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Low medication adherence associated with low intrinsic motivation: an observational study in rural Georgia HIV clinics

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Bachelor of Arts
University of Mississippi
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An abstract of
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Abstract

Low medication adherence associated with low intrinsic motivation: an observational study in rural Georgia HIV clinics

By Marion Rice

Background: Southern states have the highest prevalence of HIV in both urban and rural areas. Although geographic isolation, underfunded health and social support programs, high levels of poverty, and inadequate access to healthcare services are barriers to HIV treatment adherence in the rural South, individual-level factors challenge adherence as well. This study addressed how individual motivation among HIV-infected individuals living in the South affects antiretroviral treatment (ART) adherence, as new technologies may provide opportunities to access specific interventions that can improve motivation.

Objective: This cross-sectional study examined the relationship between sociodemographic and behavioral measures and baseline ART adherence (ART) among HIV-infected individuals living in rural Georgia and enrolled in the Music for Health Project.

Methods: We created a logistic regression model to determine which predictors are associated with participants who recently changed their ART regimen (non-adherent) versus those who were treatment naïve and newly starting an ART regimen (both adherent and non-adherent).

Results: Of 106 participants, 45% were enrolled as "regimen change" and considered less adherent. These participants reported lower ART adherence in the last 30 days than participants newly beginning ART (mean score 33.11 vs 30.74, p-value 0.0242). Most study participants were African American (75.5%), male (67%), unemployed (31.1%), and identified as homosexual or bisexual (60.4%). Regimen change participants were 8.5 years older (p value <0.0001), had attained higher levels of education (47.92% vs 19.30%, p value 0.0050), and had lived with HIV for 8.7 years longer than treatment naive participants (p-value <0.0001). Fewer treatment naive participants lived alone (5.17% vs 30.00%, p-value 0.0046). In multivariate logistic regression analysis adjusted for living alone, high external motivation (aOR: 1.89, 95% CI: 0.75, 4.78) was associated with ART non adherence, while internal motivation was inversely related to adherence (aOR: 0.86, 95% CI: 0.34, 2.21), although these associations were not statistically significant.

Conclusion: ART adherence may be influenced by internal and external motivation, and interventions to improve adherence should take into account ways to increase internal motivation in persons on ART.

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Introduction

Antiretroviral therapy (ART), using combinations of antiretroviral drugs to achieve and maintain viral suppression of HIV, improves health and prolongs life for those infected with HIV as well as prevents transmission of HIV (1, 2). Viral suppression requires high levels of consistent ART adherence, which leads to good clinical outcomes, reduced risk of drug resistance, and decreased HIV transmission (2-5). Receiving a prescription of ART is a crucial step in the HIV Care Continuum (6). While ART access is critical for HIV treatment, individual factors such as motivation to take ART medication must follow for successful ART treatment and realizing the health benefits for HIV-infected persons everywhere.

States in the Southeastern United States have the highest prevalence of HIV (7). In 2014 Georgia reported the 5th highest prevalence of HIV diagnoses, with high prevalence of HIV in both urban and rural regions of the state (7). Rural regions are largely medically underserved, and under-funded health and social services programs, high levels of poverty, geographic isolation, and poor health insurance coverage experienced by rural populations adversely affect the health of HIV-infected individuals (8, 9). Given these challenges increasing motivation for ART adherence in rural HIV-infected individuals is integral to better health outcomes.

The information-motivation-behavioral skills (IMB) model proposes that ART adherence related information, motivation, and behavior skills are central for ART adherence. ART adherence motivation includes two types of motivation. Personal, or internal, motivation

rises from an individual's beliefs about the outcomes of ART adherence with positive evaluation of outcomes associated with ART adherence. Social motivation for ART adherence is derived from an individual's perception of social support and his or her desire to comply with external pressures. Individuals with knowledge of their illness and treatment, motivation to adhere, and skills to act will be more likely to adhere to ART medication over time and experience health benefits. Conversely, individuals lacking knowledge of their illness and treatment, motivation to adhere, and skills to act may not be able to adhere to ART consistently, resulting in adverse health outcomes (10).

The IMB Theory provided an appropriate framework to explain ART adherence in a sample of HIV-infected individuals in the deep South. Participants who were better informed who perceived social support and fewer negative outcomes from adherence reported higher levels of ART adherence (11). Studies have reported positive associations between medication adherence and internal or personal motivation (12, 13). Interventions addressing motivation have successfully demonstrated improved ART adherence among participants (14, 15). Figure 1 illustrates this current study in the framework of IMB Theory.

Factors associated with ART adherence range from broad issues like provider familiarity with ART and resource availability to specific concerns such as individual behavior and health status (3). Evidence for factors associated with ART adherence vary by population and geographic location. Fewer studies in rural versus urban populations have addressed barriers to ART adherence. Past investigations were limited by participation and bias

associated with sensitive nature of HIV infection status and certain behaviors like illicit drug use and sexual activity.

Evidence associating demographic characteristics with ART adherence was inconsistent. Generally, evidence suggests an association between suboptimal ART adherence and lower income, unemployment or both (16-18); younger age (19-22); lower levels of education (16, 23-25); identifying as minority race or ethnicity (17, 19, 26); and female gender (21, 22, 25, 27).

The association between ART adherence and gender may be explained by the social context of gender in a population. For example, societal gender roles may affect an individual's motivation, economic independence, or risk behaviors, all of which may impact ART adherence (13). Women who are pregnant, postpartum, or have children tend to report suboptimal ART adherence (28, 29). While older age is often associated with ART adherence, the higher pill burden from more advanced HIV disease or co-morbidities can challenge treatment adherence (30). The association between ART adherence and employment may be related to increased social support and access to material goods that typically result from employment (18).

Studies have found strong negative associations between depression (21, 31-34), alcohol use (21, 35-37), illicit drug use (20-22, 38), and ART adherence. These relationships with ART adherence may be impacted further by interaction between drug use and alcohol use(16, 25, 39), as well as the frequency of substance use (20, 38).

Characteristics of ART medications and regimens have been shown to challenge ART adherence. ART non-adherence has been reported in individuals experiencing ART medication side effects (21, 40-42). Time living with HIV (21), co-morbidities (17), and complex ART regimens (19, 30, 43) may be associated with ART non adherence. Reasons for non-adherence often reported by individuals include simply forgetting and having difficulty with dosing schedules, and interruption of daily routines (20, 31, 38, 44-46). Low ART adherence has been associated with low social connectedness and support (29, 39, 41). HIV-infected individuals in rural areas have reported stigma related to HIV illness impacting their ART adherence (8, 47).

The purpose of this current analysis is to examine factors related to adherence in two groups of HIV-infected individuals who enrolled in the Music for Health Project (MFH) which is a randomized controlled trial to test the efficacy of a smartphone mobile app on adherence and symptom self-management. The two groups are: participants who are beginning an ART regimen for the first time and participants who are changing ART regimen for reasons often associated with ART non adherence (side effects and drug resistance).

We investigate how these groups are different at study baseline prior to receiving the intervention with respect to demographic characteristics, self-reported behaviors and symptoms, health literacy, access to care, disease progression, co-morbidities, and substance use. Our main research question addresses whether external and internal

motivations are associated with adherence. We hypothesize that participants who report higher levels of internal motivation will be more likely to be adherent to ART.

Methods

MFH has been described elsewhere (48, 49) but details relevant to this study are summarized here. MFH recruited participants from five health district sites that provide care for HIV infected residents of rural counties (defined as less than 35,000 people per the US Census Bureau definition), counties designated as Medically Underserved Areas or having Medically Underserved Populations, or are Primary Health Professional Shortage Areas (HPSA). Study sites are in the Georgia Public Health System, receive Ryan White funds and have access to the AIDS Drug Assistance Program (ADAP).

Participants were English speaking adults (age 18 or older) and diagnosed with HIV infection. Participants also met one of three inclusion criteria concerning their HIV treatment: 1) initiating ART for the first time; 2) changing ART regimen within the past three months due to side effects or virologic resistance; or 3) those with a detectable viral load and have been on a new or changed ART regimen between 3 and 12 months. Health care providers, case managers, and nurses at study sites referred potential participants. Local study site coordinators recruited and screened potential participants for bilateral hearing loss, cognitive impairment, and severe mental health issues (actively psychotic, severely depressed/suicidal, or posed a risk of harm to themselves or others). Study site coordinators enrolled persons considered eligible for the study by the above criteria. At baseline, participants completed an Audio Computer-Assisted Self-Interview (ACASI)

for ART adherence, measures of symptoms, depression, self-efficacy, attitudes, and sociodemographic information.

This analysis considered data collected by the baseline ACASI for the first 107 participants in the study. Participants were categorized by changing ART medications because of symptoms, side effects or drug resistance versus newly starting ART (naive)). Adherence lessens when individuals experience side effects and is more often a reason for regimen change than treatment failure (3). In this analysis participants enrolled as regimen change were considered non-adherent. There were no data for one participant who withdrew from the study before baseline and therefore was not included in this analysis.

The two groups were characterized by descriptive statistics of a demographic nature. Questions from survey instruments were scored and categorized per the instrument's design, and Cronbach alpha statistic was calculated for each instrument to assess internal reliability (Table 1). The treatment naive and regimen change groups were compared using Wald Chi Square, Fishers Exact Test, and Satterwhite test for significance of mean difference. Bivariate analyses between predictor variables and enrollment group described any associations. Because the main study intervention aims to increase motivation by participants to adhere to ART medication, internal and external motivation measures were included as exposures in the multivariate analysis. ACTG Adherence measures were significantly associated with the enrollment group; however, because the enrollment group was defined a priori based on assumptions about adherence, the ACTG

adherence measure was not considered in this analysis. Predictors considered for inclusion in the multivariate model were internal motivation, external motivation, living alone, having a household member with HIV, alcohol use, marijuana use, gender, age and HIV health literacy. Predictors with either a significant association with enrollment group or strong evidence for confounding in the literature were also considered in the multivariate analysis. Collinearity of predictors, significance of interaction terms and confounding were assessed. The final multivariate model was selected using an all-possible subsets approach; a 10% change in estimate was considered an indication that the predictor was a confounder. Fit of the model was assessed by Hosmer-Lemeshow goodness of fit test. Multivariate analysis was conducted using logistic regression. All statistical tests were performed at the 5% level of significance. The MFH study protocol has been approved by Emory IRB (ID IRB00055077). Funding came from the National Institute of Nursing Research/National Institute of Health (Grant Number 5R01NR012923-03).

Results

Characteristics of participants

Table 2 reports demographic characteristics of participants in both groups of the study. Average participant age was 37 years (SD 10.89), with most being African American (75.47%) and male (66.98%). Almost all females identified as heterosexual (91.43%). More men identified as homosexual, bisexual, or other than heterosexual (73.24% vs 26.76%). Most participants had obtained a high school degree or GED (66.36%), have never been married (56.60%), and did not live alone (85.85%). Of participants who did not live alone, their household size on average was 3 people (SD 1.22); 44.34% of

participants had between two and three children (SD 1.58). About one-third of participants were employed (31.31%), working an average of 32 hours per week (SD 17.03). The median monthly income of participants was $600.00 (IQR 806.00). Two-thirds of participants reported any kind of substance use in the past three months (66.99%). Alcohol consumption was reported by most of these participants (88.41%); about half reported marijuana use (49.28%), and one-quarter reported illicit substance use (24.64%).

Participants indicated that they had more effective communication with their HIV health care provider than other health care providers (2.50 vs 1.98). In the past three months participants averaged 3 (SD 3.30) visits with their HIV care provider and 1 (SD 1.95) visit with a non-HIV health care provider. Most participants reported at least one ART side effect in the past two weeks (86.92%), and of those almost all reported being bothered by at least one symptom (95.7%). Two-thirds of participants had low HIV health literacy scores (66.98%).

ACTG Adherence scores were high (mean 32, SD 5.10), indicating overall good adherence in the past month. Depression was found in one-quarter of participants (24.30%). High levels of internal ART adherence motivation were reported by 40.57% of participants. The average score for external motivation was 58.79, slightly higher than midpoint on the ART Medication Adherence External Motivation scale.

Characteristics of participants by enrollment group

Table 2 reports the demographic characteristics of participants by enrollment group. Regimen change participants comprised 45% of the study population. These participants reported lower adherence scores than the treatment naive group (p value: 0.0259). Regimen change participants were 8.5 years older (p-value <0.0001), attained higher levels of education (47.92% vs 19.30%, p-value 0.0050), and had been living with HIV diagnosis for 8.7 years longer than treatment naive participants (p-value <0.0001). Treatment naive participants more often reported living with someone else (94.83% vs 70.00%, p-value 0.0046). About half of treatment naive participants lived in a family home or apartment (53.45%, p-value 0.0015). Other characteristics were not significantly different between the two groups.

Bivariate analysis

The associations between these characteristics and enrollment group were assessed by bivariate logistic regression analysis. The unadjusted odds ratios, 95% confidence intervals, and p-values of these associations are reported in Table 2. Age, education level, housing, number of household members, years since HIV diagnosis, and ACTG Adherence scores were individually significantly associated with being in the regimen change or treatment naive group.

Multivariate analysis

Table 3 reports the results of multivariate logistic regression analysis. The odds of reporting high internal motivation and having changed ART regimen are lower than the odds of reporting high internal motivation and newly starting ART regimen, controlling for living with someone else (aOR 0.86, 95% CI: 0.34, 2.21). The odds of having higher

external motivation and having changed ART regimen are higher than the odds of reporting higher external motivation and being treatment naive, controlling for living with someone else (aOR: 1.89, 95% CI: 0.75, 4.78). Neither of these associations reached statistical significance. The odds of living with someone else and having changed ART regimen are lower than the odds of living with someone else and being treatment naive, adjusting for internal and external motivation (aOR: 0.173, 95% CI: 0.05, 0.67).

Discussion

In a model that demonstrated good fit, participants who reported lower internal motivation, higher external motivation, and lived alone tended to have a need to change ART regimens, but this relationship did not reach statistical significance. This trend indicates that interventions that increased the participant's sense of personal volition and value of ART adherence could result in long-term adherence.

The treatment naïve group includes individuals who may or may not be adherent to their ART medication regimen. Comparing this group to the regimen change group in which all individuals are assumed to be less adherent results in measures that may not show as strong a relationship as comparisons between a completely adherent and a completely non-adherent group. The lack of statistical significance for some measures in this study is not entirely unexpected.

The regimen change group reported significantly lower ART Adherence scores which supports their classification as non-adherent to their ART regimen. Both groups reported similar levels of effective provider communication, health resource utilization,

depression, and substance use. This will allow the main study to investigate changes in motivation for adherence between intervention and control groups and adherence at baseline. The treatment naive group was significantly younger than the regimen change group, which can explain the statistically significant differences between the two groups in educational attainment, housing situation, number of household members, employment and income. Most study participants experienced symptoms of their ART medication, which may result from a "breaking-in period" associated with a new ART medication regimen. Often patients report experiencing side effects during the first few weeks of taking new ART medication. The demographic characteristics of study population are similar to those of other HIV positive study populations in the Southeast, particularly in gender, sexual orientation, race, and employment (51).

Years since HIV diagnosis almost perfectly predicted being treatment naive or having changed ART regimen. This is expected, as an individual changing ART regimen is likely more progressed in their HIV disease than an individual newly starting ART medication. Thus, years since HIV diagnosis was only assessed after selection of the final model. A model including this predictor demonstrated poorer fit and was not included.

A potential limitation of this analysis was the assumption that participants included in the study because of regimen change were not adherent to previous ART medication regimens. However, the significant difference in ACTG Adherence measures indicates that regimen change participants report more reasons for missing ART medication doses

and supports this assumption. The ACTG Adherence instrument measures adherence by self-report, which may result in under or over reporting of ART adherence. It may not be possible to discern if adherence issues were related to missing doses or noncompliance with medication instructions, another form of non-adherence (39). The small sample size is a further limitation of this study. Finally, adherence may be influenced by indicators not captured by the baseline ACASI, so there may be unmeasured confounding in this analysis.

Conclusion

In conclusion, participants enrolled in MFH who were treatment naive at baseline were more likely to report higher levels of internal motivation than participants who were changing to a subsequent regimen. The significant association of participants newly beginning their first ART regimen with higher reported ART adherence supports the association between internal motivation and higher ART adherence. Conversely, regimen change participants tended to have lower scores for internal motivation than treatment naive participants although this association was not significant. These trends could be further explored in studies that investigate how increasing internal motivation by strengthening an individuals' feelings of autonomy and competence in his or her HIV treatment impacts ART medication adherence. The main study's mobile app presents an educationally sound, music-enhanced self-management adherence program designed to improve patient's knowledge, motivation, and self-efficacy in ART adherence. If successful it would provide patients a convenient resource that could reduce barriers to adherence. Particularly in rural populations where many community level barriers are

reported from HIV-infected individuals, having a portable, convenient and confidential resource could lead to sustained ART adherence and consequently better health.

Tables

Table 1. Baseline ACASI instrument description and Chronbach Alpha Coefficient, Music for Health Project, Georgia, U.S., 2016 (N=106).

Instrument Name	Description	Interpretation	Items	n	Raw alpha	Standardized alpha	Response range
Communication with Physicians questionnaire (52)	Measure respondent's communication with health care provider.	A higher score indicates better communication with physicians providing HIV related care Instrument range: (0-5)	3	106	0.75	0.74	(0-5)
		A higher score indicates better communication with physicians providing non-HIV related care Instrument range: (0-5)	3	105	0.81	0.80	(0-5)
Visits to Providers questionnaire (52)	Measures respondent's utilization of health care in the past 3 months	Each question is a single item concerning health care utilization for HIV related issues Instrument range: (0-5)	4	104	0.19	0.58	(0-33)
		Each question is a single item concerning health care utilization for non-HIV related issues Instrument range: (0-5)	4	102	0.63	0.73	(0-10)
ACTG Adherence (53, 54)	Section from the Adult AIDS Clinical Trials Group (AACTG) adherence instrument. This measures reasons participants missed ART medication in the past 30 days.	Higher scores indicate better adherence in the past 30 days. Instrument range: (0-36)	9	104	0.86	0.86	(14-36)

Instrument Name	Description	Interpretation	Items	n	Raw alpha	Standardized alpha	Response range
ART Medication Adherence Motivation - Internal Motivation (55-57)	Measures respondent's internal motivation related to ART medication regimen adherence.	Higher scores indicate higher levels of motivation. Scores were dichotomized as the highest score (84) versus all lower. Instrument range: (12-84)	12	106	0.85	0.89	(18-84)
ART Medication Adherence Motivation - External Motivation (55-57)	Measures respondent's external motivation related to ART medication regimen adherence.	Higher scores indicate higher levels of motivation. Mean scores were substituted for missing items in this instrument. Scores were dichotomized at the median (61). Instrument range: (13-96)	13	106	0.91	0.91	(13-91)
ACTG Symptom Distress Module (58)	Rates the degree of bother participants experienced for 20 symptoms during the prior two weeks.	A higher score indicates greater symptom distress.	20	104	0.91	0.91	(0-20)
Center for Epidemiological Studies Depression Scale- Revised (CESD-R) (59)	Self-report scale that surveys for depressive symptoms.	A score greater than or equal to 16 was categorized as a "depressive case". Instrument range: (0-60)	20	105	0.93	0.93	(0-57)
HIV Health Literacy (60)	Health literacy test for people in HIV treatment.	A total score of 15 or lower detects respondents with low health literacy. Instrument range: (0-21)	21	101	0.64	0.62	(3-20)

Citations (52) (53) (54) (55) (56) (57) (58) (59) (60)

Table 2. Characteristics of participants at baseline, Music for Health Project, Georgia, U.S., 2016 (N=106).

	n	mean (SD)	Count (%)
Age	106	37.15 (10.89)	
Years since HIV diagnosis	105	5.68 (8.45)	
Born outside the United States	106		7 (6.6)
Race	106		
African American			80 (75.47)
White			16 (15.09)
Other*			10 (9.43)
Male	106		71 (66.98)
Heterosexual			19 (26.76)
Homosexual, Bisexual, other			52 (73.24)
Female	106		35 (33.02)
Heterosexual			32 (91.43)
Homosexual, Bisexual, other			3 (8.57)
Education	106		
GED, High School, or below			71 (66.36)
Above High School			35 (32.71)
Current Relationship Status	106		
Married or Committed Relationship			23 (21.7)
Separated, Divorced, Widowed			23 (21.7)
Never Been Married			60 (56.6)
Housing	105		
Own home or own apartment			45 (42.86)
Family home or apartment			45 (42.86)
Not family home or apartment			15 (14.29)
Live with anyone else	106		91 (85.85)
Partner or spouse			25 (27.47)
Parent(s)			26 (28.57)
Other family members			26 (28.57)
Other			11 (12.09)
Number in household	106	3.13 (1.22)	
Another household member with HIV	106		18 (16.98)
Employed	106		33 (31.13)
Monthly Income [median (IQR)]	100	600.00 (806.00)	
Have children	106		47 (44.34)
Number of children	47	2.66 (1.58)	
Provider Communication			

	n	mean (SD)	Count (%)
With HIV Providers	106	2.5 (1.28)	
With non-HIV Providers	105	1.98 (1.4)	
Health Resource Utilization in the past 3 months			
Visits with HIV care provider	104	2.78 (3.32)	
Visits with non-HIV care providers	102	1.27 (1.96)	
ACTG Adherence Summary Score	104	32.04 (5.12)	
ART Medication Adherence Motivation			
Internal Motivation (= 84)	106		43 (40.57)
External Motivation (>61)	106		55 (51.89)
ACTG Symptom Distress Module	104		
Report at least one symptom			92 (88.46)
Bothered by at least one symptom	92		88 (95.65)
CESD-R	105		
Depressive (=< 16)			26 (24.76)
Substance use in the last 3 months			
Any substance use	103		69 (66.99)
Alcohol	69		61 (88.41)
Marijuana	69		34 (49.28)
Illicit substance use****	69		17 (24.64)
HIV Health Literacy	106		
High HIV Health literacy			35 (33.02)

*Asian/Pacific Islander, Native American/American Indian, Hispanic or Latino

**Hotel, welfare hotel, shelter, halfway house, group home, institution, street, other

***Child support, welfare, TANF, AFDC, SSI, Food Stamps, savings, selling personal items, and other

****Inhaled nitrates, cocaine, amphetamines, heroin, hallucinogens, injectable drugs, or other non-injectable drugs

Table 3. Characteristics of participants who newly starting ART regimen versus those changing ART regimen, Music for Health Project, Georgia, U.S., 2016 (N=106).

	Treatment Naïve (n=58)			Regimen change (n=48)			Comparison		Bivariate logistic regression Association with enrollment group		
	n	mean (SD)	count (%)	n	mean (SD)	count (%)	X^2	p-value	unadjusted OR	95% Confidence Interval	p value
Age	58	33.17 (9.30)		48	41.71 (10.92)			**<0.0001**	*1.09*	(1.04, 1.13)	**0.0002**
Years since HIV diagnosis	58	1.76 (4.19)		47	10.51 (9.83)			**<0.0001**	*1.22*	(1.11, 1.35)	**<0.0001**
Born outside the United States	58		5 (8.62)	48		2 (4.17)		0.4525	*2.17*	(0.4, 11.71)	0.3683
Race	58			48							
African American			43 (72.41)			38 (79.17)	ref		ref		
White			11 (18.97)			5 (10.42)		0.2795	*1.45*	(0.59, 3.57)	0.4224
Other*			5 (8.62)			5 (10.41)		1.0000			
Male	58		41 (70.69)	48		30 (62.50)	0.7965	0.3721	ref		
Heterosexual			10 (24.39)			9 (30.00)					
Homosexual, Bisexual, other			31 (75.61)			21 (70.00)					
Female	58		17 (29.31)	48		18 (37.50)			*1.45*	(0.64, 3.26)	0.3731
Heterosexual			16 (94.12)			16 (88.89)					
Homosexual, Bisexual, other			1 (5.88)			2 (11.11)					
Education	57			48							
GED, High School or below			46 (80.70)			25 (52.08)					
Above High School			11 (19.30)			23 (47.92)	10.5975	**0.0050**	*3.85*	(1.62, 9.16)	**0.0023**
Current Relationship Status	58			48							0.2526
Married or Committed Relationship			10 (17.24)			13 (27.08)	ref		ref		
Separated, Divorced, Widowed			11 (18.97)			12 (25.00)	0.0876	0.7672	*0.84*	(0.26, 2.68)	0.8390
Never Been Married			37 (63.79)			23 (47.92)	2.2395	0.1345	*0.48*	(0.18, 1.27)	0.4780
Place of Living	58			47							
Own home or own apartment			16 (27.59)			29 (61.7)	ref		ref		

	Treatment Naïve (n=58)			Regimen change (n=48)			Comparison		Bivariate logistic regression Association with enrollment group		
	n	mean (SD)	count (%)	n	mean (SD)	count (%)	X^2	p-value	unadjusted OR	95% Confidence Interval	p value
Family home or apartment			31 (53.45)			14 (29.79)	10.0198	**0.0015**	*0.25*	(0.10, 0.60)	**0.0019**
Not family home or apartment			11 (18.97)			4 (8.51)		**0.0162**	*0.20*	(0.06, 0.73)	**0.0152**
Living with someone else	58		55 (94.83)	48		36 (75.00)		**0.0046**	*0.16*	(0.04, 0.62)	**0.0078**
Partner or spouse			13 (23.64)			11 (30.56)	0.5365	0.4639	*1.42*	(0.55, 3.65)	0.4649
Parent(s)			22 (40.00)			4 (11.11)		**0.0039**	*0.19*	(0.06, 0.61)	**0.0051**
Other family members			22 (27.27)			11 (30.56)	0.1149	0.7346	*1.17*	(0.47, 2.96)	0.7347
Other			22 (12.73)			4 (11.11)		1.0000	*0.86*	(0.23, 3.17)	0.8172
Number in household	55	3.36 (1.28)		36	2.75 (1.02)		0.6136	0.0134	*0.57*	(0.41, 0.81)	**0.0016**
Another household member with HIV	58		13 (22.41)	48		5 (10.42)		0.1237	*0.40*	(0.13, 1.23)	0.1090
Employed	58		19 (32.76)	48		14 (29.17)	0.1581	0.6910	*0.85*	(0.37, 1.94)	0.6911
Monthly Income [median (IQR)]	54	470.00 (806.00)		46	710.50 (1006.00)			0.1977	*1.00*	(1.00,1.01)	0.1923
Have Children	58		22 (37.93)	48		25 (52.08)	2.1315	0.1443	*1.78*	(0.82, 3.86)	0.1458
Number of children	22	2.91 (1.72)		25	2.44 (1.45)			0.3202	*0.82*	(0.57, 1.20)	0.3090
Provider Communication	58										
With HIV Providers		2.49 (1.22)		48	2.5 (1.36)			0.9819	*1.00*	(0.74, 1.36)	0.9815
With non-HIV Providers		1.81 (1.35)		47	2.18 (1.45)			0.1871	*1.21*	(0.91, 1.60)	0.1828
Health Resource Utilizaiton in the past 3 months											
Visits with HIV care provider	56	2.82 (1.43)		48	2.73 (4.67)			0.8956	*0.99*	(0.88, 1.12)	0.8874
Visits with non-HIV care providers	55	1.05 (1.60)		47	1.53 (2.29)			0.2341	*1.14*	(0.92, 1.40)	0.2266
ACTG Adherence	57	33.11 (3.95)		47	30.74 (6.05)			**0.0242**	*0.91*	(0.84, 0.99)	**0.0237**
ART Medication Adherence Motivation	58			48							
Internal Motivation (= 84)			23 (39.66)			20 (41.67)	0.0441	0.8337	*1.09*	(0.50, 2.37)	0.8336
External Motivation (>61)			25 (43.1)			28 (58.33)	2.4368	0.1185	*1.85*	(0.85, 4.01)	0.1200
ACTG Symtpom Distress Module	58			48							

	Treatment Naïve (n=58)			Regimen change (n=48)			Comparison		Bivariate logistic regression Association with enrollment group		
	n	mean (SD)	count (%)	n	mean (SD)	count (%)	X^2	p-value	unadjusted OR	95% Confidence Interval	p value
Experienced any symptom			53 (91.38)			39 (81.25)		0.1682	*0.53*	(0.16, 1.78)	0.3014
Bothered by any symptom	53		51 (96.23)	39		37 (94.87)		1.0000	*0.72*	(0.40, 1.31)	0.2802
CESD-R	58			47							
Depressive (=< 16)			17 (29.31)			9 (19.15)		0.2167	*0.57*	(0.23, 1.43)	0.2332
Substance use in the last 3 months											
Any substance use	58		41 (70.69)	46		28 (58.33)	1.9744	0.3726	*0.61*	(0.27, 1.39)	0.2370
Alcohol	41		36 (87.80)	28		25 (89.29)		1.0000	*0.73*	(0.33, 1.60)	0.4277
Marijuana	41		22 (53.66)	28		12 (42.86)	0.7766	0.3782	*0.58*	(0.25, 1.35)	0.2030
Illicit Drugs ****	41		9 (21.95)	28		8 (28.57)		0.5779	*1.12*	(0.4, 3.190)	0.8277
HIV Health Literacy	58			48							
High HIV health literacy			19 (32.76)			16 (33.33)	0.0039	0.9501	*1.03*	(0.46, 2.31)	0.9500

*Asian/Pacific Islander, Native American/American Indian, Hispanic or Latino

**Hotel, welfare hotel, shelter, halfway house, group home, institution, street, other

***Child support, welfare, TANF, AFDC, SSI, Food Stamps, savings, selling personal items, and other

****Inhaled nitrates, cocaine, amphetamines, heroin, hallucinogens, injectable drugs, or other non-injectable drugs

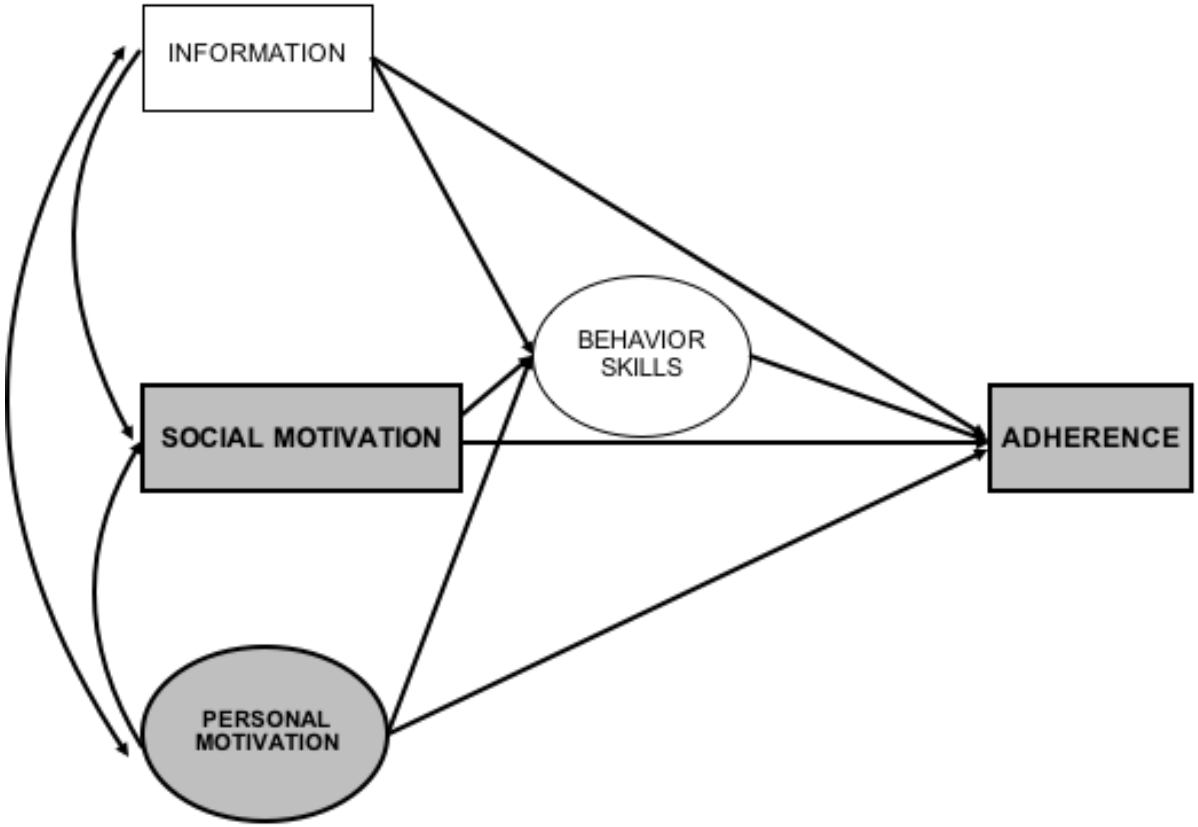
****Inhaled nitrates, cocaine, amphetamines, heroin, hallucinogens, injectable drugs, or other non-injectable drugs

Table 4. The association between internal motivation, external motivation and changing ART regimen, controlling for living alone, Music for Health Project, Georgia, U.S., 2016 (N=106).

	aOR	95% Confidence Limit	p-value
Internal Motivation (highest vs low)	*0.86*	(0.336, 2.211)	*0.7565*
External Motivation (high vs low)	*1.89*	(0.750, 4.778)	*0.1769*
Living with someone else (vs living alone)	*0.17*	(0.045, 0.665)	*0.0107*

Figures

Figure 1. Adaptation of the Information-Motivation-Behavioral Skills Model for ART Adherence (11).



References

1. Cohen MS, Chen YQ, McCauley M, Gamble T, Hosseinipour MC, Kumarasamy N, et al. Prevention of HIV-1 Infection with Early Antiretroviral Therapy. New England Journal of Medicine 2011;365(6):493-505. http://dx.doi.org/10.1056/NEJMoa1105243 30 Nov 2015.

2. World Health Organization. Consolidated Guidelines on the Use of Antiretroviral Drugs for Treating and Preventing HIV Infection: Recommendations for a Public Health Approach. In: Clinical Guidance Across the Continuum of Care: Antiretroviral Therapy. Geneva; 2013.

3. Chesney M. Adherence to HAART Regimens. AIDS Patient Care & STDs 2003;17(4):169. http://www.ncbi.nlm.nih.gov/pubmed/12737640 30 Nov 2015.

4. The HIV-CAUSAL Collaboration. The effect of combined antiretroviral therapy on the overall mortality of HIV-infected individuals. AIDS 2010;24(1):123-137. http://journals.lww.com/aidsonline/Fulltext/2010/01020/The_effect_of_combined_antiretroviral_therapy_on.17.aspx 30 Nov 2015.

5. Skarbinski J, Rosenberg E, Paz-Bailey G, et al. Human immunodeficiency virus transmission at each step of the care continuum in the united states. JAMA Internal Medicine 2015;175(4):588-596. http://dx.doi.org/10.1001/jamainternmed.2014.8180 3 Mar 2016.

6. Centers for Disease Control and Prevention. Understanding the HIV Care Continuum. 2014. December 2014. http://www.cdc.gov/hiv/pdf/dhap_continuum.pdf 3 Mar 2016

7. Centers for Disease Control and Prevention. HIV Surveillance Report, 2014; 2015.

8. Phillips DM, Forti E, Guidry JJ, Gambrell A, Bushy A, Byas K, et al. HIV/AIDS in Rural America Disproportionate Impact on Minority and Multicultural Populations: National Rural Health Association; 2004.

9. Hall HI, Li J, McKenna MT. HIV in Predominantly Rural Areas of the United States. The Journal of Rural Health 2005;21(3):245-253. http://dx.doi.org/10.1111/j.1748-0361.2005.tb00090.x 24 Jan 2016.

10. Fisher JD, Fisher WA, Amico KR, Harman JJ. An information-motivation-behavioral skills model of adherence to antiretroviral therapy. Health Psychology 2006;25(4):462-473. http://www.ncbi.nlm.nih.gov/pubmed/16846321 18 Apr 2016.

11. Amico KR, Barta W, Konkle-Parker DJ, Fisher JD, Cornman DH, Shuper PA, et al. The Information–Motivation–Behavioral Skills Model of ART Adherence in a Deep South HIV+ Clinic Sample. AIDS and Behavior 2009;13(1):66-75. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3018830/ 20 Apr 2016.

12. Williams GC, Rodin GC, Ryan RM, Grolnick WS, Deci EL. Autonomous Regulation and Long-Term Medication Adherence in Adult Outpatients. Health Psychology 1998;17(3):269-276. http://www.ncbi.nlm.nih.gov/pubmed/9619477 17 Apr 2016.

13. Holstad M, Spangler S, Higgins M, Dalmida S, Sharma S. Psychosocial Characteristics Associated with Both Antiretroviral Therapy Adherence and Risk Behaviors in Women Living with HIV. AIDS and Behavior 2015:1-13. http://dx.doi.org/10.1007/s10461-015-1209-5 6 Apr 2016.

14. Golin CE, Earp J, Tien H-C, Stewart P, Porter C, Howie L. A 2-Arm, Randomized, Controlled Trial of a Motivational Interviewing–Based Intervention to Improve Adherence to Antiretroviral Therapy (ART) Among Patients Failing or Initiating ART. Journal of Acquired Immune Deficiency Syndromes 2006;42(1):42-51. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3670099/ 18 Apr 2016.

15. DiIorio C, McCarty F, Resnicow K, Holstad MM, Soet J, Yeager K, et al. Using motivational interviewing to promote adherence to antiretroviral medications: A randomized controlled study. AIDS Care 2008;20(3):273-283. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3103182/ http://www.tandfonline.com/doi/pdf/10.1080/09540120701593489

16. Golin CE, Liu H, Hays RD, Miller LG, Beck CK, Ickovics J, et al. A Prospective Study of Predictors of Adherence to Combination Antiretroviral Medication. Journal of General Internal

Medicine 2002;17(10):756-765. http://dx.doi.org/10.1046/j.1525-1497.2002.11214.x 24 Feb 2016.

17. Bolsewicz K, Debattista J, Vallely A, Whittaker A, Fitzgerald L. Factors associated with antiretroviral treatment uptake and adherence: a review. Perspectives from Australia, Canada, and the United Kingdom. AIDS Care 2015;27(12):1429-1438. http://dx.doi.org/10.1080/09540121.2015.1114992 6 Jan 2016.

18. Nachega JB, Uthman OA, Peltzer K, Richardson LA, Mills EJ, Amekudzi K, et al. Association between antiretroviral therapy adherence and employment status: systematic review and meta-analysis. Bulletin of the World Health Organization 2015;93(1):29-41. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4271680/ 6 Jan 2016.

19. Fogarty L, Roter D, Larson S, Burke J, Gillespie J, Levy R. Patient adherence to HIV medication regimens: a review of published and abstract reports. Patient Education and Counseling 2002;46(2):93-108. http://www.ncbi.nlm.nih.gov/pubmed/11867239 27 Feb 2016.

20. García PR, Côté JK. Factors Affecting Adherence to Antiretroviral Therapy in People Living with HIV/AIDS. Journal of the Association of Nurses in AIDS Care 2003;14(4):37-45. http://www.ncbi.nlm.nih.gov/pubmed/12953611 24 Jan 2016.

21. Beer L, Skarbinski J. Adherence to Antiretroviral Therapy Among HIV-Infected Adults in the United States. AIDS Education and Prevention 2014;26(6):521-537. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4579321/ 18 Nov 2015.

22. Samji H, Taha TE, Moore D, Burchell AN, Cescon A, Cooper C, et al. Predictors of unstructured antiretroviral treatment interruption and resumption among HIV-positive individuals in Canada. HIV Medicine 2015;16(2):76-87. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4300259/ 24 Jan 2016.

23. Kleeberger CA, Buechner J, Palella F, Detels R, Riddler S, Godfrey R, et al. Changes in adherence to highly active antiretroviral therapy medications in the Multicenter AIDS Cohort Study*. AIDS 2004;18(4):683-688.

http://journals.lww.com/aidsonline/Fulltext/2004/03050/Changes_in_adherence_to_highly_active.13.aspx

24. Mbuagbaw L, van der Kop ML, Lester RT, Thirumurthy H, Pop-Eleches C, Ye C, et al. Mobile phone text messages for improving adherence to antiretroviral therapy (ART): an individual patient data meta-analysis of randomised trials. BMJ Open 2013;3(12). http://bmjopen.bmj.com/content/3/12/e003950.full.pdf 2 Nov 2016.

25. Kalichman SC, Kalichman MO, Cherry C, Hoyt G, Washington C, Grebler T, et al. Intentional Medication Nonadherence Because of Interactive Toxicity Beliefs Among HIV-Positive Active Drug Users. Journal of Acquired Immune Deficiency Syndromes 2015;70(5). http://journals.lww.com/jaids/Fulltext/2015/12150/Intentional_Medication_Nonadherence_Because_of.6.aspx 17 Nov 2015.

26. Ohl ME, Perencevich E, McInnes DK, Kim N, Rimland D, Akgun K, et al. Antiretroviral Adherence Among Rural Compared to Urban Veterans with HIV Infection in the United States. AIDS and Behavior 2012;17(1):174-180. http://dx.doi.org/10.1007/s10461-012-0325-8 4 Nov 2015.

27. Williams CT, Kim S, Meyer J, Spaulding A, Teixeira P, Avery A, et al. Gender Differences in Baseline Health, Needs at Release, and Predictors of Care Engagement Among HIV-Positive Clients Leaving Jail. AIDS and Behavior 2013;17(0 2):195-202. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3758427/ 24 Jan 2016.

28. Vyavaharkar M, Moneyham L, Tavakoli A, Phillips KD, Murdaugh C, Jackson K, et al. Social support, coping, and medication adherence among HIV-positive women with depression living in rural areas of the southeastern United States. AIDS Patient Care STDS 2007;21(9):667-80. http://www.ncbi.nlm.nih.gov/pubmed/17919094 6 Nov 2016.

29. Boehme AK, Davies SL, Moneyham L, Shrestha S, Schumacher J, Kempf M-C. A qualitative study on factors impacting HIV care adherence among postpartum HIV-infected

women in the rural southeastern USA. AIDS Care 2014;26(5):574-581. http://dx.doi.org/10.1080/09540121.2013.844759 24 Jan 2016.

30. Zhou S, Martin K, Corbett A, Napravnik S, Eron J, Zhu Y, et al. Total Daily Pill Burden in HIV-Infected Patients in the Southern United States. AIDS Patient Care and STDs 2014;28(6):311-317. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4180528/ 16 Nov 2016.

31. Heckman BD, Catz SL, Heckman TG, Miller JG, Kalichman SC. Adherence to antiretroviral therapy in rural persons living with HIV disease in the United States. AIDS Care 2004;16(2):219-230. http://dx.doi.org/10.1080/09540120410001641066 24 Jan 2016.

32. Amico KR, Konkle-Parker DJ, Cornman DH, Barta WD, Ferrer R, Norton WE, et al. Reasons for ART non-adherence in the Deep South: Adherence needs of a sample of HIV-positive patients in Mississippi. AIDS Care 2007;19(10):1210-1218. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3021466/ 20 Nov 2015.

33. Basta TB, Shacham E, Reece M. Symptoms of Psychological Distress: A Comparison of Rural and Urban Individuals Enrolled in HIV-Related Mental Health Care. AIDS Patient Care and STDs 2009;23(12):1053-1057. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2859781/ 24 Feb 2016.

34. Uthman OA, Magidson JF, Safren SA, Nachega JB. Depression and adherence to antiretroviral therapy in low-, middle- and high-income countries: a systematic review and meta-analysis. Current HIV/AIDS Reports 2014;11(3):291-307. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4359613/ 16 Nov 2015.

35. Mohammed H, Kieltyka L, Richardson-Alston G, Magnus M, Fawal H, Vermund SH, et al. Adherence to HAART Among HIV-Infected Persons in Rural Louisiana. AIDS Patient Care and STDs 2004;18(5):289-296. http://www.ncbi.nlm.nih.gov/pubmed/12042076 20 Nov 2015.

36. Grodensky CA, Golin CE, Ochtera RD, Turner BJ. Systematic Review: Effect of Alcohol Intake on Adherence to Outpatient Medication Regimens for Chronic Diseases. Journal of Studies

on Alcohol and Drugs 2012;73(6):899-910. http://dx.doi.org/10.15288/jsad.2012.73.899 24 Jan 2016.

37. Magidson JF, Li X, Mimiaga MJ, Moore AT, Srithanaviboonchai K, Friedman RK, et al. Antiretroviral Medication Adherence and Amplified HIV Transmission Risk Among Sexually Active HIV-Infected Individuals in Three Diverse International Settings. AIDS and Behavior 2015:1-11. http://dx.doi.org/10.1007/s10461-015-1142-7 16 Nov 2015.

38. Bartlett JA. Addressing the Challenges of Adherence. Journal of Acquired Immune Deficiency Syndromes 2002;29:S2-S10. http://journals.lww.com/jaids/Fulltext/2002/02011/Addressing_the_Challenges_of_Adherence_.2.aspx 24 Jan 2016.

39. Do H, Dunne M, Kato M, Pham C, Nguyen K. Factors associated with suboptimal adherence to antiretroviral therapy in Viet Nam: a cross-sectional study using audio computer-assisted self-interview (ACASI). BMC Infectious Diseases 2013;13(1):154. http://www.biomedcentral.com/1471-2334/13/154 31Oct 2015.

40. Ammassari A, Murri R, Pezzotti P, Trotta MP, Ravasio L, De Longis P, et al. Self-Reported Symptoms and Medication Side Effects Influence Adherence to Highly Active Antiretroviral Therapy in Persons With HIV Infection. Journal of Acquired Immune Deficiency Syndromes 2001;28(5):445-449. http://www.ncbi.nlm.nih.gov/pubmed/11744832 24 Feb 2016.

41. Ammassari A, Trotta MP, Murri R, Castelli F, Narciso P, Noto P, et al. Correlates and Predictors of Adherence to Highly Active Antiretroviral Therapy: Overivew of Published Literature. Journal of Acquired Immune Deficiency Syndromes 2002;31(S3):S123-S127. http://www.ncbi.nlm.nih.gov/pubmed/12562034 27 Feb 2016.

42. Savini CJ, James CW, DiGuglielmo DJ. Survey of Patient and Clinician Attitudes on Adherence in a Rural HIV Clinic. Journal of the Association of Nurses in AIDS Care 2003;14(3):72-75. http://www.sciencedirect.com/science/article/pii/S1055329005600180 24 Feb 2016.

43. Pasternak AO, de Bruin M, Bakker M, Berkhout B, Prins JM. High Current CD4+ T Cell Count Predicts Suboptimal Adherence to Antiretroviral Therapy. PLoS ONE 2015;10(10):e0140791. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4607457/ 20 Nov 2015.

44. Krummenacher I, Spencer B, Du Pasquier S, Bugnon O, Cavassini M, Schneider M. Qualitative analysis of barriers and facilitators encountered by HIV patients in an ART adherence programme. International Journal of Clinical Pharmacy 2014;36(4):716-724. http://dx.doi.org/10.1007/s11096-014-9930-0 6 Jan 2016.

45. Genberg BL, Lee Y, Rogers WH, Wilson IB. Four types of barriers to adherence of antiretroviral therapy are associated with decreased adherence over time. AIDS and Behavior 2015;19(1):85-92. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4203705/ 27 Feb 2016.

46. Safren SA, Mayer KH, Ou S-S, McCauley M, Grinsztejn B, Hosseinipour MC, et al. Adherence to Early Antiretroviral Therapy: Results From HPTN 052, a Phase III, Multinational Randomized Trial of ART to Prevent HIV-1 Sexual Transmission in Serodiscordant Couples. Journal of Acquired Immune Deficiency Syndromes 2015;69(2):234-240. http://journals.lww.com/jaids/Fulltext/2015/06010/Adherence_to_Early_Antiretroviral_Therapy__.14.aspx 24 Jan 2016.

47. Reif S, Golin CE, Smith SR. Barriers to accessing HIV/AIDS care in North Carolina: Rural and urban differences. AIDS Care 2005;17(5):558-565. http://dx.doi.org/10.1080/09540120412331319750 24 Jan 2016.

48. Holstad M, Ofotokun I, Farber E, Waldrop-Valverde D, Logwood S, Hira R, et al. There's an App for That! Promoting Antiretroviral Medication Adherence in Rural Georgia: The Music for Health Project. Journal of Mobile Techonolgy in Medicine 2013;2(4S):18. http://www.journalmtm.com/2013/theres-an-app-for-that-promoting-antiretroviral-medication-adherence-in-rural-georgia-the-music-for-health-project/ 17 Nov 2015.

49. Holstad MM. An Audio Music Self-Management Program to Improve ART Adherence in Rural GA. In. Georgia, US: National Institute of Nursing Research; 2014.

50. Reif S, Geonnotti KL, Whetten K. HIV Infection and AIDS in the Deep South. American Journal of Public Health 2006;96(6):970-973. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1470626/ http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1470626/pdf/0960970.pdf

51. Bartlett JA. Addressing the Challenges of Adherence. JAIDS Journal of Acquired Immune Deficiency Syndromes 2002;29:S2-S10. http://journals.lww.com/jaids/Fulltext/2002/02011/Addressing_the_Challenges_of_Adherence_.2.aspx

52. Lorig K, editor. Outcome Measures for Health Education and Other Health Care Interventions. Thousand Oaks, CA: Sage; 1996.

53. Holzemer WL, Bakken S, Portillo CJ, Grimes R, Welch J, Wantland D, et al. Testing a nurse-tailored HIV medication adherence intervention. Nursing Research 2006;55(3):189-197. http://www.ncbi.nlm.nih.gov/pubmed/16708043 5 Mar 2016.

54. Chesney MA, Ickovics J, Chambers D, Gifford A, Neidig J, Zwickl B, et al. Self-reported adherence to antiretroviral medications among participants in HIV clinical trials: the AACTG adherence instruments. AIDS Care 2000;12(3):255-266. http://www.ncbi.nlm.nih.gov/pubmed/10928201 21 Apr 2016.

55. Resnicow K, Jackson A, Wang T, De AK, McCarty F, Dudley WN, et al. A motivational interviewing intervention to increase fruit and vegetable intake through Black churches: results of the Eat for Life trial. American Journal of Public Health 2001;91(10):1686-1693.

56. Resnicow K, Kramish Campbell M, Carr C, McCarty F, Wang T, Periasamy S, et al. Body and soul: a dietary intervention conducted through African-American churches. American Journal of Preventive Medicine 2004;27(2):97-105. http://www.ncbi.nlm.nih.gov/pubmed/15261895 5 Mar 2016.

57. Shaikh AR, Vinokur AD, Yaroch AL, Williams GC, Resnicow K. Direct and mediated effects of two theoretically based interventions to increase consumption of fruits and vegetables

in the Healthy Body Healthy Spirit Trial. Health Education & Behavior 2011;38(5):492-501. http://www.ncbi.nlm.nih.gov/pubmed/21596903 5 Mar 2016.

58. Justice AC, Holmes W, Gifford AL, Rabeneck L, Zackin R, Sinclair G, et al. Development and validation of a self-completed HIV symptom index. Journal of Clinical Epidemiology 2001;54(12, Supplement 1):S77-S90. http://www.sciencedirect.com/science/article/pii/S0895435601004498 5 Mar 2016.

59. Van Dam NT, Earleywine M. Validation of the Center for Epidemiologic Studies Depression Scale—Revised (CESD-R): Pragmatic depression assessment in the general population. Psychiatry Research 2011;186(1):128-132. http://www.ncbi.nlm.nih.gov/pubmed/20843557 5 Mar 2016.

60. Ownby RL, Waldrop-Valverde D, Hardigan P, Caballero J, Jacobs R, Acevedo A. Development and Validation of a Brief Computer-Administered HIV-Related Health Literacy Scale (HIV-HL). AIDS and Behavior 2013;17(2):710-718. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3562365/pdf/nihms406510.pdf 5 Mar 2016.