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Patient-related Factors Predicting HIV Medication Adherence among Men and Women with Alcohol Problems

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Abstract

The study explored the relationship between HIV medication adherence and alcohol, cognitive, social and affective factors in 272 persons with alcohol problems. Alcohol and cognitive factors significantly differentiated those who did and did not adhere. Specifically, adherence confidence and number of drinks emerged as subfactors driving the associations to adherence. Among those who were less than perfectly adherent (n = 154), only alcohol factors predicted levels of nonadherence. Cognitive factors play a role in understanding some of the differences between those who do and do not adhere to their HIV medications, but they do not differentiate among levels of nonadherence.

Keywords

adherence; alcohol; HIV; medication; self-efficacy

Introduction

Since the mid-1990s people with HIV have begun living longer lives, in part due to the introduction and success of highly active anti-retroviral therapy (HAART). By 2003, 20 antiretrovirals were available for the treatment of HIV (Simoni, Pantalone, Frick, & Turner, 2003), working to suppress HIV through several different mechanisms of action. While HAART has been very effective in suppressing viral replication and slowing disease progression (Hogg et al., 1999), adhering to the complex HAART regimens can be difficult, sometimes requiring three daily dosing times with as many as 20 pills per dose. This level of pill burden has been seen as a barrier to treatment adherence and, as a result, recent regimens have become more simplified, both in the number of pills required per dose and the number of doses per day.

Studies have repeatedly found that as many as half of people taking HAART are nonadaherent (Ammassari et al., 2001; Bangsberg et al., 2003; Howard et al., 2002; Ickovics et al., 2002). Adequate adherence to HAART is generally defined as taking at least 95 percent of prescribed medication (Paterson et al., 2000) which, based on a twice a day regimen, translates into missing no more than two doses per month. The degree of adherence required with HAART is more

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stringent than that which is required for most other chronic illnesses, and can be difficult even under the best circumstances. Decreased adherence can result in inadequate viral suppression, immunologic failure, more rapid disease progression and the development of drug resistance (Bangsberg et al., 2000; Carpenter et al., 2000; Carrieri et al., 2001; Hecht et al., 1998; Paterson et al., 2000; Wood et al., 2003). As such, a thorough understanding of the range of factors that impact adherence to HAART is critical for the long-term health of those living with HIV. The purpose of this article is to examine Cognitive, Affective, Social and Alcohol factors and identify which contribute to medication adherence.

Many predictors of adherence have been studied that are referred to as 'patient'-related factors. As opposed to 'environmental' (inconvenience of treatment, poor access to healthcare and medications) or 'medication' (complexity of regimen, side-effects) factors, patient factors are characteristics of the patient that could be associated with adherence. Among others, these patient-related factors include forgetfulness, poor understanding of the relationship between nonadherence and disease progression (Wagner, Remien, Carballo-Diéguez, & Dolezal, 2002; Weiss et al., 2003), motivation to adhere (Stone et al., 1998), self-efficacy (Molassiotis et al., 2002; Murphy, Greenwell, & Hoffman, 2002), HIV knowledge (Williams, 1997), depression (Arnsten et al., 2002; Gonzalez et al., 2004; Mellins et al., 2002), anxiety (Tucker, Burnam, Sherbourne, Kung, & Gifford, 2003), alcohol and active drug abuse (Mellins et al., 2002; Tucker et al., 2003), social support (Gonzalez et al., 2004) and physician–patient relationships (Roberts, 2002). For the purposes of this article, patient-related factors were conceptually and empirically grouped into four general factors: alcohol; cognitive; affective; and social. Three of these broad factors—cognitive, affective and social—were chosen because they encapsulate the patient-related factors addressed in the literature and because they have the potential to be addressed in behavioral interventions. Alcohol was considered as a separate factor because it is an alcohol-using sample and because of its prevalence in the HIV community.

Alcohol factors

Alcohol use and problem-level drinking is common among people living with HIV (Cook et al., 2001; Galvan et al., 2002; Lefevre et al., 1995; Samet, Phillips, Horton, Traphagen, & Freedberg, 2004). Data from a national probability survey of HIV-positive adults receiving medical care in the United States (Galvan et al., 2002) found that 53 percent reported drinking in the past month, with 8 percent (or 15 percent of those reporting drinking) classified as heavy drinkers (defined as five or more drinks on four or more days during the previous month). This rate of heavy drinking is approximately twice the rate estimated among the general population (Greenfield, Midanik, & Rogers, 2000).

Alcohol consumption among persons with HIV may lead to disease progression because of impaired adherence to HIV medication. In multivariate analyses with 1910 patients taking antiretroviral medications, persons who drank tended to have worse adherence than those who did not drink, with non-adherence increasing with the level of drinking severity (Tucker et al., 2003). They found that not only did heavy drinking negatively impact adherence, but moderate drinking, too, was a risk factor for poor adherence. Persons with HIV who also have problem-level drinking face particular challenges with adherence to HAART. Problem drinking has been found to be predictive of decreased adherence (Halkitis, Parsons, Wolitski, & Remien, 2003), and problem drinkers more commonly report missing their medications due to forgetfulness or running out (Cook et al., 2001). Samet, Horton, Meli, Freedberg and Palepu (2004) found alcohol consumption to be the most significant predictor of HAART nonadherence among those with a history of alcohol problems. A longitudinal study of HIV-positive persons with alcohol and other substance use problems found that increased alcohol

use was associated with both nonadherence and HIV viral load suppression (Palepu, Horton, Tibbetts, Meli, & Samet, 2004).

Affective factors

Mental health problems, particularly mood disorders, are common among patients living with HIV (Tucker et al., 2003; Turner et al., 2001), and may pose threats to adherence. Research has shown lower rates of HAART adherence among those with a mood or anxiety disorder (Paterson et al., 2000; Tucker et al., 2003), and depression has been strongly associated with nonadherence among diverse samples of those living with HIV (Arnsten et al., 2002; Catz, Kelly, Bogart, Benotsch, & McAuliffe, 2000; Gonzalez et al., 2004; Mellins et al., 2002; Murphy et al., 2005). Depression among HIV-positive persons can result in nonadherence as patients 'give up' and may even refuse treatment altogether (Blumenfield, Milazzo, & Wormser, 1990). Depressed individuals also tend to be less motivated to take their HIV medications (Lyketsos et al., 1996), may have impaired cognitive functioning that makes it difficult to remember to follow through with treatment recommendations or may have a pessimistic outlook about the effectiveness of treatment (DiMatteo, Lepper, & Croghan, 2000). Therefore, the identification and treatment of mental health issues, particularly depression, may be a potential way to address and reduce nonadherence.

Cognitive factors

Adherence to medication can be thought of as a decision-making process involving the consideration of the pros and cons of change, an evaluation of self-efficacy to change, and attitudes held about the efficacy of medication treatment. This can be explained by the Health Belief Model (Rosenstock, 1974), which asserts that changes in beliefs about health outcome are associated with the *motivation* to take action. This model posits that a cost–benefit analysis precedes a decision to take action. Higher perceived benefits of taking medication versus costs of taking medication result in better adherence. The Theory of Reasoned Action (Ajzen & Fishbein, 1980) may also explain the beliefs and attitudes influencing adherence in that it posits that people consider their actions before deciding to perform or not perform a certain behavior. Here, *intention* drives the behavior and, in the case of adherence, intention is driven by attitudes toward adherence, how others will view their adherence or nonadherence and perceived self-efficacy to adhere. Overall, self-efficacy (Bandura, 1986) is also an important component of adherence, as having confidence in one's ability to take medication and to incorporate the treatment into their lives has been shown to lead to better adherence (Catz et al., 2000; Gifford et al., 2000; Godin, Cote, Naccache, Lambert, & Trotter, 2005). In fact, health beliefs in general have been shown to play a significant role in whether an individual decides to adhere to their regimen. Those who believe in the effectiveness of their HAART medication are more likely to adhere (Wagner et al., 2002); whereas nonadherent patients tend to perceive fewer benefits of HAART (Deschamps et al., 2004). Understanding the cognitive processes that underlie decisions to be nonadherent may be helpful when trying to understand barriers and promote HAART adherence.

Social factors

Social support has been associated with adherence to antiretroviral medication, but the relationship is not straightforward. Social support can be construed as a multidimensional construct (practical, emotional or informational support from family, friends, partners or organizations) (Schwarzer, Dunkel-Schetter, & Kemeny, 1994) or a unidimensional construct of general support (Gonzalez et al., 2004). Through stability, predictability and control, social support may provide psychological resources to help HIV-positive individuals cope with the stressful aspects of taking HIV medication (Gonzalez et al., 2004). On the other hand, social networks have been found to interfere with adherence due to spontaneous social activities,

which can disrupt evening doses (Ryan & Wagner, 2003), or as a result of issues complicated by stigma, disclosure and non-supportive others in the social network (Reynolds & Alonzo, 1998). As a result, some studies now look at a unidimensional construct of perceived quality of support and have concluded that quality of support is more consistently associated with HAART adherence than is quantity of support (Gonzalez et al., 2004).

A quality patient–provider relationship has also been identified as an important source of support to promote adherence to HIV medication (Ingersoll & Heckman, 2005; Martini, Parazzini, & Agnoletto, 2001; Roberts, 2002) as well as the perception of the provider as open, respectful, empathic and showing genuine interest (Simoni et al., 2003). For example, in a qualitative study of 28 HIV-positive persons, the need for trust in their physicians was commonly identified (Roberts, 2002). For these patients, trust in their healthcare providers meant more confidence in their treatment regimens and higher likelihood of disclosure regarding missed medications, leading to discussions about their struggles with adherence. For decades it has been shown that patients who are dissatisfied with their providers are less likely to comply with treatment recommendations than those who feel they are involved in a collaborative relationship in which they are an integral part of the decision-making process (Heszen-Klemens & Lapinska, 1984; Roter, Hall, & Katz, 1988). This patient-centered model of medication management is important in impacting adherence (Chewning & Sleath, 1996). Considering the complexity of HIV medication regimens and the frequency of side-effects, communication with providers may be essential for adherence.

Present study

The aims of this article are twofold. First, determining predictors of nonadherence requires reliable and valid measurement of these potential predictors. In their comprehensive review of the recent literature, Ammassari et al. (2002) point out problems with the previous assessments of correlates and predictors of adherence explaining that different instruments have been used to measure depression, social support, self-efficacy and beliefs about treatment making it difficult to compare studies and find common factors that affect adherence. Whereas past studies have focused on individual scales and even single items to determine a construct, this article seeks to look at broader constructs that may underlie adherence behavior. Specifically, we are interested in examining alcohol, affective, cognitive and social constructs that may be impacting adherence. In order to reduce measurement error, our constructs are composites of multiple scales obtained through factor analysis.

Second, this article aims to build on previous research by conducting analyses on perfect versus imperfect adherence as well as predicting variability among those who are less than perfectly adherent. Predicting medication adherence variability only in those who are less than perfectly adherent is rarely seen in the HIV medication adherence literature and we could find no study that compared results from those who were adherent versus nonadherent, as well as examined variability among those who were nonadherent. In contrast, such comparisons are common in the alcohol research literature, where predictors of initiation to drinking are different than those that predict frequency of consumption or alcohol problems (Prescott et al., 1994; Viken, Kaprio, Koskenvou, & Rose, 1999). We seek to understand whether the factors that predict perfect adherence are the same as the ones that predict variability in adherence among those who are nonadherent.

Method

Participants

Participants were 272 HIV-positive men and women who were currently taking antiretroviral medication, reported alcohol problems and agreed to be part of a randomized clinical trial

comparing Motivational Interviewing (MI) and Cognitive Behavioral Therapy (CBT) to education for increasing medication adherence and reducing alcohol use. Two recruitment methods were used: (1) interested patients contacted us in response to flyers placed in clinic waiting rooms and were then screened by telephone ($n = 179$, 65.8%) and (2) interested patients completed an on-site screener during HIV-related community events ($n = 93$, 34.2%). Inclusion criteria were: age greater than 18 years, a score of eight or above on the Alcohol Use Disorder Identification Test (AUDIT), and currently on a HAART regimen. A score of eight on the AUDIT suggests problem-level drinking (Maisto, Carey, Carey, Gordon, & Gleason, 2000). People for whom their drug-related problems were more severe than alcohol-related problems, and those with active psychosis were excluded.

A total number of 1285 participants telephoned the project line for screening. Of these, 898 were excluded because they failed to meet eligibility criteria at the time of phone screening or upon secondary screening during the initial visit. The most common reasons for ineligibility were greater problems associated with other drug use compared to alcohol ($n = 564$), score of less than eight on the AUDIT ($n = 308$) and no alcohol use in the past 30 days ($n = 61$). A total of 105 failed to show for their first appointment, resulting in 282 eligible participants. However, 10 of these had incomplete baseline data and were not included in the analyses, resulting in a final sample of 272. The research was reviewed and approved by the Institutional Review Board of the investigators.

The sample was predominantly male (78.3%, $n = 213$) and was ethnically diverse with 57.7 percent ($n = 157$) of the sample identifying as African American and 24.7 percent ($n = 67$) as Hispanic (see Table 1). Over half the sample (59.9%, $n = 163$) identified as gay or bisexual. Mean age was 43.7 (SD = 7.23) and ranged from 26 to 66. Over half the sample (57.7%, $n = 157$) had never been treated for alcohol use. Mean number of HAART medications was 2.82 (SD = 0.91) and the sample was on HIV medication for an average of 6.99 (SD = 4.15) years. Based on HIV PCR analyses done at the baseline assessment and transformation into log10, the mean log10 HIV viral load was detected at an average of 3.29 copies/ml (SD = 1.47). The logarithmic transformation of the absolute number of copies has become the preferred unit of measurement for viral load. Mean CD4 counts were 418.41 (SD = 296.01).

Procedures

All participants underwent a baseline interview intended to examine socio-demographic and biopsychosocial variables such as mental health, adherence-related social support and social norms, decision-making processes regarding adherence and alcohol use, regimen characteristics, motivation to change current behavior and viral load and CD4 counts. The findings reported in this article represent data from the baseline interviews. All subjects signed a written informed consent before participating in the study. The majority of the assessment was completed on an audio computer-assisted self-interview (ACASI) in which the participant responded to automated questions on a computer screen that they could either read or listen to with headphones. ACASI has been found to be an effective interview method for people of diverse educational backgrounds and because they have audio assistance it eliminates the effects that reading ability has on internal validity (Gribble, Miller, Rogers, & Turner, 1999; Turner et al., 1998). Viral load and CD4 counts were obtained through an on-site blood draw by a certified phlebotomist. The interview generally lasted about three hours and subjects were paid $30.

Analytic approach

This article seeks to look at broader constructs that may underlie adherence behaviors, therefore factor analysis was used to combine multiple scales representing the relevant domains. Maximum likelihood (ML) factor analysis was conducted in SPSS 12.0, with the composite

factor scores created using the regression approach. Binary logistic regression models were fit to the dichotomous adherence variable and linear regression models were fit to the continuous adherence variable. Scales were computed by calculating the mean of the items, and then multiplying by the total number of items. A scale score was calculated for a participant as long as 80 percent of the items were present. As a result of the use of ACASI, missing data were rare, and scale scores were able to be calculated for most participants.

Measures

Demographics—Participants were asked a series of demographic questions including age, gender, ethnicity, relationship status, sexual identity and employment status.

Cognitive factor

Adherence attitudes—This is an 18-item scale developed for a previous study on medication adherence (Halkitis, Kutnick, & Slater, 2005). It is intended to measure risk perception regarding vulnerability to treatment failure and other perceived negative health outcomes resulting from nonadherence. In our sample, the scale demonstrated good reliability (alpha = .95).

Decisional balance—To understand the decision-making process, attitudes toward adherence were measured through a 22-item measure that includes perceived pros and cons of adhering. This measure is based on the Decisional Balance Inventory (Velicer, DiClemente, Prochaska, & Brandenburg, 1985) and adapted for pros and cons of taking HIV medication. The measure demonstrated good reliability (alpha = .89) in our sample.

Confidence for adherence—This measure consists of 11 items that were specifically developed for HIV medication adherence self-efficacy based on Bandura's (1986) theory of self-efficacy and pilot work with HIV-positive adults (Parsons, Rosof, Punzalan, & DiMaria, 2005). The measure asks participants to rate on a five-point scale how confident they are that they could take their HIV medications on time under several circumstances (e.g. on vacation; out at night). The final scale consisted of one factor accounting for 46 percent of the variance with good reliability (alpha = .91).

Visual inspection of histograms of each of these cognitive scales indicated that they had an approximately normal distribution. Maximum likelihood (ML) factor analysis found the existence of one underlying factor that explained 42.18 percent of the total variance in these scales and provided a good fit to the data (χ^2 (2) = 5.55, p = .063). A score created using the regression method functioned as our measure of the Cognitive factor in all analyses.

Affective factor

Depression—Depression was assessed using the Center for Epidemiologic Studies—Depression Scale (CES-D), a 20-item, self-report inventory of depressive symptoms (Radloff, 1977). The measure has previously demonstrated strong reliability (Roberts, Andrews, & Lewinsohn, 1990) and has been used in multiple studies of HIV-positive men and women (Cockram, Judd, Mijch, & Norman, 1999; Lyketsos et al., 1993, 1996; Murphy et al., 2001; Revicki, Chan, & Gevirtz, 1998) and is one of the most widely used measures of depressive affect in the field of HIV. For our sample, the CES-D demonstrated good reliability (alpha = .86).

Anxiety—Anxiety was measured using the items related to general anxiety from the Beck's Symptom Inventory (Derogatis & Melisaratos, 1983), which has repeatedly shown excellent reliability and validity (Broday, & Mason, 1991). For our sample, the anxiety scale demonstrated good reliability (alpha = .90).

HIV concern/anxiety—This scale consists of 35 items measuring the level of worry regarding issues relevant to HIV-positive individuals (health, disclosing serostatus, side-effects of medications) (Halkitis, Kutnick, & Slater, 2005). The final scale consisted of one factor accounting for 47 percent of the variance with excellent reliability (alpha = .97).

Medication guilt—This measure assessed feelings of guilt toward nonadherence based on the Diabetes-Specific Guilt Survey created by Bybee and Zigler (1991) and modified for HIV nonadherence (Halkitis, Kutnick, & Slater, 2005). The scale included nine five-point Likert items (0 = Not at all like me to 4 = Extremely like me) to indicate the level with which feelings of nonadherence guilt were endorsed. This scale demonstrated satisfactory reliability in our sample (alpha = .78). Items included 'When I do not store my HIV medication in the way I'm instructed to, I feel badly about it' and 'When I stop taking my HIV medications for several days in a row, I feel badly about it'.

Visual inspection of histograms of each of these affective scales indicated that only *Anxiety* had a non-normal distribution. To adjust for this negative skew, this variable was natural log transformed. ML factor analysis found one factor that explained 50.26 percent of the variance and provided a good fit to the data (χ^2 (2) = 2.11, p = .348). A regression-based factor score was used as our measure of the Affective factor in all analyses.

Social factor

Relationship with healthcare provider—The quality of the relationship with a healthcare provider was assessed via the Consultation Satisfaction Questionnaire (CSQ), which includes 18 items concerning one's most recent medical consultation (Baker, 1990). The CSQ has four scales: general satisfaction; professional care; depth of relationship; and perceived time spent with the provider. Reliability indices for the subscales have ranged from .82 to .91 (Baker, 1990) and fell within this range for our sample as well. Items specific to HIV medications (e.g. 'My doctor clearly explained to me what a protease inhibitor is and how it works') were added.

Subjective social norms—This 12-item scale is based on research generated from focus groups of HIV-positive persons (Halkitis, Zade, Shrem, & Wilton, 2005) and has shown satisfactory reliability in previous studies (alpha = .78). Two factors accounted for 61 percent of the variance. Factor one corresponds to partners', friends' or health care providers' beliefs about whether a person should take medications. Factor two corresponds to partners' or friends' nonadherence. For our sample, the reliabilities for the two factors were good (alphas = .90 and .83, respectively).

Social support for medication—Social support for taking medication was assessed using a modified version of the UCLA Social Support Inventory (Schwarzer et al., 1994), which was modified for our current work such that the measure focuses on social support for HIV medication adherence. Social support among family, friends, healthcare providers and affiliated organizations is assessed and combined to create an overall social support score. The 12-item measure has previously demonstrated internal consistency (alpha = .88) in a sample of HIV-positive persons on ART (Halkitis, Kutnick, & Green, in press), and for our sample the reliability was strong (alpha = .94).

Histograms of each of these social support scales suggested all were approximately normally distributed. ML factor analysis found one factor that explained 50.48 percent of the total variance in each of these scales. A factor score created using the regression method was used as our measure of the Social factor in all analyses.

Alcohol factor

Alcohol-related problems—We assessed alcohol-related problems in two ways. First, during the screening interview we used the AUDIT, a 10-item survey, which measures alcohol consumption, dependence symptoms and personal and social harm reflective of drinking over the past 30 days. The AUDIT has demonstrated good content, criterion and construct validity (NIAAA, 1995) and reliability (alphas from .77 to .83; Bohn, Babor, & Kranzler, 1995). Then, during the ACASI, we assessed the negative consequences of alcohol use for the past 90 days on specific domains of the participants' lives using the Drinker Inventory of Negative Consequences (DrinC). The DrinC was used in Project MATCH and demonstrates good psychometric properties (Miller, Tonigan, & Longabaugh, 1995).

Current alcohol consumption—Total current alcohol consumption was assessed using a timeline follow-back interview (Sobell & Sobell, 1992) during which participants reflected back on the past 30 days to report the number of standard drinks consumed each day. Research staff assisted with the timeline interview to mark memorable events on the calendar as anchor points and then assisted the participant to recall day by day the number of standard drinks consumed.

Visual inspection of histograms of each of these variables found that the total number of standard drinks was positively skewed so it was log transformed. ML factor analysis found one factor that explained 58.31 percent of the total variance in each of these alcohol scales. A factor score created using the regression method was used as our measure of the Alcohol factor in all analyses.

Adherence

Adherence was assessed using a timeline follow-back interview to recall day by day all medication doses taken and missed during the past two weeks. A period of 14 days was used in order to have the opportunity to capture two weeks of both weekday and weekend activity. Adherence was defined as 95 percent or higher because of the need to maintain undetectable viremia (Gross, Bilker, Friedman, & Strom, 2001; Paterson et al., 2000). For the dichotomous adherence variable, a 14-day percent adherence measure was recoded so that scores of 95 percent and above were coded one (adherence) and scores below 95 percent were coded zero (nonadherent).

The first step in computing the continuous adherence variable was eliminating those who were 95 percent or more adherent ($n = 118$ eliminated, leaving $n = 154$). The remaining data showed substantial negative skew, so the data were reflected, log transformed and then reflected again to created a more normal distribution.

Results

At least 95 percent adherence was reported by 43.0 percent ($n = 118$) of the sample. To explore predictors of adherence (>95%) versus nonadherence, logistic regression was performed with dichotomous adherence as the dependent variable and the Cognitive, Affective, Social and Alcohol factors entered as independent variables. The omnibus test of the model coefficient was significant (χ^2 (4) = 19.96, $p = .001$). With all predictors included in the model, the Nagelkerke's R-Square was 9.5 percent and 62.1 percent of the cases were correctly classified as adherent or nonadherent. Results of this analysis, shown in Table 2, indicated that the Cognitive (OR = 1.36, CI = 1.01, 1.85) and Alcohol (OR = 0.55, CI = 0.39, 0.77) factors were significantly and independently related to adherence. Neither the Social nor Affective factors were significantly related to adherence. Subsequent analyses of the individual subscales in

these factors revealed that none were significantly related to the dichotomous adherence measure.

Two additional analyses were performed to explore the subfactors that underlie the association between adherence and the effects of each the Alcohol and Cognitive factor (Table 3). For the Cognitive factor, the omnibus test of the model coefficient was significant (χ^2 (4) = 43.24, p = .001), the Nagelkerke's R-Square was 19 percent, and 68.2 percent of cases were correctly classified on adherence. Among the individual components of the Cognitive factor, adherence confidence showed the only significant association with adherence (OR = 1.07, CI = 1.05, 1.10). For the Alcohol factor, the omnibus test of the model coefficient was significant (χ^2 (3) = 19.90, p = .001), the Nagelkerke's R-Square was 9 percent, and 63.3 percent of cases were correctly classified. The level of alcohol consumption (OR = 0.43, CI = 0.26, 0.74) showed the only significant association with adherence.

To explore predictors of variability in adherence among those who were less than perfectly adherent (n = 154), linear regression was performed with the continuous adherence variable as the dependent variable and the Cognitive, Social, Affective and Alcohol factors as independent variables. The omnibus test of the model coefficients was significant (F(4, 150) = 2.53, p = .04) and these factors explained only a small percentage of the variance in adherence (R^2 = .063, *adjusted* R^2 = .038). As shown in Table 2, only the Alcohol factor was significantly related to adherence among those who were less than perfectly adherent. This is in contrast to the result of the logistic regression analysis of the dichotomous adherence versus nonadherence outcome, where both the Alcohol and Cognitive factors were significant. Subsequent correlational analyses of the individual subscales of the factors revealed that adherence confidence was significantly related to the continuous measure of adherence (r = .21, p < .01), as were all of the subscales of the Alcohol factor.

Both models (for the dichotomous and continuous measures of adherence) were run again controlling for age, ethnicity and gender. The results were not changed, suggesting these demographic factors do not significantly impact the tested models.

Discussion

Adherence continues to be understood as a dynamic relationship between different aspects of the person, the medication, the healthcare system and the social context in which they live. Here we examined the complex patient-related factors involved in HAART adherence in an attempt to determine the specific roles of Alcohol, Affective, Cognitive and Social factors. The results suggest that Cognitive and Alcohol factors significantly predict whether or not an individual will adhere to their HAART medication. Further examination exploring the composite Cognitive and Alcohol factors suggests that specific subfactors drive the relationship. For the Cognitive factor, it appears that adherence confidence underlies the cognitive association to adherence; whereas attitudes toward adherence and thinking about the pros and cons of adhering play little role. In other words, self-efficacy or the belief in one's ability to take HIV medications despite the various barriers to adherence (e.g. side-effects, the often complex regimen instructions, the potential for unintended disclosure of HIV status, etc.) surfaces as the significant piece in the cognitive connection to adherence. In this case it is neither Rosenstock's Health Belief Model or Ajzen and Fishbein's Theory of Reasoned Action that explains adherence behavior; rather, Bandura's self-efficacy theory does most to explain the cognitive connection to adherence.

The second aspect distinguishing those who were adherent from those who were not was a difference in level of alcohol use. When examining the subfactors of the Alcohol factor, it was the amount of drinking that predicts whether or not someone will adhere to their medication,

regardless of the problems caused by the drinking. While we were hoping to uncover additional aspects of drinking by including problems caused by drinking in our Alcohol factor, our findings are in line with the existing literature on alcohol use which predominantly looks at drinking levels as opposed to the consequences of drinking (Halkitis et al., 2003; Tucker et al., 2003). Several explanations may account for this finding. The altered state induced by alcohol may cause heavy drinkers to forget or lose sight of the importance of taking medication (Cook et al., 2001). Frequent drinkers could also be more concerned about potentially harmful interactions between alcohol use and their HAART medication, and are thus less adherent. Heavy drinkers may also see fewer benefits from taking their medication. Taking medication implies taking steps to improve one's health, a desire to live and a willingness to endure the side-effects and other negative consequences that may occur as a result of taking HAART. Heavy drinking, on the other hand, can be construed as a lack of desire to improve one's health. In other words, the two behaviors may be incompatible.

While cognitive processes and alcohol use differed for those who were adherent and those who were not, neither Affective nor Social factors played a role in distinguishing adherence from nonadherence. Contradictory to previous findings on the effects of social support and mood states on adherence, we did not find that emotional states and levels and types of support fostered or prevented adherence to HIV medications. For social support this can be understood, perhaps, in light of the mixed advantages of social support for some HIV-positive individuals (Gonzalez et al., 2004; Ryan & Wagner, 2003). Disclosure, stigma, medication nonadherence by family and friends living with HIV and non-supportive people in the social circle complicate the potential advantages of social support (Reynolds & Alonzo, 1998). Emotional distress, too, may not impact adherence because depression and anxiety may be a result of living with HIV and, for some, may act as motivators to take medication. In other words, these factors may play some part, although their role is likely more complex and nuanced.

When looking at only the people who were not perfectly adherent (at or above the level of 95 percent), the picture looks somewhat different. For those who were nonadherent, only alcohol use predicted levels of nonadherence; the other factors were not significantly related. The cognitive processes that played a role in predicting adherence versus nonadherence, played no role in explaining levels of nonadherence in the people that were not perfectly adhering to their medication. Interestingly, what influences whether a person missed medication or not is different from what influences how much medication a person missed. One possible explanation for this is that Cognitive factors may only be important when it comes to perfect adherence because messages around adherence are clear; people are told they need to take all of their medication. In light of our findings on confidence, it may be that people whose adherence levels are below what is considered medically necessary lack confidence to take medication in general. At this point in time, HIV-positive individuals have most likely received the message from their healthcare providers that perfect adherence is the only way to maximize the effectiveness of the antiretroviral medication. Once adherence is no longer perfect it stands to reason that cognitive processes lose their importance.

In some ways these results are in line with much of the literature in that self-efficacy, an aspect of the Cognitive factor, is one element consistently associated with adherence; while depression and elements of social support have not been consistently related to HIV medication adherence. At the same time our results are at odds with other findings because elements of social support have been more reliably related to adherence. Although we hoped our use of more global factors would make up for some of the limitations in measurement, we can say our findings further illustrate that the relationship between adherence and patient factors is extremely complex. The multitude of studies that examined factors believed to predict adherence and the lack of consensus about predictors of adherence suggests a closer look at the factors that have been

examined. A meta-analysis would be a logical next step to synthesize the literature and reveal the areas having been most consistently predictive of adherence.

This study has several limitations that preclude more specific conclusions. First, there is no gold standard for measuring adherence. Consequently, our measures are another attempt at finding the best way to measure medication adherence. Additionally, there is always a question of validity when it comes to self-report data. Even though this analysis used methods to maximize recall, people tend to overestimate adherence with self-report measures (Wagner & Rabkin, 2000). To best measure adherence, multiple methods (electronic monitoring systems, medical charts, pharmacy records, biological measures) should be considered. Second, when interpreting the role of alcohol in adherence, it is important to keep in mind that everyone in the sample met the criteria for problem-level drinking. The results focus on between subject effects so that the relationship between the Alcohol factor and adherence only indicates individuals who drink more also are less adherent. To fully determine the causal effect of alcohol on adherence requires experimental research, although a design that measures daily adherence and alcohol consumption would also go a long way in answering this question.

Despite these limitations, clear indications of alcohol's influence on adherence illustrate the importance of alcohol interventions. Interventions aimed at reducing alcohol use and increasing HAART adherence would be beneficial. Identifying confidence as important to adherence is helpful when designing interventions. For example, improving confidence by teaching people skills to better adhere (such as setting goals that are attainable, examining the obstacles to adherence one at a time rather than all together, offering suggestions and information regarding medication taking and strategizing ways to take medication in ways that are convenient and most comfortable for patients) may significantly improve adherence. The use of Cognitive Behavioral Therapy may be an effective way to accomplish this goal.

Ultimately, improved adherence can lead to a longer life and, as a recent study has shown, to improved quality of life as well (Mannheimer et al., 2005). Because adherence is so important in extending and improving the lives of people living with HIV and AIDS, future studies should continue to examine the factors that prevent and promote adherence.

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References

Ajzen, I.; Fishbein, M. Understanding attitudes and predicting social behavior. Englewood Cliffs, NJ: Prentice-Hall; 1980.

Ammassari A, Murri R, Pezzotti P, Trotta MP, Ravasio L, De Longis P, et al. Self-reported symptoms and medication side effects influence adherence to highly active antiretroviral therapy in persons with HIV infection. Journal of Acquired Immune Deficiency Syndromes 2001;28:445–449. [PubMed: 11744832]

Ammassari A, Trotta MP, Murri R, Castelli F, Narciso P, Noto P, et al. Correlates and predictors of adherence to highly active antiretroviral therapy: Overview of published literature. Journal of Acquired Immune Deficiency Syndromes 2002;31:S123–S127. [PubMed: 12562034]

Arnsten JA, Demas PA, Grant RW, Gouvevitch MN, Farzadegan H, Howard AA. Impact of active drug use on antiretroviral therapy adherence and viral suppression in HIV-infected drug users. Journal of General Internal Medicine 2002;17:377–381. [PubMed: 12047736]

Baker R. Development of a questionnaire to assess patients' satisfaction with consultations in general practice. British Journal of General Practice 1990;40:487–490. [PubMed: 2282225]

Bandura A. The explanatory and predictive scope of self-efficacy theory. Journal of Social & Clinical Psychology 1986;4:359–373.

Bangsberg DR, Charlebois ED, Grant RM, Holodniy M, Deeks SG, Conroy KN, et al. High levels of adherence do not prevent accumulation of HIV drug resistance mutations. AIDS 2003;17:1925–1932. [PubMed: 12960825]

Bangsberg DR, Hecht FM, Charlebois ED, Zolopa AR, Holodniy M, Sheiner L, et al. Adherence to protease inhibitors, HIV-1 viral load, and development of drug resistance in an indigent population. AIDS 2000;14:357–366. [PubMed: 10770537]

Blumenfield M, Milazzo J, Wormser G. Non-compliance in hospitalized patients with AIDS. General Hospital Psychiatry 1990;12:166–169. [PubMed: 2335302]

Bohn MJ, Babor TF, Kranzler HR. The Alcohol Use Disorders Identification Test (AUDIT): Validation of a screening instrument for use in medical settings. Journal of Studies on Alcohol 1995;56:423–432. [PubMed: 7674678]

Broday SF, Mason JL. Reliability and validity of the Brief Symptom Inventory. Journal of Consulting and Clinical Psychology 1991;3:433–437.

Bybee JA, Zigler E. Self-image and guilt: A further test of the cognitive-developmental formation. Journal of Personality 1991;59:733–745. [PubMed: 1774617]

Carpenter CC, Cooper DA, Fischl MA, Gatell JM, Gazzard BG, Hammer SM, et al. Antiretroviral therapy in adults. Journal of the American Medical Association 2000;283:381–390. [PubMed: 10647802]

Carrieri P, Cailleton V, Le Moing V, Spire B, Dallamonica P, Bouvet E, et al. The dynamic of adherence to highly active antiretroviral therapy: Results from the French national APROCO cohort. Journal of Acquired Immune Deficiency Syndromes 2001;28:232–239. [PubMed: 11694829]

Catz SL, Kelly JA, Bogart LM, Benotsch EG, McAuliffe TL. Patterns, correlates, and barriers to medication adherence among persons prescribed new treatments for HIV disease. Health Psychology 2000;19:124–133. [PubMed: 10762096]

Chewning B, Sleath B. Medication decision-making and management: A client-centered model. Social Science and Medicine 1996;42:389–398. [PubMed: 8658233]

Cockram A, Judd FK, Mijch A, Norman T. The evaluation of depression in inpatients with HIV disease. Australian and New Zealand Journal of Psychiatry 1999;33:344–352. [PubMed: 10442790]

Cook RL, Sereika SM, Hunt SC, Woodard WC, Erlen JA, Conigliaro J. Problem drinking and medication adherence among persons with HIV infection. Journal of General and Internal Medicine 2001;16:83–86.

Derogatis LR, Melisaratos N. The Brief Symptom Inventory: An introductory report. Psychological Medicine 1983;13:595–605. [PubMed: 6622612]

Deschamps AE, De Graeve V, van Wijngaerden E, De Saar V, Vandamme AM, van Vaerenbergh K, et al. Prevalence and correlates of nonadherence to antiretroviral therapy in a population of HIV patients using Medication Event Monitoring System. AIDS Patient Care and STDs 2004;18:644–657. [PubMed: 15633262]

DiMatteo MR, Lepper HS, Croghan TW. Depression is a risk factor for noncompliance with medical treatment: Meta-analysis of the effects of anxiety and depression on patient adherence. Archives of Internal Medicine 2000;160:2101–2107. [PubMed: 10904452]

Galvan FH, Bing EG, Fleishman JA, London AS, Caetano R, Burnam MA, et al. The prevalence of alcohol consumption and heavy drinking among people with HIV in the United States: Results from the HIV Cost and Services Utilization Study. Journal of Studies on Alcohol 2002;63:179–186. [PubMed: 12033694]

Gifford AL, Bormann JE, Shively MJ, Wright BC, Richman D, Bozzette SA. Predictors of self-reported adherence and plasma HIV concentrations in patients on multidrug antiretroviral regimens. Journal of Acquired Immune Deficiency Syndrome 2000;23:386–395.

Godin G, Cote J, Naccache H, Lambert LD, Trotter S. Prediction of adherence to antiretroviral therapy: A one-year longitudinal study. AIDS Care 2005;17:493–504. [PubMed: 16036235]

Gonzalez JS, Penedo FJ, Antoni MH, Durán RE, McPherson-Baker S, Ironson G, et al. Social support, positive states of mind, and HIV treatment adherence in men and women living with HIV/AIDS. Health Psychology 2004;23:413–418. [PubMed: 15264978]

Greenfield TK, Midanik LT, Rogers JD. A 10-year national trend study of alcohol consumption, 1984–1995: Is the period of declining drinking over? American Journal of Public Health 2000;90:47–52. [PubMed: 10630136]

Gribble JN, Miller HG, Rogers SM, Turner CF. Interview mode and measurement of sexual behaviors: Methodological issues. Journal of Sexual Research 1999;36:16–25.

Gross R, Bilker WB, Friedman HM, Strom BL. Effect of adherence to newly initiated antiretroviral therapy on plasma viral load. AIDS 2001;15:2109–2117. [PubMed: 11684930]

Halkitis PN, Kutnick A, Green K. A moderational model to explain HIV medication adherence. AIDS Patient Care & STDs. in press

Halkits PN, Kutnick AH, Slater S. The social realities of adherence to protease inhibitor regimens: Substance use, health care, and psychological states. Journal of Health Psychology 2005;10:545–558. [PubMed: 16014391]

Halkitis PN, Parsons JT, Wolitski R, Remien RH. Characteristics of HIV antiretroviral treatments, access and adherence in an ethnically diverse sample of men who have sex with men. AIDS Care 2003;15:89–102. [PubMed: 12655837]

Halkitis PN, Zade D, Shrem M, Wilton L. The physical, emotional, and interpersonal impact of HAART on the lives of seropositive individuals: Physical, psychological, and social realities. Journal of Health Psychology 2005;10:345–358. [PubMed: 15857867]

Hecht FM, Grant RM, Petropoulos CJ, Dillon B, Chesney MA, Tian H, et al. Sexual transmission of an HIV-1 variant resistant to multiple reverse-transcriptase and protease inhibitors. New England Journal of Medicine 1998;339:307–311. [PubMed: 9682043]

Heszen-Klemens I, Lapinska E. Doctor–patient interaction, patients' health behavior and effects of treatment. Social Science and Medicine 1984;19:9–18. [PubMed: 6474225]

Hogg RS, Yip B, Kully C, Craib KJ, O'Shaughnessy MV, Schechter MT, et al. Improved survival among HIV-infected patients after initiation of triple-drug anti-retroviral regimens. Canadian Medical Association Journal 1999;160:659–665. [PubMed: 10102000]

Howard AA, Arnsten JH, Li YT, Vlahov D, Rich JD, Schuman P, et al. A prospective study of adherence and viral load in a large multicenter cohort of HIV-infected women. AIDS 2002;16:2175–2182. [PubMed: 12409739]

Ickovics JR, Cameron A, Zackin R, Bassett R, Chesney M, Johnson VA, et al. Consequences and determinants of adherence to antiretroviral medication: Results from Adult AIDS Clinical Trials Group protocol 370. Antiviral Therapy 2002;7:185–193. [PubMed: 12487386]

Ingersoll KS, Heckman CJ. Patient–clinician relationship and treatment system effects on HIV medication adherence. AIDS and Behavior 2005;9:89–101. [PubMed: 15812616]

Lefevre F, O'Leary B, Moran M, Mossar M, Yarnold PR, Martin GJ, et al. Alcohol consumption among HIV-infected patients. Journal of General Internal Medicine 1995;10:458–460. [PubMed: 7472704]

Lyketsos CG, Hoover DR, Guccione M, Dew MA, Wesch JE, Bing EG, et al. Changes in depressive symptoms as AIDS develops: The Multicenter AIDS Cohort Study. American Journal of Psychiatry 1996;153:1430–1437. [PubMed: 8890676]

Lyketsos CG, Hoover DR, Guccione M, Senterfitt W, Dew MA, Wesch J, et al. Depressive symptoms as predictors of medical outcomes in HIV infection: Multicenter AIDS Cohort Study. Journal of the American Medical Association 1993;270:2563–2567. [PubMed: 7901432]

Maisto SA, Carey MP, Carey KB, Gordon CM, Gleason JR. Use of the AUDIT and the DAST-10 to identify alcohol and drug use disorders among adults with a severe and persistent mental illness. Psychological Assessment 2000;12:186–192. [PubMed: 10887764]

Mannheimer SB, Matts J, Telzak E, Chesney M, Child C, Wu AW, et al. Quality of life in HIV-infected individuals receiving antiretroviral therapy is related to adherence. AIDS Care 2005;17:10–22. [PubMed: 15832830]

Martini M, Parazzini F, Agnoletto V. Characteristics of doctor–patient relationship and implication on adherence to antiretroviral treatments. HIV Medicine 2001;2:62–63. [PubMed: 11737379]

Mellins CA, Havens JF, McCaskill EO, Leu CS, Brudney K, Chesney MA. Mental health, substance use and disclosure are significantly associated with the medical treatment adherence of HIV-infected mothers. Psychology, Health, & Medicine 2002;7:451–460.

Miller, WR.; Tonigan, JS.; Longabaugh, R. Test Manual. 4. Rockville MD: National Institute on Alcohol Abuse and Alcoholism; 1995. The Drinker Inventory of Consequences (DrInC): An instrument for assessing adverse consequences of alcohol abuse. Project MATCH Monograph series

Molassiotis A, Lopez VN, Chung WY, Lam SW, Li CK, Lau TF. Factors associated with adherence to antiretroviral medication in HIV-infected patients. International Journal of STD & AIDS 2002;13:301–310. [PubMed: 11972933]

Murphy DA, Belzer M, Durako SJ, Sarr M, Wilson CM, Muenz LR. Longitudinal antiretroviral adherence among adolescents infected with human immunodeficiency virus. Archives of Pediatric Adolescent Medicine 2005;159:764–770.

Murphy DA, Greenwell L, Hoffman D. Factors associated with antiretroviral adherence among HIV-infected women with children. Women and Health 2002;36:97–111.

Murphy EL, Collier AC, Kalish LA, Assman SF, Para MF, Flanigan TP, et al. Highly active antiretroviral therapy (HAART) decreases mortality and morbidity in patients with advanced HIV disease. Annals of Internal Medicine 2001;135:17–26. [PubMed: 11434728]

National Institute on Alcohol Abuse and Alcoholism (NIAAA). NIH Publication No. 95-3769. Bethesda, MD: US Department of Health and Human Services, Public Health Service, National Institutes of Health; 1995. The physicians' guide to helping patients with alcohol problems.

Palepu A, Horton NJ, Tibbetts N, Meli S, Samet JH. Uptake and adherence to highly active antiretroviral therapy among HIV-infected people with alcohol and other substance use problems: The impact of substance abuse treatment. Addiction 2004;99:361–368. [PubMed: 14982549]

Parsons JT, Rosof E, Punzalan JC, DiMaria L. Integration of motivational interviewing and cognitive behavioral therapy to improve HIV medication adherence and reduce substance use among HIV-positive men and women: Results of a pilot project. AIDS Patient Care and STDs 2005;19:31–39. [PubMed: 15665633]

Paterson DL, Swindells S, Mohr J, Brewster M, Vergis EN, Squier C, et al. Adherence to pro-tease inhibitor therapy and outcomes in patients with HIV infection. Annals of Internal Medicine 2000;133:21–30. [PubMed: 10877736]

Prescott CA, Hewitt JK, Heath AC, Truett KR, Neale MC, Eaves LJ. Environmental and genetic influences on alcohol use in a volunteer sample of older twins. Journal of Studies on Alcohol 1994;55:18–33. [PubMed: 8189722]

Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. Applied Psychological Measurement 1977;1:385–401.

Revicki DA, Chan K, Gevirtz F. Discriminant validity of the medical outcomes study cognitive function scale in HIV disease patients. Quality of Life Research 1998;7:551–559. [PubMed: 9737145]

Reynolds NR, Alonzo AA. HIV informal caregiving: Emergent conflict and growth. Research in Nursing & Health 1998;21:251–260. [PubMed: 9609510]

Roberts KJ. Physician–patient relationships, patient satisfaction, and antiretroviral medication adherence among HIV-infected adults attending a public health clinic. AIDS Patient Care and STDs 2002;16:43–50. [PubMed: 11839218]

Roberts RE, Andrews JA, Lewinsohn PM. Assessment of depression in adolescents using the Center for Epidemiologic Studies Depression Scale. Psychological Assessment 1990;2:122–128.

Rosenstock IM. Historical origins of the Health Belief Model. Health Education Monographs 1974;2:1–8.

Roter DL, Hall JA, Katz NR. Patient–physician communication: A descriptive summary of the literature. Patient Education & Counseling 1988;12:99–119.

Ryan GW, Wagner GJ. Pill taking 'routinization': A critical factor to understanding episodic medication adherence. AIDS Care 2003;15:795–806. [PubMed: 14617501]

Samet JH, Horton NJ, Meli S, Freedberg KA, Palepu A. Alcohol consumption and antiretroviral adherence among HIV-infected persons with alcohol problems. Alcoholism: Clinical and Experimental Research 2004;28:572–577.

Samet JH, Phillips SJ, Horton NJ, Traphagen ET, Freedberg KA. Detecting alcohol problems in HIV-infected patients: Use of the CAGE questionnaire. AIDS Research and Human Retroviruses 2004;20:151–155. [PubMed: 15018702]

Schwarzer R, Dunkel-Schetter C, Kemeny M. The multidimensional nature of received social support in gay men at risk of HIV infection and AIDS. American Journal of Community Psychology 1994;22 (3):319–339. [PubMed: 7879745]

Simoni, JM.; Pantalone, DW.; Frick, PA.; Turner, BJ. Best practices in the behavioral management of chronic diseases. II, ch. 4. Los Altos, CA: Institute for Disease Management; 2003.

Sobell, LC.; Sobell, MB. Timeline follow-back: A technique for assessing self- reported alcohol consumption. In: Litton, R.; Allen, JP., editors. Measuring alcohol consumption: Psychosocial and biochemical methods. Totowa, NJ: Humana Press; 1992. p. 41-72.

Stone, VE.; Adelson-Mitty, J.; Duefield, CA., et al. Adherence to protease inhibitor therapy in clinical practice: Usefulness of demographics, attitudes and knowledge of predictors. Paper presented at the 12th World AIDS Conference; Geneva. 28 June–3 July; 1998.

Tucker JS, Burnam MA, Sherbourne CD, Kung FY, Gifford AL. Substance use and mental health correlates of nonadherence to antiretroviral medication in a sample of patients with Human Immunodeficiency Virus Infection. Journal of American Medicine 2003;114:573–580.

Turner BJ, Fleishman JA, Wenger N, London AS, Burnam MA, Shapiro MF, et al. Effects of drug abuse and mental disorders on use and type of anti-retroviral therapy in HIV-infected persons. Journal of General Internal Medicine 2001;16:625–633. [PubMed: 11556944]

Turner CF, Ku L, Rogers SM, Linberg LD, Pleck JH, Sonenstein FL. Adolescent sexual behavior, drug use, and violence: Increased reporting with computer survey technology. Science 1998;280:867–874. [PubMed: 9572724]

Velicer WF, DiClemente CC, Prochaska JO, Brandenburg N. Decisional balance measure for assessing and predicting smoking status. Journal of Personality & Social Psychologym 1985;48:1279–1289.

Viken RJ, Kaprio J, Koskenvou M, Rose RJ. Longitudinal analyses of the determinants of drinking and of drinking to intoxication in adolescent twins. Behavior Genetics 1999;29:455–461. [PubMed: 10857250]

Wagner GJ, Rabkin JG. Measuring medication adherence: Are missed doses reported more accurately than perfect adherence? AIDS Care 2000;12:405–408. [PubMed: 11091773]

Wagner GJ, Remien RH, Carballo-Diéguez A, Dolezal C. Correlates of adherence to combination antiretroviral therapy among members of HIV-positive mixed status couples. AIDS Care 2002;14:105–109. [PubMed: 11798409]

Weiss L, French T, Finkelstein R, Waters M, Mukherjee R, Agins B. HIV-related knowledge and adherence to HAART. AIDS Care 2003;15:673–679. [PubMed: 12959818]

Williams A. Antiretroviral therapy: Factors associated with adherence. Journal of the Association of Nurses in AIDS Care 1997;8(Supp 1):18–23. [PubMed: 9356958]

Wood E, Hogg RS, Yip B, Harrigan PR, O'Shaughnessy MV, Montaner JS. Effect of medication adherence on survival of HIV-infected adults who start highly active anti-retroviral therapy when the CD4+ cell count is 0.2000 to 0.350 x 10(9) cells/L. Annals of Internal Medicine 2003;139:810–816. [PubMed: 14623618]

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Table 1

Characteristics of study participants ($N = 272$)

	n	%
Race/ethnicity		
African American	157	57.7
Hispanic	67	24.7
White	30	11.0
Mixed	8	2.9
Other	10	3.7
Employment status		
Full-time	14	5.1
Part-time	32	11.8
Disabled—not working	86	31.6
Disabled—working off the books	16	5.9
Unemployed non-student	110	40.4
Unemployed student	14	5.1
Sexual identity		
Gay/homosexual	130	47.8
Straight/heterosexual	109	40.1
Bisexual	33	12.1
Relationship status		
Single	160	58.8
Currently in a relationship	112	41.2
	Mean	
Age	43.7 (SD = 7.23)	
CD4 counts	418.41 (SD = 296.01).	
log10 HIV viral load (copies/ml)	3.29 (SD = 1.47)	

Table 2

Logistic and linear models of adherence

Variable	B	SE	p
Logistic regression: adherence vs nonadherence			
Cognitive	.311	.154	.043
Affective	.084	.158	.595
Social	.067	.182	.714
Alcohol	−.593	.172	.001
Linear regression: variability in non-adherence			
Cognitive	.096	.077	.216
Affective	−.038	.084	.654
Social	.035	.096	.713
Alcohol	−.214	.092	.021

Table 3

Logistic regression for subscales of Cognitive and Alcohol factors predicting perfect adherence

Variable	B	SE	p
Subscales of Cognitive factor			
Attitudes toward adherence	.002	.012	.903
Cons of adherence	.001	.016	.967
Pros of adherence	.012	.020	.535
Confidence for adherence	.072	.013	.001
Subscales of Alcohol factor			
Number of drinks	−.834	.270	.002
DrinC score	−.008	.006	.190
AUDIT score	−.011	.020	.597