# The HIV Treatment Cascade: Is There More to the Story?

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## Background

- To benefit from antiretroviral therapy (ART), HIV-infected individuals must be aware of their HIV infection, link to and consistently engage in care, and receive and adhere to HIV treatment.

- Previous U.S. estimates have shown only 37% of HIV-infected persons are retained in care, 33% are on ART, and 25% have a suppressed viral load.

- These estimates, representing the final three steps in the HIV care cascade, are calculated in a conditional manner, with the number of persons completing the prior step serving as the base population for the next step.

- This approach may underestimate use of ART and viral suppression by excluding persons not completing prior steps in the cascade.

## Methods

- The HIV Research Network (HIVRN) is a consortium of sites that provide primary and subspecialty care to HIV-infected individuals.

- We analyzed prospectively collected data on HIV-infected adults (age ≥18 years) who established care, defined as having ≥1 primary HIV visit and CD4 test in a calendar year, at 11 HIVRN sites between Jan 1, 2010 and Dec 31, 2012.

- We defined three outcomes:
  - **Retention in care,** defined as two or more primary HIV outpatient visits separated by ≥90 days in a calendar year.
  - **Use of ART**, defined as receiving 3 antiretroviral drugs (excluding ritonavir) for ≥3 months in a calendar year.
  - **Viral Suppression,** defined as HIV RNA <400 copies/mL at the last measure in the second half (July-December) of a calendar year.

- The person-year (PY) was the unit of analysis.

- We examined **(1)** the proportion of PYs in which persons were on ART by retention in care status, and **(2)** the proportion of PYs in which persons achieved viral suppression by retention in care and ART status.

- To better characterize patients that may not require frequent HIV visits to achieve viral suppression, we used **multivariable regression** to compare characteristics of patients retained, on ART, and virally suppressed to those not retained, but on ART and virally suppressed. Models adjusted for age, gender, race/ethnicity, HIV risk factor, insurance, CD4 count, calendar year, and site of care.

**Table 1. Sample Characteristics**

| Characteristic | Total PYs N=58,908 |
|---|---|
| **Age group, years** | |
| 18-29 | 5,815 (10%) |
| 30-39 | 10,703 (18%) |
| 40-49 | 21,285 (36%) |
| ≥ 50 | 21,105 (36%) |
| **Gender** | |
| Male | 43,762 (74%) |
| Female | 15,146 (26%) |
| **Race/Ethnicity** | |
| White | 17,584 (30%) |
| Black | 26,170 (44%) |
| Hispanic | 13,531 (23%) |
| **HIV risk factor** | |
| MSM | 27,842 (46%) |
| Heterosexual | 20,575 (35%) |
| IDU | 8,221 (14%) |
| **Insurance** | |
| Private | 9,107 (15%) |
| Medicaid | 19,784 (33%) |
| Medicare | 10,556 (18%) |
| RW/Uninsured | 17,591 (30%) |
| **First CD4 Count in Year** | |
| ≤ 200 cell/mm$^3$ | 8,361 (14%) |
| 201-350 cell/mm$^3$ | 10,437 (18%) |
| 351-500 cell/mm$^3$ | 12,616 (21%) |
| > 500 cell/mm$^3$ | 27,494 (47%) |

**Table 2. Proportion of Sample Retention in Care by ART Status**

| | On ART | |
|---|---|---|
| | **Yes** N=55,013 (93%) | **No** N=3,895 (7%) |
| **Retained in Care** N=49,309 (84%) | 46,797 (85%) | 2,512 (65%) |
| **Not Retained in Care** N=9,599 (16%) | 8,216 (15%) | 1,383 (35%) |

Other/Unknown category not reported for race/ethnicity, HIV risk factor, and insurance status in Tables 1 and 4.

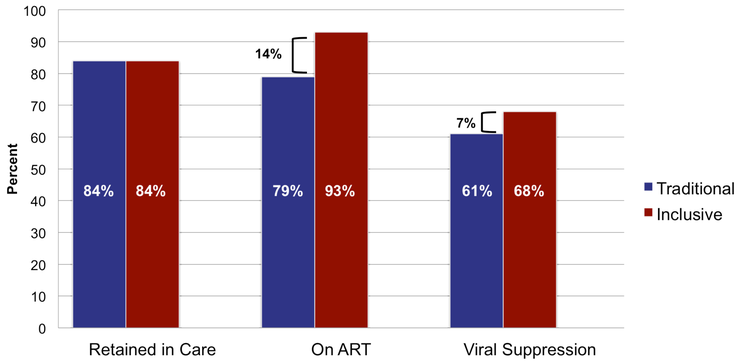
**Table 3. Proportion of Sample Retention in Care and on ART by Viral Suppression Status**

| | Viral Suppression | |
|---|---|---|
| | **Yes** N=39,856 (68%) | **No** N=19,052 (32%) |
| **Retained in Care/ On ART** N=46,797 (80%) | 36,201 (91%) | 10,596 (56%) |
| **Not Retained in Care/ On ART** N=8,216 (14%) | 3,048 (8%) | 5,168 (27%) |
| **Retained in Care/ Not on ART** N=2,512 (4%) | 489 (1%) | 2,023 (11%) |
| **Not Retained in Care/ Not on ART** N=1,383 (2%) | 118 (<1%) | 1,265 (6%) |

**Table 4. Factors Associated with Retention in Care Among PYs in which Patients were on ART and Achieved Viral Suppression**

| Characteristic | Retained in Care N=36,201 | Not Retained in Care N=3,048 | Adjusted Odds Ratio (95% CI) |
|---|---|---|---|
| **Age group, years** | | | |
| 18-29 | 2,724 (8%) | 291 (10%) | 1 [Reference] |
| 30-39 | 5,980 (17%) | 649 (21%) | 1.01 (0.86-1.18) |
| 40-49 | 13,016 (36%) | 1,157 (38%) | **1.26 (1.09-1.47)** |
| ≥ 50 | 14,481 (40%) | 951 (31%) | **1.65 (1.42-1.93)** |
| **Gender** | | | |
| Male | 27,620 (75%) | 2,357 (77%) | 1 [Reference] |
| Female | 9,199 (25%) | 691 (23%) | 1.05 (0.94-1.18) |
| **Race/Ethnicity** | | | |
| White | 11,335 (31%) | 1,230 (40%) | 1 [Reference] |
| Black | 15,223 (41%) | 1,147 (38%) | 1.08 (0.97-1.20) |
| Hispanic | 9,295 (25%) | 575 (19%) | **1.34 (1.19-1.50)** |
| **HIV risk factor** | | | |
| MSM | 17,796 (48%) | 1,537 (50%) | 1 [Reference] |
| Heterosexual | 12,785 (35%) | 977 (32%) | **0.86 (0.77-0.97)** |
| IDU | 5,025 (14%) | 414 (14%) | **0.78 (0.68-0.88)** |
| **Insurance** | | | |
| Private | 5,772 (16%) | 631 (21%) | 1 [Reference] |
| Medicaid | 12,124 (33%) | 688 (23%) | **1.35 (1.18-1.54)** |
| Medicare | 7,382 (20%) | 522 (17%) | **1.26 (1.09-1.44)** |
| RW/Uninsured | 10,485 (29%) | 1,026 (34%) | 1.08 (0.94-1.24) |
| **First CD4 Count** | | | |
| ≤ 200 cell/mm$^3$ | 3,904 (11%) | 335 (11%) | 1 [Reference] |
| 201-350 cell/mm$^3$ | 6,326 (17%) | 526 (17%) | 1.03 (0.89-1.19) |
| 351-500 cell/mm$^3$ | 8,132 (22%) | 670 (22%) | 1.06 (0.92-1.23) |
| > 500 cell/mm$^3$ | 18,457 (50%) | 1,517 (50%) | 1.10 (0.97-1.25) |

**Figure 1. Comparison of the Traditional Treatment Cascade (Dependent on Prior Steps) and the Inclusive Treatment Cascade (Not Dependent on Prior Steps)**




## Conclusions & Implications

- Excluding PYs in which patients did not complete all steps in the traditional HIV treatment cascade underestimated the proportion on ART by 14% and the proportion with viral suppression by 7%.

- Overall, 68% of PYs had patients with viral suppression. Of these, 91% met retention and ART measures and 8% were on ART, but did not meet the retention measure.

- Among PYs in which patients were on ART and achieved viral suppression, those with heterosexual and IDU risk (vs. MSM) were significantly less likely to be retained in care. Whereas, Hispanics (vs. whites), older patients (vs. younger), and persons on Medicaid or Medicare (vs. private) were significantly more likely to be retained in care.

- These results indicate that a small group of patients are able to achieve viral suppression without meeting standard definitions of retention.

- Our findings have important implications for monitoring the quality of HIV care and for meeting targets established by the National HIV/AIDS Strategy.

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