

Durable Viral Suppression Among HIV-diagnosed Persons – United States, 2012-2013

Nicole Crepez, PhD¹; Tian Tang, MS²; Gary Marks, PhD¹; Michael J. Mugavero, MD, MHS³; Lorena Espinoza, DDS, MPH¹; and H. Irene Hall, PhD¹

¹Division of HIV/AIDS Prevention, U.S. Centers for Disease Control and Prevention (CDC), Atlanta, Georgia; ²ICF International, Atlanta, Georgia; and ³University of Alabama, Birmingham, Alabama

Background

- Viral suppression is associated with reduced morbidity, mortality, and risk of transmitting HIV
- The most common measure of viral suppression is the most recent viral load (VL) in the past 12 months
- A single VL measure may underestimate or overestimate durable viral suppression and transmission risk potential among HIV-infected persons
- Longitudinal VL measures capture the dynamic nature of individuals' viral load control and risk of transmission across time

Study Purposes

- Using longitudinal VL data from the CDC's National HIV Surveillance System (NHSS), we examined:
 - durable viral suppression,
 - cumulative plasma HIV burden, and
 - person time spent above VL thresholds that increase HIV transmission over 2 years
- To identify subgroups of persons who may need more intensive clinical and behavioral interventions, these longitudinal measures were examined by: sex, race and ethnicity, HIV transmission category, age, length of time since HIV diagnosis, gaps in care

Methods

Data Source

Data reported to CDC through July 2015 from 17 jurisdictions with complete reporting of CD4 cell count and VL test results to NHSS: California, the District of Columbia, Hawaii, Illinois, Indiana, Iowa, Louisiana, Maryland, Michigan, Missouri, New Hampshire, New York, North Dakota, South Carolina, Texas, Utah, and West Virginia

Analytic Cohort

- persons aged ≥13 years with HIV infection diagnosed before 2011
- resided in the 17 jurisdictions at time of diagnosis
- alive at the end of 2013
- With at least one VL test in 2011 (an indicator of care engagement)
- With at least two VL results during the 2-year observation period (2012-2013)

Definitions of Three Longitudinal VL Measures:

- 1) Durable Viral Suppression:** all VL values <200 copies/mL over the 2-year period
- 2) Viremia Copy-years:**
 - HIV plasma burden for each time interval between two consecutive VL values was calculated by multiplying the average of the two VL values by the time interval between the two measures
 - The viremia copy for each segment of a person's VL curve were then summed to calculate viremia copy-years for the 2-year period
- 3) Person-time above Selected Viral Load Threshold**
 - Estimated the amount of time spent above a VL threshold for each pair of VL results
 - Summed the estimated days above the threshold during consecutive pairs of VL results to yield a single value per person
 - Aggregated the amount of person-time above the threshold across the analytic cohort over the 2-year period
 - Three VL thresholds were used: 200, 1500, and 10000 copies/mL

Results

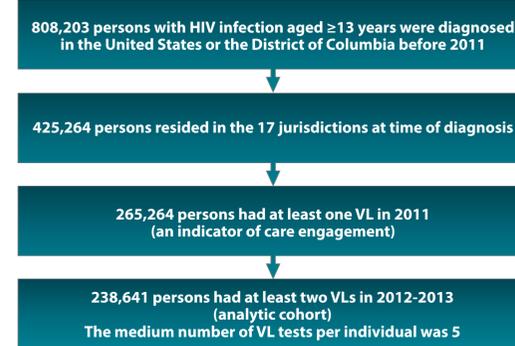


Table 2. Characteristics of analytic cohort and persons with durable viral suppression, 2012-2013

| Characteristic | N | % | % had durable viral suppression | Prevalence Ratio | % 95 Confidence Interval |
|---|---------------|------------|---------------------------------|------------------|--------------------------|
| Sex | | | | | |
| Male | 181673 | 76.1 | 64.0 | Reference | |
| Female | 56968 | 23.9 | 54.8 | 0.86 | (0.85, 0.86) |
| Race/ethnicity | | | | | |
| Black/African American | 89519 | 37.5 | 52.6 | 0.72 | (0.71, 0.72) |
| Hispanic/Latino | 58990 | 24.7 | 61.3 | 0.84 | (0.83, 0.84) |
| White | 74765 | 31.3 | 73.4 | Reference | |
| Transmission category | | | | | |
| Male-to-male sexual contact | 117110 | 49.1 | 67.9 | Reference | |
| Injection drug use-Male | 16156 | 6.8 | 53.0 | 0.78 | (0.77, 0.79) |
| Injection drug use-Female | 10730 | 4.5 | 47.3 | 0.7 | (0.68, 0.71) |
| Male-to-male sexual contact and injection drug use | 14689 | 6.2 | 53.2 | 0.78 | (0.77, 0.80) |
| Heterosexual contact-Male | 11993 | 5 | 58.7 | 0.87 | (0.85, 0.88) |
| Heterosexual contact-Female | 28858 | 12.1 | 57.5 | 0.85 | (0.84, 0.86) |
| Age group at the end of 2010 | | | | | |
| 13-24 | 10370 | 4.3 | 38.4 | 0.53 | (0.52, 0.55) |
| 25-34 | 31552 | 13.2 | 51.6 | 0.71 | (0.71, 0.72) |
| 35-44 | 62649 | 26.3 | 59.4 | 0.82 | (0.82, 0.83) |
| 45-54 | 87513 | 36.7 | 64.5 | 0.89 | (0.89, 0.90) |
| ≥55 | 46557 | 19.5 | 72.2 | Reference | |
| Length of time from HIV diagnosis to the end of 2010 | | | | | |
| <1 year | 11977 | 5 | 57.3 | 0.92 | (0.90, 0.93) |
| 1-2 years | 23495 | 9.8 | 59.6 | 0.96 | (0.95, 0.97) |
| 3+ years | 203169 | 85.1 | 62.3 | Reference | |
| Gap in care (any two VL tests >12 months apart)^a | | | | | |
| No | 205729 | 86.2 | 62.9 | Reference | |
| Yes | 32899 | 13.8 | 55.4 | 0.88 | (0.87, 0.89) |
| Total | 238641 | 100 | 61.8 | | |

^a 13 cases had missing/invalid value on this variable

Durable viral suppression is defined as all VL values were < 200 copies/mL during 2012 and 2013

Table 1. Durable viral suppression, cumulative plasma HIV burden, and transmission risk potential among persons aged ≥ 13 years with HIV infection diagnosed before 2011, alive through 2013, and in care, 17 U.S. jurisdictions, 2012-2013

| Outcomes | Persons in HIV care N=238,641 | Persons without durably viral suppression during 2012-2013 N=91,120 |
|---|----------------------------------|--|
| Percentage of persons who maintained durable viral suppression | 61.8% | --- |
| Cumulative plasma HIV burden: | | |
| Geometric mean viremia copy-years | 345 ^a | 7,261 ^b |
| Transmission risk potential: | | |
| Mean number of days (% of 2-year time) spent above 200 copies/mL | 173 ^a (23.7%) | 438 ^b (60.0%) |
| Mean number of days (% of 2-year time) spent above 1,500 copies/mL | 124 ^a (17.0%) | 316 ^b (43.2%) |
| Mean number of days (% of 2-year time) spent above 10,000 copies/mL | 84 ^a (11.5%) | 215 ^b (29.5%) |

Durable viral suppression is defined as all VL values were < 200 copies/mL during 2012 and 2013

^aDue to some missing/invalid data, results are based on 238,628 persons living with diagnosed HIV

^bDue to some missing/invalid data, results are based on 91,107 persons living with diagnosed HIV

Table 3. Cumulative plasma HIV burden and transmission risk potential among persons without durable viral suppression, by Characteristics, 2012-2013

| Characteristics | N | Cumulative Plasma HIV Burden | HIV Transmission Risk Potential | | |
|---|--------------|--------------------------------------|--|--|---|
| | | Viremia copy-years Geometric Mean | Person-time above 200 copies/mL Mean number of days | Person-time above 1,500 copies/mL Mean number of days | Person-time above 10,000 copies/mL Mean number of days |
| Sex | | | | | |
| Male (reference) | 65356 | 7010 | 427 | 308 | 213 |
| Female | 25751 | 7939 ^a | 466 ^a | 337 ^a | 221 ^a |
| Race/ethnicity | | | | | |
| Black/African American | 42455 | 8815 ^a | 469 ^a | 345 ^a | 233 ^a |
| Hispanic/Latino | 22806 | 6352 ^a | 419 ^a | 297 ^a | 201 ^b |
| White (reference) | 19887 | 5408 | 396 | 276 | 192 |
| Transmission category | | | | | |
| Male-to-male sexual contact (reference) | 37646 | 6620 | 419 | 302 | 209 |
| Injection drug use – Male | 7587 | 7280 ^c | 436 ^a | 310 ^c | 209 ^d |
| Injection drug use – Female | 5652 | 9331 ^a | 470 ^a | 345 ^a | 232 ^a |
| Male-to-male sexual contact and injection drug use | 6877 | 9950 ^a | 452 ^a | 339 ^a | 243 ^a |
| Heterosexual contact – Male | 4949 | 7373 ^c | 438 ^a | 314 ^c | 216 ^d |
| Heterosexual contact – Female | 12271 | 8001 ^a | 464 ^a | 337 ^a | 222 ^a |
| Age group at the end of 2010 | | | | | |
| 13-24 | 6383 | 13254 ^a | 537 ^a | 422 ^a | 276 ^a |
| 25-34 | 15259 | 12377 ^a | 491 ^a | 383 ^a | 266 ^a |
| 35-44 | 25448 | 9006 ^a | 450 ^a | 332 ^a | 233 ^a |
| 45-54 | 31089 | 5836 ^a | 413 ^a | 286 ^a | 194 ^a |
| ≥55 (reference) | 12928 | 3181 | 365 | 226 | 143 |
| Length of time from HIV diagnosis to the end of 2010 | | | | | |
| < 1 year | 5111 | 8897 ^a | 459 ^a | 349 ^a | 231 ^a |
| 1-2 years | 9491 | 8645 ^a | 464 ^a | 351 ^a | 232 ^a |
| 3+ years (reference) | 76505 | 7010 | 434 | 310 | 212 |
| Gap in care (any two VL tests >12 months apart) | | | | | |
| No (reference) | 76421 | 6052 | 411 | 288 | 192 |
| Yes | 14686 | 18739 ^a | 582 ^a | 467 ^a | 337 ^a |
| Total^a | 91107 | 7261 | 438 | 316 | 215 |

^ap<.0001; ^bp<.001; ^cp<.01; ^dp>.05 (non-significant); durable viral suppression is defined as all VL values were < 200 copies/mL during 2012 and 2013; ^eDue to some missing/invalid data, results are based on 91,107 persons living with diagnosed HIV

Discussion

- Approximately 62% of persons had durable viral suppression for two years, indicating sustained treatment success
- However, 38% did not achieve durable viral suppression
- Persons without durable viral suppression spent an average of 60% of 2-year time with VL above 200 copies/mL and as well as a considerable length of time above 1,500 and 10,000 copies/mL that considerably increase the risk of transmitting HIV infection
- The high proportion of time these individuals spent above transmission risk thresholds raises concern because they were not isolated blips of viremia, but rather extended periods of many months of elevated risk transmission potential.
- Compared to respective counterparts, women, racial/ethnic groups other than white, persons with HIV infection attributed to transmission other than MSM, younger age groups, persons with HIV diagnosed more recently, and persons with a gap in care:
 - Were less likely to had durable viral suppression
 - Had higher viremia copy-years, and
 - Had greater person-time above 200, 1500, and 10,000 copies/mL thresholds

Limitations

- Patient-level data on ART are not available to verify individual treatment status
- For persons who moved to another jurisdiction outside of the 17 jurisdictions during the 2-year period, VL records may not be available
- Better understanding of the HIV transmission risk associated with VL above the transmission risk threshold requires concurrent information on sexual behavior, which is not available in the national HIV surveillance system

Implications for Clinical Practices, Disease Monitoring, and Care and Prevention Efforts

- Viral burden was higher among populations known from previous research to have suboptimal engagement in HIV-related medical care. Tailored care and treatment efforts are needed to address disparity in viral suppression
- Longitudinal VL data can better track viral dynamics over time, and help identify individuals whose viral control is low, for targeted outreach interventions
- There is still considerable room to increase provider's delivery of brief prevention counseling to HIV patients, especially those who are not durably suppressed as recommended by treatment & care guidelines

Contact Information

For more information, please contact Nicole Crepez (ncrepez@cdc.gov)

National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention
Division of HIV/AIDS Prevention

