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Increase in CD4 Count Among New Enrollees in HIV Care in the Modern Antiretroviral Therapy Era

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Abstract

Background—Earlier HIV diagnosis and engagement in care improves outcomes and is cost-effective, as a result in 2006 the Centers for Disease Control and Prevention (CDC) revised the HIV screening guidelines. We sought to determine whether the CD4 count (CD4) at presentation, a surrogate for time to presentation, increased during the study period. Our *a priori* hypothesis was that the CD4 at presentation increased during the study period, particularly after the CDC guideline revision.

Methods—We performed a retrospective cohort study analyzing data from the HIV Research Network (HIVRN), a consortium of 18 US clinics caring for HIV-infected patients. HIV-infected adults (≥ 18 years old) newly presenting for care between 2003 and 2011 were included in this study. Multivariable linear regression examined associations with CD4 at enrollment. Calendar year was modeled as a linear spline with a change in slope at 2008, allowing determination of the mean change in CD4 per year over the years 2003–07 and 2008–11.

Results—Over 13543 newly presenting subjects enrolled from 2003–11. Median CD4 at enrollment rose from 285 to 317 cells/mm³ between 2003–07 and 2008–11 ($p < 0.001$). After adjusting for age, race/ethnicity, gender, HIV risk factor, and clinic site, the mean increase in CD4 count at presentation per year was 13.3 cells/mm³/year (95% Confidence Interval 6.4–20.1 cells/mm³/year) greater over the years 2008–11 than 2003–07.

Conclusions—We demonstrate a small, but statistically significant increase in CD4 at presentation after the CDC guideline revision. More efforts are needed to decrease time to presentation to HIV care.

Keywords

HIV; CD4 count; presentation to care; linkage to care; HIV screening

BACKGROUND

In September 2006, the Centers for Disease Control and Prevention (CDC) recommended HIV testing in all health-care settings.¹ The revision was catalyzed in part by evidence that decreasing the time to presentation leads to improved outcomes^{2,3} and decreased secondary transmission,⁴ as well as by studies demonstrating the cost-effectiveness of increased screening.^{5–7} Increased screening detects asymptomatic HIV infections earlier, shortening the time from HIV infection to presentation to care.

However, before the benefits of increased screening can be realized, individuals must be linked to HIV care and treatment. Only about 80% of persons living with HIV in the U.S.

know their HIV status, of whom only 75–77% have ever presented for care.^{8,9} Improvements in both screening and linkage to care at the population level would decrease the average time from HIV infection to presentation to HIV care and drive up the CD4 count (CD4) at presentation to HIV care.

Results of prior studies of CD4 at presentation to care in the modern ART era have been mixed. Althoff *et al.* demonstrated a significant increase in median CD4 at presentation from 256 cells/mm³ to 317 cells/mm³ between 1997 and 2007 in the North American-AIDS Cohort Collaboration on Research and Design (NA-ACCORD).¹⁰ In contrast, HIV Outpatient Study (HOPS) investigators showed no increase in CD4 at diagnosis between 2000 and 2009.¹¹ Additionally, these studies demonstrate disparities in late presentation by race/ethnicity, HIV risk factor, and age. Given the conflicting results of these prior reports we examined the CD4 at enrollment to care among patients enrolled in a multicenter HIV cohort from 2003–2011 to determine if CD4 at enrollment changed over time, in particular, following the CDC guideline revision. We also sought to examine possible racial/ethnic, HIV risk, and age disparities in enrollment CD4 trends.

METHODS

Participants

The HIV Research Network (HIVRN) is a consortium of primary and subspecialty medical care providers at 18 clinical sites for HIV-infected adult and pediatric patients.¹² The analyses included 17 sites that collect comprehensive inpatient and outpatient utilization data. One pediatric site had no subjects eligible for the study (all <18 years old) and was excluded. One adult site was excluded from the 2011 data, because enrollment during this year was reported as the date of a medical practice merger rather than the actual date of enrollment to HIV care. Data from this site for 2003–2010 were retained. Sites are located in the Eastern (7), Midwestern (1), Southern (5), and Western U.S. (4). Fourteen sites have academic affiliations; 4 are community-based. Analyses were limited to adult patients (>18 years old) who enrolled at an HIVRN site between January 1, 2003 and December 31, 2011.

Data Collection

Participating sites abstract clinical and demographic data elements from patients' medical records; abstracted data are assembled into a uniform database.^{13–16} Abstracted data were sent in electronic format to a data-coordinating center. Following quality control and verification, these data were combined across sites to construct a multi-site database. The study was approved by the Institutional Review Board of the Johns Hopkins School of Medicine as well as by each of the participating sites. IRBs at some clinics require written informed consent; others waived the requirement because only existing de-identified data were collected.

Definitions

New presenters were defined as newly enrolled subjects having: (i) HIV RNA > 400 copies/ml at enrollment, (ii) no use of ART prior to the enrollment CD4, and (iii) no HIVRN clinic visits prior to enrollment month. Demographics collected were age (categorized in

decades) race/ethnicity (white, black, Hispanic, and other/unknown), gender, and HIV risk factors, coded as men who have sex with men (MSM), heterosexual transmission (HET), injection drug use (IDU), and other/unknown (OTH). In subjects with multiple behavioral HIV risk factors, a single category was designated based on the following order of priority: IDU, MSM, HET, OTH. CD4 and HIV-1 RNA at enrollment were defined as the measurement nearest to enrollment but not >6 months before or after enrollment. Subjects without a CD4 and viral load within 6 months of enrollment were excluded (N=334).

Statistical Analyses

CD4 at enrollment was the primary outcome. Multivariable linear regression (MLR) models included age, gender, race/ethnicity, and HIV risk factor. The primary independent variable of interest was calendar year of enrollment. Enrollment year was analyzed as a continuous variable, generating a slope in the linear regression model, reflecting the change in mean CD4 per year. Based on our interest in the change in CD4 per year after the CDC guideline revision in late 2006 a knot in the linear spline was placed at 2008 (allowing 15 months for uptake of guidelines); thus the magnitude of the (linear) association between year and CD4 (i.e., the slope) could change between 2003–07 and 2008–11. All MLR analyses were adjusted for clinic site and used robust standard errors to account for clustering. Interactions between spline terms and each demographic characteristic (race/ethnicity, HIV risk, and age) were tested in order to determine if demographic characteristics modified the effect of calendar year on CD4 count at presentation.

In separate analyses we made comparisons within age, race/ethnicity, and HIV risk groups in a given enrollment year using a MLR including interactions between enrollment year as a categorical variable and the demographic variable of interest (age, race/ethnicity, HIV risk), adjusting for the remaining variables. Linear combinations of coefficients were used to make comparisons among non-referent categories.

In addition to analyzing mean CD4, we also examined change in the proportion of subjects presenting early (CD4 at enrollment < 350 cells/mm³). We used a multivariable linear regression (MLR) of subjects with CD4 at enrollment < 350 cells/mm³ (a dichotomous variable) on year as a continuous variable with a knot in the linear spline at 2008 adjusted for demographics, HIV risk, race/ethnicity, and clinic site. This models the change in proportion of subjects presenting early from 2003–07 and 2008–11.

RESULTS

We identified 13,543 newly presenting patients who enrolled in the HIVRN between 2003 and 2011: 7,200 between 2003 and 2007 and 6,343 between 2008 and 2011. The median number of new patients was 1,370 per year over the interval 2003 to 2007 and 1,582 per year over the interval 2008–2011 ($p=0.142$). The median number of new patients per year in whites was 401.5 over years 2003 to 2007 and 382 over years 2008–2011 ($p=0.54$), in blacks was 641.5 over years 2003–07 and 791 over years 2008–11 ($p=0.086$), and in Hispanics was 285 over years 2003–07 and 309 over years 2008–11 ($p=0.806$). Patient characteristics stratified by time period appear in Table 1.

Overall, the median CD4 at enrollment rose from 285 to 317 cells/mm³ between 2003–07 and 2008–11 ($p<0.001$) (Results not shown). Median CD4 counts for 2003–07 and 2008–10 stratified by demographics are displayed in Table 2.

The percentage of newly presenting subjects with CD4 at enrollment ≥ 350 cells/mm³ increased from 40.8% in 2003–07 to 44.3% in 2008–11 ($\chi^2=19.7$, $p<0.001$). There was no increase in the mean percentage of subjects with CD4 ≥ 350 cells/mm³ over the years 2003–07 (−0.19% [95% Confidence Interval (CI) −0.90%, 0.52%]), but there was an increase of 1.45% per year [0.73%, 2.16%] from 2008–11. (Results not shown)

The unadjusted annual mean CD4 at enrollment did not significantly increase over the interval 2003–07 (−1.8 cells/mm³/year, 95% CI −5.7, 2.2) but increased by 12.3 cells/mm³/year [95% CI 8.5, 16.1] over the interval 2008–11, for an overall mean increase in CD4 per year of 14.1 cells/mm³/year [7.1, 21.0] (Results not shown). After adjusting for demographic factors and clinic site, annual mean CD4 at enrollment did not significantly increase over the interval 2003–07 but did significantly increase by 11.2 cells/mm³/year [7.4, 14.9] over the interval 2008–11 (Table 3A). The difference in the slope was 13.3 cells/mm³/year [6.4, 20.1] comparing 2003–07 to 2008–11. Females had a higher CD4 at enrollment than did males (Table 3A). Variations by age, race/ethnicity, and HIV risk are addressed in the following section.

Demographic Variations in CD4 Trends

Race/ethnicity—In 2003 the adjusted mean CD4 at enrollment was 69.3 cells/mm³ [28.5, 110.0] greater in whites than in blacks, 69.2 cells/mm³ [25.6, 112.8] greater in whites than Hispanics, and not significantly different between blacks and Hispanics. In 2011 the adjusted mean CD4 at enrollment was 49.3 cells/mm³ [13.6, 83.0] greater in whites than in blacks, 59.0 cells/mm³ [17.8, 100.2] greater in whites than Hispanics, and not significantly different between blacks and Hispanics.

The difference in the slope between 2003–07 and 2008–11 was 19.3 cells/mm³/year [5.9, 32.8] for whites and 10.8 cells/mm³/year [0.9, 20.6] for blacks, but there was no significant increase in Hispanics (11.3 cells/mm³/year [−2.3, 24.9]) or other/unknown race (16.2 cells/mm³/year [−23.0, 55.4]) (Figure 2 and Table 3B).

HIV Risk—In 2003 the adjusted mean CD4 at enrollment was 79.3 cells/mm³ [45.0, 113.6] greater in MSM than in heterosexual risk, 70.8 cells/mm³ [10.7, 130.9] greater in IDU than heterosexual risk, and not significantly different between MSM and IDU. In 2011 the adjusted mean CD4 at enrollment was 45.2 cells/mm³ [12.7, 77.7] greater in MSM than in heterosexual risk and not significantly different between either MSM and IDU or IDU and heterosexual risk.

MSM and heterosexual risk groups had an increase in slope of CD4 at enrollment per year over the interval 2008–11 (Table 3B). There was no increase in the slopes of CD4 at enrollment per year among IDU and other HIV risk categories over the interval 2008–11 (Table 3B).

Age—For those >30 years old, age categories did not differ in adjusted mean CD4 at enrollment in 2003. In 2003, subjects <30 years old had an adjusted CD4 at enrollment greater than subjects in age categories 31–40 years (69.1 cells/mm³ [30.4, 107.8]), 41–50 years (82.5 cells/mm³ [40.7, 124.2]), and >50 years (72.5 cells/mm³ [–13.8, 158.9])—not significant). In 2011 the adjusted mean enrollment CD4 was 63.4 cells/mm³ [17.5, 109.3] greater in 31–40 years than >50 years, but not significantly different between either 31–40 years and 41–50 years or 41–50 years and >50 years. However, the adjusted 2011 mean enrollment CD4 in subjects <30 years was greater than subjects in age categories 31–40 years (52.1 cells/mm³ [16.0, 88.3]), 41–50 years (79.9 cells/mm³ [41.8, 117.9]), and >50 years (115.5 cells/mm³ [72.2, 158.8]).

CD4 at enrollment increased per year over the interval 2008–11 for age categories: <30 years, 31–40 years, 41–50 years, but not for >50 years (Figure 2 and Table 3B). Compared to age category >50 years, the CD4 at enrollment slope over the interval 2008–11 was greater in age categories <30 years (13.4 cells/mm³/year [0.9–25.9]) and 31–40 years (17.8 cells/mm³/year [5.1–30.5]).

DISCUSSION

This study demonstrates an increase in CD4 at enrollment of 11.2 cells/mm³/year among new presenters at HIVRN sites over the interval 2008–11 after adjusting for demographic factors and clinic site. In contrast there was no change in CD4 count at enrollment over the years 2003–07. Our data suggest that while time to presentation to care and degree of immunosuppression at presentation have been decreasing among persons living with HIV since 2008, the rate of decrease is very slow. Finally, like previous studies, we demonstrate that there continue to be disparities in enrollment CD4 among those presenting to HIV care, with lower CD4 counts among Hispanics and blacks compared to whites, heterosexual risk compared to MSM, and age >30 years compared to age <30 years.

The observed increase in CD4 at enrollment per year has several implications. We observed that the proportion CD4 <350 cells/mm³ increased by 1.45% per year after 2008. This increase represents over 500 patients per year linked to care with a CD4 <350 cells/mm³, to the extent that these data can be extrapolated to the national level (assuming 48,000 HIV diagnoses per year in the U.S.¹⁷ and 77% linkage to care⁸). While encouraging, this likely represents less than 3% of late presenters in the United States, assuming 54% late presentation percentage.^{10,18}

Our findings suggest that the time to presentation, as assessed by enrollment CD4, is declining slowly and further interventions for HIV testing and linkage to care are needed. Diagnosis and linkage to care are necessary for HIV-infected patients to present for care.^{8,9} Recently the U.S. Preventative Services Task Force released a statement recommending screening of all patients between 15 and 64 years of age or patients of any age with HIV risk factors.¹⁹ Furthermore, in July 2012 the FDA approved the first over-the-counter oral rapid HIV test. These new recommendations and testing technologies may increase screening rates and further decrease the time to presentation.

A recent systematic review found no meaningful increase in CD4 at presentation in developed countries from 1992–2011.²⁰ The meta-regression used in this analysis only examined CD4 as a continuous linear trend over the study period and did not allow the slope to vary after 2007 as in our analysis and was limited by sparse data over 2010 and 2011. Furthermore, this analysis was unable to adjust for demographic factors. For these reasons we believe our model better represents the current trends in CD4 at presentation in the United States.

Whites had a higher CD4 at enrollment than did blacks or Hispanics from 2003 through 2011; however, we did observe an increase in CD4 at enrollment for both blacks and Hispanics. Nevertheless, there is cause for concern in both these racial/ethnic groups. It has long been recognized that blacks carry the largest burden of HIV infection in the United States.¹⁷ More recently, a CDC study found that rates of new HIV diagnoses in Hispanics were 2.8 fold higher than in Whites in 2010.²¹ Given that the burden of new HIV diagnoses is in blacks and Hispanics and the slow rate of increase in CD4 count at enrollment, additional targeted efforts focusing on decreasing time to presentation to care are need in these racial/ethnic groups.

According to our model, MSM had a higher CD4 at enrollment than did subjects with heterosexual risk in all years. This may be due to increased awareness of HIV risk among MSM resulting in increased patient-initiated screening. MSM may also encounter health care more frequently and have increased provider-initiated HIV screening. In contrast to MSM and heterosexual risk, IDU failed to increase mean CD4 at enrollment between 2008–11. In part this may be driven by low numbers of IDU participants in our study. However, it is also plausible that improvements in screening and linkage to care in MSM and heterosexual risk would not necessarily have a similar impact in IDU.

Consistent with a prior study that showed subjects < 35 years old were less likely to present late,¹¹ we found that adult subjects < 30 years had higher enrollment CD4 than those subjects >30 years. Furthermore we showed that subjects >50 years old did not have any improvement in enrollment CD4 over time, whereas in all other age categories there was an increase over 2008–11 (Table 3B). It is known that CD4 decreases with age in HIV seronegative individuals,²² and that older individuals have lower CD4 after seroconversion²³. To what degree these age-related CD4 effects contribute to the observed disparity is not known. Nevertheless, age-related changes in CD4 should not have affected the annual increase in enrollment CD4 and suggest that there was not a decrease in time to presentation to care in patients older than 50 years between 2008–11. Additional studies to confirm this finding and develop interventions are needed.

This study has several limitations. We sought to determine if time to presentation was decreasing over time and, in particular, after the CDC guideline revision in September 2006; however, it should be noted that there are many other possible explanations for the increasing CD4 at presentation for HIV care after 2008. The changes to the HIV screening guidelines are well-documented and occur at the national level, but changes in other aspects of screening such as increased awareness about HIV and improved access to testing may be heterogeneous and represent potential contributing factors that were not directly assessed.

HIV screening practices may have also changed by race/ethnicity over the study period. During 2007–10 the CDC launched the Expanded Testing Initiative (ETI),²⁴ which was focused on increasing HIV testing among blacks and Hispanics. We have no information about participation in the ETI by any of our participating sites. Introduction of rapid HIV testing also occurred during the study period, which may have heterogeneously affected local screening practices. This study was not able to directly assess the effect of the many changes in HIV screening that have occurred during the study period.

Similarly, we had no means of assessing time to linkage to care within our cohort, but this clearly can affect time from HIV infection to presentation to care as well. Future studies should assess changes in linkage to HIV care. CD4 is not a perfect surrogate for time to presentation. At the population level we know that CD4 decline is roughly linear over time,²⁵ but there is wide individual variation and even variation among race/ethnicity^{26–28}. However, there currently is no better method for retrospectively assessing time from HIV infection to presentation to care. It is possible that a small portion of our newly presenting subjects had received HIV care prior to enrollment. We took measures to exclude such patients from analyses; however, we do not have comprehensive access to all outside medical records preceding enrollment. Finally, the HIVRN population is selected from patients who primarily present to urban academic HIV specialty clinics, which limits generalizability.

In summary, we have demonstrated a small, but statistically significant increase in CD4 count at enrollment in new presenters to primary HIV care in the years following the CDC HIV testing guideline revision. This increase is encouraging, but many patients continue to present late and the current rate of increase is slow. Additionally our study suggests that racial/ethnic, HIV risk factor, and age-related disparities exist in time to presentation to HIV care. Further population-specific efforts are needed to decrease the time from HIV infection to presentation to care.

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Figure 1.

Mean and Predicted Mean CD4 Count at Enrollment Among New Presenters from 2003–2011 with Corresponding 95% Confidence Intervals.*

*Solid lines denote mean CD4 count at enrollment predicted by the multivariable linear regression model (Table 3A) for all new presenters. Dashed lines denote actual mean CD4 count at enrollment for all new presenters. Enrollment CD4 was predicted for each subject using the adjusted MLR (Table 3A) and the mean of the predicted enrollment CD4 was plotted for each enrollment year. As the inputs to the model (the demographic and behavioral risk composition of the underlying cohort) vary from year to year, the mean predicted CD4 may not be perfectly linear when plotted against calendar year.

Figure 2.

Mean and Predicted Mean CD4 Count at Enrollment Among New Presenters from 2003–2011 Stratified by Race/Ethnicity (Panel A) and Age Category (Panel B)*

* Solid lines denote mean CD4 count at enrollment predicted by the multivariable linear regression model (Table 3B) for all new presenters, stratified as indicated. Dashed lines denote actual mean CD4 count at enrollment for all new presenters, stratified as indicated. Other race is not shown. Enrollment CD4 was predicted for each subject using the adjusted MLR (Table 3B) and the mean of the predicted enrollment CD4 was plotted for each enrollment year. As the inputs to the model (the demographic and behavioral risk composition of the underlying cohort) vary from year to year, the mean predicted CD4 may not be perfectly linear when plotted against calendar year.

Table 1

Basic Demographic and Clinical Characteristics of New Presenters to the HIV Research Network Cohort from 2003–2011

Variable	No. (%)		P value
	2003–2007	2008–2011	
Variable	N = 7200	N = 6343	
Age(years), Mean(SD)	38.2 (10.1)	37.4 (11.4)	<0.001
Age Categories			<0.001
30	1745 (24.2)	2053 (32.4)	
31–40	2469 (34.3)	1696 (26.7)	
41–50	2160 (30.0)	1744 (27.5)	
>50	826 (11.5)	850 (13.4)	
Gender			0.001
Male	5391 (74.9)	4848 (76.4)	
Female	1809(25.1)	1495(23.6)	
Race			<0.001
Black	3405 (47.3)	3279 (51.7)	
White	2033 (28.2)	1572 (24.8)	
Hispanic	1516 (21.1)	1212 (19.1)	
Other	246 (3.4)	280 (4.4)	
HIV Risk Factor			<0.001
HET	2698 (37.5)	2341 (36.9)	
MSM	3041 (42.2)	2935 (46.3)	
IDU	1016 (14.1)	543 (8.6)	
Other	445 (6.2)	524 (8.3)	
CD4 Category (cells/mm3)			<0.001
<50	1196 (16.6)	817 (12.9)	
50–199	1528 (21.2)	1268 (20.0)	
200–349	1537 (21.3)	1429 (22.5)	
350–499	1420 (19.7)	1290 (20.3)	
500	1519 (21.1)	1539 (24.3)	
Log10 HIV RNA (copies/ml), median(IQR)	4.6 (3.9 – 5.1)	4.4 (3.7 – 5.0)	<0.001

Error! Not a valid link.HET – heterosexual transmission, MSM - men who have sex with men, IDU – injection drug use

* No. (%) unless otherwise noted.

^b Based on t-test for normally distributed data, χ^2 test for binary outcomes, and Kuzick's test for nonparametric trends.

Table 2

Median CD4 Count at Enrollment in the HIV Research Network Cohort from 2003–07 and 2008–11 Stratified by Demographics

	2003–07	2008–11	P Value*
	cells/mm ³ (IQR)	cells/mm ³ (IQR)	
Race/Ethnicity			
Black	265.0 (82.0 – 444.0)	312.0 (130.0 – 478.0)	<0.001
White	335.0 (157.0 – 506.0)	365.5 (186.0 – 553.5)	<0.001
Hispanic	256.0 (93.0 – 433.0)	267.5 (109.0 – 448.0)	0.207
Other	321.0 (106.0 – 507.0)	338.5 (154.0 – 534.0)	0.350
HIV Risk			
MSM	322.0 (135.0 – 487.0)	347.0 (178.0 – 515.0)	<0.001
IDU	278.5 (99.0 – 458.5)	292.0 (144.0 – 499.0)	0.024
HET	254.0 (83.0 – 438.0)	282.0 (102.0 – 462.0)	0.001
Other	255.0 (70.0 – 450.0)	300.0 (102.5 – 480.0)	0.066
Age at Enrollment			
30	356.0 (200.0 – 518.0)	384.0 (238.0 – 543.0)	<0.001
31–40	276.0 (93.0 – 455.0)	303.0 (116.0 – 487.0)	0.001
41–50	251.5 (78.0 – 432.5)	259.5 (99.5 – 451.0)	0.033
>50	232.5 (81.0 – 407.0)	247.0 (97.0 – 426.0)	0.105

* Cuzick's test for trend

Table 3

A. Multivariable Linear Regression of CD4 Count at Enrollment on Calendar Year in New Presenters to the HIV Research Network Cohort from 2003–2011*			
Variable	CD4 (95% CI)[†]	P value	
Change in CD4 count by Year [‡]			
2003–2007	–2.1 (–6.1, 1.8)	0.286	
2008–2011	11.2 (7.4, 14.9)	<0.001	
Age (years)			
>50	Ref		
41–50	2.5 (–13.1, 18.2)	0.751	
31–40	18.9 (3.5, 34.4)	0.016	
30	88.3 (72.7, 104.0)	<0.001	
Gender			
Male	Ref		
Female	67.4 (55.0, 79.7)	<0.001	
Race/Ethnicity			
Black	Ref		
White	46.2 (33.9, 58.4)	<0.001	
Hispanic	–16.8 (–28.3, –5.4)	0.004	
Other	26.1 (1.3, 50.9)	0.039	
HIV Risk			
HET	Ref		
MSM	43.6 (31.8, 55.4)	<0.001	
IDU	34.6 (18.3, 50.9)	<0.001	
Other	–11.8 (–30.5, 6.9)	0.216	
Intercept	242.4 (221.1, 263.7)	<0.001	
B. Multivariable Linear Regression of CD4 Count at Enrollment on Calendar Year in New Presenters by Race/Ethnicity in the HIV Research Network Cohort from 2003–2011**			
Stratification Category	2003–07	2008–11	
	Adjusted Mean CD4 Count in 2003 (95% CI)	CD4 count/year (95% CI)[‡]	CD4 count/year (95% CI)[‡]
Race/Ethnicity			
Black	237.8 (214.4, 261.2)	–0.4 (–6.1, 5.2)	10.3 (4.9, 15.8)
White	288.1 (257.7, 318.5)	–3.8 (–11.6, 4.0)	15.5 (8.1, 22.9)
Hispanic	230.8 (204.0, 257.6)	–3.0 (–10.6, 4.5)	8.3 (0.4, 16.1)
Other	292.8 (224.9, 360.7)	–8.5 (–31.9, 15.0)	7.8 (–12.0, 27.5)
HIV Risk			
MSM	294.2 (269.4, 318.9)	–6.0 (–11.7, –0.2)	14.2 (8.9, 19.4)
HET	235.9 (211.9, 259.9)	0.6 (–5.6, 6.8)	10.2 (3.6, 16.7)
IDU	280.4 (239.4, 321.5)	–2.4 (–14.8, 10.1)	8.0 (–4.9, 21.0)
Other	211.9 (175.2, 248.6)	9.3 (–4.5, 23.0)	0.2 (–13.3, 13.6)

B. Multivariable Linear Regression of CD4 Count at Enrollment on Calendar Year in New Presenters by Race/Ethnicity in the HIV Research Network Cohort from 2003–2011**

Stratification Category		2003–07	2008–11
	Adjusted Mean CD4 Count in 2003 (95% CI)	CD4 count/year (95% CI) [‡]	CD4 count/year (95% CI) [‡]
Age			
>50	219.1 (172.2, 266.1)	6.2 (–8.7, 21.2)	–1.3 (–11.9, 9.3)
41–50	237.4 (209.7, 265.0)	–3.4 (–10.4, 3.5)	10.0 (2.6, 17.4)
31–40	253.1 (226.6, 279.7)	–5.7 (–12.0, 0.7)	16.5 (9.5, 23.5)
30	310.6 (281.7, 339.5)	–0.1 (–7.5, 7.2)	12.2 (5.5, 18.8)

* New presenters only and adjusted for clinic site.

[†] Mean CD4 count difference (cells/mm³) relative to reference group

[‡] The mean change in CD4 count per year (cells/mm³/year) over each year of the designated time period (ie 2003–07 or 2008–10).

** New presenters only, model demonstrating interaction of demographic factors on the association of CD4 count and time period and adjusted for demographics and clinic site.