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Health Literacy and Adherence to Antiretroviral Therapy Among HIV-Infected Youth

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Abstract

Health literacy has been associated with adherence to antiretroviral therapy (ART) in HIV-infected adults, but this association has not been demonstrated in HIV-infected adolescents. Using an expanded health literacy model, we examined the relationship between health literacy, functional literacy, beliefs about ART, media use, and adherence to ART. A convenience sample of HIV-infected adolescents ($n = 50$) was recruited for this cross sectional study. The primary outcome of adherence was measured with 3-day self-reports. Health literacy as measured by the Test of Functional Health Literacy in Adults (TOFHLA) was not predictive of adherence ($p = .15$). Participants with higher positive outcome expectancy scores regarding ART were more likely to report 100% adherence, and participants with below grade level reading were less likely to report 100% adherence ($p < .05$). Our findings highlight the importance of assessing both health beliefs and reading skills as part of adherence support for HIV-infected youth.

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Keywords

adherence; antiretroviral adherence; beliefs; functional literacy; health literacy; HIV-infected adolescents; media use

In the United States, approximately 90 million individuals have inadequate levels of health literacy (National Research Council, 2011), and the need for improved health literacy is included as an objective in Healthy People 2020 (U.S. Department of Health and Human Services, 2012). Individuals with inadequate levels of health literacy have been shown to have more hospitalizations, emergency room visits, lack of preventative health care services, and increased risk of death (Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011).

Among HIV-infected adults, lower health literacy has been associated with higher serum viral loads, decreased CD4+ T lymphocyte cell counts, and poor adherence to antiretroviral therapy (ART; Kalichman, Cherry, & Cain, 2005; Kalichman & Rompa, 2000). Suboptimal adherence is associated with the development of resistance to ART and subsequent reduction of treatment options (Williams et al., 2006); it is one of the main causes of ART failure (Paterson et al., 2000; Sethi, Celentano, Gange, Moore, & Gallant, 2003). Treatment of HIV infection with ART has resulted in significant reductions in HIV-related morbidity and mortality (El-Sadr et al., 2006; Helleberg et al., 2012), further highlighting the importance of optimal adherence.

In the adolescent population there is limited research on the relationship between health literacy and health outcomes; most research to date on adolescents has focused on functional literacy or ability to read and write rather than health literacy (Manganello, 2008). Health literacy has been described as the skill to gain access to, understand, and use information in ways that promote and maintain health (Nutbeam, 1998) and therefore must be viewed in the broader context of individual factors, language, and culture (Institute of Medicine, 2009). For example, the current generation of youth has unprecedented access to the larger world due to advances in media and technology (Brown & Bobkowski, 2011) and commonly uses the Internet to gain health-related information (Gray, Klein, Noyce, Sesselberg, & Cantrill, 2005). Yet adolescents will only obtain maximum benefit if they are able to search for, evaluate, and use online Internet information effectively. Individual beliefs surrounding health care are also an important component of health-related decision-making, and perceived threat of illness has been shown to be predictive of better ART adherence in behaviorally HIV-infected youth (Garvie et al., 2011). A single study in HIV-infected teens reported no significant association between health literacy and adherence to ART (Murphy et al., 2010). These findings, however, were inconsistent with results of a study with HIV-infected adults, where a robust relationship between health literacy and adherence was demonstrated (Kalichman et al., 2008). The primary objective of this exploratory study was to examine the relationship between health literacy, functional literacy, beliefs about antiretroviral (ARV) medications, media use, and adherence to ART in HIV-infected adolescents (ages 13–24 years).

Methods

This was a multi-site cross-sectional descriptive survey design study. Potential predictors of adherence to ART were analyzed in a sample of 50 HIV-infected adolescents.

Sample

A convenience sample of youth with HIV infection was recruited from four HIV specialty clinical settings; both perinatally (mother-to-child) and behaviorally infected youth were eligible. Criteria for study participation were: HIV seropositive status, ages 13–24 years, fully disclosed of HIV diagnosis, English speaking, current treatment with a prescribed ART regimen for 6 months or longer, and absence of major neurocognitive deficits allowing for completion of survey instruments.

Settings/Recruitment

After approval by the appropriate institutional review boards (IRB), recruitment of eligible participants from four HIV specialty clinics occurred from September 2010 through April 2011. Clinical sites were affiliates of a large, urban, academic health care center. Informed consent and/or assent were obtained from all study participants in accordance with the regulations specific to the protection of study volunteers of the IRB at each institution. If the study candidate was between the ages of 13 and 17 years, the research study was described in detail by the principal investigator or physician collaborator to both the eligible participant and his or her parent/legal guardian; signed written and verbal assent was then obtained. Eligible participants ages 18 years and older were able to provide signed written and verbal consent in the absence of a parent/legal guardian. During the consent process, participants were given an opportunity to ask questions and at study completion were compensated with a \$20.00 gift card.

Instruments

Screening for study eligibility was performed with the Mini Mental Health State Exam (MMSE) and Rosenbaum hand held vision card. The MMSE (Folstein, Folstein, & McHugh, 1975) was used to assess neurocognitive deficits. A cut-off score of 24 was selected because in the one known study to date with HIV-infected youth, a score of less than 24 was used to identify HIV dementia (Lyon, McCarter, & D'Angelo, 2009). Visual screening was performed as recommended as a preliminary procedure for the TOFHLA.

Test of Functional Health Literacy in Adults (TOFHLA)—The TOFHLA is a validated health literacy-screening tool that measures both numeracy and literacy. Classification of health literacy scores is categorized into three levels, inadequate (0–59), marginal (60–74), and adequate (75–100; Parker, Baker, Williams, & Nurss, 1995). Adequate reliability of the shortened version TOFHLA (S-TOFHLA) has been reported in the adolescent HIV-infected population (Cronbach's $\alpha > 0.7$); the numeracy component of the S-TOFHLA has been described as less reliable in HIV-infected youth ($\alpha = 0.56$; Murphy et al., 2010). Therefore, the full version TOFHLA was selected for use in this study.

Rapid Estimate of Adult Literacy in Medicine-teen (REALM-teen)—REALM-teen is a brief and reliable word recognition measure designed to predict general reading ability in health care settings among teens in sixth through twelfth grades (Davis et al., 2006), consisting of 66 health related words arranged in increasing order of difficulty. Adolescents are asked to speak the word aloud, in the order listed. The total score is based on the number of words pronounced correctly and is related to grade level. The internal consistency is excellent (Cronbach's $\alpha = 0.94$) with strong test-retest reliability ($r = 0.98$); the REALM-teen has high criterion based validity, when correlated with the Wide Range Achievement Test, third Edition (WRAT-3; $r = 0.83$) and takes less than 3 minutes to administer (Davis et al., 2006).

Beliefs about Medication Scale (BAMS)—The BAMS is a 59-item questionnaire using a 7-point Likert scale to assess perceived threat of illness, positive outcome expectancy, negative outcome expectancy, and intent to adhere regarding oral medication adherence (Riekert & Drotar, 2002). Psychometric properties include demonstrated reliability ($\alpha = 0.79$ – 0.87 ; test-retest reliability, $r = 0.71$ – 0.77) and validity with a sample of chronically ill teens ($n = 133$), including youth with HIV-infection (Riekert & Drotar, 2002).

Media Use Questionnaire—This measure was developed by the investigator to assess media ownership and also daily time spent with media devices outside of school or work related to, and not related to, use of the Internet. The Media Use Questionnaire included 12 survey items. Items measuring time spent using common media devices were categorical and developed based on categories and results of the Kaiser Family Foundation (2010) report. The number of categories ranged from *no time* to various levels of minutes and hours. There were also two survey items designed to evaluate the preferred media source for obtaining health related information. The tool was pilot tested for face validity and usability by 12 teens from a local high school, who reported that the instrument was easily comprehended, reflective of modern media devices and daily time usage, and required 10 minutes or less to complete.

Measurement of Adherence

3-Day Self-Reported Adherence Estimates—Because self-reported adherence has been significantly associated with HIV-1 RNA levels in HIV-infected individuals ages 18 years and older (Nieuwkerk & Oort, 2005; Simoni et al., 2006) and in HIV-infected children and adolescents (Garvie, Wilkins, & Young, 2010; Van Dyke et al., 2002), adherence estimates were measured by 3-day participant self-report. Assessment of adherence to ART with self-report of missed doses has been widely used in HIV clinical and research practice, since the development of the adherence questionnaire used in the Adult AIDS Clinical Trial Group (AACTG) studies (Chesney et al., 2000), and a priori reliability estimates have been described as good; Cronbach's α of questions relating to missed doses (yesterday, 2, 3, and 4 days ago) was 0.81 (Reynolds et al., 2007).

To minimize the potential for social desirability bias (Garvie et al., 2010; Simoni et al., 2006), questions were worded in a non-punitive manner, assuming a missed dose. For

example, the investigator would state, “*Before beginning the questionnaires, could you tell me how many doses of your HIV medicines you missed yesterday? How many doses did you miss on (investigator names day 2 days ago)? How many doses did you miss on (investigator names day 3 days ago)?*” This method has been previously tested and validated in HIV-infected youth, and 3-day recall of missed ARV dosing has been shown to predict HIV-quantitative viral load among HIV-infected adolescents (Garvie et al., 2010).

An average missed doses calculation (Garvie et al., 2010) was computed: reported number of doses missed per medication multiplied by the dosing schedule (once daily, twice daily, etc.) during the previous 3 days divided by total number of prescribed doses over the previous 3 days. This percentage was subtracted from 100% to obtain the 3-day adherence estimate. Medications that were not a component of the ART regimen were not included in the calculation and participants reporting *don’t know* to the number of missed ARV medications were scored as having missed the dosage for the time period assessed (morning and/or evening of the specific day).

Data Collection

The MMSE and vision screen were first administered and then self-reported adherence estimates were obtained. Data from the screening instruments (TOFHLA, REALM-teen, BAMS, and Media Use Questionnaire) were collected in face-to-face interviews during a regularly scheduled clinic visit. The order of the study instruments was randomly selected. Because of potential for low literacy in this population (Brackis-Cott, Kang, Dolezal, Abrams, & Mellins, 2009), the investigator read each survey item from the BAMS and Media Use instruments to the participant. This was done to minimize the potential for any embarrassment related to reading difficulties (Wolf et al., 2007). The average time to complete the screening measures, primary study instruments, and adherence estimate was 43 minutes.

Data extraction from the medical records included demographic, psychosocial and HIV clinical history, and laboratory biomarkers, and were typically based on the date of study enrollment. Quantitative serum HIV viral load and CD4+ T lymphocyte counts were examined for 6 months prior to study interview.

Data Analysis

Dichotomous variables were created for continuous variables including TOFHLA scores (inadequate health literacy = 0–74, adequate health literacy = 75–100), 3-day adherence estimates (< 100% adherent, 100% adherent; Simoni et al., 2006), and quantitative HIV viral loads (< 400 copies/ml, > 400 copies/ml). Reading grade level equivalent for participant raw scores on the REALM-teen were compared to the chronological age of each participant and a dichotomous age-level reading variable was created (< grade level reading, ≥ grade level reading). Binary variables based on self-reported frequencies were computed for time spent using media devices/sources. A composite variable was constructed to describe the combined time spent using television, audio devices, and playing video games (TAV). Scores for total TAV time were divided into three categories (< 1 hour per day, 1–3 hours per day, and > 3 hours per day). A total beliefs composite score was computed by combining

each of the subscales in the BAMS (positive outcome expectancy, negative outcome expectancy, intent to adhere, perceived threat). Survey items were reverse coded as per the scoring instructions of the BAMS, so that a higher score indicated more positive beliefs.

Potential confounding variables in this study included age, gender, education, mode of HIV transmission, clinical stage of HIV disease, current psychological/psychiatric history, and substance use (Comulada, Swendeman, Rotheram-Borus, Mattes, & Weiss, 2003; Murphy et al., 2005; Rudy, Murphy, Harris, Muenz, & Ellen, 2009). Bivariate analyses were computed to examine the correlation between each of these potential confounders and level of adherence (< 100% adherence, 100% adherence). Because of potential clinical and psychosocial differences between youth with perinatally and behaviorally acquired HIV infection, bivariate analyses were performed to test for differences by mode of HIV transmission in potential confounders, as well as health literacy, reading age levels, and scores on the BAMS. Statistically significant variables were included into the multivariable analyses.

IBM SPSS Statistics, version 19 (Chicago, IL), was used to perform all statistical analyses. Descriptive statistics, and bivariate and multivariable analyses using logistic regression were computed with the level of significance set to 0.05. Log transformation of quantitative serum HIV viral load was performed, and if zero values existed, the number 1 was added. Non-parametric statistical tests were used for non-normally distributed data.

Results

The final sample population included 50 participants, ages 13–24 years, ($M = 19.7$ years; $SD = 3.13$; median = 20.4 years [range = 13.75 – 24.83]) either perinatally ($n = 40$) or behaviorally ($n = 10$) infected. Demographic and HIV characteristics of the cohort are summarized in Tables 1 and 2. HIV biomarkers (CD4+T lymphocytes counts, serum HIV viral load) were available from the participant's medical record on the same day self-reported adherence estimates were obtained in 56.0% (28/50) of the sample population. Of the remaining participants, the date of HIV biomarkers preceded adherence estimates by 1 day to 5 weeks in 16.0% (8/50) and 6 to 9 weeks in 24.0% (12/50) of the remaining sample. Two of the 50 participants (4.0%) had either one or both of the documented HIV biomarkers preceding self-reported adherence estimates by 13 to 16 weeks.

Mode of HIV Transmission

There was a statistically significant difference in reported substance use by mode of HIV transmission, with 94.3% of perinatally HIV-infected youth reporting no use in comparison to the 5.7% of youth with behavioral transmission ($p = .0001$). No other statistically significant differences were observed when comparing youth by mode of HIV transmission. However, a trend toward statistical significance ($p = .052$) was observed when comparing mean positive outcome expectancy scores with higher mean rank scores in youth with behavioral infection (mean rank = 33.5) in comparison to scores in youth with perinatal infection (mean rank = 23.5).

Health Literacy Characteristics

Most participants (80.0%) had adequate health literacy levels as measured by the TOFHLA (median total TOFHLA score = 83.5; range = 35–99). Median numeracy and reading comprehension raw scores among youth were 14.5 (range = 5–17 out of a possible range of 0–17) and 44.0 (range = 14–50 out of a possible range of 0–50).

Literacy Skills

Thirty-six of the 50 subjects (72.0%) had below-grade-level reading, despite nearly half having completed high school and 30.0% being enrolled in college courses at the time of study enrollment. Although the mean age was 19.7 years, 42.0% of participants had raw scores on the REALM-teen consistent with a sixth to seventh reading grade level equivalent.

Media Use

Common media devices (computer, Internet access, DVD/VCR player, television, cable/satellite television) were reported in the homes of more than 90.0% of the sample, and cellular phone ownership was reported by 46 of 50 participants. More than half of participants reported not spending any time reading offline (56.0%) or online (60.0%). Television viewing was more than 1 hour in 30 of 50 (60.0%) participants, and this included 8 respondents reporting television-viewing times of more than 5 hours daily. Time spent on social Websites was more than 1 hour in nearly half the sample (48.0%), including 17 youths who reported spending more than 3 hours on these websites. Text messaging of more than 25 texts during the previous day was frequently reported in more than half the respondents (54.0%), and listening to music offline was reported by 25 of the participating youth (50.0%). The minimum amount of total time spent using television and audio devices and playing video games was 1–3 hours/day in 58.0% of youth.

Beliefs about Medications

Total beliefs and subscale scores are depicted in Table 3. Higher scores were suggestive of higher levels of reported agreement.

Self-Reported Adherence

Three-day self-reported adherence was highly negatively skewed with a median 3-day adherence estimate of 100.0% ($M = 86.0$, $SD = 26.92$; range = 0–100). There were no statistically significant correlations between self-reported adherence estimates (dichotomized as 100% or < 100%) and gender, education, mode of HIV transmission, AIDS diagnosis, substance use, psychological/psychiatric illness (all p values > .05) or between age and self-reported adherence (Spearman's $\rho = -0.087$, $p = .55$).

There was a strong, negative correlation between self-reported adherence and quantitative serum HIV viral load (Spearman's $\rho = -0.615$, $p < .001$), and a statistically significant positive, moderate correlation existed between adherence and both CD4+T-lymphocyte count (Spearman's $\rho = 0.378$, $p = .007$) and CD4+ T-lymphocyte percentage (Spearman's $\rho = 0.371$, $p = .008$).

There were no statically significant associations between health literacy and adherence or functional literacy and adherence (all p values $> .05$), but total beliefs, positive outcome expectancy, and intent to adhere were positively and significantly associated with adherence (Table 4). Among the 40 HIV-infected youth with adequate health literacy, 21 (95.5%) reported spending 5 minutes or more reading offline rather than no time at all, in comparison to one of the 10 participants (4.5%) with inadequate health literacy who spent at least 5 minutes reading ($p = .02$). No other statistically significant findings were found with time spent using other media devices and health literacy levels.

Multivariable Analyses

Using self-reported 3-day adherence estimates (100% adherent, $< 100\%$ adherent) in a fitted logistic regression model, health literacy was not predictive of adherence ($p = .15$).

Participants with higher positive outcome expectancy scores were significantly more likely to have self-reported adherence estimates of 100% (adjusted OR = 1.07, 95% CI = 1.018–1.117), and the odds of 100% adherence were significantly lower among participants with below-grade-level reading compared to those with grade level or above grade level reading and 100% adherence (63.9% and 85.7% respectively; adjusted OR = 0.07, 95% CI = 0.005–0.831; Table 5).

Discussion

The findings of this study make several important contributions to the body of knowledge regarding HIV-infected adolescents. At the time of this research, we describe the results of the first known study to examine the relationships between health and functional literacy levels, beliefs about ART, media use, and adherence to ART in HIV-infected youth. We also report the first known data quantifying media use in the HIV-infected adolescent population. Clearly, media may offer tremendous potential for novel and improved methods to deliver health education in high-risk youth such as the adolescent participants in this study. Although health literacy was not predictive of adherence in this study, beliefs of positive outcome expectancy and functional literacy skills were predictive of self-reported adherence.

The proportion of youth who reported 3-day adherence of 100% in this study was higher than previous reports in HIV-infected youth (Chandwani et al., in press; Murphy et al., 2010, Murphy et al., 2005; Murphy, Wilson, Durako, Muenz, & Belzer, 2001; Naar-King et al., 2006; Williams et al., 2006). While it is crucial to consider the inherent risk of bias in the interpretation of these self-reported adherence estimates, the strong correlation between self-reported adherence and quantitative HIV viral load strengthen these results because viral load has been significantly associated with self-reported adherence in other studies with HIV-infected youth (Garvie et al., 2010; Murphy et al., 2005; Williams et al., 2006) and adults (Reynolds et al., 2007; Simoni et al., 2006). Additionally, our method of data collection of self-reported adherence estimated in this study was designed to reduce social desirability bias and over inflation of the results.

Consistent with the findings from one other study of health literacy and adherence in HIV-infected youth (Murphy et al., 2010), we found no significant correlation between health

literacy and adherence to HIV treatment in our study. However, there were some important differences between our study and that of Murphy and colleagues (2010), including a larger sample size ($N = 186$) of primarily behaviorally HIV-infected youth with 50.0% having education of less than high school graduation, and their inclusion of participants with high risk behaviors such as unprotected sex during the previous 3 months, substance use issues, or poor adherence. These differences may explain the lower percentage of youth (33.7%) in Murphy and colleagues' (2010) study with 3-day self-reported adherence of 90.0% and greater. Despite these distinctions, in both studies 80.0% and more of participants had adequate levels of health literacy and were receiving care at multidisciplinary, primary HIV care centers. Such state-of-the-art medical care may have positively influenced health literacy levels.

In this study, the high number of participants (72.0%) with below-grade-level reading was of particular concern, and may be explained by multiple factors. Potential biologic considerations include subtle cognitive deficits due to the impact of ongoing HIV viral replication in the central nervous system, the role of chronic inflammation, and the effect of HIV on the developing brain in perinatally HIV-infected youth (Hazra, 2010). Although there has been a significant decrease in the incidence of HIV-related encephalopathy since the development of effective ART (Patel et al., 2009), HIV-associated neurocognitive disorders persist despite treatment with ART (Mothobi & Brew, 2012). Additionally, possible psychosocial factors contributing to low literacy include lower socioeconomic backgrounds of study participants and primary residence in disadvantaged neighborhoods. Similar to the findings in our study, reading grade level has been associated with ART adherence. In one study with HIV-infected adults, low literacy as measured by the REALM was a significant predictor of medication non-adherence during the preceding 4 days (AOR 3.3, 95% CI = 1.3–8.7) but this relationship was mediated by self-efficacy (Wolf et al., 2007).

One surprising finding not previously described among HIV-infected youth was the disconnect between the functional and health literacy scores in this study (i.e., relatively higher health literacy scores). A likely explanation is related to the long-term exposure of the participants to the health care system, health care professionals, and frequent medical encounters throughout their life spans. This finding highlights the larger context in which health literacy exists and supports movement away from definitions with an exclusive focus on functional literacy.

In our study, beliefs of positive outcome expectancy regarding ART were significantly associated with adherence, indicating that health beliefs may be assessed and targeted for intervention. Individual beliefs (total beliefs and perceived threat of illness) were significant predictors of medication adherence in one study of behaviorally HIV-infected youth (Garvie et al., 2011). Health beliefs of the modern adolescent are influenced by a wide variety of factors including the education system, cultural norms, and media.

The HIV-infected youth in our study were well equipped with media; more than 90.0% owned a computer with Internet access and 74.0% reported going online during the preceding day. This information is valuable because 70.0% reported that their first choice

for seeking health related information would be via the Internet. Considering the combined effects of low reported time spent reading and the high percentage of below-grade-level reading in this sample population, augmentation of traditional education extending beyond written pamphlets may be needed. Efforts to promote adolescent health literacy should include online access to reliable sources of health information (Ghaddar, Valerio, Garcia, & Hansen, 2012).

The methodological limitations of this study include use of self-reported adherence, a small sample size, and a wide age span given that age-related developmental differences may have influenced beliefs about HIV illness and ART. Additionally, the read-along style of the BAMS and Media Use Questionnaire may have influenced participant responses. Although the Media Use Questionnaire underwent initial pilot testing in this study, additional testing will be needed to establish reliability for future research.

Conclusions

In summary, our research tested an expanded health literacy framework in an HIV-infected cohort specifically for the outcome of adherence to ART. Both beliefs and reading levels were predictive of ART adherence, highlighting the importance of comprehensive models in the care of HIV-infected youth.

Health literacy as measured with the TOFHLA was not predictive of self-reported adherence, and this may have been explained by the smaller than anticipated sample size as well as the high levels of both adherence and health literacy among the participants. Although it is plausible that the favorable HIV health outcomes (i.e., high self-reported adherence, good HIV biomarkers) observed among participating youth may have been explained by the high percentage with adequate health literacy levels; the study was not sufficiently powered to provide confirmatory data. Considering the paucity of evidence examining the relationship between health literacy and treatment adherence in HIV-infected adolescents and young adults and the significant association shown in HIV-infected adults, additional research is warranted.

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Clinical Considerations

- Health beliefs about ART need to be assessed as part of ongoing adherence support and especially before the initiation of an ARV regimen.
- Three-day self-reported adherence estimates, when used in combination with HIV-biomarkers, offer a feasible and practical method to measure ART adherence in HIV-infected youth.
- Considering that low functional literacy is a risk factor for suboptimal adherence among HIV-infected youth, augmentation of traditional education extending beyond written pamphlets is needed.
- Media use and ownership is high in HIV-infected youth, and nurses need to periodically assess media sources used to obtain HIV- and ART-related health information.

Table 1Demographic Characteristics of Study Population ($N=50$)

Variable	Results
	<i>M (SD)</i>
Age in years	19.7 (3.13)
	<i>n (%)</i>
Gender	
Male	28 (56.0)
Female	22 (44.0)
Race/Ethnicity	
African American	28 (56.0)
Caucasian	3 (6.0)
Hispanic/Latino	13(26.0)
Asian/Mixed/Other	6 (12.0)
Sexual Orientation	
Heterosexual	37 (74.0)
Homosexual (gay/lesbian)	9 (18.0)
Bisexual	2 (4.0)
Unknown	2 (4.0)
Education	
High School Drop Out/No GED	8 (16.0)
8 th Grade Student	2 (4.0)
High School Student	16 (32.0)
High School/GED Graduate	5 (10.0)
Post High School Vocational/Educational Training	4 (8.0)
College Student	15 (30.0)
Substance Use/Abuse	
No reported use	34 (68.0)
Alcohol	6 (12.0)
Marijuana	4 (8.0)
Health Care Insurance	
Yes	50 (100.0)
No	0 (0)
Psychiatric/Psychological Disorder	
Yes	18 (36.0)
No	29 (58.0)
No recent evaluation	3 (6.0)

Note. GED = General educational development test

Table 2HIV Characteristics of Study Population (*N*=50)

Variable	Results		
	<i>n</i> (%)	<i>M</i> (<i>SD</i>)	Median (range)
Mode of HIV transmission			
Perinatal	40 (80.0)		
Sexual	10 (20.0)		
CDC stage			
Stage 1 (Asymptomatic)	6 (12.0)		
Stage 2	20 (40.0)		
Stage 3 (AIDS)	24 (48.0)		
AIDS diagnosis			
Yes	24 (48.0)		
No	26 (52.0)		
Log₁₀ HIV viral load (copies/ml)		1.18 (1.84)	0 (0–5.42)
Log₁₀ HIV viral load dichotomized			
< 400 copies/ml	37 (74.0)		
> 400 copies/ml	13 (26.0)		
CD4+T lymphocyte count (cells/mm³)		562.88 (310.94)	552.5 (3 – 1584.0)
CD4+T-lymphocyte percentage		26.98 (9.81)	28.0 (1 – 42.0)
Adherence dichotomized			
100% reported adherence	35 (70.0)		
< 100 % reported adherence	15 (30.0)		
3-day self-reported adherence estimates		86.0 (26.92)	100.0 (0–100)

NOTE: *M* = mean; *SD* = standard deviation

Table 3Participant Scores on the Beliefs about Medications Scale (BAMS; $N=50$)

Total Beliefs and Subscales	Results	
	<i>M (SD)</i>	Median (range)
Total Beliefs Composite Score (53–371)	238.7 (28.46)	240.5 (160–291)
Positive Outcome Expectancy (20–140)	114.4 (17.51)	117.0 (56–140)
Negative Outcome Expectancy (13–91)	37.9 (14.53)	36.5 (14–76)
Perceived Threat (13–91)	44.7 (13.67)	43.0 (22–79)
Intent to Adhere (7–49)	41.7 (8.22)	43.0 (7–49)

NOTE: *M* = mean; *SD* = standard deviation; Upper/lower limits of scores on Beliefs about Medications Scale (BAMS) shown above in parentheses

Table 4Correlation of Adherence with Beliefs, Health Literacy, and Literacy (*N* =50)

Variable	Antiretroviral Adherence	<i>p</i>-Value*
Beliefs		
Total Beliefs	0.264	.06
Positive Outcome Expectancy	0.360	.01
Negative Outcome Expectancy	−0.085	.56
Perceived Threat	−0.005	.98
Intent to Adhere	0.420	.002
Health Literacy		
TOFHLA Total Score (0–100)	−0.011	.94
Literacy		
REALM Raw Total Score (0–66)	−0.122	.40

NOTE: TOFHLA = Test of Functional Health Literacy in Adults; REALM = Rapid Estimate of Adult Literacy in Medicine; Self-reported 3-day antiretroviral adherence estimates used in analyses

* Correlation tested using Spearman's Rank Correlation Coefficient

Table 5

Predictors of Adherence as Measured by 3-day Self-Report ($N = 50$)

Predictor Variable	β	Standard Error	Odds Ratio	95% CI	p -Value
Health Literacy					
	−0.048	0.033	0.954	0.893–1.018	.15
Positive Outcome Expectancy	0.064	0.023	1.07	1.018–1.117	.006
Reading Age Level					
< age grade reading	−2.711	1.288	0.07	0.005–0.831	.035
age grade reading ^a					
Substance Use					
No reported Use	−0.571	0.816	0.565	0.114–2.80	.49
Reported Use ^a					

NOTE: β = beta coefficient; CI = confidence interval;

^a reference category Health literacy was measured with TOFHLA, possible range of scores = 0–100 Positive outcome expectancy was a subscale in the BAMS, possible range of scores = 20–140.