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# HIV Continuum of Care for Youth in the United States

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## Abstract

**Background—**Beneficial HIV treatment outcomes require success at multiple steps along the HIV Continuum of Care. Youth living with HIV are a key population, and sites in the Adolescent Medicine Trials Network for HIV/AIDS Interventions (ATN) are known for modeling optimum HIV adolescent care.

**Methods—**A longitudinal cohort study conducted at 14 network sites across the United States assessed how the later steps of the Continuum of Care were achieved among youth: engagement,

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treatment and viral load suppression. Youth aged 13–24 who were behaviorally-infected with HIV and linked to care at an ATN-affiliated site were eligible to participate.

**Results—**A total of 467 youth were enrolled and had one year of available data. Most were ages 22–24 (57%), male (79%), and black/non-Hispanic (71%). Most used alcohol (81%) and marijuana (61%) in the three months prior to enrollment, and 40% had a history of incarceration. Among this cohort of youth, 86% met criteria for care engagement; among these, 98% were prescribed antiretroviral therapy and 89% achieved viral load suppression. Sustained viral load suppression at all measured time points was found among 59% with initial suppression. Site characteristics were notable for prevalence of adherence counseling (100%), case management (100%), clinic-based mental health (93%) and substance use (64%) treatment.

**Conclusions—**Youth living with HIV in the United States can be successfully treated at health care sites with experience, excellence, and important resources and services. Sustained viral load suppression may be an important step to add to the Continuum of Care for youth.

### Keywords

Youth Living with HIV; HIV Continuum of Care; HIV treatment; United States

## Introduction

Although the HIV pandemic continues, remarkable success has been achieved in areas of testing, treatment, and prevention over the past decade. When HIV is treated effectively, sustained viral load (VL) suppression minimizes the risk for HIV-associated illness as well as disease transmission. With increasing recognition on the importance of treatment as prevention[1], and because of demonstrated success in HIV treatment in many countries throughout the world, the Joint United Nations Programme on HIV/AIDS (UNAIDS) has boldly called for an end of the HIV pandemic by 2030.[2] Ambitious targets of “90/90/90” will need to be achieved by 2020 in order to reach this goal. That is, 90% of persons with HIV are diagnosed, 90% of those diagnosed are on treatment, and 90% of those on treatment have achieved VL suppression.[2]

In the United States (US), the HIV/AIDS bureau (HAB) of the Health Resources and Services Administration (HRSA) is charged with the administration of the Ryan White Federal Program to support those with HIV who do not have the medical insurance and other financial resources to manage their disease.[3] HAB embraces the HIV Continuum of Care (CoC)[4] as a model outlining sequential steps that must be achieved in order for someone with HIV to move from diagnosis to VL suppression. Along the CoC, once youth have been diagnosed and linked to care, specific milestones include engagement in care, prescription of antiretroviral therapy (ART), and VL suppression.[5]

Mugavero and colleagues identify some of the systemic factors in health care delivery that can lead to fragmentation of HIV care.[6] These authors point out that care engagement itself is a dynamic process that includes three components: 1) linkage, 2) retention, and 3) re-engagement. Initial linkage to care upon a positive HIV test result is a critical component of care engagement. Linkage can be followed by ongoing care, and care retention, but someone

can also fall out of care at any point. Best practices and systems that support care retention and re-engagement are necessary in order to achieve the medical care goal of viral suppression[6], and this is particularly germane to HIV-infected adolescents and young adults.

Adolescents are a key population globally recognized as being especially vulnerable to HIV disease.[7] Initial diagnosis and linkage to care is a challenge, and for HIV-infected youth aged 15–24 in the US, estimates are that only 51% are aware of their diagnosis and 68% are then linked to care.[8] Once linked to care and then sufficiently engaged in care, reported rates of VL suppression among youth living with HIV (YLWH) in the US have varied widely (30.51% to 50.5%) and have raised two major concerns.[9, 10] First is the need to understand the prevalence and HIV-care impact of other challenges faced by YLWH, including substance use, mental illness, lack of social support, and socioeconomic constraints. Second is the recognition that critical metrics, such as VL suppression, can only be meaningfully interpreted within the context of how well youth progress and achieve successive milestones across the CoC.

Healthcare providers who embrace the “90/90/90” targets set by UNAIDS are called upon to measure successes, identify and overcome barriers, and share best practices, especially as they may apply to HIV among marginalized and underserved populations. In the US, the Adolescent Medicine Trials Network for HIV/AIDS Interventions (ATN) conducted a study focused on the latter steps of the CoC in order to evaluate the success of HIV treatment for youth at its ATN youth-focused medical centers and clinics as well as to assess factors impacting CoC outcomes. Generally located in urban areas with high HIV disease burden, many of these sites are known for modeling optimum HIV adolescent care in the US. Effective treatment among HIV youth in the US, even at specialized centers, is difficult to achieve but critical in order to reach the UNAIDS targets of 90/90/90. This study, ATN 125, was conducted to measure and evaluate the effectiveness of initial and ongoing treatment for HIV-infected youth at academic medical centers across the US.

## Methods

### Participants and Recruitment

From February 2015 through February 2016, participants were recruited from 14 adolescent medicine clinics located throughout the US in areas with established HIV epidemics. Adolescents were approached at clinic visits by research staff and had to be: a) 13 through 24 years of age; b) behaviorally-infected with HIV; c) currently receiving or planning to receive medical care at one of the participating sites; d) ability to understand written and/or spoken English, and f) give permission for research staff to access their medical records in order to be included. The study was approved by the Institutional Review Boards (IRBs) at each of the participating clinics.

### Study Procedures

After the initial screening process, all eligible youth were invited to participate, and consent was obtained. Participants then completed an audio-computer assisted self-interview (ACASI) to assess multiple measures described below. Participants were given a small

incentive, determined by each site and approved by their IRB, for their time and effort completing the assessment.

Research staff abstracted biomedical and visit appointment information from the participants' medical record, including: date of initial HIV diagnosis; date of first HIV-related medical care visit; initial VL, initial CD4 count (percentage and absolute count, if available). For participants already in care, additional data was collected retrospectively up to 26 weeks prior to enrollment that included: all VL results, CD4 counts, any diagnosis of a sexually transmitted infection (STI), treatment assessment (clinician prescribed and subject acceptance of/adherence to ART), and subject healthcare utilization.

## Measures

**Demographic characteristics—**Participants' demographic characteristics were ascertained including age, gender, ethnicity, race, education, employment status, annual income, and living situation. Additional questions were asked about age at time of HIV diagnosis, HIV disclosure, and any history of incarceration.

**Substance Use, Mental Health, and Adherence—**The Brief Symptoms Inventory (BSI)[11] was included as an assessment of mental health; the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST)[12] measured substance use; and questions were included to assess readiness and self-efficacy/ability for health care.

## Statistical Analysis

For each patient, a one-year study period was defined. The start of the study period was the date of the patient's first HIV-related visit if they were new to care or were reengaging in care. For participants already engaged in care at enrollment, up to 6 months (180 days) of data was collected retrospectively and the first date for which data were collected was considered the subject's start date for the study. Patients were required to have at least one year of possible follow-up on study to be included in this analysis. Originally the study was designed to collect data for two years on all subjects, however, the study was ended prematurely due to funding constraints, and so full-year follow-up data was not available for all who enrolled.

Steps in the CoC were defined as follows. Engagement in care was defined using the HRSA HAB measure[13] that requires at least two HIV primary care visits, separated by at least 90 days in a one-year measurement period. Patients were considered to have been prescribed ART if they reported a health care provider prescribed ART at any time since the last medical record abstraction, including continuing previously prescribed ART. Three different viral suppression outcomes were used among participants who either were on ART at enrollment or initiated ART during the study period: (1) attained suppression during the study period (at least one plasma HIV-1 RNA VL <200 copies/ml); (2) at least 50% of VLs during the study period at <200 copies/ml; and (3) 100% of VLs during the study period at <200 copies/ml. Steps in the CoC were treated as conditional; that is, only patients who completed the previous step(s) were considered at each subsequent step.

Variables were summarized using frequency counts and percentages. Completion of each step of the CoC (yes vs. no) was modeled separately using logistic regression models. Successful completion of the step was modeled as the event. Independent variables considered included demographic measures such as age, gender, race, ethnicity, living arrangement, income, and education as well as behavioral measures including disclosure, alcohol and substance use, mental health, and ability to keep healthcare appointments. Because this was a multi-site study with patients clustered within sites, stratification by site was included in all models. Univariate results were used to construct separate multi-variable (MV) logistic models for each step in the CoC. Data on all variables included in the MV models are shown in the tables. Odds ratios and associated 95% confidence intervals are reported. All analyses were performed using SAS®, version 9.4 (SAS Institute, Cary, NC).

## Results

The study enrolled 924 youth. With early termination of the study, a full year of data was available for 467 youth. Demographic characteristics and other self-reported experiences determined by the baseline ACASI are presented in Table 1. Most participants (57%) were between the ages of 22 and 24, while 16% were teenagers. The majority were male (79%) and Black/Non-Hispanic (71%), with a high school education or less (63%). While 58% were employed, half reported earning less than $6000 per year. A spectrum of living situations were endorsed, with 43% living in their parents' home and 29% living in their own house/ apartment. Many reported a history of incarceration (40%).

Half of the youth (51%) have been diagnosed with HIV for less than three years as determined by record abstraction of the date of initial diagnosis as compared to the date of enrollment. ACASI results indicate that most (85%) had disclosed their status to someone, and most felt ready to attend medical appointments (80%). Prevalent in this cohort are depressive symptoms (43%), alcohol use (81%), marijuana use (61%), and use of other drugs (22%).

Figure 1 depicts CoC assessments beginning with the step of retention in care. Among this cohort, 86% (n=403) met the HAB definition for care engagement, having at least two care visits 90 days apart within a one-year period. Of these youth meeting the HAB definition of engagement, 98% were prescribed ART (394/403), and 89% achieved VL suppression (360/403). Further evaluation demonstrated that 81% of youth meeting the HAB definition of engagement achieved VL suppression for at least half of the VL measurements taken during the study period, and 59% meeting the HAB definition of engagement achieved VL suppression for all VL measurements.

Table 2 describes the factors found to be significantly associated with each step along the CoC from the MV logistic models. Being completely ready to go to medical appointments (AOR 2.17, 1.13–4.17) was associated with meeting the HAB criteria for engagement in care. Among those engaged in care, being male (AOR 5.85, 1.04–33.33), using alcohol less than 1–2 times per month vs. daily or almost daily (AOR 21.65, 1.55–302.51), and using alcohol weekly vs. daily or almost daily (AOR 26.63, 1.18–600.18) were each associated with being started on ART. Factors associated with achieving VL suppression on at least half

of the measures included having no income vs. an income of more than $12,000 per year (AOR 4.18, 1.55–11.24), being very confident about ability to keep a medical appointment vs. being “pretty sure” (OR 2.82, 1.44–5.56), and having never been incarcerated (AOR 1.99, 1.09–3.62). Factors associated with achieving VL suppression at all measurements were living in one’s own house/apartment vs. other (other includes foster home/ group home, halfway house, shelter, on the street) (AOR 3.42, 1.27–9.26) and never having been incarcerated (AOR 2.08, 1.32–3.28).

Further evaluation of incarceration history associated with achieving 50% VL suppression showed that having a history or being in jail 2–5 times (AOR 0.41, 0.18–1.95) ater than 5 times (AOR 0.17, 0.04–0.70) compared to never being incarcerated was associated with decreased success. Being incarcerated once compared to never being incarcerated had no significant association. When looking at 100% VL suppression, having a history of being in jail one time (AOR 0.52, 0.30–0.91) or 2–5 times (AOR 0.46, 0.24–0.88) compared to never being incarcerated was associated with decreased success, while being incarcerated more than five times did not reach statistical significance. There were no associations found with a recent history of incarceration (in last 90 days) and any of the VL suppression outcome measures.

Engagement in care was associated with VL suppression ($p < 0.001$). Among the 64 youth who did not meet the HAB criteria for care engagement, 91% (n=58) were prescribed ART, 58% (n=37) achieved VL suppression, 55% (n=35) achieved VL suppression for at least half of the VL measurements taken during the study period, and 42% (n=27) achieved VL suppression for all VL measurements.

There were some differences between sites in CoC outcomes when they were looked at in univariate logistic modeling but they were not consistent for all CoC outcomes and thus were accommodated for by stratifying by site for all further univariate and multivariable logistic modeling. Characteristics of the sites include the fact that all were affiliated with an academic medical center, and all were supported with Ryan White funding. Figure 2 highlights some additional site characteristics. All had clinic-based case management, and patient navigators, and all offered specific counseling for medication adherence. Most also offered clinic-based mental health (93%) and substance use treatment (64%), and also utilized peer support groups (86%).

## Discussion

This study has three key findings. First, once youth are successfully tested for HIV and linked to care, many engage in care and remain in care. However, even at optimal sites, the rate of engagement is less than 90%. Second, most youth who engage in care will achieve viral suppression. Notably, this rate is also less than 90%, and initial suppression is not a surrogate for sustained suppression. Third, a remote history of incarceration is an important risk for HIV treatment failure among youth.

Youth face multiple challenges that trained and experienced care providers can help them overcome in order to achieve the medical goal of viral suppression. One can compare the

ambitious UNAIDS targets of “90/90/90” to the success achieved by previously supported ATN sites across the US in terms of HIV treatment and suppression. First, any success in care must be contextualized in terms of the large proportion of HIV-infected youth who are not diagnosed or ever linked to care. UNAIDS call for 90% of those living with HIV to know their status by 2020, while epidemiologic data estimates that only 51% of HIV-infected youth in the U.S. are aware of their status.[8] Next, UNAIDS calls for 90% of all persons diagnosed with HIV to receive sustained antiretroviral therapy. Therapy requires linkage to care, and while not part of this study, it is notable that the ATN has done separate work in this area. Innovative implementation programs such as the Strategic Multisite Initiative for Identification, Linkage and Engagement or SMILE have been described elsewhere[14] and will be detailed further in forthcoming publications. Still, once linked to care at ATN sites and engaged in care, youth in our study were able to achieve a noteworthy treatment milestone of 97% treated. Notably, youth who do not meet HAB criteria engagement have lower rates of treatment and suppression, and they are a potential group that may benefit from targeted interventions. Finally, UNAIDS calls for achievement of viral suppression among 90% of those receiving treatment by 2020. Again, the cohort we studied was just shy of meeting this goal in 2015, with 89% achieving suppression.

Earlier studies done by the ATN suggested that challenges faced by YLWH were actually preventing successful HIV treatment. Kahana and colleagues (2015) described data from a cross-sectional cohort study of 2,196 perinatally- and behaviorally-infected YLWH from 20 ATN-affiliated adolescent medicine clinics which showed that while 82.4% of perinatally- and 49.1% of behaviorally-infected youth reported current ART use, only 37.0% of perinatally- and 27.1% of behaviorally-infected youth were virologically suppressed.[15] In an earlier study, it was reported that between 2002 and 2008, only 69% of behaviorally-infected youth who met clinical criteria (having at least 2 CD4 measurements, 350 cells/mm3) had initiated ART (compared with 79% of adults).[16] Saberi et al. examined data from 1,317 HIV-infected individuals who were 12–24 years old (mean age = 20.0 years), were on ART, and were behaviorally-(52.7%) and perinatally-(39.1%) infected with HIV. Mean self-reported ART adherence over the prior seven days was 86.1% (median = 100%); 50.5% of the sample had an undetectable plasma HIV RNA.[10] In this study, a cohort of youth was followed for a full year to determine how well they achieved treatment milestones along the CoC.

The current study was conducted from 2015–2016, and HIV treatment guidelines had evolved by then to essentially support universal treatment.[17] This may be a critical factor, especially to clarify the almost complete prescribing of ART to this cohort. The availability of newer medications that were better tolerated supported the implementation of these newer guidelines. Temporal bias is therefore likely to account in part for the higher rates of suppression found among our cohort as compared to ones described even just a few years ago. The finding that young men were more likely to be prescribed therapy than young women is interesting to consider, although prescribing rates were above 95% for both groups. Other reasons that the VL suppression rates found in this study are higher than many others reported in the literature may include the intensive support services available. Sites universally reported the availability of adherence counseling, clinic-based case management services and clinic-based patient navigators, and most also offered clinic-based mental

health services and clinic-based substance use treatment. These support services, offered at highly experienced sites and often integrated into best practices, may also explain the relatively high rates of VL suppression that we observed.

Achieving initial VL suppression is an important first step to sustained suppression. Almost 90% (89%) of this cohort did achieve VL suppression, but this dropped to 81% when measured at least half of the time, and further to 59% when measured all of the time. The UNAIDS target of 90% VL suppression is clearly important, but at least for youth it must be recognized that this is not a surrogate for durable VL control. Single point in time suppression is not sufficient. Adding the step of Sustained Suppression to the CoC for YLWH will not only allow for more meaningful measurements, but also support further research to assess how this higher goal might be achieved. It may be that select support services are necessary.

In addition to studies done by the ATN, work by the Centers for Disease Control and Prevention and others have demonstrated challenges to successful HIV treatment based upon age, race, substance use, and mental health.[18–23] Analysis of our large cohort notably lacks associations with successful treatment based on age (although the range was quite narrow), race/ethnicity, education, mental health indicators, and substance use other than alcohol. There were also no significant differences by site. Sites were all affiliated with academic medical centers and were well-resourced with clinic-based support services for youth facing challenges with mental health, substance use, adherence, and other medical and/or socioeconomic needs that could be addressed by case management. Results of this study arguably support the need to provide clinic-based supportive services to YLWH in order to achieve treatment success.

Factors that did remain significantly associated with treatment success included living situation, heavy alcohol use, and incarceration history. Living situations that include supportive families are likely to be helpful. Stronger case management and enhanced substance use treatment might also support the first two factors. Incarceration, though, needs substantial work. In a comprehensive review article, Wakerman and Rich consider the epidemiology of HIV in US correctional facilities.[24] These authors describe wide state-by-state variations in how HIV is handled in jails and prisons across the US and note that “tremendous variability results in dramatic differences in the provision of care and health outcomes.” YLWH who are incarcerated not as juveniles, but as adults, may be especially vulnerable to the stigma and violence the authors describe when confidentiality is not maintained. Further research among YLWH in jails and prisons is needed in order to optimize care.

The current study’s findings must be interpreted in light of some limitations. First, our findings may not be generalizable beyond the adolescents and young adults who participated in this study and are receiving care at one of the participating ATN sites. Future work needs to be expanded to include YLWH who are not currently in care, who are in care at a non-academic/non-adolescent focused clinic in the US, and YLWH who live outside of the US. Second, some of our data are based upon self-report measures, which may be subject to bias or errors. We used ACASI to minimize this possibility and encouraged participants to

answer questions honestly and carefully. Third, the study was stopped prematurely due to budgetary restrictions so we did not have longer-term longitudinal data as originally planned for a substantial number of participants and this also limited further subgroup analyses such as among those who only initiated ART during the study period. Still, our cohort with a full 12 months of follow-up is large and geographically representative of urban areas across the US. Finally, participant enrollment could have been subject to bias as sites were aware that CoC outcomes would be evaluated and compared across sites. Still, all sites were strongly encouraged to enroll participants regardless of their medication adherence or viral load suppression.

YLWH are a priority population for us to treat, particularly young racial and ethnic minority men who have sex with men in the US. Testing and linkage to care is difficult, and if we only achieve treatment success in a minority of HIV–infected youth then true success cannot be claimed. However, ATN sites have achieved remarkable results while caring for our YLWH. They are to be commended, and also asked to share further insights and best practices that may not have been captured in the assessment of site characteristics done as part of this study. Further studies with this dataset are being done in an attempt to identify key elements of the care and services being provided at these sites. The CoC has been a transformative framework for HIV care. Although we found that youth can achieve VL suppression without meeting the criteria for engagement, engagement was predictive of VL suppression. Ultimately, sustained suppression is more meaningful to achieve long-term health benefit. Our findings suggest that sustained suppression should be added as the final step to the CoC, at least for youth.

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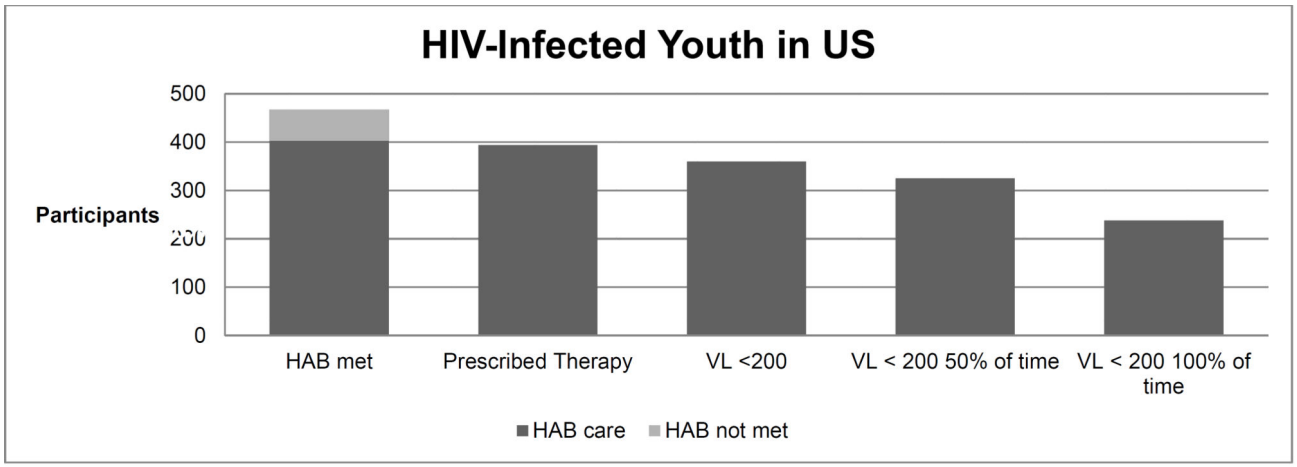


| HAB met among Cohort | Prescribed Therapy among those who met HAB | VL <200 among those who met HAB | VL < 200 50% of time among those who met HAB | VL < 200 100% of time among those who met HAB |
|---|---|---|---|---|
| 86% (403/467) | 98% (394/403) | 89% (360/403) | 81% (325/403) | 59%% (238/403) |

**Figure 1.**
Continuum of Care for HIV-infected Youth at ATN clinic sites

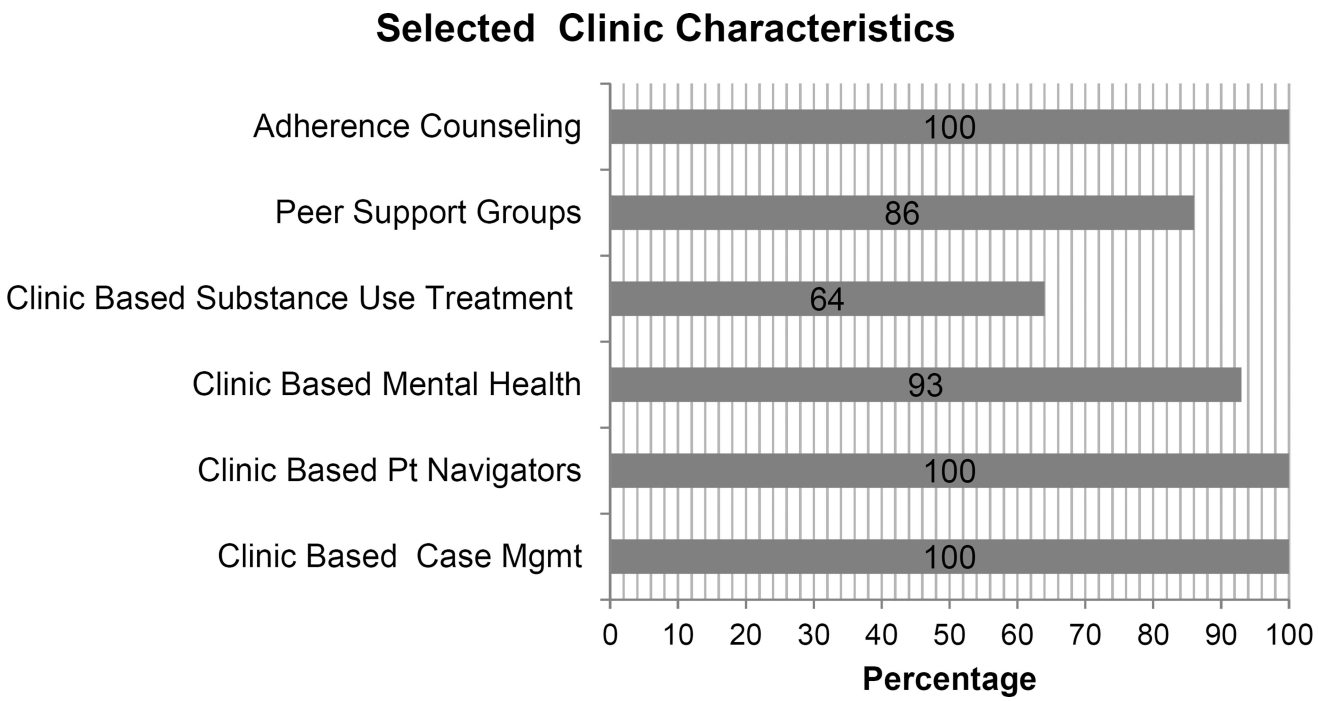


**Figure 2.**
Selected Clinic Characteristics of 14 ATN Sites in the US

## Table 1

Demographic characteristics (N=467)

| Cohort Characteristics | n (%) |
|---|---|
| Age | |
| 16–17 | 14 (3.0%) |
| 18–19 | 59 (12.6%) |
| 20–21 | 125 (26.8%) |
| 22–24 | 268 (57.4%) |
| Gender (at birth) | |
| Male | 371 (79.4%) |
| Female | 96 (20.6%) |
| Gender Identity | |
| Male | 344 (73.7%) |
| Female | 100 (21.4%) |
| Trans female | 16 (3.4%) |
| Gender non-conforming | 3 (0.6%) |
| Other | 4 (0.9%) |
| Race/Ethnicity | |
| Black/non-Hispanic | 330 (70.7%) |
| Hispanic | 81 (17.3%) |
| White/non-Hispanic | 16 (3.4%) |
| Other/non-Hispanic | 34 (7.3%) |
| Did not identify | 6 (1.3%) |
| Education | |
| Less than high school | 85 (18.2%) |
| High school or GED | 208 (44.5%) |
| More than high school | 170 (36.4%) |
| None, no formal schooling | 3 (0.6%) |
| Don’t know/refuse to answer | 1 (0.2%) |
| Employment Status | |
| Employed | 271 (58%) |
| Income (annual) | |
| 0 < $600 | 90 (19.3%) |
| $600–$5,999 | 145 (31.0%) |
| $6,000–$35,999 | 156 (33.4%) |
| >$36,000 | 8 (1.7%) |
| Refuse to answer/don’t know | 68 (14.6%) |
| Living situation (current) | |
| Own house/apartment | 137 (29.3%) |
| Parents’ house/apartment | 199 (42.6%) |

| Cohort Characteristics | n (%) |
|---|---|
| Other family member(s) house/apartment | 50 (10.7%) |
| Non-family member's house/apartment | 43 (9.2%) |
| Other | 37 (7.9%) |
| Refuse to answer | 1 (0.2%) |
| Incarceration History | |
| Ever been in jail/prison? | |
| Yes | 184 (40.0%) |
| **HIV Treatment Factors** | |
| Number of Years Infected with HIV | |
| ≤ 1 year | 134 (28.7%) |
| 1–2 years | 103 (22.1%) |
| 2–4 years | 122 (26.2%) |
| 5 or more | 107 (23.0%) |
| Have you disclosed your HIV status to anyone? | |
| yes | 396 (85.0%) |
| no | 70 (15.0%) |
| **Health Care Appointment Readiness and Ability** | |
| Readiness: I am ready to go to medical appointments | 369 (80.0%) |
| Self-Efficacy: I am very sure that I can keep doctor appointments | 335 (72.0%) |
| **Select Items from Brief Symptom Inventory** | |
| BSI_Somatization | 158 (34.5%) |
| BSI_Depression | 199 (43.1%) |
| BSI_Anxiety | 143 (31.0%) |
| **Select Items from the ASSIST** | |
| How often have you used alcohol in past 3 months | |
| Never | 89 (19.2%) |
| Once or twice per month | 269 (58.0%) |
| Weekly | 91 (19.6%) |
| Almost Daily or Daily | 15 (3.2%) |
| How often have you used marijuana past 3 months | |
| Never | 180 (39.1%) |
| Once or twice per month | 101 (21.9%) |
| Weekly | 38 (8.2%) |
| Almost Daily or Daily | 142 (30.8%) |
| How often used Cocaine, Amphetamines, Inhalants, Sedatives, Hallucinogens, Opiates in past 3 month | |
| Never | 361 (78.0%) |
| Once or twice per month | 87 (18.8%) |
| Weekly | 10 (2.2%) |
| Almost Daily or Daily | 5 (1.1%) |

Missing values: Age 1, Incarceration 2, Number of years HIV+ 1, Disclosed 1, Ready to go to appointments 5, self-efficacy 2, BSI Somatization 9, BSI Depression 5, BSI Anxiety 5, ASSIST alcohol 3, ASSIST marijuana 6, ASSIST other drugs 4.

## Table 2

Factors significantly associated with each step of the CoC for youth*

| Stage of the COC | Significant Factor(s) | AOR | 95% CI | P Value |
|---|---|---|---|---|
| HAB met | Completely Ready to go to Med Appt vs Other | 2.17 | 1.13–4.17 | 0.02 |
| Prescribed Therapy | Gender Male vs Female | 5.85 | 1.04–33.33 | 0.05 |
| | Alcohol 1–2 times per month vs. daily or almost daily | 21.65 | 1.55–302.51 | 0.02 |
| | Alcohol weekly vs. daily or almost daily | 26.63 | 1.18–600.18 | 0.04 |
| *Achieving* VL suppression 50% of the time | No or little Income vs. Income of at least $1000/ month or more | 4.18 | 1.55–11.24 | <0.01 |
| | Very sure can keep medical appointments vs. pretty sure | 2.82 | 1.43–5.56 | <0.01 |
| | Jail ever No vs. Yes | 1.99 | 1.09–3.62 | 0.02 |
| *Achieving* VL Suppression 100% of the time | Live in own house or apartment vs other | 3.42 | 1.27–9.26 | 0.02 |
| | Jail ever No vs. Yes | 2.08 | 1.32–3.28 | < 0.01 |

OR: odds ratio; CI: confidence interval; VL: viral load; HAB: HIV/AIDS Bureau measure

*Separate multivariate logistic regression models were fit for each step of the CoC. Successfully completing the step was the event. Each model included site as a stratification factor. In addition to the variables shown: the “HAB met” model also included confidence about ability to keep a medical appointment; the “Prescribed Therapy” model also included BSI Somatization, BSI Depression, BSI Anxiety, and the BSI general symptoms index; the “Achieving VL suppression 50% of the time” model also included living arrangement, years HIV+, and alcohol use.