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Characterizing HIV medication adherence for virologic success among individuals living with HIV/AIDS: Experience with the CNS HIV Antiretroviral Therapy Effects Research (CHARTER) cohort

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Abstract

Antiretroviral therapy (ART) has changed HIV related illness from terminal to chronic by suppressing viral load which results in immunologic and clinical improvement. Success with ART is dependent on optimal adherence, commonly categorized as >95%. As medication type, class and frequency of use continue to evolve, we assessed adherence levels related to viral suppression. Using a cross-sectional analysis with secondary data (n = 381) from an ongoing multi-site study on impact of ART on the Central Nervous System (CNS), we compared self-reported adherence rates with biological outcomes of HIV-RNA copies/ml, and CD4 cell/mm³. Adherence to ART measures included taking all prescribed medication as directed on schedule and following dietary restrictions. While depression was a barrier to adherence, undetectable viral suppression was achieved at pill adherence percentages lower than 95%. Practice, research and policy implications are discussed in the context of patient-, provider-, and system-level factors influencing adherence to ART.

Introduction

HIV medication in the form of antiretroviral therapy (ART) is able to prevent depletion of CD4⁺ T-cells by blocking viral replication and thus averting life-threatening opportunistic infections. Adherence to ART is second only to CD4⁺ T-cell counts and HIV-RNA recovery in predicting HIV related survival (Hart et al., 2010; Paterson et al., 2000). In order to maintain therapeutic drug concentrations sufficient to inhibit viral replication, patients on ART optimally should take ART as directed for every dose (Godin, Côté, Naccache, Lambert, & Trottier, 2005; Simoni, Amico, Pearson, & Malow, 2008). Such optimal

adherence may be enhanced by tailored behavioral interventions such as use of reminder devices or reinforcement from friends and family (Simoni, Amico, Smith, & Nelson, 2010).

Optimal adherence to ART means that medicines need to be taken at exactly the same time each day and follow food or fasting requirements at least 95% of the time or more (Bangsberg & Deeks, 2002; Harman, Amico, & Johnson, 2005). This entails adhering to schedule of pills and necessary dietary restrictions, learning the numbers and colors of pills to be taken, as well as those of concomitant medications, and relearning different combinations of pills in the event a regimen is altered (Chesney et al., 2000; Mannheimer, Friedland, Matts, Child, & Chesney, 2002). Adherence to ART is a difficult feat to achieve and maintain, and the lack of optimal adherence is considered an important barrier to treatment success both nationally and internationally (HRSA, 2005; Medley, Garcia-Moreno, McGill, & Maman, 2004; Mills et al., 2006).

As a consequence of suboptimal adherence, HIV may have the opportunity to replicate in presence of the drug and develop resistance (Pham, 2009). Resistant virus in sub-optimally adherent individuals could potentially be transmitted, thus spreading the challenges of resistant virus in the population (Wainberg, Zaharatos, & Brenner, 2011). With over 40,000 new infections occurring in the U.S. every year, infection with drug resistant strains of HIV represents a threat to the health of the public (Bae, Guyer, Grimm, & Altice, 2011; Wainberg et al., 2011). Given the importance of adherence in achieving long term sustainable success with ART, a variety of types of adherence support interventions have been investigated with various levels of success as suggested by systematic reviews and meta analyses (Bae et al., 2011; Dean, Walters, & Hall, 2010; Hart et al., 2010). Additionally, pharmaceutical advances have made adherence to ART less challenging since HIV medications currently available have longer half-lives and lower numbers of pills (Nachega, Mugavero, Zeier, Vitória, & Gallant, 2011). However, with the evolution of newer drugs and easier regimens, it is imperative to evaluate adherence in this changing context.

Study Aims

This study analyzes data on rates of ART adherence associated with critical therapeutic outcomes including increased CD4 counts and viral suppression. Given the improved efficacy of ART including drugs with longer half-lives and lower pill burdens, this study addressed the following questions: 1) at what level of adherence does viral suppression take place, 2) do the demographic, behavioral and clinical characteristics of people reporting optimal adherence differ from those who do not? and 3) what factors are associated with likelihood of adherence to ART? Answers to these questions will assist in understanding relationships between adherence and biological successes along with understanding factors contributing to adherence barriers.

Methods

This study draws secondary data from a sample of individuals living with HIV/AIDS who participated in an ongoing multi-site study undertaken to evaluate the impact of antiretroviral therapy (ART) on the central nervous system (CNS). The CNS HIV Anti-Retroviral Therapy Effects Research (CHARTER) study is a multi-site observational study that assesses the occurrence and characteristics of HIV-related neurological and psychiatric complications within the context of modern antiretroviral treatment. The CHARTER study received institutional review board clearance from each of the participating sites. While no human subject involvement was necessary for this analysis, the current study did receive institutional review board clearance from Washington University School of Medicine.

The current analysis (n = 381) includes participants in the CHARTER study enrolled up to the third year till 2007 who met the criteria of taking ART for at least 16-24 weeks, a necessary timeframe to reach viral suppression following ART start (Phillips et al., 2001).

Measures

Adherence to ART—Adherence to ART, the dependent variable in this analysis, was constructed from a self-reported questionnaire based on a four day recall, widely used by the AIDS Clinical Trials Group (ACTG) (Chesney et al., 2000). The ACTG adherence measure has been found to provide a reliable estimate of adherence that is significantly associated with plasma HIV concentration (Bangsberg, 2006b; Samet, Sullivan, Traphagen, & Ickovics, 2001; Simoni et al., 2008). The questions included in this measure consisted of information on proximal and distal factors related to medication adherence. Proximal adherence included asking patients to list names, doses and schedules of medications and recalling the frequency of each medication. The participant filled a chart with all medication names along with the prescribed schedule and number of pills. The number of pills missed was compared with the original pills prescribed. Another proximal variable included identifying skipped medications over the past four days (yes/no), and recalling how closely a specific schedule of medication dosage was followed on a 5-point Likert scale (0 = never; 5 = all of the time). Patients were also asked about adherence to taking medication along with the prescribed dietary guidelines on a 5-point Likert scale (0 = never; 5 = all of the time). The distal variables referred to reasons for missing medication, and other HIV related symptoms experienced in the past two weeks (Chesney et al., 2000). In congruence with other studies and clinical trials using this adherence measure, the ACTG Adherence to HIV medications was scored as the ratio and percentage of pills taken over pills prescribed, the percentage of pills taken on schedule, and the percentage of pills taken following specific instructions (Erlen, Sereika, Cook, & Hunt, 2002; Mannheimer et al., 2002; Reynolds et al., 2004).

For the purposes of this analysis, adherence status was dichotomized. Adherent participants were those who: 1) took prescribed doses of ART at least 95% of the time, 2) took at least 95% of the prescribed doses on schedule all the time, and 3) took at least 95% of the prescribed doses on schedule every time along with following any specific instructions all the time. Non-adherent participants fail to meet at least one of these criteria. The 95% adherence threshold was maintained in the interest of minimizing possible viral rebound resulting from sub-optimal adherence among participants in this large multi-site study.

Sociodemographic factors—Sociodemographic variables were drawn from the CHARTER database corresponding to the participants in the subset selected for this analysis. Biological sex was measured as a dichotomized variable, age measured as a continuous variable, race/ethnicity recorded as a categorical variable, education measured as number of years in school, current employment status, and highest position ever held, as categorized by the participant.

Beck Depression Inventory—The Beck Depression Inventory (second edition) or BDI-II (Beck, Steer, & Brown, 1996) was designed to assess existence and severity of symptoms of depression self-reported by the participant, as most accurately corresponding to the depression symptoms of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (Beck et al., 1996). This instrument contains 21 items symptoms of depression, scored on a four point scale, that ranges from 0-3 corresponding to the severity of the symptom described. Two items (questions 16 and 18) have seven options to indicate changes in appetite and sleep. The total score on BDI-II was obtained by adding the scores from each of the 21 items, and ranged from 0-63. The scores were divided into minimal (0-13), mild

(14-19), moderate (20-28), and severe (29-63) categories of depression symptoms as experienced by participants within the last two weeks, corresponding to the DSM-IV criteria (Beck et al., 1996). The BDI-II has a high alpha coefficient of 0.92 when validated among outpatients in clinic settings and among college students. BDI-II demonstrated construct validity and was able to distinguish between patients with and without depressive symptomatology adequately among a wide range of populations including minorities (Gary & Yarandi, 2004), elderly (Heckman et al., 2002), psychiatric outpatients (Judd et al., 2005), and persons living with HIV/AIDS (Steer, Kumar, Ranieri, & Beck, 1998; Trepanier et al., 2005).

Substance abuse—Measured as both current and past (ever), substance use as indicated by the participant. For the purposes of this analysis, substance use was assessed as the extent of use of mood altering substances and was measured on a scale of 0-2 where 0 referred to non-use, 1 corresponded to using mood altering substances at least four times in the preceding six months, and 2 referred to use of mood altering substances five times or more in the past six months.

Modified Activities of Daily Living—The modified ADL (Lawton & Brody, 1969) consists of a list of the following 16 everyday functions: housekeeping, managing finances, buying groceries, cooking, planning social activities, understanding reading materials/TV, transportation, using the telephone, home repairs, bathing, dressing, shopping, laundry, talking/keep track of medication, child care and work (score range: 0 to 16 points, 16 meaning no help needed). The ADL provides a well-accepted and easy to use format to describe the behavior as stated above among various populations (Chong, 1995; Fillenbaum, 1988; Gore-Felton et al., 2005; Katz, Downs, Cash, & Grotz, 1970). A higher score in ADL is representative of higher independence. In this study, the ADL raw scores were computed to generate a dichotomous variable of ADL (independent/dependent) to determine functional ability.

Patient's Own Assessment of Functioning—The PAOF (Chelune, Heaton, & Lehman, 1986) is a questionnaire where participants self-report their own ratings of how often they experience difficulties under five diverse cognitive domains: memory (10-items), language and communication (9-items), sensory-perceptual and motor skills (5-items), higher level cognitive and intellectual functions (9-items). The 33-item self-report instrument is, “designed to elicit patient's self-perception regarding the adequacy of their functioning in various everyday tasks and activities” (Chelune et al., 1986, p. 96.). The participant's assessment of functioning was obtained from their rating of the frequency of particular difficulty on a 6-point scale (1 = almost always; 2 = very often; 3 = fairly often; 4 = once in a while; 5 = very infrequently; 6 = almost never). The total score was a summation of all item scores divided by total number of items to reflect a mean of total subjective neurological complaints. A lower score indicated higher severity of neurocognitive deficits as reported by the patient (Chelune et al., 1986). Even though exact psychometric properties were not available for this measure, the PAOF has been used in other studies to detect patient's subjective complaints regarding cognitive deficits (Burdick, Endick, & Goldberg, 2005; Heaton et al., 2010; Valcour, Paul, Chiao, Wendelken, & Miller, 2011).

Global Deficit Score—HIV related neurocognitive factors drawn from the Global Deficit Score (GDS), a battery of neurological tests evaluated seven ability domains potentially affected by HIV. The seven domains are: information processing speed, motor coordination and praxis, attention and working memory, learning, recall, verbal fluency, and executive functioning (Carey et al., 2004; Heaton et al., 1995; Letendre et al., 2004). The GDS provides a composite index for these ability domains and has been standardized to measure

ability domains among people living with HIV (Carey et al., 2004; Heaton et al., 1995). The GDS summarizes participant's performance test scores in each of these domains and provides raw scores that are then converted to standardized T scores, transformed to deficit scores to reflect GDS for each participant in a range of 0 to 5, where higher scores indicate higher levels of impairments (Carey et al., 2004; Heaton et al., 1995). Further, the GDS cutoff point at 0.50 was able to determine the neurocognitive impairment among HIV infected individuals as compared to healthy controls at an excellent specificity of 0.89 and a Positive Predictive Power of 0.83. Overall, the GDS was effective in identifying and accurately classifying HIV-infected individuals with neuropsychological impairments based on the gold standard clinical rating approach (Carey et al., 2004).

For the clinical factors, CD4 cell count was a continuous variable assessing number of cells/mm³. HIV-RNA (viral load) was also a continuous variable that assessed number of copies/ml. The HIV/AIDS diagnostic area identified by the Center for Diseases Control and Prevention (CDC) was measured as a categorical variable where 1 = Asymptomatic HIV infection, 2 = Symptomatic HIV Infection, and 3 = AIDS.

Data Analysis

This study determined the impact of key psychosocial and behavioral characteristics of ART adherence among individuals living with HIV/AIDS and examined predictors of adherence. A conservative estimate 40 copies/ml was marked as a determinant of viral suppression. Univariate analyses explored and described the adherence rate including percentage of pills taken and compared individuals who attained viral suppression below 40 copies/ml with those who did not. Next bivariate analyses using chi-square and independent samples t-tests determined proportional and mean differences to explore how adherent participants differed from the non-adherent in key demographic, behavioral and psychosocial characteristics. Effect size was calculated for these comparisons to provide meaningful interpretations beyond what tests of statistical significance can provide (Cohen, 1988). Third, in the interest of the principle of parsimony (Garson, 2008), binary logistic regression with backward elimination option was employed to determine independent predictors of likelihood of ART adherence. For the purposes of this analysis, ethnicity was dummy coded to reflect the different categories of race/ethnicity and African American was retained as the reference group. An interaction term of depression and ethnicity was introduced in the model after evaluating theoretical and statistical support for such additions. Theoretically, the role of race and ethnicity has been inconsistently related to both ART adherence and guideline-concordant care for depression, hence the addition of the interaction terms in the model (Cooper et al., 2003; Miranda & Cooper, 2004). Statistically, an exploratory analysis without the additional variables was found to be not significant [$\chi^2(10) = 16.02, p = 0.099$], and hence there was support to add the interaction terms in the model.

Results

A majority of the participants were male (73%) in their mid-forties, with the mean age of 44.4 ($SD = 7.76$). About half of the respondents identified belonging to the African American ethnicity. Respondents reported an average of 12.4 years of education ($SD=2.4$). Participants reported mild neurocognitive impairments with a mean GDS score of 0.65. They also met the criteria for mild depressive symptomatology as suggested by the mean BDI-II score of 14. About 37% of the participants met the CDC's diagnostic criteria of advanced AIDS stage. Almost 16% of the participants had a history of lifetime substance dependence. In terms of daily functioning, 76% of the participants were reported independence in activities of daily living, a finding also supported by a low mean score of 6.7 on patient's assessment of own functioning. The nadir CD4 ever for this group was 152

cells/mm³, and the mean CD4 was 478 cells/mm³ (median 442 cells/mm³). The participants had low viral load levels, though not undetectable at below 40 copies/ml.

Overall, the participants reported high adherence to ART and took over 92% of total pills that were prescribed. Although 203 (53%) participants reported adherence >95%, 221 participants (58%) actually suppressed viral loads to below 40 copies/ml. Most of the participants took their pills as prescribed, with 248 (65%) respondents taking all prescribed medication on schedule. While a little less than a third of the participants did not have any special instructions to be followed pertaining to dietary intake related to medication, 66% of those who did, also followed those instructions. As a result of these variations in taking exact number of medication, on schedule following instructions, about 53% (n=203) of the total participants in this study were found to be adherent to ART at >95% of the time, with 58% (n=221) of the total achieving viral suppression.

Comparing ART adherence based on number of pills taken on schedule following instructions, the adherers (n= 203) and the non-adherers (n=178) had different characteristics. The adherers were older than the non-adherers by about two years, had a lower plasma viral load, and had fewer depressive symptoms when evaluated by the BDI. As demonstrated in Table 2, the sociodemographic, behavioral and clinical differences between adherers and non-adherers were of statistical significance, however they all resulted in small effect sizes as per Cohen's estimation (Cohen, 1988). The adherent group had simpler therapy regimen with fewer daily pills ($M = 6.52$, $SD = 4.19$) compared to the non-adherent patients ($M = 8.02$, $SD = 5.02$; $t[380] = 3.18$, $p < .01$; $d = .327$). On average, the non-adherent group skipped two or more pills ($M = 2.39$, $SD = 5.82$) compared to none missed by the adherent group in the four day recall per the ACTG questionnaire. There were more females in the non-adherent group, and more Caucasian participants, though the effect size was small. The largest effect size was observed in following medication schedule where 53% of the adherent group took their pills on time compared to only 11.8% of the non-adherers [Pearson $\chi^2(4) = 233.02$, $p < .001$; Cramer's $V = .782$].

Additional bivariate analysis evaluating viral suppression rates revealed that individuals who took their medication following all instructions most of the time or all of the time were more likely to achieve viral suppression. Those on non-nucleoside reverse transcriptase inhibitors (NNRTIs) were also more likely to have viral suppression compared to those with other regimen.

When analyzing factors associated with likelihood of ART adherence given some of the significant differences between adherers and non-adherers, a binary logistic regression with backward elimination option was run assessing likelihood of non-adherence. The backward elimination procedure removed variables in order of least significance and the least significant effects that were removed were ethnicity, interaction effects between depression and ethnicity representing all groups, age, CDC's stage of illness, and patient's assessment of own functioning. The overall model was significant [$\chi^2(10) = 26$, $p = 0.003$] and accounted for 8.8% of variance in adherence. The odds ratio of 1.027 suggested every unit rise in depressive symptomatology on the BDI accounted for 3% greater likelihood of non-adherence while controlling for other factors.

Discussion

Despite less than perfect adherence by strict guidelines, some individuals achieved viral suppression with or without adequate recovery of CD4. Individuals who were more likely to miss their medication were also sicker with lower CD4 counts, reported higher substance dependence, and were more likely to be ADL dependent compared to their adherent

counterparts. The non-adherent individuals reported higher depressive symptoms. Although effect sizes indicated minor differences, results also identified a non-adherent group that comprised of younger white females with higher daily pill burden compared to their adherent counterparts. While prior studies have overwhelmingly identified African American females to be at a higher risk for both HIV related morbidity and mortality, our findings reveal a non-adherent group comprising of White female participants, consistently identified to be at a lower risk. The primary finding of interest is the fact that increases in depressive symptomatology is associated with increased likelihood of non-adherence to medication support newly emerging studies supporting the same (Kong, Nahata, Lacombe, Seiber, & Balkrishnan, 2012). While our study does not explicitly evaluate the role of mental health status, the finding that individuals who were non-adherent were more likely to report both depression symptoms and substance use point toward the need to include the role of mental health and substance use and treatment in future studies on HIV medication adherence. This finding directly eludes to previous studies that have supported the need for comprehensive case management approaches including depression care for persons living with HIV/AIDS (Burbridge, Cruess, Antoni, & Meagher, 2011).

While our findings demonstrate viral suppression is achievable with less than perfect ART adherence, it does not negate the importance of taking HIV medications optimally all the time (Bangsberg, 2006a). If viral suppression can be achieved at less than 95% adherence, this allows for a wider window of opportunity for those individuals who have barriers to ART adherence (Gay et al., 2011).

This study does not try to minimize the importance of adherence, but presents findings suggesting greater efficacy of HIV medications in achieving viral suppression in our study participants within the time frame up to 2007. As HIV medication regimen has continued to improve and evolve towards easier dosage and fewer side effects, our study participants were still receiving an average seven pills per day, an improvement of earlier regimen, however, still daunting by some standards. Given the human challenge of maintaining strict adherence, the overall success of HIV therapeutics in recent years reinforces our findings that present medications may be more forgiving in requirements for strict adherence, presumably due to greater potency and improved pharmacokinetic parameters.

While the findings are encouraging in terms of achieving ART adherence and associated viral suppression at lower than the prescribed 95% level, future research needs to evaluate psychosocial characteristics of adherent long term survivors in an effort to design interventions to help patients for whom adherence remains difficult, especially individuals with history of substance use and other comorbidities.

These findings need to be interpreted within the context of the study limitations. First, because the design was cross-sectional in nature, temporal ordering of variables does not permit firm conclusions to be reached regarding the causal effects of depression to non-adherence. Second, even though biological outcomes validated patient adherence, the self-reported adherence to missed doses was dependent on memory recall of the participants and could have been under- or over-reported due to social desirability bias. Additionally, the four day recall used in the ACTG questionnaire has been previously found to be less than perfect in assessing adherence over a longer period of time. Third, the participants were drawn from a specific sample, individuals participating in a research study. While the study sought to be representative of the community, no research sample can be completely representative. Co-morbidities such as substance use and other life challenges such as unemployment, poverty, homelessness, might be under or over-represented and thus this sample may not be generalizable to other populations living with HIV infection.

Despite the limitations, the findings merit further exploration. The association between ART adherence and depressive symptomatology requires further attention as sustained non adherence can lead not only to loss of virologic suppression, deterioration in immune function but also development of drug resistant mutations (Doyle et al., 2012; Hong et al., 2011). The particular finding that White female participants reported higher depression symptoms and lower adherence raises concerns regarding accessibility and availability of adequate mental health care and treatment geared towards this population. This is particularly relevant as HIV infection continues to remain highly stigmatized despite the impressive biomedical advancements over the last three decades (Rao et al., 2012). HIV as a chronic disease is yet to receive the same level of acceptance, empathy and support as many other chronic diseases such as hepatitis B or diabetes or cancer (Zaidi, Griffiths, Newson-Smith, & Levack, 2012). The shame, secrecy and silence related to HIV infection creates an environment where depression and related mental health concerns can develop uninhibited (Israelski et al., 2007; Miller, Grover, Bunn, & Solomon, 2011). Within a fragmented system of HIV care in the US, sexual risk behavior related to depression and mental illnesses may not be adequately addressed (Nurutdinova, Rao, Shacham, Reno, & Overton, 2011) and our findings corroborate to the fact that individuals with depression are more likely to be non-adherent, hence needing therapeutic intervention and support at a regular basis.

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Table 1
Adherence to ART: percentage of pills, frequency of dosage and dietary requirements

Adherence to Antiretroviral Therapy	n = 381
Percentage of doses taken:mean (range)	96.5 (0 – 100)
On schedule: All the time (%)	248 (65)
Special instructions (%)	268 (70)
Followed instructions: All the time (%)	180 (66)
Reported >95% Adherence (%)	203 (53.2)
Undetectable Viral Load (%)	221 (58.3)

Table 2
Comparing Sociodemographic, Behavioral, Clinical and Adherence Characteristics of Adherers and Non-Adherers

Variable	Adherer n=203 Mean (SD)/Frequency (%)	Non-adherer n=178 Mean (SD) Frequency (%)	t-statistic or Chi-square	Effect size Cohen's d/ Cramer's V
Age	45.3 (7.7)	43. 6 (7.8)	2.18*	.22
Male	151 (40.0%)	126 (33.1%)	<i>Fisher's Exact</i>	.04
African American	106 (28.0%)	94 (25.0%)	<i>Fisher's Exact</i>	.006
Education (No. of years)	12.5 (2.5)	12.2 (2.3)	1.30	.13
Employed	36 (9.4%)	39 (10.2%)	<i>Fisher's Exact</i>	.05
Substance dependence	25 (6.7%)	35(9.4%)	<i>Fisher's Exact</i>	.09
Had AIDS diagnosis	148 (39.0%)	139 (36.5%)	<i>Fisher's Exact</i>	.06
CD4 cell/mm ³	496 (282)	457 (328)	1.24	.13
Plasma Viral Load (log)	2.2 (.9)	2. 5 (1.2)	-2.54*	.26
Depression (BDI Score)	12.5 (10.2)	15.5 (10.9)	-2.75**	.28
Activities of Daily Living	161 (42.3%)	129 (34.0%)	<i>Fisher's Exact</i>	.08
Mean daily pill burden	6.52 (4.1)	8.02 (5.0)	-3.18**	.32
Mean daily skipped pills	0.00 (0.00)	2.39 (5.9)	-5.83***	.59
Percentage of pills taken	100 (0.00)	92.48 (15.01)	7.12***	.73
Special instructions	132 (34%)	136 (36%)	<i>Fisher's Exact</i> *	.12
Followed instructions	132 (49%)	48 (18%)	128.15***	.69
Pills always on schedule	203 (53%)	45 (12%)	233.02***	.78

* p<.05;

** <.01;

*** p<.001

Table 3
Viral suppression based on ART adherence characteristics and Regimen Type

ART Adherence Factors	Viral suppression achieved		Chi-square	Effect size (Cramer's V)
ART on Schedule	No (%)	Yes (%)	9.22*	.156
Never	2 (.5)	1 (.3)		
Some of the time	6 (1.6)	2 (.5)		
About half of the time	7 (1.8)	3 (.8)		
Most of the time	49 (12.9)	61 (16.1)		
All of the time	95 (25.1)	153 (40.4)		
Total	159 (42)	220 (58)		
ART Following Instructions			2.38	.09
Never	3 (1.1)	3 (1.1)		
Some of the time	7 (2.6)	7 (2.6)		
About half of the time	5 (1.9)	6 (2.2)		
Most of the time	27 (10.1)	30 (11.2)		
All of the time	68 (25.5)	111 (41.6)		
Total	110 (41.2)	157 (58.8)		
Percentage of pills taken			30.35	.28
0-25%	0 (0)	0 (0)		
25-49%	2 (.6)	0 (0)		
50-60%	1 (.3)	1 (.3)		
61-70%	3 (.8)	1 (.3)		
71-80%	10 (3)	9 (2.7)		
81-85%	5 (1.3)	4 (1.2)		
86-90%	6 (1.8)	5 (1.3)		
91-95%	3 (.8)	3 (.8)		
96-99%	6 (1.8)	2 (.5)		
100%	123 (32.5)	195 (51.5)		
Total	159 (42)	220 (58)		
Regimen Type			16.52***	.21
NNRTI based	32 (8.4)	83 (21.9)		
Other	8 (2.1)	17 (4.5)		
PI based	106 (28)	108 (28.5)		
PI/NNRTI	13 (3.4)	12 (3.2)		
Total	159 (42)	220 (58)		

* p<.05;

*** p<.001

Table 4
Results from Logistic Regression Analyses of Predictors of Likelihood of Adherence among Individuals Living with HIV/AIDS

Variables	β	SE	Odds ratio (95% Wald CI)	Wald χ^2
1. Age	-0.0217	0.014	0.979 (0.952 - 1.006)	2.3408
2. Gender (Male)	-0.0719	0.252	0.931 (0.567 - 1.526)	0.0812
3. Ethnicity (dummy coded White)	0.1475	0.384		0.1470
4. Ethnicity (dummy coded Hispanic)	-0.5552	0.759		0.5341
5. Ethnicity (dummy coded Others)	2.8365	1.825		2.4144
6. BDI* White (interaction)	-0.0092	0.021		0.1868
7. BDI* Hispanic (interaction)	0.0445	0.045		0.9603
8. BDI* Others (interaction)	-0.3236	0.197		2.6803
9. BDI (Depressive Symptomatology)	0.0179	0.017		1.1154
10. Lifetime Substance dependence	0.2921	0.324	1.339 (0.708 - 2.532)	0.8083
11. CDC AIDS diagnosis	0.3690	0.255	1.446 (0.877 - 2.386)	2.0877
12. Independence in Activities of Daily Living	-0.0866	0.283	0.917 (0.526 - 1.598)	0.0934
13. Patient's Assessment of Own Functioning	0.0218	0.018	1.022 (0.986 - 1.059)	1.4195
<i>Logistic Regression Backward Elimination Procedure</i>				
BDI (Depressive Symptoms)	0.027	0.009	1.027*** (1.007 - 1.047)	7.3464

* p<.05;

**

p<.01;

*** p<.001