Best Practices in Cascade Analytics and Costing as Steps to 95-95-95

Webinar Series: Five Ways to Accelerate Progress Toward the 95-95-95 Goals
Today’s webinar

**Purpose:** Understand methodological approaches and key considerations for conducting analyses to strengthen HIV prevention and treatment cascades

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Reuben Granich (Independent consultant)

Catherine Barker Cantelmo (HP+)
PEPFAR: Evidence for Epidemic Control

Bryan N. Patenaude, Sc.D.
Data for Epidemic Control

PEPFAR is currently utilizing various tools to collect data and evidence on progress toward Epidemic Control at all stages of the treatment and prevention cascades including:

- **Population-based HIV Assessments (PHIA)** for detailed epidemiologic impact data
- **Monitoring Evaluation, and Reporting (MER)** indicators to get more detailed programmatic data.
- **Sustainability Index and Dashboards (SID)** to assist PEPFAR teams and government partners in making informed investment decisions around sustainability.
- **Site Improvement Through Monitoring System (SIMS)** to increase the impact of PEPFAR programs on the HIV epidemic through standardized monitoring of the quality of PEPFAR support at the site level.
Epidemic Control & Data

- Detailed data is essential in working with the international community toward the UNAIDS 95-95-95 goals, reaching and maintaining epidemic control, and upholding the pillars of PEPFAR

Figure from a presentation of Ambassador Birx to Civil Society on September 24, 2017 titled “Using Data to Focus Program on Locations and Populations for Maximal Impact”
Evidence & The Treatment Cascade

• In pursuit of these goals, understanding investments at every step of the treatment cascade is essential for:
  — Pinpointing failure points hindering progress toward epidemic control
  — Understanding how scale-up of particular interventions impacts each step in the cascade
  — Prioritizing interventions to optimize impact

• In addition to understanding population cascades, a more nuanced understanding of sub-population cascades is important for groups including:
  — Key populations
  — Adolescent girls and young women
  — Young men
Cascade Data & Sub-Populations

- We already have evidence that treatment cascades vary drastically by demographic characteristics and use this to assist in target & priority setting.

Uganda Treatment Cascade (Ages 18-24, 2017 Q1)

Figure from a presentation of Ambassador Birx to Civil Society on September 24, 2017 titled “Using Data to Focus Program on Locations and Populations for Maximal Impact.”
**Costing Along Cascades**

• Given a limited budget, costing along sub-population cascades, rather than at the population-level, will be increasingly important in making progress toward efficient epidemic control and will greatly contribute to:
  - Optimizing individual program efficiency
  - Rigorously assessing the performance of sub-population programming
  - Developing a cost-effective portfolio of programs to meet targets
  - Promoting & planning for sustainable domestic resource mobilization
  - Linking investments to outcomes
  - Budgeting for future investments and understanding how costs relate to scale up (yield curves)
References


“Using Data to Focus Program on Locations and Populations for Maximal Impact”
PEPFAR Presentation from Ambassador Birx to CSO on September 24, 2017
Cascade Analytics: Methodological Approach and Country Examples

Cathy Barker Cantelmo (HP+)
HIV prevention and treatment cascade: Evidence needs

What are the **failure points** along the cascade and corresponding **interventions needed** to address these issues?

How does scaling up a package of interventions **affect** each step along the cascade?

What are the total **resource requirements** for implementing strategies to strengthen the cascade?

What strategies are the most **cost-efficient** or **cost-effective**?

Given budget constraints, what is the **optimal allocation** of funds to achieve desired impacts?
Existing costing approaches

<table>
<thead>
<tr>
<th>Strategic plan costing</th>
<th>Intervention costing</th>
<th>Unit costing</th>
<th>Cost-effectiveness or cost-benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What:</strong> Estimates the cost of reaching objectives and targets within a strategic plan</td>
<td><strong>What:</strong> Estimates the total cost of a specific intervention, such as commodity costs for ART</td>
<td><strong>What:</strong> Estimates the cost of reaching one person through a program or intervention</td>
<td><strong>What:</strong> Compares relative costs to the health impact (e.g., lives saved) or benefits (e.g., costs saved)</td>
</tr>
<tr>
<td><strong>Why:</strong> Understand total resource requirements and use for resource mobilization</td>
<td><strong>Why:</strong> Deeper dive in understanding resource needs</td>
<td><strong>Why:</strong> Analyze technical efficiency issues; used in other cost analyses</td>
<td><strong>Why:</strong> Address allocative efficiency issues</td>
</tr>
</tbody>
</table>

*These approaches fail to consider how interventions are linked*
How to conduct HIV cascade analyses

1. Identify the problem
2. Understand why there are cascade failures
3. Identify possible responses to strengthen cascade
4. Estimate the cost of various strategies/options
5. Select cost-effective, cost-efficient strategies to reach end goal of viral suppression

- Measure achievement (routine data, surveys)
- Assess availability, utilization, and quality
- Interview program managers, service providers, people living with HIV, and other stakeholders
- Identify inputs, quantities needed, and unit costs
- Determine efficacy of interventions
- Apply predictive models to estimate future costs and impacts
Understanding costs along the HIV treatment cascade

Select costs involved:

- PLHIV
- Diagnosed
- Linkage and treatment initiation
- ART maintenance and retention
- Viral suppression

- Demand creation
- Testing outreach
- Testing and counseling staff
- Testing kits
- Linkage facilitators
- Facility staff
- Information systems
- Referral systems
- ARVs
- Lab testing
- Facility staff
- Patient tracing
- Viral load testing
- Adherence counseling
- Community/peer support

Strategies and unit costs may vary by age, sex, geographic location, and other demographic and clinical characteristics
Step 1: Identification

Identification issues

- Need to optimize testing yields given budget constraints
  - Trade-offs in cost and efficiency between testing modes (e.g., mobile testing)
  - Cost and efficiency of strategy depends on the population group and country’s epidemic

- Barriers to identification include:
  - Stigma and discrimination
  - Cost (to the client) of time and transport to visit facility
  - Hard-to-reach populations
  - Age of consent laws (children)
Improving testing strategy could identify more people living with HIV and may be more cost-efficient.

An improved test yield scenario may cost more, but it costs less per person identified than the constant test yield scenario.
Step 2: Linkage and treatment initiation

- Large source of leakage along cascade in some countries, but often ignored

- Barriers to linkage and treatment initiation include:
  - Stigma and discrimination/disclosure concerns
  - Place/point of testing does not offer treatment (may require intra- or inter-facility transfer)
  - Poor monitoring and tracking linkage to care
  - Age of consent laws (children)
  - Country has not adopted test-and-start and still has eligibility criteria
Step 3: ART maintenance and retention in care

Once initiated on treatment, models of care may vary based on patient’s:
  - Age
  - Response to treatment
  - Location
  - Key population/risk status
  - Other clinical factors (e.g., pregnancy)

Barriers to retention in care include:
  - Stigma and discrimination/disclosure concerns
  - Cost to patient (time, travel) to attend regular clinical visits
  - Poor peer or community support
  - Long wait times at clinic
  - ARV stock outs
  - Poor follow-up with patients (including on lab results)
Step 4: Viral suppression

Viral suppression issues

- Lack of viral load testing
  - Choosing immunological vs. viral load monitoring
  - Poor lab infrastructure, including sample transport systems

- Poor adherence
  - Drug toxicity
  - Lack of treatment literacy
  - Stigma and discrimination/disclosure concerns
  - Lack of community or peer support
  - ARV stock-outs
Kenya: Pediatric treatment cascade

Dec. 2014 CLHIV & pediatric ART patients (0-14 yrs)

- CLHIV0-14: 159,775
- Eligible for ART: 79%
- Diagnosed: 54%
- On ART: 41%
- Retained, Dec. 2015*: 37%
- Virally suppressed, Dec. 2015*: 25%

*All percentages with children living with HIV (CLHIV) as denominator

## Kenya: Cascade analysis methodology

<table>
<thead>
<tr>
<th>Bottleneck assessment</th>
<th>Data collection</th>
<th>Analysis</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group interviews with PEPFAR implementing partners (IPs)</td>
<td>Identify challenges and responses, overarching and age-specific</td>
<td>Needs assessment for ACT scale-up</td>
<td></td>
</tr>
<tr>
<td>Expenditures and service targets for 0-19 ART, by cascade step</td>
<td>Unit costs per cascade step; projection of ART scale-up costs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Kenya: Key findings and takeaways

Select examples of qualitative findings on identification

<table>
<thead>
<tr>
<th>Failure Point</th>
<th>Primary Response/Opportunity</th>
<th>Bottleneck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delays in testing and results reporting</td>
<td>• Reduce turnaround time</td>
<td>• Sample transport to testing laboratories</td>
</tr>
<tr>
<td></td>
<td>• Implement HEI tracking</td>
<td>• Laboratory test handling capacity/pace</td>
</tr>
<tr>
<td></td>
<td>• Implement POC testing</td>
<td>• Resources to fully expand HIV-exposed infant tracking system (HIT System)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• POC equipment</td>
</tr>
<tr>
<td>Lack of home-based testing</td>
<td>• Though data show facility-based testing is preferred/more productive, targeted home-based tests may find some HIV-positive HEI</td>
<td>• Low caregiver knowledge and acceptance of testing</td>
</tr>
<tr>
<td></td>
<td>• Additional HIV counseling and testing counselors may improve knowledge and acceptance</td>
<td>• Lack of guidance on risks of accidental disclosure and appropriate response</td>
</tr>
<tr>
<td>Case finding targets needed</td>
<td>• County/facility-level targets needed to assess performance, provide guidance</td>
<td>• Incomplete data to set appropriate targets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Monitoring system for case-finding performance*</td>
</tr>
</tbody>
</table>
Kenya: Key findings and takeaways

Identification is biggest barrier to scale up, yet spending is relatively low (US$3-7 per person)

Savings may be possible by preventing need for high-costs activities like LTFU tracking

Wide variation in costs between IPs
Ghana: HIV treatment cascade

- 90% of PLHIV
- 81% of PLHIV
- 73% of PLHIV

PLHIV Diagnosed: 54%
Initiated: 35%
Retained: 27%
Virally Suppressed: 23%

46% loss from Diagnosis to Initiation
35% loss from Initiation to Retention
22% loss from Retention to Viral Suppression
16% loss overall

Source: Ghana Spectrum file 2016; NACP 2017 Treat All Update; GHS 2016; HPP: Prioritizing HIV Interventions in a Resource-Constrained Setting
Ghana: Cascade analysis methodology

**Rationale**
Provide evidence on the resource needs for Ghana to meet 90-90-90 by 2020 and used to advocate for financing and inform policy

**Study Considerations**
Interventions to help retain clients and reinitiate those LTFU and the possibility for cost efficiencies from differentiated care

<table>
<thead>
<tr>
<th>Category</th>
<th>Costs estimated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commodities</td>
<td>ARVs, other drugs, laboratory reagents and consumables, test kits, supplies</td>
</tr>
<tr>
<td>Human resources for health</td>
<td>Salary cost or stipend based on labor intensity of ART services, travel costs</td>
</tr>
<tr>
<td>Health system costs</td>
<td>Procurement and supply chain management costs, shared facility overhead, costs to change policy guidelines</td>
</tr>
</tbody>
</table>
The government’s HTC strategy is limited because it does not consider varying costs by testing mode or specify a cost-efficient testing mix.

Community and outreach testing is needed to find PLHIV that don’t come forward on their own or are located in hard to reach places.
Ghana: Key findings and takeaways

**Undifferentiated care - 140,448**
- **New patient**: 8 clinical visits per year, 6 annual lab tests
- **Stable, established patient**: 5 clinical visits per year, 5 annual lab tests
- **Unstable patient**: 12 clinical visits per year, 5 annual lab tests

Resources needed: $21.6 million

**Differentiated care - 196,568**
- **New patient**: 3 clinical visits per year, 2 annual lab tests
- **Stable, established patient**: 2 clinical visits per year, 2 annual lab tests
- **Unstable patient**: 12 clinical visits per year, 3 annual lab tests

ART patients targeted for 2017
Differentiated care models could lead to potential cost efficiency of $31 million from 2017 to 2020
Indonesia: Cascade analysis approach

**Intervention mix and improved unit costs, per province:**
- Interventions needed by: major cascade step × sub-population × district × scenario
- Unit costs based on within-province data collected from NGO/CSOs and DHO

**Cascade analysis**
- Map interventions to specific improvements in a cascade step
- Total cost estimate for each scenario
- Overall estimate of cascade improvement

**Modeling impact analysis**
- Province-level estimate of impact
- Cost-effectiveness of increasing coverage

**Local budget advocacy tool**
- Tool for CSOs to influence local budgets

**Key benefits**
- Understand impact and cost of key interventions to improve the HIV care cascade
- Differentiate approach by sub-population and better target resources
- Link HIV resource estimates to local budget and planning cycle
- Improve district and provincial (aggregate) HIV care cascade

With:

[Linkages logo]
90-90-90 and HIV Care Continua

Reuben Granich, MD, MPH; Senior Public Health Consultant; San Francisco, California
90-90-90 and Care Continua Methods

- All people living with HIV serve as the care continua (“cascade”) denominator
- 90-90-90 has a “floating denominator”
- People diagnosed with HIV, on ART and virally suppressed are numerators
- Direct methods of estimation and determining numerators are favored
  - Representative population-based surveys for PLHIV estimates (e.g., PHIA)
  - Number of people diagnosed with HIV
  - Number of people on ART
  - Number of people on ART who are virally suppressed
90-90-90 and Care Continua Methods

Care Continuum Calculations:

0.9*0.9*0.9 = 0.73 or 73% of PLHIV

0.95*0.95*0.95 = 0.86 or 86% of PLHIV

Or

10M (27%) PLHIV unsuppressed

5.2M (14%) of PLHIV unsuppressed
Status and methodology of publicly available national HIV care continua and 90-90-90 targets: A systematic review

Reuben Grano

Abstract

Background

In 2014, the Joint United Nations Program on HIV/AIDS (UNAIDS) issued treatment goals for human Immunodeficiency Virus (HIV). The 90-90-90 target specified that by 2020, 90% of individuals living with HIV will know their HIV status, 90% of people with diagnosed HIV infection will receive antiretroviral treatment (ART), and 90% of those taking ART will be virally suppressed. Consistent methods and routine reporting in the public domain will be necessary for tracking progress towards the 90-90-90 target.

Methods and findings

For the period 2010–2016, we searched PubMed, UNAIDS country progress reports, World Health Organization (WHO), UNAIDS reports, national surveillance and program reports, United States President’s Emergency Plan for AIDS Relief (PEPFAR) Country Operational Plans, and conference presentations and/or abstracts for the latest available national HIV care continua in the public domain. Continua of care included the number and proportion of people living with HIV (PLWH) who are diagnosed on ART, and virally suppressed out of the estimated number of PLWH. We refined the described methods for indicators to derive high-, medium-, and low-quality continua. For 2010–2016, we identified 93 national care continua with viral suppression estimates representing 19.7 million (54%) of the 2013 global estimate of PLWH. Of the 93, 5 (with 2% of PLWH) were high quality, using standard surveillance methods to derive an overall denominator and program data from national reports for estimating gaps in the continua. Only nine countries in sub-Saharan Africa had care continua with viral suppression estimates. Of the 93 countries, the average proportion of the aggregate of PLWH from all countries on ART was 48%, and the proportion of PLWH who were virally suppressed was 40%. Seven countries (Sweden, Cambodia, United Kingdom, Switzerland, Denmark, Finland, and New Zealand) were within 12% and 16% of achieving the 90-90-90 target for "on ART" and for "total suppression" respectively. The limitations to consider when interpreting the results include significant variation in methods.
### Methodology

**Identification (216)**
- 35 continuum identified through PubMed search
- 181 continuum identified through UNAIDS country reports, WHO reports, PEPFAR country operational plans, national reports, and conference papers

**Screening (120)**
120 recent continuum selected (2010-16)
- 11 continuum that reported preliminary/unconfirmed national figures excluded

**Data collection (109)**
For 109 continuum, data were collected on the 4 key continuum indicators
- 33 continuum that did not have viral suppression estimates excluded

**Methods review and data analysis (76)**
Each indicator was graded on methods, which was used to grade the continuum. Progress towards the 90-90-90 targets was also analyzed for the 76 continua

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Tripled cascades for Africa through PEPFAR open data effort:

- 96 older and/or duplicate continuum excluded
- 11 continuum that reported preliminary/unconfirmed national figures excluded
- 33 continuum that did not have viral suppression estimates excluded

Reuben Granich\(^1\), Somya Gupta\(^1\), Irene Hall\(^2\), John Aberle-Grasse\(^2\), Shannon Hader\(^2\), Jonathan Mermin\(^2\)

Search end date: May 2017
People living with HIV with viral suppression (2010-2016) UNAIDS target 73%
Proportion of people living with HIV on ART and with viral suppression

Target: 73%

76 countries with complete care continua
Top 10 countries with > 67% viral suppression (2010-2016)

76 countries with complete care continua; * Marked countries have high quality cascade
### Documenting and grading continua methods

<table>
<thead>
<tr>
<th>Country</th>
<th>Source</th>
<th>Estimated People</th>
<th>People Living with Sed HIV Data on Prior HIV Tests</th>
<th>People Receiving ART</th>
<th>People on ART with Suppressed Viral Load</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>_registers of AIDS Direction (Ministry of Health), registrations in semiprivate and private health subsystems</td>
<td></td>
<td></td>
<td>Registers of AIDS Direction (Ministry of Health), registrations in semiprivate and private health subsystems</td>
<td>VL &lt;50 copies/mL Data from AIDS Direction. Calculated using a sample of people on ART receiving VL.</td>
<td>Medium</td>
</tr>
<tr>
<td>Armenia</td>
<td>National Center for AIDS Prevention (NCAP), Ministry of Health</td>
<td></td>
<td></td>
<td>National Center for AIDS Prevention (NCAP), Ministry of Health</td>
<td>VL &lt;250 copies/mL Based on data from NCAP laboratory</td>
<td>Medium</td>
</tr>
<tr>
<td>Austria</td>
<td>National registration of new diagnosis, registry and deaths</td>
<td></td>
<td></td>
<td>ART coverage is estimated as average of 4 approaches: ARV prescription, report, Australian HIV Registry and deaths</td>
<td>ART coverage is estimated as average of 4 approaches: ARV prescription, report, Australian HIV Registry and deaths</td>
<td>Medium</td>
</tr>
<tr>
<td>Belgium</td>
<td>National cohort data, national estimate &amp; notifications with Brussels Hospital</td>
<td></td>
<td></td>
<td>SINAN and SIM</td>
<td>SINAN and SIM</td>
<td>Medium</td>
</tr>
<tr>
<td>Brazil</td>
<td>Country presentation, Sistema de Informacao de Agravos de Notificacao or System for notifiable diseases information (SINAN) and Sistema de Informacao de Mortalidade System on Information on Mortality (SIM)</td>
<td></td>
<td></td>
<td>SINAN and SIM</td>
<td>SINAN and SIM</td>
<td>Medium</td>
</tr>
<tr>
<td>Cambodia</td>
<td>PEPFAR Country Operational Plan, UNAIDS estimate</td>
<td></td>
<td>Calculated as: # of pre-ART + ART patients at end of 2014 plus new positive diagnoses in 2015 minus deaths in 2015 from pre-ART and ART</td>
<td>National Centre for HIV/AIDS, Dermatology and STIs (NCHADS) program data</td>
<td>VL &lt;1,000 copies/mL Data from VL lab database. Calculated using a sample of people on ART receiving VL (65% PL HIV on ART tested for VL)</td>
<td>Medium</td>
</tr>
<tr>
<td>China</td>
<td>PEPFAR Regional Operational Plan, UNAIDS estimate</td>
<td>National Center for AIDS/STD Control and Prevention (NCAIDS) program data</td>
<td></td>
<td>NCAIDS program data</td>
<td>VL &lt;1,000 copies/mL NCAIDS program data (viral load test for 90% of PL HIV on ART)</td>
<td>High</td>
</tr>
</tbody>
</table>
Next generation cascades...

- Key populations (MSM, FSW, PWID)
- HIV and TB
- Pediatric
- Sub-national
- Fast Track Cities
- Age categories
- Population-based surveillance
End of AIDS: “Big Five” Major Innovations

Unified leadership around 90-90-90

Multi-disease prevention campaign

Cohort and unique identifier

Universal regimen (TLD)

HIV self-testing
Facility-based data: Quality and bottlenecks

**Quality:**
- Standardize diagnosed, ART, and VL definitions and standardize denominators
- Complete data is everyone’s job
- Ensure patient data informs cascade and vice versa
- Simplicity-quality trumps quantity
- Triangulate between patient card/file, master record and lab data
- Cohort and unique identifier-many benefits including addressing loss to follow-up

**Bottlenecks:**
- Complexity-complex computer systems and analyses
- Accessibility-data is in computer or otherwise not available
- Lack of data use-something to be “sent up” but not used by staff to improve health and control epidemic
Conclusions

- Use common definitions for 90-90-90 and cascade

- Use national and local data
  - Look at cascade by jurisdiction/province
  - Construct national and provincial trends
  - Review facility-based data to see data quality and bottlenecks
  - Consider risk population cascades
  - Keep cost in mind—build in rough costing data

- Implement unique identifier + cohort approach
  - National, province and facility-level cohorts

- Use simple data set to drive both clinical and program success—complexity is not necessarily better!
Thank you

Leadership matters but most of the time the cats will show leaders the way....
Questions?
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