Published in final edited form as:
J Acquir Immune Defic Syndr. 2008 August 1; 48(4): 408–417. doi:10.1097/QAI.0b013e31817bbe80.

Adherence to Antiretrovirals Among US Women During and After Pregnancy

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Abstract

Background—Antiretrovirals (ARVs) are recommended for maternal health and to reduce HIV-1 mother-to-child transmission, but suboptimal adherence can counteract its benefits.

Objectives—To describe antepartum and postpartum adherence to ARV regimens and factors associated with adherence.

Methods—We assessed adherence rates among subjects enrolled in Pediatric AIDS Clinical Trials Group Protocol 1025 from August 2002 to July 2005 on tablet formulations with at least one self-report adherence assessment. Perfectly adherent subjects reported no missed doses 4 days before their study visit. Generalized estimating equations were used to compare antepartum with postpartum adherence rates and to identify factors associated with perfect adherence.

Results—Of 519 eligible subjects, 334/445 (75%) reported perfect adherence during pregnancy. This rate significantly decreased 6, 24, and 48 weeks postpartum [185/284 (65%), 76/118 (64%), and 42/64 (66%), respectively ($P < 0.01$)]. Pregnant subjects with perfect adherence had lower

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Presented in part, (Abstract 706) at the 13th Conference on Retroviruses and Opportunistic Infections, February 5-8, 2006, Denver, CO.

viral loads. The odds of perfect adherence were significantly higher for women who initiated ARVs during pregnancy ($P < 0.01$), did not have AIDS ($P = 0.02$), never missed prenatal vitamins ($P < 0.01$), never used marijuana ($P = 0.05$), or felt happy all or most of the time ($P < 0.01$).

Conclusions—Perfect adherence to ARVs was better antepartum, but overall rates were low. Interventions to improve adherence during pregnancy are needed.

Keywords

pregnancy; adherence; HIV-1 infection; substance use; depression; viral suppression

INTRODUCTION

The morbidity and mortality of HIV-1—infected patients has dramatically decreased in resource-rich settings with the use of highly active antiretroviral therapy (HAART).1 The short- and long-term success of HAART is directly related to the degree of adherence to therapy because adequate therapeutic levels of antiretrovirals (ARVs) are needed to suppress viral replication and prevent development of resistance.2,3 This is particularly relevant for protease inhibitor (PI)—based regimens, which require more than 90% adherence to achieve adequate viral suppression.3-5 Lower ARV adherence rates have been documented in several populations, including adolescents, active drug users, and patients with mental illness.6-8 Barriers to adherence include pill burden and limited knowledge of the benefits of or dosing schedule of ARV therapy.9-12 Overall, average rates of adherence to HAART among these diverse populations range from 60% to 70%.6-8,10 Thus, increased efforts to understand and overcome factors related to poor adherence are necessary to optimize health outcomes.

It is recommended that HIV-1—infected pregnant women receive ARVs during pregnancy to prevent mother-to-child transmission (MTCT) and/or for their own health.13 Poor adherence to ARVs during pregnancy can lead to suboptimal viral suppression, development of viral resistance, a higher risk of MTCT, and MTCT of a resistant HIV-1 strain.2,14-16 Current knowledge of adherence during pregnancy is limited. The objectives of this study were to estimate and compare rates of self-reported adherence with ARVs among HIV-1—infected women during pregnancy and postpartum and to identify factors associated with self-reported adherence.

METHODS

Pediatric AIDS Clinical Trials Group P1025

Pediatric AIDS Clinical Trials Group Protocol 1025 (P1025) is a prospective cohort study of HIV-1—infected women and their infants. Subjects are enrolled either during pregnancy (as early as 14 weeks gestation) or postpartum (up to 14 days after delivery) and remain under follow-up until 48 weeks postpartum.17 Enrollment began in October 2002 and is ongoing. The objectives of P1025 include assessment of adherence to ARVs during pregnancy and postpartum.

Study visits occur at 14-20, >20-30, and >30 weeks gestation; at delivery; and at 6, 12, 24, 36, and 48 weeks postpartum. P1025 visits are conducted during routine clinical visits, and most laboratory measures are abstracted from clinically indicated testing, including flow cytometry and plasma HIV-1 RNA concentration (viral load). Mode of delivery, pregnancy outcome, and HIV-1 infection status of the infant are collected. Signs and symptoms are assessed at each study visit, with abnormalities graded as mild, moderate, severe, or life threatening. Subjects complete behavioral questionnaires to ascertain substance use patterns

(alcohol, tobacco, methadone, or illicit drugs such as marijuana, cocaine, heroin, or amphetamines) that are returned to the data management center in sealed envelopes without site review. Subjects also complete questionnaires that include quality-of-life issues and a 5-item version of the Mental Health Inventory to monitor for depression. The 5-item version of the Mental Health Inventory has been validated as an effective approach to screen reproductive age women and HIV-1—infected male adults for depression in outpatient settings.[18,19]

Information regarding adherence to ARVs is collected by self-report at each study visit using a questionnaire completed by the subject, which includes current ARV regimen, the number of doses missed for each ARV of the regimen over the 4 days before the study visit, and the last time an ARV dose was missed. Additional questions address factors thought to influence adherence, such as the strength of the subject's support network, health status, attitudes regarding taking ARVs, reasons for missing doses, and use of any aids to improve adherence. The analysis described in this manuscript is limited to assessment of adherence rates during pregnancy and postpartum, the variables associated with reported perfect adherence, and the association of adherence with viral load.

Study Population, Outcomes of Interest, and Covariates

Subjects were eligible for inclusion in this analysis if they were enrolled during their first pregnancy on P1025 by August 1, 2005 (because women participating in the study for a second time might have different adherence outcomes), had at least one completed self-report adherence form in the study database during our defined visit windows, and were on a tablet-based ARV regimen (because the consequences of missing 1 liquid dose may be different from missing at least one tablet dose). The primary outcome of interest was adherence to prescribed ARVs during the 4 days before each study visit. Adherence was classified as perfect if the patient attended the clinic visit, completed the self-report adherence form, and filled in complete information on all drugs over the 4 days before the study visit. Conversely, adherence was classified as imperfect if at least one dose of any ARV had been indicated as being missed or if there was incomplete information on any of the 4 days. If patients missed the clinic visit or did not submit an adherence assessment, their adherence outcome was considered to be missing. A second measure of adherence, when the subject last missed an ARV dose (ranging from never to within the last week), was also examined. We focused on 4 time points: (1) pregnancy: if a subject completed more than one adherence assessment during pregnancy, the assessment completed at the study visit closest to and before delivery was used and if the subject had not yet delivered, the most recent adherence assessment was used; (2) postpartum, week 6: adherence assessment at a study visit between 2 and 10 weeks after delivery and closest to week 6; (3) postpartum, week 24: adherence assessment at a study visit between 20 and 28 weeks after delivery and closest to week 24; and (4) postpartum, week 48: adherence assessment at a study visit between 44 and 52 weeks after delivery and closest to week 48.

Covariates collected during the same time window periods and closest to the date of the adherence assessment were included as independent variables. Substance use during pregnancy was defined as any reported use of alcohol, methadone, or illicit drugs such as marijuana, cocaine, heroin, or amphetamines at any time during pregnancy. Substance use during the postpartum period was defined as any reported use of the same drugs listed above during pregnancy or up to the adherence assessment date for weeks 6, 24, or 48, respectively. Information on ARV dosing frequency was taken from the study treatment record completed by a study nurse. Because the number of pills per dose is not collected, the most common dosing schedule (based on the experience of 3 of the authors, A.D.B., M.S., and R.E.T.) was used for each ARV. Subjects were classified as ARV naive if their first use

of ARVs was during the index pregnancy. Subjects who had previously used ARVs for their own health or to decrease MTCT were classified as ARV experienced.

Statistical Methods

Differences in adherence between groups were compared using χ^2 test or Fisher exact tests for categorical data and Wilcoxon rank sum tests for continuous data.20 Relatively few subjects had adherence data at all 4 time points: subjects who enrolled into P1025 after delivery had no adherence data collected during pregnancy, some subjects had not completed all postpartum visits as they were still in follow-up, and, although most subjects received ARVs during pregnancy, many stopped after delivery if ARV therapy for their own health was not recommended. Generalized estimating equations (GEEs)21 were used to model the self-report adherence rates to account for the multiple measurements of each subject and allow all subjects, regardless of the number of visits, to be included in the analysis. A binary outcome was used to assess perfect adherence compared with imperfect adherence using a binomial link, and an ordinal outcome was used to assess when the last ARV dose had been missed using a multinomial link. Contrasts were set up to formally test for different adherence rates during pregnancy and across the postpartum visits. To assess which factors influenced adherence, we fit the GEE models with each factor individually and then combined them into a multivariate model starting with all factors significant at the $P = 0.10$ level and dropping the least significant factor one at a time until the most parsimonious model was found with all factors significant at the $P = 0.05$ level. Because GEEs require strong assumptions regarding missing data (missing completely at random), analyses were repeated using the subset of subjects with complete data during pregnancy and at the 6- and 24-week postpartum visits, in the women with adherence assessments during pregnancy and at least one visit postpartum, and also using nonlinear mixed models, 22 which only require the data to be missing at random.

RESULTS

Study Population

By August 1, 2005, 599 subjects had enrolled into P1025 for the first time, 526 subjects had at least one self-report adherence form in the database in the time point windows, and 519 were on tablet formulations. These 519 subjects constitute the study population. Of the 73 women on tablet formulations with no adherence forms in the time point windows, 49 had either enrolled on the study less than 3 months before the data cutoff date or had enrolled close to delivery and had not yet reached the 6-week follow-up time point, allowing insufficient time for data entry to have taken place, 6 did have at least one adherence form but they were completed outside the defined visit windows, and 18 had no adherence forms submitted with no explanation. The only statistically significant differences between those included or excluded from the study population (519 vs 80) were in the proportions of subjects receiving ARVs at enrollment (95% of those included vs 69% of others, $P < 0.01$) and in viral loads (28% of those included had detectable viral loads vs 43% of others, $P < 0.01$). Because subjects had to be receiving ARVs to complete an adherence form and because women receiving ARVs are more likely to have lower viral loads, these differences arose because of the inclusion criteria for the analysis.

Baseline characteristics of the study population (at the time of enrollment into P1025) are shown in Table 1. Of the 519 subjects in the study population, 468 (90%) enrolled before delivery. Among subjects receiving ARVs at enrollment, the median duration of receipt of ARVs was 1.3 years. The median CD4 count was 456 cells/mm^3, and the median viral load was,400 copies/mL. Forty-three (8%) subjects reported past or current intravenous drug use at study entry. During pregnancy, 97/408 (24%) of subjects reported smoking tobacco,

147/419 (35%) reported using marijuana, 130/416 (31%) reported using alcohol, 64/415 (15%) reported using cocaine, and 85/417 (20%) reported using any illicit drugs (cocaine, heroin, amphetamines or methamphetamines, or barbiturates) or methadone. The majority of the study participants received PI-based regimens, whether ascertained cross sectionally at each adherence assessment (59% as illustrated on Table 1) or longitudinally across up to 4 adherence assessments (63%) (data not shown).

A summary of the number of subjects who were on study, receiving ARVs and with a self-report adherence form at each time point, is shown in Table 2. Of the 519 women in the study population, 74 only had adherence information postpartum, 206 only had adherence information during pregnancy, and 239 had adherence information during pregnancy and at least one visit after delivery. Among the 360 subjects still receiving ARVs after delivery, an increasing proportion did not complete the self-report adherence form. Missed study visits accounted for 37% of the missing forms during the antepartum and postpartum periods, with the proportion increasing from delivery onward. The remaining subjects attended the study visit but did not complete the forms. The most common documented reason for not completing the form was running out of time during the study visit.

Self-report Adherence Rates During Pregnancy and Associations With Viral Load and CD4+ Count

Among pregnant subjects receiving ARVs and with self-report adherence forms completed (n = 445), 75% reported perfect adherence during the 4 days before their study visit closest to and before delivery. The majority (53%) reported that the last time they had missed any dose was more than 3 months before the study visit. Subjects initiating ARVs during pregnancy (ARV naive) had lower median plasma HIV-1 RNA ($P = 0.01$) concentrations and higher median CD4 counts ($P < 0.01$) than those who had received ARVs before pregnancy (ARV experienced, measurements closest to and within 12 weeks before or up to 4 weeks after date of adherence assessment). Overall rates of perfect adherence were higher among ARV-naive than experienced subjects, although the difference was not statistically significant (78% vs 72%, $P = 0.18$). In both groups of subjects, higher rates of perfect adherence were observed in subjects with lower viral loads, but the differences were only statistically significant among ARV-experienced subjects ($P < 0.01$). Specifically, 84% of subjects with viral loads of ≤50 copies/mL reported perfect adherence compared with 74% of subjects with viral loads of >50-400 copies/mL and 58% of subjects with >400 copies/mL ($P < 0.01$). Differences in perfect adherence according to CD4+ counts did not reach statistical significance but showed a similar trend: 76% among subjects with CD4+ count >350 cells/mm^3, 74% (201-350 cells/mm^3), and 55% (≤200 cells/mm^3)($P = 0.08$).

Comparison of Self-report Adherence Rates During Pregnancy and Postpartum

Lower proportions of subjects reported perfect adherence postpartum (Table 2); of those who remained on ARVs postpartum, 185/284 (65%), 76/118 (64%), and 42/64 (66%) had perfect adherence at 6, 24, and 48 weeks, respectively. Subjects were significantly more likely to have perfect adherence during pregnancy compared with postpartum [odds ratio = 1.69, 95% confidence interval (CI): 1.25 to 2.27, $P < 0.01$]. When subjects were asked about the last time they had missed a dose during pregnancy, 198/440 (45%) reported that they never missed a dose. Postpartum, this proportion decreased to 109/282 (39%) at 6 weeks, 45/113 (40%) at 24 weeks, and 24/64 (38%) at 48 weeks, showing similar trends as in the missed dose adherence measure.

We also compared the perfect adherence rates between the 74 women only contributing adherence assessments postpartum and the 239 women contributing assessments antepartum and postpartum because the women entering the study later may have been at higher risk due

to inadequate prenatal care. At weeks 6, 24, and 48, they did have lower rates (6%-14%) of perfect adherence, but the differences were not statistically significant. In addition, the median time between the first prenatal visit and delivery was longer for the 74 than for the 239 women who had an adherence assessment during pregnancy.

Factors Associated With Perfect Adherence

Results from univariate models relating to covariates collected only during pregnancy are shown in Table 3. The only factor significantly associated with the odds of perfect adherence during pregnancy was never missing prenatal vitamins ($P < 0.01$). Results from univariate models of correlates of perfect adherence antepartum and postpartum are shown in Table 4. Perfect adherence rates and the number of subjects in each level of each covariate are shown during pregnancy and at week 48. These models assume that the effect of each factor is the same at each time point but are adjusted for the varying adherence rates at each visit. The frequency of administration was not included as a measure of regimen complexity as almost all subjects were receiving ARVs twice daily.

The most parsimonious multivariate model of perfect adherence is shown in Table 5. Use of prenatal vitamins was only collected during pregnancy, so its value was imputed for the postpartum time points to allow the covariate to be included in the multivariate model. Subjects who initiated ARVs during the current pregnancy ($P < 0.01$), those with less advanced HIV-1 disease ($P = 0.02$), those who never missed prenatal vitamins ($P < 0.01$), those who felt happy all or most of the time ($P < 0.01$), and those who did not use marijuana ($P = 0.05$), had higher odds of perfect adherence. Results for the GEE models were similar for the subset of women with at least one assessment during pregnancy and at least one after delivery (n = 239, Table 5), when only subjects with complete data during pregnancy and at the week 6 and 24 visits were included (n = 71) and when analyzed using nonlinear mixed models (data not shown).

Factors Associated With Time Since the Last Missed Dose

Univariate and multivariate models were also fit to the answer to the question about when the subject had last missed an ARV dose. Patients responded on a 6-point scale: never, more than 3 months ago, 1-3 months ago, 2-4 weeks ago, 1-2 weeks ago, or within the past week. For analysis, we collapsed the responses into 3 categories: (1) more than 3 months ago, (2) more than one week ago but less than 3 months ago, or (3) within the last week. Odds ratios larger than “1” indicate longer times since the last dose was missed relative to the reference category. Factors significantly associated with a longer time since last missed dose in univariate models, but which were not statistically significant in the final multivariate model, included the mother not being infected with HIV-1 perinatally (4.08, 95% CI: 1.72 to 9.69, $P = 0.01$), disagreeing about friends/family helping take the medications (1.45, 95% CI: 1.05 to 1.99, $P = 0.02$), feeling calm and peaceful all or most of the time (1.49, 95% CI: 1.14 to 1.95, $P < 0.01$), feeling tired none or some of the time (relative to all or most of the time) (2.05, 95% CI: 1.50 to 2.80, $P < 0.01$), having enough energy all or most of the time (1.65, 95% CI: 1.26 to 2.15, $P < 0.01$), not smoking during the pregnancy or after delivery (1.53, 95% CI: 1.09 to 2.14, $P = 0.02$), and being on ARVs less than one year before the adherence visit (1.54, 95% CI: 1.16 to 2.06, $P < 0.01$). The final multivariate model (Table 6) included starting ARVs during the current pregnancy, ($P < 0.01$), never missing prenatal vitamins ($P < 0.01$), feeling happy all or most of the time ($P = 0.03$), no use of marijuana during pregnancy or postpartum ($P = 0.02$), and no use of alcohol during pregnancy or postpartum ($P = 0.01$) Results for the GEE models were similar for the subset of women with at least one assessment during pregnancy and at least one after delivery (n = 239, Table 6), when only subjects with complete data during pregnancy and at the week 6 and 24 visits were included (n = 71) and when analyzed using nonlinear mixed models (data not shown).

DISCUSSION

Our study showed that, in a cohort of pregnant women primarily receiving PI-based HAART regimens, only 75% reported perfect adherence during pregnancy, and adherence rates declined further during the postpartum period. Even among subjects who needed HAART for their own health according to viral load and CD4 measures, adherence rates dropped to 65% by 6 weeks postpartum and remained at that level up to 48 weeks postpartum. Initiation of ARVs during the current pregnancy, less advanced HIV-1 disease, no use of marijuana, feeling happy all or most of the time, and never missing prenatal vitamins were significantly associated with perfect self-reported adherence 4 days before the study visit. The same factors were significantly associated with longer intervals between a missed dose and the study visit, except for maternal HIV-1 disease stage and alcohol use. Both ARV-naive and ARV-experienced subjects with lower viral loads closest to the time of delivery had higher rates of perfect adherence. However, this observation only reached statistical significance among ARV-experienced subjects.

Our results confirm the correlation between viral load suppression and ARV adherence previously described by Wilson22 among pregnant women on single drug or combination ARV regimens and described in other studies of nonpregnant subjects.2,3,23 We also verify, with a simpler, low-cost approach, the decrease in ARV adherence postpartum as described by Ickovics et al24 using Medication Events Monitoring Systems. Paterson, Bangsberg, and others3-5 have shown that, among individuals receiving PI-based regimens, adherence rates lower than 90% are suboptimal for achieving and maintaining viral suppression. Sixty-three percent of our study population received a PI-based regimen, and the overall adherence rate was only 75%, which could lead to the development of ARV resistance among these reproductive age women. Nonadherent pregnant women might limit their ARV treatment options in future pregnancies or when treatment is needed for maternal health. Thus, our observations validate concerns raised by pre-HAART studies and support the imminent need for effective strategies to enhance adherence in this population.

The rate of illicit drug use within our cohort was higher than anticipated (20%) but consistent with CDC reports among HIV-1—infected pregnant women.25 Use of alcohol and marijuana was associated with decreased ARV adherence, confirming previous reports in nonpregnant subjects.7,9,26 Feeling happy all or most of the time was a significant predictor of adherence, consistent with depression being a barrier to adherence of ARV therapy.8,27

Other factors associated with perfect adherence included initiation of ARVs during the current pregnancy and taking prenatal vitamins as prescribed. Initially described by Wilson, 23 taking vitamins is likely a marker of compliance with all treatment recommendations including ARVs. ARV-naive patients could be more motivated to be adherent and, in our cohort, such subjects had lower viral load at entry than ARV-experienced subjects, and thus their viral suppression might be easier to attain. Alternatively, ARV-experienced subjects could exhibit signs of treatment fatigue observed among patients with chronic illness, be depressed, or be challenged by complex HAART regimens which reduce their likelihood of adherence.28,29 These observations should be confirmed and evaluated in more detail in future studies.

The complexity of the ARV regimen was not associated with adherence, probably because there is limited data regarding safety (for the women and the fetus) and pharmacokinetics of many ARVs during pregnancy, limiting the options when these are used solely for MTCT. 30-34 Most regimens used by the study subjects had similar dosing schedules (twice a day) and number of pills (each dose consisted of 3-4 pills). Alternatively, this observation could

imply that, if a patient is committed to taking ARVs, the number of pills or the schedule of doses does not hinder their adherence. A higher level of education was associated with better adherence to ARVs in a univariate model, confirming prior reports that low health literacy hinders understanding of the disease process, treatment options, and ability to follow treatment instructions.10,12,35 Stone et al10 showed that HIV-1—infected women who understood the correct dosing of their medications and treatment restrictions had better adherence.

Our study has certain limitations including solely using patient's self-report as the assessment of adherence and relying on self-report of substance abuse. Although, currently, there is no "gold standard" to measure adherence, this approach may be biased because subjects want to report better adherence to their caregivers. The generalizability of our results may be limited because subjects enrolled in P1025 and who were included in our study population are not necessarily representative of all HIV-1—infected pregnant women in the United States.17 Our analyses only included subjects who attended study visits, were receiving ARVs, and who completed the self-report adherence information. Women who only had adherence assessments postpartum had lower rates of perfect adherence at their postpartum visits than women with adherence assessments during pregnancy, and it is also likely that subjects missing study visits or dropping out of this study would be less adherent to their HIV-1 medications, likely making our reported estimates of rates of perfect adherence at each time point overly optimistic. This, however, only serves to emphasize the need for interventions to improve adherence in pregnant HIV-infected women.

Nonetheless, this report summarizes observations from the largest cohort prospectively monitoring ARV adherence in the HAART era among HIV-1—infected women during and after pregnancy. In our study, perfect self-reported adherence was associated with viral load, which validates the utility of this simple, low-cost approach to monitoring adherence. We also identified characteristics associated with adherence. Thus, subjects without such characteristics may need additional support with their ARV medications. Future studies should further investigate tools for depression screening; ascertain the role of ARV-related toxicities and support networks on adherence; and monitor the consequences of poor adherence on pregnancy outcomes, rates of MTCT of HIV-1, and the development of ARV resistance.

Acknowledgments

The authors would like to thank the women and babies who participated in P1025. We appreciate the contributions of Emily Demske and Carol Elgie to the conduct of the study. We also want to acknowledge the following sites and individuals who participated in conducting the P1025 study.

University of Medicine and Dentistry of New Jersey (UMDNJ)-New Jersey Medical School, Department of Pediatrics, Division of Allergy, Immunology and Infectious Diseases: Charmane Calilap-Bernardo, RN, James Oleske, MD, MPH, Jocelyn Grandchamp, RN; Boston Medical Center, Division of Pediatric Infectious Diseases: Mark Mirochnick, MD, Desiree Jones, RN; David Geffen School of Medicine at University of California, Los Angeles (UCLA)-Department of Pediatrics, Division of Infectious Diseases: Maryanne Dillon, BSN, Audra Deveikis, MD; Long Beach Memorial Medical Center, Miller Children's Hospital: Susan Marks, RN, Audra Deveikis, MD; Harbor-UCLA Medical Center-Department of Pediatrics, Division of Infectious Diseases: Margaret A. Keller, MD, Spring Wettgen, RN, PNP; University of Maryland Medical Center, Division of Pediatric Immunology and Rheumatology: John Farley, MD, MPH, Georgine Price, BSN, MPH; Texas Children's Hospital, Allergy & Immunology Clinic: Chivon D. Jackson, RN, BSN, Hunter A. Hammill, MD; Children's Memorial Hospital-Department of Pediatrics, Division of Infectious Disease: Brenda Wolfe, RN, CNS, ACRN, Jessica Shore, RN, BSN; Cook County Hospital: Maureen Haak, RN, MS, James B. McAuley, MD, MPH; University of Chicago-Department of Pediatrics, Division of Infectious Disease: Linda Walsh, MP, John Marcinak, MD; Mount Sinai Hospital Medical Center, Chicago, Women's and Children's HIV Program: Daniel Johnson, MD, Dominika Kowalski, RN, Brenda Wolfe, CNS; Columbia University Medical Center, Pediatric AIDS Clinical Trial Unit (ACTU): Diane Tose, CNM, Seydi Vazquez, RN, MSN; University of Miami Miller School of Medicine, Division of Pediatric Immunology & Infectious Diseases: Charles Mitchell, MD, Gwendolyn B. Scott, MD; University of

California San Francisco, School of Medicine, Department of Pediatrics: Diane Wara, MD, Maureen Shannon, FNP, PhD; University of California San Diego, Mother, Child & Adolescent HIV Program: Andrew D. Hull, MD, Mary Caffery, RN, MSN, Linda Proctor, RN, MSN, CNM; Duke University School of Medicine-Department of Pediatrics, Children's Health Center: Kareema Whitfield, BSW, CRC, Felicia Wiley, RN; New York University, School of Medicine, Division of Pediatric Infectious Diseases: Maryam Minter, RN, Sandra Deygoo; Jacobi Medical Center: David Garry, DO, Mindy Katz, MD, Raphaelle Auguste, RN; University of Washington, School of Medicine-Children's Hospital and Regional Medical Center: Jane Hitti, MD, MPH, Michele Acker, PNP; University of Illinois College of Medicine at Chicago, Department of Pediatrics: Mark Vajaranant, MD, Harriett Wittert, RN; San Juan City Hospital: Midnela Acevedo, MD, Elvia Perez, RN; Yale University School of Medicine-Department of Pediatrics, Division of Infectious Disease: Warren A. Andiman, MD, B. Joyce Simpson, RN, MPH; State University of New York (SUNY) at Stony Brook School of Medicine, Division of Pediatric Infectious Diseases: Sharon Nachman, MD, Jennifer Griffin, NP; Wayne State University, School of Medicine, Children's Hospital of Michigan: Theodore Jones, MD, Ellen Moore, MD; Howard University Hospital, Department of Pediatrics & Child Health: Sohail Rana, MD, Caroline Reed, MSN; LA County/University of Southern California, Medical Center: Ana Melendrez, RN, LaShonda Spencer, MD; University of Florida Health Science Center Jacksonville, Division of Pediatric Infectious Disease & Immunology: Mobeen H. Rathore, MD, Isaac Delke, MD; Children's Hospital-University of Colorado at Denver and Health Sciences Center, Pediatric Infectious Diseases (This research was supported by Grant Number MO1 RR00069, General Clinical Research Centers Program, National Center for Research Resources, NIH.): Adriana Weinberg, MD, Carol Salbenblatt, MSN; North Broward Hospital District, Children's Diagnostic & Treatment Center: Ana M. Puga, MD, Guillermo Talero, MD, Amy Inman, BS; St. Jude Children's Research Hospital, Department of Infectious Diseases: Edwin Thorpe, Jr, MD, Nina K. Sublette, RN, MSN, FNP; University of Puerto Rico, U. Children's Hospital AIDS: Ruth Santos, RN, Irma Febo, MD; Bronx-Lebanon Hospital Center, Infectious Diseases: Mavis Dummitt, RN, Mirza Baig, MD; University of Massachusetts Memorial Children's Medical School, Department of Pediatrics: Katherine Luzuriaga, MD, Sharon Cormier, RN; Baystate Health, Baystate Medical Center: Barbara W. Stechenberg, MD, Eileen Theroux, RN, BSN; Tulane University Health Sciences Center: Chi Dola, MD; LSU Health Sciences Center: Robert Maupin, MD; University of Alabama at Birmingham, Department of Pediatrics, Division of Infectious Diseases: Robert Pass, MD, Marilyn Crain, MD, MPH.

Supported by International Maternal Pediatrics Adolescents AIDS Clinical Trails (formerly PACTG) and Adult AIDS Clinical Trial Group (AACTG) funded by the National Institute of Allergy and Infectious Diseases, National Institutes of Health, U01 AI41110, AI27658, and by the Pediatric/Perinatal HIV Clinical Trials Network funded by the National Institute of Child Health and Human Development and National Institutes of Health, HD-3-3345.

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TABLE 1

Baseline Characteristics of the Study Population (n = 519)

Characteristic	Level	N	% (of Known)
Race/ethnicity	White non-Hispanic/other	73	14.1
	Black non-Hispanic	288	55.5
	Hispanic	158	30.4
Age (yrs)	≤21	70	13.5
	>21-30	258	49.7
	>30	191	36.8
Country of birth	United States	389	75.2
	Other	128	24.8
	Unknown	2	-
Highest education level	≤11th grade	217	42.1
	High school graduate	207	40.2
	Beyond high school	91	17.7
	Unknown	4	-
No. previous live births	None	137	26.6
	At least one	378	73.4
	Unknown	4	-
HIV risk behavior	Sexual contact	428	82.8
	IV drug use	31	6.0
	Perinatally infected	14	2.7
	Other	44	8.5
	Unknown	2	-
Year of HIV diagnosis	<1990	26	5.0
	1990-1999	188	36.4
	≥2000	303	58.6
	Unknown	2	-
Initiated ARVs before current pregnancy	Yes	311	60.3
	No	205	39.7
	Unknown	3	-
Receiving ARVs at entry into P1025	None	28	5.4

Characteristic	Level	N	% (of Known)
	NRTI only (monotherapy)	88 (5)	17.0
	NNRTI with no PIs	95	18.3
	PIs with or without NNRTI	308	59.3
CDC disease category	A	425	82.2
	B	36	7.0
	C	56	10.8
	Unknown	2	-
CD4 count (cells/mm^3)*	≤100	23	4.7
	101-200	39	7.9
	201-350	96	19.4
	>350	336	68.0
	Unknown	25	-
CD4%*	≤14%	56	11.4
	15%-25%	132	26.8
	>25%	305	61.9
	Unknown	26	-
Plasma HIV-1 RNA concentration (copies/mL)*	≤50	123	25.0
	>50-≤400	234	47.5
	>400-1000	49	9.9
	>1000-10,000	56	11.4
	>10,000	31	6.3
	Unknown	26	-

IV, intravenous; NRTI, nucleoside reverse transcriptase inhibitor; NNRTI, nonnucleoside reverse transcriptase inhibitor; CDC, Center for Disease Control.

*Laboratory values included if within 12 weeks before to 4 weeks after enrollment to P1025.

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TABLE 2

Number of Women in Study Population (n = 519) on Study, Receiving ARVs, and With a Self-report Adherence Form at Each Time Point

	On Study	Receiving ARVs	Self-report Adherence Form in Database	Report Perfect Adherence
Time Point	**n**	**n (% of on Study)**	**n (% of on ARVs)***	**n (% With Form)**
Pregnancy†	468	466 (99.6)	445 (95.5)	334 (75.1)
6 wks postpartum‡	475	360 (75.8)	284 (78.9)	185 (65.1)
24 wks postpartum§	372	226 (60.8)	118 (52.2)	76 (64.4)
48 wks postpartum‖	224	150 (70.0)	64 (42.7)	42 (65.6)

*If self-report adherence form in database during pregnancy or within 2-10 (week 6), 20-28 (week 24), or 44-52 (week 48) weeks after delivery.

†If enrolled before delivery.

‡If on study at least 10 weeks.

§If on study at least 28 weeks.

‖If on study at least 52 weeks.

TABLE 3

Predictors of Perfect Self-report Adherence During Pregnancy: Univariate Models

			Perfect Adherence			
Category	**Covariate**	**Levels**	**%**	**N**	**OR (95% CI)**	**Overall *P***
	Planned pregnancy	No	73	322	0.75 (0.44 to 1.27)	0.26
		Yes	79	103	Reference	
	Years on ARVs	≤1	76	208	1.14 (0.74 to 1.77)	0.54
		>1	74	234	Reference	
Attitude to ARVs (among those expressing an opinion)	ARVs help prevent baby becoming HIV+	Agree	75	394	1.65 (0.59 to 4.57)	0.39
		Disagree	65	17	Reference	
	ARVs might harm baby	Agree	73	56	0.87 (0.46 to 1.67)	0.69
		Disagree	76	281	Reference	
Other medications	Last time missed prenatal vitamins	Never	83	234	2.82 (1.77 to 4.48)	<0.01
		Sometimes	64	172	Reference	
Substance use at entry	Hx IV drug use	None	75	398	0.75 (0.32 to 1.76)	0.47
		Current/past	80	35	Reference	
	Ever smoked	No	76	204	1.25 (0.79 to 1.97)	0.35
		Yes	72	177	Reference	

OR, odds ratio.

TABLE 4

Predictors of Perfect Self-report Adherence During Pregnancy and at all Postpartum Visits: Univariate Models

			Perfect Adherence*					
			During Pregnancy		Week 48			
Category	**Covariate (Overall *P*)†**	**Levels**	**%**	**N**	**%**	**N**	**OR (95% CI)**	**Wald *P*‡**
Demographics	Age (yrs) (0.22)	≤21	64	63	40	5	0.63 (0.38 to 1.05)	0.08
		21-30	78	220	62	26	0.95 (0.67 to 1.35)	0.77
		≥30	75	162	57	33	Reference	-
	Race/ethnicity (0.19)	Black non-Hispanic	73	252	57	30	1.00 (0.61 to 1.64)	0.99
		Hispanic	81	126	71	28	1.38 (0.81 to 2.34)	0.24
		White/other	70	67	83	6	Reference	-
	Education level (0.02)	Beyond high school	78	255	75	40	1.47 (1.06 to 2.02)	0.02
		≤11th grade	71	187	50	24	Reference	-
HIV/pregnancy: Is this essential here?	Perinatally infected? (0.17)	No	76	430	66	64	2.07 (0.85 to 5.02)	0.11
		Yes	54	13	-	0	Reference	-
	Years since learning HIV+ to delivery (0.68)	0-5	74	270	65	40	1.25 (0.77 to 2.04)	0.37
		6-10	78	94	57	14	1.20 (0.69 to 2.08)	0.53
		>10	67	55	80	10	Reference	-
Characteristics of ARV regimen	Use of ARVs before current pregnancy (0.03)	No	79	174	75	20	1.46 (1.05 to 2.02)	0.03
		Yes	73	269	63	43	Reference	-
	PI-containing regimen (0.62)	No	73	173	66	29	1.08 (0.79 to 1.49)	0.62
		Yes	76	272	66	35	Reference	-
	No. pills/dose (0.47)	≤4	74	180	68	31	1.12 (0.82 to 1.54)	0.47
		>4	76	265	64	33	Reference	-
	Meal restrictions? (0.67)	No	74	170	66	29	1.07 (0.78 to 1.48)	0.67
		Yes	76	275	66	35	Reference	-
HIV disease status	CDC disease category (0.02)	A/B	77	388	68	53	1.88 (1.15 to 3.07)	0.01
		C	67	55	55	11	Reference	-
Attitude to ARVs	ARVs make mother healthier (0.37)	Agree	74	383	66	53	0.75 (0.39 to 1.46)	0.39
		Disagree	79	19	71	7	Reference	-
	ARVs not taken properly will not work as well (0.21)	Agree	74	387	65	54	0.69 (0.38 to 1.27)	0.24

Category	Covariate (Overall *P*)†	Levels	Perfect Adherence* During Pregnancy %	N	Perfect Adherence* Week 48 %	N	OR (95% CI)	Wald *P*‡
		Disagree	79	33	80	5	Reference	-
	Have good understanding of HIV (0.72)	Agree	75	414	65	54	1.13 (0.59 to 2.18)	0.71
		Disagree	64	22	83	6	Reference	-
	Have good understanding of how ARVs work (0.16)	Agree	75	415	63	54	0.61 (0.28 to 1.31)	0.20
		Disagree	64	22	100	5	Reference	-
Social support	Friends/family are supportive (0.96)	Agree	75	341	61	46	1.01 (0.63 to 1.64)	0.96
		Disagree	71	41	88	8	Reference	-
	Partner is supportive (0.60)	Agree	76	318	70	40	1.13 (0.71 to 1.82)	0.60
		Disagree	62	53	67	6	Reference	-
	Friends/family help take ARVs (0.28)	Agree	75	211	61	31	0.82 (0.58 to 1.17)	0.28
		Disagree	71	122	75	12	Reference	-
Factors associated with depression	Have trouble with attention (0.35)	All/most of the time	78	23	50	2	0.74 (0.41 to 1.35)	0.33
		Never/some of the time	75	408	66	62	Reference	-
	Feel calm and peaceful (0.05)	All/most	80	225	67	33	1.35 (1.00 to 1.80)	0.05
		Never/some	71	204	65	31	Reference	-
	Feel downhearted and blue (0.48)	All/most	73	33	60	5	0.82 (0.48 to 1.40)	0.47
		Never/some	76	397	66	59	Reference	-
	Feel tired (0.01)	All/most	71	128	80	10	0.63 (0.44 to 0.91)	0.01
		Never/some	77	301	62	53	Reference	-
	Had enough energy (0.01)	All/most	79	199	74	35	1.45 (1.09 to 1.92)	0.01
		Never/some	72	232	55	29	Reference	-
	Have been happy (0.01)	All/most	80	257	71	38	1.51 (1.13 to 2.01)	0.01
		Never/some	68	174	58	26	Reference	-
Substance use (either during pregnancy or up to 6-, 24-, or 48-wk follow-up)	Smoking (0.58)	No	75	311	63	38	1.10 (0.78 to 1.55)	0.58
		Yes	74	97	70	20	Reference	-
	Alcohol (0.02)	No	77	286	46	11	1.50 (1.08 to 2.10)	0.02
		Yes	71	130	71	48	Reference	-
	Marijuana (<0.01)	No	80	272	68	41	1.76 (1.23 to 2.51)	<0.01
		Yes	67	147	61	18	Reference	-

Category	Covariate (Overall *P*)†	Levels	Perfect Adherence* During Pregnancy %	During Pregnancy N	Week 48 %	Week 48 N	OR (95% CI)	Wald *P*‡
	Cocaine (0.97)	No	76	351	65	49	1.01 (0.63 to 1.62)	0.97
		Yes	72	64	70	10	Reference	-
	Any illicit drug use (0.51)	No	74	332	65	46	0.87 (0.57 to 1.32)	0.51
		Yes	77	85	69	13	Reference	-

OR, odds ratio; CDC, Center for Disease Control.

*Raw percentages of participants with perfect adherence during pregnancy and at week 48.

†Overall significance of covariate.

‡Significance of odds ratio for each level of covariate relative to reference level.

TABLE 5

Multivariate Model for Predictors of Perfect Self-report Adherence

		n = 519		n = 239	
Covariate	**Levels**	**OR (95% CI)**	**Overall *P***	**OR (95% CI)**	**Overall *P***
Use of ARVs before current pregnancy	No	1.92 (1.26, 2.91)	<0.01	2.27 (1.40 to 3.69)	<0.01
	Yes	Ref		Reference	
CDC disease category	A/B	2.09 (1.17, 3.72)	0.02	1.86 (0.97 to 3.59)	0.08
	C	Ref		Reference	
Last time missed prenatal vitamins	Never	2.27 (1.51, 3.41)	<0.01	2.08 (1.29 to 3.35)	<0.01
	Sometimes	Ref		Reference	
Feeling happy	All or most	1.78 (1.24, 2.54)	<0.01	1.69 (1.14 to 2.51)	0.01
	Never or some	Ref		Reference	
Use of marijuana during pregnancy/postpartum	No	1.55 (1.01, 2.38)	0.05	1.48 (0.89 to 2.47)	0.14
	Yes	Ref		Reference	

CDC, Center for Disease Control.

TABLE 6

Multivariate Model for Predictors of Time Since Dose Last Missed

		n = 519		n = 239	
Covariate	**Levels**	**OR (95% CI)**	**Overall *P***	**OR (95% CI)**	**Overall *P***
Use of ARVs before current pregnancy	No	2.05 (1.42, 2.96)	<0.01	2.23 (1.43 to 3.48)	<0.01
	Yes	Ref		Reference	
Last time missed prenatal vitamins	Never	2.39 (1.64, 3.48)	<0.01	1.89 (1.20 to 2.99)	0.01
	Sometimes	Ref		Reference	
Feeling happy	All or most	1.50 (1.06, 2.12)	0.03	1.56 (1.04 to 2.34)	0.04
	Never or some	Ref		Reference	
Use of marijuana during pregnancy/postpartum	No	1.61 (1.10, 2.36)	0.02	1.62 (1.01 to 2.58)	0.04
	Yes	Ref		Reference	
Use of alcohol during pregnancy/postpartum	No	1.61 (1.15, 2.24)	0.01	1.79 (1.22 to 2.64)	<0.01
	Yes	Ref		Reference	

OR, odds ratio.

J Acquir Immune Defic Syndr. Author manuscript; available in PMC 2009 October 20.