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Predictors of medication adherence among HIV-infected youth

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Abstract

The purpose of this study was to examine the rates of medication adherence among HIV-infected adolescents/young adults and to explore the relationship between negative affect, cognitive ability/formal reasoning, and substance use on the medication adherence of these youth. Forty-two HIV-positive youth (25 males, 17 females; age range 16 – 24) currently taking antiretroviral medications were recruited to participate in a one-hour interview. Using the time-line follow-back calendar method, 66% of participants had missed a dose of medicine in the past week while 42% missed a dose ‘yesterday’. Multiple regression analyses demonstrated that both depression and age of first marijuana use were statistically significant predictors of non-adherence ($p < .01$, $R^2 = .326$). Specifically, higher rates of depressive symptoms and younger age of first marijuana use predicted higher rates of non-adherence. Developmentally, 69% of the sample had yet to begin the transition from concrete thinking to formal or abstract reasoning. The results from this project demonstrate that adherence to antiretroviral medications continues to be a problem with HIV-infected youth. These results are an important first step toward the development of interventions aimed at increasing medication adherence among adolescents and young adults living with HIV.

Keywords

HIV/AIDS; medication adherence; adolescence

Introduction

The human immunodeficiency virus (HIV), the virus that causes acquired immune deficiency syndrome (AIDS), continues to spread in the US and around the world. Recent analysis of the trends in HIV infection in the US suggests that young people, ages 13 – 24, are increasingly at risk of infection (CDC, 2000). In the US over 816,000 people have been diagnosed with AIDS since 1981 (Centers for Disease Control and Prevention [CDC], 2003). The CDC (2003) reports just over 33,000 cumulative AIDS cases in people between the ages of 13 – 24 and it is estimated that at least half of all new HIV infections in the U.S.

are among people under the age of 25. Furthermore, African-American and Latino youth (ages 13 – 19) have been disproportionately affected by the AIDS epidemic (CDC, 2003).

For individuals living with HIV, the last decade has provided many advances in medical treatment, most notably combination antiretroviral medications. With the advent of these often complex drug regimens, the issue of adherence to medication has become increasingly critical. Traditionally, adherence to medication regimes has been less than optimal. Studies in adults estimate that up to 60% of patients do not follow their medical regimes, with approximately one-third not filling in prescriptions, one-third discontinuing medications against physician recommendations, and one-third making errors in the medication protocol (O'Brien et al., 1992; Simons, 1992). Rates of adherence among adolescents and young adults with chronic illnesses, such as diabetes, cancer, epilepsy, are equally concerning and have been estimated to be about 50% for pediatric populations overall (LaGreca & Schuman, 1995; Litt & Cuskey, 1980; Pidgeon, 1989).

The consequences of non-adherence to medication, particularly with HIV drugs, are manifested at multiple levels. Not only does poor adherence to medication negatively affect the patient's prognosis, but concerns are rising about the threat of multi-drug resistant strains of HIV and their impact on public health (Mehta et al., 1997). A recent multicentre study of treatment adherence has demonstrated that adherence of 95% or greater may be necessary for successful virologic outcomes (Paterson et al., 2000). As the numbers of adolescents and young adults with HIV continue to increase, it becomes important to investigate medication adherence within an age group with historically low rates of adherence for other diseases (Tebbi, 1992; Van Sciver et al., 1995).

Adolescents/young adults and medication adherence

Estimated rates of general adherence to medical regimens vary greatly depending on demographic variables (i.e., age and race), type of illness and degree of severity, as well as method of measurement. In one of the few published studies of adherence among HIV-infected youth, Murphy et al. (2001) report that initial data from the REACH (Reaching for Excellence in Adolescent Care and Health) cohort demonstrate that less than half of the participants reported full adherence to antiretroviral medication. Of the 161 HIV-infected adolescents recruited from 13 cities, 7% of the participants could not correctly identify their prescribed medications and 11% could identify them but reported consistently missing at least one medication.

For adolescents living with HIV, the issues surrounding taking medication are further compounded by the fear of social isolation and rejection by family and friends when their medications disclose their HIV status (Hosek et al., 2000). Belzer and colleagues (1998) found that the most common reasons for not taking antiretroviral medications among HIV-infected youth were the side effects, the inconvenience of the regimen, and having the medications serve as a reminder of their HIV-infection. Thus, many physical, psychological, and social issues may interfere with optimal adherence to complicated HIV medication regimens among adolescents and young adults. For the purposes of this study, negative affect, cognitive functioning, and substance use will be explored.

Adherence and negative affect

Negative affective states, including depression and anxiety, have been associated with non-adherence in a range of illnesses, including cancer, diabetes, and epilepsy (Dunbar-Jacob et al., 1998). Negative affect can also adversely affect medication adherence among people living with HIV through cognitive feelings of helplessness and apathy as well as physical constraints due to loss of appetite or fatigue (Griffith, 1990; Hecht, 1997; Singh et al., 1996). A recent study of 366 HIV-infected patients attending a medical facility, found that both depression and anxiety were significantly associated with worse compliance to treatment (Gordillo et al., 1999). For youth in the REACH cohort, higher levels of depression were significantly associated with decreased adherence (Murphy et al., 2001). In a qualitative study of HIV-infected adolescents, Hosek et al. (2000) found that adolescents who expressed hopelessness about their future due to HIV also reported difficulties with taking their antiretroviral medications. Therefore, the affective response associated with hopelessness may also interfere with an individual's willingness or ability to adhere to medication regimens.

Adherence and cognitive functioning

According to Piaget (1955), the adolescent years mark the emergence of formal operational thought, which includes propositional thinking, probabilistic reasoning, combinatorial analysis, and abstract reasoning. Extrapolating from Piaget's theory, the absence of formal reasoning abilities may inhibit individuals living with HIV from being able to understand the combinatorial nature of complex regimens or to adequately conceptualize the future consequences of non-adherence to prescribed medications. LaGreca & Schuman (1995) suggest that this cognitive shift allows individuals to become more aware of the complexities associated with their illness. Thus, as the process of cognitive maturation and formal reasoning develop, the ability of these youth to comprehend and adhere to the complex medication regimens prescribed to HIV-positive individuals may improve.

Of further importance is the idea that the cognitive abilities of youth with HIV play a critical role in understanding their medication regimens (Kalichman, 1998). In fact, approximately 20% of people participating in HIV clinical trials do not comprehend anti-retroviral instructions (Chesney, 1997). Kalichman and Rompa (2000) found that the inability to read and/or comprehend basic healthcare information was associated with significantly worse health outcomes.

Adherence and substance use

Among adolescents and young adults in the US, alcohol and substance use are prevalent (CDC, 1998; Johnston et al., 1998). Extremely high rates of alcohol and other drug use can be found within various HIV-infected populations and studies demonstrated that substance use acts as a barrier against adequate adherence to medication (Mannheimer et al., 1998; Singh et al., 1996; Soto et al., 1998; Stephenson, 1999; Treisman, 1999; Wall et al., 1995). In fact, some practitioners suggest that substance use issues must be addressed prior to the prescription of antiretroviral therapy and that ignoring these issues will only compromise medical treatment (Cheever, 2000; Soto et al., 1998).

The purpose of this study was to explore the factors of negative affect, cognitive functioning, and substance use as they relate to medication adherence among adolescents and young adults living with HIV. Given the lack of published research in the area of HIV-infected youth, this study was exploratory in nature. Not only will this study serve to expand the literature in an underdeveloped area, but it will also provide insight into what areas should be targeted by prevention and intervention programmes. Therefore, the overarching aim of this study is to better understand adherence among HIV-infected youth so that interventions can be developed which will help prolong their lives.

Method

Research participants

All participants for this study were recruited from the CORE Center in Chicago, USA, an outpatient healthcare facility that provides services for individuals living with HIV as well as other infectious diseases. The research participants for this study consist of 42 adolescents and young adults (25 males, 17 females), mean age of 20 years (range 16 – 25 years), who are living with HIV. Seventy-six percent of the sample identified as African-American, 12% Latino, 10% Multi-racial/Bi-racial, and 2% Caucasian. Fifty-five percent of the sample identified their sexual orientation as ‘straight’, 26% as gay, and 19% as bisexual. The median number of months since testing positive for HIV for these participants was 23.5, with a range of 5 months to 10 years. The mean number of years of education for the participants was 11.5 years.

All interviews were conducted by the first author and the questions from the interview were read to the participants since varying levels of education and reading abilities may have impacted the quality and validity of the data. The interviews took approximately one hour to complete. Following the interview, participants were debriefed and token compensation in the amount of \$30 was provided.

Measures

General demographics

Gender, age, ethnicity, and length of time since being diagnosed with HIV were determined through a self-report questionnaire.

Medical adherence

Time-Line Follow-Back—(TLFB; Sobell et al., 1979). This calendar method, which was originally developed to gather information on daily alcohol consumption, was used as a temporal ordering cue to help participants piece together their adherence rates over the two weeks prior to the interview. First, participants were shown a calendar of the previous 14 days. They were then asked to remember any significant events (i.e., holidays, birthdays, deaths) or daily occurrences (i.e., work/school schedule) that happened during that period. Participants were then asked about the number of missed doses of medication for each day. A proportion of medication non-adherence (total number of missed doses during 2-week period/total number of prescribed doses during 2-week period) was calculated. Thus,

percentile scores for medication adherence ranged from 0 to 100, with higher scores indicating greater non-adherence.

AIDS Clinical Trial Group Adherence Follow-up Questionnaire—(ACTG; Chesney et al., 2000). This scale examines the possible reasons for missing medications over the past month. The questionnaire asks participants to rate on a 4-point likert scale (from Never to Often) how often they have missed taking their medications over the past month due to 17 possible reasons. Total scores range from 17 to 68 with higher numbers indicating increased difficulties taking medications over the past month. See Table I for internal consistencies.

Cognitive ability

Arlin Test of Formal Reasoning (ATFR; Arlin, 1982)—An abbreviated form of the ATFR was used that consisted of 16 multiple-choice items organized into four subtests in order to assess the formal operational abilities theorized by Piaget. Total scores on the ATFR can range from 0 to 16. Five levels of reasoning (concrete, high concrete, transitional, low formal, and high formal) are then derived from the total scores.

Vocabulary test—The Vocabulary subtest from the Wechsler Adult Scales of Intelligence – Third Edition (WAIS-III; The Psychological Corporation, 1997) was used to measure verbal cognitive ability. Thirty-five successive words of an increasing degree of unfamiliarity were presented both orally and visually to the participant who responded with an oral definition. Vocabulary total scores can range from 0 to 70, with age-scaled scores ranging from 1 to 15.

Block Design test—The Block Design subtest from Wechsler Adult Scale of Intelligence – Third Edition (WAIS-III; Psychological Corporation, 1997) was used to measure non-verbal cognitive ability, which is less dependent on the educational experience of the participants. Each participant copied nine designs from a visual stimulus by using blocks. Total scores on Block Design ranges from 0 to 51, with age-scaled scores ranging from 1 to 15.

Negative affective states

Center for Epidemiological Studies – Depression Scale (CES-D; Radloff, 1977)—The CES-D was used to assess depressive symptomatology. The CES-D consists of 20 items reflective of depressive symptoms, which are rated on a 4-point scale according to how often the respondent has experienced each symptom during the past week. Reported alpha coefficients for the CES-D among adolescents have ranged across samples from .87 to .92 (Roberts et al., 1990).

State-Trait Anxiety Inventory – Trait (STAI; Spielberger et al., 1983)—The Trait Anxiety Inventory was used to assess symptoms of anxiety through the use of 20 items on a 4-point response scale (ranging from “almost never” to “almost always”). The questionnaire assesses feelings of apprehension, tension, nervousness, and worry associated with permanent states of anxiety.

Beck Hopelessness Scale (Beck et al., 1982)—This scale was designed to measure hopelessness, a component of depression, as the extent of negative attitudes about the future without the confound of physical symptomology. The scale consists of 20 True/False items. Total scores for the BHS range from 0 to 20 with higher scores indicating greater hopelessness. Beck and Steer (1988) suggest that scores of 9 or higher are indicative of moderate or greater hopelessness while scores of 3 or less indicate the absence of hopelessness.

Substance use

Addiction Severity Index (ASI; McLellan et al., 1980)—The Addiction Severity Index has been used extensively in substance abuse research (McClellan et al., 1992). The ASI is a semi-structured interview designed to address seven potential problem areas in substance abusing patients: medical status, employment and support, drug use, alcohol use, legal status, family/social status, and psychiatric status. For the purposes of this study, only the information gathered in the alcohol and drug sections was used.

Results

Descriptive results

In order to examine negative affective states, levels of cognitive functioning, rates of substance use, and rates of medication adherence among young people living with HIV, frequencies of these scaled variables were first calculated. The mean scores and standard deviations for all predictor and outcome variables were then calculated. Gender comparisons were then conducted using two-tailed *t*-tests for continuous variables.

Medication Adherence—The participants in this study averaged 3 doses of medication per day in their current regimen. Each dose consisted of an average of 6 pills (range 2 – 16), which indicates that each participant is prescribed an average of 18 pills per day. Table II displays the percentages of missed doses.

When participants were asked how well they usually take their medications, 19% stated that they always take all of the pills on time and according to directions, 29% stated that they always take all of the pills but not always on time or according to directions, 36% stated that they sometimes miss or forget to take the pills, 9% stated that they are not too careful about taking the pills, and 7% stated that they do not take the pills at all.

With regard to whether or not participants follow food requirements and/or instructions when taking their medications, 24% stated that they always follow the food directions, 14% stated that they follow the food directions most of the time, 19% stated that they sometimes follow the food directions, and 43% of the participants indicated that they do not pay attention to the food directions/instructions.

Using the ACTG questionnaire, participants were asked about their reasons for missing their medication over the past month. The reasons and percentage of participants endorsing that reason are displayed in Table III.

With regard to their individual medication regimens, 36% of participants felt they were very familiar with their HIV medications, 55% were somewhat familiar, and 9% were not familiar at all. With regard to the concept of drug resistance, 60% of participants felt they were very familiar with the concept, 33% were somewhat familiar, and 7% were not familiar at all. Participants were then asked what was important to them when making the decision to take or not take HIV medication. The factors and the number of participants endorsing each factor are displayed in Table IV.

Cognitive Ability—On the Vocabulary subtest, the average raw score was 23.62 with an average age-scaled score of 6.64. On the Block Design subtest, the average raw score was 26.86 with an average age-scaled score of 8.74. A paired samples *t*-test indicated that the participants' age-scaled scores on Block Design were significantly higher ($p < .001$) than the Vocabulary age-scaled scores. On the ATFR, 7.7% of participants fell into the concrete category of reasoning, 61.5% high concrete, 15.4% transitional, 12.8% low formal, and 2.6% high formal reasoning. There were no significant gender differences on any measure of cognitive ability.

Negative Affect—Using gender-based clinical cutoff points on the CES-D (16 for males, 21 for females) as adapted by Murphy and colleagues (2001), 40% of male participants and 35% of female participants met or exceeded the clinical cutoff score for depressive symptomatology. On the STAI, 33% of the participants exceeded the cutoff for medium to high trait anxiety using a clinical cutoff score of 50 as recommended by Fell, Newman, HERN, and colleagues (1993). On the BHS, only 8% of the participants scored 9, which is indicative of moderate or greater hopelessness according to Beck and Steer (1988) while over 66% of the participants scored 3, which indicates the absence of hopelessness. There were no significant gender differences on any of the negative affect measures.

Substance Use—The average reported age for first use of alcohol among the participants was 15, while the average age reported for first use of marijuana was 16. Seventy-five percent of the participants reported that they had used alcohol in the past 30 days, while 56% reported marijuana use in the past 30 days. On average, participants used alcohol 4 days out of the past 30 days and marijuana 6 days out of the past 30 days. Two participants reported the use of drugs other than alcohol and marijuana, yet neither participant had used that drug in the past 30 days. There were no significant gender differences on any measure of substance use.

Regression analyses

Prior to performing regression analyses, correlation matrices were developed to test for multi-collinearity among the predictor variables. Due to the high multi-collinearity between the CES-D scores and the STAI score ($r = .822, p < .01$), these measures were standardized and combined into one composite Depression/Anxiety measure.

Stepwise multiple linear regressions was used to examine the relationship between the predictor variables in each construct (i.e., negative affect, cognitive ability, substance use)

and the outcome variable of medication adherence. The strongest predictors from each construct were then placed into a final regression model to test their relationship with medication adherence.

Adherence and Negative Affect—The independent variables of the Depression/Anxiety composite score and the BHS score were entered into the regression equation to test their relationship with the dependent variable of medication adherence. The Depression/Anxiety composite score approached significance ($p = .059$) and the overall model accounted for close to 10% ($R^2 = .099$) of the variance.

Adherence and Cognitive Ability—The independent variables of Vocabulary total score, Block Design total score, and ATFR total score were entered into the regression model to test their relationship with the dependent variable of medication adherence. Overall, the model accounted for only 3% of the variance ($R^2 = .030$) and no significant relationships were found.

Adherence and Substance Use—The independent variables of Age of First Alcohol Use, Alcohol Use in Past 30 Days, Age of First Marijuana Use, and Marijuana Use in Past 30 days were placed into the regression equation with the dependent variable of medication adherence. Overall, the model accounted for close to 20% of the variance ($R^2 = .195$) and Age of First Marijuana Use approached significance ($p = .073$).

Full Model—The final aim was to examine whether elevated levels of negative affect, decreased levels of cognitive functioning, and increased levels of substance use will combine to predict decreased rates of medication adherence. After identifying the strongest predictor variable within each previous regression, the independent variables of the Depression/ Anxiety composite score, Block Design total score, and Age of First Marijuana Use were entered into the model using a stepwise elimination procedure to examine their relationship to the dependent variable of medication adherence. Both the Depression/ Anxiety composite scale and Age of First Marijuana use were statistically significant predictors of non-adherence ($p < .05$), while Block Design was excluded from the model. The final model accounted for a substantial percentage of the overall variance ($R^2 = .326$, $p < .01$). Table V displays the regression summary for the three independent variables.

Discussion

The results from this study support the existing literature by demonstrating that rates of adherence to HIV medications are poor in adolescent populations (Chesney et al., 2000; Malow et al., 1998; Muma et al., 1995; Murphy et al., 2001). The results from the current study found that just under half of the participants (42%) reported missing a dose of medication the day before the interview. Two-thirds of the participants reported missing a dose of medication in the past week and 80% reported missing a dose of medication in the past two weeks. While 60% of the sample reported that they were ‘very familiar’ with the idea of drug resistance, over half (56%) of the participants were less adherent than the 95% deemed necessary to prevent drug resistance and virologic failure (Patterson et al., 2000). Thus, while participants report being familiar with their medications and the consequences

of non-adherence, their behaviour suggests that factors other than understanding the regimen may interfere with adherence.

The results from the current study indicate that when the participants were asked about the factors that were important to them in making the decision to start antiretroviral therapy, 78% reported that the number of pills they would have to take was an important factor. However, when participants were asked about the reasons why they had missed medication over the past month, only 19% reported that the number of pills they had to take was a reason that they missed. Therefore, when adolescents are deciding to begin a regimen, the number of pills involved in that regimen seems to be important. However, once a regimen has begun, the number of pills is not a frequently endorsed reason for non-adherence. This discrepancy may represent initial fears by the adolescent about beginning a burdensome and complicated medication regimen. These fears may dissipate after the regimen has begun and the adolescent realizes that the number of pills they have to take is not a significant factor in adhering to the medication. Perhaps other factors, such as remembering to take the dose of medication, are more detrimental to adherence than the number of pills in each dose.

For the participants in this study, 88% of the sample reported that considering the side effects was an important factor in making the decision to start medication. However, only 26% of the participants reported side effects as a reason for missing medication over the past month. As with the number of pills, it appears that fears about the side effects of the medication are important to the participants when deciding to begin a regimen. The following concerns were frequently cited by participants as important when deciding to begin medication: the side effects (88.1%), the number of pills (78.6%), how often medication needs to be taken (71.4%), and whether medication is taken with or without food (57.1%). Yet when exploring the actual reasons for missing medication, the most frequently endorsed items related more to incorporating the medications into their daily routine rather than concerns about the regimen itself. Such items included forgetting to take medication (73.8%), falling asleep or sleeping through a dose time (64.3%), not having the medication with them (64.3%), being too busy to take the medication (57.1%), or having a change in their routine that interfered with taking the medication (52.4%). Again, a distinction is made between initial concerns regarding antiretroviral therapy and the actual issues that interfere with consistent adherence. These differences may represent unrealistic appraisals by the participants regarding a burdensome medication regimen or how the regimen will fit into their daily lives. The differences may also represent a lack of knowledge or misunderstanding about the regimens, how the pills will be taken, or what the potential side effects might be.

Negative affect

The rates of depressive symptomatology among this sample of adolescents were substantial, with 35% of females and 40% of males exceeding the gender-based clinical cutoff scores as adapted by Murphy and colleagues (2001). While the rates of depressive symptoms endorsed by female participants in this sample are similar to rates of depressive symptomatology found among female participants in the general adolescent literature, the

rates of depressive symptomatology for HIV-infected male participants greatly exceeds the rates reported among non-infected males (Roberts et al., 1991).

In examining the relationship between negative affect and medication adherence, the Depression/Anxiety composite scores approached significance ($p = .059$) as a predictor of non-adherence to antiretroviral medication. These results are supported by other recent studies of the impact of depression on adherence among both adult and adolescent HIV-infected populations (Gordillo et al., 1999; Murphy et al., 2001). These findings are very important in light of the prevalence of depressive disorders among HIV-infected individuals, particularly in adolescent populations (Cochran & Mays, 1994; Katz et al., 1996; Murphy et al., 2001). The high prevalence of depressive symptomatology among HIV-positive individuals and the relationship between these symptoms and non-adherence also speak to the need for routine screening of mood disorders when determining if an adolescent is ready to begin antiretroviral therapy (Ciesla & Roberts, 2001).

Cognitive ability

In order to assess for verbal and non-verbal cognitive strengths, two subtests from the WAIS-III were used. First, when considering these results, it is important to acknowledge that intelligence tests have been found to be Euro-centric and favoring of middle-class education (Sattler, 1992). Keeping these limitations in mind, the results from the current study indicated that participants performed significantly lower on the test of verbal ability (Vocabulary) than on the test of non-verbal ability (Block Design). The results failed to show any significant relationships between the predictor variables of cognitive ability and the outcome variable of medication adherence. While the existing literature provides evidence for the relationship between cognitive ability and adherence (Cheever, 2000; Kalichman & Rompa, 2000; Klosinski & Brooks, 1998), the absence of significant results in this study may be related to the lack of variance among the cognitive ability measures or the limited range for scores on the ATFR.

Substance use

For the purposes of these analyses, the most significant substance use measure (Age of First Use of Marijuana) was used in the regression equations. The use of the 'age of first use' variable rather than other markers of substance use, such as marijuana use in the past 30 days, highlights some of the variability in the definition of the construct of substance use. The variables of 'age of first use' versus 'use in the past 30 days' measure potentially different components of substance use behaviour. The measurement of 'age of first use of marijuana' may be a more appropriate measurement of chronic substance use over time. For example, age of first use may represent a marker for additional risk behaviors, including decreased health-seeking behaviours. In addition, early marijuana use may represent lifestyle behaviors that contradict the consistency needed for adequate adherence to medications. For example, adolescents who begin using drugs at a younger age are more likely to use other drugs and maintain a peer group that uses drugs (Hansen & O'Malley, 1995).

Limitations

While this study was conceptualized as an exploration of adherence within an understudied population, there are still limitations to the findings, particularly surrounding the sample. The sample of participants used for this study was selected based on convenience, which limits generalization to larger populations. The youth selected for this study were receiving services at a publicly funded hospital, which may be different from youth receiving services through private insurance or who have an ability to pay for medical care. Furthermore, adolescents living with HIV who are actively seeking healthcare services may represent a minority of the HIV-infected youth population. Thus, this sample cannot be assumed to represent youth who do not know they have HIV or youth who have been diagnosed with HIV but choose to not seek medical care. Finally, participants for this study were recruited from only one location. Ideally, a variety of sites would have been used that could have produced greater racial, ethnic, and socio-economic diversity.

Future research

While this study demonstrates preliminary results regarding medication adherence among HIV-infected youth, results from larger, multi-site adherence research programs must still be examined. Further examination of the psychological and cognitive factors that impact adherence is needed, utilizing larger sample sizes and more sensitive and comprehensive measures.

With a large number of studies focusing on the predictors of adherence, the focus must begin to shift toward the development of appropriate interventions to improve adherence. Specifically, interventions need to be developed that will improve adherence while also addressing many of the contextual variables that impact adherence, such as depression and substance use. Several current research projects have begun to evaluate methods for improving adherence, including directly observed therapy, buddy systems, and pagers that remind patients to take their medication (Simoni et al., 2003; Safren et al., 2003). However, adherence interventions specific to adolescents have been more limited in number (Rogers et al., 2001). Preliminary evidence from existing intervention studies suggests that adherence is most likely to be improved if the interventions are comprehensive, longitudinal, and specific to the individual (Tuldra & Wu, 2002).

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Table I

Cronbach's alpha coefficients for standardized scales

Measure	Alpha
Self-Report of Adherence (SRA)	.74
AIDS Clinical Trial Group Questionnaire (ACTG)	.88
Block Design Test	.79
Vocabulary Test	.93
Arlin Test of Formal Reasoning	.62
Center for Epidemiological Studies – Depression Scale (CES-D)	.90
State-Trait Anxiety Inventory – Trait Scale (STAI)	.92
Beck Hopelessness Scale (BHS)	.85

Table II

Percent of doses missed by participants using different time points

Time points of missed doses	Percent of participants
Missed dose “yesterday”	42
Missed dose in past week	66
Missed dose in past two weeks	80
Less than 95% adherent to their regimen	56

Table III

Reasons for missing medications over past month

Reason	Percent of participants
Simply forgot	73.8%
Fell asleep or slept through dose time	64.3%
Didn't have medication with you	64.3%
Were too busy with other things	57.1%
Had a change in daily routine	52.4%
Had problems taking pills at specific times	45.2%
Did not want others to notice you taking meds	42.9%
Had already missed medications so figured just miss the rest	38.1%
Felt sick or ill	35.7%
Felt the medication is a reminder about HIV	33.3%
Did not like the taste	31.0%
Felt depressed or overwhelmed	28.6%
Wanted to avoid side effects	26.2%
Felt healthy and didn't think you needed medication	23.8%
Had too many pills to take	19.0%
Felt like the drug was toxic or harmful	16.7%
Were confused about what you're supposed to do	9.5%

Table IV

Important factors when deciding whether to take medication

Factor	Percentage of participants
If the medication works	90.5%
The side effects	88.1%
How many pills I have to take	78.6%
How often I have to take the medicine	71.4%
If I need to take the medication with or without food	57.1%
What times of day I need to take the medicine	52.4%
How the medication will interact with other drugs I take	50.0%
If I think I can follow the instructions	31.0%
How I have to store the medication	23.8%
How much the medications cost	14.3%

Table V

Stepwise regression analysis summary for full model variables predicting non-adherence

Variable	<i>B</i>	<i>SEB</i>	β	<i>R</i> ²
Depression/Anxiety composite score	.693	.255	.438*	.204
Age of first marijuana use	-6.219	2.869	-3.49*	.122
Block design total score	–	–	–	.122

Note: $R^2 = .326$ ($p < .01$)

*
 $p < .05$