CD4 Cell Count Monitoring Frequency Among HIV+ Persons in New York City (NYC), 2007-2011

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Abstract **#557**

Background

- Guidelines differ about the appropriate frequency of CD4 testing in clinically stable HIV+ patients with suppressed HIV viral load (VL).
  - National /state guidelines advise CD4 testing every 6-12 mos.[1,2]
  - Quality management protocols require CD4 monitoring every 6 mos.[3]
- At least 2 recent analyses (of data from the Veteran's Administration[4] and the ARTEMIS trial[5]) suggest that less frequent testing might be appropriate
- Modeling suggests that less frequent testing would save money[6]
- We used NYC surveillance data to:
  1. Explore current CD4 testing patterns among virologically and immunologically stable patients in NYC, 2007-2011; and
  2. Determine whether some patients could safely undergo CD4 testing less often.

Methods

Study design/data source

- We constructed a population-based, retrospective open cohort using NYC HIV Surveillance Registry (HSR) data beginning 1/1/07.
  - The NYC HIV Surveillance Registry contains all diagnoses of HIV and AIDS and is continuously updated with new diagnoses, laboratory results and vital status data as required by law.[7] As of 12/31/12, NYC HSR contained a cumulative total of >220,000 cases and >7,000,000 laboratory tests.
- To enter the cohort in the following calendar year, HIV+ patients ≥13 years had to show the following in the previous year:
  - ***Stable* viral suppression** (≥1 VL in the previous calendar year; all measurements <400 copies/mL); and
  - ***Stable* immune status** (≥1 CD4 in the prior calendar year; all measurements ≥200 cells/mm^3).
- Each subsequent year, eligible patients not previously enrolled entered the cohort on January 1. Patients were followed through 2012, and censored at first VL≥400 copies/mL or the last CD4/VL.
- The initial CD4 count value at cohort entry was estimated by assuming a linear change between the last CD4 (previous year) and the first CD4 of that year.

Measures

Outcome 1: Annual frequency of CD4 monitoring.
Outcome 2: Probability of CD4 dropping to <200 cells/mm^3.

Analysis

- **Outcome 1:**
  - Only patients who remained virologically and immunologically stable for the entire year were included. To examine differences by covariates, analysis was limited to the 2011 cohort.
  - Mean (standard deviation [SD]) and median (interquartile range [IQR]) were used to describe frequency of CD4 monitoring.
- **Outcome 2**
  - A multivariate Cox model was used to identify factors associated with maintenance of CD4≥200 cells/mm^3.

Results

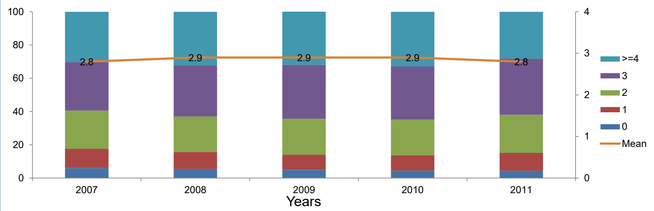
Table 1. Frequency of CD4 testing among stable HIV patients in New York City by patient characteristics, 2011.

	Total	≤ 1 CD4 test in 2011		2 or 3 CD4 tests in 2011		≥ 4 CD4 tests in 2011	
		N	%	N	%	N	%
Total	31,333	4,742	15.1	17,764	56.7	8,827	28.2
Sex							
Male	22,225	3,558	16.0	12,534	56.4	6,133	27.6
Female	9,108	1,184	13.0	5,230	57.4	2,694	29.6
Age (years)							
0-19	450	50	11.1	217	48.2	183	40.7
20-39	7,378	1,210	16.4	4,407	59.7	1,761	23.9
40-59	20,491	3,141	15.3	11,538	56.3	5,812	28.4
60+	3,014	341	11.3	1,602	53.2	1,071	35.5
Race/ethnicity							
White	7,595	1,548	20.4	4,307	56.7	1,740	22.9
Black	12,567	1,799	14.3	7,102	56.5	3,666	29.2
Hispanic	10,300	1,290	12.5	5,836	56.7	3,174	30.8
Other	871	105	12.1	519	59.6	247	28.4
Transmission risk							
MSM	12,198	2,092	17.2	6,981	57.2	3,125	25.6
IDU	4,476	541	12.1	2,303	51.5	1,632	36.5
Heterosexual	6,447	857	13.3	3,828	59.4	1,762	27.3
Perinatal	492	54	11.0	244	49.6	194	39.4
Other	93	11	11.8	63	67.7	19	20.4
Unknown	7,627	1,187	15.6	4,345	57.0	2,095	27.5
Year of diagnosis							
Pre-1995	6,847	967	14.1	3,692	53.9	2,215	32.3
1995-1999	7,705	1,126	14.6	4,364	56.6	2,215	28.7
2000-2004	10,318	1,694	16.4	5,939	57.6	2,685	26.0
2005-2010	6,424	950	14.8	3,763	58.6	1,711	26.6

IDU, injection drug users; MSM, men who have sex with men.

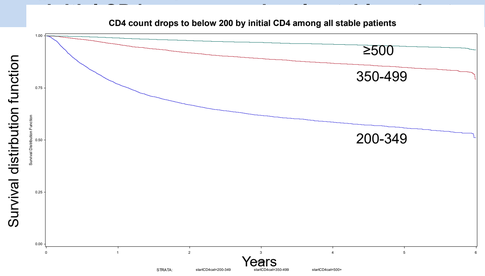
Key result:
- In 2011, 28.2% of stable HIV patients had four or more CD4 measurements.
- The annual number of CD4 measurements among stable patients varied little by gender, race/ethnicity, transmission risk, or year of diagnosis, but the most frequent testing appeared to occur among patients at the extremes of age.

Figure 1. Frequency of CD4 testing among stable HIV patients in New York City, 2007-2011.



Key result: Mean annual number of CD4 measurements among stable patients was 2.8 (± SD: 1.3) and showed no significant variation by year (2007-2011).

Figure 2. Subsequent CD4 count <200 cells/mm^3 by



Key result: Two years after entering, 91% and 98% of those with initial CD4 350-499 and ≥500 cells/mm^3 respectively, maintained CD4≥200.

Table 2. Factors associated with CD4<200 cells/mm^3 among stable HIV patients in NYC, 2011.

Characteristic	$_{adj}$HR	95% CI	P value
Sex			
Male	Ref		
Female	1.04	0.98, 1.10	0.25
Race			
White	Ref	-	-
Black	1.24	1.16, 1.33	< 0.01
Hispanic	1.28	1.19, 1.38	< 0.01
Other	0.78	0.64, 0.96	0.02
Age			
13-19	Ref	-	-
20-39	0.79	0.59, 1.05	0.11
40-59	1.00	0.75, 1.33	1.00
60+	1.28	0.96, 1.71	0.10
Risk			
MSM	Ref	-	-
Heterosexual	1.20	1.10, 1.31	< 0.01
IDU	1.92	1.80, 2.06	< 0.01
Other/unknown	1.23	1.15, 1.33	< 0.01
Year of diagnosis			
Pre-1995	1.60	1.47, 1.74	< 0.01
1995-1999	1.40	1.29, 1.52	< 0.01
2000-2004	1.19	1.09, 1.29	< 0.01
2005-2010	Ref	-	-
Initial CD4 count (cells/mm^3)			
200-349	13.41	12.52, 14.36	< 0.01
350-499	3.28	3.03, 3.28	< 0.01
500+	Ref	-	-

CI, confidence interval; adjHR, adjusted hazard ratio; IDU, injection drug users; MSM, men who have sex with men; Ref, reference.

Key result: Compared to those with initial CD4≥500 cells/mm^3, those with CD4 200-349 cells/mm^3 and CD4 350-499 cells/mm^3 were more likely to have a CD4 dip <200 cells/mm^3, controlling for sex, race/ethnicity, age, HIV risk group, and diagnosis year.

Limitations

- Use of surveillance data for the analytic cohort is limited by the following:
  - Only CD4 measurements obtained in the jurisdiction are reported and can be considered (probability of CD4 dipping to <200 cells/mm^3 and CD4 testing frequency may be underestimated)
  - Other covariates, such as comorbidities that might drive CD4 trajectories or measurement frequency (e.g., antiretroviral therapy use), are not available.
- The definition of stable viral suppression (VL<400 copies/mL) :
  - Exceeds that used currently for NYC surveillance analyses (VL<200)
  - Exceed that used for some time by clinicians.

Discussion

Summary

- In a population-based cohort with well-controlled HIV, initial CD4 at cohort entry was a strong, independent predictor of maintaining CD4≥200 cells/mm^3.
  - The probability of maintaining CD4≥200 cells/mm^3 for at least 2 years was >90% among those with initial CD4≥350 cells/mm^3.
- Over 2007-2011, clinicians maintained a practice of obtaining approximately 2-3 CD4 measurements per year.
  - In 2011, 85% of stable patients had testing at least twice yearly.

Monitoring implications

- For patients with CD4≥350 cells/mm^3 who are virologically stable, these findings suggest that limited CD4 monitoring is appropriate.
  - Additional testing is unlikely to require clinical action (e.g., initiation of prophylaxis for opportunistic infections).
- For patients with CD4<350 cells/mm^3 who are virologically stable, CD4 should be measured according to existing guidelines.

Fiscal implications

- At the New York State Medicaid rate of US$64.93 for a CD4 test (2013), for stable patients with CD4≥350 cells/mm^3, NYC would save:
  - ~US$1.3 million annually if CD4 monitoring were limited to twice yearly
  - ~US$3.0 million annually if CD4 monitoring were limited to once yearly
- Future analyses are planned to study the impact of the new NYS guidelines[2] (released January 2014); they also advise less frequent monitoring of stable patients.

References

1. Panel on Antiretroviral Guidelines for Adults and Adolescents. Guidelines for the use of antiretroviral agents in HIV-1-infected adults and adolescents. Department of Health and Human Services. Available at http://aidsinfo.nih.gov/ContentFiles/AdultandAdolescentGL.pdf. Accessed 2/19/14.
2. New York State HIV Clinical Resource. Update: Antiretroviral therapy, Section VI.A: Virologic and Immunologic Monitoring . Available at: http://www.hivguidelines.org/clinical-guidelines/adults/antiretroviral-therapy/. Accessed 2/19/14.
3. HIVQUAL-US. Adult HIV Ambulatory Care Quality of Care Indicator Definitions. Available at: https://www.ehivqual.org/scripts/2011%20eHIVQUAL%20Indicator%20Definitions%20-%20Adult%20Ambulatory%20Care.pdf. Accessed 2/19/14.
4. Gale HB et al. *Clin Infect Dis.* 2013;56(9):1340-3.
5. Girard PM et al. *AIDS* 2013;*27(17)*:2759-63.
6. Hyle EP et al., *JAMA Intern Med.* 2013;173(18):1746-8.