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Suggested running head: Personal HIV Knowledge, appointment adherence and HIV outcomes

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Abstract

HIV knowledge may impact patient access, understanding, and utilization of HIV medical information. This study explored the relationship between personal HIV knowledge, appointment adherence and treatment outcomes. HIV-infected individuals ($n = 210$) were assessed on factors related to HIV knowledge and appointment adherence. Adherence data and laboratory values were extracted from medical records. HIV knowledge was measured by participants' knowledge of their CD4 count and viral load (VL) and adherence was defined as attendance at $> 75\%$ of appointments. Two thirds of participants were adherent, but only one third knew their CD4 count and VL. Controlling for time since last appointment, HIV knowledge more than doubled the odds of appointment adherence. In combination with relationship with provider, knowledge predicted increased CD4 count and increased odds of an undetectable VL by almost five times. Personal HIV knowledge may be a valuable indicator of engagement in care and may also facilitate improved treatment outcomes.

Keywords

HIV; adherence; knowledge; treatment outcomes

Introduction

Despite progress in treatment for HIV infection, many HIV positive individuals are not consistently engaged in routine clinical care and therefore cannot benefit from available treatment. [1] Studies have shown that those who miss HIV clinic appointments are more likely to be advanced in their disease, and to have higher morbidity and mortality. [2-4] Non-adherence to clinic appointments has also been related to poor HIV outcomes, including an AIDS-defining CD4 cell count and detectable viral load after one-year among patients having a non-detectable viral load at the earliest visit. [5] Identification of predictors of poor HIV appointment adherence could facilitate the development of interventions that might therefore maximize the benefits of treatment and minimize viral transmission. [6]

In the US, HIV disproportionately affects minorities and those with lower socioeconomic status (SES). Among the disadvantages related to low SES, poor educational quality and low literacy may have the most profound effect on medical treatment of those with HIV/AIDS. Literacy for health information is a key contributor to health status, and HIV-specific health

literacy may impact the motivation and ability of patients to access, understand, and use HIV medical information to maintain their health. [7-9] However, for patients to comprehend how to prevent their HIV infection from developing into AIDS requires them to understand the relationship between HIV and the immune system and the meaning of their CD4 and viral load values. It may be postulated that persons with low health literacy may be less knowledgeable about their disease, its course and symptom profile, and may understand less the need for preventive medical care and routine laboratory tests.

Patients with limited health literacy may not have the requisite skills or opportunity to effectively understand and act upon the need to maintain regular HIV care. Although low health literacy has been linked to poorer health status, increased hospitalization rates, non-adherence to medications and decreased screenings across a number of diseases, [10-13] including HIV, comparatively little is known about the impact of personal HIV-knowledge, e.g., knowledge of one's own laboratory values, on adherence to routine clinical and laboratory appointment attendance and treatment outcome.

This study explored the relationship between personal HIV knowledge and appointment adherence by examining retrospective medical records of health status and outpatient HIV clinic and laboratory appointments. It was hypothesized that low personal HIV knowledge would be associated with non-adherence to appointments and poor health outcomes.

Methods

This study was part of a larger survey of 210 HIV positive men and women receiving care at the University of Miami/Jackson Memorial Hospital (UM/JMH) Special Immunology Clinics (SI) and the Borinquen Community Health Center in South Florida. From May, 2009 to October, 2010, participants were recruited from UM/JMH and Borinquen by flyers or word of mouth and screened by the study recruiter for eligibility (HIV positive serostatus, currently receiving care in the facility, 18 years of age or more, ability to communicate in English, no current psychotic disorder, no history of head trauma with loss of consciousness or existing CNS disease). After pre-screening and provision of informed consent and HIPAA release, eligibility was verified by medical record abstraction. Baseline assessments, consisting of demographics and neuropsychological and psychosocial status, were conducted by a trained assessor in a private office located in a building separate from the HIV clinics. Participants were provided with compensation to cover their time and travel expenses. Patients at both clinics were routinely scheduled for a minimum *each* of one regular physician appointment and one laboratory appointment every 3 months (+/-2 weeks). Among established patients, a minimum of 4 routine appointments during the 7-month study period were scheduled; patients new to the clinic or who were having HIV-related health problems were scheduled more often. Electronic patient medical records were utilized at both clinics and records were abstracted to assess appointment adherence and biological assessments of viral load and CD4 over the previous 7 months.

Assessments

Independent and dependent variables

Appointment Adherence: Appointment adherence was operationalized as the percentage of appointments attended out of the number scheduled. The percentage of appointments missed out of the total number of scheduled medical appointments for each participant was examined rather than the absolute number of appointments kept, following the methodology of Catz et al. [14] to account for individual variations in the number of scheduled appointments (i.e., sicker patients have more appointments). Non-attendance was defined as the percentage of total medical appointments (i.e., appointments with a physician, nurse

practitioner and laboratory technicians) at the outpatient clinics which were “no-showed” (e.g., missed but not cancelled or rescheduled prior to the appointment time) during the 7-month period preceding the baseline assessment. Laboratory visits and clinical visits were combined to provide overall adherence rather than adherence specific to clinical interactions. Appointments missed due to inpatient hospitalization were not included in the non-adherent calculation.

HIV Knowledge: HIV knowledge was operationalized as participants’ knowledge of their CD4 count and viral load (copies/mL) values. Responses were categorized within estimated value ranges (i.e., six ranges for CD4 count: 0-50, 50-99, 100-199, 200-349, 350-500, 500; four ranges for viral load: undetectable, <5000, 5,000 – 100,000, >100,000), as well as “don’t know” and “not applicable.” [15] “Not applicable” represented those participants who believed they had never been tested, though, in fact, all participants were actively in care and had been tested. Laboratory records of CD4 values were not available for 29 participants and viral load values were not available for 32 participants; these participants were excluded from HIV knowledge range analyses unless they responded “don’t know” or “not applicable.” Participants were dichotomized into those who knew both their CD4 count and viral load and those who did not. Biological and disease related outcomes. Viral load, CD4 count (cells/uL), time since HIV diagnosis, time since last VL/CD4 assessment, use of antiretrovirals, length of time in HIV treatment and what type (if any) of health insurance were abstracted from electronic medical records.

Control variables—Variables selected for control were based on previous literature in which they had been associated with attendance (i.e., gender, homelessness, transportation, income, substance use, provider relationship, depression) or health literacy outcomes (i.e., age, time since last visit, time HIV, time on ART, education, cognitive functioning.).

Demographics: Demographics assessed included age, gender, education, income, housing and mode of transportation.

Substance use: Alcohol and drug use was assessed using the Addiction Severity Index (ASI). [16] The ASI assessed the number of days of alcohol and drug use for all classes of drugs in the past 30 days.

Provider relationship: Patient relationship with providers was assessed using the 19-item Attitudes Toward HIV Healthcare Providers Scale. [17] Items were rated on a 6-point Likert scale (ranging from strongly agree to strongly disagree) and examined patients’ attitudes toward his or her medical providers. Higher scores indicated more positive attitudes towards providers. Depression. The Center for Epidemiological Studies – Depression 10 [18-19] is widely used 10-item self-report scale measuring current depressive symptomatology. The 10-item questionnaire has good predictive accuracy in comparison with the 20-item version ($\kappa = .97$, $P < .001$). Items responses are rated using a Likert scale ranging from 0, “rarely or none of the time” to 3, “all of the time.” Scores range from 0-30, a score of > 10 is indicative of significant depressive symptoms. The CES-D has very high internal consistency, adequate test-retest repeatability ($r = .71$) and well established validity across a wide variety of demographic characteristics in the general population. [19]

Cognitive functioning: The HIV Dementia Scale (HDS) [20] was used to assess neuropsychological (NP) impairment associated with HIV infection. The HDS used consisted of 3 items measuring delayed verbal recall, processing speed and visuoconstructive skills. Total scale scores range from 0 to 12 and were utilized in analyses.

Statistical Analyses

Univariate analyses (range, mean, standard deviation) were conducted for demographic variables. Bivariate analyses were conducted in order to examine factors related to appointment adherence and HIV knowledge, and to determine the relationship of adherence and knowledge with treatment outcomes. Continuous variables were assessed using t-tests, and Chi-square tests of independence were computed for categorical variables. Multivariable logistic regression was used to determine which factors would contribute to appointment adherence and CD4 and VL knowledge, adjusting for all moderately associated ($p < .15$) variables. Multivariable linear regression and logistic regression were used to assess the contribution of adherence and knowledge to CD4 count and having an undetectable viral load, also adjusting for moderately associated covariates. All statistical analyses were conducted using SPSS version 19.0 (IBM Corporation).

Results

Demographics

Participants ($n = 210$) ranged from 24 to 70 years old ($m=47$), and just over half were women (53%). Most (86%) were single or divorced. Eighty three percent of participants were African-American, 11% were Hispanic. On average, participants reported an income of \$617 per month, primarily from their own Social Security Insurance or Social Security Disability Insurance (64%), or from spouse/partner or family (14%). Those with the highest income (5 participants, +2 SD) all received Ryan White or Medicaid services, similar to the overall sample. Ninety one percent were unemployed at study entry, and only 14% reported owning a car, but 94% had a regular place to stay. All participants had insurance for the seven months preceding study entry; insurance was primarily through Medicaid (68%) or Ryan White. The majority of participants reported being heterosexual (83%), and the most common reported source of HIV infection was heterosexual sex (79%). Participants had been diagnosed with HIV an average of 13 years and 95% were receiving antiretroviral therapy. HIV dementia (cognitive functioning) scores obtained ranged from zero to 12, with a mean of 7.3 ± 3.1 . Table I details participant demographics.

Appointment adherence

Appointment adherence data was available for 206 participants. Most participants were adherent to their appointments; 58% of participants attended > 75% of medical appointments, 60% attended > 75% of lab appointments, and 62% attended > 75% of total appointments. Due to a non-normal distribution, attendance was categorized into quartiles; to provide adequate cell values, quartiles were then collapsed into dichotomies of < 75% and more than 75% adherence to appointments. Participants were less likely to have attended appointments in the last seven months who reported using alcohol or drugs ($\chi^2 = 5.2$, $p = .03$) or reported higher levels of depression ($t(139) = 2.6$, $p = .01$). Attendance at appointments was not related to age, income, having transportation, length of time since HIV diagnosis, being homeless in the past seven months, or cognitive functioning. Table II presents factors related to appointment adherence and personal HIV knowledge.

A logistic regression analysis was conducted to assess the impact of HIV-specific knowledge on appointment adherence, adjusting for age, time since diagnosis, alcohol and drug use, depression, and relationship with provider. The results are presented in table III. HIV-specific knowledge, i.e., knowledge of CD4 cell count and viral load, was associated with 2.8 greater odds of adherence to HIV-related appointments (model χ^2 (5 df) = 20.9, $p = .001$, pseudo- $R^2 = .15$).

HIV knowledge

Medical record data was available for 206 participants, of those, HIV viral load reports were available for 178 participants and CD4 cell counts were available for 181. Eighty five participants (48%) had an undetectable VL and the mean CD4 count was 463 ± 278 . When comparing participant reported CD4 cell count and viral load to medical records, ninety six participants (53%) knew the correct value of their VL, 98 (52%) knew their CD4 count (cells/uL), and 69 (37%) knew both values. Income was related to knowledge of CD4 and viral load ($t(180) = 3.2, p = .001$). Age, education, substance use, depression, cognitive functioning and length of time since HIV diagnosis or last CD4 count and last viral load count were not related to knowledge of CD4 and viral load (see table II).

A logistic regression was conducted to assess factors contributing to knowledge of CD4 and VL, adjusting for substance use, time since last CD4 and VL count, alcohol and drug use, and cognitive functioning. Appointment adherence was associated with a 2.6 greater odds of knowledge of CD4 and VL and income was associated with 1.02 greater odds of knowledge of CD4 and VL (model $\chi^2(6 \text{ df}) = 23.2, p = .001$, pseudo- $R^2 = .17$) (see table III).

Treatment outcomes

Treatment outcomes differed between genders, by cognitive functioning and substance use, and were related to relationship with provider. CD4 counts were higher among women ($t(179) = 2.5, p = .01$), those with better cognitive functioning ($r = .20, p = .01$), those with a more favorable attitude towards their provider ($r = .17, p = .03$), and those not endorsing alcohol or drug use ($t(179) = 2.0, p = .04$). Women were more likely to have an undetectable viral load ($\chi^2 = 4.2, p = .04$). Those who had not been homeless in the past seven months ($\chi^2 = 4.3, p = .04$), or had been living with HIV longer ($t(176) = 3.0, p = .003$) were also more likely to have an undetectable viral load.

Linear regression was conducted to assess the relative contribution of appointment adherence and knowledge to CD4 count, when adjusting for gender, cognitive functioning, provider relationship, and drug and alcohol use. The results are presented in table IV. As can be seen in the table, the full model, including all contributors, demonstrated that attitude toward health care provider and knowledge predicted higher CD4 count and better cognitive functioning was associated with higher CD4 count (see table IV). The full model explained 26% of the variance in CD4 count, a 16% improvement over the model not including knowledge (full model $R^2 = .26, F(6, 168) = 10.0, p < .001$; reduced model $R^2 = .10, F(4, 170) = 4.7, p = .001$). Appointment adherence did not make a contribution to the overall model of CD4 count. CD4 count was positively skewed (skew = 0.6), but regression diagnostics indicated a good model fit.

Logistic regression was conducted to determine the relative contribution of appointment adherence and knowledge to an undetectable viral load, adjusting for gender, homelessness and time since HIV diagnosis. The full model, including all contributors, demonstrated that knowledge of one's CD4 count and VL increased the odds of an undetectable viral load by 4.9 and that each additional year since HIV diagnosis increased the odds by 1.1. The pseudo R^2 for the full model, was .25, compared to .08 in the model without knowledge (full model $\chi^2 = 37.1, p < .001$; reduced model $\chi^2 = 11.1, p = .01$). Appointment adherence did not make a contribution to the overall model of viral load (see table IV).

Discussion

This study sought to examine the relationship between personal HIV knowledge and appointment adherence, and hypothesized that greater knowledge would be associated with adherence to appointments and improved health outcomes. In fact, results indicated that

personal HIV knowledge and appointment adherence were associated, but that only knowledge, not adherence to appointments, contributed to treatment outcomes.

Previous studies have illustrated that patients less engaged in HIV care were more likely to miss appointments in the last month and to have poorer adherence to HIV medications and provider advice. [21] Knowledge of viral load and CD4 values may indicate greater engagement in care. Appointment attendance may be necessary, but not sufficient, to achieve optimal treatment outcomes, and the relationship obtained between personal HIV knowledge and treatment outcomes suggests that knowledge may be an essential component in achieving optimal health.

The information motivation behavior (IMB) [22] model of health behavior change has increasingly been applied to HIV as an integrated conceptualization for understanding and promoting HIV/AIDS medication adherence behavior. The elements of the IMB model, HIV medication adherence information, HIV medication adherence motivation, and HIV medication adherence behavioral skills, have been found to predict HIV medication adherence behavior. [23] HIV knowledge may represent an element of the knowledge gain underlying motivational and behavioral change. As found in previous studies [12], results of this study supported HIV information-based interventions to enhance knowledge and behavior in this population.

This study examined primarily very low income, racial/ethnic minority persons, many of whom reported active alcohol or drug use and exhibited limitations in cognitive functioning. Only about half were adherent to appointments and one third were able to report their HIV VL and CD4 values. Many HIV positive persons come from hard-to-reach populations that have historically distrusted health authorities, and patients transitioning from sporadic to regular use of medical services have reported difficulties in communicating with providers. [24-25] Results suggest that increased efforts are needed to increase both appointment attendance and personal HIV knowledge in these populations.

Health literacy has been associated with numeracy and education [26-27]. It is therefore likely that HIV knowledge may have also been related to numeracy; however, in the current study, HIV knowledge was associated only with income, and adherence was associated only with depression and substance use. Previous studies of HIV knowledge have focused primarily on variables related to prevention of transmission; however, in the current study, personal HIV knowledge was conceptualized as the patient's awareness of their own treatment outcomes (i.e., viral load, CD4). Results suggest that assessment of HIV knowledge should consistently include patient understanding of treatment outcomes as well as transmission.

In contrast with previous studies in which certain demographic characteristics (e.g., lower income, substance use) were associated with poor appointment adherence and "no shows," [28-30] this study found only income to make a modest contribution to knowledge. However, those with the highest income used services identical to the entire sample and all received Ryan White or Medicaid, and appointment attendance was also not associated with income. In contrast, the constellation of drug use and depression was associated with non-adherence. Both cognitive depressive symptoms and severe depression have been linked with reduced medication adherence, [31] highlighting the importance of targeting this comorbidity in treatment of this population. Psychological interventions have been found to be effective, especially those that incorporate a cognitive-behavioral component, in reducing depression among people living with HIV. [32]

This study had several limitations. Naturally, those who do not attend medical appointments may lack HIV-specific knowledge because HIV care providers cannot provide such

information to the patient if he or she missed their appointment, though analyses controlled for time since appointment. An additional limitation is those participants for whom lab values could not be confirmed; these patients may represent the most non-adherent, and yet could not be included in these analyses. Additionally, knowledge of laboratory values does not necessarily imply understanding of those values. Further research is needed to determine the reason for the lack of knowledge (forgetting, poor comprehension of meaning of value) so that acquisition of treatment-related knowledge can be addressed early in care. Finally, as a cross-sectional study, the temporal relationship between independent and dependent variables cannot be ascertained. It is not possible to say whether appointment attendance predicted knowledge, or knowledge predicted appointment adherence; this study only reports the relationship between the two. An examination of prospective outcome data is anticipated to evaluate a predictive model.

Unlike other indicators of health status such as adherence to medications, increasing attendance at routine physician/clinic appointments may be a more easily modifiable target for improving the benefits of HIV care. HIV treatment requires a lifetime commitment, and HIV care providers are an essential component in the HIV patient's health network. The relationship between providers and patients was associated with CD4 outcomes in this study. Interventions should explore clinical opportunities for providers to discuss the role of viral load in disease progression and the role of CD4 cells in immune functioning with their patients. Previous literature has indicated that physicians may underestimate their use of technical language with patients and give little attention to determining patient understanding of medical instructions. [33] Interventions to enhance patient-provider communication regarding markers of effective treatment outcomes represent a simple and potentially important adjunct to existing care protocols. Patient comprehension of HIV-specific information regarding their own treatment may represent an important step toward achieving optimal health outcomes, and physicians and health care providers should be encouraged to capitalize on their important relationship with patients to enhance personal HIV knowledge in this vulnerable population.

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References

1. Mugavero MJ, Amico KR, Westfall AO, et al. Early retention in HIV care and viral load suppression: implications for a test and treat approach to HIV prevention. *J Acquir Immune Defic Syndr*. 2012; 59:86–93. [PubMed: 21937921]
2. Brennan AT, Maskew M, Sanne I, Fox MP. The importance of clinic attendance in the first six months on antiretroviral treatment: a retrospective analysis at a large public sector HIV clinic in South Africa. *J Int AIDS Soc*. 2010; 13:49. [PubMed: 21134297]
3. Park WB, Choe PG, Kim SH, et al. One-year adherence to clinic visits after highly active antiretroviral therapy: A predictor of clinical progress in HIV patients. *Journal of Internal Medicine*. 2006; 261:268–275. [PubMed: 17305649]
4. Robbins GK, Daniels B, Zheng H, Chueh H, Meigs JB, Freedberg KA. Predictors of antiretroviral treatment failure in an urban HIV clinic. *J Acquir Immune Defic Syndr*. 2007; 44:30–37. [PubMed: 17106280]
5. Berg MB, Safren SA, Mimiaga MJ, Grasso C, Boswell S, Mayer KH. Nonadherence to medical appointments is associated with increased plasma HIV RNA and decreased CD4 cell counts in a community-based HIV primary care clinic. *AIDS Care*. 2005; 17:902–907. [PubMed: 16120506]
6. Cohen MS, Chen YQ, McCauley M, et al. HPTN 052 Study Team. Prevention of HIV-1 infection with early antiretroviral therapy. *N Engl J Med*. 2011; 365:493–505. [PubMed: 21767103]

7. Wolf MS, Davis TC, Arozullah A, et al. Relation between literacy and HIV treatment knowledge among patients on HAART regimens. *AIDS Care*. 2005; 17:863–873. [PubMed: 16120503]
8. Wolf MS, Davis TC, Osborn CY, Skripkauskas S, Bennett CL, Makoul G. Literacy, self-efficacy, and HIV medication adherence. *Patient Educ Couns*. 2007; 65:253–60. [PubMed: 17118617]
9. Nutbeam D. Evaluating health promotion - progress, problems and solutions. *Health Promotion International*. 1998; 13:27–44.
10. Wolf MS, Gazmararian JA, Baker DW. Health literacy and functional health status among older adults. *Arch Intern Med*. 2005; 165:1946–1952. [PubMed: 16186463]
11. Berkman ND, Sheridan SL, Donahue KE, Halpern DJ, Crotty K. Low health literacy and health outcomes: an updated systematic review. *Ann Intern Med*. 2011; 155:97–107. [PubMed: 21768583]
12. Kalichman SC, Pope H, White D, et al. Association between health literacy and HIV treatment adherence: further evidence from objectively measured medication adherence. *J Int Assoc Physicians AIDS Care*. 2008; 7:317–323.
13. Peterson NB, Dwyer KA, Mulvaney SA, Dietrich MS, Rothman RL. The influence of health literacy on colorectal cancer screening knowledge, beliefs and behavior. *J Natl Med Assoc*. 2007; 99:1105–1112. [PubMed: 17987913]
14. Catz SL, McClure JB, Jones GN, Brantley PJ. Predictors of outpatient medical appointment attendance among persons with HIV. *AIDS Care*. 1999; 11:361–373. [PubMed: 10474634]
15. Blair JM, McNaghten AD, Frazier EL, Skarbinski J, Huang P, Heffelfinger JD. Clinical and behavioral characteristics of adults receiving medical care for HIV infection --- Medical Monitoring Project, United States, 2007. *MMWR Surveill Summ*. 2011; 60:1–20. [PubMed: 21881551]
16. McLellan AT, Kushner H, Metzger D, et al. The Fifth Edition of the Addiction Severity Index. *J Subst Abuse Treat*. 1992; 9:199–213. [PubMed: 1334156]
17. Bodenlos JS, Grothe KB, Whitehead D, Konkle-Parker DJ, Jones GN, Brantley PJ. Attitudes toward health care providers and appointment attendance in HIV/AIDS patients. *J Assoc Nurses AIDS Care*. 2007; 18:65–73. [PubMed: 17570301]
18. Andresen EM, Malmgren JA, Carter WB, Patrick DL. Screening for depression in well older adults: evaluation of a short form of the CES-D (Center for Epidemiologic Studies Depression Scale). *Am J Prev Med*. 1994; 10:77–84. [PubMed: 8037935]
19. Radloff L. The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*. 1977; 1:385–401.
20. Power C, Selnes OA, Grim JA, McArthur JC. HIV Dementia Scale: a rapid screening test. *J Acquir Immune Defic Syndr Hum Retrovirol*. 1995; 8:273–278. [PubMed: 7859139]
21. Bakken S, Holzemer WL, Brown MA, et al. Relationships between perception of engagement with health care provider and demographic characteristics, health status, and adherence to therapeutic regimen in persons with HIV/AIDS. *AIDS Patient Care STDS*. 2000; 14:189–197. [PubMed: 10806637]
22. Fisher JD, Fisher WA. Changing AIDS-risk behavior. *Psychol Bull*. 1992; 111:455–474. [PubMed: 1594721]
23. Fisher JD, Fisher WA, Amico KR, Harman JJ. An information-motivation-behavioral skills model of adherence to antiretroviral therapy. *Health Psychology*. 2006; 25:462–473. [PubMed: 16846321]
24. Mallinson RK, Relf MV, Dekker D, Dolan K, Darcy A, Ford A. Maintaining normalcy: A grounded theory of engaging in HIV-oriented primary medical care. *ANS Adv Nurs Sci*. 2005; 28:26–277.
25. Waldrop-Valverde D, Jones D, Weiss S, Kumar M, Metsch L. The effects of low literacy and cognitive impairment on medication adherence in HIV positive injecting drug users. *AIDS Care*. 2008; 20:1202–1210. [PubMed: 19012081]
26. Waldrop-Valverde D, Osborn CY, Rodriguez A, Rothman RL, Kumar M, Jones DL. Numeracy Skills Explain Racial Differences in HIV Medication Management. *AIDS & Behavior*. 2010; 14:799–806. [PubMed: 19669403]

27. Relf MV, Mallinson RK, Pawlowski L, Dolan K, Dekker D. HIV-related stigma among persons attending an urban HIV clinic. *J Multicult Nurs Health*. 2005; 11:14–22.
28. Israelski D, Gore-Felton C, Power R, Wood MJ, Koopman C. Sociodemographic characteristics associated with medical appointment adherence among HIV seropositive patients seeking treatment in a county outpatient facility. *Prev Med*. 2001; 33:470–475. [PubMed: 11676589]
29. Mugavero MJ, Lin H, Allison JJ, et al. Failure to establish HIV care: Characterizing the “no show” phenomenon. *Clinical Infectious Diseases*. 2007; 45:127–130. [PubMed: 17554713]
30. Giordano TP, Visnegarwala F, White AC, et al. Patients referred to an urban HIV clinic frequently fail to establish care: Factors predicting failure. *AIDS Care*. 2005; 17:773–783. [PubMed: 16036264]
31. Wagner GJ, Goggin K, Remien RH, et al. A Closer Look at Depression and Its Relationship to HIV Antiretroviral Adherence. *Ann Behav Med*. 2011; 42:352–360. [PubMed: 21818528]
32. Sherr L, Clucas C, Harding R, Sibley E, Catalan J. HIV and Depression - a systematic review of interventions. *Psychol. Health Med*. 2011; 16:493–527. [PubMed: 21809936]
33. Williams MV, Davis T, Parker RM, Weiss BD. The role of health literacy in patient physician communication. *Fam Med*. 2002; 34:383–389. [PubMed: 12038721]

Table I**Demographics**

Characteristic	n(%) Min-Max, m(sd)
Age	24-70, 47(7)
Gender	
Male	97(47%)
Female	111(53%)
Marital Status	
Married	19(9%)
Single/Never Married	119(57%)
Divorced	61(29%)
Widow/Widower	10(5%)
Ethnicity	
African-American	174(83%)
Hispanic	22(11%)
White	9(4%)
Other	5(2%)
Monthly Income	0-3500, 616(407)
Main Source of Income	
Salary/Wages	20(10%)
SSI/SSDI	135(64%)
Spouse, Partner, or Family	29(14%)
No Income	9(4%)
Other	17(8%)
Time since HIV Diagnosis (years)	<1-31, 13(7)
HIV Dementia (Cognitive Functioning)	0-12, 7.3(3.1)

Table II

Factors associated with appointment adherence and personal HIV knowledge.

Characteristic /Measure	Adherent (n=126) n(%), m(sd)	Nonadherent (n=79) n(%), m(sd)	$\chi^2/t, p$
Age	47.6(7.1)	46.0(7.8)	1.5, .13
Income	592.7(357.2)	658.7(482.1)	-1.1, .27
Transportation			0.8, .37
Yes	20(16%)	9(12%)	
No	106(84%)	70(88%)	
Homeless in Past 7 Months			0.1, .83
Yes	24(19%)	16(20%)	
No	102(81%)	63(80%)	
Time since HIV Diagnosis	13.6(7.2)	11.9(6.8)	1.6, .11
Alcohol/Drug use			5.2, .03
Yes	56(45%)	48(61%)	
No	70(55%)	31(39%)	
Depression	9.7(5.9)	12.2(7.4)	-2.6, .01
Cognitive Functioning	7.2(3.1)	7.6(3.2)	-1.0, .34
Attitude Toward Provider	107.5(10.3)	103.8(16.1)	1.8, .07
	Knew CD4 & VL (n = 69)	Did Not Know CD4 & VL (n = 117)	
Age	46.9(7.4)	47.0(7.5)	-.12, .90
Income	749.4(556.4)	545.3(295.0)	3.2, .001
Years of school completed	11.1(2.5)	11.0(1.9)	0.2, .84
Substance Use			3.2, .08
Yes	29(42%)	65(56%)	
No	40(58%)	52(44%)	
Time since HIV diagnosis (Months)	13.6(6.9)	12.3(7.2)	1.2, .22
Time since last VL lab test (Months)	1.14(1.14)	1.5(1.4)	-1.5, .12
Time since last CD4 lab test (Months)	1.1(1.3)	1.5(1.7)	-1.5, .12
Depression	10.8(5.7)	10.2(7.2)	0.5, .61

Characteristic /Measure	Adherent (n=126) n(%), m(sd)	Nonadherent (n=79) n(%), m(sd)	$\chi^2/t, p$
Cognitive Functioning	7.7(3.2)	7.0(3.0)	1.5, .13
Attitude Toward Provider	106.4(11.2)	107.0(13.0)	-.77, .44

Table III

Logistic regressions predicting appointment adherence and HIV knowledge.

Outcome= Appointment Adherence				
Predictor	B(SE)	Wald(df)	p	OR(95% CI)
Knowledge of CD4/VL	1.04(.36)	8.5(1)	.004	2.8(1.4, 5.7)
Time since HIV diagnosis (Months)	.02(.02)	1.2(1)	.27	1.0(.99, 1.1)
Age	.02(.02)	1.1(1)	.30	1.0(.98, 1.1)
Alcohol/Drug use	-.59(.33)	3.1(1)	.08	.56(.29, 1.1)
Depression	-.03(.03)	1.3(1)	.25	.97(.92, 1.0)
Attitude Toward Provider	.01(.02)	.47(1)	.49	1.0(.98, 1.1)
Outcome = Knowledge of CD4/VL				
Predictor	B(SE)	Wald(df)	p	OR(95% CI)
Adherence	.97(.39)	6.3(1)	.01	2.6(1.2, 5.6)
Income	.02(.001)	8.3(1)	.004	1.02(1.0, 1.003)
Substance Use	-.51(.35)	2.1(1)	.15	.60(.30, 1.2)
Time since last VL	-.19(.20)	.84(1)	.36	.83(.56, 1.2)
Time since last CD4	.01(.18)	.01(1)	.98	1.0(.71, 1.4)
Cognitive Functioning	.06(.06)	1.0(1)	.31	1.1(.95, 1.2)

Table IV

Linear regression predicting CD4 count and logistic regression predicting undetectable viral load.

Outcome = CD4 Count				
Predictor	B(95% CI)	t(df)	p	
Gender (Female)	42.7(−35.0, 120.4)	.08(1)	.28	
Drug use	−43.8(−118.0, 31.4)	−1.2(1)	.25	
Adherence	14.4(−65.5, 94.4)	0.4(1)	.72	
Cognitive functioning	14.2(2.0, 26.3)	2.3(1)	.02	
Attitude Toward Provider	3.3(.21, 6.3)	2.1(1)	.04	
Knowledge of CD4/VL	229.2 (152.3, 306.1)	5.9(1)	<.001	
Outcome = Undetectable Viral Load				
Predictor	B(SE)	Wald(df)	p	OR(95% CI)
Gender (Female)	.36(.37)	.94(1)	.33	1.4(.69, 3.0)
Homelessness	−.63(.50)	1.6(1)	.21	.53(.20, 1.4)
Time since HIV dx	.05(.03)	3.8(1)	.05	1.1(1.0, 1.1)
Adherence	.42(.36)	1.3(1)	.25	1.5(.75, 3.1)
Knowledge of CD4/VL	1.6(.36)	19.9(1)	<.001	4.9(2.4, 9.9)