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## Predictors of HAART Utilization for Behaviorally HIV-1 Infected Youth: Impact of Adult vs. Pediatric Clinical Care Site

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**Disclaimer:** The views expressed in this paper are those of the authors. No official endorsement by DHHS, the National Institutes of Health, or the Agency for Healthcare Research and Quality is intended or should be inferred.

**Implications and Contributions:** To our knowledge, this is the first study to specifically examine the impact of clinic type (adult or pediatric-focused) on HAART utilization and sustainability in this population. The findings may have implications for best practices in the care of HIV-infected youth.

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Community Health Network, Rochester, New York (Roberto Corales, D.O.)  
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Agency for Healthcare Research and Quality, Rockville, Maryland (Fred Hellinger, Ph.D., John Fleishman, Ph.D., Irene Fraser, Ph.D.)  
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## Abstract

**OBJECTIVES**—We evaluated highly active antiretroviral therapy (HAART) utilization in youth infected with HIV through risk behaviors (BIY) who met treatment criteria for HAART. We assessed the impact of receiving care at an adult or pediatric HIV clinical site on initiation and discontinuation of the first HAART regimen in BIY.

**METHODS**—This was a retrospective analysis of treatment-naive BIY, aged 12–24, who enrolled in the HIV Research Network (HIVRN) between 2002 and 2008 and who met criteria for HAART. The outcomes were time from meeting criteria to initiation of HAART and time to discontinuation of the first HAART regimen. Analyses were conducted using Cox proportional hazards regression.

**RESULTS**—Of 287 treatment-eligible youth, 198 (69%) received HAART and 58/198 (29.3%) subsequently discontinued HAART. In multivariable analyses, there was no significant difference in the time between meeting treatment criteria and initiating HAART for BIY followed at adult or pediatric HIV clinical sites. However, BIY followed at adult sites discontinued HAART sooner than BIY followed at pediatric HIV clinical sites (AHR 3.19 [1.26–8.06]).

**CONCLUSIONS**—Two thirds of treatment-eligible BIY in the HIVRN cohort initiated HAART; however, one third who initiated HAART discontinued HAART during the study period. Identifying factors associated with earlier HAART initiation and HAART sustainability can inform interventions to enhance HAART utilization among treatment-eligible youth. The finding of earlier HAART discontinuation for youth at adult care sites deserves further study.

## Keywords

adolescents; youth; highly active antiretroviral therapy (HAART); disparities; utilization; HIV Research Network; clinical site

## Background

An estimated 50% of incident human immunodeficiency virus (HIV) infections in the United States are acquired during the second decade of life<sup>1,2</sup>. Although behaviorally-infected youth (BIY) often present early in infection with fewer HIV sequelae than adults, many meet criteria for antiretroviral treatment<sup>1</sup>. Most medical providers of HIV-infected youth strive to balance the main goal of prescribing a potent antiretroviral regimen with providing support for and reducing barriers to adherence<sup>3</sup>. However, successful HIV treatment in youth is challenging due to poor clinical attendance, intolerance of side effects, limited parental involvement, and depression. In addition, especially among BIY, cognitive and developmental immaturity often create a sense of invincibility and underestimation of personal risk, which may adversely affect adherence to medication<sup>2,4</sup>. Several studies have

noted lower adherence (29–50%) in youth who started HAART<sup>5–7</sup> when compared to the 80–90% reported in adult cohorts on similar regimens<sup>8,9</sup>. We previously examined HAART initiation in BIY as compared to adult patients >25 years old and found significantly lower rates of HAART initiation among BIY. Lower CD4 and better HIV clinic attendance were associated with increased likelihood of HAART initiation<sup>10,11</sup>. Given those findings, we hypothesized that HIV clinic site, specifically, pediatric or adult site, may impact HAART utilization among BIY.

The ages of BIY span from 12 to 24 years, with the large majority between the ages of 18 and 22 at diagnosis and entry into care. Many pediatric HIV clinical centers see patients through age 24, and some adult clinical centers may see patients as young as age 16. Therefore, BIY can be referred to either pediatric or adult HIV clinical sites, where they may be cared for by providers with varied training and experience with this population (e.g., pediatric, adolescent, or internal medicine-trained providers). There may be specific clinic and provider factors that may differ at pediatric-centered vs. adult-centered facilities, including but not limited to comfort with the patient population, and youth-friendly services and facilities. Differences in care and outcomes between adult and pediatric providers have been documented in other clinical conditions<sup>12,13</sup>. Clinic-related features may influence the likelihood that BIY patients initiate or continue a HAART regimen.

Discontinuation of HAART may be related to poor outcome expectancy and self-efficacy, difficulty with pills, and poor tolerability of side effects<sup>14,15</sup>. Given differences in pill burden, side effects, and tolerability between protease inhibitor (PI) and non-nucleoside reverse transcriptase inhibitor (NNRTI) based regimens, sustainability of HAART may vary by regimen type among BIY.

We conducted analyses of BIY meeting treatment criteria in a large national cohort to assess the impact of HIV clinical site on initiation and continuation of HAART. We examined whether site of care (adult vs. pediatric) and type of regimen affects HAART initiation and sustainability for BIY.

## METHODS

### Study Setting and Participants

This was a retrospective cohort study of BIY between the ages of 12 and 24 who were enrolled in the HIV Research Network (HIVRN). HIVRN is a consortium of 18 high-volume U.S. clinic sites that provide primary and subspecialty care to HIV-infected children, youth, and adult patients. The fourteen sites, three pediatric and 11 adult, that contributed patients to this analysis were geographically distributed: Northeast (3), Southern (5), West (4), Midwest (2)<sup>16</sup>. Sites annually abstracted specified data elements from patients' medical records; abstracted data were assembled into a uniform database, as previously described<sup>16</sup>. Adolescents and young adults were followed at pediatric or adult sites, as there were no adolescent-only sites that exclusively cared for BIY included in the network. The study was approved by the Johns Hopkins Institutional Review Board (IRB) as well as the IRB at each participating institution.

Patients were included if they were between 12 and 24 years old, had at least one CD4 value, HIV-1 RNA assessment, and one outpatient visit within any given calendar year between the years 2002 and 2008, and were treatment-naïve when first meeting treatment criteria. Patients classified as BIY had acquired HIV through sexual exposure (either heterosexual or men who have sex with men [MSM]), injection drug use [IDU], or a combination of risk factors [i.e. MSM and IDU]). Patients were excluded if they acquired infection perinatally, through blood transfusion, or if the mode of acquisition was unknown

(to avoid inclusion of perinatally-infected youth who were diagnosed late), as these patients have very different clinical trajectories and are more likely to have initiated HAART at very young ages.

### Data Collection and Measures

Demographic and clinical data were collected from the clinical database. Race/ethnic group was based on data recorded in the medical record and classified as White, Black, Hispanic, and other. The number of outpatient clinic/office visits was determined for each calendar year and categorized as <4 or ≥4 HIV provider visits per year based on the Department of Health and Human Services' (DHHS) recommendation for quarterly clinical follow-up<sup>17</sup>. Outpatient clinic visits excluded emergency department visits and were limited to visits to an HIV healthcare provider, not including administrative, laboratory testing, nurse-only, psychiatry, or visits in which an HIV healthcare provider was not seen. Clinical site was classified as adult or pediatric. Mental health and substance abuse data were incomplete and therefore not evaluated.

HAART was defined as concomitant use of ≥3 antiretroviral drugs from at least two classes, including acceptable triple NRTI regimens<sup>18</sup>. In the retrospectively abstracted data, HAART initiation was specifically defined as HAART being prescribed at any time after meeting treatment criteria. DHHS' guidelines were used to categorize patients' need for HAART during a calendar year. Patients were classified as meeting DHHS criteria based on having two CD4 measurements <350 cells/mm<sup>3</sup> subsequent to enrollment. This CD4 level was the recommended threshold in the guidelines between 2002 and 2008<sup>17</sup>. Meeting treatment criteria was considered permanent; specifically, once patients met treatment criteria, they were considered to always be in need of treatment.

Analysis of time to HAART initiation and factors associated with HAART initiation among BIY as compared to adults ≥25 years has been previously conducted by our group<sup>11</sup>. Therefore, we focused this analysis specifically on the impact of clinical site on HAART initiation. In addition, BIY youth aged 12–17 were not included in prior analyses. Time to initiation was calculated from the date patients first met CD4 criterion for treatment and the prescription date of the first HAART regimen. For the assessment of HAART initiation, patients were censored at their last clinical visit. The duration of the first HAART regimen was calculated from the start and stop dates of the first HAART regimen and any subsequent regimens. Discontinuation was defined as being off of HAART for at least 60 days. For examining discontinuation of HAART, patients were censored at their last known HIV clinical visit. For patients who discontinued HAART regimen, we assessed the year after discontinuation of the regimen to see if patients were still in care and if HAART was subsequently re-initiated.

**Statistical analysis**—The impact of clinical site on time to HAART initiation and discontinuation was evaluated. We used Chi-squared tests and Wilcoxon rank sum tests to assess differences in demographic and clinical variables between pediatric and adult sites. The primary outcomes of interest were time to HAART initiation and, once initiated, time to discontinuation of the first HAART regimen. Cox proportional hazards regression analysis was used to assess covariates associated with earlier initiation and discontinuation of the first HAART regimen. The final models included gender, race, CD4 cell count category when meeting treatment criteria (<200 vs. 200–350 cells/mm<sup>3</sup>), number of outpatient visits made in the year after treatment eligibility (<4 vs. ≥4), the calendar year the patient met treatment criteria, insurance during the year the patient met treatment criteria, and adult or pediatric HIV provider clinical site. HIV acquisition risk was not included in the analysis as nearly all youth in this cohort were infected sexually. We examined the impact of regimen

type, categorized as protease inhibitor (PI)- based vs. non-nucleoside reverse transcriptase inhibitor (NNRTI)-based vs. triple NRTI-based HAART, on duration of the first HAART regimen. We assessed potential interactions between key variables and none were found to be significant. Kaplan-Meier estimates were used to graphically examine the time-to-event analyses; and the log rank test was used to compare the survival curves. The proportionality assumption was assessed graphically. Data were analyzed using STATA 10.0 (Stata Corp., College Station, TX).

## RESULTS

287 treatment-eligible HAART-naïve BIY were identified. The majority of youth (78.4%) were followed at adult clinical sites. At the time of initial treatment eligibility, the median age was 21 years [IQR: 20–23]; 23 (8.0%) were under 18 years old (Table 1). Approximately 72% were male, 67.6% black, and 58.2% had an HIV risk factor of MSM. Youth followed at pediatric sites tended to be younger, to have attended 4 HIV provider visits in the calendar year after meeting treatment criteria, and to have had a greater likelihood of being covered by public insurance. Of patients meeting DHHS treatment criteria, 198 (69.0%) were treated with HAART during the study period, including 40/62 (64.5%) of those at pediatric and 158/225 (70.2%) ( $p=.39$ ) of those followed at adult HIV clinical sites. There were a total of 2,840 patient-years of follow-up. The median time from meeting treatment criteria to HAART initiation was 198 days (IQR: 35–988 days).

In multivariate analyses (Table 2), CD4 count  $<200$  vs.  $200\text{--}350$  cells/mm<sup>3</sup> (Adjusted hazard ratio [AHR] 2.00 [95% CI 1.39–2.87]) and 4 outpatient HIV provider visits in the year after meeting treatment criteria (AHR 2.20 [95% CI 1.48–3.26]) were associated with a greater hazard of being initiated on HAART. Receiving care at an adult clinical site was not significantly associated with HAART initiation (Adjusted hazard ratio [AHR] 1.23 [95% CI 0.80–1.87]).

### Discontinuation of HAART

Fifty-eight BIY (29.3%) discontinued their first HAART regimen; 6/40 (15.0%) vs. 52/158 (32.9%) of those followed at pediatric vs. adult clinical sites,  $p=.026$ . The duration of the first regimen was longer for those followed at pediatric sites (1059 days [IQR 447–1550]) than for those followed at adult sites (467 days [IQR 168–1053]);  $p=.01$ . Forty-one of 58 (70.7%) had virologic data available at the time of discontinuation; 22/41 (53.7%) had log<sub>10</sub> HIV-1 RNA measurements  $> 400$  copies/mL. Examination of virologic non-suppression and HAART discontinuation by site type revealed that 3/3 (100%) of those at pediatric sites and 19/38 (50%) at adult sites were not suppressed at the time of HAART discontinuation,  $p=.09$ . In Cox regression analyses, the only factor that was independently associated with earlier discontinuation of the first HAART regimen was receiving care at an adult HIV clinical site (AHR 3.19 [95% CI 1.26–8.06]) (Table 3) (Figure 1).

For the 58 BIY who discontinued HAART, six followed at pediatric and 52 at adult clinical sites; 3(50.0%) and 31 (59.6%) were in care the subsequent year, with no difference between pediatric and adult clinical sites ( $p=.65$ ). All three (100%) vs. 24/31 (77.4%) of those who remained in care at pediatric vs. adult clinical sites, respectively, were on HAART during the subsequent year;  $p=.36$ .

**Regimen details**—The medications comprising the HAART regimen were available on 176/198 (88.9%) of patients who started HAART. Ninety-one (51.7%) started NNRTI-based, 85 (48.3%) started PI-based. By Kaplan-Meier univariate estimations, PI-based regimens were used longer (median 581 [IQR 203–1200] days) than NNRTI-based regimens (median 447 [IQR 245–1059] days,  $p=.02$ ). However, in the Cox proportional hazards

regression analysis of HAART discontinuation, no significant differences in likelihood of discontinuation by HAART regimen were observed for PI-based (AHR 1.26 [95% CI 0.70–2.27]) compared to NNRTI-based regimens. (Results not shown) Adult site was again, the only variable significantly associated with HAART discontinuation (AHR 3.64 [95% CI 1.35–0.83]).

## DISCUSSION

In this longitudinal study examining HAART initiation and maintenance in a cohort of BIY, we found that 69% of those eligible for treatment were prescribed HAART over the study period. This study indicates that BIY in need of HAART are starting therapy at lower rates than reported for adult cohorts<sup>19;20</sup>, such as the HAART utilization rate of 91% in HIVRN adult patients 18 years of age (median of 41 years) meeting treatment criteria reported by Gebo *et al*<sup>19</sup>. The lower rates seen in BIY youth are similar to those seen in marginalized populations such as IDUs<sup>19;20</sup>, persons with mental health diagnoses<sup>21</sup>, and commercial sex workers.<sup>22</sup> The factors associated with HAART initiation in BIY are similar to those reported in adult cohorts, including lower CD4 count and adherence to quarterly clinic visits<sup>23</sup>. Of note, factors associated with HAART in adult cohorts, such as race, risk group, and insurance had little variation in the BIY sample, which may lead to nonsignificant results.

While studies in BIY have focused on barriers to adherence in this population<sup>15;24;25</sup>, few studies have examined disparities in HAART within the BIY population. The comparison of the BIY HAART initiation rates with those reported for adults and not those reported for perinatally-infected youth in this study is deliberate, as the longstanding relationships with providers and recommendations for early and continued HAART in young children make perinatally-infected youth quite different from BIY. The lower likelihood of HAART initiation for BIY underscores the importance of designing novel mechanisms to engage and maintain BIY youth into care. Studies that delineate specific factors associated with HAART initiation are critical for informing appropriate interventions to improve management in this population.

Importantly, our study found that BIY receiving care at adult clinical sites were equally as likely to start HAART as those being seen at pediatric sites. However, receiving care at an adult clinical site was independently associated with a greater hazard of discontinuing one's first HAART regimen, the regimen most likely to achieve durable virologic suppression and immune recovery<sup>26;27</sup>. Furthermore, there was no evidence that this difference was driven by level of immunosuppression or attending regular clinic visits. Greater HAART discontinuation in adult HIV clinical sites in this study may reflect differences in clinic structure, available programs to support HAART adherence and sustainability, or an increased emphasis on social services and case management. These findings could also reflect differences in provider and staff approach to adolescent and young adult patients, as well as BIY interactions with clinical staff. However, we were unable to evaluate the impact of these factors in the current study.

Differences in treatment practices between pediatric and adult providers have been observed in other chronic illnesses, such as end stage renal disease<sup>12;13</sup>. Pediatric clinical sites are more likely to have providers and support staff who are familiar with and/or have received specific training about adolescents and young adult development and behavior, lower patient to provider ratios, youth-friendly facilities and programs, such as technologies (e.g., texting) targeted at youth to encourage attendance to appointments and adherence to HAART<sup>28–31</sup>. Although the reason for the observed difference was not specifically studied, the finding that HAART utilization in youth may differ by being cared for at a pediatric facility is intriguing

and may have implications for best practice guidelines for this vulnerable population. It is possible that caring for youth in a clinic that addresses the unique developmental and psychosocial needs of this population may be the ideal treatment setting, particularly as BIY engage into care and initiate HAART; however, more study is needed. Furthermore, the difference observed lends further support for the value of systematic transition from pediatric to adult-centered care to minimize loss to follow up and ensure optimal HAART outcomes<sup>32;33</sup>. For patients maintained on HAART, we did not examine subsequent virologic suppression, CD4 outcomes, or resistance. Though this was beyond the scope of these analyses, future studies should address this critical outcome to truly understand best practice and optimize care for this population.

Lower CD4 counts have previously been associated with a greater likelihood of starting HAART<sup>19</sup>. As therapies have become more simplified with less recognized toxicities, recommendations for initiation of HAART have shifted to higher CD4 thresholds. It is therefore expected that increased numbers of BIY will qualify for therapy according to the new HAART guidelines; however, if there is not an accompanying increase in the likelihood of initiating HAART, it is possible that the proportion of patients who need HAART and receive it may actually decrease<sup>34,35</sup>.

Attendance at four or more outpatient clinic visits in the year after meeting treatment criteria was used as a marker of adequate outpatient utilization, based on the DHHS recommendations<sup>3</sup>, similar to prior adult HIVRN studies<sup>36</sup>. While in a prior analysis there was an association of attendance to outpatient visits and starting HAART, there was no relationship between attendance and HAART discontinuation in this analysis<sup>23</sup>. Clinic attendance may be a marker for unmeasured variables including patient engagement into care; greater access to providers, clinic support personnel, and services; and better monitoring of immune status. However, it is intriguing that clinic attendance was not independently associated with HAART discontinuation. Likewise, regimen type was not associated with HAART discontinuation.

It should be noted that while our study design has allowed us to identify associations, we were unable to determine causal relationships. Also, although the sites in the sample encompass a broad geographic distribution, the sample is small and not nationally representative and may not generalize to all HIV clinical sites; however, the use of multiple sites does afford greater generalizability than a single-site study would provide. Moreover, the sites in the HIVRN were all highly experienced in the management of HIV infection; results may differ at sites with smaller caseloads of HIV-infected patients. Additionally, in identifying patients who were not receiving HAART, we were unable to assess whether they refused it or whether other complex medical decision-making by them and their providers resulted in their not being on HAART; these data are not available in the database. We do not have data on why HAART was discontinued. We did not have access to socioeconomic and psychosocial variables such as income, educational level, family awareness/support of HIV diagnosis, mental health and substance abuse treatment, or unstable housing which have previously been shown to be associated with HAART utilization<sup>20</sup>. We did not assess outcomes (e.g., decreases in HIV-1 RNA) as we were underpowered and it was beyond the scope of the current analysis; future analyses will need to examine the long-term outcomes of HAART in youth, including virologic suppression, CD4 outcomes, and development of resistance.

It is highly probable that increased numbers of youth in need of treatment will be identified as the CDC guidelines for universal opt-out testing are implemented and with newer data supporting initiating treatment at higher CD4 levels<sup>34;37</sup>. The association of pediatric clinical site with HAART sustainability should prompt further study into the clinical and

psychosocial characteristics as well as the types of targeted interventions that may enhance effective HAART utilization for this vulnerable population.

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## Abbreviations

<b>HAART</b>	highly active antiretroviral therapy
<b>HIV</b>	human immunodeficiency virus
<b>HIVRN</b>	HIV Research Network
<b>BIY</b>	youth infected through risk behaviors
<b>DHHS</b>	Department of Health and Human Services
<b>MSM</b>	men who have sex with men
<b>IDU</b>	injection drug use

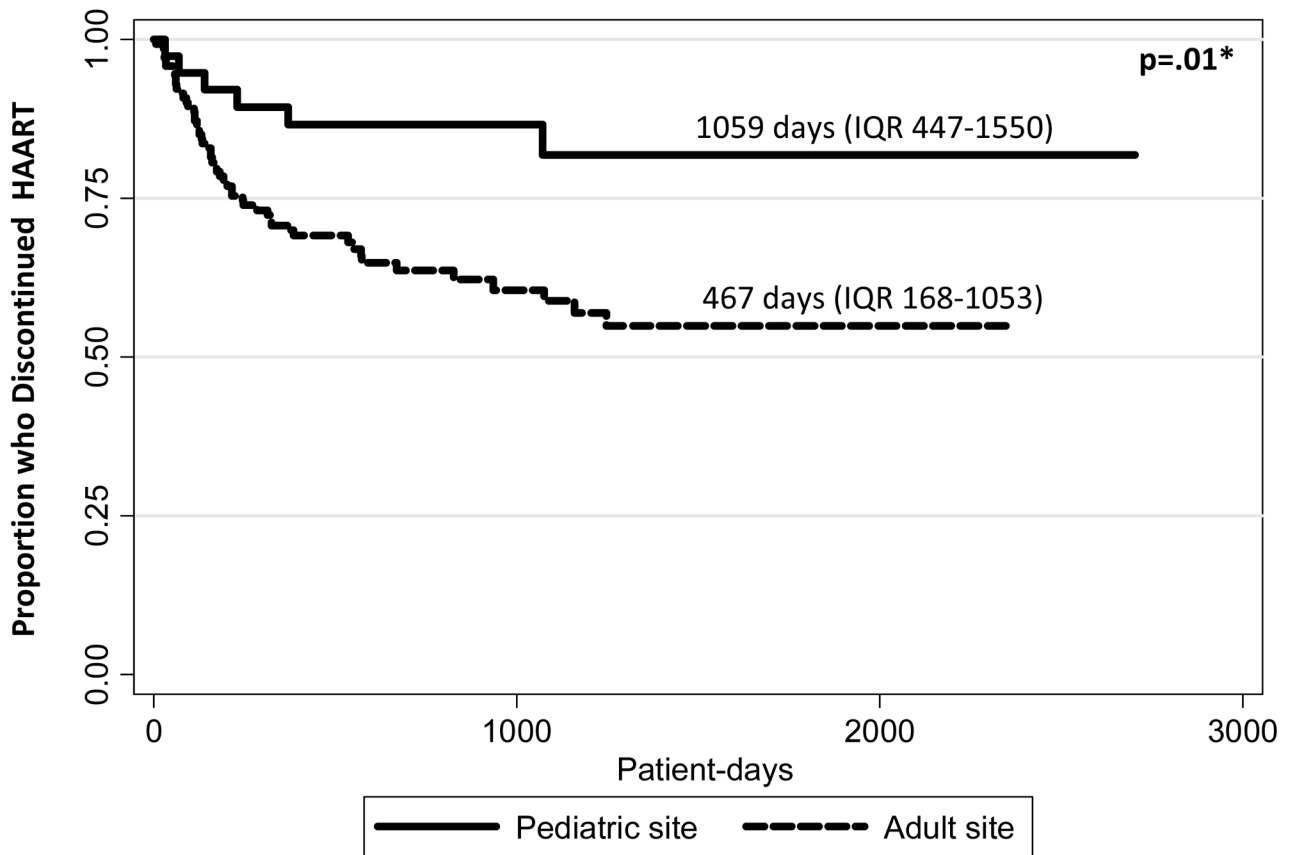
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**Fig 1. Kaplan-Meier estimate of time to discontinuing HAART for behaviorally HIV-Infected youth who have initiated HAART**  
 Kaplan-Meier univariate estimate of time to HAART discontinuation. \*Log-rank test.

**Table 1**

Characteristics of treatment-naïve youth ages 12–24 enrolled in the HIVRN cohort meeting treatment criteria in or after 2002 through 2008

	<b>Pediatric site N=62 (21.6%)</b>	<b>Adult site N=225 (78.4%)</b>	<b>Total N=287(100%)</b>	<b>P-value</b>
<b>Age, years (median (inter-quartile range))</b>	20 (17–21) (Range 14–24)	22 (20–23) (Range 15–24)	21 (20–23)	<b>.001</b>
<b>Male</b>	38 (61.3)	169 (75.1)	207 (72.1)	.081
<b>Race</b>				<b>.015</b>
Black	52 (83.9)	142 (63.1)	194 (67.6)	
Hispanic	3 (4.8)	47 (20.9)	50 (17.4)	
White	7 (11.3)	29 (12.9)	36 (12.5)	
Other/unknown	0 (0)	7 (3.1)	7 (2.4)	
<b>HIV acquisition risk<sup>1,2</sup></b>				.058
MSM	27 (43.6)	140 (62.2)	167 (58.2)	
Hetero	34 (54.8)	78 (34.7)	112 (39.0)	
IDU <sup>3</sup>	1 (1.6)	3 (1.3)	4 (1.4)	
Hetero + IDU	0 (0.0)	3 (1.3)	3 (1.1)	
MSM + IDU	0 (0.0)	1 (0.4)	1 (0.3)	
<b>CD4+ T cells when first met criteria (cells/mm<sup>3</sup>)</b>				.711
<200	18 (29.0)	60 (26.7)	78 (27.2)	
200–350	44 (71.0)	165 (73.3)	209 (72.8)	
<b>4 HIV provider visits within a year of meeting treatment criteria</b>	49 (79.0)	129 (57.3)	178 (62.0)	<b>.002</b>
<b>Insurance<sup>4</sup></b>				<b>.002</b>
Uninsured/Ryan White/Other	27 (43.5)	139 (61.8)	166 (57.8)	
Private	2 (3.2)	20 (8.9)	22 (7.7)	
Public	33 (53.2)	63 (28.0)	96 (33.4)	
Unknown	1 (0.0)	3 (1.3)	3 (1.1)	
<b>Year first met treatment criteria</b>				<b>.041</b>
2002	4 (6.4)	9 (4.0)	13 (4.5)	
2003	7 (11.3)	20 (8.9)	27 (9.4)	
2004	7 (11.3)	39 (17.3)	46 (16.0)	
2005	9 (14.5)	41 (18.2)	50 (17.4)	
2006	19 (30.6)	30 (13.3)	49 (17.1)	
2007	7 (11.3)	41 (18.2)	48 (16.7)	
2008	9 (14.5)	45 (20.0)	54 (18.8)	
<b>HAART Ever Started</b>	40 (64.5)	158 (70.2)	198 (69.0)	.390

<sup>1</sup>Excluded if HIV acquired vertically, via blood transfusion, or if unknown mode of acquisition;

<sup>2</sup>Categories mutually exclusive.

<sup>4</sup>Insurance coverage included private insurance, public (Medicaid, Medicare, Dual insurance with Medicaid/Medicare), and Uninsured/Ryan White/Other (e.g., Veteran's administration, county health program), and Unknown insurance coverage.

**Table 2**

Patient characteristics associated with HAART initiation in treatment-naïve youth (12–24 years old) meeting treatment criteria

	Univariate (HR (95% CI))*	Multivariate (AHR (95% CI))*
Female	0.86 (0.60–1.24)	1.05 (0.71–1.54)
Black	0.86 (0.60–1.24)	0.80 (0.52–1.23)
Hispanic	0.87 (0.55–1.35)	0.69 (0.41–1.18)
White	1.0 (Ref)	1.0 (Ref)
<b>HIV acquisition risk*</b>		—
IDU	0.58 (0.23–1.50)	
<b>CD4+ T cells when first met criteria</b>		
<200 cells/mm <sup>3</sup>	<b>2.57 (1.81–3.64)</b>	<b>2.00 (1.39–2.87)</b>
200–350 cells/mm <sup>3</sup>	1.0 (Ref)	1.0 (Ref)
<b>Attending 4 outpatient HIV provider visits in the 365 days after meeting treatment criteria</b>	<b>1.67 (1.14–2.43)</b>	<b>2.20 (1.48–3.26)</b>
< 4 visits	1.0 (Ref)	1.0 (Ref)
<b>Insurance<sup>†</sup></b>		
Uninsured/RW/Other	1.0 (Ref)	1.0 (Ref)
Private	0.94 (0.47–1.88)	1.01 (0.52–1.98)
Public	0.80 (0.54–1.18)	0.82 (0.56–1.18)
<b>Clinical site characteristic</b>		
Pediatric	1.0 (Ref)	1.0 (Ref)
Adult	1.15 (0.78–1.70)	1.23 (0.80–1.87)
<b>Year first meeting treatment criteria for HAART</b>		
2002	1.0 (Ref)	1.0 (Ref)
2003	0.44 (0.15–1.26)	0.49 (0.17–1.36)
2004	0.66 (0.25–1.69)	0.48 (0.19–1.19)
2005	0.68 (0.26–1.76)	0.47 (0.19–1.16)
2006	0.63 (0.24–1.66)	0.50 (0.20–1.25)
2007	0.44 (0.16–1.21)	0.32 (0.12–0.81)
2008	0.75 (0.28–1.97)	0.86 (0.33–2.21)

\* Cox proportional hazards regression multivariate model sex, race/ethnicity, clinic utilization, insurance in the year treatment criteria met, CD4 category, year met criteria for HAART; and adult or pediatric HIV clinical site. Output is hazard ratio (HR) and adjusted hazard ratio (AHR). Bolded values indicates significant findings.

<sup>†</sup>Insurance coverage included private insurance, public (Medicaid, medicare, Dual insurance with Medicaid/medicare), and Other/Unknown insurance (e.g., Veteran's administration, county health program).

**Table 3**

Hazard of discontinuing the first HAART regimen for treatment-naïve youth (12–24 years old) criteria in the HIV Research Network

	Univariate (HR (95% CI))*	Multivariate (AHR 95% CI)*
Female	0.85 (0.44–1.61)	0.85 (0.35–1.74)
<b>Race</b>		
Black	0.99 (0.54–1.79) (0.84–2.01)	0.69 (0.35–1.34)
Hispanic	0.44 (0.19–1.01)	0.39 (0.15–0.99)
White	1.0 (Ref)	1.0 (Ref)
<b>CD4+ T cells when first met criteria</b>		
<200 cells/mm <sup>3</sup>	1.0 (Ref)	1.0 (Ref)
200–350	0.95 (0.54–1.65)	1.04 (0.57–1.87)
<b>Attending 4 outpatient HIV provider visits in the year after meeting treatment criteria</b>		
<4 visits	0.64 (0.36–1.16)	0.68 (0.36–1.25)
<b>Clinical site characteristic</b>		
Pediatric	1.0 (Ref)	1.0 (Ref)
Adult	<b>2.93 (1.26–6.85)</b>	<b>3.19 (1.26–8.06)</b>
<b>Insurance<sup>L</sup></b>		
Uninsured/R-W/Other	1.0 (Ref)	1.0 (Ref)
Private	1.12 (0.32–3.90)	0.62(0.18–2.11)
Public	0.64 (0.31–1.31)	0.56 (0.27–1.13)

\* Cox proportional hazards regression multivariate model including sex, race/ethnicity, clinic utilization, insurance in the year treatment criteria met, CD4 category, year met criteria for HAART; and adult or pediatric HIV clinical site. Output is hazard ratio (HR) and adjusted hazard ratio (AHR). Bolded values indicate significant findings.

<sup>L</sup>Insurance coverage included private insurance, public (Medicaid, Medicare, Dual insurance with Medicaid/Medicare), and Other/Unknown insurance (e.g., Veteran's administration, county health program).