Published in final edited form as:

Pediatr Infect Dis J. 2018 July ; 37(7): 673–677. doi:10.1097/INF.0000000000001866.

Psychiatric Disorders, Antiretroviral Medication Adherence, and Viremia in a Cohort of Perinatally HIV-Infected Adolescents and Young Adults

Amelia Bucek, MPH¹, Cheng-Shiun Leu, PhD¹, Stephanie Benson, BA¹, Patricia Warne, PhD¹, Elaine J. Abrams, MD², Katherine S. Elkington, PhD¹, Curtis Dolezal, PhD¹, Andrew Wiznia, MD³, and Claude Ann Mellins, PhD¹

¹HIV Center for Clinical and Behavioral Studies, New York State Psychiatric Institute and Columbia University

²ICAP, Columbia University Mailman School of Public Health

³Jacobi Medical Center, Albert Einstein College of Medicine

Abstract

Background—Perinatally HIV-infected (PHIV+) adolescents and young adults (AYA) are at risk for sub-optimal antiretroviral therapy (ART) adherence, and mental health and substance use problems that, in HIV-infected adults, predict non-adherence. Studies on the relationship between psychiatric and substance use disorders (SUD) and adherence among PHIV+ AYA are limited, but may be important to informing evidence-based interventions to promote adherence.

Methods—Data were analyzed from three annual follow-up interviews (FU2–4, N=179) in a longitudinal study of PHIV+ AYA. Psychiatric disorders (anxiety, disruptive behavior, mood, SUD) were assessed with the Diagnostic Interview Schedule for Children. Adherence was self-reported missed ART doses within the past week. Viral load (VL) results were abstracted from medical charts. Multiple logistic regression analyzed cross-sectional associations between psychiatric disorders and 1) missed ART dose and 2) VL >1,000 copies/ml. Multiple linear regression assessed associations between psychiatric disorders and proportion of VL values >1,000 copies/ml over time.

Results—At FU2 53% of PHIV+ AYA had any psychiatric disorder, 35% missed an ART dose in the past week, and 47% had a VL >1,000 copies/ml. At FU2, behavioral disorders were associated with missed dose ($p=.009$) and VL >1000 ($p=.019$), and mood disorders were associated with missed dose ($p=.041$). At FU4, behavioral disorders were associated with missed dose ($p=.009$). Behavioral disorders ($p=.041$), SUD ($p=.016$), and any disorder ($p=.008$) at FU2 were associated with higher proportion of VLs >1000 across FU2–4.

Corresponding author: Amelia Bucek, MPH, New York State Psychiatric Institute, 1051 Riverside Drive, Unit 15, New York, NY 10032, (p) 646-774-6906, (f) 646-774-6986, bucekam@nyspi.columbia.edu.

Conflicts of Interest:

The authors have no conflicts of interest to report.

Conclusions—Addressing psychiatric disorder and SUD among PHIV+ AYA may improve ART adherence outcomes in this population. Targeted interventions should be developed and tested.

Keywords

perinatal-HIV; adherence; psychiatric disorder; youth

Introduction

Although global access to antiretroviral treatment (ART) has increased, adherence remains a significant barrier to actualizing the full potential of treatment. ART adherence is necessary to suppress viral replication, prevent drug resistance, limit opportunistic infections, and improve HIV health outcomes.^{1,2} Moreover, viral suppression achieved through ART adherence is critical in preventing further transmission of HIV.³ Adolescence and young adulthood are developmental stages associated with sub-optimal medication adherence across chronic illnesses,^{4–6} and HIV is no exception.^{7,8} A recent review found that only 62% of HIV+ adolescents and young adults (AYA) globally are adherent to ART.⁹ Given that the number of HIV+ AYA is increasing around the world due to new infections and the aging of perinatally HIV-infected (PHIV+) children, it is a critical time to intervene.¹⁰

Among HIV+ AYA, PHIV+ individuals are at particular risk for suboptimal adherence¹¹ as well as mental health and substance use problems,^{12,13} which are among the strongest predictors of ART non-adherence in adults.^{14–17} In particular, studies show that PHIV+ AYA have rates of psychiatric disorders as high as 61%¹⁸ and use substances at rates similar to their uninfected peers.¹⁹ Given these risks and the life transitions associated with adolescence and young adulthood, ART adherence can be a critical challenge for PHIV+ AYA. Despite these risks, few studies have examined the association of mental health with adherence in this population, with mixed results. Some research suggests that mental health, substance use, and behavioral problems co-occur with ART non-adherence, however they were limited by cross-sectional design.^{20–22} One longitudinal study found no significant association between history of psychiatric diagnosis and history of ART adherence problems among PHIV+ AYA,²³ but mental health data were not standardized, and diagnoses may have been provided by non-mental health clinicians. Moreover, most studies on mental health and adherence in HIV+ AYA have relied on symptom questionnaires that do not examine actual psychiatric disorder, nor categories of disorder,^{24,20,21} which are crucial for developing targeted evidence-based interventions. One exception is Kacanek et al.,²⁵ who found an association between mood and behavior disorder and lower adherence, but inclusion criteria limited analysis to those who were adherent at study entry and included children and adolescents only, not young adults.

Although there is limited evidence on the association between mental health and substance use disorders (SUD) and ART adherence problems among PHIV+ AYA, an association – particularly with mood and SUD– has been demonstrated in adults and behaviorally HIV-infected AYA.^{26–28,15} This literature has led to the creation of targeted evidence-based interventions to address co-occurring ART adherence and depression problems^{29,30} and

adherence and substance use problems.³¹ Given the millions of youths growing up with HIV around the world, it is important to identify the factors contributing to ART non-adherence for PHIV+ AYA so that effective interventions can be developed.

This study examines the associations of specific categories of psychiatric disorders, including substance use, with ART adherence over three time points among PHIV+ AYA. Using a highly validated psychiatric diagnostic interview, we document the association of anxiety, mood, behavior, and SUD with both adherence and a biomarker of HIV-related health (viremia).

Materials and Methods

Participants and Procedures

The Child and Adolescent Self-Awareness and Health study (CASA) is an ongoing longitudinal cohort study of PHIV+ youth and perinatally HIV-exposed but uninfected youth and their caregivers. Youth-caregiver dyads were recruited from 2003–2008 from medical centers in New York City. Inclusion criteria at baseline were youth aged 9–16 with perinatal exposure to HIV; cognitive capacity to complete the interview (excluding youth with severe mental deficiency, autism, or psychosis); English- or Spanish-speaking; and caregiver with legal capacity to sign consent for youth participation. All youth provided assent. These analyses focus on PHIV+ youth only. Of the 206 enrolled PHIV+ youth/caregiver dyads, 196 completed the baseline interview and 164 caregiver-youth dyads completed a follow-up (FU1) interview approximately 18 months later.

CASA obtained additional funding to continue following the cohort (CASA2) and investigate the impact of HIV on youth as they moved through adolescence into young adulthood. Three annual follow-up assessments (FU2, FU3, and FU4) were added. All participants from the initial CASA were eligible to participate if they met the following criteria: youth was ≥13 years and at least 12 months had elapsed since last follow up. A total of 179 PHIV+ AYA completed FU2; 148 completed FU3, and 146 completed FU4.

Interviews were administered by trained bachelor- and masters-level research assistants at the participant's home, medical center, or CASA offices. Caregivers were interviewed separately (usually concurrently with the youth). Caregivers and AYA ≥18 years gave written informed consent. Youth <18 gave written assent and caregivers provided written informed permission for youth participation. Participants were compensated for time and travel expenses.

Data sources for these analyses include PHIV+ AYA and caregiver interviews from FU2, FU3, and FU4, and PHIV+ AYA medical chart data, including viral load, obtained directly to correspond with interview dates.

Measures

Demographics—Demographic variables include AYA age (measured continuously), sex (female vs. male), race (African-American/Black vs. other race), and per capita household income (measured continuously). Caregiver type (biological parent vs. other) provides

information on family context. Two variables describe the cognitive ability of the participants: history of special education enrollment (yes vs. no) and the Peabody Picture Vocabulary Test (PPVT-III) standard score (measured continuously), a valid measure used to assess receptive language and vocabulary acquisition.³²

Psychiatric disorder—Psychiatric functioning of AYA was assessed with the Diagnostic Interview Schedule for Children (DISC-IV) child and young adult versions. This structured diagnostic instrument asks participants about symptoms experienced in the past year of the most common psychiatric diagnoses as defined by the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders system.³³ Diagnoses included: anxiety disorders (social phobia, separation anxiety disorder, specific phobia, panic disorder, agoraphobia, generalized anxiety disorder, obsessive-compulsive disorder), mood disorders (major depression, dysthymic disorder, mania, hypomania), disruptive behavior disorders (attention deficit hyperactivity disorder, oppositional defiant disorder, conduct disorder), and substance use disorders (alcohol, marijuana, other substance use disorder). AYA met criteria for a disorder if they screened positive on the DISC-IV, through self-report and/or caregiver report. The DISC-IV can assign multiple concurrent diagnoses if participants meet diagnostic criteria for more than one diagnosis. Study variables included *any mood disorder*, *any anxiety disorder*, *any disruptive behavior disorder*, and *any substance abuse disorder*, as well as summary variables of *any psychiatric disorder* (including any of the above categories) and *any psychiatric disorder excluding substance use* (includes *anxiety*, *mood*, or *disruptive behavior disorders* only). The DISC-IV was administered at FU2 and FU4 only.

Adherence—To measure adherence in youth on ART, we used a single, validated self-report item.³⁴ Both AYA and caregivers reported on the last time the youth missed an ART dose (within the past week, 1 month ago, 2–3 months ago, >3 months ago, and never). Responses were dichotomized as missed dose within the past week vs. more than a week ago or never. Prior research using this item with a similar population³⁵ found a significant association between missed dose in the past week and detectable viral load, validating this cut-off. If either AYA or caregiver reported a missed dose within the past week, it was considered a missed ART dose.

HIV RNA viral load—Viral load (VL) data were obtained from participants' medical charts. At each follow-up interview, the three VL results closest to the interview date were abstracted, so that a maximum of nine VL results were obtained for each participant. VL values were dichotomized as ≤1,000 copies/ml vs. >1,000 copies/ml. For cross-sectional analyses, the VL value from the test occurring closest to but within 90 days of the interview date was selected. For longitudinal analyses, a continuous proportion variable was calculated from the number of VL values collected during the study period, with values >1,000 copies/ml divided by the total number of values abstracted (maximum of nine per participant). All participants with VL data within the study timeframe were included in the analyses. VL was assessed as a biomarker of HIV-related health.

Data Analysis

All analyses were conducted using IBM SPSS Statistics for Windows, Version 23.0. Descriptive statistics provide an overview of all study variables. Multiple logistic regression was used for cross-sectional analysis at both FU2 and FU4 of the association between the six psychiatric disorder variables and 1) report of missed ART dose within the past week and 2) closest VL >1,000 copies/ml. Multiple linear regression analyzed the relationship between the six psychiatric disorder variables at FU2 and the proportion of all VLs >1,000 copies/ml across FU2, FU3, and FU4. All models were adjusted for age, to account for the range of ages in our sample, and for sex, which may influence adherence outcomes.^{34,36} Analyses that adjusted for race (data not shown) did not alter the significant findings, likely due to the fact that two-thirds of the sample was African American. Post-hoc, we tested for potential confounding by household income, caregiver type, history of special education, and PPVT score. Bivariate analyses were conducted for each of these four variables with every psychiatric disorder predictor as well as the outcomes of missed ART dose in the past week and VL>1,000 copies/ml.

Results

Descriptive data (Table 1)

Among the 179 PHIV+ participants included in the analyses, 51% were female, 67% were African-American/Black, and 44% were Latino. The age range was 13–24 years (median= 18 years) at FU 2 and 15–26 years (median= 20 years) at FU4. The average per capita household income was \$10,168 and 26% of participants had a biological parent as their primary caregiver. Half the sample had a history of special education enrollment and mean PPVT standard score was 81.88, which is more than one standard deviation below average. Mean time between FU2 and FU4 assessments was 2.7 years. At FU2 and FU4, 35% and 42%, respectively, reported a missed ART dose in the past week. Medical chart data showed that 47% at FU2 and 31% at FU4 had a VL>1,000 copies/ml. Most participants had a VL within 90 days of the interview and were included in cross-sectional analysis (96% at FU2; 77% at FU4). Across FU2, FU3, and FU4, the mean proportion of all VL results >1,000 copies/ml was 0.43. On average, participants contributed 7.27 VL data points for this analysis.

At both FU2 and FU4, over half of AYA met criteria for any psychiatric disorder, with anxiety disorders most prevalent (27% at FU2; 32% at FU4), particularly generalized anxiety and specific phobias. Disruptive behavior disorders were the second most common diagnosis at FU2 (21%), particularly oppositional defiant disorder. Substance use disorder was the second most common diagnosis at FU4 (25%), with marijuana and alcohol abuse/dependence as the leading subcategories. Mood disorder had the lowest prevalence (13% at FU2; 11% at FU4), with major depression the leading subcategory at both time points (data for subcategories not shown).

Cross Sectional Analyses: psychiatric disorder and adherence and VL at FU2 and FU4

At FU2, multiple logistic regression analyses adjusted for age and sex showed a significant association between missed ART dose in past week and two psychiatric disorder variables:

mood disorder ($p=.041$, $OR=2.65$) and disruptive behavior disorder ($p=.009$, $OR=2.98$) (Table 2). Disruptive behavior disorder was also significantly associated with VL >1,000 copies/ml ($p=.019$, $OR=2.57$). The association between SUD and VL >1,000 copies/ml was just shy of significant ($p=.051$, $OR=2.27$). At FU4, disruptive behavior disorder was the only diagnosis that achieved statistical significance in its association with missed ART dose in past week ($p=.009$, $OR=5.05$); its association with VL >1,000 copies/ml was close to significant ($p=.059$, $OR=3.44$).

Potential confounding by household and cognitive variables was assessed post-hoc. Bivariate analyses found no significant associations between household income, biological parent caregiver, history of special education, or PPVT score and any of the psychiatric disorder diagnoses, missed ART dose in the past week, or VL >1,000 copies/ml at FU2 (data not shown). At FU4, significant associations were found between having a biological caregiver and increased mood disorder, and missed ART dose only (data not shown). However, mood disorder was not associated with missed ART dose at FU4 in our cross-sectional analyses (Table 2). Therefore, the household and cognitive variables were not confounders and were not added to the model.

Longitudinal Analyses: FU2 psychiatric disorder and proportion of VL >1,000 copies/ml over time

Lastly, a multiple linear regression adjusted for age and sex was conducted to evaluate the association between psychiatric disorders at FU2 and the proportion of VLs >1,000 copies/ml across FU2, FU3, and FU4. A higher proportion of VLs >1,000 copies/ml was significantly associated with having any psychiatric disorder ($p=.008$), a disruptive behavior disorder ($p=.041$), and a substance use disorder ($p=.016$) at FU2 (Table 3.)

Discussion

The PHIV+ AYA in CASAH exhibited a high prevalence of psychiatric disorder and viremia, and reported sub-optimal adherence. We found significant cross-sectional associations between psychiatric disorder and both outcomes tested: missed ART dose in the past week and VL>1,000 copies/ml within 90 days of assessment. Disruptive behavior disorder and mood disorder were significantly associated with missed doses, and disruptive behavior disorder was associated with high VL. Furthermore, in what we believe to be the first analysis to examine psychiatric disorder as a predictor of viremia over time, we found that disruptive behavior disorder, substance use disorder, and any psychiatric disorder diagnosis were associated with higher proportion of VLs >1,000 copies/ml collected over the following 2–3 years.

This study's findings support the literature on the association between psychiatric disorder and ART non-adherence among PHIV+ AYA,^{20–22, 25} and strengthen the evidence for this relationship by measuring psychiatric disorder with a detailed, standardized diagnostic tool, the DISC-IV, rather than with self-reported psychological symptom checklists, and by examining associations over time. We found support for our hypothesis that psychiatric disorder may be associated with or predict viremia that is likely due to non-adherence. Therefore, addressing mental health and substance use problems may be an effective means

of improving adherence and health outcomes in this population, as well as preventing new infections by controlling viremia. This hypothesis could be tested in trials of mental health interventions for PHIV+ AYA that assess ART adherence outcomes.

Much of the literature on mental health and medication adherence focuses on mood disorders, particularly depression.³⁷ In this analysis, mood disorder was associated with missed dose only at one time point, FU2. Disruptive behavior disorder emerged as the diagnosis most consistently associated with missed ART dose and viremia across analyses: significant associations were found in FU2 and FU4 cross-sectional analyses and in longitudinal analysis. This finding supports other studies of PHIV+ individuals that found relationships between non-adherence and disruptive behavior, particularly ADHD,^{21,25} as well as a study of behaviorally infected adolescents that found an association with conduct disorder.³⁸ Previous studies focused on younger children and adolescents. We now add to this literature demonstrating that the relationship between disruptive behavior and poor adherence persists in an older AYA population. Of the 37 PHIV+ AYA who met diagnostic criteria for disruptive behavior disorder at FU2, oppositional defiant disorder (ODD) was the most prevalent subcategory, suggesting that it may be driving the association with adherence (data not shown). We did not have the power to examine the associations of specific subcategories of diagnoses. Future research should investigate the role of disruptive behavior disorder subcategories on adherence among AYA.

Prior research has shown that substance use is a barrier to ART adherence in AYA and in adults.^{11, 16} In our cross-sectional analysis, the association of SUD with viremia was shy of significant. However, it was a significant predictor of viremia over time in longitudinal analyses. We did not have the power to look at specific substance use disorders (e.g. alcohol vs. marijuana). Additional research is needed to assess the association between SUD in adolescence and young adulthood on VL outcomes later into adulthood to more specifically inform interventions.

Similarly, a diagnosis of any psychiatric disorder was not significantly associated with missed ART dose or viremia in cross-sectional analysis, but was predictive of future viremia. It is possible that a measure that includes multiple indicators collected over a period of time, such as the proportion of VL>1,000 copies/ml used in this study, may more accurately signal clinically relevant suboptimal adherence than an outcome variable assessed at a single time point.

The AYA in this cohort exhibited markers of suboptimal cognition and lived in low-income households with caregivers who were primarily not their biological parent. However, these potential barriers to adherence were largely not associated with the psychiatric disorders, missed ART dose, and VL variables assessed in this study. Nonetheless, future studies should consider the social and contextual issues that may affect the relationship between psychiatric disorder and ART adherence.

This study has several limitations. VL data were abstracted from participant medical charts and were subject to variations in when (relative to our assessments) and how often the AYA attended doctor appointments. Although parameters were set for the cross-sectional analysis

to include only the closest VL result collected within 90 days of psychiatric assessment, samples drawn on the day of the assessment would have enabled a more rigorous design. Furthermore, VL testing data were sometimes missing or outside the 90-day window established for these analyses. The missed-dose adherence variable was self-report but a more objective measure of adherence may have yielded more reliable results. Complete information on mental health services and psychotropic medications prescribed to the AYA would have allowed us to assess the effect of such treatment on ART adherence. Finally, analysis of different combinations of psychiatric disorder comorbidities may have yielded more nuanced findings with clinical utility for healthcare providers.

Despite these limitations, the findings presented in this paper contain information that can help providers identify PHIV+ AYA at risk for suboptimal adherence. Although some AYA may experience psychiatric disorder concurrently with poor adherence, psychiatric disorder may also warn of future adherence problems. Much of the literature has focused on mood disorders, but our data suggest that, among PHIV+ AYA, disruptive behavior disorders, including ADHD, ODD, and conduct disorder, may be just as important, if not more so. Substance use, including alcohol and marijuana, was also a critical factor. Appropriate assessment and treatment of specific categories of psychiatric and substance use problems by skilled mental health care providers may improve adherence and prevent poor health outcomes in PHIV+ AYA, who are especially vulnerable. Future research should assess the impact of mental health services and treatment on adherence outcomes in this population. Integrated care systems that address mental health as a component of HIV care might be one of the most effective ways to identify and treat disorder and improve ART pill-taking behaviors of PHIV+ AYA.

Acknowledgments

Source of Funding:

This research was supported by NIMH grant R01-MH069133 (PI: Claude Ann Mellins, Ph.D.) and NIMH center grant P30-MH43520 (PI: Robert H. Remien, Ph.D.) Dr. Elkington was supported by NIMH grant K01-MH89832 (PI: Katherine Elkington, Ph.D.)

References

1. Viswanathan S, Detels R, Mehta SH, et al. Level of adherence and HIV RNA suppression in the current era of highly active antiretroviral therapy (HAART). *AIDS Behav.* 2015; 19:601–611. [PubMed: 25342151]
2. Bangsberg DR, Perry S, Charlebois ED, et al. Non-adherence to highly active antiretroviral therapy predicts progression to AIDS. *AIDS.* 2001; 15:1181–1183. [PubMed: 11416722]
3. Cohen MS, McCauley M, Gamble TR. HIV treatment as prevention and HPTN 052. *Curr Opin HIV AIDS.* 2012; 7:99–105. [PubMed: 22227585]
4. Datye KA, Moore DJ, Russell WE, et al. A review of adolescent adherence in type 1 diabetes and the untapped potential of diabetes providers to improve outcomes. *Curr Diab Rep.* 2015; 15:621.
5. Drotar D, Bonner M. Influences on adherence to pediatric asthma treatment: a review of correlates and predictors. *J Dev Behav Pediatr.* 2009; 30:574–582. [PubMed: 19996903]
6. Hanghøj S, Boisen KA. Self-reported barriers to medication adherence among chronically ill adolescents: a systematic review. *J Adolesc Health.* 2014; 54:121–138. [PubMed: 24182940]
7. Haberer J, Mellins C. Pediatric adherence to HIV antiretroviral therapy. *Curr HIV/AIDS Rep.* 2009; 6:194–200. [PubMed: 19849962]

8. Murphy DA, Wilson CM, Durako SJ, et al. Antiretroviral medication adherence among the REACH HIV-infected adolescent cohort in the USA. *AIDS Care*. 2001; 13:27–40. [PubMed: 11177463]
9. Kim SH, Gerver SM, Fidler S, et al. Adherence to antiretroviral therapy in adolescents living with HIV: Systematic review and meta-analysis. *AIDS*. 2014; 28:1945–1956. [PubMed: 24845154]
10. UNICEF. [Accessed August 16, 2016] Turning the tide against AIDS will require more concentrate focus on adolescents and young people. May, 2016. Available at: <http://data.unicef.org/hiv-aids/adolescents-young-people.html>
11. Macdonell KE, Naar-King S, Huszti H, et al. Barriers to medication adherence in behaviorally and perinatally infected youth living with HIV. *AIDS Behav*. 2013; 17:86–93. [PubMed: 23142855]
12. Mellins CA, Malee KM. Understanding the mental health of youth living with perinatal HIV infection: lessons learned and current challenges. *J Int AIDS Soc*. 2013; 16:18593. [PubMed: 23782478]
13. Williams PL, Leister E, Chernoff M, et al. Substance use and its association with psychiatric symptoms in perinatally HIV-infected and HIV-affected adolescents. *AIDS Behav*. 2010; 14:1072–1082. [PubMed: 20725774]
14. Langebeek N, Gisolf EH, Reiss P, et al. Predictors and correlates of adherence to combination antiretroviral therapy (ART) for chronic HIV infection: a meta-analysis. *BMC Med*. 2014; 12:142. [PubMed: 25145556]
15. Uthman OA, Magidson JF, Safren SA, et al. Depression and adherence to antiretroviral therapy in low-, middle- and high-income countries: a systematic review and meta-analysis. *Curr HIV/AIDS Rep*. 2014; 11:291–307. [PubMed: 25038748]
16. Gonzalez A, Barinas J, O’Cleirigh C. Substance use: Impact on adherence and HIV medical treatment. *Curr HIV/AIDS Rep*. 2011; 8:223–234. [PubMed: 21858414]
17. Pence BW. The impact of mental health and traumatic life experiences on antiretroviral treatment outcomes for people living with HIV/AIDS. *J Antimicrob Chemother*. 2009; 63:636–640. [PubMed: 19153077]
18. Mellins CA, Brackis-Cott E, Leu CS, et al. Rates and types of psychiatric disorders in perinatally human immunodeficiency virus-infected youth and seroreverters. *J Child Psychol Psychiatry*. 2009; 50:1131–1138. [PubMed: 19298479]
19. Elkington KS, Bauermeister JA, Santamaria EK, et al. Substance use and the development of sexual risk behaviors in youth perinatally exposed to HIV. *J Pediatr Psychol*. 2015; 40:442–454. [PubMed: 25476800]
20. Mellins CA, Tassiopoulos K, Malee K, et al. Pediatric HIV/AIDS Cohort Study 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]
21. Malee K, Williams P, Montepiedra G, et al. Medication adherence in children and adolescents with HIV infection: associations with behavioral impairment. *AIDS Patient Care STDS*. 2011; 25:191–200. [PubMed: 21323533]
22. Williams PL, Storm D, Montepiedra G, et al. Predictors of adherence to antiretroviral medications in children and adolescents with HIV infection. *Pediatrics*. 2006; 118:e1745–e1757. [PubMed: 17101712]
23. Kapetanovic S, Wiegand RE, Dominguez K, et al. Associations of medically documented psychiatric diagnoses and risky health behaviors in highly active antiretroviral therapy experienced perinatally HIV-infected youth. *AIDS Patient Care STDS*. 2011; 25:493–501. [PubMed: 21745118]
24. Naar-King S, Montepiedra G, Garvie P, et al. Social ecological predictors of longitudinal HIV treatment adherence in youth with perinatally acquired HIV. *J Pediatr Psychol*. 2013; 38:664–674. [PubMed: 23629146]
25. Kacanek D, Angelidou K, Williams PL, et al. Psychiatric symptoms and antiretroviral non-adherence in US youth with perinatal HIV: A longitudinal study. *AIDS*. 2015; 29:1227–1237. [PubMed: 26035322]

26. Azar MM, Springer SA, Meyer JP, et al. A Systematic Review of the Impact of Alcohol Use Disorders on HIV Treatment Outcomes, Adherence to Antiretroviral Therapy and Health Care Utilization. *Drug Alcohol Depend.* 2010; 112:178–193. [PubMed: 20705402]
27. Springer SA, Dushaj A, Azar MM. The impact of DSM-IV mental disorders on adherence to combination antiretroviral therapy among adult persons living with HIV/AIDS: a systematic review. *AIDS Behav.* 2012; 16:2119–2143. [PubMed: 22644066]
28. Ingersoll K. The impact of psychiatric symptoms, drug use, and medication regimen on non-adherence to HIV treatment. *AIDS Care.* 2004; 16:199–211. [PubMed: 14676026]
29. Safren S, O’Cleirigh C, Tan JY, et al. A randomized controlled trial of cognitive behavioral therapy for adherence and depression (CBT-AD) in HIV-infected individuals. *Health Psychol.* 2009; 28:1–10. [PubMed: 19210012]
30. Magidson JF, Seitz-Brown CJ, Safren SA, et al. Implementing behavioral activation and Life-Steps for depression and HIV medication adherence in a community health center. *Cogn Behav Pract.* 2014; 21:386–403. [PubMed: 25419102]
31. Ingersoll KS, Dillingham RA, Hettema JE, et al. Pilot RCT of bidirectional text messaging for ART adherence among nonurban substance users with HIV. *Health Psychol.* 2015; 34:1305–1315.
32. Dunn, LM. PPVT-III : Peabody Picture Vocabulary Test. Circle Pines, MN: American Guidance Service; 1997.
33. American Psychiatric Association (APA). Diagnostic and Statistical Manual of Mental Health Disorders. 4. Washington, DC: Author; 1993.
34. Chesney MA, Ickovics JR, Chambers DB, et al. Self-reported adherence to antiretroviral medications among participants in HIV clinical trials: the AACTG adherence instruments. Patient Care Committee & Adherence Working Group of the Outcomes Committee of the Adult AIDS Clinical Trials Group (AACTG). *AIDS Care.* 2000; 12:255–266. [PubMed: 10928201]
35. Usitalo A, Leister E, Tassiopoulos K, et al. Relationship between viral load and self report measures of adherence among youth with perinatal HIV infection. *AIDS Care.* 2014; 26:107–115. [PubMed: 23800360]
36. Tapp C, Milloy M, Kerr T, et al. Female gender predicts lower access and adherence to antiretroviral therapy in a setting of free healthcare. *BMC Infect Dis.* 2011; 11:21466704.
37. Nel A, Kagee A. Common mental health problems and antiretroviral therapy adherence. *AIDS Care.* 2011; 23:1360–1365. [PubMed: 22022846]
38. Walkup J, Akincigil A, Bilder S, et al. Psychiatric diagnosis and antiretroviral adherence among adolescent Medicaid beneficiaries diagnosed with human immunodeficiency virus/acquired immunodeficiency syndrome. *J Nerv Ment Dis.* 2009; 197:354–361. [PubMed: 19440109]

TABLE 1

Demographics N=179

Sex (% female)	51%	
Race (% African American)	67%	
Ethnicity (% Latino)	44%	
Caregiver type (% biological parent)	26%	
Special education (% ever enrolled)	50%	
	Mean (SD)	
Per capita household income	\$10,168 (\$6770)	
PPVT standard score	81.88 (12.55)	
	FU2	FU4
Median age (range)	18 (13–24)	20 (15–26)
Any psychiatric disorder	53%	53%
Anxiety disorder	27%	32%
Mood disorder	13%	11%
Disruptive behavior	21%	12%
Substance abuse	19%	25%
Any psychiatric disorder, excluding substance use	43%	39%
Missed ART dose in the past week	35%	42%
Viral load >1,000 copies/ml	47%	31%
	FU2–FU4	
Proportion of all viral loads >1,000 (mean)	.43	
Mean time between FU2 and FU4	2.7 years	

FU2 and FU4 Cross-sectional Analysis of Psychiatric Disorder and Missed Dose and Psychiatric Disorder and Viral Load—Adjusted for Age and Sex

TABLE 2

Disorder	FU2			FU4		
	Missed ART Dose Past Week		Viral Load >1,000	Missed ART Dose Past Week		Viral Load >1,000
	OR (adj)	p-value		OR (adj)	p-value	
Any psychiatric disorder	1.83	.082	1.72	1.46	.296	1.49
Any psychiatric disorder, excluding substance use	1.76	.104	1.37	1.82	.103	1.32
Anxiety disorder	1.96	.078	1.08	1.37	.415	1.20
Mood disorder	2.65	.041	.850	.876	.817	1.21
Disruptive behavior disorder	2.98	.009	2.57	5.05	.009	3.44
Substance abuse disorder	1.66	.255	2.27	1.26	.590	.816

Table 3

Linear Regression of FU2 Psychiatric Disorder on Proportion Viral Loads across FU2, FU3, & FU4– Adjusted for Age and Sex

FU2 Disorder	Proportion Viral Loads >1,000
	p-value
Any psychiatric disorder	.008
Any psychiatric disorder, excluding substance use	.091
Anxiety disorder	.413
Mood disorder	.472
Disruptive behavior disorder	.041
Substance abuse disorder	.016