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Rates and Correlates of Antiretroviral Therapy Use and Virologic Suppression among Perinatally and Behaviorally Infected HIV+ Youth Linked to Care in the United States

Shoshana Y. Kahana, Ph.D.,

Division of Epidemiology, Services, and Prevention Research, National Institute on Drug Abuse/
National Institutes of Health, Bethesda, Maryland, kahanas@mail.nih.gov

Maria Isabel Fernandez, Ph.D.,

College of Osteopathic Medicine, Nova Southeastern University, Ft. Lauderdale, FL

Patrick A. Wilson, Ph.D.,

Mailman School of Public Health, Columbia University, New York City, NY

Jose A. Bauermeister, Ph.D., MPH,

School of Public Health, University of Michigan, Ann Arbor, MI

Sonia Lee, Ph.D.,

Maternal Pediatric Infectious Disease Branch, Eunice Kennedy Shriver National Institute of Child
Health and Human Development /National, Institutes of Health, Bethesda, Maryland

Craig M. Wilson, MD, and

School of Public Health, University of Alabama at Birmingham, Birmingham, Alabama

Lisa B. Hightow-Weidman, MD, MPH

Division of Infectious Diseases, University of North Carolina at Chapel Hill, Chapel Hill, North
Carolina

Dr. Kahana is the corresponding author for this manuscript.

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Study concept and design: Kahana, Fernandez, P. Wilson, Lee, C. Wilson, Hightow-Weidman

Acquisition of data: Kahana, Fernandez, P. Wilson, Lee, Hightow-Weidman

Analysis and interpretation of data: Kahana, Fernandez, P. Wilson, Bauermeister, Hightow-Weidman

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Abstract

Objective—To measure rates of ART use and virologic suppression among perinatally infected (PIY) and behaviorally infected youth (BIY) linked to care in the United States, and examine the effects of demographic, biomedical, and psychosocial factors on those rates.

Methods—Between 2009–2012, 649 PIY and 1,547 BIY in 20 Adolescent Medicine Trials Network for HIV/AIDS Interventions sites completed cross-sectional surveys via audio computer-assisted self-interviews. Viral load data were collected from chart abstraction or blood draw.

Results—Overall 82.4% of PIY and 49.1% of BIY reported current ART use. Only 37.0% of PIY and 27.1% of BIY were virologically suppressed. Virologic suppression rates did not vary as a function of time since HIV diagnosis in either group. Consistent HIV care and no current substance abuse were significant correlates of ART use among PIY. These variables and non-African American race were some factors associated with virologic suppression for PIY (ORs P s < .05). Among BIY, older age, heterosexuals, employment, and education were significantly related to ART use (ORs P s < .05); suppression was related to ART use >6 months, >90% ART adherence, and consistent HIV care (ORs P s < .05). Nearly 75% ($n = 498$) of non-suppressed youth reported unprotected sex in the past 3 months.

Conclusions—There are continued challenges with successfully treating youth even once diagnosed and linked to HIV care. Strategies targeting barriers to ART access, use and virologic suppression are needed to optimize the impact of the "Treatment as Prevention" paradigm among PIY and BIY.

Introduction

Youth ages 13–24 years accounted for 26% of incident HIV infections in 2010 in the United States (US), with rates of new HIV infections in young people continuing to rise.¹ These trends are largely driven by escalating rates among young men who have sex with men (YMSM), with an estimated 34% increase in HIV incidence for YMSM from 2006–2009. Reducing such disparities is a major focus of the domestic HIV agenda, as reflected in the 2010 National HIV/AIDS Strategy.³ Furthermore, therapeutic advances in antiretroviral therapy (ART) are reducing mortality rates and prolonging survival among perinatal cohorts of HIV-infected youth in the US.^{4,5}

The "HIV Treatment Cascade" identifies stages along a continuum of HIV care services, with the ultimate goal of viral load suppression.^{6,7} Of the estimated 1,148,200 persons living with HIV in 2009 in the US derived from national surveillance data, 81.9% had been diagnosed, 65.8% were linked to care, 36.7% were retained in care, 32.7% were prescribed antiretroviral therapy (ART), and 25.3% had a suppressed viral load (<200 copies/mL).⁵ Approximately 60–80% of clinical cohorts of persons in care achieve viral suppression.^{8,9}

Among HIV+ youth ages 13–24, only 40.5% have received a diagnosis and 30.6% linked to care.⁹ Further, youth living with HIV/AIDS (YLHIV) have consistently been found to have lower rates of viral suppression than older adults and many are not prescribed ART even when medically indicated.^{10,11} In a cohort of HIV-infected young MSM of color, only one-half of the cohort with CD4 counts > 350 cells/mm³ had been prescribed ART.¹² Data from a

large HIV clinical cohort indicated that between 2002–2008 only 69% of behaviorally infected youth (BIY) who met clinical criteria (having at least two CD4 measurements <350 cells/mm³) had initiated ART (compared to 79% of adults).¹⁰ Recent CDC data indicate that African Americans aged 18–24 displayed the lowest level of viral suppression (18.3%) among all groups of individuals in the US.¹³

In order to achieve the potential promise of the “Treatment as Prevention” strategy (i.e., transmission of HIV can be decreased if all infected persons are put on ART—regardless of CD4 count),^{14,15} there is a need to estimate the proportion of youth included in each component of the HIV care cascade and characterize barriers and facilitators to retention at each stage. Although some information regarding the early (e.g. HIV testing) steps of the cascade has been reported for YLHIV,^{16–19} little attention has focused on youth after diagnosis or linkage to care. What has been published for YLHIV has included a literature review based on smaller clinical trials or has focused separately on either BIY or PIY, those recently diagnosed, or with cohorts that do not reflect current treatment standards. Furthermore, little data has looked at time lags between components of the HIV care cascade among youth, such as time since testing positive for HIV and ART initiation, or between ART uptake and virologic suppression.

Given that youth have not achieved full physical or cognitive maturity, linking and engaging HIV-infected youth in care can be challenging.^{20,21} One important barrier to linkage and engagement in care is the dearth of HIV-specialty care specifically geared toward adolescent developmental needs and the lack of seamless transition procedures to adult-based health care.²² YLHIV must navigate traditional adolescent development issues with the added burden of living with a highly stigmatized illness while not yet having fully developed the internal and social resources to deal with these complex and often competing demands.

The distress associated with living with HIV can impede engagement in care and result in high rates of emotional and behavioral problems, including various psychiatric and substance use disorders. Both mental health and substance use are linked to decreased ART adherence^{23–25} as well as with engaging in HIV transmission risk behaviors (e.g., condomless vaginal/anal intercourse with HIV-negative and status-unknown partners), and potentially transmitting HIV to these partners.^{26–30} Some patient characteristics, such as substance use and unstable housing, may elicit concerns among providers about patients’ treatment readiness and may be perceived as significant barriers to initiating youth on ART, despite the landmark results of HPTN 052 and effects of early ART initiation on decreasing HIV infectivity and reducing the likelihood of HIV transmission.^{15, 31–33} Finally, perinatally infected youth (PIY) face additional challenges such as HIV treatment fatigue due to use of ART since birth as well as accumulation of resistance mutations resulting in limited ART options.^{33–34} Thus, factors influencing access, utilization of and response to HIV treatment as well as engagement and retention in care may differ between PIY and BIY who acquired HIV infection as adolescents or young adults.

The primary goal of this paper is to characterize ART use and virologic suppression rates among HIV+ youth who have been diagnosed and linked to care in the US. We present data on ART use and virologic suppression as a function of length of time since HIV diagnosis

and examine demographic, biomedical, and behavioral/ psychosocial correlates of ART use and virologic suppression for PIY and BIY. Given the potential biomedical and psychosocial differences between the PIY and BIY, our goal was not to directly compare them but rather to glean rates and correlates for each in order to inform future intervention development targeted toward improving viral suppression for both groups.

Methods

From December 2009 to June 2012, 2,225 YLHIV linked to care at clinics associated with the Adolescent Medicine Trials Network for HIV/AIDS Interventions (ATN) were recruited to participate in a cross-sectional survey. The 20 clinics were geographically representative of the HIV epidemic in the US and Puerto Rico (see Acknowledgements for cities represented).

To be eligible, youth had to be: 1) between 12 and 26 years of age (inclusive); 2) HIV-infected; 3) aware they were HIV-infected; 4) linked to or receiving care in one of the ATN's clinical sites or affiliates (e.g., had at least one clinic visit during the enrollment period); and 5) able to understand English or Spanish. The study was approved by the Institutional Review Boards at each participating site as well as those from the members of the protocol team.

Research staff approached all youth meeting eligibility criteria during one of their scheduled clinic visits. After a thorough explanation of the study, staff obtained signed informed consent or assent from youth agreeing to participate. Within two weeks of providing consent, participants completed audio-computer assisted self-interviews (ACASI) to assess psychosocial and health factors, which took approximately 45 to 90 minutes. Participants were given a small incentive determined by the sites' IRB as compensation for their time.

Plasma HIV-1 RNA level (VL) and CD4+ T-cell count data (CD4) obtained within the prior six months were abstracted from medical records. The minority ($n = 153$; 7.0%) of participants who did not have VL and CD4 evaluations within six months of the study had blood collected at the baseline visit for these measurements. Because of the variability in type of VL assay used across the study sites (i.e. Bayer/Siemens Versant HIV-1 RNA 3.0 (bDNA), Roche Amplicor® HIV-1 Monitor – Standard/ ultrasensitive, Roche COBAS AmpliPrep/ COBAS® Taqman® HIV-1 Test, v1.0, 2.0, and Abbott RealTime HIV-1 Assay), the corresponding assay cut-off for the lower limit of VL (LLD) was used. A dichotomous variable to designate virologically suppressed (non-detectable) or virologically non-suppressed (detectable) was created. Twenty-nine cases in which the reported viral load did not correspond with the LLD of the reported assay were removed. Sensitivity analyses on cases in which the assay VL LLD was <400 and cases in which the assays were unknown revealed no significant differences in overall rates of detectability and minimized concerns about potential bias in the reported VL measurements.

The psychosocial assessment measured 4 primary domains: 1) substance use; 2) mental health; 3) sexual behavior; and 4) HIV related adherence. Participants reported demographic

information, such as age, birth sex and self-identified gender, race and ethnicity, self-identified sexual orientation, route of infection, employment, and housing status.

The following measures were utilized:

Mental Health

Mental health issues were assessed with the Brief Symptom Inventory (BSI),³⁵ which yields nine primary symptom scales, a global severity index (GSI), and has norms for adolescents, adults and gender. The GSI reflects an overall evaluation of a respondent's psychopathological status.

Substance Use

The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST)³⁶ was used to assess substance use behaviors. The ASSIST is an eight-item questionnaire that assesses the frequency and consequences of substance use. For current use (past three months) any response of 4 (indicating daily or almost daily use) was considered "problematic substance use." The Car, Relax, Alone, Forget, Friends, Trouble (CRAFT)³⁷ questionnaire is a six-item measure designed to assess the consequences of alcohol and/or marijuana use by adolescents and young adults in clinical settings. Scores of ≥ 2 are suggestive of problem substance use, abuse or dependence.

Sexual Behavior and Activity

Utilizing findings from previous research, ATN scientists developed a 38-item questionnaire to assess sexual activity. Participants reported the number of sex partners and the frequency of protected and unprotected oral, vaginal, and anal sexual activity with HIV+ and HIV-/unknown status female and male partners during the past three months.

ART Adherence

Utilizing findings from previous research,³⁸ ATN scientists developed a 25-item questionnaire to assess medication regimen, frequency of dosing and number and type of pills prescribed per day, and number of doses missed in the last 7 days. Adherence was dichotomized as $< 90\%$ and $\geq 90\%$. Adherence to scheduled medical appointments with HIV care provider over the past 12 months was assessed by self-reported number of missed visits. The appointments variable was dichotomized as 1 vs. ≥ 2 missed appointments.

Participants who self reported being on ART and had a current regimen identified during medical chart review were classified as "currently on ART." Those regimens which included drugs taken for differential lengths of time or dosing frequencies (QD vs. BID) were classified by the drug taken for the longest amount of time and the most frequently administered drug. Given that six months on an effective ART regimen should be sufficient to result in virologic suppression, suppression rates were only calculated for those youth on ART who had been taking them for at least 6 months. Regimens were classified as protease inhibitor (PI), non-nucleoside reverse-transcriptase inhibitors (NNRTI), and integrase strand transfer inhibitor-based (ISTI) regimens based on the presence of only one these drug classes as the anchor drug. Regimens that included both PIs, NNRTIs and/ other classes of

drugs, such as Fusion Inhibitors and CCR5 co-receptor antagonists, were classified as “Other.” Finally, youth were classified as “eligible” for ART based on CD4 count ≥ 500 cells/mm³, the threshold at which initiation was uniformly recommended under DHHS treatment guidelines active at the time of this study, as well as the more strict guidelines of CD4 ≥ 350 cells/mm³.^{39,40}

Statistical Plan

All analyses were conducted using PASW/SPSS, version 18.0. Participants were classified as PIY and BIY; 29 cases where mode of transmission was unknown or related to blood transfusion were excluded. Frequencies, means and other measures of central tendencies on demographic, biomedical, and psychosocial/behavioral factors were computed for each group to describe the sample. Demographic factors used in the analysis consisted of birth sex, race, ethnicity, age, sexual orientation, education, employment, and housing status. Youth between 12–17 years were defined as younger, while those 18+ years were defined as older youth. Biomedical factors (other than ART use and length of time since diagnosis) consisted of ART regimen type, length of time on ART regimen, and regimen dosing. Psychosocial factors considered in the analysis included: adherence $\geq 90\%$, minimal missed HIV care appointments (≤ 1) over past year, sexual risk over past 3 months (any unprotected sex; any unprotected sex with serodiscordant/status unknown partner; and total number of sex partners), and problematic and clinically indicative substance use (defined as ≥ 2 on the CRAFFT or ≥ 4 on any substance on the ASSIST), elevated psychological distress (GSI and on the BSI).

The rates of ART use and virologic suppression among the entire sample and each subgroup (BIY and PIY) were calculated as were rates for each subgroup by time since HIV diagnosis. Different categories of length of time since HIV diagnosis were used for BIY and PIY because of the significant differences between the two groups in time since HIV diagnosis.

Bivariate logistic regression analyses were conducted in order to determine the odds ratio (OR) of the demographic, biomedical, and psychosocial/behavioral correlates with 2 separate primary outcomes-ART use and virologic suppression. Because of expected interactions between many of the variables of interest, multivariate logistic regressions for ART use and virologic suppression were conducted with the significant correlates ($P < .10$) from the bivariate analyses for the PIY and BIY groups separately. Race, ethnicity, and gender were controlled for in all multivariate models. Given the sample size of each subgroup, stratifying allowed for examination of how the different factors under study were associated with virologic suppression for PIY and BIY, while also accounting for the biomedical and psychosocial differences between the groups. For brevity, only statistical findings with $P \leq 0.05$ are discussed in the text.

Results

Baseline demographic, biomedical and psychosocial/behavioral characteristics for both PIY ($n = 649$) and BIY ($n = 1547$) groups are presented in Table 1.

ART Use and Virologic Suppression among PIY and BIY

While 82.4% of PIY and 49.1% of BIY were currently taking ART, only 37.0% of PIY and 27.1% of BIY were virologically suppressed (Table 1). Seventy five percent of PIY ($n = 488$) and 33.4% ($n = 517$) of BIY reported taking an ART regimen consecutively for at least the past 6 months (Table 2). Virologic suppression rates among these youth were 45.9% for PIY and 63.6% for BIY. More than half ($n = 504$, 56.3%) of our cohort not on ART had CD4 count ≥ 500 cells/mm³, and just over a quarter ($n = 250$; 27.9%) had CD4 ≥ 350 cells/mm³.

ART Use and Virologic Suppression among PIY and BIY as a Function of Time since HIV Diagnosis

Among PIY, there were significantly greater odds that PIY diagnosed for longer periods of time (≥ 11 years prior) reported taking ART as compared to PIY diagnosed more recently (OR: 1.62 (95% CI: 1.07–2.44), $P = 0.02$). Viral suppression was not related to time since HIV diagnosis (0–5 years, 6–10, 11+; years all ORs P s: *ns*), even when accounting for continuous ART use for ≥ 6 months.

The likelihood of ART use among BIY diagnosed in the past 12 months (OR: 0.30 (95% CI: 0.24–0.37), $P < 0.001$) was lower compared to those with greater time since HIV diagnosis. BIY diagnosed 5 or more years prior to enrollment reported greater likelihood of ART use (OR: 1.53 (95% CI: 1.15–2.20), $P = 0.003$) as compared to youth diagnosed more recently (0–4 years). Rates of virologic suppression did not follow a linear relationship with time since HIV diagnosis among BIY (also when accounting for ART use for ≥ 6 months). BIY diagnosed within the past 2 years displayed greater likelihood of viral suppression as compared to youth diagnosed in the past year (OR: 1.69 (95% CI: 1.09–2.60), $P = 0.02$). Conversely, BIY diagnosed within the past 5 or more years displayed significantly lower likelihood (OR: 0.60 (95% CI: 0.39–0.90), $P = 0.02$) of virologic suppression as compared to youth diagnosed within the past 4 years.

With the exception of those diagnosed within the past 6–12 months, percent viral suppression rates remained between 30–39% across each subsample of youth irrespective of time since diagnosis (Table 2).

Multivariate Correlates of ART Use and Virologic Suppression: PIY

In multivariate analyses, ART use among PIY was significantly associated with consistent appointment keeping (OR: 0.48) and lack of problematic substance use (OR: 0.55; all ORs P s $< .05$; see Table 3). Non-African American racial status (OR: 0.56), younger age (12–17; OR = 0.61), ART use ≥ 6 months (OR: 2.48), ART adherence $\geq 90\%$ (OR: 1.79), not missing more than one HIV care appointment over past year (OR: 0.52) and lack of problematic substance use (OR: 0.60) were all significant correlates of virologic suppression (all ORs P s $< .05$; see Table 3).

Multivariate Correlates of ART use and Virologic Suppression: BIY

Among BIY, youth who were male (OR: 0.54), older (18+ years; OR: 2.55), identified as heterosexual (0.68), employed (OR: 1.29), and more highly educated (OR: 1.55) each were

significantly associated with ART use (all ORs P s < .05; see Table 4). Virologic suppression was significantly associated with greater educational attainment (OR: 1.98), ART use 6 months (OR: 4.65), 90% ART adherence (OR: 1.81), and minimal (1) missed appointments (OR: 0.50; all ORs P s < .05; see Table 4).

Virologic Suppression and Behavioral (Sexual) Risk Behaviors

A significant proportion of youth (30.5%; n = 669) in the sample engaged in unprotected sex over the past 3 months. Two-thirds (74.4%; n = 498) of youth who engaged in unprotected sex had detectable viremia, including 76.1% (n = 509) who reported having unprotected sex with a serodiscordant or serostatus unknown partner in the past three months.

Discussion

To our knowledge, this is the first study to report on ART use and virologic suppression rates among a large national representative sample of both PIY and BIY linked to HIV care at 20 adolescent medicine clinics the US. Several key findings are worth highlighting. Only about 1/3 of youth (37.0% of PIY and 27.1% of BIY) currently linked to care at ATN clinical sites were virally suppressed. Even after accounting for ART use for at least six months, the rates of suppression are unacceptably low (45.9% for PIY and 63.6% for BIY). This is particularly troubling since our sample was linked to, and receiving care at, adolescent medicine clinics specializing in HIV care and did not include the youth unaware of their HIV diagnosis. Furthermore, is also not clear that suppression rates are in any meaningful way a function of length of time since HIV diagnosis among youth in our sample, suggesting continuing psychosocial and likely structural challenges. This highlights the public health imperative to assist youth to access and adhere to ART and ultimately achieve virologic suppression.

Rates of ART use in this sample are consistent with findings from other studies. A majority of PIY in this sample reported current ART use, which concords with increases in ART prescription rates over time (2002–2010) in a cohort of 521 PIY in the US.¹⁹ Less than half of BIY in our sample were currently taking ART, which is consistent with research from a smaller multi-site clinical cohort of 268 BIY (age 18–29) in which 31.3% of youth meeting clinical criteria had not initiated ART.⁸ Depending on the treatment guidelines active at the time of study or currently used (CD4 < 500 cells/mm³ vs. CD4 ≥ 350),^{39,40} 25.7–56.3% of youth in our sample who were eligible for ART were not taking it. Future research needs to ascertain if these youth, particularly BIY, were ever offered or prescribed ART, as well as the reasons they may have rejected ART use, such as financial barriers, stigma associated with HIV and/or ART use, treatment expectancies, etc. It bears mentioning that although the Patient Protection and Affordable Care Act offers great promise for the expansion of health coverage among young adults in particular (i.e., remaining on their parents' insurance through age 26), there are data suggesting that even in universal access to no-cost care, late initiation of ART occurs among up to 40% of HIV+ men and women aged 18 to 29 years in Canada.⁴¹ Thus, the delays in the initiation of ART or barriers to ART use may be beyond purely economic and also reflect a confluence of cultural, psychosocial, social, and structural etiologies that require further delineation.

One additional factor requiring further investigation is the degree to which providers may be hesitant to prescribe ART for those individuals whom they perceive as not being ready to initiate or have refused treatment.^{31,32} Given the risks of resistance mutations associated with ART nonadherence^{42–43}, providers may opt to delay ART until they identify appropriate “treatment readiness” among patients. This potential provider bias or concern of not wanting to prescribe ART to youth they deem potentially non-adherent or less “responsible” and rigorous in their health care behaviors and scheduling demands of ART is partially supported by the findings that consistent appointment keeping, lack of symptomatic substance use, older age, employment, and higher levels of educational attainment were significantly related to ART use among both BIY and PIY. Some initial promising tools to assess treatment readiness among individuals with HIV are being developed.^{44,45} Future research to validate measures of patient readiness for treatment, understand factors related to treatment decisions among providers, and develop provider-focused interventions meant to facilitate youth’s treatment readiness for ART is needed.

There were no racial differences among BIY in our sample with respect to virologic suppression rates, which is consistent with other studies reporting no significant racial or ethnic differences in viral load suppression rates after controlling for ART use.^{7,46} However, African-American PIY in our sample were more likely to be virologically non-suppressed, even after controlling for ART use, which replicates other findings on black race being independently associated with higher likelihood of detectable viremia among PIY¹⁹ and overall racial health disparities with respect to virologic outcomes among African-American youth and younger adults.^{11,47} Length of time since HIV diagnosis is a key difference between PIY and BIY and there may be multi-level or systemic factors leaving African-American PIY with prolonged disease particularly vulnerable to non-suppression. One possibility may be poor suppression rates due to prior inferior prior HIV therapeutics and multiple regimens.⁴⁸ Future research needs to examine this and others potential factors further. Furthermore, the degree to which advances in HIV treatment can potentially reduce racial health disparities requires further examination, as does the identification and dissemination of the core components of HIV service delivery programs that effectively eliminate HIV-related disparities.

Once diagnosed, many youth continue to engage in sexual and drug use behaviors that can contribute to the risk for ongoing transmission and acquisition of other STDs. Consistent with previous studies,^{26–30} a large proportion (30.5%; n = 669) of our sample reported engaging in unprotected sex, including nearly 75% (74.4%; n = 498) of viremic youth who reported having unprotected sex with a serodiscordant or serostatus unknown partner in the past three months. This has clear public health implications for ongoing transmission of HIV and highlights the critical need for secondary HIV prevention and/or risk reduction interventions in combination with increased provision of ART targeting YLHIV. The HIV secondary preventive interventions should target mental health and substance use issues as well given the high prevalence rates for each among YLHIV as well as the fact that they are related to ongoing risk transmission behavior.^{23–28}

Our findings must be interpreted in light of certain limitations. Since our data are cross-sectional, it was not possible to assess causality or longitudinal trajectories of ART use and

virologic suppression rates. In addition, some of our data were derived solely by self-report, such as adherence to ART regimens, which could account for the lower rates of virologic suppression than the self-report data would have predicted. However, the accurateness of self-report, and ACASI specifically, as they relate to the reporting of sexual behavior among youth is more established,^{49–50} limiting some concerns about the relationship between self-reported behavior and relevant clinical outcomes. Moreover, the authors are not aware of any research suggesting differential self-report reporting outcomes for African-American as compared to other racial and ethnic groups, and as such it is likely that the racial differences seen in the study represent a finding that is not explained solely by self-report methodology. Future research should incorporate multi-informant reporting (i.e., patient, caregiver/parent, physician, and objective measurement, such as electronic monitoring) to more comprehensively and accurately assess participant behavior. Further, the majority (93%) of the virologic suppression data were not collected at the same time as the ACASI interview (although always within 6 month period) which could also have led to somewhat higher rates of detectable viral load among those recently diagnosed and not yet given ART. Finally, the authors did not obtain data on caregiver serostatus or role in HIV care and we relied on “time since diagnosis” as the only available proxy for engagement in care

Our findings highlight the continued challenges of successfully treating youth even once they are linked to HIV medical care. Focused strategies that target multiple barriers to ART access, uptake, use, and ultimately the achievement of virologic suppression are needed in order to fully optimize the potential impact of the “Treatment as Prevention” paradigm among PIY and BIY.

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References

1. CDC. Vital signs---HIV testing, infection and risk behaviors among youth--United States. MMWR. 2012; 61:971. [PubMed: 23190571]
2. Prejean J, Song R, Hernandez A, et al. Estimated HIV Incidence in the United States, 2006–2009. PLoS One. 2011; 6:e17502. [PubMed: 21826193]
3. National HIV/AIDS Strategy for the United States. [accessed July 14, 2010] 2010 Jul. Available at: <http://www.whitehouse.gov/administration/eop/nap/nhas>
4. Kapogiannis BG, Soe MM, Nesheim SR, et al. Mortality trends in the US Perinatal AIDS Collaborative Transmission Study (1986–2004). Clin Infect Dis. 2011; 53:1024–1034. [PubMed: 22002982]
5. Brady MT, Oleske JM, Williams PL, et al. Declines in mortality rates and changes in causes of death in HIV-1-infected children during the HAART era. J Acquir Immune Defic Syndr. 2010; 53:86–94. [PubMed: 20035164]
6. Gardner EM, McLees MP, Steiner JF, et al. The spectrum of engagement in HIV care and its relevance to test-and-treat strategies for prevention of HIV infection. Clin Infect Dis. 2011; 52:793–800. [PubMed: 21367734]
7. Hall HI, Frazier EL, Rhodes P, et al. Differences in human immunodeficiency virus care and treatment among subpopulations in the United States. JAMA Internal Medicine. 2013; 173:1337–1344. [PubMed: 23780395]
8. Marks G, Gardner LI, Craw J, et al. The spectrum of engagement in HIV care: do more than 19% of HIV-infected persons in the US have undetectable viral load? Clin Infect Dis. 2011; 53:1168–1169. Author's reply 9–70. [PubMed: 21976466]
9. Dombrowski JC, Kitahata MM, Van Rumpae SE, et al. High levels of antiretroviral use and viral suppression among persons in HIV care in the United States, 2010. J Acquir Immune Defic Syndr. 2013; 63:299–306. [PubMed: 23572013]
10. Agwu AL, Fleishman JA, Korthuis PT, et al. Disparities in antiretroviral treatment: a comparison of behaviorally HIV-infected youth and adults in the HIV Research Network. J Acquir Immune Defic Syndr. 2011; 58:100–107. [PubMed: 21637114]
11. Althoff KN, Rebeiro P, Brooks JT, et al. Disparities in the quality of HIV care when using US Department of Health and Human Services Indicators. Clin Infect Dis. 2014 Jan 23. [Epub ahead of print].
12. Hightow-Weidman LB, Jones K, Phillips G, et al. for The YMSM of Color SPNS Initiative Study Group. Baseline clinical characteristics, antiretroviral therapy use, viral load suppression among HIV-Positive young men of color who have sex with men. AIDS Patient Care STDS. 2011; 25:S9–S14. [PubMed: 21711145]
13. Whiteside YO, Cohen SM, Bradley H, et al. Progress along the continuum of HIV care among blacks with diagnosed HIV-United States, 2010. MMWR Morb Mortal Wkly Rep. 2014; 63:85–89. [PubMed: 24500286]
14. Montaner JS, Lima VD, Barrios R, et al. Association of highly active antiretroviral therapy coverage, population viral load, and yearly new HIV diagnoses in British Columbia, Canada: a population-based study. Lancet. 2010; 376:532–539. [PubMed: 20638713]
15. Cohen MS, Chen YQ, McCauley M, et al. Prevention of HIV-1 infection with early antiretroviral therapy. N. Engl. J. Med. 2011; 365:493–505. [PubMed: 21767103]

16. Zandoni BC, Mayer KH. The adolescent and young adult HIV cascade of care in the United States: exaggerated health disparities. *AIDS Patient Care STDS*. 2014; 28(3):128–135. [PubMed: 24601734]
17. Ellen JM, Kapogiannis B, Fortenberry JD, et al. HIV viral load levels and CD4 cell counts of youth in 14 US cities. *AIDS*. 2014 Epub.
18. Agwu AL, Neptune A, Voss C, et al. CD4 counts of nonperinatally HIV-infected youth and young adults presenting for HIV care between 2002–2010. *JAMA Ped*. 2014 Epub.
19. Agwu AL, Fleishman JA, Rutstein R, Korthuis PT, Gebo KA. Changes in advanced immunosuppression and detectable HIV viremia among perinatally HIV-Infected youth in the multisite United States HIV Research Network. *Journal of the Pediatric Infectious Diseases Society*. 2013; 2:215–223.
20. Fortenberry JD, Martinez J, Rudy BJ, Monte D. Linkage to care for HIV-positive adolescents: a multisite study of the adolescent medicine trials units of the adolescent trials network. *J Adolesc Health*. 2012; 51:551–556. [PubMed: 23174464]
21. Philbin MM, Tanner A, Duval A, et al. Linking HIV-positive adolescents to care in 15 different clinics across the United States: creating solutions to address structural barriers for linkage to care. *AIDS and Behavior*. 2013 [Epub ahead of print].
22. Committee on Pediatric AIDS. Transitioning HIV-Infected youth into adult health care. *Pediatrics*. 2013; 132:192–197. [PubMed: 23796739]
23. Hosek SG, Harper GW, Domanico R. Psychological predictors of medication adherence among HIV-infected youth. *Psychology, Health and Medicine*. 2005; 10:166–179.
24. Gonzalez JS, Batchelder AW, et al. Depression and HIV/AIDS treatment nonadherence: a review and meta-analysis. *J Acquir Immune Defic Syndr*. 2011; 58:181–187. [PubMed: 21857529]
25. Mellins CA, Malee KM. Understanding the mental health of youth living with perinatal HIV infection: lessons learned and current challenges. *Journal of the International AIDS Society*. 2013; 16:1–19. [PubMed: 24008177]
26. Mellins CA, Tassiopoulos K, Malee K, et al. Behavioral health risks in perinatally HIV-exposed youth: co-occurrence of sexual and drug use behavior, mental health problems, and nonadherence to antiretroviral treatment. *AIDS Patient Care STDS*. 2011; 25:413–422. [PubMed: 21992620]
27. Setse RW, Siberry GK, Gravitt PE, et al. Correlates of sexual activity and sexually transmitted infections among human immunodeficiency virus-infected youth in the LEGACY cohort, United States, 2006. *The Pediatric Infectious Disease Journal*. 2011; 30:967–973. [PubMed: 22001904]
28. Mayer KH, O'Leary C, Skeer M, et al. Which HIV-infected men who have sex with men in care are engaging in risky sex and acquiring sexually transmitted infections: findings from a Boston community health centre. *Sex Transm Infect*. 2010; 86:66–70. [PubMed: 19720603]
29. Ezeanolue EE, Wodi AP, Patel R, et al. Sexual behaviors and procreational intentions of adolescents and young adults with perinatally acquired human immunodeficiency virus infection: experience of an urban tertiary center. *J Adolesc Health*. 2006; 38:719–725. [PubMed: 16730601]
30. Bruce D, Kahana SY, Harper GW, et al. Alcohol use predicts sexual risk behavior with HIV-negative or partners of unknown status among young HIV-positive men who have sex with men. *AIDS Care*. 2013; 25:559–565. [PubMed: 22971018]
31. Gagliardo C, Murray M, Saiman L, et al. Initiation of antiretroviral therapy in youth with HIV: a U.S.-based provider survey. *AIDS Patient Care STDS*. 2013; 27:498–502. [PubMed: 23937549]
32. Lee L, Rand CS, Ellen JM, et al. Factors informing HIV providers' decisions to start antiretroviral therapy for young people living with behaviorally acquired HIV. *J Adolesc Health*. 2014 Apr 29. [Epub ahead of print].
33. Mofenson LM, Cotton MF. The challenges of success: adolescents with perinatal HIV infection. *Journal of the International AIDS Society*. 2013; 16:18650. [PubMed: 23782484]
34. Hazra R, Siberry GK, Mofenson LM. Growing up with HIV: children, adolescents, and young adults with perinatally acquired HIV infection. *Annual Review of Medicine*. 2010; 61:169–185.
35. Derogatis, L.; Spencer, M. *The Brief Symptom Inventory (BSI): Administration, scoring, and procedures manual-1*. Baltimore: Johns Hopkins University School of Medicine, Clinical Psychometrics Research Unit; 1982.

36. WHO ASSIST Working Group. The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST): Development, reliability and feasibility. *Addiction*. 2002; 97:1183–1194. Available at http://www.who.int/substance_abuse/activities/assist/en/index.html. [PubMed: 12199834]
37. Knight JR, Sherritt L, Shrier L, et al. Validity of the CRAFFT substance abuse screening test among adolescent clinic patients. *Archives of Pediatrics & Adolescent Medicine*. 2002; 156:607–614. [PubMed: 12038895]
38. Davies G, Koenig LJ, Stratford D, et al. Overview and implementation of an intervention to prevent adherence failure among HIV-infected adults initiating antiretroviral therapy: lessons learned from Project HEART. *AIDS Care*. 2006; 18:895–903. [PubMed: 17012078]
39. 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. 2009 Dec 1.:1–161.
40. Lundgren JD, Wood R. universal antiretroviral therapy for HIV infection? *Clin Infect Dis*. 2013; 57:888–890. [PubMed: 23759346]
41. Palmer AK, Cescon A, Chan K, et al. Factors associated with late initiation of highly active antiretroviral therapy among young HIV-positive men and women aged 18 to 29 years in Canada. *J Int Assoc Provid AIDS Care*. 2014; 13:56–62. [PubMed: 24309754]
42. Bangsberg DR, Moss AR, Deeks SG. Paradoxes of adherence and drug resistance to HIV antiretroviral therapy. *J Antimicrob Chemother*. 2004; 53:696–699. [PubMed: 15044425]
43. Wainberg MA, Friedland G. Public health implications of antiretroviral therapy and HIV drug resistance. *JAMA*. 1998; 279:1977–1983. [PubMed: 9643862]
44. Enriquez M, Gore PA Jr, O'Connor MC, et al. Assessment of readiness for adherence by HIV-positive males who had previously failed treatment. *J Assoc Nurses AIDS Care*. 2004; 15:42–49. [PubMed: 14983560]
45. Fernandez MI, Hosek S, Warren JC, et al. Development of an easy to use tool to assess HIV treatment readiness in adolescent clinical care settings. *AIDS Care*. 2011; 23:1492–1499. [PubMed: 22022853]
46. Hanna DB, Buchacz K, Gebo KA, et al. Trends and disparities in antiretroviral therapy initiation and virologic suppression among newly treatment-eligible HIV-infected individuals in North America, 2001–2009. *Clin Infect Dis*. 2013; 56:1174–1182. [PubMed: 23315317]
47. Ryscavage P, Anderson EJ, Sutton SH, Reddy S, Taiwo B. Clinical outcomes of adolescents and young adults in adult HIV care. *J Acquir Immune Defic Syndr*. 2011; 58:193–197. [PubMed: 21826014]
48. Van Dyke RB, Patel K, Siberry GK, et al. Antiretroviral treatment of US children with perinatally acquired HIV infection: temporal changes in therapy between 1991 and 2009 and predictors of immunologic and virologic outcomes. *J Acquir Immune Defic Syndr*. 2011; 57:165–173. [PubMed: 21407086]
49. Dolezal C, Dolezal C, Marhefka SL, Santamaria EK, et al. A comparison of audio computer-assisted self-interviews to face-to-face interviews of sexual behavior among perinatally HIV-exposed youth. *Arch Sex Behav*. 2012 Apr; 41(2):401–410. [PubMed: 21604065]
50. Vanable PA, Carey MP, Brown JL, et al. Test-retest reliability of self-reported HIV/STD-related measures among African-American adolescents in four U.S. cities. *J Adolesc Health*. 2009 Mar; 44(3):214–221. [PubMed: 19237106]

Table 1

Demographic, Biomedical, and Psychosocial Characteristics of Perinatally and Behaviorally Infected HIV+ Youth (n=2196)

	Perinatal Infected (n = 649) No. (%) or Mean $\pm$ SD	Behavioral Infected (n =1547) No. (%) or Mean $\pm$ SD
Age, y	17.89 $\pm$ 2.9	21.18 $\pm$ 2.1
Sex, Gender*		
Males	288 (44.4)	1175 (76.0)
Females	356 (54.9)	368 (23.8)
Transgender	2 (0.3)	54 (3.5)
No answer/Missing	5 (.8)	4 (.3)
Race		
African American on Hispanic	425 (65.5)	1043 (67.4)
White	81 (12.5)	191 (12.3)
Mixed	71 (10.9)	173 (11.3)
Asian/Other	53 (8.2)	131 (8.5)
No answer/missing data	19 (2.9)	9 (0.6)
Latino/Hispanic Ethnicity	127 (19.6)	304 (19.7)
Sexual Orientation		
Heterosexual	568 (87.5)	417 (27.0)
Gay/Lesbian	27 (4.2)	837 (54.1)
Bisexual	43 (6.6)	225 (14.5)
Questioning/Queer/Other	5 (0.8)	58 (3.8)
No answer/missing data	6 (0.9)	10 (0.6)
Highest Level of Education		
No High School Completion	331 (51.0)	422 (27.3)
High School Graduate/GED	195 (30.0)	562 (36.3)
Some College/College or Technical School Graduate	101 (15.6)	554 (35.8)
No answer (missing data)	22 (3.4)	9 (0.6)
Currently Employed	128 (19.7)	596 (38.5)
Stably Housed	615 (94.8)	1441(93.1)
Length of Time since HIV Diagnosis (Days)	4133.29 $\pm$ 2079.0	737.93 $\pm$ 715.8
0–12 mos.	28 (4.3)	621 (40.1)
13–24 mos.	23 (3.5)	304 (19.7)
25+ mos.	598 (92.1)	622 (40.2)
CD4 Cell Count (Range)	540.84 $\pm$ 337.3 (1–2320)	503.26 $\pm$ 241.0 (4–1670)
VL		
Suppressed (Undetectable)	240 (37.0)	420 (27.1)
Nonsuppressed (Detectable)	390 (60.1)	1105 (71.4)
Missing	19 (2.9)	22 (1.4)
Current ART Use	535 (82.4)	759 (49.1)
ART for 6 months	488 (75.2)	517 (33.4)

	Perinatal Infected (n = 649) No. (%) or Mean $\pm$ SD	Behavioral Infected (n =1547) No. (%) or Mean $\pm$ SD
Type of Regimen (ART)		
PI	305 (57.0)	384 (50.6)
NNRTI	100 (18.7)	338 (44.5)
Integrase	3 (0.56)	22 (2.9)
Other **	127 (23.7)	15 (2.0)
Adherence to ART (last 7 days)	85.19 $\pm$ 23.4	87.5 (23.0)
% 90 Adherence	310 (57.9)	477 (62.9)
Missed # of HIV Care Appts. over past 12 months (M, SD)	1.47 $\pm$ 3.8	1.70 $\pm$ 3.0
Sex Risk		
Any unprotected sex	90 (13.9)	579 (37.4)
Any unprotected sex with serodiscordant/status unknown partner	77 (11.9)	405 (26.2)
Total number of sex partners in past 3 mos. (2)	123 (19.0)	803 (51.9)
ASSIST Current (4 on any substance)	105 (16.2)	661 (42.7)
CRAFFT (2 as clinically significant)	231 (35.6)	973 (62.9)
Global Severity Index (clinically indicative) on BSI***	142 (21.9)	804 (52.0)

Note: VL = viral load; ART = antiretroviral therapy; PI = protease inhibitor; NNRTI = non-nucleoside reverse-transcriptase inhibitors; Integrase = integrase strand transfer inhibitor-based regimens; ASSIST= The Alcohol, Smoking and Substance Involvement Screening Test; *CRAFFT*=Car, Relax, Alone, Forget, Friends, Trouble (keywords in a screening questionnaire to identify at-risk teen substance abusers; BSI = *Brief Symptom Inventory*).

* In Table 1, the male, female, and transgender variable is defined by the gender that individuals currently endorse for themselves.

** Regimens that included both PIs, NNRTIs and other classes of drugs, such as Fusion Inhibitors and CCR5 co-receptor antagonists, were classified as "Other."

*** = Clinically indicative: males 19, GSI 1.71; females 19, GSI 1.59; males 20, GSI 0.58; females 20, GSI 0.78)

Table 2
Antiretroviral Therapy Use and Suppression Rates by Time Since HIV Diagnosis for HIV+ Youth Linked to Care

	<i>Entire</i>		<i>Sample</i>		<i>On ART for 6 months</i>		
	On ART- no. (%)	VL Suppressed -no. (%)	Total - no. (%)	Adherence no. (%)	90% no. (%)	VL Suppressed- no. (%)	
<i>Perinatally Infected</i>							
Diagnosed with HIV in past 0–60 mos. (0–5 yrs.) (n = 115)	93 (80.9)	39 (33.9)	83 (72.2)	51 (61.5)		36 (43.4)	
Diagnosed with HIV in past 61–120 mos. (6–10 yrs.) (n = 140)	107 (76.4)	48 (34.3)	98 (70.0)	55 (56.1)		42 (42.9)	
Diagnosed with HIV in past 121 mos. (11 yrs.) (n = 394)	335 (85.0)	153 (38.8)	307 (77.9)	170 (43.2)		146 (43.2)	
<i>Behaviorally Infected</i>							
Diagnosed with HIV in past 0–12 mos. (0–1 yr.) (n = 621)	197 (31.7)	84 (13.5)	63 (10.1)	38 (60.3)		39 (61.9)	
Diagnosed with HIV in past 13–24 mos. (2 yrs.) (n = 304)	172 (56.6)	115 (37.8)	135 (44.4)	85 (63.0)		98 (72.6)	
Diagnosed with HIV in past 25–48 mos. (3–4 yrs.) (n = 391)	256 (65.5)	153 (39.1)	205 (52.4)	114 (55.6)		131 (63.9)	
Diagnosed with HIV in past 49 months (5 yrs.) (n = 231)	134 (58.0)	68 (29.4)	114 (49.4)	59(51.75)		61 (53.5)	

Note: ART = antiretroviral therapy; VL = viral load; yrs=years; no.= number.

Table 3

Multivariate Analyses of Current ART Use and Virologic Suppression among Perinatally Infected Sample (n=649)

Variable	Odds Ratio	95% Confidence Interval	p value
<i>ART Use</i>			
Birth Sex (male vs. female)	.87	.55–1.36	.530
Race (other vs. African-American)	.66	.36–1.20	.169
Ethnicity (other vs. Latino)	1.05	.51–2.15	.897
Age (12–17 vs. 18+ years)	.66	.41–1.06	.085
Missed Appt. (1 vs. 2+)	.48	.30–.76	.002
ASSIST Current (4 on any substance) (no/yes)	.55	.32–.95	.033
<i>VL Suppression</i>			
Birth Sex (male vs. female)	1.04	.69–1.58	.852
Race (other vs. African-American)	.56	.34–.95	.030
Ethnicity (other vs. Latino)	.64	.35–1.16	.141
Age (12–17 vs. 18+ years)	.61	.40–.92	.018
Sexual Orientation (heterosexual vs. gay/bisexual/other)	.52	.26–1.05	.068
PI Regimen vs. All	.67	.41–1.10	.112
NNRTI Regimen vs. All	1.81	.98–3.36	.058
ART 6 months (no/yes)	2.48	1.09–5.63	.030
Missed Appt. (1 vs. 2+)	.52	.32–.87	.012
ART Adherence 90% (no/yes)	1.79	1.17–2.72	.007
CRAFFT (2 as clinically significant) (no/yes)	.60	.38–.95	.030

Note: ART = antiretroviral therapy; VL = viral load; PI = protease inhibitor; NNRTI = non-nucleoside reverse-transcriptase inhibitors; CRAFFT=Car, Relax, Alone, Forget, Friends, Trouble (keywords in a screening questionnaire to identify at-risk teen substance abusers; BSI = *Brief Symptom Inventory*).

* For the purposes of these multivariate analyses, the authors used “Birth Sex” (male or female). Authors didn’t run transgender as a separate correlate simply because the numbers were very low and thus would have been difficult with such small numbers to find any meaningful differences.

** = Clinically indicative: males 19, GSI 1.71; females 19, GSI 1.59; males 20, GSI 0.58; females 20, GSI 0.78).

$p < .05$ bolded.

Table 4

Multivariate Analyses of Current ART Use and Virologic Suppression among Behaviorally Infected Sample (n = 1547)

Variable	Odds Ratio	95% Confidence Interval	p value
<i>ART Use</i>			
Birth Sex (male vs. female)	.54	.38–.77	.001
Race (other vs. African-American)	1.15	.88–1.49	.311
Ethnicity (other vs. Latino)	1.12	.82–1.52	.481
Age (12–17 vs. 18+ years)	2.55	1.44–4.51	.001
Sexual Orientation (heterosexual vs. gay/bisexual/other)	.68	.49–.95	.023
Completed High School (no/yes)	1.55	1.20–1.99	.001
Employment (none vs. part/full time)	1.29	1.04–1.61	.021
<i>VL Suppression</i>			
Birth Sex (male vs. female)	.93	.60–1.44	.750
Race (other vs. African-American)	1.03	.67–1.59	.894
Ethnicity (other vs. Latino)	1.35	.81–2.24	.245
Completed High School (no/yes)	1.98	1.29–3.02	.002
ART 6 months (no/yes)	4.65	3.17–6.81	.001
Missed Appt. (1 vs. 2+)	.50	.35–.72	.001
ART Adherence 90% (no/yes)	1.81	1.27–2.58	.001

Note: ART = antiretroviral therapy; VL = viral load

p < .05 bolded.