# HIV Community Viral Load Trends in South Carolina

Hrishikesh Chakraborty[1], Sharon Weissman[2] Wayne A Duffus[2], Akhtar Hossain[1], Ashok Varma Samantapudi[1], Medha Iyer[3], Helmut Albrecht[2]

[1]Department of Epidemiology and Biostatistics. [2]Department of Medicine, Division of Infectious Disease.[3]Department of Health Services Policy and Management.
University of South Carolina, Columbia, South Carolina, USA.

## Background

- Community Viral Load (CVL) has been proposed as a tool to monitor the HIV epidemic and serves as a marker of community HIV transmission risk [1, 2]. Recent studies have provided evidence supporting CVL as a means of estimating community HIV incidence.
- CVL is defined as an aggregate measure of the VLs of individuals in a particular geographic location or community, and is calculated as the mean, median or most recent VL in a given time period [1, 3, 4].
- The rationale behind using CVL as a marker of HIV transmission risk, and ultimately HIV incidence, is that, as coverage of Antiretroviral Therapy (ART) increases, more individuals with HIV will be virologically suppressed. This will result in a decrease in the CVL as well as a reduction in HIV transmission risk which will, in turn, decrease HIV incidence [1].
- Evaluating the trends in CVL over time can provide useful insight into public health efforts to curb the HIV epidemic in a community or subgroups within the community.
- South Carolina (SC), a predominantly rural state, has consistently ranked in the top ten in the US in the annual AIDS case rate for the past several years.

## Objectives

Given the HIV burden in SC, this study analyzed CVL trends in SC by gender, race, residence, HIV risk group, residence at diagnosis, and prescription of single tablet regimen (STR) or multiple tablet regimen (MTR) as first antiretroviral drug treatment.

## Methods

- Data were obtained from the SC enhanced HIV/AIDS reporting system (eHARS), the AIDS Drug Assistance Program (ADAP), and the Provide Enterprise (PE) case management databases over the time period from 2004 to 2013.
- The eHARS database included patient's socio-demographic characteristics, CD4 count, and VL measurements. ART information was obtained from the ADAP and PE datasets. The sample included all SC residents aged ≥ 13 years who were living with HIV between January 1, 2004 and December 31, 2013.
- Each of the 46 SC counties was defined as a community. CVL was calculated as the average of all individual $\log_{10}$ transformed VLs during each quarter for each community and was generated for each subgroup based on gender, race, HIV risk group and prescribed treatment with STR or MTR at the beginning of study period.
- The weighted mixed effects model incorporated time, CD4 count, mid-quarter average age, gender, race, residence at diagnosis, HIV risk group, and first antiretroviral drug as predictor variables. Interactions between gender and CD4 count as well as between time and other community characteristics were also examined.

## Results

- We found notable disparities in CVL trends (slopes) over time by gender, HIV risk groups, residence at diagnosis, and initial treatment regimen.
- We observed significant declines in CVL measures over time ($p < .0001$). It was also negatively associated with CD4 count ($p < .0001$) and mid-quarter average age ($p < .0001$).
- Females had lower CVL than males ($p = 0.0001$), however CVL reduction was also slower in females compared to males ($p < .0001$).
- Black Americans were found to maintain a higher CVL level than Whites ($p < .0001$), but no disparity was found in the rate of CVL decline by race ($p = .26$).
- Rural communities had higher levels of CVL compared to urban communities ($p < .0001$) and CVL in urban areas declined faster than in rural areas ($p < .0001$).
- CVL in men having sex with men (MSM) declined faster compared to all other risk groups ($p < .0001$).
- Patients prescribed STR had a higher CVL level than patients prescribed MTR ($p < .0001$). CVL among STR users declined considerably faster than MTR users ($p < .0001$).

## Discussion

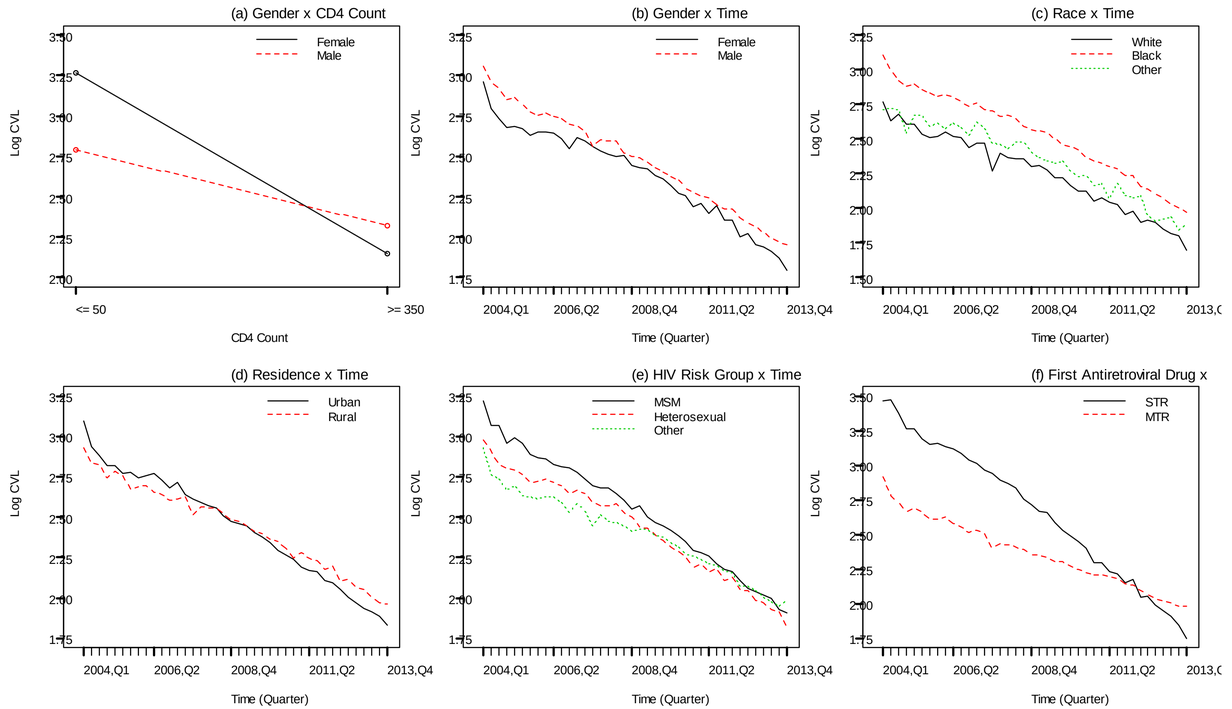
- This study is the first to examine CVL trends in SC.
- Although the average CVL decreased over time, the decrease is not uniform by community characteristics.
- This study found that women had slower rate of CVL reduction compared to males, higher CVL level among Blacks compared to Whites, slower CVL reduction in urban areas compared to rural areas. This may be because of delayed diagnosis, linkage to care, and retention to care.
- This study found that individuals initiating treatment with STRs had greater declines in CVL compared with those starting treatment with MTRs. As HIV drugs become generic, policies may be developed to promote the use of generic medications and thus restrict the use of STRs. SC data suggests that this could have a downstream impact on CVL and potentially on HIV infection rates.
- Future research should focus on identifying possible mechanisms or pathways for the observed disparities in CVL decline among specific subgroups such as young black MSM vs old black MSM.
- A better understanding of these pathways will help health care and public health officials identify points of intervention to reduce and ultimately eliminate disparities.

**Table 1: $\log_{10}$ Community Viral Load by Different Groups.**

| | 2004 Mean (Min – Max) [$\log_{10}$ copies/ml] | 2009 Mean (Min – Max) [$\log_{10}$ copies/ml] | 2013 Mean (Min – Max) [$\log_{10}$ copies/ml] |
|---|---|---|---|
| **Overall** | 3.02 (2.21 – 4.25) | 2.66 (2.12 – 3.33) | 2.14* (1.73 – 2.69) |
| **Gender** | | | |
| Male | 3.08 (1.64 – 4.59) | 2.69 (1.83 – 3.25) | 2.16* (1.68 – 3.17) |
| Female | 2.93 (1.87 – 3.79) | 2.62 (1.88 – 3.61) | 2.10* (1.58 – 2.81) |
| **Race** | | | |
| White | 2.69 (0.00 – 5.37) | 2.37 (1.34 – 3.26) | 1.89* (0.66 – 3.32) |
| Black | 3.07 (2.24 – 4.59) | 2.72 (1.97 – 3.62) | 2.19* (1.68 – 2.74) |
| Other | 3.27 (0.00 – 5.47) | 2.59 (1.68 – 4.03) | 2.11* (0.00 – 4.37) |
| **HIV Risk group** | | | |
| Heterosexual | 2.94 (1.81 – 4.29) | 2.64 (1.69 – 3.48) | 2.08* (1.51 – 3.12) |
| MSM | 3.08 (0.00 – 4.73) | 2.70 (1.88 – 3.75) | 2.19* (1.62 – 3.54) |
| Other | 3.07 (2.15 – 5.24) | 2.63 (1.75 – 3.24) | 2.15* (1.43 – 2.91) |
| **Residence at Diagnosis** | | | |
| Urban | 3.04 (0.00 – 5.63) | 2.65 (1.33 – 4.79) | 2.13* (0.00 – 4.37) |
| Rural | 2.97 (2.14 – 4.67) | 2.67 (1.78 – 4.82) | 2.15* (1.35 – 6.12) |
| **Initial Antiretroviral Drug Rx** | | | |
| STR | 3.34 (0.00 – 5.51) | 2.82 (1.70 – 4.15) | 2.01* (1.26 – 3.32) |
| MTR | 2.89 (0.00 – 5.58) | 2.58 (1.97 – 3.11) | 2.03* (1.32 – 2.72) |

Note: All estimates are weighted average over community values.
* Significantly different from 2004 value at 5% level.

**Figure 1: Trends in adjusted $\log_{10}$ community viral loads by Gender and CD4 cell count and by Gender, Race, Residence, HIV Risk Group, first antiretroviral drug and time: Quarter 1, 2004 to Quarter 4, 2013.**




## References

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