducted a structured narrative review of peer-reviewed studies and programmatic reports published from 2010 onward, synthesizing evidence on breakdowns across the HIV care cascade using a systems-oriented analytical framework.
Results: Evidence consistently identified linkage to care and long-term retention on antiretroviral therapy as the most vulnerable cascade transitions. Attrition was driven by interacting individual, health system, and structural factors, including stigma, fragmented service delivery, weak health information systems, and restrictive policy environments. Aggregate cascade indicators frequently masked subnational disparities and systemic weaknesses.
Conclusion: Cascade breakdowns reflect system-level failures that directly compromise national HIV program performance. Strengthening continuity of care and integrating equity-oriented, system-resilient strategies are essential for achieving sustainable epidemic control.

1. Introduction

More than four decades after the emergence of the HIV epidemic, HIV remains a major global public health concern despite remarkable advances in biomedical prevention, diagnostics, and treatment. The scale-up of antiretroviral therapy has substantially reduced HIV-related morbidity and mortality and transformed HIV infection into a manageable chronic condition for many individuals. Nevertheless, progress has been uneven across regions and populations, with persistent challenges related to late diagnosis, inconsistent engagement in care, and suboptimal viral suppression, particularly in low- and middle-income countries where health systems face enduring structural and resource constraints [1].

The HIV care cascade, which delineates the sequential stages of diagnosis, linkage to care, retention in care, initiation of antiretroviral therapy, and achievement of viral suppression, has become a cornerstone framework for assessing the performance of national HIV responses. Initially conceived as a descriptive model, the cascade is now widely employed as an evaluative and accountability tool by governments, donors, and international agencies. Importantly, the cascade extends beyond a clinical representation of patient care, serving as a proxy measure of health system functionality, service integration, and policy effectiveness [2]. As such, it provides a systems-oriented lens through which national HIV control efforts can be critically examined.

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1.1. Rationale for Focusing on Breakdowns

Although the HIV care cascade is central to global monitoring efforts, national HIV programs frequently emphasize aggregate cascade indicators when reporting progress. Global targets, including the 95–95–95 benchmarks promoted by UNAIDS, offer a concise summary of national achievements but often obscure substantial attrition occurring between specific stages of care. As a result, apparent progress at the population level may coexist with significant failures in continuity of care that remain insufficiently interrogated [3].

Breakdowns along the cascade have profound epidemiological, clinical, and programmatic consequences. Incomplete linkage to care and poor retention undermine the preventive benefits of treatment, sustaining HIV transmission within communities. Treatment interruptions and inconsistent viral suppression increase the risk of antiretroviral drug resistance, threatening long-term treatment efficacy. Moreover, cascade failures are not evenly distributed, disproportionately affecting marginalized populations and exacerbating existing health inequities. From a health systems perspective, losses along the cascade represent inefficiencies that weaken the return on substantial investments in HIV testing, treatment, and monitoring [4].

1.2. Research Gap

While a substantial body of literature has examined the HIV care cascade, several critical limitations persist. Many studies focus on individual cascade stages in isolation, limiting insight into how failures at one point influence outcomes across the continuum. In addition, a significant proportion of published evidence originates from high-income settings, constraining the generalizability of findings to regions with the highest HIV burden. Furthermore, existing research often prioritizes individual-level behavioral determinants of attrition while giving comparatively limited attention to health system organization, policy environments, and governance structures that shape access to and continuity of care.

Consequently, there remains a lack of integrative reviews that synthesize evidence across cascade stages and explicitly link breakdowns in care to the design and performance of national HIV control programs. Addressing this gap is essential for informing policy and programmatic strategies that move beyond narrow performance metrics toward sustainable epidemic control.

1.3. Aim and Objectives of the Review

The aim of this review article is to systematically synthesize and critically appraise existing evidence on breakdowns across the HIV care cascade and to examine their implications for national HIV control programs. Specifically, the review seeks to identify cascade stages associated with the greatest attrition, to analyze individual-, community-, and system-level drivers of these breakdowns, and to assess how cascade gaps undermine the achievement of national and global HIV targets. By integrating findings across diverse contexts, this review aims to inform evidence-based strategies for strengthening continuity of care and enhancing the effectiveness and equity of national HIV responses.

2. Literature Review

2.1. Conceptual Evolution of the HIV Care Cascade

The HIV care cascade has undergone substantial conceptual evolution since its initial formulation as a linear depiction of patient progression from diagnosis to viral suppression. Early cascade models were primarily descriptive, designed to quantify the proportion of people living with HIV who successfully navigated successive stages of care. Over time, the cascade has been increasingly adopted as a performance assessment framework for national HIV programs, enabling cross-country comparisons and informing global accountability mechanisms. This shift has elevated the cascade from a clinical monitoring tool to a central instrument of health policy evaluation [5].

More recent scholarship has emphasized that the cascade should not be interpreted as a purely linear or static pathway. Instead, it reflects a dynamic process shaped by health system organization, policy environments, and social contexts. Attrition at any stage may result in cyclical movement in and out of care rather than permanent loss, particularly in settings characterized by fragile health systems. Consequently, contemporary interpretations of the cascade highlight the importance of continuity, transitions between stages, and the capacity of systems to re-engage individuals who disengage from care. This reconceptualization underscores the cascade's utility as a systems-performance framework that captures both service delivery effectiveness and broader structural constraints [6].

2.2. Magnitude and Patterns of Attrition Across the Cascade

A substantial body of empirical literature documents attrition at each stage of the HIV care cascade, with patterns varying across geographic regions, epidemic contexts, and population groups. The initial stage of diagnosis remains a critical bottleneck, as a significant proportion of people living with HIV are still unaware of their status in many settings. Late diagnosis is consistently associated with poorer clinical outcomes and reduced effectiveness of treatment-as-prevention strategies [7].

Linkage to care following diagnosis represents another major point of loss. Studies across diverse contexts have reported delays or complete failure to link newly diagnosed individuals to sustained HIV care, often within the first months after testing. Even among those who initiate antiretroviral therapy, long-term retention in care poses a persistent challenge. Evidence indicates that disengagement frequently occurs within the first year of treatment, undermining viral suppression and increasing the risk of onward transmission. Although global targets emphasize viral suppression as the ultimate outcome, the literature demonstrates that suppression is contingent upon uninterrupted engagement across all preceding stages of the cascade [8, 9].

Importantly, aggregate national indicators often mask substantial heterogeneity within countries. Subnational analyses reveal that cascade attrition is frequently concentrated among specific demographic and geographic groups, including adolescents and young adults, men, mobile populations, and residents of rural or underserved areas. These patterns suggest that cascade performance is deeply intertwined with social determinants of health and structural inequalities [10, 11].

2.3. Determinants of Cascade Breakdowns

Individual and Community-Level Factors

At the individual and community levels, stigma remains one of the most consistently cited barriers across all cascade stages. Fear of disclosure, anticipated discrimination, and internalized stigma discourage HIV testing, delay care-seeking, and contribute to poor retention. Socioeconomic vulnerability, including poverty, food insecurity, and unstable housing, further constrains individuals' ability to engage consistently with care. Gender norms and power dynamics also shape cascade outcomes, influencing health-seeking behaviors and access to services in gender-specific ways.

Community-level factors, such as social support networks and local perceptions of health facilities, play a critical role in facilitating or hindering engagement in care. The literature increasingly emphasizes that individual behavior cannot be disentangled from the social environments in which care is sought and delivered [12].

Health System Factors

Health system characteristics are central drivers of cascade breakdowns. Fragmented service delivery models, long waiting times, inadequate staffing, and frequent stock-outs of essential commodities have been repeatedly associated with poor linkage, retention, and treatment adherence. Weak health information systems limit the ability of programs to track patients across facilities and over time, resulting in misclassification of loss to follow-up and missed opportunities for re-engagement.

In many settings, HIV services remain insufficiently integrated into primary health care, creating parallel systems that are difficult for patients to navigate. The literature also highlights the role of provider attitudes and competencies, as negative interactions with health workers can discourage continued engagement in care [11].

Structural and Policy Drivers

Structural and policy-level factors exert a profound influence on cascade performance. Restrictive laws and policies, including criminalization of key populations, undermine access to services and exacerbate mistrust of health systems. Financing constraints, donor dependency, and shifts in funding priorities affect the sustainability and reach of national HIV programs. Evidence suggests that countries with more decentralized, flexible, and community-engaged policy frameworks tend to demonstrate stronger cascade outcomes.

Global policy agendas, including targets articulated by UNAIDS, have catalyzed progress but have also contributed to a focus on headline indicators that may overlook underlying system weaknesses. This tension between global accountability and local realities is a recurring theme in the literature.

2.4. Implications of Cascade Breakdowns for National HIV Control Programs

The cumulative evidence indicates that cascade breakdowns have significant implications for the effectiveness and sustainability of national HIV control programs. Attrition at early stages diminishes the impact of downstream investments, while failures in retention and viral suppression compromise the preventive benefits of widespread treatment. Programs that prioritize coverage metrics without addressing continuity risk overstating progress and misallocating resources.

Moreover, persistent cascade gaps challenge efforts to achieve equity in HIV outcomes, as marginalized populations are disproportionately affected by system failures. The literature suggests that without deliberate attention to these disparities, national programs may inadvertently reinforce existing social and health inequities [13].

2.5. Synthesis and Conceptual Implications

Taken together, the reviewed literature underscores the need for an integrative perspective that views the HIV care cascade as a complex, interconnected system rather than a series of discrete steps. Breakdowns are rarely attributable to a single factor; instead, they emerge from the interaction of individual vulnerabilities, health system limitations, and structural constraints. This synthesis highlights the importance of shifting analytical and programmatic focus from isolated cascade indicators toward the integrity of transitions between stages, thereby informing more responsive and resilient national HIV control strategies [7].

Figure 1 presents a multi-level conceptual framework illustrating how individual, health system, and structural drivers interact to produce breakdowns across the HIV care cascade, with feedback loops linking these disruptions to suboptimal national program outcomes.

This conceptual framework synthesizes evidence from the literature to illustrate how breakdowns in the HIV care cascade emerge from interacting drivers across multiple levels. Cascade stages are represented along the horizontal axis, emphasizing transitions rather than isolated endpoints. The vertical layers depict individual, health system, and structural or policy-level determinants that influence movement through the cascade. Feedback loops highlight how cascade failures reinforce health system strain, inequities, and suboptimal national program outcomes, thereby perpetuating further attrition. The framework underscores the need for continuity-focused and system-oriented approaches to national HIV control. The framework was developed by the authors through thematic synthesis of the reviewed evidence."

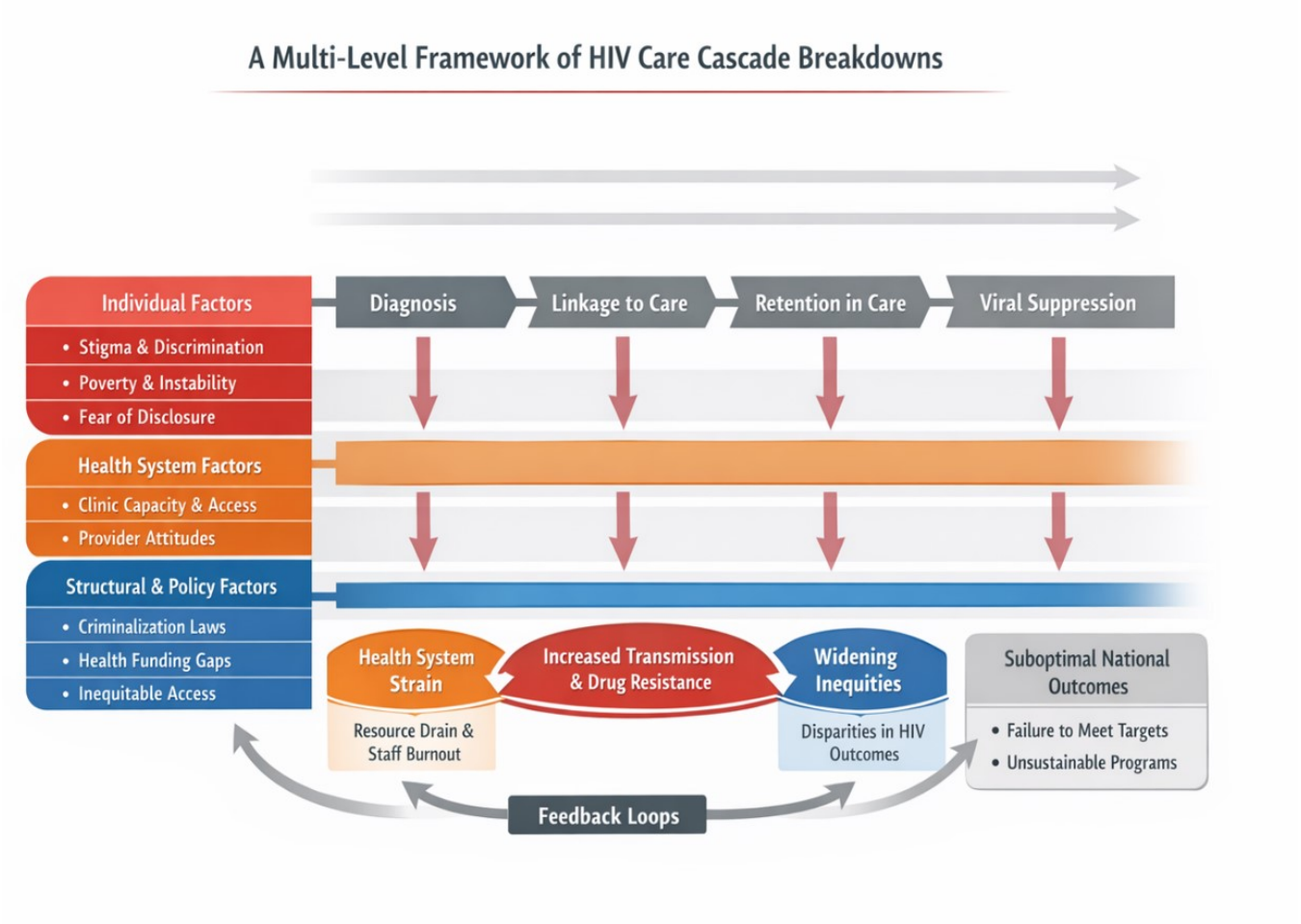

Figure 1: A Multi-Level Framework of HIV Care Cascade Breakdowns

3. Methodology

3.1. Review Design and Approach

This study was conducted as a structured narrative review with a systematic search strategy to synthesize and critically appraise existing evidence on breakdowns across the HIV care cascade and their implications for national HIV control programs. A review design was selected to allow for the integration of diverse study types, including quantitative analyses, qualitative studies, mixed-methods research, and programmatic reports, which together provide a comprehensive understanding of cascade dynamics beyond what could be captured through a single methodological approach. The review was guided by established principles for transparent and reproducible evidence synthesis to enhance methodological rigor and credibility.

3.2. Data Sources and Search Strategy

A comprehensive literature search was conducted across major bibliographic databases, including PubMed, Scopus, Web of Science, and Embase. To capture policy-relevant and programmatic evidence, supplementary searches were performed using Google Scholar and through the websites of international health agencies and national HIV programs. The search strategy combined controlled vocabulary terms and free-text keywords related to HIV, the care cascade, continuum of care, linkage to care, retention, antiretroviral therapy, viral suppression, and national HIV programs. Searches were limited to articles published in English to ensure consistency in interpretation and synthesis.

The search period focused on publications from 2010 onward, corresponding to the global scale-up of treatment-as-prevention strategies and the increasing adoption of cascade-based monitoring frameworks. Reference lists of included articles were manually screened to identify additional relevant studies not captured through the database searches.

3.3. Eligibility Criteria

Studies were eligible for inclusion if they met the following criteria: they examined one or more stages of the HIV care cascade; reported empirical findings or programmatic analyses related to cascade attrition or continuity of care; and explicitly discussed implications for health systems, policy, or national HIV control efforts. Both population-based studies and facility-level analyses were included to capture variability across contexts.

Studies were excluded if they focused exclusively on biomedical efficacy without reference to care delivery or programmatic factors, were limited to narrowly defined clinical cohorts without broader relevance to health systems, or lacked sufficient methodological detail

to support critical appraisal. Editorials, commentaries, and opinion pieces were excluded unless they provided substantive synthesis of empirical evidence relevant to cascade performance.

3.4. Study Selection and Data Extraction

Titles and abstracts identified through the search strategy were screened for relevance, followed by full-text review of potentially eligible articles. Data extraction was conducted using a standardized framework designed to capture key study characteristics, including geographic setting, study design, population focus, cascade stages examined, and reported determinants of attrition. In addition, data were extracted on health system and policy factors influencing cascade performance, as well as reported programmatic consequences of cascade breakdowns.

To support integrative synthesis, extracted findings were mapped across cascade stages and categorized according to individual-, community-, health system-, and structural-level drivers. This approach enabled comparison across studies and facilitated identification of recurring patterns and cross-cutting themes.

3.5. Data Synthesis and Analytical Framework

A thematic synthesis approach was employed to integrate findings across heterogeneous sources. Rather than aggregating quantitative estimates, the analysis focused on identifying consistent patterns of breakdown across the cascade and elucidating the mechanisms through which these breakdowns affect national HIV control efforts. Findings were interpreted through a systems-oriented analytical framework that conceptualizes the HIV care cascade as a set of interconnected transitions influenced by multilevel determinants.

This framework guided the examination of how attrition at specific stages undermines downstream outcomes and how health system and policy contexts shape overall cascade integrity. By synthesizing evidence across stages and settings, the review aimed to generate insights that are transferable across national programs while remaining sensitive to contextual variation. All tables and figures presented in this review were synthesized by the authors based on the included literature and do not reproduce previously published figures.

3.6. Quality Considerations and Limitations

Given the inclusion of diverse study designs, formal meta-analysis and uniform quality scoring were not undertaken. Instead, methodological rigor was assessed qualitatively, with attention to study design appropriateness, clarity of cascade definitions, and transparency of analytical methods. Greater weight was accorded to studies employing longitudinal or population-based designs, clearly defined cascade indicators, transparent analytical methods, and explicit consideration of health system or policy-level determinants. Studies meeting multiple criteria were prioritized during synthesis.

This review is subject to limitations inherent in narrative synthesis, including potential publication bias and heterogeneity in cascade definitions across studies. Nevertheless, the structured search strategy, transparent eligibility criteria, and systematic synthesis approach strengthen the validity of the findings and support their relevance for informing national HIV control strategies.

4. Results

4.1. Overview of the Evidence Base

A total of 24 studies were included in the final synthesis, encompassing quantitative, qualitative, mixed-methods studies, and programmatic reports across diverse geographic and epidemic contexts."

The literature reviewed reflects a broad and diverse evidence base examining the HIV care cascade across multiple regions and epidemic contexts. Included studies comprised population-based analyses, cohort studies, facility-level evaluations, qualitative investigations, and national and subnational program reports. The majority of studies originated from low- and middle-income countries, particularly in sub-Saharan Africa, where the HIV burden is highest, although evidence from high-income settings provided important comparative insights into health system performance and policy implementation. Collectively, the reviewed literature examined all major stages of the HIV care cascade, with substantial variability in methodological approaches, cascade definitions, and outcome measures [7, 14].

Across settings, the evidence consistently demonstrated that attrition occurs at multiple points along the cascade, with losses accumulating as individuals progress from diagnosis to sustained viral suppression. While some countries reported improvements in overall cascade indicators over time, disaggregated analyses revealed persistent vulnerabilities within specific transitions and populations.

4.2. Cascade Stages Associated With Greatest Attrition

The diagnosis stage emerged as a critical point of attrition, particularly in settings with limited access to routine testing or where stigma and fear of discrimination remain pronounced. A substantial proportion of people living with HIV continue to be diagnosed at advanced stages of disease, indicating missed opportunities for earlier detection and timely intervention. Late diagnosis was consistently associated with poorer clinical outcomes and reduced likelihood of sustained engagement in care [15].

Linkage to care following diagnosis represented another major bottleneck across the reviewed studies. Even in contexts with expanded testing services, delays in initiating care or complete failure to link newly diagnosed individuals to treatment programs were frequently reported. Structural barriers, such as geographic distance to facilities and fragmented referral systems, compounded individual-level challenges and contributed to early losses along the cascade [16].

Retention in care and long-term treatment continuity were identified as the most fragile components of the cascade. Although many individuals successfully initiated antiretroviral therapy, disengagement within the first year of treatment was common. The literature highlighted that retention is not a singular event but an ongoing process influenced by cumulative health system interactions, social circumstances, and policy environments. Viral suppression outcomes closely mirrored retention patterns, underscoring the interdependence of cascade stages [17]. Table 1 synthesizes evidence across studies to illustrate how failures at specific transition points in the HIV care

cascade translate into broader programmatic and policy-level consequences. Rather than reiterating prevalence estimates, the table highlights systemic mechanisms of attrition and their implications for national HIV control efforts.

Table 1: Cascade Transition Failures and Their Programmatic Consequences

Cascade Transition	Dominant Failure Mechanisms	Affected Populations	Programmatic Consequences	Policy-Level Implications
Diagnosis → Linkage to Care	Weak referral systems, stigma at point of diagnosis, geographic and financial barriers, fragmented service delivery	Newly diagnosed individuals, men, adolescents, rural populations	Delayed ART initiation, loss of preventive benefit of early diagnosis, increased late presentation	Need for integrated testing–treatment models, strengthened referral accountability, community-based linkage strategies [18]
Linkage → Retention in Care	Overburdened facilities, poor patient–provider interactions, inadequate follow-up mechanisms	Young adults, mobile populations, socioeconomically vulnerable groups	High early loss to follow-up, inefficient use of testing and initiation resources	Investment in differentiated service delivery and patient-tracking systems [19]
Retention → Sustained ART	Treatment fatigue, service interruptions, stock-outs, competing social priorities	Long-term ART users, individuals with unstable livelihoods	Treatment interruptions, increased risk of drug resistance	Strengthening supply chains, social support integration, long-term adherence policies [20]
ART → Viral Suppression	Inconsistent adherence support, limited viral load delayed clinical response	Key populations, adolescents, patients in low-	Suboptimal treatment-as-prevention transmission	Expansion of viral load monitoring, timely regimen focused treatment policies [21]

4.3. Drivers of Cascade Breakdowns Across Levels

Analysis of the reviewed evidence revealed that cascade breakdowns are driven by interacting factors operating at multiple levels. At the individual level, stigma, socioeconomic vulnerability, and competing life priorities were recurrently associated with delayed care-seeking and treatment interruptions. Adolescents, men, and key populations were disproportionately affected, reflecting both social marginalization and service delivery models insufficiently tailored to their needs.

Health system factors featured prominently across all cascade stages. Inadequate human resources, high patient volumes, long waiting times, and inconsistent availability of medications undermined both initial engagement and long-term retention. Weak health information systems limited the ability of programs to track patient movement across facilities, leading to misclassification of outcomes and obscuring true patterns of disengagement and re-engagement in care.

Structural and policy-level drivers further shaped cascade performance. Restrictive legal environments, particularly those criminalizing key populations, were consistently linked to reduced service uptake and continuity. Financing instability and reliance on external donors influenced program sustainability, while limited integration of HIV services into broader health systems created parallel structures that were difficult to navigate for patients [22].

4.4. Programmatic Consequences of Cascade Failures

The reviewed literature highlighted several programmatic consequences of persistent cascade breakdowns. Attrition at early stages diminished the impact of downstream investments in treatment and monitoring, reducing the overall effectiveness of national HIV responses. Incomplete viral suppression among those on treatment weakened the preventive benefits of antiretroviral therapy and sustained transmission within communities.

Cascade failures also contributed to inequitable health outcomes, as losses were concentrated among populations already facing social and economic disadvantage. This pattern undermined national commitments to equity and universal health coverage. Furthermore, the evidence suggested that reliance on aggregate cascade indicators may create a false sense of progress, masking system weaknesses that threaten the long-term sustainability of epidemic control efforts.

Overall, the results indicate that while substantial progress has been made in expanding HIV services, persistent and interconnected breakdowns across the care cascade continue to limit the effectiveness of national HIV control programs. These findings underscore the need for a systems-oriented response that prioritizes continuity of care and addresses the structural drivers of attrition.

5. Discussion

This review synthesizes evidence demonstrating that persistent breakdowns across the HIV care cascade remain a central barrier to achieving effective and equitable national HIV control, despite substantial biomedical and programmatic advances. The findings highlight that attrition is not confined to a single stage of care but occurs cumulatively across diagnosis, linkage, retention, and viral suppression. Importantly, these

breakdowns reflect systemic weaknesses rather than isolated individual failures, underscoring the need to reframe the HIV care cascade as a dynamic health system process rather than a static sequence of clinical milestones.

One of the most salient insights from this review is the fragility of transitions between cascade stages. While national programs have expanded HIV testing and treatment coverage, the evidence indicates that linkage to care and long-term retention remain particularly vulnerable points. These transitions are shaped by the interaction of individual vulnerabilities with health system capacity and policy environments. The persistence of late diagnosis and delayed linkage suggests that expanded service availability alone is insufficient without concurrent investments in community engagement, stigma reduction, and streamlined referral systems. Similarly, high rates of early treatment disengagement reflect cumulative system-level stressors, including overburdened facilities, inconsistent service quality, and limited mechanisms for patient follow-up.

The findings further suggest that the emphasis on aggregate cascade targets may inadvertently obscure underlying programmatic weaknesses. Global benchmarks, including those articulated by UNAIDS, have played a critical role in mobilizing political commitment and resources. However, reliance on headline indicators can mask substantial heterogeneity within countries and divert attention from populations and geographic areas experiencing the greatest losses along the cascade. A narrow focus on endpoint outcomes, such as viral suppression, risks undervaluing the importance of continuity and resilience within health systems, particularly in contexts characterized by social and economic instability [23].

Equity emerges as a cross-cutting concern throughout the reviewed literature. Cascade breakdowns disproportionately affect adolescents, men, mobile populations, and key populations, reflecting broader patterns of marginalization and exclusion. These disparities are amplified by structural and legal barriers that limit access to care and undermine trust in health systems. The evidence suggests that without explicit strategies to address these inequities, national HIV programs may achieve overall improvements in cascade indicators while leaving the most vulnerable groups behind. Such outcomes challenge the ethical and public health foundations of national HIV responses and undermine progress toward universal health coverage.

From a policy and programmatic perspective, the review underscores the need for a shift from coverage-driven approaches toward models that prioritize continuity of care and system integration. Strengthening linkage and retention requires investments in differentiated service delivery, decentralized care models, and robust health information systems capable of tracking patient trajectories across facilities and over time. Integration of HIV services into primary health care may reduce fragmentation and improve accessibility, particularly for individuals managing multiple health and social needs. Moreover, policies that enable community-based service delivery and task sharing have demonstrated potential to mitigate health system constraints and improve cascade outcomes [23].

The findings of this review align with emerging calls to reconceptualize HIV program monitoring frameworks. Rather than relying solely on linear cascade indicators, national programs may benefit from metrics that capture transitions, re-engagement, and duration of viral suppression. Such measures would provide a more accurate reflection of system performance and support adaptive responses to emerging gaps. Importantly, these approaches require political commitment, sustainable financing, and alignment between national priorities and global accountability mechanisms [13].

This review has several limitations that warrant consideration. The heterogeneity of study designs, cascade definitions, and outcome measures limited the ability to draw direct quantitative comparisons across settings. Additionally, reliance on published literature may have introduced publication bias, as programmatic failures are less likely to be reported than successes. Nonetheless, the consistency of themes across diverse contexts strengthens confidence in the overarching conclusions.

In summary, the evidence synthesized in this review indicates that addressing breakdowns in the HIV care cascade requires moving beyond incremental improvements within individual stages toward comprehensive, system-level strategies. National HIV control programs that prioritize continuity, equity, and integration are more likely to translate biomedical advances into sustained population-level impact. These insights provide a foundation for reorienting policy and programmatic efforts toward more resilient and people-centered HIV responses.

Policy Implications

The findings of this review highlight that national HIV control strategies must move beyond coverage-oriented targets toward policies that prioritize continuity of care across the cascade. Policymakers should adopt cascade monitoring frameworks that capture transitions, re-engagement, and durability of viral suppression rather than static endpoint indicators alone.

Investments in differentiated service delivery, decentralized care models, and interoperable health information systems are essential for strengthening linkage and long-term retention. In addition, legal and policy reforms that reduce stigma and criminalization of key populations are critical to improving cascade performance and advancing equity. Positioning the HIV care cascade as a diagnostic tool for system performance—rather than solely as an accountability metric—can enhance the efficiency, sustainability, and fairness of national HIV responses.

6. Conclusion

This review synthesizes evidence demonstrating that persistent breakdowns across the HIV care cascade continue to undermine the effectiveness of national HIV control programs, despite major advances in biomedical interventions and expanded service coverage. Attrition occurs at multiple, interconnected points along the cascade, with particularly pronounced losses during transitions between diagnosis and linkage to care, as well as during long-term retention on antiretroviral therapy. These breakdowns reflect systemic and structural weaknesses rather than isolated individual behaviors, highlighting the limitations of approaches that prioritize coverage metrics without sufficient attention to continuity of care.

The findings underscore that national progress toward global HIV targets does not necessarily equate to durable epidemic control. Aggregate cascade indicators may mask substantial heterogeneity within countries and obscure persistent inequities affecting marginalized and key populations. As a result, national programs may overestimate their performance while critical gaps in service delivery, health system capacity, and policy environments remain unaddressed. The persistence of late diagnosis, treatment interruptions, and suboptimal viral suppression illustrates the need to move beyond linear representations of the cascade toward a more nuanced understanding of patient trajectories and system performance.

Strengthening national HIV responses requires a strategic shift toward integrated, people-centered, and system-resilient models of care. Investments in differentiated service delivery, decentralized and community-based approaches, and robust health information systems are essential for improving linkage, retention, and sustained viral suppression. Equally important are policy reforms that reduce structural barriers, address stigma and discrimination, and align HIV programs with broader health system strengthening and universal health coverage agendas.

In conclusion, reframing the HIV care cascade as a dynamic and interconnected system offers a critical opportunity to enhance the effectiveness, equity, and sustainability of national HIV control efforts. By prioritizing continuity of care and addressing the multilevel drivers of attrition, national programs can more effectively translate scientific advances into long-term population health gains and move closer to achieving sustained epidemic control.

Future research should prioritize longitudinal analyses of cascade transitions, measures of re-engagement and durability of viral suppression, and evaluation of system-resilience interventions within national HIV programs.

Article Information

Disclaimer (Artificial Intelligence): The author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.), and text-to-image generators have been used during writing or editing of manuscripts.

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