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Examination of the Role of Religious and Psychosocial Factors in HIV Medication Adherence Rates

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Contents

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Abstract

Optimal adherence to antiretroviral therapy (ART) is associated with favorable HIV outcomes, including higher CD4 cell counts, HIV virus suppression and a lower risk of HIV transmission. However, only 25% of people living with HIV/AIDS (PLWH) in the USA are virally suppressed. Sub-optimal adherence (<90–95%) contributes to antiretroviral resistance and worse medical outcomes, including more rapid progression to AIDS and death. Psychosocial factors and religion/spirituality (R/S) have a significant impact on ART adherence, but the findings are mixed. The purpose of this study was to examine religious and psychosocial correlates and predictors of ≥90% ART adherence in PLWH. A cross-sectional study was conducted with a sample of 292 outpatient PLWH in the Southeastern USA. Participants completed computerized surveys. The mean ART adherence percentage was 80.9% and only about half reported ≥90% adherence. There were statistically significant differences in ART adherence rates based on age, depressive symptom status and frequency of religious attendance and prayer. Praying at least once a day was significantly associated with ≥90% ART adherence (OR = 2.26, 95% CI [1.06–4.79], $p < 0.05$). Social support satisfaction was also significantly associated with ART adherence (OR = 1.52, 95% CI [1.11–2.08], $p < 0.05$) and energy/fatigue/vitality (OR = 1.03, 95% CI [1.00–1.05], $p < 0.05$).

Introduction

Optimal adherence to antiretroviral therapy (ART) is critical to achieving and sustaining favorable HIV outcomes and HIV prevention. Lower or undetectable viral load resulting from optimal ART adherence is linked to a lower risk of HIV transmission (Eaton et al. 2012; Nguyen et al. 2011). However, only 25% of people living with HIV/AIDS (PLWH) in the USA are virally suppressed (Centers for Disease Control and Prevention 2012). Insufficient or sub-optimal adherence (<90–95%) contributes to antiretroviral resistance and worse medical outcomes, including more rapid progression to AIDS and death (Balbinet

al. [1999]; Bangsberg et al. [2001]; Gardner et al. [2008]; Kremer et al. [2009]; Mannheimer et al. [2008]; Montaner et al. [1998]; Paterson et al. [2000]; Stansell et al. [2001]). However, improvements of even 5–10% in adherence may lead to better biological outcomes (Bangsberg et al. [2001]; Liu et al. [2006]; Paterson et al. [2000]).

Although there has been major progress in HIV treatment and control, the absence of a cure and continued spread of the virus make it a difficult chronic disease to treat. However, research indicates that psychosocial factors, including coping, depression, social support, quality of life (QOL) factors—particularly religion/spirituality (R/S)—have a significant impact on an HIV patient's medical decision-making and treatment adherence. In previous studies, R/S has been significantly associated with better ART adherence (Dalmida [2006]; Dalmida et al. [2009]; Konkle-Parker et al. [2008]). However, some reports highlight only the negative effect of R/S beliefs on medication adherence (Finocchario-Kessler et al. [2011]; Wanyama et al. [2007]). R/S can also dually serve as a barrier and facilitator for medication adherence among PLWH (Kisenyi et al. [2013]; Kremer et al. [2006]; Tumwine et al. [2012]; Vyas et al. [2014]). These mixed findings regarding the role of R/S call for more research to better understand the relationship of religious and psychosocial factors in adherence to ART. The purpose of this study was to examine the role of religious and psychosocial factors in ART adherence rates in PLWH and to identify predictors of greater than 90% ART adherence.

Background

Psychosocial Factors and Adherence

Decisions to adhere or not adhere to ART depend not only on patient medical characteristics, but also on psychosocial factors, including coping, mental health, quality of life (QOL), individual beliefs about ART, complementary/alternative medicine and spirituality (Bader et al. [2006]; Kremer et al. [2006]; Lyimo et al. [2014]). Coping, mental health (*i.e.,* depression) and social support are among the most commonly cited psychosocial predictors of ART adherence in PLWH (Bader et al. [2006]; Dalmida et al. [2009]; Finocchario-Kessler et al. [2011]; Fogarty et al. [2002]). Depression in PLWH adversely affects adherence to ART (Dalmida et al. [2009]; Gonzalez et al. [2011a], [b]; Harding et al. [2010]; Safren et al. [1999], [2001]; Sherr et al. [2011]).

A classic review of HIV medication adherence studies (Fogarty et al. [2002]) found that: (1) social and psychological factors reflecting emotional adjustment to HIV/AIDS were related to better adherence; (2) gender was not consistently related to adherence, no evidence of effects from CD4 count or HIV viral load; and (3) younger age, minority status and a history of substance abuse were often related to non-adherence (mixed effects for race/ethnicity and age). In one study of 100 PLWH (Bader et al. [2006]), poorer QOL and poorer physical functioning were associated with ART discontinuation and working and maintaining a regular daily routine were associated with better adherence. In a study of 158 PLWH (Lyimo et al. [2014]), adherence was primarily predicted by negative rather than positive coping mechanisms.

Religion/Spirituality and Health in PLWH

Religion is an important part of daily life for the majority of PLWH (85%), who often rely on R/S means when facing problems/difficulties (72%) and self-identify as "religious" (86%) or "spiritual" (95%) (Lorenz et al. 2005). Of the many psychosocial factors, R/S has been found to be significant sources of stress reduction, positive coping skills and existential well-being among HIV patients (Dalmida et al. 2011; Koenig et al. 1988). In addition to being significant factors that enhance positive coping, medication adherence and immune function, R/S is also important in the daily lives of PLWH (Dalmida et al. 2009; Ironson et al. 2006; Kaldjian et al. 1998; Koenig 1998; Tarakeshwar et al. 2006).

Religion/Spirituality and Medical Treatment and Adherence

R/S also plays a key role in patients' medical decisions and medical care (Bader et al. 2006; Kaldjian et al. 1998; Parsons et al. 2006). In a study of 100 PLWH (Bader et al. 2006), "turning to spirituality" was significantly higher in PLWH who were treatment naïve than in those who were treatment experienced (F = 7.70 p = 0.007), in PLWH seeking or planning to seek mental health care than in those who were not (F = 8.05 p = 0.006), and in women than in men (F = 13.65 p < 0.001). Among 306 PLWH (Parsons et al. 2006), being in medical care was significantly related to a stronger belief that HIV is not a sin in the eyes of God (p = 0.001). A longer lag since the last appointment kept was related to less frequent church attendance and a poorer relationship with God (Parsons et al. 2006). The gap between diagnosis and the start of medical care for HIV was related (p = 0.007) to a poorer relationship with God, more education and a stronger belief that HIV is a punishment from God (Parsons et al. 2006).

The efficacy of HIV treatment is directly reliant on adherence. Patients' decision to take or not take their medication can be directly influenced by R/S (Bosworth 2006; Koenig and Cohen 2002; Kremer et al. 2006). Prayer is frequently reported as a facilitator to medication adherence, and in one study its influence was similar to or above the doctor's recommendation to adhere (Konkle-Parker et al. 2008). Overall, religion and various dimensions of R/S are significantly associated with ART adherence among PLWH (Dalmida et al. 2009; Finocchario-Kessler et al. 2011; Kisenyi et al. 2013; Konkle-Parker et al. 2008; Kremer et al. 2006, 2009; Vyas et al. 2014). However, R/S has been identified as—both—a barrier to and facilitator for medication adherence (Kisenyi et al. 2013; Tumwine et al. 2012; Vyas et al. 2014).

In a study of HIV, men and women (Kremer et al. 2009) believing that health was controlled by God or a higher power were 4.75 times more likely to refuse ART compared to those not sharing this belief. On the contrary, those who believed that spirituality helped them cope with the side effects of medication reported better adherence (Kremer et al. 2009). In a longitudinal study of 350 HIV-infected adults (Vyas et al. 2014), higher annual household income (p = 0.004) and religious affiliation (p = 0.031) were predictive of greater medication adherence. Participants who said that their beliefs gave meaning to their lives, made them feel they had a connection with a higher being, were influential during their recovery, and helped them feel connected to humanity were more likely to be ≥90% adherent (p < 0.015). Conversely, participants who believed God created all things in the universe; that God will not turn his back on them; and those who regularly attended religious services, participated in religious

rituals, and prayed and meditated to get in touch with God were less likely to be ≥90% adherent (*p* = 0.025). Similarly, in a longitudinal study of 204 PLWH (Finocchario-Kessler et al. 2011), the belief that God is in control of one's health was negatively associated with ≥90% ART adherence. One prospective observational study (Wanyama et al. 2007) of 558 PLWH found that 1.2% of patients discontinued ART because of a belief in spiritual healing and subsequently died. Studies have also revealed both positive and negative roles of religious leaders and spiritual healers as promoters or discouragers of ART adherence (Maman et al. 2009; Roura et al. 2010; Thielman et al. 2014; Tumwine et al. 2012).

The purpose of this study was to examine the role of religious and psychosocial factors in ART adherence rates in PLWH and correlates and predictors of 90% or better ART adherence. Based on previous studies and findings, we expected that PLWH in the Southeastern USA with higher self-reported R/S and more frequent religious behavior/practices might have better ART adherence.

Methods

Participants and Procedures

A cross-sectional design was used with a non-probability sample of 292 PLWH. The sample was recruited over a 6-month period from an outpatient infectious disease clinic at a large university-affiliated health center and two AIDS service organizations in the Southeastern USA. Approval was obtained from the university's Institutional Review Board and recruitment sites prior to beginning. Subjects were recruited using study fliers. Interested participants provided written informed consent after a complete description of the study to the subjects by study staff. Eligibility criteria required participants to be HIV-positive, 18 years of age or older, able to speak and understand English and mentally competent as determined by a screening assessment with the mini mental status examination (scores ≥ 27). The MMSE was administered by a trained research interviewer, and all other questionnaires were administered using the Audio Computer-Assisted Self Interview (ACASI) on laptop computers. Instrument reliabilities and scores are presented in Table 1. Each participant received $15 for participating in the study.

Table 1 . Sample characteristics

Variable	*n*	%
Race/ethnicity		
Black	263	90.4
White	18	6.2
Age		
<50 years	206	70.5
≥50 years	85	29.1
Birth sex		
Female	163	56.2
Male	127	43.8
Educational level		
Less than high school	40	12.1

Variable	n	%
High school or G.E.D.	154	53.1
College or technical school	85	29.3
Grad or professional school	11	3.8
Marital status		
Married	35	12.0
Divorced/separated/widowed	106	36.4
Single/never married	106	36.4
Committed relationship	44	15.1
Employment status		
Part-time	23	8.0
Unemployed or on disability	256	88.6
Annual income		
<$11,000	200	73.0
≥$11,000	74	25.3
Sexual orientation		
Straight or heterosexual	167	58.2
Gay or homosexual	54	18.8
Bisexual	26	9.1
Religious service attendance		
Never or hardly (1–2 times per year)	65	24.1
1–2 times a month or so	106	33.2
More than once a week	124	42.8
Prayer		
Never	10	3.4
Less than daily	88	30.3
Daily or more often	192	66.2
Identification as religious person		
Very	80	27.7
Moderately	108	37.4
Slightly	56	19.4
Not at all	7	2.4
Religious affiliation		
Christian/Catholic/Adventist/Methodist	83	28.5
Baptist	139	48.9
Jewish, Muslim or Buddhist	13	4.6
Belief in God, no affiliation	24	8.5
Atheist or no belief in God	4	1.4
ART medication adherence		
<90% adherence	136	46.6
≥90% adherence	106	36.3

Measures

Demographic

Socio-demographic information was collected using a 20-item form developed for this study, which asked about age, race/ethnicity, gender, year of HIV diagnosis, approximate annual and monthly income, highest level of education completed and employment/occupational status.

Religion/Spirituality

A modified version of the Brief Multidimensional Measure of Religiousness/Spirituality (BMMRS) (Fetzer Institute 1999) assessed religious involvement or behavior and self-rated spirituality and religiousness. The BMMRS contains items surveying a variety of dimensions of R/S, including daily spiritual experiences, meaning, values/beliefs, forgiveness, private religious practices, religious and spiritual coping, religious support, R/S history, commitment, organizational religiousness, religious preference and overall self-ranking (as a religious or spiritual person). Thirty-three of the original 38 items were administered. For the current study, only self-rated religiousness, religious affiliation and religious behavior (religious attendance and prayer) were analyzed, based on findings from previous research. Items about forgiveness, financial contribution to religious organizations and volunteer hours with religious organization(s) were omitted. No reliabilities were calculated for individual items used.

Religious Coping

Religious coping was assessed using brief religious coping scale (RCOPE) (Pargament et al. 1998), which has 14 items that measure positive religious coping and negative religious coping, with 7 items each (Pargament et al. 1998). Participants rate their use of individual coping strategies when dealing with difficult life situations using a 4-point rating scale from (1) "not at all" to (4) "a great deal." Positive religious coping items include strategies such as seeking spiritual support and benevolent reappraisals. The negative religious coping scale contains items related to spiritual struggle such as, "I questioned God's love for me" and "I wondered whether God had abandoned me." Responses are summed to create subscale scores, with higher scores representing more frequent use of negative or positive religious coping.

Perceived Stress

Stress was assessed using the Perceived Stress Scale (PSS) (Cohen et al. 1983), which consists of 10 items designed to tap the degree to which respondents found their lives unpredictable, uncontrollable and overloaded. This scale has been reliably used in populations of PLWH.

Depressive Symptoms

The Center for Epidemiological Studies Depression scale (CES-D) was used to assess symptoms of depression over the previous 7 days (Radloff and Locke 1986). The scale consists of 20 items, each of

which is scored on a 4-point frequency scale from (0) "rarely" to (3) "most or all" of the time. Radloff (1977) established that CES-D scores of 16 or above indicated a significant level of depression. The CES-D scale reliability has been established and used successfully in PLWH (Miles et al. 1997; Vedhara et al. 1999).

Social Support

Satisfaction with social support was assessed using the Social Support Questionnaire–6 (SSQ-6) (Sarason et al. 1987), a six-item, abbreviated version of the 27-item Social Support Questionnaire. The items assess the number of available people that the individual feels he or she can turn to and the individual's degree of satisfaction with the perceived support available on a 6-point Likert scale, from 1 for "very dissatisfied" to 6 for "very satisfied." The SSQ-6 has high internal reliability, with alphas from 0.90 to 0.93. Cronbach's alpha in this study was 0.94.

HIV Medication Adherence

The Antiretroviral General Adherence Survey (AGAS) (Holstad et al. 2006; Holstad et al. 2010) was used to measure adherence to HIV medications. The AGAS is comprised of 5 items that focus on the ease and ability of taking HIV medications as prescribed. Responses are reported on a 6-point Likert scale with responses ranging from 1 (*none of the time*) to 6 (*all of the time*). Four items focus on the perceived ability to take ART as the healthcare provider recommended, and one item asks participants to rate how often, in general, they were able to take the medications as recommended in the previous 30 days. Total scores range from 5 to 30, with higher scores indicating higher levels of adherence. Raw scores can be described as a proportion by dividing the score by the total possible (*i.e.,* a raw score of 27 translates into 90% adherence) (Holstad et al. 2010). The proportion score can be used to assess the overall level of adherence in the 30-day period. We also used a dummy-coded adherence score for some analyses: 0 = <90% adherence or AGAS score of <27; 1 = ≥90% adherence (or AGAS score of ≥27).

Quality of Life

Health-related quality of life (HRQOL) was measured using the RAND-36-Item Health Survey 1.0 (Hays et al. 1993), which assesses HRQOL in eight dimensions and includes physical functioning, role limitations due to physical health, role limitations due to emotional or personal problems, vitality (energy/fatigue), general health, emotional well-being, social functioning and bodily pain experienced during the previous 4 weeks (Hays et al. 1993). Subscale response sets vary between scales. For example, for the physical functioning scale, responses occur on a 3-point scale that include (1) "yes, limited a lot," (2) "yes, limited a little," or (3) "no, not limited at all" in response to a list of daily activities such as walking, bending, vacuuming or engaging in sports. The emotional well-being scale responses are on a 6-point scale ranging from, (1) "all of the time" to (6) "none of the time." Items are recoded per a scoring key provided by RAND researchers where a high score denotes a more favorable state of health with a range of 0–100 (from lowest to highest).

Statistical Analyses

Data were analyzed using the IBM® SPSS 22.0 statistical software package. Descriptive statistics were used to describe the sample. Histograms, box-plots and Shapiro–Wilk normality test were used to examine normality of the data. Only age, years living with HIV and the energy/fatigue HRQOL subscale were normally distributed; therefore, Spearman's rho bivariate correlations were used to examine the bivariate associations between adherence and covariates. 5% significance levels were used unless otherwise indicated. For some analyses, we dichotomized age (<50 and ≥50 years old) based on widely accepted national guidelines from the Centers for Disease Control and Prevention (Castro et al. 1993), which consider HIV-infected individuals aged 50 years and older as older adults. Chi-square tests were used to examine associations between categorical variables and percent ART adherence. One-way analysis of variance (ANOVA) was used to examine differences in mean adherence percentages by socio-demographic, depressive symptom status and religious factors. The F-statistic and p value were used to indicate significant differences in the reported means.

Logistic regression analyses examined the ability of religious coping scores to distinguish between participants that adhered to ART ≥90% versus those who adhered to ART <90%. The dummy coded, binary ART adherence variable was the dependent variable. A 3-block stepwise logistic regression model was conducted using the backward method. Significant socio-demographic covariates were entered together in the first step, significant psychosocial and physical variables in the second step, and significant religious variables were entered in the last step. Collinearity statistics, including a tolerance of less than 0.20 or 0.10 and/or a variance inflation factor (VIF) of 5 or 10 and above, were used to indicate a multicollinearity problem (O'brien 2007). None of the independent variables included in the regression model indicated multicollinearity. For each model, the omnibus tests (Chi-square statistic and p value < 0.005), percentage of correct estimation and Nagelkerke R-square statistic for each block provided an evaluation of the overall significance of the models and various statistics, including beta coefficients, standard error of the betas, Wald Chi-square, odds ratio (exponentiated beta) and confidence interval, provided evaluation of the significance (p value < 0.05) of each independent variable. The Hosmer and Lemeshow goodness-of-fit test provided an estimate of how well the model fit the data.

Results

Sample Characteristics

Sample characteristics are presented in Table 1. The final sample included 292 predominantly African-American PLWH who resided in the Southeastern USA. Blacks made up 90% of the sample. More than half of the participants were female (56%), had attained a high school diploma or GED (53%) and self-identified as heterosexual (58%). Majority (73%) of the participants were either divorced/separated/widowed (36%) or single/never married (36%). The sample was largely economically disadvantaged and impoverished. The majority of participants were unemployed or on disability (89%) and earned less than $11,000 annually (73%). More than three quarters of the participants attended religious services fairly regularly with almost half attending more than once per week (42.8%) and one-third reported attending at least one or twice per month (33%). Most of them

prayed daily or more often (66%) and a small proportion (3.4%) reported never praying. Most identified themselves as moderately or very religious (65%) and 2% were not religious at all. The sample was predominantly Christian, from a range of denominations—the largest was Baptist (49%). Almost half of participants reported less than 90% proportion of taking medications as prescribed within the previous 30 days (47%). The average adherence rate was 81% (SD = .19; not shown in table).

Bivariate Correlation Results: Correlates of 90% or Better ART Adherence
The descriptive characteristics of the psychosocial, religious and demographic factors assessed and their correlations with the dichotomous ART adherence variable (0 = <90%, 1 = ≥90% adherence) are presented in Table 2. Average age of participants was 45.1 years (SD 7.75), and they had been living with HIV for 10.8 years (SD 6.96) on average. Prayer (daily or more often), religious attendance (weekly or more often) and higher social support satisfaction, physical role limitations, emotional role limitations, physical function, energy/vitality, emotional well-being and social functioning scores were significantly correlated with ≥90% adherence. Conversely, higher depressive symptoms, perceived stress and negative religious coping scores were significantly correlated with <90% adherence.

Table 2. Instrument scores and correlates of greater than 90% ART adherence

	Descriptive						Correlates of ≥90% ART Medication adherence[a]	
	n	Mean	SD	Min	Max	Alpha	r	pvalue
HIV medication adherence	239	24.3	5.87	5	30	0.78	—	—
Depressive symptoms	275	19.3	12.84	0	57	0.91	−.32	.000
Positive religious coping	291	16.6	5.06	0	21	0.92	0.12	.061
Negative religious coping	291	4.9	5.34	0	21	0.86	−.29	.000
Social support satisfaction	288	30.5	8.15	5	36	0.91	0.29	.000
Physical role limitations	289	47.9	41.91	0	100	0.86	0.13	.048
Physical function	290	58.7	28.59	0	100	0.9	0.16	.013
Emotional role limitations	289	52.4	44.2	0	100	0.86	0.24	.000
Energy/vitality	289	53.1	21.6	0	100	0.68	0.26	.000
Emotional well-being	289	62.4	23.83	8	100	0.82	0.36	.000
Social functioning	289	67.0	29.38	0	100	0.55	0.28	.000
Pain	289	60.4	29.89	0	100	0.85	0.12	.059
Perceived stress	290	17.9	7.65	0	38	0.86	−.35	.000
Years diagnosed with HIV	281	10.8	6.96	0	35	—	−.08	.249
Age (continuous)	291	45.1	7.75	19	67	—	.03	.676
Age (0 = <50, 1 = ≥50)	291	—	—	—	—	—	.10	.112
Gender[b]	290	—	—	—	—	—	−.06	.396
Race[c]	281	—	—	—	—	—	.01	.928
Income[d]	274	—	—	—	—	—	.09	.159
Marital status[e]	291	—	—	—	—	—	.07	.317
Education[f]	290	—	—	—	—	—	.10	.132
Sexual orientation[g]	247	—	—	—	—	—	−.06	.380
Religious affiliation[h]	263	—	—	—	—	—	−.12	.076

	Descriptive						Correlates of ≥90% ART Medication adherence[a]	
	n	Mean	SD	Min	Max	Alpha	r	pvalue
Prayer[i]	242	–	–	–	–	–	.18	.005
Religious attendance[j]	241	–	–	–	–	–	.16	.001

Bold values indicate statistical significance ($p < 0.05$)

[a]ART adherence proportion within previous 30 days: 0 = <90%, 1 = ≥90%

[b]Gender: 0 = female, 1 = male

[c]Race: 0 = non-Black, 1 = Black

[d]Annual income: 0 = < $21,000, 1 = ≥ 21,000

[e]Marital status: 0 = *separated, widowed, divorced, never married,* 1 = *married* or *in a committed relationship*

[f]Education: 0 = *less than high school*, 1 = high school or greater

[g]Sexual orientation: 0 = *heterosexual* or *straight*, 1 = *gay or bisexual*

[h]Religious affiliation: 0 = *atheist/no belief in God*, 1 = *Christian,* 2 = other

[i]Prayer: 0 = less than daily, 1 = daily or several times daily

[j]Religious attendance: 0 = less than weekly, 1 = weekly or more

Results of Chi-Square Tests of Association

The results of the Chi-square test for the associations between ART adherence and the various psychosocial, religious and demographic factors assessed are presented in Table 3. All the variables assessed were statistically significant at $p < 0.05$, except for age. Compared to PLWH who reported <90% adherence, a higher proportion of PLWH who reported ≥90% adherence, reported no symptoms of depression, prayed daily or more often, attended religious services weekly or more often, reported having a life-changing religious experience and experienced a significant gain in their faith and no loss in faith. Conversely, among those who reported depressive symptoms ($n = 137$), 69% were <90% adherent vs. 31% who reported ≥90% adherence (X^2 (1) = 18.6, $p < .01$), indicating that those who PLWH who were depressed were more likely to less adherent. Similarly, among those who prayed less than daily ($n = 83$), 69% were non-adherent versus 31% who were adherent (X^2 (1) = 8.0, $p = .01$). PLWH who attended religious services less than weekly tended to be significantly more likely to report <90% adherence (64%) than ≥90% adherence (37%).

Table 3. Association between ART adherence and psychosocial, religious and demographic factors

Variables	n	<90% adherence 136 n (%)	≥90% adherence 106 n (%)	Chi-square (df)	pvalue
Age				5.72 (1)	.111
<50 years	166	99 (59.6)	67 (40.4)		
≥50 years	76	37 (48.7)	39 (51.3)		

Variables	n	<90% adherence	≥90% adherence	Chi-square (df)	*p*value
		136	106		
		n (%)	*n* (%)		
Depressive symptoms				18.55 (1)	.000
Non-depressed	103	42 (40.8)	61 (59.2)		
Depressed	137	94 (68.6)	43 (31.4)		
Prayer				7.99 (1)	.005
<daily	83	57 (68.7)	26 (31.3)		
≥daily	159	79 (49.7)	80 (52.9)		
Religious attendance				6.46 (1)	.011
<weekly	137	87 (63.5)	50 (36.5)		
≥weekly	104	49 (47.1)	55 (52.9)		
Life-changing religious experience				4.05 (1)	.044
No	57	39 (68.4)	18 (31.6)		
Yes	182	97 (53.3)	85 (46.7)		
Significant gain in faith				8.91 (1)	.003
No	46	35 (76.1)	11 (23.9)		
Yes	193	100 (51.8)	93 (48.2)		
Significant loss in faith				4.19 (1)	.041
No	160	83 (51.9)	77 (48.1)		
Yes	79	52 (65.8)	27 (34.2)		

Bold values indicate statistical significance ($p < 0.05$)

Mean Differences in ART Adherence Rates

ANOVA results (Table 4) showed that average ART adherence rates differed significantly between participants based on age, depressive symptoms status, religious attendance and prayer. That is, there

were significantly higher mean ART adherence percentages among PLWH who: (a) were ≥50 years compared to <50 years (M = 0.85 vs 0.79); (b) were not depressed compared to those depressed (M = 0.87 vs. 0.76); (c) attended religious services at least once a week compared to those who attended less than once a week (M = 0.84 vs. 0.78); and (d) who prayed at least once a day compared to less than once a day (M = 0.83 vs. 0.77).

Table 4. Mean differences in ART adherence rates by age, depressive symptoms and religious factors

Variable	N	%	% ART adherence			
			Mean	SD	F	Sig.
Age					5.861	.016
<50 years	206	70.5	.79	.20		
≥50 years	85	29.1	.85	.17		
Depressive symptoms					17.61	.000
Non-depressed	164	56.2	.87	.17		
Depressed	125	42.8	.76	.20		
Religious attendance					5.901	.016
<weekly	166	56.8	.78	.21		
≥weekly	124	42.5	.84	.18		
Prayer					5.791	.017
<daily	98	33.6	.77	.20		
≥daily	192	65.8	.83	.19		

Bold values indicate statistical significance ($p < 0.05$)

Logistic Regression Results: Predictors of 90% or Better ART Adherence
The results of the 3-block stepwise logistic regression analysis predicting 90% or greater ART adherence from socio-demographic, psychosocial and physical variables in addition to religious variables are presented in Table 5. Assessment of goodness of fit using the Hosmer–Lemeshow (H–L) test produced insignificant results ($p > .05$) in all the three models, indicating that the models fit the data well. All overall model blocks, except model/block 1, were statistically significant as indicated by overall Chi-square statistics for each block that were significant at 1% level. The final model (block 3) predicted 63.6% of the responses correctly and the Nagelkerke R^2 was .309, indicating that the predictors accounted for approximately 30.9% of the variance in adherence.

Table 5. Summary of logistic regression analysis for variables predicting ≥90% ART medication adherence rates

Independent variable	B	SE (B)	χ^2	df	Sig.	Odds ratio e^{β}	95% CI for Exp (B) Lower	Upper
Block 1 (demographic factors)			3.281	2	.194			
Age[a]	.597	.347	2.964	1	.085	1.817	.921	3.586
Years diagnosed with HIV	−.035	.024	2.131	1	.144	.965	.920	1.012
Overall χ^2			3.281	2	.194			
Nagelkerke R^2 = .020								
% correct (≥90% adherence) = 31.3								
Goodness-of-fit test: Hosmer and Lemeshow			15.472	8	.051			
Block 2 (psychosocial factors)			46.410	9	.000			
Social support satisfaction	.419	.160	6.875	1	.009	1.521	1.112	2.081
Physical function	−.003	.008	.143	1	.706	.997	.981	1.013
Role limitations due to physical problems	−.001	.006	.016	1	.899	.999	.988	1.010
Role limitations due to emotional problems	.001	.005	.050	1	.824	1.001	.991	1.012
Energy/fatigue/vitality	.027	.012	4.889	1	.027	1.028	1.003	1.053
Social functioning	.000	.008	.000	1	.998	1.000	.984	1.017
Pain	−.006	.007	.690	1	.406	.994	.980	1.008
Perceived stress	−.061	.036	2.904	1	.088	.941	.877	1.009
Depression	.015	.022	.424	1	.515	1.015	.971	1.060
Overall χ^2			49.691	11	.000			
Nagelkerke R^2 = .272								

Independent variable	B	SE (B)	χ^2	df	Sig.	Odds ratio e^β	95% CI for Exp (B) Lower	Upper
% correct (≥90% adherence) = 65.7								
Goodness-of-fit test: Hosmer and Lemeshow			8.270	8	.408			
Block 3 (religious factors)			7.907	4	.095			
Negative religious coping	−.035	.036	.950	1	.330	.966	.900	1.036
Prayer[b]	.813	.385	4.471	1	.034	2.255	1.061	4.793
Positive religious coping	−.058	.039	2.222	1	.136	.943	.873	1.019
Religious attendance[c]	.417	.367	1.289	1	.256	1.517	.739	3.117
% correct (≥90% adherence) = 63.6								
Overall χ^2			57.597	15	.000			
Nagelkerke R^2 = .309								
Goodness-of-fit test: Hosmer and Lemeshow			5.992	8	.648			

Bold values indicate statistical significance ($p < 0.05$)

e^B or Exp (B) = exponentiated B, equivalent to the odds ratio. B, SE(B), e^β are from the final block in the full model

[a]Age group: 0 = < 50 years, 1 ≥ 50 years
[b]Prayer: 0 = less than daily, 1 = daily or several times daily
[c]Religious attendance: 0 = less than weekly, 1 = weekly or more

After controlling for all the variables, prayer was the only religious variable that significantly predicted adherence. Whereby, compared to those who prayed less than daily, PLWH who prayed at least once daily were 2.26 times more likely to adhere to ART medications ≥90% of the time (95% CI [1.06–4.79], $p < 0.05$). Additionally, higher social support satisfaction (OR = 1.52, 95% CI [1.11–2.08], $p < 0.05$) and energy/fatigue/vitality (OR = 1.03, 95% CI [1.00–1.05], $p < 0.05$) scores were significantly associated with ≥90% ART adherence.

Discussion

This study was designed to examine the ability of religious coping scores to predict ART medication adherence, taking into consideration select demographic and psychosocial factors in a sample predominantly composed of Black, economically disadvantaged and impoverished PLWH. Results showed that more than three quarters of the participants attended religious services fairly regularly. The mean ART adherence rate was 81%, with almost half of the participants reporting less than 90% adherence. These rates are consistent with previous studies showing moderate to low ART adherence among HIV-infected adults (Fogarty et al. 2002; Hinkin et al. 2004). ANOVA analysis indicated that there were statistically significant differences in mean ART adherence rates based on age, depressive symptom status, religious attendance and prayer. These findings are similar to previous studies that found that average ART adherence scores differed by age such that PLWH who are 50 years or older report better adherence (Fogarty et al. 2002; Hinkin et al. 2004). Additionally, the results regarding differences in ART adherence rates based on depressive symptom status are consistent with the findings from previous studies regarding the deleterious effects of depressive symptoms on ART adherence in PLWH (Dalmida et al. 2009; Gonzalez et al. 2011a, b; Harding et al. 2010; Safren et al. 1999, 2001; Sherr et al. 2011).

No known studies have compared ART adherence rates or percentages based on frequency of religious attendance or prayer. Nonetheless, previous studies have also identified prayer as a facilitator to medication adherence (Konkle-Parker et al. 2008). However, a study by Vyas et al. 2014 found that those who regularly attended religious services and "prayed and meditated to get in touch with God" were less likely to be ≥90% adherent. Our study found the exact opposite, supported by Chi-square tests and partially supported by logistic regression.

Logistic regression analyses showed that praying at least once a day was significantly associated with ≥90% ART adherence (2.2 times more likely). Greater satisfaction with social support was also significantly associated with ≥90% adherence such that PLWH who were most satisfied with their social support were 1.5 times more likely to report adhering to their ART 90% or better within the previous 30 days. Comprehensive reviews have also identified the positive role of social support in ART adherence (Fogarty et al. 2002), and previous studies have identified positive associations between social support satisfaction and ART adherence scores (Dalmida et al. 2009). This is one of the first studies to identify the role of vitality in ART adherence in PLWH. Results showed that PLWH in the sample who reported greater vitality were one time more likely to adhere to their ART at least 90% of the time. This is also one of the first known studies to identify the role of life-changing religious experiences and gains or losses in faith in ART adherence among PLWH. Unlike some previous studies (Vyas et al. 2014), this study did not identify income or religious affiliation as significant correlates or predictors of ART adherence.

Some of this study's notable limitations include the cross-sectional design which prevents the ability to make causal inferences and the limited generalizability to similar PLWH. Additionally, the study was conducted in the Southeastern region of the USA—the "Bible Belt" and majority of the participants were African-American and impoverished; therefore, findings may only be generalizable to similar

PLWH and those in this region or similar. This study did not examine the relationship between ART adherence and R/S factors related to meaning and purpose in life, which have previously been associated with ≥90% ART adherence (Vyas et al. 2014).

In spite of the limitations and mixed findings regarding the dual role of religious and spiritual factors in ART adherence, this study: (a) confirms findings from previous studies, (b) challenges/confronts findings from other studies and (c) offers new findings regarding the role of vitality, life-changing religious experiences and gains or losses in faith in better understanding ART adherence. Some of the differences in findings may be due to how variables such as "regular" religious attendance or frequency of prayer were defined or coded and whether meditation was combined into one variable along with prayer. Additionally, it is important to note that this study included a fairly homogenous sample of predominantly African-American, impoverish, PLWH in the Southeastern USA. Some of the previous studies including Vyas et al. (2015) included samples of PLWH on the West Coast USA (California), which may have different R/S beliefs and experiences from the "Bible Belt" region of the USA. It is also important to note that religious beliefs, interpretations, experiences and behaviors are not identical, even within religious traditions, and do not form a coherent system that permeate all aspects of people's lives (Chaves 2010). These incongruences may affect individuals' general and health-related decision-making behavior and may help explain some of the variations in findings between samples and studies.

Conclusions

This study showed that about half of PLWH still struggle to achieve optimal ART adherence and are therefore in need of support. ART adherence rates vary among PLWH and may be based on age, depressive symptom status and religious behavior, including frequency of religious attendance and prayer. Additionally, prayer, energy/vitality and social support are significant predictors of ART adherence. These factors should, therefore, be assessed and considered in the treatment plan as healthcare providers collaborate with patients and other members of the care team, including mental health providers, social workers and chaplains or pastoral counselors.

Notes

Acknowledgement

Compliance with Ethical Standards

Conflict of interest

The authors declare that there are no conflicts of interest.

Ethical Approval

All procedures performed in this study were in accordance with the ethical standards of the University and University Medical Center Institutional Research Boards.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

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